ENVIRONMENTAL ASSESSMENT
SR 520 BRIDGE REPLACEMENT AND HOV PROGRAM

DECEMBER 2009

SR 520, Medina to SR 202: Eastside Transit and HOV Project

Appendix L
Ecosystems Discipline Report

Washington State Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

SR 520, Medina to SR 202: Eastside Transit and HOV Project Environmental Assessment

Ecosystems

Discipline Report

Prepared for

Washington State Department of Transportation
Federal Highway Administration

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November 13, 2009

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Attachments

Exhibits

Acronyms and Abbreviations

Ballard Locks	Hiram M. Chittenden Locks
BFW	bankfull width
BMP	best management practice
CAL	corrugated aluminum
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMP	corrugated metal
CPC	cast in place concrete
CST	corrugated steel
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dBA	A-weighted decibels
dbh	diameter at breast height
DPS	distinct population segment
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FCo	Federal Species of Concern
FHWA	Federal Highway Administration
FT	Federally Threatened
GIS	geographic information system
HGM	hydrogeomorphic
HOV	high-occupancy vehicle
HPA	Hydraulic Project Approval
HPMC	Hunts Point Municipal Code
I-405	Interstate Highway 405
I-90	Interstate 90
KMC	Kirkland Municipal Code
L1	limnetic or open-water habitat
L2	littoral or shoreline habitat
LWD	large woody debris

MAP	Multi-Agency Permitting (Team)
mg/L	milligrams per liter
MMC	Medina Municipal Code
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service (now known as NOAA Fisheries)
NOAA Fisheries	National Oceanic and Atmospheric Administration, National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife
PEM	palustrine emergent
PFO	palustrine forested
PHS	Priority Habitat and Species
PSS	palustrine scrub-shrub
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SPCC	spill prevention control and countermeasures
SR	State Route
TDA	threshold discharge area
TSS	total suspended solids
TESC	temporary erosion and sediment control
TNW	traditional navigable water
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDNR	Washington State Department of Natural Resources
WDFW	Washington State Department of Fish and Wildlife
WRIA	water resource inventory area
WSDOT	Washington State Department of Transportation

Introduction

Why are ecosystems considered in an Environmental Assessment?

An ecosystem is a biological community interacting with its physical and chemical environment as an integrated, dynamic unit. Ecosystems are made up of living organisms, including humans, and the environment they inhabit. Understanding the relationship between living organisms and their environment is integral to the environmental review process. Various federal, state, and local regulations including the National Environmental Policy Act (NEPA) and the Washington State Environmental Policy Act (SEPA) require evaluation of the effects of a proposed project on ecosystem structure, function, and process.

This discipline report describes the analysis of three important biotic resources—wetlands, fish, and wildlife habitat. Water is integral to these resources and is also a key driver for many other physical and chemical processes, especially those related to stormwater. Because of its complexity, a discussion of water resources is presented separately in the Water Resources Discipline Report (WSDOT 2009).

This report is organized into sections by ecosystem resource (wetlands, fish resources, and wildlife and habitat). Proposed mitigation is discussed at the end of each resource section, and references are provided at the end of the report.

What are the key points of this report?

The SR 520, Medina to SR 202: Eastside Transit and HOV Project study area contains a number of important wetland, fish, and wildlife resources that are essential to the health and sustainability of the natural ecosystem.

The No Build Alternative would have the following effects:

- No wetland or buffer areas would be filled; therefore, the No Build Alternative would have the least effect on wetlands and buffers.
- Runoff from the roadway would not be treated, as is the case today, which would result in a continuing negative effect on water quality

in the wetlands located adjacent to and downstream of SR 520, including Lake Washington and its tributary streams, where fish rear.

- Noise levels would increase with increased traffic levels over current conditions, and could affect wildlife.

The Build Alternative would affect ecosystem conditions and functions in a number of ways. Some of the effects would be beneficial (e.g., restoring streams, providing stormwater treatment facilities, and adding noise walls). There would also be negative effects, such as filling of wetlands. These effects would be mitigated in accordance with applicable local, state, and federal laws and in keeping with the Washington State Department of Transportation's (WSDOT's) policy for no net loss of wetland functions and values (WSDOT 2001). The Build Alternative would have the following effects:

Wetland Effects by Alternative (in acres)

Alternative	Wetland	Wetland Buffer
No Build Alternative	0	0
Build Alternative (operation)	7.0	1.7
Build Alternative (construction)	1.6	0.9

- Stormwater facilities would treat roadway runoff by reducing sediment loads to all receiving water bodies, including streams and Lake Washington. Metals loading would increase or decrease depending on the individual basin. Discharges from stormwater facilities would meet state and federal water quality regulations.

- Seven acres of wetlands near the existing roadway would be partially or entirely filled under the Build Alternative. The filled wetlands would lose their capacity to provide water quality and hydrologic functions and habitat for wildlife.

- WSDOT will compensate for wetland effects by rehabilitating approximately 27 acres of a wetland at the Keller Mitigation Site in Redmond, Washington, near the eastern terminus of the project.

- Under the Build Alternative, WSDOT would use temporary work areas both within and outside of the existing project right of way. Construction activities would affect 1.6 acres of wetlands by vegetation clearing. Implementing erosion and sediment control measures, spill prevention plans, and other best management practices (BMPs) would minimize construction effects. After construction of the project, the affected wetland areas would be restored by replanting with appropriate native wetland vegetation.

- The Build Alternative would require construction activities that could affect fish, aquatic species, and habitat. Water quality in streams could be affected by construction activities such as replacing or extending culverts and installing retaining walls. Construction activities occurring within or directly adjacent to streams could increase turbidity and total suspended solids (TSS) levels.

- The Build Alternative would also have positive effects on individual habitat conditions for fish. In the study area, the project would replace or remove existing culverts to improve fish passage to habitats upstream of the SR 520 corridor on five streams, thus improving access for fish that use tributary streams and decreasing the total length of culverts.

- The project would lengthen the main stem and South Fork of Yarrow Creek and add habitat features and riparian vegetation to benefit fish. Project-wide, channel realignments and culvert removals and replacements would result in a gain of 980 linear feet of open-channel habitat within fish-bearing streams, including a reduction of 857 linear feet in the stream length confined in culverts. The overall results of the stream crossing improvements and the channel realignments would be a substantial net increase in both in-stream habitat quality and quantity within the study area. In addition, improved fish passage conditions downstream of the channel enhancements would result in greater fish use of these stream reaches.

- The Build Alternative would affect wildlife by removing vegetation and wildlife habitat, adding noise disturbance from highway construction, and changing barriers to animal movement. Specific effects on wildlife would vary throughout the corridor.

- The Build Alternative would include noise walls along the majority of the corridor, which would reduce noise disturbance in the adjacent habitats. Noise from construction activities could affect bird species.

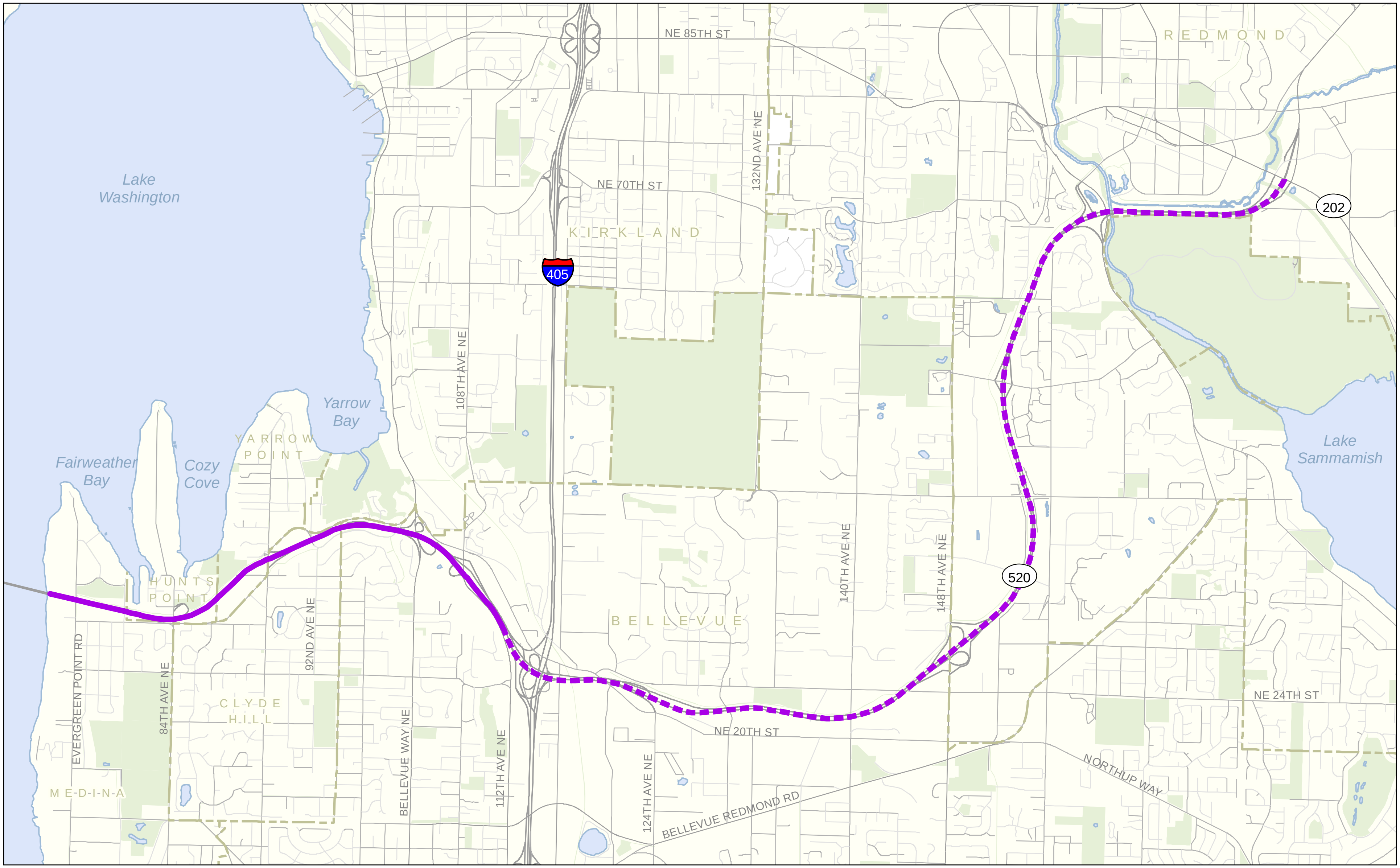
The key elements of the Build Alternative that have the potential to affect ecosystem resources in the study area are summarized in Exhibit 1.

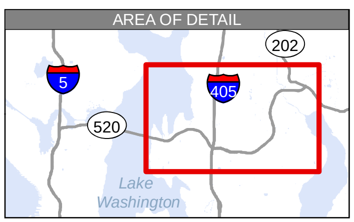
Exhibit 1. Key Elements and Potential Ecosystem Effects of the Build Alternative

Project Element	What It Involves	How It Could Affect Ecosystems
Roadway widening	Widens the roadway. Requires culvert replacement and retrofit. Adds noise walls along corridor.	Increases impervious surface. Fills or clears wetlands and wetland buffers. Removes riparian vegetation. Improves fish passage by replacing culverts. Reduces noise effects in the corridor, which benefits wildlife using adjacent habitats. Increase the barrier to wildlife crossing SR 520 but also keeps wildlife off the roadway. It also adds more opportunities for smaller animals to cross through culverts.
Stormwater facilities	Treats and detains highway stormwater runoff in an area where there is no treatment or detention.	Reduces sediment loads and treats metals in runoff prior to entering tributary streams or Lake Washington. Minimizes peak flow effects caused by undetained releases of runoff.
Construction activity	Requires excavators and other large equipment to construct the additional lanes.	Creates noise disturbance to wildlife. Fills or clears wetlands and wetland buffers.

What are the project alternatives?

WSDOT is proposing to construct the SR 520, Medina to SR 202: Eastside Transit and HOV Project to reduce transit and high-occupancy vehicle (HOV) travel times and to enhance travel time reliability, mobility, access, and safety for transit and HOVs in rapidly growing areas along the State Route (SR) 520 corridor east of Lake Washington. Exhibit 2 shows the project vicinity. Some of the improvements included in this project were originally part of the SR 520 Bridge and HOV Project. On June 18, 2008, the Federal Highway Administration (FHWA) authorized WSDOT to develop the SR 520, Medina to SR 202: Eastside Transit and HOV Project as an independent project. The project includes building a complete HOV system between Lake Washington and 108th Avenue NE and restriping the existing HOV lanes from the outside lanes to the inside lanes between the 108th Avenue NE interchange and SR 202 in Redmond.





Construction Extent

Restriping Extent

Park

City Limits

N

0 0.5 1 Miles

Source: King County (2005) GIS Data (Streets), King County (2007) GIS Data (Waterbody) and CH2M HILL (2008) GIS Data (Parks and Streams). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 2. **Project Vicinity**

Medina to SR 202: Eastside Transit and HOV Project

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The portion of the project between Evergreen Point Road and 108th Avenue NE was previously part of the SR 520 Bridge Replacement and HOV Project. The SR 520, Medina to SR 202: Eastside Transit and HOV Project has been an independent project to address needs specific to the portion of SR 520 east of Lake Washington. The project limits extend approximately 8.8 miles along SR 520 from the east shore of Lake Washington (vicinity of Evergreen Point Road) to the interchange with SR 202 in Redmond.

WSDOT is considering two alternatives for the project: the Build Alternative and the No Build Alternative.

Build Alternative

Under the Build Alternative, the proposed project would include the improvements described below.

SR 520 Improvements from Lake Washington to I-405

The proposed project would reconstruct SR 520 from just west of Evergreen Point Road to just east of 108th Avenue NE. Elements constructed as part of this section include the following:

- Construct a new eastbound HOV lane from Lake Washington to the existing eastbound HOV lane west of the I-405 interchange. This improvement would complete the currently discontinuous HOV network on the Eastside and improve travel time reliability for buses and carpools.
- Relocate the existing westbound HOV lane from the outside lane to the inside lane from Lake Washington to I-405. This change would enhance safety by eliminating the need for merging vehicles to weave across the faster-moving HOV lanes to reach the general-purpose lanes.
- Construct a lid with inside transit stop over SR 520 at Evergreen Point Road.
- Construct a new lid and modify the existing half-diamond interchange at 84th Avenue NE.
- Construct a new lid with inside transit stop over SR 520 at 92nd Avenue NE and modify the existing interchange.
- Reconfigure the existing interchange at Bellevue Way NE.

What is a lid?

The term "lid" is short for "lidded highway". Lids are long bridges that cover a length of highway. Lid surface areas can carry paths and trails to connect communities across the highway, landscaping to create open space and places for passive recreation, and items such as pergolas, seating, and transit waiting areas.

- Construct new HOV direct access ramps at 108th Avenue NE. This improvement would create a more efficient connection for transit and HOV from SR 520 to the South Kirkland Park-and-Ride via local streets.

- Add a bike/pedestrian path from Lake Washington to approximately 108th Avenue NE. This improvement would facilitate nonmotorized use of SR 520, provide transit connections for bikes and pedestrians, and complement the existing nonmotorized transportation network on the Eastside.

SR 520 Improvements from I-405 to SR 202

- Restripe existing eastbound and westbound HOV lanes from the outside to the inside lane. This change would enhance safety by eliminating the need for merging vehicles to weave across the faster-moving HOV lanes to reach the general-purpose lanes.

Other Improvements

- Provide noise walls between Evergreen Point Road and Bellevue Way NE.

- Provide retaining walls and stormwater management system improvements.

- Improve stream habitat by realigning portions of the Yarrow Creek channel and shortening some culverts.

- Improve fish passage culvert crossings to restore fish passage and open up habitat that was previously inaccessible to salmon and other fish species.

- Mitigate the project's effects on wetlands and streams at a site or sites as determined through future negotiations with permitting agencies.

No Build Alternative

Under the No Build Alternative, the project would not be built. Only routine maintenance, repair, and minor safety improvements would take place on SR 520 in the study area over the next 20 years. The No Build Alternative would not improve transit reliability and transit and HOV travel times on SR 520. Also included in the No Build Alternative for traffic modeling purposes is the assumption that the SR 520, Bridge

Replacement and HOV Project would not be built until this project is complete.

WSDOT is evaluating the No Build Alternative to provide a reference point for comparing the effects, both positive and negative, associated with the proposed project.

What policies and regulations protect ecosystems?

Federal, state, and local laws protect ecosystems because of the ecological and social functions and values of ecosystems (Exhibit 3). The primary federal regulations or statutes that apply to wetlands, fish, streams, and wildlife in the study area are the Clean Water Act (CWA) Sections 401 and 404, the Endangered Species Act (ESA), the Migratory Bird Treaty Act, the Rivers and Harbors Act, and the Coastal Zone Management Act (CZMA). State and local regulations that apply to these resources include the State Hydraulic Code, the Shoreline Management Act (SMA), and local sensitive/critical area ordinances.

A general goal of these regulations is to protect water quality, shorelines, streams, wetlands, and riparian areas and associated terrestrial habitats, as well as the species that depend on these areas.

Exhibit 3. Federal, State, and Local Regulations or Statutes Governing Ecosystems Potentially Affected by the Project

Regulation/Statutes	Overseeing Agency	Regulated Resources/Areas
Federal		
Federal Endangered Species Act, 16 United States Code (U.S.C). 1531-1534	National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries); U.S. Fish and Wildlife Service (USFWS)	Threatened and endangered fish, plants, and animals
Fish and Wildlife Coordination Act, 16 U.S.C. 661-667	USFWS; NOAA Fisheries; Washington State Department of Fish and Wildlife (WDFW)	All fish and wildlife, especially riparian and aquatic wildlife
Clean Water Act, Section 303	U.S. Environmental Protection Agency (EPA)	Waters of the United States
Clean Water Act, 33 U.S.C. 1251, Section 401	EPA (Administered by the Washington State Department of Ecology [Ecology])	Waters of the United States, including wetlands
Clean Water Act, 33 U.S.C. 1344, Section 404	EPA, U.S. Army Corps of Engineers (USACE)	Waters of the United States, including wetlands
Rivers and Harbors Act, Section 10, 33 U.S.C. 403, 407	U.S. Coast Guard	Navigable waters
Coastal Zone Management Act (CZMA), 6 U.S.C. 1451, 15 Code of Federal Regulations (CFR) 923-930	USACE (or other federal permitting agency), Ecology	Coastal zones
Federal Migratory Bird Treaty Act, 16 U.S.C. 703-712	USFWS	Migratory birds
Magnuson-Stevens Fishery Conservation and Management Act, Section 305(b)(2)	NOAA Fisheries	Essential fish habitat
Bald and Golden Eagle Protection Act	USFWS	Bald and golden eagles
State		
Washington State Endangered Species Act, Washington Administrative Code (WAC) 232-12-297	WDFW	All state-listed threatened and endangered species
Washington State Fish and Game Code, Revised Code of Washington (RCW) Titles 75 and 77	WDFW	All state-listed priority habitats and species
Shoreline Management Act, RCW 90.58	Ecology	All fish and wildlife within designated shoreline zones

Exhibit 3. Federal, State, and Local Regulations or Statutes Governing Ecosystems Potentially Affected by the Project

Regulation/Statutes	Overseeing Agency	Regulated Resources/Areas
Washington State Water Pollution Control Act, RCW 90.48	Ecology	Waters of the state
Hydraulic Project Approval (HPA) RCW 77.55	WDFW	The bed or flow of waters of the state
Aquatic Use Authorization RCW 79.90 and 79.91	Washington State Department of Natural Resources (WDNR)	State-owned aquatic lands
State Aquatic Land Management, WAC 332-30	WDNR	State-owned aquatic lands
Washington Bald Eagle Protection Rules, WAC 232-12-292	WDFW	Eagle habitat
Local		
Medina Environmentally Sensitive Areas Code, Chapter 18.12	Medina	Protection of wetlands and ponds, particularly at Fairweather Park and Overlake Golf Course. Protection of habitats important to maintaining the geographic distribution of WDFW priority species. Fairweather Park is mentioned as an area that contains relatively undisturbed open space and provides potential habitat for priority species.
Shoreline Management Master Program, Medina Municipal Code (MMC) 18.08.010	Medina	Regulates activities within 200 feet of the shoreline. Utilities and government facilities are allowed within the shoreline.
Hunts Point Sensitive Areas Code, Chapters 16.05.330 and 16.15	Hunts Point	Chapter 16.05.330 provides that sensitive areas would be designated according to WAC 197-11-908; Chapter 16.15 designates Wetherill Park as a sensitive area and provides protection for this area.
Shoreline Master Program, Hunts Point Municipal Code (HPMC) 16.10.010	Hunts Point	Regulates activities within 200 feet of the shoreline. A conditional use permit would likely be required because single-family residences are the only allowed primary use.
Clyde Hill Sensitive Areas Code, Chapter 18.04.300	Clyde Hill	Designation of sensitive areas according to WAC 197-11-908
Yarrow Point Critical Areas Ordinance No. 387	Yarrow Point	Designation of Morningside Park and wetlands as critical habitats and protection for these areas. Wetherill Park (which is jointly owned with the Town of Hunts Point) is also designated as critical habitat, and the Wetherill Park Commission is acknowledged to be the regulator of the preserve.

Exhibit 3. Federal, State, and Local Regulations or Statutes Governing Ecosystems Potentially Affected by the Project

Regulation/Statutes	Overseeing Agency	Regulated Resources/Areas
Kirkland Sensitive Areas Map, Code Chapter 24.02.130 Environmental procedures, Chapter 90	Kirkland	Kirkland Sensitive Areas Map (Code Chapter 24.02.130) designates Yarrow Bay wetlands and other riparian and wetland habitats as sensitive areas, but provides no specific protection measures for individual wildlife species; defines environmental procedures including SEPA and Shoreline Master Program regulations. Chapter 90 regulates drainage basins, including lakes, streams, and wetlands.
Kirkland Zoning Regulations, Code 23.90.90	Kirkland	Protection of riparian habitats and establishment of stream buffer widths.
Kirkland Shoreline Master Program, Kirkland Municipal Code (KMC) 24.05	Kirkland	Regulates activities within 200 feet of the shoreline. Utilities, government facilities, and transportation systems are a permitted use.
Bellevue Critical Area Overlay District, Ordinance 5680, Part 20.25H and Part 20.50 (Definitions)	Bellevue	Regulation of riparian and wetland habitats; no provision for specific protection of individual wildlife species.
Shoreline Master Program, Bellevue Land Use Code 20.25, 20.30R	Bellevue	Regulates activities within 200 feet of the shoreline.

Wetlands

Wetlands are transitional zones between aquatic environments and dry land. Their physical, biological, and chemical functions provide ecological benefits. For example, the capacity of wetlands to store water and trap sediments can reduce downstream flooding and improve overall water quality. Wetland vegetation slows the movement of water, reducing stream bank and shoreline erosion. In addition, wetlands generally support diverse vegetation types, which provide food and habitat for wildlife. Wetlands also provide educational and recreational opportunities for humans.

Affected Environment

How was the information on wetlands collected?

The ecosystems analysts collected information on wetlands within the study area from a variety of reliable sources. The analysts consulted numerous digital and paper maps to determine the location of known and potential wetlands. Digital sources examined included aerial photographs, National Wetlands Inventory data, King County Soil Survey, and current wetland mapping from local governments. The ecosystems analysts further supplemented existing information with data collected in the field.

How were wetlands identified in the field?

Ecosystems analysts examined an area approximately 200 feet wide on either side of the proposed project footprint to verify the location of previously mapped wetlands and to locate wetlands not appearing on existing inventories. East of I-405, except for restriping, no construction activity or road improvements would occur; therefore, this area was excluded from the study area. In addition, wetlands in the Cozy Cove and Yarrow Bay areas were investigated because the project could potentially affect these areas.

The analysts identified and delineated wetlands in the study area using the 1987 *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Washington State Wetland Identification and Delineation Manual* (Ecology 1997). These manuals outline a three-parameter approach for identifying wetlands that involves determining whether wetland plants, water, and soils are present. In addition, the ecosystems analysts collected data on these three parameters in areas representative of typical site conditions. The *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (April 2008) was not used because the wetland delineations occurred in 2007, before the supplement was implemented.

Wetland vegetation is adapted to saturated soil conditions. The ecosystems analysts evaluated each wetland for its dominant plants, and the wetland indicator status of these plants, to determine if the vegetation met the wetland vegetation criterion based on the wetland indicator category assigned by the USFWS (Reed 1993, 1997).

The ecosystems analysts also evaluated evidence of wetland hydrology. In evaluating wetlands, wetland hydrology is satisfied if the soil is seasonally inundated or saturated to the surface for a prolonged duration. Indicators of wetland hydrology are surface inundation, saturated soils, drainage patterns, water marks on vegetation, water-stained leaves, and oxidized root channels.

Hydric soils have an identifiable color pattern, which occurs if the soil is saturated, flooded, or ponded for a long period of time. Low-chroma colors typically form in the soil matrix, and redoximorphic features of contrasting color (known as redoximorphic features) form within the matrix. Other important indicators of wetland soils include accumulations of organic matter at the surface, a sulfur odor, and organic matter stains. The ecosystems analysts excavated soil pits and used Munsell color charts (GretagMacbeth 1994) to describe soil colors.

Licensed land surveyors surveyed the wetlands and this information was incorporated into geographic information system (GIS) format. The ecosystems analysts supplemented these data with aerial photographs in order to interpret and map wetland boundaries beyond the delineation study area.

Furthermore, the ecosystems analysts identified each wetland using a unique designation consisting of a two-letter abbreviation of the watershed location: a single letter for direction (north or south of SR 520) and a number.

How were the wetlands classified and rated?

Wetlands are generally classified according to their physical characteristics. For the purposes of this study, the ecosystems analysts used two wetland classification systems.

Cowardin Classification System

The first classification system used by the ecosystems analysts was the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979), also known as the Cowardin system. The Cowardin system allows wetlands to be classified based on their vegetation and hydrologic characteristics. USFWS uses the Cowardin system. Exhibit 4 summarizes the Cowardin classification system, which is illustrated in Exhibit 5.

Exhibit 4. Overview of the Cowardin Classification System for Wetlands in the Study Area

Abbreviation	System	Subsystem	Class
PEM	Palustrine—All nontidal wetlands dominated by trees, shrubs, emergents, mosses, or lichens.	Not applicable.	Emergent—Characterized by erect, rooted, herbaceous hydrophytes[a] present for most of the growing season in most years. Usually dominated by perennial plants.
PSS	As above.	Not applicable.	Scrub-Shrub—Areas dominated by woody vegetation less than 6 meters (20 feet) tall. Species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted.
PFO	As above.	Not applicable.	Forested—Characterized by woody vegetation that is 6 meters tall or taller.
L1AB/L2AB	Lacustrine—Wetlands and deepwater habitats with all of the following characteristics: occurs in topographic depressions or dammed river channels; lacking trees, shrubs, and persistent emergents; are greater than 20 acres in size. L1 refers to limnetic or open-water habitats and L2 refers to littoral or shoreline habitats.	• Limnetic—All deepwater habitats within the lacustrine system; many small lacustrine systems have no limnetic subsystem. • Littoral—All wetland habitats in the lacustrine system. Extends from shoreward boundary to 2 meters (6.6 feet) below annual low water or to the maximum extent of nonpersistent emergents, if these grow at depths greater than 2 meters (6.6 feet).	Aquatic Bed—Dominated by plants that grow on or below the water surface for most of the growing season.

Note: Definitions based on information from USFWS *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979).

[a] Hydrophytes are plants adapted to living in saturated soils (Cowardin et al. 1979).

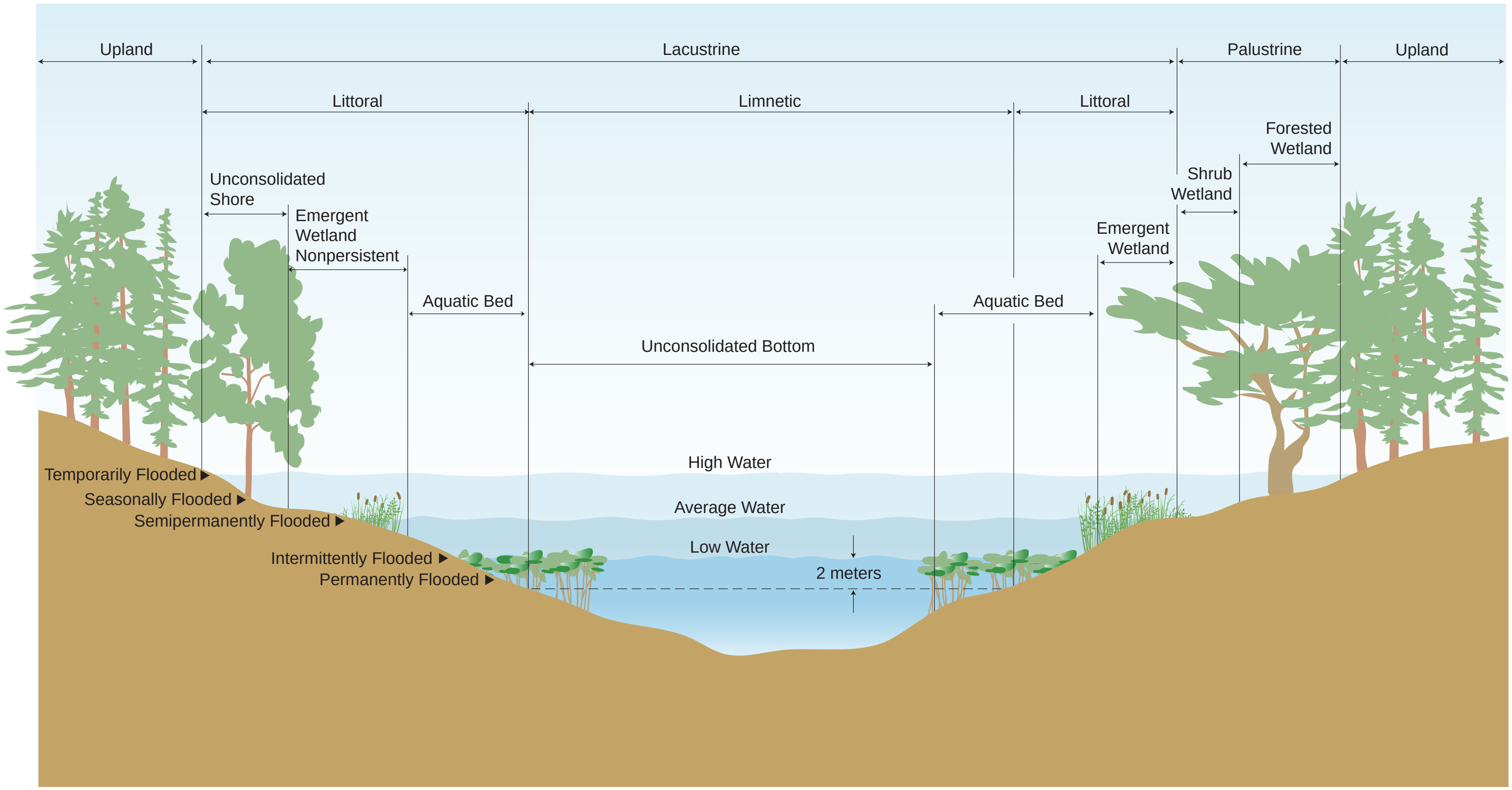


Exhibit 5. **Distinguishing Features and Examples of Habitats Using the Cowardin System**

I-5 to Medina: Bridge Replacement and HOV Project

To better explain the wide variety of habitats in the study area, the ecosystems analysts defined wetlands and deepwater habitats separately. The term *wetland* does not include deep, permanent water. Both wetlands and deepwater habitats must be considered in an ecological approach to classification.

According to Cowardin, wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water (Cowardin et al. 1979). The boundary between wetland and deepwater habitat in the palustrine and lacustrine systems lies roughly at a depth of 6.6 feet below low water (Cowardin et al. 1979). Wetlands transition to uplands when soils are no longer saturated for long periods during the growing season and dominant plants are not adapted to saturated soils.

Deepwater habitats are permanently flooded lands lying below the deepwater boundary of wetlands. Deepwater habitats include environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live, whether or not they are attached to the substrate (Cowardin et al. 1979). Deepwater habitats are true aquatic environments, and the associated fish and wildlife using these habitats are discussed in the *Fish Resources* and *Wildlife and Habitat* sections of this report.

HGM Classification System

The second system used to classify wetlands in the study area considered landscape position, primary source of water, and the direction of water flow through the wetland. This classification system is referred to as the hydrogeomorphic (HGM) classification, which is based on the methods defined in *A Hydrogeomorphic Classification for Wetlands* (Brinson 1993). Exhibit 6 summarizes the HGM classification system, which is illustrated in Exhibit 7.

Exhibit 6. Overview of the Hydrogeomorphic Classification System for Wetlands in the Study Area

HGM Class/Geomorphic Setting	Primary Water Sources	Water Flow Properties
Depressional Wetlands	Precipitation, groundwater	Vertical fluctuations
Riverine Wetlands	Overbank flooding, groundwater, lateral flow, and precipitation	Unidirectional
Lake-fringe Wetlands	Lateral flow and precipitation	Bidirectional
Slope Wetlands	Precipitation, lateral flow, and groundwater	Unidirectional

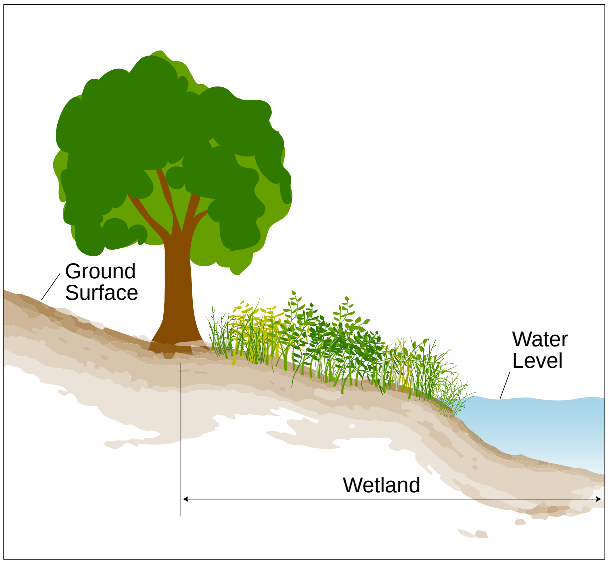
Note: Based on *A Hydrogeomorphic Classification for Wetlands* (Brinson 1993).

Depressional wetlands occur in topographic depressions. Dominant water sources are precipitation, groundwater discharge, and flow from adjacent uplands. Elevation contours are closed, thus allowing the accumulation of surface water. Depressional wetlands are either outflow or closed. Depressional outflow wetlands are those that have a surface water outlet (outflow) to a downgradient aquatic body. Depressional closed wetlands are those that have no surface water outflow to channels, streams, or rivers.

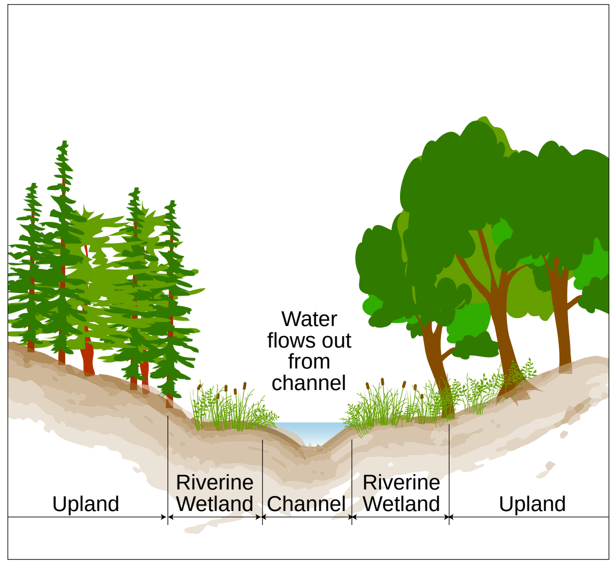
Riverine wetlands occur in valleys associated with stream or river channels. They are located in the active floodplain of a river and are linked to the river water dynamics. The primary source of water is frequent flooding (overbank flooding) from the stream or river.

Lake-fringe wetlands are vegetated wetlands adjacent to an area of open water that is larger than 20 acres and more than 6.6 feet deep over 30 percent of the open-water areas. The primary water source is the adjacent open water.

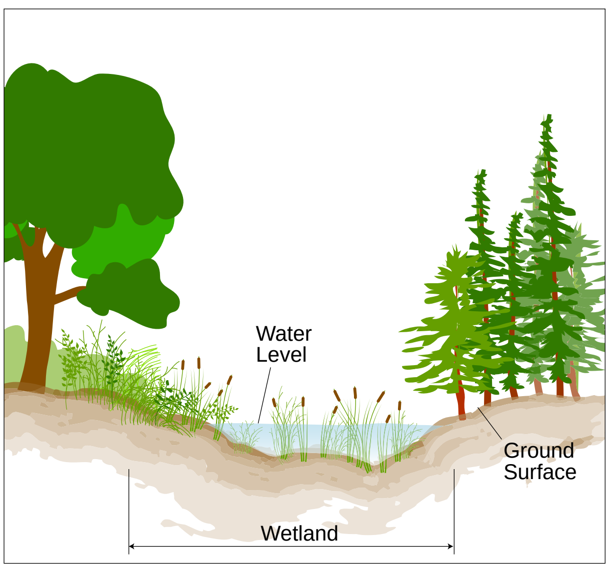
Slope wetlands occur on hill or valley slopes where the groundwater surfaces and runs along the surface or immediately below the soil surface. Water flow is unidirectional and there is no defined stream channel.



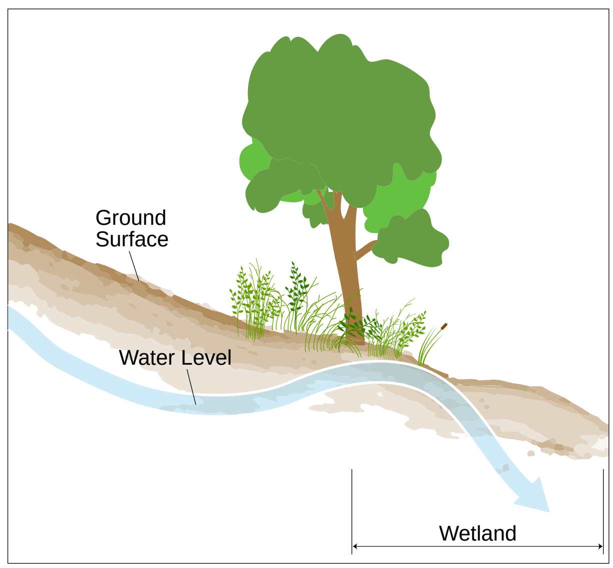
Lake-fringe Wetland



Riverine Wetland



Depressional Wetland



Slope Wetland

Exhibit 7. **Illustration of the Hydrogeomorphic Classification System**

Medina to SR 202: Eastside Transit and HOV Project

Wetland Rating Systems

Resource agencies and regulatory jurisdictions rate or categorize wetlands according to their relative rarity or importance, and they also define buffer requirements and mitigation ratios for mitigation purposes. Numerous systems for rating wetlands exist, but all of these systems tend to focus on the common elements of the functions and values of the wetland, sensitivity to disturbance, rarity, and irreplaceability.

At the state level, wetlands are categorized according to the Washington State Wetland Rating System for Western Washington developed by Ecology (Hruby 2004). Exhibit 8 summarizes the rating criteria for each wetland category (Hruby 2004). This Ecology method rates wetlands based on the HGM class.

Exhibit 8. **Ecology Criteria for Wetland Rating Categories**

Category		Rating Criteria
Category I	(a)	Include unique or rare wetland types (bog, estuary, mature/old-growth forested); or,
	(b)	Are especially sensitive to disturbance; or,
	(c)	Are relatively undisturbed and provide functions/values impossible to replace within a human lifetime; or,
	(d)	Wetlands documented as high quality by the Natural Heritage Program; or,
	(e)	Wetland with documented occurrence of state sensitive plant(s) by the Natural Heritage Program; or,
	(f)	Perform the highest level of wetland functions (scoring > 70 points).
Category II	(a)	Perform at a moderately high level of wetland functions (scoring 51 to 69 points); or,
	(b)	Interdunal wetlands[a] > 1 acre in size.
Category III	(a)	Perform with a moderate level of functions (scoring 30 to 50 points); or,
	(b)	Interdunal wetlands between 0.1 and 1 acre in size.
Category IV	(a)	Are wetlands with lowest level of functions (scoring < 30 points) and frequently disturbed.

Source: Hruby (2004).

[a]Interdunal wetlands form in the “deflation plains” and “swales” that are geomorphic features in areas of coastal dunes.

Ratings are used during the permit review process to establish buffer requirements, to determine allowable effects, and to determine the replacement ratios for compensatory mitigation. The individual wetland ratings provided in this report are based on current data and regulations, and would be refined (as appropriate) if local jurisdictions adopted new standards or if new information became available. Wetlands in Kirkland were rated according to Kirkland’s rating system. The other jurisdictions in the study area either use the Ecology rating system or do not have a rating system. The rating systems and corresponding buffer requirements used by local jurisdictions within the study area are summarized in Exhibit 9.

Exhibit 9. Summary of Local Wetland Rating Systems[a] and Buffer Requirements in the Study Area

Rating System	Ratings	Buffer Requirements (in feet)
Medina		
Ecology rating system, MMC 18.12.290.	Category I	100 [b]
	Category II	75 [b]
	Category III	50 [b]
	Category IV	35 [b]
Hunts Point		
No rating system; Hunts Point Municipal Code (HPMC) 16.05.330. Hunts Point Code provides that sensitive areas would be designated according to WAC 197-11-908.	NA	None
Yarrow Point		
Ecology rating system (per Ordinance 387).	Per Ecology	None
Clyde Hill		
No rating system.	NA	None
Kirkland		
Three wetland types based on association with Lake Washington, functional attributes, sensitivity to disturbance, size, rarity, and irreplaceability. Designates Yarrow Bay wetlands and other riparian and wetland habitats as sensitive areas. Kirkland Zoning Code 90.30 to 90.40.	Type 1 Type 2 Type 3	75 to 100[c] 50 to 75[c] 25 to 50[c]
Bellevue		
Ecology rating system. Bellevue Land Use Code 20.25H.095.	Category I	75-190[d]
	Category II	75-225[d]
	Category III	60-110[d]
	Category IV (over 2,500 sq. ft.)	40[d]

NA = not applicable

[a] Local critical areas ordinances and respective buffer widths may be revised in the future to reflect changes in Ecology's 2004 rating system. WSDOT will apply the appropriate buffers during project permitting.

[b] These are standard buffer widths. Buffers can be reduced on a case-by-case basis.

[c] Wetlands in primary basins receive the wider of the two listed buffer widths; wetlands in secondary basins receive the narrower buffers.

[d] Buffers are for undeveloped sites and vary with habitat score. Buffers for developed sites are established through previously approved and recorded Native Growth Protection Areas or Native Growth Protection Easements.

How were wetland functions assessed?

The ecosystems analysts qualitatively characterized functions using Ecology's wetland rating system (Hruby 2004). The Ecology method uses a semi-quantitative scoring system for characterizing functions. The Ecology rating system considers functions as well as wetland scarcity and sensitivity to alteration.

Wetlands generally perform three types of functions. These functions are related to improving water quality (biogeochemical functions), maintaining the water regime in a watershed (hydrologic functions), and supporting food webs and providing habitat (habitat functions) (Sheldon et al. 2003).

The functions a wetland provides are determined by the characteristics of the wetland, the wetland's location within the landscape, the surrounding land use (such as urban, agricultural, or wilderness area), and the opportunity of the wetland to perform a given function (Hruby 2004). For this study, the upland habitats, buffers, and contiguous wetlands adjacent to the delineated wetlands were also considered in the functions assessment because adjacent land uses affect the performance of wetland functions.

Wetland water quality and hydrologic functions include removing sediment and contaminants, providing storage for base flow to streams or groundwater, and attenuating flood flows. Performance of these functions is closely correlated to the size, shape, presence of pollutants, and position of the wetlands within the watershed.

Wetland habitat functions involve producing and exporting organic matter and the presence of wildlife habitat. The capacity to perform these functions depends on the size of the wetland, the presence of multiple plant communities, and how much permanent water is present in the wetland.

Different types of animals have different and specific habitat needs. The quality of wetland invertebrate habitat depends on the mixture of open water and emergent vegetation, diverse plant assemblages, the presence of decaying wood, and a marked seasonal variation in water levels. Permanent flowing water often supports a unique combination of invertebrate species (Sheldon et al. 2003).

In addition to their hydrologic and biological value, wetlands have value as a cultural resource. Documented educational/scientific use, public ownership, and accessibility to humans are the major criteria required for these values.

How was information about jurisdictional ditches collected?

CWA jurisdiction may also be extended to waters that are not traditional navigable waters (TNWs) of the United States if the USACE standards for jurisdictional ditches are met. The analysts examined potential ditches to determine if they met these USACE standards. The ditches met these standards if the areas showed scour marks, lacked vegetation, had a defined channel, and had flowing or standing water.

Where in the study area do wetlands occur and why?

Wetlands occur where specific hydrologic, biological, and geologic conditions combine to create saturated or inundated soils that support specific kinds of plants. Water is the defining characteristic of a wetland. It creates the conditions that dominate the soil-forming processes and acts as a limiting condition for plant growth. A wetland must have water for a sufficient period of time during the growing season to create anaerobic soil conditions and to support plant communities adapted to those conditions.

> It is important to note that even though a soil survey shows a particular soil type in a mapped area, this area can also include pockets of different soil types because of the gross scale of the mapping. Human activities, including the placement of fill during development, can also affect soil characteristics, so that wetlands sometimes occur where soil types have been mapped as nonhydric.

Wetlands in the study area receive water from several sources. Some wetlands are situated along the shores of Lake Washington where water is present throughout the year. Other wetlands are located along the SR 520 corridor, along streams, on hill slopes, or in depressions. These wetlands receive water as runoff from SR 520, when streams overflow their banks, from subsurface flow where the water table is close to the surface, and/or directly from precipitation. Additional information on water resources in the study area are provided in the Water Resources Discipline Report (WSDOT 2009a).

The study area is in the Puget Sound Trough, which is a broad lowland located between the western Cascades and the Olympic Peninsula with a history of extensive glaciation. Glacial processes created the landforms in this region and provide base material for the region's soils. The landforms of the region typically comprise a series of north–south trending ridges and valleys, showing the direction of glacial advance. During their advances and retreats, the glaciers deposited a thick layer of unsorted material, including clays, sands, gravels, silts, and boulders. This material is commonly called till, which can be several thousands of feet thick in some areas (Alt and Hyndman 1984). More recently, rivers, streams, and lakes occupied the low-lying areas, depositing loose materials. Stream-deposited materials are called *alluvium*, and lakebed deposits are called *lacustrine deposits*. As these parent materials eroded and broke down, they formed the soils of the region. Some of the soils are poorly drained or impede infiltration of water, which leads to the formation of wetlands. These soils are considered to be hydric (wetland) soils. Other freer-draining soil types (called nonhydric soils) support upland habitats. Within these two general soil groups, there are a number of individual soil series, or types (Snyder et al. 1973). Exhibit 10 summarizes the soil types in the study area. Additional information on geology and soils in the study area can be found in the Geology and Soils Technical Memorandum (WSDOT 2009b).

Exhibit 10. **Summary of Soil Types in the Study Area**

Soil Series	Drainage Class	Hydric?	Parent Material/Location	Native Vegetation
Alderwood	Moderately well drained	No [a]	Glacial till/uplands	Conifers
Bellingham	Poorly drained	Yes	Alluvium/depressions	Grasses and sedges
Everett	Somewhat excessively well drained	No	Glacial outwash/terraces and outwash plains	Conifers
Kitsap	Moderately well drained	No	Glacial lake deposits/terraces	Conifers and shrubs
Norma	Poorly drained	Yes	Alluvium/depressions and valleys	Sedges, grasses, conifers, and hardwoods
Seattle	Very poorly drained	Yes	Till and alluvium/ depressions and valleys	Sedges
Tukwila	Very poorly drained	Yes	Alluvium/depressions and valleys	Grasses, sedges, rushes, and shrubs
Urban land	Varies	No	Fill over various native soil types in urbanized areas	Varies

Source: King County soil survey (Snyder et al. 1973).

[a] The Soil Conservation Service (1991) (now called the Natural Resources Conservation Service) designates the Alderwood series soils as nonhydric; however, these soils can support the development of wetlands because of compacted till that exists at depths between 20 and 40 inches.

Puget Sound is located within the western hemlock forest zone described in *Natural Vegetation of Oregon and Washington* (Franklin and Dyrness 1988). Western hemlock and western red cedar are the dominant upland forest species in this zone, although Douglas fir is also very common. Most wetlands in the study area support a mixture of native and introduced species. Red alder, black cottonwood, western red cedar, and Oregon ash generally dominate the forested wetlands. Dominant species in the shrub wetlands include various willows, Himalayan blackberry, red-osier dogwood, rose spirea, and salmonberry. Along Lake Washington and in wetlands with open water, cattails, rushes, horsetails, and various native and nonnative grasses dominate.

What are the characteristics of wetlands in the study area?

The study area contains 40 wetlands. These wetlands include examples of all four HGM classifications: depressional, riverine, lake-fringe, and slope. Exhibit 11 describes these wetlands and summarizes their classification and ratings, and Exhibit 12 shows them on a map.

Depressional wetlands form in closed topographic depressions where water accumulates. The study area contains 10 wetlands that were rated as depressional wetlands. One of these wetlands (FCS-1) is in the Fairweather Creek watershed, three (CCN-1, CCN-2, and CCN-2A) are in the Cozy Cove watershed, three (YBN-1, YBN-1B, and YBS-2A) are in the Yarrow Bay watershed, and three (YCN-3, YCS-4, and YCS-5) are in the Yarrow Creek watershed. Two of these wetlands have multiple HGM categories: Wetland CCN-1 is also lake-fringe and Wetland YBN-1 is also riverine and lake-fringe. The depressional wetlands support forest, scrub-shrub, and emergent communities.

Exhibit 11. Summary of Wetlands in the Study Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification[a]	Approximate Size (acres)	Rating Ecology/ Local[b]	Dominant Vegetation	Soil Characteristics
Fairweather Creek							
FC Park	Medina	Slope/groundwater	Scrub-shrub	0.2	IV/IV	Western red cedar, Pacific ninebark, black twinberry, rose spirea, and creeping buttercup.	No sample taken; permission was not granted to take sample plots in the wetland.
FCN-3	Medina	Slope/runoff	Emergent	<0.1	IV/IV	Bentgrasses and creeping buttercup.	Gravelly loam (10YR 3/2) with redoximorphic features over clay loam (2.5Y 5/1) with redoximorphic features.
FCS-1	Medina and Hunts Point	Depressional Outflow/runoff	Emergent	<0.1	IV/IV/NA	Creeping buttercup, reed canarygrass, and bentgrasses.	Loam (10YR 3/2) with redoximorphic features over silt loam (2.5YR 6/2) with redoximorphic features.
FCS-2	Hunts Point	Slope/runoff	Emergent	0.2	IV/NA	Reed canarygrass, bentgrasses, field horsetail, and small-fruited bulrush.	Gravelly loam (10YR 4/2) with redoximorphic features over clay loam (2.5YR 6/2) with redoximorphic features.
FCS-3A	Hunts Point	Slope/groundwater seep may be the result of the SR 520 road cut.	Emergent	<0.1	IV/NA	Bentgrass and soft rush.	Clay loam (10YR 2/1) over loamy sand (2.5Y 3/2) with redoximorphic features.
FCS-3B	Hunts Point	Slope/groundwater seep may be the result of the SR 520 road cut.	Emergent	<0.1	IV/NA	Bentgrass and soft rush.	Clay loam (10YR 2/1) over loamy sand (2.5Y 3/2) with redoximorphic features.
FCS-3C	Hunts Point	Slope/groundwater seep may be the result of the SR 520 road cut.	Emergent	<0.1	IV/NA	Bentgrass and soft rush.	Clay loam (10YR 2/1) over loamy sand (2.5Y 3/2) with redoximorphic features.
FCS-3D	Hunts Point	Slope/groundwater seep may be the result of the SR 520 road cut.	Emergent	<0.1	IV/NA	Bentgrass and soft rush.	Clay loam (10YR 2/1) over loamy sand (2.5Y 3/2) with redoximorphic features.
FCS-3E	Hunts Point	Slope/groundwater seep may be the result of the SR 520 road cut.	Emergent	<0.1	IV/NA	Bentgrass and soft rush.	Clay loam (10YR 2/1) over loamy sand (2.5Y 3/2) with redoximorphic features.

Exhibit 11. Summary of Wetlands in the Study Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification[a]	Approximate Size (acres)	Rating Ecology/ Local[b]	Dominant Vegetation	Soil Characteristics
Cozy Cove							
CCN-1 [c]	Hunts Point, Yarrow Point	Lake-Fringe, Depressional Outflow/Lake Washington and runoff	Forested, Scrub-shrub, Emergent, Aquatic bed	8.4	III/sensitive area/III	Oregon ash, creeping buttercup, bentgrasses, Pacific willow, black cottonwood, Himalayan blackberry, and purple loosestrife.	Loam (10YR 3/2) with redoximorphic features over clay loam (10YR 5/1).
CCN-2	Hunts Point	Depressional Closed/runoff	Forested, Emergent	0.3	III/NA	Bentgrasses, Oregon ash, Himalayan blackberry, and soft rush.	Loam (10YR 3/2) with redoximorphic features over gravelly clay loam (10Y 5/1) with redoximorphic features.
CCN-2A	Hunts Point	Depressional Closed/runoff	Forested	<0.1	III/NA	Reed canarygrass, bentgrasses, Himalayan blackberry, Oregon ash, giant horsetail, and soft rush.	Loam (10YR 4/2) with redoximorphic features over gravelly sandy loam (2.5Y 4/2) with redoximorphic features.
CCS-1	Hunts Point	Slope/precipitation and interflow	Scrub-shrub, Emergent	0.5	IV/NA	Himalayan blackberry, field horsetail, Watson willowherb, and reed canarygrass.	Loam (10YR 3/2) over loam (10YR 4/2).
CCS-3 [d]	Hunts Point	Slope/runoff, may have groundwater component	Emergent	<0.1	IV/NA	Himalayan blackberry, red-osier dogwood, bentgrasses, creeping buttercup, and soft rush.	Loam with gravel (2.5 Y 4/1) over gravelly loam (2.5Y 4/1) with redoximorphic features.
CCS-4	Yarrow Point	Slope/groundwater and runoff	Scrub-shrub	<0.1	IV/IV	Himalayan blackberry.	Loam (10YR 3/2) with redoximorphic features over gravelly loam (2.5Y 5/3).
CCS-5	Yarrow Point/ Hunts Point	Slope/groundwater	Forested, Emergent	<0.1	III/III/NA	Himalayan blackberry, Pacific willow, red alder, common ladyfern, reed canarygrass, and giant horsetail.	Loam (10YR 3/1) over sandy loam (10YR 3/2) with redoximorphic features.

Exhibit 11. Summary of Wetlands in the Study Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification[a]	Approximate Size (acres)	Rating Ecology/ Local[b]	Dominant Vegetation	Soil Characteristics
Yarrow Bay							
YBN-1 [c]	Kirkland	Lake-Fringe, Riverine, Depressional Outflow/ Lake Washington and Yarrow Creek; culverts convey runoff from the south and east.	Forested, Scrub-shrub, Emergent, and Aquatic Bed	75.8	I/1	Red alder, black cottonwood, paper birch, Himalayan blackberry, salmonberry, reed canarygrass, Japanese knotweed, ladysthumb, Watson willowherb, and field horsetail. Also mannagrass ssp., American skunkcabbage, water-cress, and water parsley.	Multiple soil characteristics from different sample plots such as very dark grayish brown (10YR 3/2), silt loam, over very dark gray (10YR 3/1), silt loam
YBN-1A	Kirkland	Riverine/Cochran Springs Creek	Scrub-shrub, Forested	<0.1	III/3	Giant horsetail, Himalayan blackberry, Pacific willow	
YBN-1B	Kirkland	Depressional Outflow/groundwater, precipitation	Forested	<0.1	III/3	Pacific willow and bentgrasses.	Duff over gravely silty loam (2.5Y 3/1) over sand (10Y 4/1) over silt loam (10YR 2/1).
YBN-2	Kirkland	Slope/runoff	Emergent	<0.1	IV/3	Red alder, red-osier dogwood, salmonberry, cutleaf blackberry, Indian plum, Himalayan blackberry, and field horsetail.	Gravelly loam (10YR 3/2) over loam (2.5Y 5/2 and 2.5Y 4/2) over loam (10Y 5/1).
YBS-1	Bellevue	Slope/groundwater	Forested, Emergent	1.9	III/III	Reed canarygrass and Sitka willow.	Loam (10YR 3/2) over loam (2.5Y 4/2) with redoximorphic features.
YBS-2A	Bellevue	Depressional Closed/runoff and possibly groundwater	Emergent	0.11	III/III	Red alder, reed canarygrass, red elderberry, and giant horsetail.	Loam (10YR 3/2) over loam (2.5Y 4/2) over loam (5Y 6/2) with redoximorphic features.
YBS-2B	Bellevue	Slope/runoff and possibly groundwater	Emergent	<0.1	IV/IV	Big leaf maple, common ladyfern, and giant horsetail.	Clay loam (10YR 5/6) with redoximorphic features over clay loam (5Y 5/1) with redoximorphic features.
YBS-2C	Bellevue, Clyde Hill	Riverine/unnamed stream, runoff and possibly groundwater	Scrub-shrub	<0.1	III/III/NA	Salmonberry, climbing nightshade, and common ladyfern.	Silt loam (10YR 2/1).
YBS-3	Clyde Hill	Slope/groundwater	Forested, Emergent	2.1	III/NA	Bentgrasses, red alder, field horsetail, and Watson willowherb.	Silt loam (10YR 3/2) over fine sandy loam (2.5Y 4/2) with redoximorphic features.

Exhibit 11. Summary of Wetlands in the Study Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification[a]	Approximate Size (acres)	Rating Ecology/ Local[b]	Dominant Vegetation	Soil Characteristics
Yarrow Creek							
YCN-1	Bellevue	Riverine/Yarrow Creek	Emergent	<0.1	III/III	Reed canarygrass, Himalayan blackberry.	Silt loam (10YR 3/1) over silt loam (3/2) with redoximorphic features.
YCN-2	Bellevue	Riverine/Yarrow Creek	Emergent	0.2	III/III	Reed canarygrass.	Very silty loam (10YR 3/2) over silt loam (10YR 3/1) with redoximorphic features.
YCN-3	Bellevue	Depressional Outflow/runoff	Emergent	0.1	IV/IV	Reed canarygrass, cattail, and cutleaf blackberry.	Silty loam (10YR 2/2) with redoximorphic features and loamy sand (10GY 4/1).
YCN-3A	Bellevue	Riverine, Slope/Yarrow Creek	Emergent	0.6	III/III	Reed canarygrass, mowed grasses, and Himalayan blackberry.	Silt loam (10YR 3/1) with redoximorphic features and occasional cobbles.
YCN-3B	Bellevue	Riverine /Yarrow Creek	Scrub-shrub, Forested	<0.1	III/III	Reed canarygrass, red alder, rose spirea, black cottonwood, and grasses.	Loamy sand (10YR 5/1) with redoximorphic features.
YCN-4A	Bellevue	Riverine/South Fork Yarrow Creek	Forested	0.2	II/II	Salmonberry, black cottonwood, Himalayan blackberry, and red alder.	Silty loam (N 4/1) with redoximorphic features and loamy sand with redoximorphic features.
YCN-5[e]	Bellevue	Slope/runoff	Emergent	0.5	III/III	Bentgrass and red fescue.	Sandy loam over clay loam to clay (10YR 5/1) with redoximorphic features.
YCN-6[e]	Bellevue	Slope/runoff	Emergent	0.2	IV/IV	Bentgrasses, red fescue, and reed canarygrass.	Clay loam (10YR 4/1) over clay loam (10YR 6/1) with redoximorphic features.
YCN-7[e]	Bellevue	Riverine/Yarrow Creek and runoff	Forested	<0.1	IV/IV	Panicled bulrush, field mint, red alder, and big leaf maple.	Sand (10YR 2/2).
YCN-8[e]	Bellevue	Riverine/Yarrow Creek and runoff	Forested	<0.1	IV/IV	Salmonberry, red alder, and big leaf maple.	Sandy loam (2.5Y 3/1) over sand (2.5Y 4/2) over sand (2.5Y 4/3).
YCS-1	Bellevue	Riverine/Yarrow Creek	Emergent	0.5	II/II	Reed canarygrass, Himalayan blackberry, bentgrasses, and red alder.	Silt loam (10YR 3/1) with redoximorphic features over sandy loam (10Y 2.5/1).

Exhibit 11. Summary of Wetlands in the Study Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification[a]	Approximate Size (acres)	Rating Ecology/ Local[b]	Dominant Vegetation	Soil Characteristics
YCS-2	Bellevue	Riverine, Slope/Yarrow Creek, groundwater	Forested, Emergent	2.2	II/II	Reed canarygrass, salmonberry, Pacific willow, red alder, Himalayan blackberry, and rose spirea.	Silt loam (7.5YR 4/6 with redoximorphic features).
YCS-4	Bellevue	Depressional Outflow/runoff and precipitation	Emergent	1.0	IV/IV	Reed canarygrass.	Sandy loam with cobble (10YR 3/1).
YCS-5	Bellevue	Depressional Outflow/runoff	Emergent	0.3	III/III	Reed canarygrass, rose spirea, and Pacific willow.	Sandy silt loam (10YR 3/1) with redoximorphic features.
YCS-6[e]	Bellevue	Slope/runoff	Emergent	0.2	IV/IV	Bentgrasses, red fescue, and reed canarygrass.	Clay loam (10YR 4/1) over clay loam (10YR 5/6) with redoximorphic features.

[a] Cowardin et al. (1979). Forested, scrub-shrub, and emergent are part of the palustrine (freshwater) system.

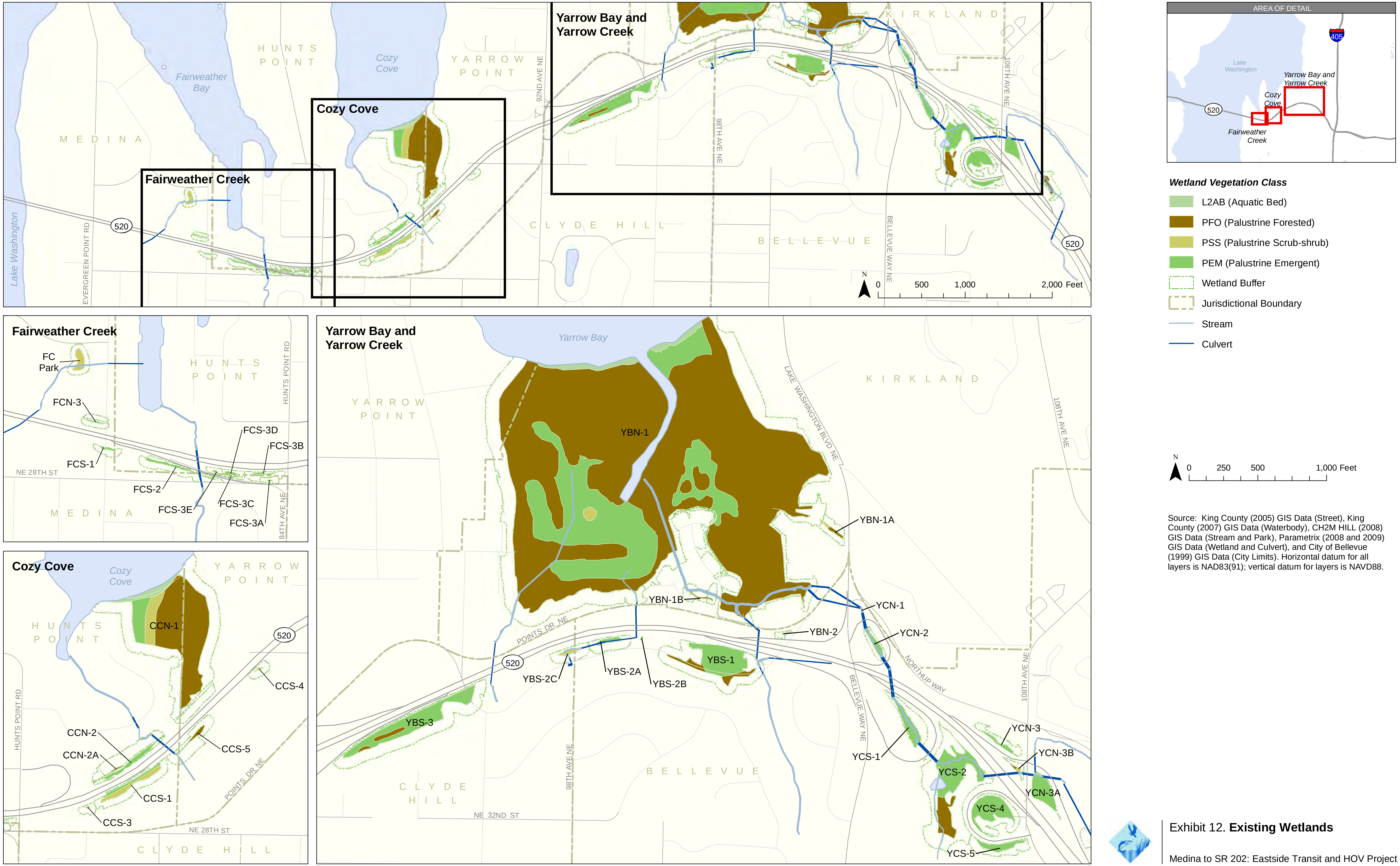
[b] Hruby (2004); see Exhibit 9 for additional information on local wetland ratings.

[c] Wetland CCN-1 and Wetland YBN-1 extend outside of the study area, and the total area of these wetlands is included.

[d] Wetland CCS-2 was deleted because it was determined by USACE to be a ditch in September 2009.

[e] Data from I-405, NE 8th Street to SR 520 Braided Crossing Project (WSDOT 2007).

NA = not applicable



Source: King County (2005) GIS Data (Street), King County (2007) GIS Data (Waterbody), CH2M HILL (2008) GIS Data (Stream and Park), Parametrix (2008 and 2009) GIS Data (Wetland and Culvert), and City of Bellevue (1999) GIS Data (City Limits). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 12. **Existing Wetlands**

Medina to SR 202: Eastside Transit and HOV Project

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The forested communities contain Oregon ash, black cottonwood, Pacific willow, red alder, and a relatively disturbed understory, which may include giant horsetail, common ladyfern, and Himalayan blackberry. The shrub communities include various willows, red-osier dogwood, and Himalayan blackberry. Emergent depressional wetlands include reed canarygrass, bentgrass, and soft rush. Creeping buttercup is also common in many of these wetlands.

Forested wetland

Riverine wetlands form in a narrow zone along streams and rivers that receive overbank flows from the stream. The 11 wetlands classified as riverine in the study area are located along Cochran Springs or Yarrow Creek or its tributaries (YBN-1A, YBS-2C, YCN-1, YCN-2, YCN-3A, YCN-3B, YCN-4A, YCN-7, YCN-8, YCS-1, and YCS-2); they range in size from less than 0.1 acre to over 2 acres (see Exhibit 12). Two of the wetlands listed above have two HGM classes; Wetlands YCN-3A and YCS-2 also have a slope component. These wetlands include forest, shrub, and emergent communities, and species present include red alder, various willow, salmonberry, rose spirea, Himalayan blackberry, cattails, and reed canarygrass.

Scrub-Shrub wetland

Wetlands that have a lake-fringe component are found along the shores of Yarrow Bay and in Wetherill Park. The lake-fringe part of these wetlands is technically outside of the study area; however, it was included to accurately describe the wetlands. Water levels in Lake Washington are the driving hydrologic influence for these wetland categories. The two wetlands that have a lake-fringe class are CCN-1 and YBN-1. They are large wetlands (approximately 8.4 and 75.8 acres, respectively) and include forest, scrub-shrub, emergent, and aquatic bed communities. A greater number of plant species are present in these wetlands than in other wetlands in the study area (see Exhibit 12). In addition to the red alder and black cottonwood found in most wetlands, these two large wetlands also support western red cedar and

Emergent wetland

paper birch. The shrub communities are predominantly willow and salmonberry, although Himalayan blackberry is also present. Emergent communities include mannagrass, American skunkcabbage, watercress, and water parsley.

Slope wetlands typically occur in steeper areas where the groundwater table meets the ground surface or in areas of surface runoff from SR 520. Nineteen wetlands of this type are found in the study area—eight in the Fairweather Creek watershed (FC Park, FCN-3, FCS-2, FCS-3A, FCS-3B, FCS-3C, FCS-3D, and FCS-3E), four in the Cozy Cove Creek watershed (CCS-1, CCS-3, CCS-4, and CCS-5), four in the Yarrow Bay watershed (YBN-2, YBS-1, YBS-2B, and YBS-3), and three in the Yarrow Creek watershed (YCN-5, YCN-6, and YCS-6). These wetlands range from less than 0.1 acre to 2 acres. Wetlands YCN-3A and YCS-2 also have a slope component. Forest, shrub, and emergent communities are represented, and include red alder, Oregon ash, Himalayan blackberry, reed canarygrass, fescue, and soft rush. This vegetation is typical of the more disturbed wetland communities in urbanized areas of Puget Sound.

What functions do wetlands in the study area provide?

Wetlands in the study area perform a variety of water quality, hydrologic, biological, and social functions. Exhibit 13 summarizes these functions according to HGM class.

The depressional wetlands are typically less than 0.3 acre, with the exception of CCN-1 and YBN-1. Although small, these wetlands have the potential to improve water quality because of their vegetation. In addition, Wetlands CCN-2, CCN-2A, and YBS-2A are closed systems that are able to trap pollutants in runoff, which can improve water quality in downgradient areas. The depressional wetlands in the study area have the opportunity to improve water quality because of their proximity to SR 520 and residential development. Wetlands CCN-2 and CCN-2A have moderate functions in reducing flooding and erosion because they do not have any outlets and drain into Yarrow Creek, which has flooding problems. The other depressional wetlands have a limited ability to reduce flooding and stream degradation due to their small sizes and locations low in the watershed.

Exhibit 13. Summary of Wetland Functions in the Study Area

Wetlands by HGM Class	Wetland Functions[a]			
	Water Quality	Hydrologic	Habitat	Social Values
Depressional				
FCS-1, CCN-2, CCN-2A, YBN-1B, YBS-2A, YCN-3, YCS-4, and YCS-5	Moderate	Low to Moderate	Low	None
Riverine[b]				
YBN-1A, YBS-2C, YCN-1, YCN-2, YCN-3B, YCN-4A, YCN-7, YCN-8, and YCS-1	Moderate	Moderate	Low to Moderate	None
Slope				
FC Park, FCN-3, FCS-2, FCS-3A, FCS-3B, FCS-3C, FCS-3D, FCS-3E, CCS-1, CCS-3, CCS-4, CCS-5, YBN-2, YBS-1, YBS-2B, YBS-3, YCN-5, YCN-6, and YCS-6	Low to Moderate	None to Low	Low to Moderate	Only FC Park has educational value
Depressional and Lake-Fringe[c]				
CCN-1 and YBN-1	Moderate to High	Moderate	Moderate to High	Yes

[a] Functions rated using Ecology's wetland rating system (Hruby 2004); this information is available upon request.

[b] YCN-3A and YCS-2 were rated as riverine but both also have a slope component.

[c] CCN-1 and YBN-1 have multiple HGM classes but were rated as depressional (CCN-1: depressional and lake-fringe; YBN-1: depressional, riverine, and lake-fringe).

The depressional wetlands rated low for the potential and opportunity to provide habitat. They are of low quality and contain few habitat features. The depressional wetlands are not publicly owned and are difficult to access; therefore, they do not have educational and recreational uses.

Wetlands CCN-1 and YBN-1 have multiple HGM categories; Wetland CCN-1 is depressional and lake-fringe and YBN-1 is depressional, riverine, and lake-fringe. These wetlands were rated as depressional wetlands; however, they are quite different from the other depressional wetlands because they have more than one HGM class and are much larger. For these reasons, they were grouped separately in Exhibit 13. These wetlands can remove pollutants in runoff (especially YBN-1) from upslope areas, and their vegetation protects the shores of Lake

Washington from erosion; however, they have a limited ability to control flood flow because of their lakeshore location.

The habitat value of these wetlands is moderate to high because of their sizes and diversity. Greater diversity of bird species is generally associated with larger wetlands, but this is likely due to the larger number of habitat types in larger wetlands (Sheldon et al. 2003). Wood ducks use these wetlands, as do other species. Stable water levels and dense emergent and shrub vegetation provide good habitat for invertebrates and amphibians. Wetland-dependent mammals such as beavers may be found in these wetlands, and other wetland users such as opossums, mountain beavers, raccoons, mice, moles, and voles may also use this habitat.

Both wetlands have protected status—CCN-1 is in Wetherill Park and YBN-1 is a designated sensitive area. Wetland CCN-1 is located near homes and the Points Loop Trail. It is publicly owned and contains maintained trails, which allow opportunities for passive and active recreational use. Wetland YBN-1 is publically owned and is accessible via a public trail around the southern boundary; however, it does not have parking nor direct access into the wetland.

Riverine wetlands in the study area can provide storage for overbank flows in Yarrow Creek, and their vegetation can trap pollutants. For these reasons, riverine wetlands rate slightly higher than depressional wetlands for these functions. In addition, the forest vegetation and shrub vegetation (and to a lesser extent the emergent vegetation) protect the banks of Yarrow Creek and provide organic matter to the stream.

The riverine wetlands have a constant supply of water and are connected to other upstream and downstream habitats. Emergent species, trees, and shrubs provide food, cover, and debris that serve as habitat.

All of these factors indicate that these riverine wetlands may provide suitable habitat for invertebrates. Side channels and inundated areas adjacent to the stream also may provide habitat for amphibians. Because of their confined nature and dense tree and shrub cover, riverine wetlands in the study area provide limited habitat for waterfowl but may be desirable for wetland mammals. The connection to other upstream and downstream habitats would also be desirable for beavers and would provide potential travel corridors for casual wetland users such as raccoons and opossums.

The riparian wetlands are located either on restricted WSDOT right of way or on private land and some are difficult to access. For these reasons, the riparian wetlands do not have educational and recreational uses.

Slope wetlands do not effectively store flood flows or trap pollutants because water cannot be stored on slopes or hillsides. Slope wetlands discharge water that can export fine organic matter downslope to neighboring wetlands.

The slope wetlands in the study area cannot retain large amounts of water, so are not likely to provide suitable habitat for wetland-dependent amphibians, reptiles, birds, or mammals. These wetlands do provide habitat for other wetland users and disturbance-tolerant species. Larger forested components of Wetlands YBS-1 and YBS-3 provide structural habitat for disturbance-tolerant species; however, adjacent emergent portions are mowed, which reduces the overall habitat value of the slope wetlands.

Slope wetlands are located on private land or in restricted WSDOT right of way; thus, they are generally inaccessible and educational or research opportunities are not available. The exception is Wetland FC Park in Fairweather Park, which does provide opportunities for recreation and educational uses.

Where in the study area do ditches occur and what functions do they provide?

Four ditches (Ditches DCCS2-1, DYBS1-1, DYBS3-1, and DYCS4-1) in the study area met USACE jurisdictional criteria and might be affected by the project. Two of these ditches have standing water during the field investigation (Ditches DCCS2-1 and DYCS4-1); the other two ditches (Ditches DYBS1-1 and DYBS3-1) had flowing water. The primary function of the identified ditch segments is conveyance.

Potential Effects of the Project

What methods were used to evaluate potential effects on wetlands?

The GIS team calculated the physical effects of the proposed project by overlaying the operation and construction limits onto the wetland and buffer maps to determine the extent and location of fill and clearing for the Build Alternative. The ecosystems analysts used the GIS data and other information to evaluate project effects on wetland functions and values. The calculations of wetland and buffer fill were based on preliminary engineering and are approximate.

How would project construction affect wetlands?

To build the new road and other project-related facilities, some construction would take place outside of the footprint of the permanent infrastructure. Construction effects would result from the installation of temporary structures, the placement of temporary fill for roads or staging, and clearing activities in adjacent portions of the right of way. The construction limits would extend beyond the area affected by the permanent infrastructure, increasing the type and amount of wetland alteration. After project construction was complete, the areas affected by construction will be restored and replanted with appropriate native vegetation.

How much additional wetland area would project construction affect?

Build Alternative

Construction of the Build Alternative would affect 1.6 acres of wetland outside of the permanent road footprint. Less than 0.1 acre of Category I wetland (all forested); 1.4 acre of Category II wetland (less than 0.1 acre forested, 1.4 acre emergent); and 0.1 acres of Category III wetland (all emergent) would be temporarily affected.

In addition, 0.9 acre of wetland buffer would be affected by construction. Trees and shrubs would be cleared in certain areas to facilitate road construction. The largest area of construction effects would be associated with improvements to Yarrow Creek (Wetland YCS-2). WSDOT will revegetate the affected areas after construction and stabilize any exposed areas to minimize adverse effects. A temporary erosion and sedimentation control plan will be implemented to minimize effects.

No Build Alternative

There would be no construction effects to wetlands or wetland buffers related to the No Build Alternative.

How would operation of the project affect wetlands?

The Build Alternative would expand the existing road and bicycle/pedestrian corridor, and build stormwater facilities in and adjacent to wetlands and wetland buffers. Construction would remove trees and shrubs, and convert pervious areas to impervious areas. Filling a wetland or altering its vegetation reduces the wetland's capacity to store stormwater, filter pollutants, protect stream banks and lakeshores, and provide wildlife habitat. These alterations can also reduce the uniqueness of wetlands (by removing some vegetation types) or decrease their educational or scientific value by limiting access, thereby reducing the wetland size or changing the wetland character.

Throughout this document, the term **operational effects** is used to distinguish the effects associated with the installation of permanent facilities, such as the new roadway, from the effects of construction activity (which are temporary). Characterizing these effects as permanent does not mean they would not be offset through appropriate mitigation actions. All effects of the project, whether operational or associated with construction, will be appropriately mitigated.

WSDOT will mitigate for the effects of the Build Alternative by creating, restoring, and/or enhancing wetlands in accordance with federal, state, and local laws. The goal of the mitigation will be to achieve no net loss of wetland functions and values, including hydrologic and habitat functions (see the *Wetlands Mitigation* discussion at the end of this section).

How much wetland area would be filled as a result of the project?

Build Alternative

The Build Alternative would widen the roadway surface from 4 lanes to 6 lanes, improve existing on- and off-ramps, replace existing culverts, and add or expand stormwater facilities at 11 locations to treat runoff from existing and new road surfaces. These activities would fill approximately 7.0 acres of wetland in the SR 520 corridor. This would include less than 0.1 acre of Category I (all forested) wetland; 0.3 acre of Category II wetland (less than 0.2 acre forested and 0.1 acre emergent); 4.9 acres of Category III wetlands (0.4 acre forested, 0.1 acre scrub-shrub, and 4.4 acre emergent); and 1.8 acre of Category IV wetland (0.3

Permanent Wetland Effects for the Build Alternative (in acres)

Type of Effect	Wetland	Wetland Buffer
Fill	~7.0	~1.7

acre scrub-shrub and 1.5 acre emergent). The Build Alternative would also fill approximately 1.7 acres of wetland buffer. Affected wetlands and buffers are shown in Exhibits 14 and 15.

The Build Alternative would completely fill 22 wetlands (FCN-3, FCS-1, FCS-2, FCS-3A through 3E, CCN-2, CCN-2A, CCS-1, CCS-3, CCS-4, CCS-5, YBN-2, YBS-2A, YBS-2B, YBS-2C, YBS-3, YCN-1, YCN-3, and YCN-3B). The filling of most of these wetlands would be a direct result of widening SR 520. Of these wetlands, 5 are depressional, 3 are riverine, and 14 are slope HGM classes. Most of these wetlands are small (19 are 0.1 acre or less) and were likely formed as a result of the original construction of SR 520. The remaining wetlands that would be completely filled range from 0.2 acre to 2.1 acres. The largest of these is Wetland YBS-3 (2.1 acres). In addition, approximately 74 percent (1.4 acres) of Wetland YBS-1 within the study area would be filled; however, this wetland extends outside of the study area and filling would not result in a complete loss of the wetland, because the remaining area would still maintain wetland characteristics and functions.

The Build Alternative would also partially fill eight other wetlands. Wetland YBN-1 is a large lake-fringe, riverine, and depressional wetland; less than 0.1 acre of this wetland would be affected by project operation. This effect would be related to the Yarrow Creek improvements. Wetland YCN-2 is a riverine wetland and one-quarter of it would be filled (less than 0.1 acre). Wetland YCN-3A is a riverine and slope wetland and approximately 70 percent of it would be filled (0.4 acres). Wetland YCN-4A is a small riverine wetland, with approximately 15 percent (less than 0.1 acre) affected by project operation. Wetland YCS-2 is a large riverine and slope wetland; approximately 10 percent (0.2 acre) of this wetland would be permanently filled and 0.4 acre of its buffer affected. Some of the operational effects associated with Wetland YCS-2 and YCS-1 would be associated with the improvements to the East Tributary to Yarrow Creek. Wetland YCS-1 is riverine wetland and approximately 10 percent would be filled (less than 0.1 acre). Wetland YCS-4 is a depressional wetland and 70 percent would be filled (1.0 acre). Wetland YCS-5 is a small depressional wetland, and less than 0.1 acre of this wetland would be filled. In addition, all three jurisdictional ditches would be permanently filled.

As mentioned above, 1.7 acres of wetland buffer would be permanently filled. Less than 0.1 acre of Category I wetland buffer, 0.2 acre of Category II wetland buffer, 1.1 acres of Category III wetland buffer, and 0.5 acre of Category IV wetland buffer would be affected. Affected buffers are shown in Exhibits 14 and 15.

Summarizing the fill effects by HGM class, the Build Alternative would fill 4.4 acres of slope wetland, 0.4 acre of riverine wetland, 1.5 acres of depressional wetland, 0.6 acre of wetland with two HGM classes (riverine and slope), and less than 0.1 acre of a wetland with three HGM classes (lake-fringe, riverine, and depressional). WSDOT will provide mitigation to compensate for the adverse effects.

No Build Alternative

The No Build Alternative would not fill wetlands in the SR 520 corridor.

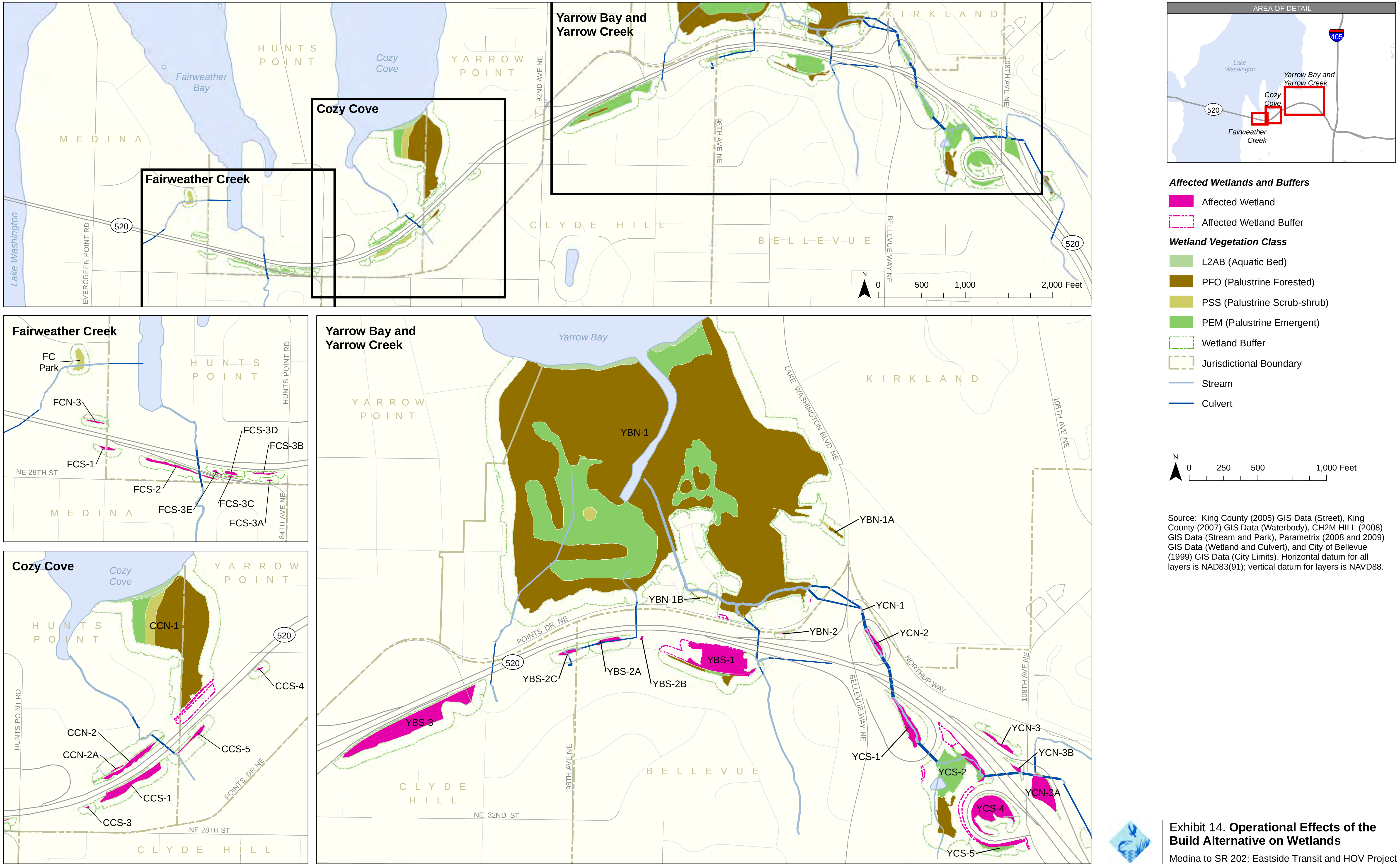

Exhibit 14. **Operational Effects of the Build Alternative on Wetlands**

Medina to SR 202: Eastside Transit and HOV Project

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Exhibit 15. Affected Wetlands and Wetland Buffers in the Study Area

	Operational (acres)[a]		Construction (acres)[a]	
Wetland	Wetland	Buffer	Wetland	Buffer
Fairweather Creek				
FC Park	-	-	-	-
FCN-3	<0.1	-	-	-
FCS-1	<0.1	-	-	-
FCS-2	0.2	-	-	-
FCS-3A	<0.1	-	-	-
FCS-3B	<0.1	-	-	-
FCS-3C	<0.1	-	-	-
FCS-3D	<0.1	-	-	-
FCS-3E	<0.1	-	-	-
Cozy Cove				
CCN-1	-	0.5	-	<0.1
CCN-2	0.3	-	-	-
CCN-2A	<0.1	-	-	-
CCS-1	0.5	-	-	-
CCS-3	<0.1	-	-	-
CCS-4	<0.1	-	-	-
CCS-5	0.1	-	-	-
Yarrow Bay				
YBN-1	<0.1	<0.1	<0.1	<0.1
YBN-1A	-	-	-	-
YBN-1B	-	-	-	-
YBN-2	<0.1	-	-	-
YBS-1	1.4	0.6	-	<0.1
YBS-2A	0.1	-	-	-
YBS-2B	<0.1	-	-	-
YBS-2C	0.1	-	-	-
YBS-3	2.1	-	-	-

Exhibit 15. Affected Wetlands and Wetland Buffers in the Study Area

	Operational (acres)[a]		Construction (acres)[a]	
Wetland	Wetland	Buffer	Wetland	Buffer
Yarrow Creek				
YCN-1	<0.1	-	-	-
YCN-2	<0.1	-	<0.1	-
YCN-3	0.1	-	-	-
YCN-3A	0.6	<0.1	-	<0.1
YCN-3B	<0.1	-	-	-
YCN-4A	<0.1		<0.1	
YCN-5	-	-	-	-
YCN-6	-	-	-	-
YCN-7	-	-	-	-
YCN-8	-	-	-	-
YCS-1	0.1	-	0.3	-
YCS-2	0.2	0.2	1.1	0.5
YCS-4	1.0	0.5	-	0.3
YCS-5	<0.1	<0.1	<0.1	<0.1
YCS-6	-	-	-	-
Total	**7.0**	**1.7**	**1.6**	**0.9**

[a] "-" no effect.
[B] Wetland CCS-2 was deleted because it was determined to be a ditch by USACE in September 2009.

How would the project affect the water quality and hydrologic functions of wetlands?

Build Alternative

The Build Alternative would increase the impervious surface of the roadway by 1 to 32 percent, depending on the basin (WSDOT 2009a). Eleven new stormwater facilities (seven constructed wetlands, one media filter drain, one water quality vault, one bioswale, and one detention pond) would be constructed to treat and detain stormwater runoff from the existing and new road surfaces. The Build Alternative would be designed according to the 2008 *Highway Runoff Manual* (WSDOT 2008); as a result, it would likely not affect the hydrologic functions of wetlands in the study area.

The Build Alternative would reduce the amount of wetland area available to provide water quality functions. However, new stormwater facilities would be constructed to mitigate for water quality functions lost in this portion of the study area. Compared with existing conditions, the Build Alternative would add stormwater treatment along the roadway where none currently exists. Sediment loads in roadway runoff would be reduced in all basins in the study area. Metals loading would increase or decrease depending on the individual basin, but overall, the metal loading would slightly decrease. Effects on water quality within specific basins are discussed in the Water Resources Discipline Report (WSDOT 2009a).

Effects of the Build Alternative on hydrologic functions for each wetland type are discussed further below. Wetland restoration and enhancement will be provided to offset and compensate for these effects.

Depressional Wetlands

Most of the depressional wetlands in the study area would be filled (either completely or nearly so) under the Build Alternative. Filling these wetlands could reduce the water storage capacity of the affected basins. However, because SR 520 is located in the lower portions of the watershed, reducing the water storage capacity would have a relatively small effect on peak flow discharges. The proposed stormwater facilities would detain and release flows to Lake Washington and streams in the study area.

In the study area, depressional wetlands could be susceptible to hydrologic alterations caused by increases in impervious surface. The likelihood and magnitude of these types of effects depend on how much of a wetland's contributing drainage area is filled. For example, if a substantial portion of the drainage area for an individual wetland is filled, the resulting hydrologic change (less water reaching the wetland) could alter the wetland hydroperiod (the length of time that the wetland is saturated or inundated), which could in turn change the plant composition.

Most of the depressional wetlands that would be filled under the Build Alternative are small (0.3 acre or less), and they do not likely play a substantial role in improving water quality because of the limited surface area available for sediment trapping and biofiltration. Wetland YCS-4, a 1-acre depressional wetland, would be completely filled; however, it has low potential to improve water quality because it is mowed occasionally. In addition, a stormwater wetland would be constructed in the same location, which would function to detain water and improve water quality. The water quality treatment provided by the proposed stormwater facilities should offset the functional loss of these depressional wetlands to a large degree. Moreover, additional wetland mitigation would be provided to compensate for the effects.

Lake-Fringe Wetlands

Under the Build Alternative, there would be no operational effects to Wetland CCN-1 and only minor effects to Wetland YBN-1. Effects to Wetland YBN-1 would be less than 0.1 acre and are discussed above. These water levels would not be affected by the relatively small changes in impervious surface.

Riverine Wetlands

Almost all of the riverine wetlands in the study area would be affected by the project. Most of these effects to wetlands would be related to mitigation for fish resources. WSDOT will make numerous improvements to Yarrow Creek and the South Fork Yarrow Creek, including restoring and lengthening portions of the channel and restoring and improving habitat. In addition, WSDOT will provide stormwater treatment for all new and existing impervious surfaces within the study area. Also, treated stormwater would be discharged into Yarrow Creek within the wetlands and all water would be detained and released to emulate the natural hydrograph. There would be minor effects to the hydrologic functions of riverine wetlands. Overall, habitat would be improved. Please refer to the *Fish Resources* section for more details.

Slope Wetlands

Groundwater seeping at the surface is the primary source of water for slope wetlands. The Build Alternative would completely fill Wetland YBS-3 (2.1 acres), and partially fill a large portion of Wetland YBS-1 (1.6 acres). Both of these wetlands are Category III. These wetlands provide minimal hydrologic functions because slope wetlands do not impound significant amounts of water. However, some water quality functions would be lost from the loss of vegetation and small depressions that trap sediment.

No Build Alternative

The No Build Alternative would not change the amount of impervious surface in the study area, and no changes to hydrologic functions would be expected. Currently, water runs off SR 520 directly into streams and wetlands. Under the No Build Alternative, this untreated runoff, which carries pollutants from the road surface to the streams and wetlands, would continue.

How would the project affect the habitat functions of wetlands?

Build Alternative

The Build Alternative would fill wetlands with different HGM characteristics; refer to Exhibit 17 for a summary. WSDOT will provide mitigation to compensate for adverse effects on habitat functions in the study area.

Depressional Wetlands

The Build Alternative would affect small depressional wetlands throughout the study area. Most of these wetlands have low to moderate habitat functions because of their limited size, relatively homogenous structure, and periodic disturbance from mowing. Nevertheless, this alternative would reduce the amount of cover and foraging habitat for invertebrates, amphibians, some (nonwetland) birds, and mammals that occasionally use these wetlands.

Lake-Fringe Wetlands

The Build Alternative would not affect habitat in Wetland CCN-1 and the lake-fringe component of Wetland YBN-1. Wetlands with multiple HGM classes provide high-quality habitat because of their size and diversity.

Riverine Wetlands

The Build Alternative would affect riverine wetlands associated with Yarrow Creek. These wetlands provide suitable habitat for many species of birds and invertebrates, and Yarrow Creek and its tributaries may provide habitat for amphibians. The tree and shrub cover in the riparian corridor provides shade for fish that are presumed to use these streams. The riparian corridor also provides some connectivity to other wetlands upstream and downstream, which makes some of these wetlands desirable habitat for beavers. Casual wetland users and disturbance-tolerant species may also use these wetlands as a travel corridor. By displacing a portion of this habitat, the Build Alternative could decrease the food, cover, and nesting/breeding habitat available to the species mentioned above. However, WSDOT is proposing to improve Yarrow Creek and South Fork Yarrow Creek, which would improve the habitat in this area.

The Build Alternative would completely fill Wetlands YCN-2 and YCN-3A and partially fill Wetland YCS-2, which have both riverine and slope HGM classes. In this area, WSDOT will make habitat improvements to the East Tributary to Yarrow Creek, which will offset the negative effects to wetlands associated with the East Tributary to Yarrow Creek.

Slope Wetlands

Slope wetlands in the study area provide small areas of seasonal surface water that can serve as habitat for invertebrates and possibly other animals. Wetland YBS-1 and Wetland YBS-3 make up most of the slope wetland effects. However, these wetlands have poor quality habitat, in part due to their locations adjacent to SR 520. As a result, the effects to habitat would be low.

No Build Alternative

The No Build Alternative would not fill wetlands or buffers, so no wetland habitat would be lost. The wetlands would continue to receive untreated runoff that could affect the habitat quality of the wetlands. Wetlands would likely continue to be maintained (mowed) within the SR 520 right of way, which would decrease habitat quality.

How would the alternatives differ in their effects on wetlands?

Areas of wetland fill or alteration under the Build Alternative and No Build Alternative are summarized in Exhibit 16, and functional effects are summarized in Exhibit 17.

Exhibit 16. Summary of Wetland and Buffer Effects (in acres)

Wetland Category[a]	No Build Alternative		Build Alternative	
	Wetland	**Buffer**	**Wetland**	**Buffer**
Construction Effects[b]				
I	No fill or clearing in wetlands or buffers.		<0.1	<0.1
II			1.4	0.5
III			0.1	<0.1
IV			-	0.3
Total			1.6	0.9
Operational Effects				
I	No fill in wetlands or buffers.		<0.1	<0.1
II			0.3	0.2
III			4.9	1.1
IV			1.8	0.5
Total			7.0	1.7

Note: Affected areas were calculated using GIS analysis data gathered in the field and existing information. Affected area estimates were based on preliminary design information and are subject to change. Totals may not add up due to rounding.

[a] Hruby (2004).

[b] Construction effects are clearing of vegetation.

No wetland or buffer areas would be filled or cleared with the No Build Alternative. However, the No Build Alternative would not treat runoff from the roadway, which has a continuing negative effect on water quality and habitat downstream from SR 520. Wetlands would likely continue to be maintained (mowed) within the SR 520 right of way, which decreases the habitat quality. There would be no construction effects because no construction would occur under this alternative. No mitigation would be required or implemented under this alternative.

The Build Alternative would affect wetland and buffer areas, and would have a correspondingly larger effect on wetland functions than the No Build Alternative. WSDOT will mitigate these effects to result in no net loss of functions. Wetlands mitigation is described in the following section.

Construction of the Build Alternative would temporarily clear wetland and upland vegetation. Emergent wetlands and forested buffers would be most affected by the clearing activities.

Exhibit 17. Summary of Effects on Wetland Functions

Wetlands by HGM Class	Wetland Functions[a]			
	Water Quality	**Hydrologic**	**Habitat**	**Social Values**
Depressional				
FCS-1, CCN-2, CCN-2A, YBS-2A, YCN-3, YCS-4, and YCS-5	Less wetland area reduces the potential to remove pollutants; stormwater treatment would generally reduce some pollutant loading downstream.	Filling wetland would reduce the capacity of these wetlands to provide flood storage.	Minimal effect to habitat because these wetlands provide poor habitat.	Do not provide this function.
Riverine[b]				
YBS-2C, YCN-1, YCN-2, YCN-3B, YCN-4A, and YCS-1	Less wetland area reduces the potential to remove pollutants; stormwater treatment would generally reduce some pollutant loading downstream.	Filling wetland would reduce the capacity of these wetlands to provide flood storage.	Moderate effects to habitat. However, improvements to Yarrow Creek would offset these effects.	Do not provide this function.
Slope				
FCN-3, FCS-2, FCS-3A, FCS-3B, FCS-3C, FCS-3D, FCS-3E, CCS-1, CCS-3, CCS-4, CCS-5, YBN-2, YBS-1, YBS-2B, and YBS-3	Less wetland area reduces the potential to remove pollutants; stormwater treatment would generally reduce some pollutant loading downstream.	Filling wetland would reduce the capacity of these wetlands to provide flood storage. Effect would be small because slope wetlands provide low to no hydrology functions.	Minimal effect to habitat because these wetlands provide poor habitat.	Only FC Park has educational value, and it would not be affected.
Depressional and Lake-Fringe[c]				
YBN-1	No effect	No effect	No effect	No effect

[a] Functions rated using Ecology's wetland rating system (Hruby 2004); detailed rating forms are available upon request.

[b] YCN-3A and YCS-2 were rated as riverine but both also have a slope component.

[c] YBN-1 has multiple HGM classes but was rated as depressional (YBN-1: depressional, riverine, and lake-fringe).

Wetlands Mitigation

Federal regulators, Washington state agencies (including WSDOT), and some local governments require that mitigation efforts follow a prescribed sequence:

1. Avoid the effect altogether by not taking a certain action or parts of an action;
2. Minimize the effect by limiting the degree or magnitude of the action and its implementation by using appropriate technology or by taking affirmative steps to avoid or reduce effects;
3. Rectify the effect by repairing, rehabilitating, or restoring the affected environment;
4. Reduce or eliminate the effect over time by preservation and maintenance operations during the life of the action;
5. Compensate for the effect by replacing, enhancing, or providing substitute resources or environments; or
6. Monitor the effect and take appropriate corrective measures.

Despite extensive avoidance and minimization measures, the Build Alternative would have unavoidable effects on wetlands and buffers. These unavoidable effects would be offset by compensatory mitigation. The No Build Alternative would not affect wetlands or buffers; therefore, no mitigation would be implemented under this alternative.

What has been done to avoid or minimize negative effects on wetland?

WSDOT has designed the project to minimize the operational and construction effects of the Build Alternative to the greatest extent practicable. Total avoidance was not possible due to the location of the project along the existing road rights of way and the constraints associated with safety and design guidelines. Specific aspects of the design that have been incorporated to avoid and minimize effects on wetlands include the following:

- Retaining walls will be used instead of standard fill slopes to reduce the footprint of the at-grade roadway sections and reduce the amount and extent of wetland fill.

- Noise walls will be installed along the majority of the SR 520 corridor to minimize noise disturbance, which would benefit wildlife using the wetland habitat adjacent to the roadway.
- Stormwater treatment facilities will be constructed to treat roadway runoff before discharging to downstream aquatic habitat. This would improve water quality in the study area.
- Existing roadway ramps will be removed to offset some of the effects of new impervious surface and create areas for habitat restoration.

WSDOT would use BMPs during construction. These practices include implementing temporary erosion and sediment control measures and a stormwater management and pollution prevention plan; operating construction equipment from mats or steel plates to minimize soil compaction when working in or near sensitive areas; and prohibiting servicing and refueling of vehicles within 100 feet of wetlands to reduce potential spills of petroleum and hydraulic fluids in sensitive areas. WSDOT would restore cleared areas to preconstruction grades and replant the areas with appropriate native herbaceous and woody species.

How would the project repair, rehabilitate, or restore effects on wetlands?

After project construction is complete, the areas temporarily affected by construction would be restored and replanted with appropriate vegetation.

How could the project compensate for unavoidable adverse effects on wetlands?

Compensatory mitigation will be used to replace the areas of wetland and buffer filled and to offset the loss of wetland and buffer functions. No buffer replacement would be provided if there was a complete loss of wetland area and function. Wetland buffers would be required on wetlands that were used in the mitigation. The goal of the compensatory mitigation would be to achieve no net loss of wetland area or function.

Most of the affected wetlands in the study area are Category III and IV, with smaller effects to Category II wetlands. These effects are expected to be mitigated at several sites with wetlands that rated Category II, but with significant areas of invasive species or relatively low habitat scores.

The final compensatory mitigation for the project will be a comprehensive package developed in accordance with federal, state, and local regulatory agencies. This package will be consistent with WSDOT policy regarding compensatory wetland mitigation.

According to the wetlands ordinance for the municipalities of Medina (2005), Kirkland (2002, retrieved February 13, 2009), and Bellevue (2006, retrieved February 13, 2009), the standard ratios for creation or re-establishment of wetlands are the same as those presented jointly by USACE and Ecology in the *Wetland Mitigation in Washington State: Part 1*: *Agency Policies and Guidance* (Ecology et al. 2006). No ratios are provided for rehabilitation or enhancement in these municipalities. Hunts Point, Clyde Hill, and Yarrow Point do not have mitigation requirements listed in their codes. As result, the ecosystems analysts used mitigation ratios by Ecology (2006) to determine the amounts of wetland mitigation. These ratios are not necessarily the ratios that would be used for the SR 520, Medina to SR 202: Eastside Transit and HOV Project but serve as guidance.

Approach to Mitigation

WSDOT identified wetland mitigation candidates sites using a hierarchical selection process based on the watersheds in the study area. The process was intended to provide a list of sites that not only provide mitigation appropriate to the level of project effects, but that provide benefits that extend beyond the site boundaries. Examples of these benefits include addressing limiting factors at the watershed level and providing critical linkages in habitat corridors.

Key steps in the mitigation site selection process are as follows:

- The mitigation site selection study area includes the area from Juanita Creek basin on the north to Interstate 90 (I-90) on the south, Lake Sammamish drainage to the east, as well as portions of the cities of Bellevue, Kirkland, and Redmond.

- To select the most appropriate potential wetland mitigation sites, WSDOT identified nine broad parameters that would define the best sites for the master list of potential mitigation sites. These nine parameters were divided into opportunity parameters and risk parameters. The "opportunity set" includes size, mitigation type, special characteristics (e.g., sites with high restoration potential, palustrine and riverine habitats), location, and cost. The "risk set" includes availability, hydrology, hazardous waste, and cultural resources.

- The initial screening focused more on risk factors to eliminate high-risk sites quickly, and then focused on opportunities.
- Generally, the sorting identified the top 10 sites with the greatest mitigation potential.
- Final site selection was based on the amount of mitigation available at the sites and suitability of the mitigation. The selection incorporated input from the Multi-Agency Permitting (MAP) Team and local jurisdiction.

Proposed Wetland Mitigation

The proposed project would adversely affect 8.6 acres of wetlands (7.0 acres from operation and 1.6 acres from construction effects). These numbers have not been adjusted to subtract conversion of wetlands to streams or stream buffer. These effects would reduce or eliminate water quality, hydrologic, and habitat functions in the affected wetlands and watersheds.

To meet requirements of federal, state, and local regulations and policies, WSDOT proposes to rehabilitate26.9 acres of Category II riverine/depressional flow-through wetland at the Keller Mitigation Site in Redmond, Washington. This mitigation site is located between the confluence of Bear and Evans Creek in the Sammamish River Basin near the eastern terminus of the project. The proposed rehabilitation is expected to provide or exceed the same type and level of wetland functions as those affected by the project.

In addition to the wetland effects, the project will affect 2.6 acres (1.7 acres from operation and 0.9 acre from construction) of standard wetland buffers. Mitigation for effects to buffers will take the form of buffers appropriate to protect the expected wetland functions at the Keller Mitigation Site. The width of these buffers will be based on the Ecology/USACE/EPA joint guidance (Ecology et al. 2006), and will incorporate the expected wetland rating, habitat value, and nearby land uses. In areas where the proposed buffers are actually wetland, one-half of the mitigation ratio for wetland mitigation will be assumed. Based on the current level of information, the area of wetland to be used as buffer is expected to be approximately 3.4 acres. Exhibit 18 summarizes the overall mitigation needs of the project.

Exhibit 18. Potential Mitigation Needs for the Project

Operational Wetland Effects[a]		Rehabilitation of Same Category Wetland	
Ecology Wetland Category	Area (acres)	Ratio	Proposed Rehabilitation Area (acres)
Category IV	1.8	3:1	5.4
Category III	4.9	4:1	19.6
Category II	0.3	6:1	1.8
Category I	< 0.1	12:1	0.1
Total Mitigation Provided	7.0		26.9

Source: Granger et al. (2005)

[a] Affected wetland areas are based on the design as of September 21, 2009.

There would be approximately 31.6 acres of area available for potential mitigation at the proposed mitigation site. The proposed rehabilitation provides sufficient mitigation for all of the effects resulting from the project and meets the requirements as outlined in the joint guidance Ecology/USACE/EPA (Ecology et al. 2006). Because the site selected is a relatively distinct ecological unit, it would not be appropriate to rehabilitate only the portion necessary for the SR 520, Medina to SR 202: Eastside Transit and HOV Project. As a result, the mitigation concept provides excess wetland/functional buffer mitigation. The excess mitigation capacity at the Keller Mitigation Site will serve as advance mitigation for wetland and stream impacts associated with future WSDOT roadway improvement projects.

The construction of the project would affect 1.6 acres of wetlands. These effects would result from culvert replacements and stream improvements in the Yarrow Creek corridor. Mitigation for construction effects will be onsite at a 1:1 ratio. Specific mitigation activities will include culvert replacement, fish passage improvements (some locations), stream habitat improvements, and replanting disturbed riparian areas (including wetlands and buffers) with native trees and shrubs that are generally absent in these areas currently.

Fish Resources

Why are fish resources important?

The Lake Washington watershed supports a diverse group of fish species, including several species of native salmon and trout. Many of these species are an integral part of the economy and culture of the Pacific Northwest. Large-scale alteration and destruction of fish habitat within the Lake Washington watershed has occurred over the last 100 years, adversely affecting local fish populations. The fish resources of Lake Washington and the streams and rivers that drain into the lake may be further affected in different ways by the alternatives proposed for the project. This section describes the assessment of those resources to provide the foundation for evaluating the potential effects of the project alternatives on fish resources.

The study area includes both anadromous salmonids (fish that migrate to the ocean) produced in the Lake Washington watershed and resident salmonids (fish that spend their entire lives within a freshwater stream). The project alternatives have the potential to either positively or negatively affect productions of salmonids and other aquatic organisms within the Lake Washington watershed, including threatened populations of Chinook salmon and steelhead, and bull trout.

Is the project within a recognized tribal fishing area?

The project site is within the “usual and accustomed” fishing areas of the Muckleshoot Indian Tribe. The Muckleshoot usual and accustomed fishing area includes Lake Washington.

The Muckleshoot and other tribes harvest adult salmon from Lake Washington pursuant to judicially recognized treaty rights, as interpreted by the Boldt Decision of 1974. Over the years, judicial decisions have affirmed that treaty Indian Tribes have a right to harvest fish free of state interference, subject to conservation principles; to co-manage the fishery resource with the state; and to harvest up to 50 percent of the harvestable fish. (For details on these judicial decisions, refer to *United States v. Washington*, 384 F. Supp. 312 [W.D. Wash. 1974], aff’d 520 F.2d 676 [9th Cir. 1975]; *Washington v. Washington State Commercial Passenger Fishing Vessel Ass’n*, 433 U.S. 658 [1979]).

The Muckleshoot Tribe has a staff of fisheries biologists that takes an active role in managing salmonids within the area. Tribal fishing can occur at multiple and variable locations within the Lake Washington system. WSDOT is coordinating with the Muckleshoot Tribe because the proposed project could affect access to the Muckleshoot's affirmed treaty fishing areas. For more information, see the Indian Fishing Rights section in the Cultural Resources Technical Memorandum (WSDOT 2009a).

Affected Environment

How was the information on streams and fish resources collected?

Ecosystems analysts collected documented information on fish species and their distribution and habitat within the area by reviewing literature such as peer-reviewed articles in scientific journals, technical reports, and data from various state, county, and city agencies. The biologists also inspected habitat conditions within area streams.

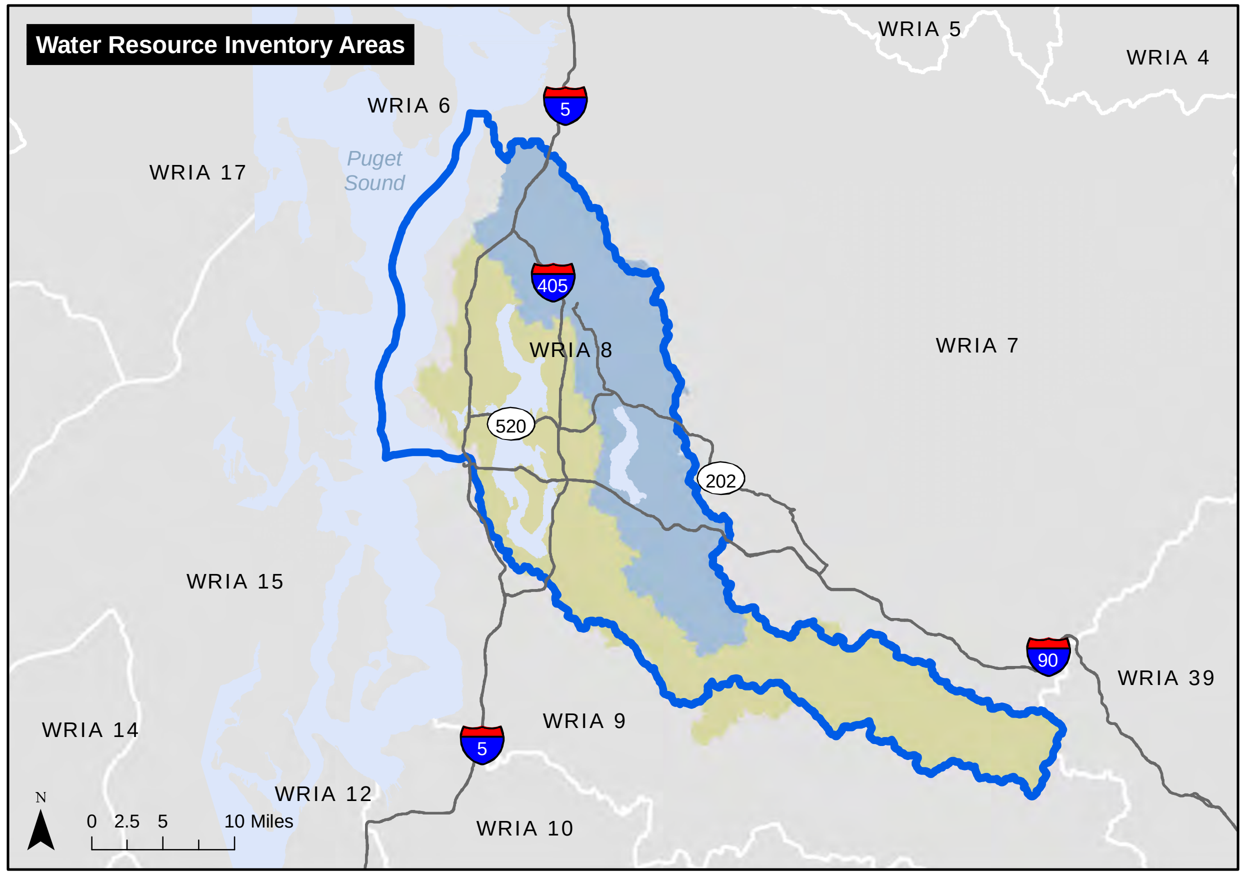
What field surveys of fish resources and habitat were conducted for this project?

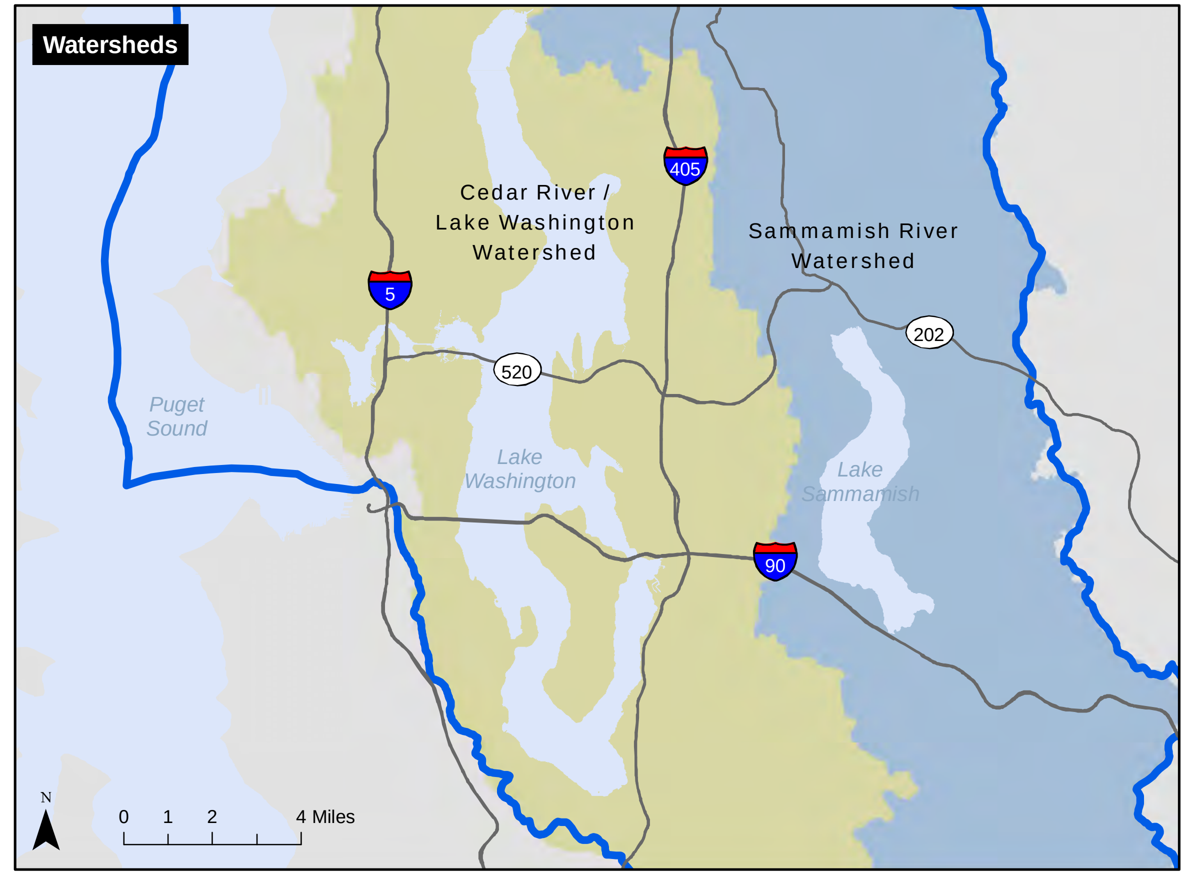
The biologists surveyed and characterized the in-stream habitats of the following Lake Washington tributary streams within and adjacent to the project right of way: unnamed tributary to Fairweather Bay, Fairweather Creek, Cozy Cove Creek, Yarrow Creek, South Fork Yarrow Creek, and three tributaries to Yarrow Creek (east, west, and two tributaries to Yarrow Bay wetlands). The biologists used stream habitat survey procedures consistent with the current King County Level I (Basic) stream survey methods and guidelines (King County 1991), except that pools were measured using methods to account for residual pool size (Pleus et al. 1999).

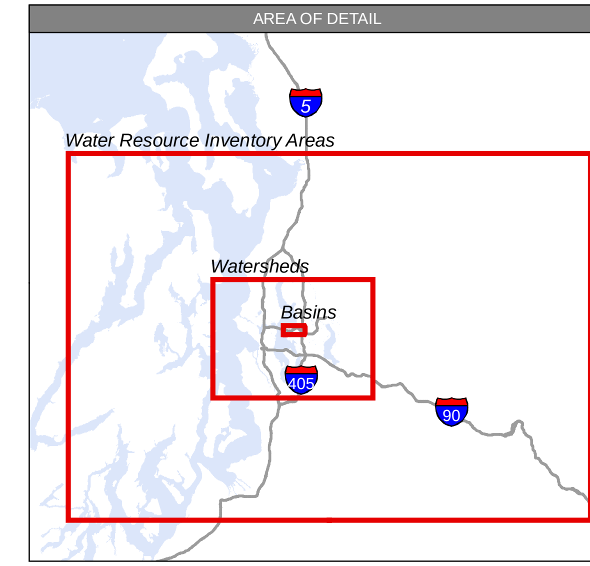
The habitat surveys occurred from August 7 to August 16, 2007, and involved measurements and/or qualitative descriptions of in-stream and riparian habitat features, including in-stream habitat type, stream widths and depths, stream bank condition and stability, substrate composition, large woody debris (LWD) presence, riparian vegetation type and condition, and the presence of fish passage obstructions. For each stream, these features were surveyed in an area that extended about 500 feet upstream and downstream of the SR 520 corridor. The biologists determined fish usage, in part, from existing data and discussions with local resource agency representatives. Additional methods included visual sightings of fish in the creeks and spotchecking with a backpack electroshocker in May 2002 (although electrofishing efforts were limited in scope and scale and were used only to document the presence of individual fish species but not the absence of any particular species). Resource agency representatives and the ecosystems analysts inspected aquatic and riparian habitat and fish passage conditions along the SR 520 corridor on multiple occasions during development of the project alternatives.

What are the general habitat characteristics of Lake Washington and its tributaries?

Lake Washington and the entire study area are within the Lake Washington watershed (water resource inventory area [WRIA] 8). See the Water Resources Discipline Report (WSDOT 2009b) for information on water quality in the study area. The Lake Washington watershed comprises 13 major drainage subbasins and numerous smaller drainages, totaling about 656 miles of streams, two major lakes, and numerous smaller lakes (Exhibit 19). The eastern shoreline of Lake Washington occurs along the Eastside communities of Medina, Hunts Point, Yarrow Point, Bellevue, and Kirkland. There are tributaries supporting important fish resources in all of the Eastside communities, including Clyde Hill (Exhibit 20). Attachment 1 provides information on tributaries to Lake Washington.







Study Area

Jurisdictional Boundary

Water Resource Inventory Area 8 Boundary

Water Resource Inventory Area

Watershed

Cedar River / Lake Washington Watershed

Sammamish River Watershed

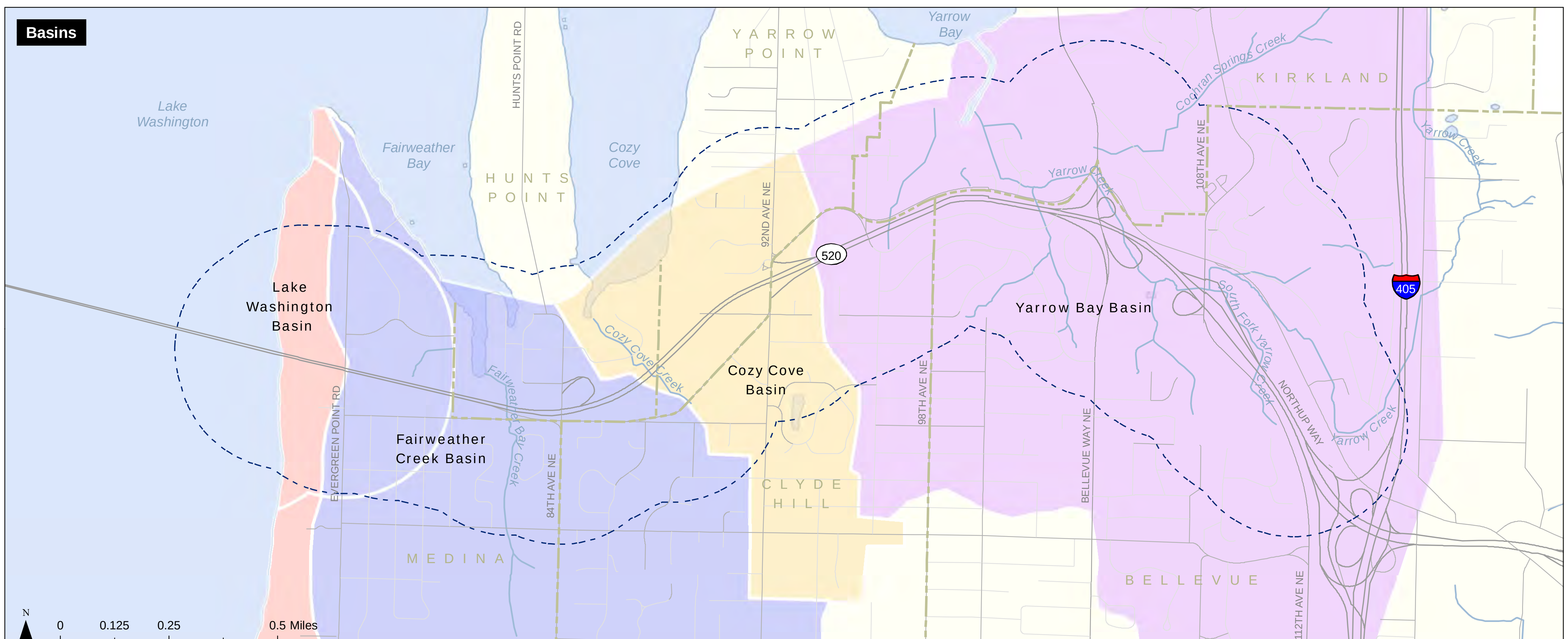
Creek Basin

Cozy Cove

East Lake Washington

Fairweather Creek

Yarrow Creek



Source: Ecology (2000) GIS Data (WRIA), WSDOT (2004) GIS Data (State Route), King County (2004) GIS Data (City Limits), King County (2005) GIS Data (Stream and Street), King County (2007) GIS Data (Waterbody), City of Bellevue (1999) GIS Data (City Limits), and King County (2006) GIS Data (Watershed). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 19. **Location of Affected Watersheds, Basins and Creeks**

Medina to SR 202: Eastside Transit and HOV Project

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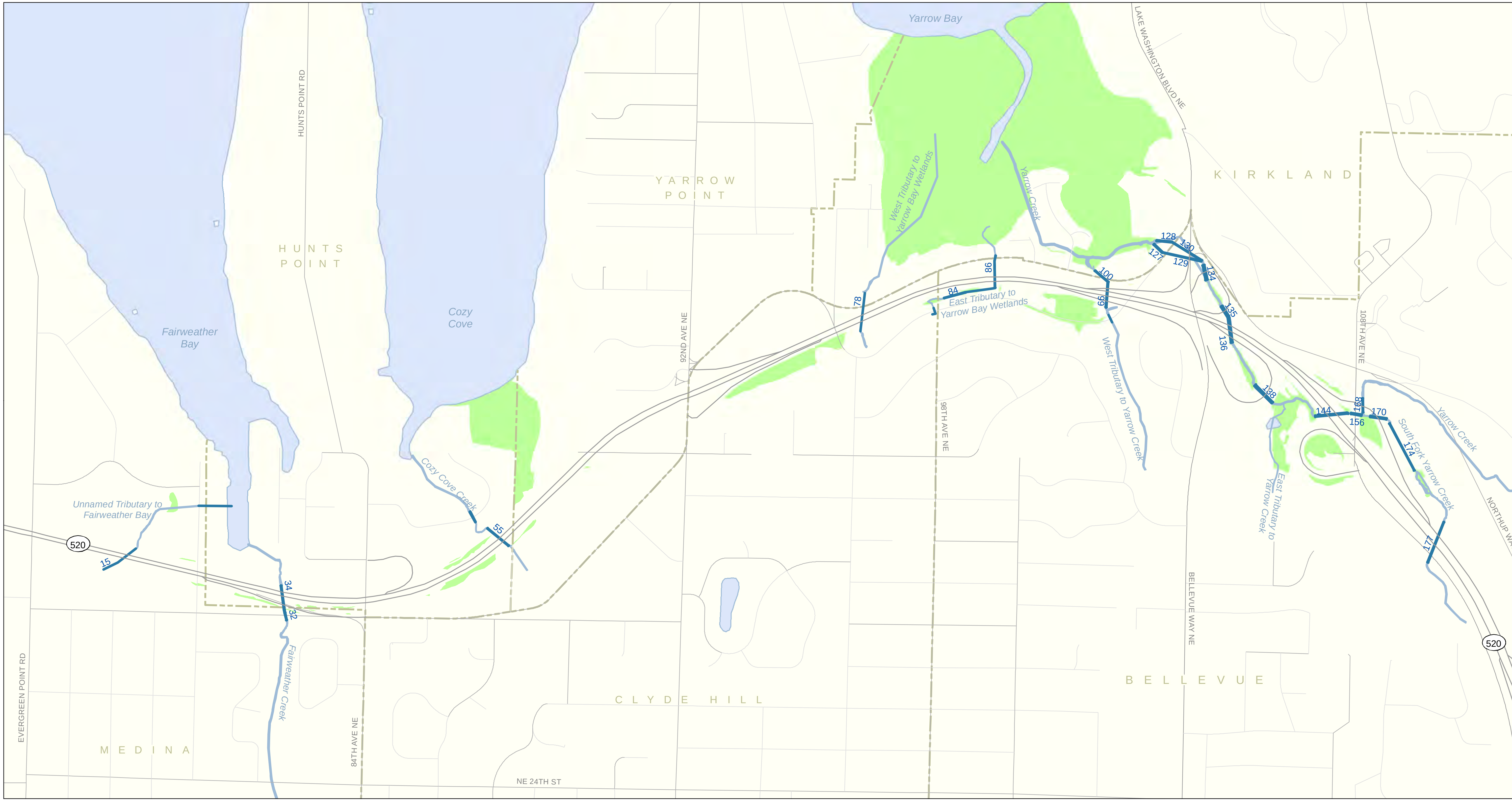

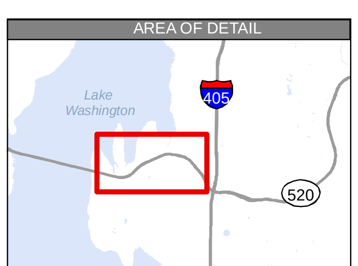

15 Existing Culvert (Structure ID)

Stream

Wetland

Jurisdictional Boundary

N

0 500 1,000 2,000 Feet

Source: Parametrix (2009) GIS Data (Wetland and Culvert), King County (2005) GIS Data (Stream and Street), City of Bellevue (1999) GIS Data (City Limits), and King County (2007) GIS Data (Waterbody). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 20. **Existing Stream Alignments and Culvert Locations**

Medina to SR 202: Eastside Transit and HOV Project

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Shoreline habitat conditions at Evergreen Point are affected by the large concentration of boat traffic relatively close to the shoreline in this area, resulting in considerable wave action along the shore. Portions of the Eastside shoreline have large expanses of shallow water occupied by extensive beds of aquatic vegetation. Vegetation densities tend to be relatively low, close to shore, and substrate material relatively large. In general, the lake bottom substrate is cobble and gravel near the shoreline and transitions to sand and finer material moving away from the shoreline. The substrate along the eastern shoreline of Lake Washington near the SR 520 corridor consists of substantially less organic material and silt than exists along the western shoreline of the lake.

The shoreline is mostly lined with landscaped yards of private residences. Much of the shoreline is modified with bulkheads and boat docks, although the shoreline immediately under the existing bridge is relatively unmodified, with a naturally sloping shoreline. In-water structures in the study area include several private residential docks extending waterward from the shoreline. The average dock length is approximately 75 feet and the average dock width is approximately 8 feet.

Aquatic vegetation in the study area is patchy and consists of five species of aquatic plants: waterweed, pondweed, Eurasian milfoil, nodding waternymph, and American wildcelery. A nonnative invasive species (Eurasian milfoil) is the most dominant aquatic plant, followed by pondweed and American wildcelery, which are both native species.

Lake bottom substrate within the study area is dominated primarily by cobble and sand. In general, substrate near the shore consists of cobble and transitions through gravel to sand moving offshore. Some areas of bare clay are present in patches throughout the surveyed area.

Lake Washington's shoreline is an important fish resource that generally supports juvenile salmonid rearing and migration, as well as sockeye spawning at some locations. When they enter Lake Washington, young Chinook salmon have been found to preferentially rear along the shorelines in water that is less than 3 feet deep with a sandy gravel substrate (Tabor et al. 2004). Young Chinook find abundant prey and apparently refuge from large predatory fish in this shallow water habitat. There are naturally sloped gravelly beaches along parks and some private residences, but much of the Lake Washington shoreline has bulkheads. Bulkheads and shoreline armoring that produce hard vertical faces at the shorelines have modified or eliminated the shallow water preferred by young Chinook. Water depths adjacent to most bulkheads are generally several feet at the shoreline (2 to 6 feet deep or more). A variety of predatory fish such as bass, perch, bullhead, and northern pikeminnow (some of which prey on young salmonids) favor bulkhead habitat. Later, as the young Chinook grow, they move offshore into deeper water (Tabor et al. 2004). At other locations, broad muddy substrates that support water lilies and Eurasian milfoil provide habitat that is more suitable for juvenile salmonid predators than juvenile salmonids.

Lake Washington has a large number of tributaries that provide fish habitat (Williams et al. 1975). Although only a few of the larger tributaries support sustaining populations of Chinook salmon, many smaller tributaries support other anadromous and resident salmonids. Small numbers of bull trout have occasionally been reported in Lake Washington.

What fish species occur in the study area?

Many fish species inhabit the Lake Washington watershed. Most of these species are likely to occur at least occasionally in the study area. The more common of these species are listed in Exhibit 21, which also provides information on the general habitat used by the species of greatest concern within the watershed.

Exhibit 21. Lake Washington Watershed Prevalent Fish Species and Their Ecological Roles

Species Scientific Name	Federal and State Status[a]	Native or Nonnative Species	Ecological Role
River lamprey *Lampetra ayresi*	FCo, SC	Native	Salmonid predator observed in Lake Washington system. High predation rates measured for this species.
Bull trout *Salvelinus confluentus*	FT, SC	Native	Overlapping habitat with other salmonids, but very low numbers or nonexistent in most of watershed. Major fish predator.
Cutthroat trout *Oncorhynchus clarki*	None	Native	Young compete with other salmonids for prey. Adult cutthroat consume fish, including juvenile Chinook and sockeye salmon. Population likely smaller than some other potential predators.
Steelhead/rainbow trout *Oncorhynchus mykiss* (anadromous/resident)	FT	Native	Overlapping habitat with other salmonids; consume similar prey. Some predation on young salmonids probable.
Chinook salmon *Oncorhynchus tshawytscha*	FT, SC	Native	Wild and hatchery origin.

Exhibit 21. Lake Washington Watershed Prevalent Fish Species and Their Ecological Roles

Species Scientific Name	Federal and State Status[a]	Native or Nonnative Species	Ecological Role
Coho salmon *Oncorhynchus kisutch*	FCo for Puget Sound	Native	Probably most abundant in north Lake Washington area; primarily hatchery origin.
Sockeye salmon/ kokanee *Oncorhynchus nerka* (anadromous/resident)	None	Native[b]	Pelagic in open-water areas.
Largemouth bass *Micropterus salmoides*	None	Nonnative	Major fish predator that occupies shoreline habitat. Young compete with young salmonids for some prey.
Smallmouth bass *Micropterus dolomieui*	None	Nonnative	Major fish predator that occupies salmonid lake habitat, resulting in some prey competition. Population size uncertain.
Brown bullhead *Ictalurus nebulosus*	None	Native	Competitor with young salmonids for similar prey.
Longfin smelt *Spirinchus thaleichthys*	None	Native	Pelagic in open-water areas. Little likelihood of salmonid prey competition.
Northern pikeminnow *Ptychocheilus oregonensis*	None	Native	Major fish predator that occupies salmonid fish habitat. Former common name was “northern squawfish.”
Peamouth chub *Mylochelius caurinus*	None	Native	Large numbers. Some occupy shallow benthic habitat; consume some of same prey as young salmonids.
Threespine stickleback *Gasterosteus aculeatus*	None	Native	Numerous, substrate-oriented, often near aquatic vegetation; provide prey for larger fish.
Pelagic sculpin *Cottus aleuticus*	None	Native	Pelagic in open-water areas. Some overlap in prey with young salmonids. Sculpins represent 72 percent of Lake Washington biomass.
Prickly sculpin *Cottus asper*	None	Native	Benthic habitat from shorelines to deep water. Prey competition with young salmonids. Sculpins represent 72 percent of Lake Washington biomass. Larger sculpins prey on small fish.
Yellow perch *Perca flavescens*	None	Nonnative	Prey overlap with young salmonids. Abundant but substantially less than peamouth.

[a] FCo=Federal Species of Concern, FT=Federally Threatened, SC=State Candidate Species.
[b] Introduced stock; uncertain whether there was originally a native stock inhabiting this watershed.

Salmonids in the Lake Washington watershed are a mix of native and nonnative (introduced stocks) species, and sometimes this mix can occur within a species. For example, recent evidence for sockeye indicates that the Cedar River and Issaquah Creek spawners are likely descendents of introduced fish (Baker Lake stock), while those spawning in Bear Creek may be native fish (Hendry et al. 1996). All sockeye tend to have similar life history patterns in the Lake Washington watershed, but the returning adults of Cedar River sockeye tend to be larger and older than the Bear Creek spawners (Hendry and Quinn 1997). Juvenile sockeye salmon commonly rear in the lake for a year including the open water along the floating portion of the Evergreen Point Bridge.

Chinook salmon naturally reproduce in many of the watershed streams and are supplemented by hatchery production of fish originally from the Green River (Weitkamp and Ruggerone 2000). Steelhead/rainbow trout are a mix of introduced hatchery and native stocks. Cutthroat trout are assumed to be native coastal cutthroat. A number of other introduced (exotic) species also occur in Lake Washington, such as black crappie, carp, tench, and goldfish.

Lake Washington and the Ship Canal provide the migratory corridor and juvenile-rearing area for salmonids produced in the Lake Washington watershed. The connection of the Ship Canal with Lake Washington allows all fish to move freely between the two areas. Anadromous salmonids migrate through Lake Union and the Ship Canal on their way to Puget Sound as juveniles and again on their return spawning migration as adults. Juvenile salmonids migrating and rearing in the study area include subyearling Chinook and chum salmon. Yearling sockeye, coho salmon, and steelhead, along with a few Chinook salmon, also migrate to Puget Sound through the Ship Canal. Adults of each salmon species migrate upstream through the Ship Canal to Lake Washington tributaries. Subadult and adult bull trout and cutthroat trout also most likely migrate in both directions through the Ship Canal.

The Lake Washington shoreline at the existing and proposed east end of the Evergreen Point Bridge has been identified in the past as a place where sockeye salmon spawn based on WDFW map records (Kurt Buchanan, Biologist, WDFW, Olympia, Washington. July 26, 2004. Personal communication). However, no recent surveys have been conducted to determine if spawning sockeye continue to use this location (Exhibit 22). The sockeye spawning area that is located under the east highrise of the Evergreen Point Bridge is one of more than 85 shoreline spawning areas identified in Lake Washington on maps provided by WDFW (Kurt Buchanan, Biologist, WDFW, Olympia, Washington. July 26, 2004. Personal communication). This spawning area under SR 520 represents less than 1 percent of the identified sockeye shoreline spawning areas within Lake Washington. Sockeye typically spawn in areas of clean gravel substrate and groundwater upwelling. A recent shoreline habitat survey (WSDOT 2009c) indicates that while there were some areas of clean gravel in the area that could potentially support sockeye spawning, most of the nearshore substrate

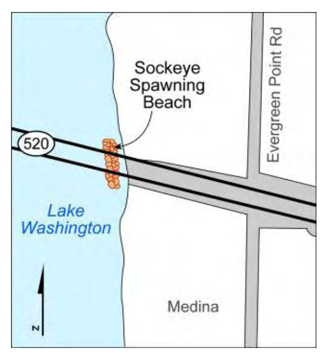


Exhibit 22. **Previously Identified Sockeye Salmon Spawning Beach**

consisted of cobble material while the offshore areas were dominated by sandy substrate.

Lake Washington tributaries provide spawning and early rearing habitat for anadromous Chinook, coho, and sockeye salmon and steelhead trout. Cutthroat trout are also present in many of the tributaries and the lake. Rainbow trout were commonly planted in Lake Washington in the past and are still present in the lake.

Several observers have reported sightings of individual bull trout in the watershed, but there is no evidence of a substantial population or of reproduction occurring within Lake Washington or the lake's tributaries. There is a substantial reproducing population of bull trout in Chester Morse Reservoir in the upper Cedar River watershed and the major tributaries of the Cedar River. Some bull trout observed in the Ship Canal and Lake Washington may have originally come from this upper Cedar River population and moved downstream, thus becoming isolated from their original population. Bull trout produced in other watersheds may occasionally migrate into the Ship Canal and Lake Washington, or prey on juvenile salmon downstream from the Hiram M. Chittenden Locks (Ballard Locks).

USFWS has identified Lake Washington as critical foraging, migration, and overwintering habitat for bull trout; this also includes the lower Cedar River, the Sammamish River, Lake Sammamish, Lake Union, the Ship Canal, and all accessible tributaries and lakes. As part of its critical habitat designation, USFWS did not identify specific physical features in Lake Washington that may be important to bull trout survival.

Do any federally listed fish species or federal fish species of concern occur in the study area?

Lake Washington supports one or more life stages of Chinook salmon, steelhead, and bull trout, all of which are currently listed as threatened under the ESA. Ecosystems analysts verified the current ESA listing of these fish species on March 26, 2009 (National Marine Fisheries Service [NMFS] 2009; USFWS 2009).

Lake Washington Chinook salmon are a part of the threatened Puget Sound evolutionarily significant unit (ESU) (NMFS 1999). NMFS designated critical habitat for the Puget Sound ESU of Chinook salmon, which includes Lake Washington, as well as the Ship Canal and Lake Union between the Ballard Locks and Lake

> An ESU or **evolutionarily significant unit** of a fish species is the term used by the National Marine Fisheries Service (NMFS) for the population protected by a listing under the ESA, while a DPS or **distinct population segment** is a similar term for populations protected by ESA listing used by both NMFS and USFWS.

Washington (NMFS 2005). No critical habitat is designated for any streams crossed by the proposed project alignment.

The Puget Sound steelhead distinct population segment (DPS) is listed as threatened under ESA (NMFS 2007). As of March 26, 2009, critical habitat had not been proposed or designated for this DPS.

USFWS listed the Coastal–Puget Sound DPS of bull trout as threatened in King County, including the population in the Lake Washington watershed (USFWS 1999). Distribution of bull trout in the Lake Washington watershed is uncertain, but individuals have been observed recently near the Ballard Locks and at various other locations over a number of years. USFWS has designated bull trout critical habitat in Lake Washington and in the Ship Canal and Lake Union between the Ballard Locks and Lake Washington (USFWS 2005). USFWS indicates that these areas provide foraging, migratory, and overwintering habitat for bull trout outside of currently delineated core areas in the Puget Sound Recovery Unit. USFWS has not proposed critical habitat for bull trout in any Lake Washington tributaries crossed by the alignment of the proposed project.

The Puget Sound/Strait of Georgia population of coho salmon is listed as a species of concern by NOAA Fisheries.

Do any state-listed or other state priority fish species occur in the study area?

Priority fish species include all state endangered, threatened, sensitive, and candidate species, and species of recreational, commercial, or tribal importance that are considered vulnerable. All fish species with state candidate status that occur in the study area also hold a federal designation and are discussed above. No state sensitive, threatened, or endangered fish species occur in the study area. Other fish species that are designated as priority species (WDFW 2009) may occur within the study area, both in Lake Washington and its tributaries. These are chum, sockeye, and kokanee salmon and rainbow and coastal cutthroat trout.

What are the general habitat characteristics of study area streams?

In the study area, the SR 520 corridor directly crosses or is adjacent to nine streams, as described earlier (see Exhibit 20). This section discusses the stream characteristics that help to sustain fish resources.

General Habitat Characteristics

Fish species have evolved to cope with a sequence of habitats found in natural watersheds. Fish are affected by habitat conditions within a stream, which in turn are affected by conditions within the entire watershed. For example, water quality and streamflow are affected when water percolates through the soil to the stream, even though the source of this water may be a great distance from the stream.

Human activity in the Lake Washington watershed affects fish habitat in a variety of ways. Land clearing removes shade and large streamside trees that once fell periodically into a stream. Construction adjacent to streams often causes erosion, which in turn fills the water with sediment that can clog spawning gravel. Many of these effects can be controlled by appropriate project design and the application of appropriate BMPs. Culverts can block fish passage and alter water flow. Removing creek meanders (straightening stream channels) and filling wetlands eliminates feeding areas and the slow water habitats important for sheltering salmonids from the high winter streamflows.

In the study area, salmonid species (salmon and trout) are the most sensitive to in-stream habitat conditions. Salmonids depend on healthy in-stream habitats for food, water volume, cover, water quality, and fish passage.

Channel Morphology

The physical form of the streambed (channel morphology) directly influences fish habitat quality and quantity. Stream habitat can be classified into units such as pools, riffles, and runs/glides. Almost all salmonid species spawn in riffles or pools. For maximum use, these areas should be plentiful, of adequate size, and contain properly sized substrate (gravel and small cobbles). A 1-to-1 pool-to-riffle ratio is considered optimum for aquatic habitat. The number of pools is another important measure of the quality of fish habitat. Generally, streams with a high percentage of riffles and few pools are low in fish biomass and species diversity.

Stream Substrate

The size and distribution of stream substrate (stream bottom material) is also an important habitat variable, particularly for salmonids. Salmonids require beds of gravel for spawning. Some species prefer to lay their eggs in pea-sized gravel, while others can use large rocks. Fine sediment can seriously reduce salmonid spawning success by smothering salmonid embryos (cutting them off from a supply of oxygenated water) and limiting the capability of juvenile fish emerging from the redds (salmonid nests). Sediment suspended in the water column can also affect the health of individual fish. Potential sources of fine sediment in urban and urbanizing streams include surface erosion from new construction, roads, and unstable gullies and slopes.

Sediment

The erosion of stream banks, whether from natural or manmade causes, may deliver large amounts of sediment into a stream, to the detriment of water quality and fish habitat. As the sediment moves through the stream system, it can disrupt run-riffle-pool sequences, fill spawning gravels with fine sediment, and scour riffles. Streams in forested or undeveloped areas have been shown to have more stable flows and less sediment than streams in cultivated or developed watersheds.

Large Woody Debris

Large pieces of wood, referred to as LWD, play an important habitat role in Pacific Northwest streams. LWD produces and enhances fish habitat, because it forms pools and increases channel complexity in streams. It also provides cover where fish can hide from predators and can improve both the quantity and quality of fish habitat. During periods of low flow and winter high-flow conditions, LWD modifies streamflow, adds structure, and increases the volume of usable habitat for some fish in small streams. Finally, LWD plays a very important role in retaining nutrients and regulating temperatures in streams. How large a piece of LWD needs to be to provide these functions is relative to its ability to affect morphological processes within a stream. For streams of the size of those within the study area, pieces of wood 12-inches in diameter or larger would serve this function. Smaller wood is also important because it increases wood jam complexity and provides primary source food for the stream food web.

Fish Passage

Unobstructed fish passage is particularly important for anadromous fish, including juveniles migrating to the sea and adults returning to the streams to spawn. During migration periods, anadromous fish frequently encounter culverts (pipes or arches that allow water to flow from one side of a road to the other). Culvert openings that are too high above the stream channel for fish to jump into or that are positioned at a grade too steep for fish to ascend can be barriers to fish migration and limit the distribution of a species and productivity of the stream.

Riparian Vegetation

Streamside (riparian) vegetation plays a number of important roles in supporting the in-stream habitat components listed above. Riparian vegetation influences the complexity of the stream food web and the water quality of stream channels in the following ways:

- Contributing LWD to the stream channel to create pool habitat.
- Shading the streams to maintain cool stream temperatures required by salmonids and other aquatic biota.
- Contributing organic debris, leaf litter, and other stream inputs that support many stream food webs.
- Stabilizing stream banks, which minimizes stream bank erosion and reduces the occurrence of landslides.

In addition, riparian vegetation reduces fine sediment input to the stream system; filters nutrients and pollutants from shallow groundwater and stormwater runoff; and supports wildlife with refuge, feeding and watering habitat and by providing migration corridors.

Study Area Streams

The basic characteristics of study area streams are shown in Exhibit 23. Attachment 1 summarizes the physical habitat conditions in the streams that cross or are adjacent to the proposed project corridor. The stream data were generated during the 2007 summer low-flow habitat surveys, as described above. Exhibit 24 summarizes the known and presumed fish use of study area streams based on existing data and observation of in-stream habitat conditions. A detailed discussion of in-stream habitat and fish use for each stream follows.

Washington State Department of Natural Resources (WDNR) Stream Type Definitions
(from WAC 222-16-031)

Type S Streams: Streams classified as "shorelines of the state" under Chapter 90.58 RCW.

Type F Streams: Streams and water bodies that are known to be used by fish, or meet the physical criteria to be potentially used by fish. Fish streams may or may not have flowing water all year; they may be perennial or seasonal.

Type Np Streams: Streams that have flow year-round, but do not meet the physical criteria of a Type F stream.

Type Ns Streams: Streams that do not have surface flow during at least some portion of the year, and do not meet the physical criteria of a Type F stream.

Exhibit 23. **Regulatory Features of Streams that Cross through the Study Area**

Stream	Receiving Water	Jurisdiction	Approximate Stream Length in Jurisdiction (miles)	Local Jurisdiction Stream Type or Class	Local Jurisdiction Riparian buffer (feet)[a]
Unnamed Tributary to Fairweather Bay	Lake Washington	Hunts Point	<0.1	None [b]	0 [b]
		Medina	0.2	Type F	100
Fairweather Creek	Lake Washington	Hunts Point	0.1	None [b]	0[b]
		Medina	1.0	Type 1	100
Cozy Cove Creek	Lake Washington	Hunts Point	0.2	None [b]	0[b]
		Yarrow Point, Clyde Hill	0.4	None [b]	NA[b]
West Tributary to Yarrow Bay Wetlands	Yarrow Bay Wetlands	Kirkland	0.3	75	Class A
		Clyde Hill	0.1	None [b]	NA[b]
East Tributary to Yarrow Bay Wetlands	Yarrow Creek	Kirkland	<0.1	Class A	75
		Bellevue	0.1	Type N	50
West Tributary to Yarrow Creek	Yarrow Creek	Kirkland	<0.1	Class A	75
		Bellevue	0.7	Type F	100
Main Stem Yarrow Creek	Lake Washington	Kirkland	0.5	Class A	75
		Bellevue	>2.4	Type F	100
East Tributary to Yarrow Creek	Yarrow Creek	Bellevue	0.3	Type F	100
South Fork Yarrow Creek	Yarrow Creek	Bellevue	0.6	Type F	100

[a] Buffer widths were determined from city codes as follows: Medina, Chapter 18.12.440-; Hunts Point, Chapter 16.15; Clyde Hill, Chapter 18.04.300; Kirkland, Chapter 90.90; and Bellevue, Chapter 20.25H.070.

[b] No streams within Hunts Point, Clyde Hill, or Yarrow Point are recognized under the Sensitive Areas Ordinances of these cities.

Exhibit 24. **Habitat Conditions and Salmonid Distribution in the Surveyed Reaches of Streams Crossing the Proposed Project Corridor**

Stream Name	WDNR Stream Type	Confirmed Fish Use	Presumed Fish Use
Unnamed Tributary to Fairweather Bay	Type F	None	Yes, but unlikely, based on stormwater conveyance and discharge system at mouth
Fairweather Creek	Type F	Coho salmon downstream of SR 520[a,b] Cutthroat trout downstream of SR 520[a]	NA
Cozy Cove Creek	Type F	Cutthroat trout downstream of SR 520[c]	Coho salmon
West Tributary to Yarrow Bay Wetlands	Type F (downstream of SR 520)	None	Coho salmon and cutthroat trout downstream of SR 520
East Tributary to Yarrow Bay Wetlands	Type F (downstream of SR 520)	None	Coho salmon and cutthroat trout downstream of SR 520
West Tributary to Yarrow Creek	Type F	Cutthroat trout upstream of SR 520[c] Coho salmon downstream of SR 520[d]	NA
Yarrow Creek	Type F	Cutthroat trout to near headwaters[b,d,e] Coho downstream of SR 520[c,d,f]	NA
East Tributary to Yarrow Creek	Type F	None	Cutthroat trout
South Fork Yarrow Creek	Type F	None	Cutthroat trout downstream of SR 520

[a] Anderson and Ray et al. (2001)
[b] StreamNet (2009)
[c] 2002 electrofishing associated with SR 520 stream investigations
[d] City of Bellevue (2001)
[e] WDFW (2009)
[f] Williams et al. (1975)

Unnamed Tributary to Fairweather Bay

Exhibit 25. Detailed Map of the Unnamed Tributary to Fairweather Bay and Fairweather Creek

The Unnamed Tributary to Fairweather Bay is a short (0.2 mile long) stream that drains Fairweather Park, on the north side of SR 520, and also provides some drainage from the SR 520 roadway and some area south of the highway (Exhibit 25). The stream, which discharges into the east shoreline of Fairweather Bay via a discharge pipe under 80th Avenue NE, originates at the outlet of two corrugated metal culverts which discharge into a catch basin on the north side of SR 520. These culverts receive stormwater from paved areas within and south of the SR 520 right of way. The stream is perennial, which likely indicates groundwater input into the upstream pipe system, as no open channel conveyance was observed above the catch basin. The watershed is moderately developed upstream of SR 520, while the majority of open channel is located in an undeveloped area, with some residential development at the stream mouth.

The upstream-most reach of the stream, from the catch basin outlet downstream to about 20 feet at the right-of-way fence, is entirely lined with quarry spalls. At the fence line, the stream channel enters a forested setting and begins forming an incised channel. The upper reaches of the channel do not have well defined bed and bank, with flow (primarily stormwater driven) scouring over tree roots and other vegetation. Evidence of occasional high volume flows is present, with major stream incision occurring in the middle reaches of the stream. The channel incision reaches a depth of 4 to 10 feet, with bank top widths of about 10 to 20 feet. Several foot bridges cross over the stream at various locations. The bridges have been widened recently to accommodate stream incision and widening.

The stream enters a culvert and stormwater conveyance system just west of 80th Avenue NE. The area surrounding the culvert inlet has been armored by gabion baskets on all sides, forming an artificial pool structure with an overflow sill on the south side. An overflow channel routes high flows to a secondary culvert located to the south. Both the primary culvert and overflow culvert appear to connect to a stormwater discharge system, which ultimately flows east to Lake Washington at one or more discharge points. Based on the size of the outlet culverts, and the presence of inline vaults, fish passage from Lake Washington to the stream is unlikely.

Numerous large tree roots, ample woody debris, and timber grade control structures form a predominance of a step-pool morphology, with few riffles. Gravels and silt predominate, with a relatively high degree of embedded fine sediment.

The riparian area is predominantly intact with primarily native species. Canopy dominants include red alder and bigleaf maple, with scattered western red-cedar and cottonwood. The understory is diverse, and is comprised of Indian plum, salmonberry, snowberry, western hazelnut, ninebark, red-osier dogwood and sword fern. Invasive species were limited, with only occasional presence of Himalayan blackberry.

Upstream (south) of SR 520, the stream habitat quality is poor. Riparian vegetation consists of grass and a few shrubs, with almost no tree cover except for a few scattered red alders. Invasive species such as English ivy, nightshade, and Himalayan blackberry make up more than half of the existing riparian vegetation.

The stream is not listed for exceedences on the Ecology 303(d) list (Ecology 2009). The fish resources of the stream have not been inventoried, and no fish were observed during field reconnaissance efforts. Downstream barriers, high stream flows, likely limit the use of this stream by anadromous salmonids.

Fairweather Creek

Fairweather Creek (WRIA 08-0257), also referred to as Medina Creek, is a very small stream (1.1 miles long) that drains approximately 600 acres from Medina north into Fairweather Bay (Exhibit 25). SR 520 crosses the lower reaches of the stream, about 400 feet upstream of Fairweather Bay. Fairweather Creek is a WDNR Type F stream located in the Medina and Hunts Point jurisdictions. The watershed covers approximately 600 acres, and the elevation difference between the headwaters and the mouth is approximately 20 feet. The watershed is heavily developed, primarily for residential uses.

Upstream (south) of SR 520, the stream habitat quality is poor. Riparian vegetation consists of grass and shrubs, with almost no tree cover except for a few scattered red alders. Invasive species such as English ivy, nightshade, and Himalayan blackberry make up more than half of the existing riparian vegetation. Fairweather Creek crosses the SR 520 corridor through two separate in-line culverts (under SR 520 and an abandoned road) separated by about 5 feet (about 0.5 mile east of the Lake Washington shoreline). On the north side of SR 520, the stream flows for another 400 feet north before discharging into Fairweather Bay. In this reach, the stream flows through a single-family residential neighborhood, with landscaped lawns immediately adjacent to the stream. Another culvert conveys the stream under Fairweather Place NE. Here, the stream is channelized with riprap banks 4 to 5 feet high. No LWD was present within either of the two surveyed reaches. Only two functional pools were observed (one each upstream and downstream of SR 520), and both were small and of relatively poor quality. The dominant stream substrate is large gravel, with a relatively high degree of embedded fine sediments.

The base streamflow of Fairweather Creek is approximately 2 cubic feet per second (cfs) and the 2-year peak flow is estimated at 36.5 cfs (Anderson and Ray et al. 2001). High stream velocities, combined with elevated levels of pollutants in the stream in the winter and high in-stream temperatures in the summer, probably limit the use of this stream by anadromous salmonids (Anderson and Ray et al. 2001).

Fairweather Creek
This view of Fairweather Creek, just upstream of SR 520, is typical of stream conditions throughout. Although trees are present, ornamental and nonnative shrubs dominate, and habitat complexity is limited by surrounding development.

Both the lower 0.1 mile of Fairweather Creek (downstream of SR 520) and Fairweather Bay are listed on the 2008 Ecology 303(d) list for Category 5 (impaired) waters for temperature, dissolved oxygen, and fecal coliform bacteria (Ecology 2009). King County water quality monitoring data from 2000 to 2008 show that the mean temperature in Fairweather Creek was 13.1°C (with a range of 5.1°C to 23.9°C) and that dissolved oxygen levels averaged 9.5 milligrams per liter (mg/L) (with a range of 5.5 to 12.3 mg/L) during the same period (King County 2004). Sustained stream temperatures of more than 20ºC can be lethal for salmon (Groot and Margolis 1991). Furthermore, more than 30 percent of water samples from this period had temperatures that were higher than state water quality standards.

King County has collected sediment data from Fairweather Creek since 1987 (King County 2008). Although data from 1987 through 2002 did not identify any significant trends in Fairweather Creek sediments for the parameters tested, results indicate that Fairweather Creek occasionally exceeded the sediment quality guidelines for lead, nickel, and zinc. It is unknown why concentrations of these metals exceed sediment quality in this creek. Of the 27 streams monitored in King County, Fairweather Creek had the fourth highest metals concentrations.

The fish resources of Fairweather Creek have not been extensively inventoried, although StreamNet (2009) and Williams et al. (1975) indicate that coho salmon use the stream for rearing below SR 520. Three coho salmon and eleven cutthroat trout, all juveniles, were present downstream from SR 520 in a 2001 stream survey (Anderson and Ray et al. 2001). Stickleback and sculpin were also present. No known fish surveys have occurred upstream of SR 520.

In 2002, a salmon incubator was installed behind a residence on Medina Circle, upstream of SR 520, in a project funded by Medina (Joe Willis, Public Works Director, City of Medina, Washington. January 6, 2009. Personal communication). The City of Medina continued to fund this project each year through at least 2008. Each year, approximately 10,000 coho salmon fry were hatched from eggs in a 5-gallon incubator and released onsite. Anecdotal reports indicate that adult coho salmon have returned to the stream, although none have been reported upstream of SR 520.

There are no known recent reports of salmonids present upstream of SR 520, probably because of two in-line culverts under SR 520 (Exhibit 26). During storms, these culverts have peak velocities substantially greater than recommended velocities for salmonids, thus creating velocity barriers that can flush fish downstream (WSDOT 2008a).

The small size of Fairweather Creek (average bankfull channel width is less than 7 feet) makes it unlikely that any Lake Washington Chinook salmon spawn here. Furthermore, it is highly unlikely that salmon extensively spawn or rear in the surveyed reach because of the low diversity of habitat types, poor riparian and stream cover conditions, and degraded substrate conditions. A single report (Metro 1990) indicated a few juvenile Chinook salmon using the stream. This was likely juveniles migrating along Lake Washington shorelines using the mouth of the stream for short-term rearing. However, the quality of habitat is substantially degraded from natural conditions, and would not likely support large numbers of Chinook juveniles.

Exhibit 26. Summary of Fish Passage Conditions Along Surveyed Streams of the Proposed Project Corridor

Stream Name	Structure ID	Structure Location	Structure Type and Size	Structure Length (feet)	Structure Slope (percent)	Outlet Drop (feet)	Barrier per WSDOT (2008)	Barrier Status per WDFW[e]	Estimated Potential Habitat Gain (feet) and Quality Upstream of Structure	Comments
Unnamed Tributary to Fairweather Bay	A	Under 80th Avenue NE	Unknown	Approx. 320 feet	Unknown	Submerged	Not classified	Barrier (drop)	600 feet of fair/poor quality habitat	Mouth of stream is piped into complex stormwater conveyance system with series of several catch basins; submerged outlet into Lake Washington.
Fairweather Creek	32	Under abandoned access road	48-inch-diameter CPC	79	1.2	0	Yes	Barrier (depth)	2,000 feet of fair quality habitat	
	34	Under SR 520	60-inch-diameter CAL	194	0.2	0	Yes	Barrier (slope)	2,000 feet of fair/poor quality habitat	In-channel riprap at stream outlet to Lake Washington and pipe under Fairweather Place NE are both potential downstream barriers.
Cozy Cove Creek	55	Under SR 520	48-inch-diameter CAL	214	3.0	0	Yes	Barrier (slope)	600 feet of fair/poor quality habitat	Property flooding reported by owner at structure outlet; entire right bank has riprap at outlet.
West Tributary to Yarrow Bay Wetlands	78	Under SR 520	36-inch-diameter CMP	302	7.4	20 - 25 feet	Yes	Barrier (drop)	140 feet of nonfish habitat	From outlet of stormwater system at NE 35th Street to inlet of structure, water flows in asphalt channel with 15% slope; stream starts at SR 520 structure outlet; pipe has 20- to 25-foot drop at outlet; headcut erosion

Exhibit 26. Summary of Fish Passage Conditions Along Surveyed Streams of the Proposed Project Corridor

Stream Name	Structure ID	Structure Location	Structure Type and Size	Structure Length (feet)	Structure Slope (percent)	Outlet Drop (feet)	Barrier per WSDOT (2008)	Barrier Status per WDFW[e]	Estimated Potential Habitat Gain (feet) and Quality Upstream of Structure	Comments
										occurs at outlet.
East Tributary to Yarrow Bay Wetlands	84/86[a]	Under SR 520	24-inch-diameter CST	668	7.6	1.6	Yes	Unknown	190 feet of poor quality habitat	Inlet of structure is buried and connected to another structure that runs a long distance in roadside ditch; stream above this structure was manmade.
West Tributary to Yarrow Creek	99/100[b]	Under SR 520	48-inch-diameter CPC	337	2.9	0	Yes	Barrier (slope)	> 1 mile of moderate quality habitat	Structure inlet and outlet are different sizes. The upstream structure connects to the downstream structure under NE Points Drive, upstream structure is 54-inch CMP. Structure has a bend and changes direction under NE Points Drive.
	99A	Under abandoned Lake Washington Boulevard	24-inch-diameter CMP	63	11.5	3	Yes	Barrier (slope)	>1 mile of moderate quality habitat	Structure is located under an abandoned portion of the old Lake Washington Boulevard. The structure has a 2-foot drop through a trash rack at the inlet and a 6-foot drop over riprap at the outlet.

Exhibit 26. Summary of Fish Passage Conditions Along Surveyed Streams of the Proposed Project Corridor

Stream Name	Structure ID	Structure Location	Structure Type and Size	Structure Length (feet)	Structure Slope (percent)	Outlet Drop (feet)	Barrier per WSDOT (2008)	Barrier Status per WDFW[e]	Estimated Potential Habitat Gain (feet) and Quality Upstream of Structure	Comments
Yarrow Creek	127/129[c]	Under Lake Washington Boulevard	Inlet is 48-inch-diameter CPC. Outlet is two 42-inch wide by 38-inch high arch CPCs	405	1.3	0	Yes	Unknown Status	> 1 mile of moderate quality habitat	This structure potentially connects to other drainage structures under Lake Washington Boulevard. This conveyance system is a series of three pipes. The upstream pipe (48-inch CPC) may flow into some type of vault structure underneath Lake Washington Boulevard. Two arch CPCs then drain from the vault to the discharge point. A trash/beaver rack occurs at the inlet of the structure with a 1.85-foot drop to the inlet.
	128/130[d]	Under Lake Washington Boulevard	Inlet is 48-inch-diameter CPC. Outlet is 60-inch-diameter CPC	397	1.3	0	Yes	Unknown Status	> 1 mile of moderate quality habitat	This structure potentially connects to other drainage structures under Lake Washington Boulevard. A trash/beaver rack occurs at the inlet of the structure with a 1- to 2-foot drop to the inlet.
	134	Under on-ramp-Bellevue Way to	Dual, 48-inch-diameter	119	0.6	0	Yes	Barrier (depth)	> 1 mile of moderate quality	Beaver activity noted in general area.

Exhibit 26. Summary of Fish Passage Conditions Along Surveyed Streams of the Proposed Project Corridor

Stream Name	Structure ID	Structure Location	Structure Type and Size	Structure Length (feet)	Structure Slope (percent)	Outlet Drop (feet)	Barrier per WSDOT (2008)	Barrier Status per WDFW[e]	Estimated Potential Habitat Gain (feet) and Quality Upstream of Structure	Comments
		SR 520 westbound	CAL						habitat	
	135	Under on-ramp, Bellevue Way northbound to SR 520 westbound	Dual, 45 inches wide by 51 inches high CAL	104	0.4	0	Yes	Barrier (depth)	> 1 mile of moderate quality habitat	Beaver activity noted in general area.
	136	Under SR 520	Dual, 48-inch-diameter CAL	194	0.4	0	Yes	Unknown	> 1 mile of moderate quality habitat	Beaver activity noted in general area. There are three additional stormwater pipes at the inlet.
	138	Under off-ramp, SR 520 eastbound to Bellevue Way northbound	Dual, 48-inch-diameter CMP	193	0.3	0	Yes	Barrier (depth)	> 1 mile of moderate quality habitat	Beaver activity noted in general area.
	144	Under SR 520	Dual, 36-inch-diameter CPC	259	0.5	0	Yes	Barrier (depth)	>1 mile of moderate quality habitat	

Exhibit 26. Summary of Fish Passage Conditions Along Surveyed Streams of the Proposed Project Corridor

Stream Name	Structure ID	Structure Location	Structure Type and Size	Structure Length (feet)	Structure Slope (percent)	Outlet Drop (feet)	Barrier per WSDOT (2008)	Barrier Status per WDFW[e]	Estimated Potential Habitat Gain (feet) and Quality Upstream of Structure	Comments
	156	Under 108th Avenue NE	Dual, 36-inch-diameter CPC	82	0.0	0	Yes	Barrier (depth)	1 mile of moderate quality habitat	Negatively sloped pipe.
	168	Under off-ramp, SR 520 westbound to108th Avenue NE	48 inches wide by 30 inches high arch CMP	110	1.4	0	Yes	Barrier (slope)	2 miles of moderate quality habitat	
South Fork of Yarrow Creek	170	Under off-ramp, SR 520 westbound to108th Avenue NE	Dual, 36-inch-diameter CPC	128	0.7	0	Yes	Non-barrier	1,500 feet of moderate quality habitat	No water flows through left bank structure; all flow is directed through right bank structure.
	174	Under WSDOT maintenance facility	36-inch-diameter CAL	417	2.0	0	Yes	Barrier (slope)	1,000 feet of moderate quality habitat	
	177	Under SR 520	36-inch-diameter CMP	342	3.6	3.5	Yes	Barrier (drop)	Over 500 feet of moderate quality spawning habitat	

Exhibit 26. Summary of Fish Passage Conditions Along Surveyed Streams of the Proposed Project Corridor

Stream Name	Structure ID	Structure Location	Structure Type and Size	Structure Length (feet)	Structure Slope (percent)	Outlet Drop (feet)	Barrier per WSDOT (2008)	Barrier Status per WDFW[e]	Estimated Potential Habitat Gain (feet) and Quality Upstream of Structure	Comments

[a] During the field screening, it was determined that structures 84 and 86 are joined in-line and function as a single structure.

[b] During the field screening, it was determined that structures 99 and 100 are joined in-line and function as a single structure.

[c] During the field screening, it was determined that structures 127 and 129 are joined in-line and function as a single structure.

[d] Structures 128 and 130 are joined in-line and function as a single structure.

[e] Designated as a barrier by WDFW in the WSDOT Fish Passage Inventory Report (2008b) and/or WDFW Fish Passage and Diversion Screening Database.

Structure Type Key: CPC = cast in place concrete; CAL = corrugated aluminum; CMP = corrugated metal; CST = corrugated steel

Cozy Cove Creek

Cozy Cove Creek is a short (approximately 0.4 mile long), small stream (average channel bankfull width is less than 9 feet) that drains from Clyde Hill north into Cozy Cove, which is part of Lake Washington (Exhibit 27). The Cozy Cove Creek basin comprises approximately 189 acres. Lake Aqua Vista, a manmade lake within Clyde Hill, was developed in the 1960s for aesthetic purposes and is now also used as a stormwater retention/detention pond that drains into Cozy Cove Creek. The watershed is heavily developed (total impervious area of approximately 31 percent), primarily for residential uses.

Cozy Cove Creek
Located just downstream of SR 520, Cozy Cove Creek is an example of a stream affected by residential development. The stream is channelized and contained within riprapped banks. The riparian vegetation consists exclusively of grass and landscaping as the stream flows through residential yards.

Cozy Cove Creek is a WDNR Type F stream located in the Hunts Point and Yarrow Point jurisdictions. After the stream crosses the SR 520 corridor through a 214-foot-long and 48-inch-diameter culvert, it flows for about 1,000 feet north before discharging to the cove. The stream flows through single-family residential neighborhoods, with landscaped lawns immediately adjacent to the stream.

Exhibit 27. Detailed Map of Cozy Cove Creek

Just prior to flowing into the cove, the stream runs through emergent and scrub/shrub wetlands. From this wetland upstream to SR 520, the stream is extensively channelized, with most of the bank length armored by riprap. The riparian vegetation zone is very narrow in this reach and is dominated by grass and a few shrubs. Upstream (south) of SR 520, the stream flows through a landscaped trail system located between several residences. This reach includes many footbridges and several artificial log weir-formed pools. The riparian zone is wider, with vegetation consisting of grass, shrubs, and some mixed trees.

Except for the log weirs, only two pieces of in-stream LWD were present in the surveyed area. The functional pools only occupy about 5 percent of the habitat (by length). Large gravel is the dominant stream substrate and there is a moderate degree of substrate embeddedness. The amount of surface fines varies, but is typically less than 10 percent. About 540 feet upstream of SR 520, the culvert under NE 28th Street is a total barrier to fish passage because its outlet is perched 4.5 feet above the channel.

The fish resources of Cozy Cove Creek have not been inventoried, but juvenile cutthroat trout were observed in the stream during May 2002 habitat surveys. The small size of the stream and its limited accessible length make it unlikely that any of Lake Washington's salmon spawn in the stream. Juvenile coho and possibly Chinook salmon migrating along Lake Washington shorelines may use the lower reaches of the stream or the wetland at the mouth of the stream for short-term rearing, although the quality of habitat is substantially degraded from natural conditions.

For the past 15 years, a salmon incubator has been in operation on the stream. The incubator is located approximately 25 feet upstream of the inlet to the culvert under SR 520 (Joe Willis, Public Works Director, City of Medina, Washington. January 6, 2009. Personal communication). Each year, approximately 10,000 to 80,000 coho salmon fry were hatched from eggs in a 5-gallon incubator and released onsite.

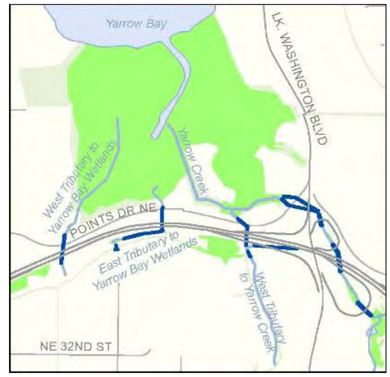


Exhibit 28. **Detailed Map of West and East Tributaries to Yarrow Bay Wetlands**

West Tributary to Yarrow Bay Wetlands

The West Tributary to Yarrow Bay wetlands is the westernmost stream that flows into the Yarrow Bay wetlands. The Yarrow Bay wetland complex (over 80 acres) is one of the few remaining large wetland areas along the shores of Lake Washington (Exhibit 28). The wetland filters contaminants from surface water runoff prior to reaching Lake Washington and serves as an important storage area for flood waters. Beaver activity in the wetland provides substantial LWD input that provides habitat for salmonids.

The stream originates in Clyde Hill from a stormwater pipe that discharges from under NE 35th Street. The water flows down a steep concrete chute (15-percent grade) to the base of the slope. This chute provides no fish habitat and serves as a fish passage barrier. Below the chute, the stream flows over some broken concrete slabs before entering the long, steep culvert under SR 520 and NE Points Drive, which is also a total fish passage barrier due to slope (7 percent) and a 20-foot drop at the outlet.

Culvert on West Tributary to Yarrow Bay Wetlands
This culvert is an example of a complete fish passage barrier. The pipe, which runs under NE Points Drive and SR 520, had a 6-foot drop from the outlet in 2002 (top), while the drop was about 20 feet in 2007 (bottom photo from 2007) due to continued erosion into a layer of clay.

Substantial erosion occurs at the outlet, probably because of scouring from high peak flows. The stream is entrenched downstream through a relatively high-gradient reach of exclusively riffle habitat. Farther downstream, the stream gradient decreases and the channel becomes braided and diffused as it enters the Yarrow Bay wetland complex in Kirkland. The substrate is dominated by large gravel. Although a moderate amount of LWD is present, it does not form pools. The riparian corridor along the stream is a wide and well-developed deciduous forest consisting of moderately dense, medium-sized trees. Bankfull channel widths in this reach average about 8 feet.

There are no known fish inventories of this tributary; however, based on the stream size and in-stream habitat conditions, the stream could support cutthroat trout in the lower reaches below the existing culvert.

East Tributary to Yarrow Bay Wetlands

At the time of the survey, the East Tributary to Yarrow Bay wetlands had a very low flow of less than 0.5 cfs. The stream originates at the outlet of a stormwater drainage system, located on a steep slope between SR 520 and an abandoned section of Lake Washington Boulevard. The narrow stream channel (less than 3 feet) runs generally east through a wetland and contains uniform riffle habitat. Substrate consists mainly of gravels, although embeddedness is high.

Only about 200 feet of open channel occurs on the south side of SR 520, before the stream enters a conveyance system consisting of three separate pipes joined underground (174 feet, 236 feet, and 259 feet). The pipes are placed in an "L" configuration, with a 90-degree bend, to convey the stream north across SR 520 and NE Points Drive. The culvert is considered a full fish passage barrier due to its excessive length and slope.

Exiting the culvert on the north side of SR 520, the stream is entrenched before it meanders within an ill-defined riffle/glide channel through the Yarrow Bay wetlands, flowing into the Yarrow Creek main stem in Kirkland. Substrate in the 160-foot-long reach consists of fine sediments and gravels. Riparian cover is relatively good, consisting of overhanging shrubs and some deciduous trees.

There are no known fish inventories of this stream; however, based on the stream size and in-stream habitat conditions, the stream could support cutthroat trout up to the impassable culvert under NE Points Drive and SR 520. Cutthroat may use this downstream reach for short-term rearing, although the quality of habitat is substantially degraded from natural conditions. Streamflow and habitat conditions upstream would likely not support salmonids.

Yarrow Creek and its Tributaries

The Yarrow Creek basin comprises approximately 640 acres. Yarrow Creek (WRIA 08-0252) originates in Bridle Trails State Park (about 2 miles north of the I-405/SR 520 interchange) at an elevation of 400 feet and flows 2.95 miles before entering Lake Washington along the northeastern shoreline. Flowing south from the headwaters, the stream crosses I-405, then flows about another mile in a general northwesterly direction (paralleling SR 520) before flowing through the Yarrow Bay wetlands into Yarrow Bay in Kirkland (Exhibit 29). In the reach paralleling SR 520, the main stem Yarrow Creek crosses SR 520 twice: once near Lake Washington Boulevard and again near 108th Avenue NE. King County (2004b) measured mean streamflows in Yarrow Creek at between 1 and 2 cfs.

Exhibit 29. Yarrow Creek and Associated Tributaries

Two tributary streams to Yarrow Creek (west and east) flow north from Bellevue, cross SR 520, and flow into Yarrow Creek near the south edge of the Yarrow Bay wetlands. Streamflow in these tributaries is less than 1 cfs under most conditions; however, specific flow data are not available.

Main Stem of Yarrow Creek

Located downstream from NE 108th Street (south of SR 520), the Yarrow Creek main stem is an example of a reach that has been affected by invasive, nonnative vegetation. This area is dominated by reed canarygrass. Stream substrate is primarily silt and sand.

The lower main stem of Yarrow Creek flows through an extensive wetland complex (Wetland YBN-1). The habitat consists primarily of glides with bankfull widths from 20 to over 50 feet. The stream undergoes frequent overbank flows and the boundary between the stream and wetland is ill-defined, particularly in the winter. There is a relatively large number of pools present, and the riparian vegetation consists of scrub/shrub wetland plants with a few smaller, scattered deciduous trees. Some LWD is present, and there is overhanging vegetation and undercut banks to provide fish cover. In addition, several long-term beaver dams impound significant pools, and provide good quality salmonid-rearing habitat, which would allow fish access for refuge from fast-flowing water in the main channel. Substrate in the glide and pool areas consists of mostly fine sediment, but coarse gravels and small cobbles predominate in riffles.

Main Stem of Yarrow Creek

Conditions in this photo of Yarrow Creek downstream of SR 520 are indicative of common winter overbank flows that form an inundated wetland-stream complex within the Yarrow Bay wetlands.

Yarrow Creek is on the 2008 Ecology 303(d) list for exceeding the dissolved oxygen and fecal coliform criteria (Ecology 2009). In recent years (2000 to 2008), King County water quality monitoring data indicate that about 20 percent of the samples in Yarrow Creek exceeded the fecal coliform standards and about 4 percent exceeded the dissolved oxygen standards (King County

2008). Metals measured in stormwater samples did not exceed the state criteria (King County 2008). The mean temperature was measured at 10.6ºC (with a range of 6.9ºC to 15.4ºC); no samples exceeded the state water temperature standards.

The middle reaches of the Yarrow Creek main stem cross SR 520 twice, at the SR 520 interchange with Lake Washington Boulevard and at the 108th Avenue NE interchange. The stream flows through multiple culverts at the six stream crossings, with more than 900 feet of stream contained in these pipes. All of the structures were assessed as fish passage barriers due to slope and/or velocities. In the vicinity of the interchanges, the stream is almost all glide habitat, with a riparian zone consisting of grasses and a few shrubs. No pools and only a single piece of LWD were observed, and the substrate was dominated by fine sediment. These reaches represent degraded stream habitat. Upstream of SR 520, where Yarrow Creek parallels NE Northup Way, habitat conditions improve, with a greater variety of habitat types and substrates.

West Tributary to Yarrow Creek

Exposed gravels and cobbles caused by high-flow pooling immediately upstream of the flow control device/culvert under the abandoned Lake Washington Boulevard.

The fish resources of Yarrow Creek have not been extensively inventoried. The stream historically supported coho salmon (Williams et al. 1975), which may have used the stream until the 1970s (Kerwin 2001). It is likely that juvenile coho salmon use the stream channels through the wetland because they have been found in the nearby Cochran Springs Creek, another tributary to Yarrow Creek (The Watershed Company 1998). Cutthroat trout inhabit almost the entire length, from the mouth at Yarrow Bay upstream to Bridle Trails State Park (The Watershed Company 1998; City of Bellevue 2001). Cutthroat trout were observed in the east tributary and in the main stem immediately upstream and downstream of I-405. Kokanee were presumed to have used the stream, based on historical records of a Native American village located near its mouth (Buerge 1984; Tobin and Pendergrass 1993).

Multiple fish passage barriers at Lake Washington Boulevard and farther upstream make it highly unlikely that any anadromous salmon access upstream areas for spawning. Juvenile Chinook salmon migrating along Lake Washington shorelines may use the mouth and the Yarrow Bay wetlands for short-term rearing, although none have been reported in recent surveys.

West Tributary to Yarrow Creek

The West Tributary is the longest of the surveyed tributaries. It flows south from Bellevue through relatively high-quality riffle and pool habitat. South of SR 520, riparian conditions are good, with wide (100 to 300 feet) buffers of dense, mixed forest. LWD is abundant, which results in the formation of several pocket pools with cover for fish. However, due to pool filling with fine sediments, these pools are not of sufficient size or depth to qualify as functional pools. General substrate conditions are good, with a variety of small to large gravels predominating in the substrate. A high percentage of fines was also recorded, which may have resulted in the pool filling noted above.

At the bottom of the hill slope, the stream flows in a pipe under an abandoned section of Lake Washington Boulevard. Here, upstream fish passage is completely impeded by a drop structure located at a partially screened culvert. In addition, the culvert outlet is perched and has a steep approach over rubble and riprap. Between this culvert and the culvert under SR 520, 70 feet of a partially entrenched open channel consists primarily of riffles with relatively embedded medium gravels. Here, the forested riparian zone is substantially reduced from 20 to 100 feet. The stream is conveyed by two in-line culverts, with different inlet and outlet sizes. The upstream structure connects to the downstream structure under NE Points Drive and the culvert changes directions in this location. This crossing was designated as a fish passage barrier to upstream migration (WSDOT 2008a,b).

The habitat downstream of the SR 520 culvert is of much lower gradient. The channel is not well defined but it is substantially braided as it enters the Yarrow Bay wetlands and Yarrow Creek. At low flows, water depths in the braided sections may not be deep enough for fish migration, but at higher flows the reach is accessible to fish, including salmonids. Although there are no known fish inventories of this stream, based on 2002 WSDOT electrofishing surveys and in-stream habitat conditions, the stream supports cutthroat trout at least to the barrier culvert under the abandoned Lake Washington Boulevard. Coho salmon may also be present, up to the impassable culvert under the abandoned road, based on available habitat quality and quantity.

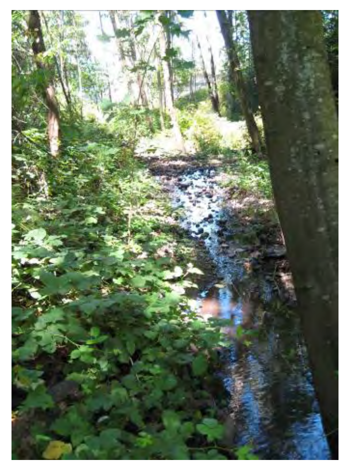
East Tributary to Yarrow Creek

The stream is located on the south side of SR 520, between the Lake Washington Boulevard/Bellevue Way and 108th Avenue NE interchanges. This forked, left-bank tributary to Yarrow Creek is approximately 0.3 mile long and originates on either side of an apartment complex located on NE 29th Street. The lower 250 feet of the stream flows through a reed canarygrass-dominated wetland in an entrenched channel. The channel is about 3 feet wide with vertical walls. No pools or other complex habitat features were present in the lower reach and riparian vegetation was almost completely dominated by nonnative grasses. Farther upstream, entrenchment becomes less pronounced, and the riparian zone is dominated by a deciduous and coniferous forest.

The single known fish inventory of this stream (City of Bellevue 2001) indicated that the length of the east fork is fish bearing (WDNR Type F), although no fish were detected during the recent survey. Although the tributary channel is slightly perched above the main stem at the confluence during low summer flows, a fish-passable hydrologic connection likely exists at higher flows. Based on this information, the stream supports, or has the potential to support cutthroat trout. Anadromous salmonids would be precluded by the multiple fish passage barriers located downstream on the Yarrow Creek main stem.

South Fork Yarrow Creek

This stream is located on both sides of SR 520, east of the 108th Avenue NE interchange. This left-bank tributary to Yarrow Creek is approximately 0.6 mile long and originates on the west side of SR 520, between 110th Avenue NE and 112th Avenue NE. A perched culvert under SR 520 represents a total fish passage barrier. In addition, two more fish passage barriers exist downstream, under the WSDOT maintenance facility and under the SR 520 off-ramp to 108th Avenue NE.



South Fork Yarrow Creek

This stream has riffle habitat and a mature riparian zone consisting of forest. In addition, channel complexity (meanders and in-stream structure) is relatively high.

Habitat near the stream mouth (within and downstream of the maintenance facility) is of limited quality, with uniform run-type habitat in an entrenched channel. No pools or other complex habitat features were present in this lower reach and riparian vegetation was almost completely dominated by nonnative grasses.

However, the reach upstream of the maintenance facility to SR 520 represents relatively good quality habitat, with numerous meanders and some complex in-stream features such as overhanging vegetation, undercut banks, and some small and large woody debris. Although larger (functional) pools were limited, numerous smaller "pocket" pools likely provide refuge to smaller fish, including juvenile cutthroat trout. A dense riparian zone, ranging from 50 to 100 feet wide, consists of coniferous and deciduous trees, and appears to provide adequate shade and a source of wood for the stream reach. Within this forested reach, the channel has a 10-foot bankfull width and a small floodplain is present. Stream substrate consists of gravels and cobbles with moderate embeddedness.

Upstream of SR 520, the channel is more entrenched, with limited floodplains. Stream substrate displays greater embeddedness, with more silt and sand present. The riparian zone is mixed forest, although coniferous trees are sparser than downstream and more invasive shrub vegetation, such as reed canarygrass and Himalayan blackberry, is present.

Although no records of fish use were noted for this stream, the stream is a WDNR Type F based on the moderately good upstream habitat conditions and the absence of natural fish barriers on the stream.

Potential Effects of the Project

What methods were used to evaluate the project's potential effects on fish resources?

Ecosystems analysts analyzed the potential effects of the project on fish resources by assessing project design data and WSDOT construction practices to identify changes to fish habitat likely to occur during and following construction of the preferred project alternative. This assessment included GIS analysis of stream channel (including culverts) and riparian buffer effects and quantitative analyses of the effects of project stormwater on pollutant loading. Ecosystems analysts worked collaboratively with the design team to minimize project effects on aquatic resources and to design channel relocations and fish passage structures to provide the maximum benefit to aquatic species and habitat.

How would construction of the project affect fish and aquatic habitat?

Ecosystems analysts evaluated construction effects on fish and aquatic species, as well as their habitat, by determining construction actions that might temporarily disturb in-water sediments and fish passage. They also evaluated the potential for accidental spills of hazardous materials.

Build Alternative

Under the Build Alternative, water quality in streams could be affected by construction activities, such as replacing or extending culverts and installing retaining walls or stormwater outfalls below the ordinary high water mark. Construction activities occurring within or directly adjacent to streams could increase turbidity and TSS levels. Streams that could be affected are those crossing or flowing adjacent to SR 520, where construction work must take place in-water (below the ordinary high water mark) or adjacent to or above water bodies in the study area.

These effects will be avoided, minimized, and mitigated through the development and implementation of temporary erosion and sediment control (TESC) and spill prevention control and countermeasures (SPCC) plans. Details on the TESC and SPCC plans are discussed in the *Fish Resources Mitigation* section of this report.

In addition, the construction would require substantial in-water work within project streams, including temporary stream bypasses and de-watering of stream reaches. The in-water work area would be separated from the existing stream with a cofferdam (constructed of sandbags or sheet piling) to minimize the introduction of runoff or sediment into the stream channel during installation and operation of the stream diversion. Prior to any in-water work associated with the diversion inlet, the diversion location would be screened-off with upstream and downstream block nets, and all fish would be removed within the work area. All fish exclusion and removal activities would follow NMFS-approved WSDOT protocols for these activities (WSDOT 2006). With these techniques and application of appropriate BMPs (see *Fish Resources Mitigation* section), minimal disturbance to fish populations would be anticipated.

Lastly, construction of the proposed project would require clearing of riparian buffers for construction access. The ecosystems analysts calculated operational riparian buffer effects by using the footprint of permanent structures (see *How would operation of the project affect fish and aquatic habitat?*), while the limits of construction were used to calculate riparian effects. To construct the project, about 3.0 acres of riparian vegetation would be cleared along several streams (Exhibit 30).

Temporary clearing of vegetative material along affected stream corridors could result in a short-term reduction of in-stream cover, which would have adverse effects on fish. Although the existing riparian conditions along the streams vary, the majority of streams have riparian buffers that are already moderately to severely degraded under existing conditions. Furthermore, the existing buffers of streams with the greatest amount of project effects consist primarily of non-native vegetation such as reed canarygrass and the effected areas are relatively small when compared with the amount of overall buffer for the individual streams. Based on these factors, many of the functions that riparian vegetation provides (such as LWD recruitment, contribution of organic material, and regulation of stream temperatures) are already altered and would not be substantially affected compared with existing conditions. Furthermore, all riparian buffer areas that undergo clearing for construction would be fully revegetated following completion of construction activities. Native trees and shrubs will be planted and maintenance and monitoring procedures followed to ensure proper levels of plant survival and cover, ultimately resulting in an improved riparian zone condition, with increased densities of native shrubs and trees.

Exhibit 30. Riparian Buffer Effects on Streams from the Build Alternative during Construction

Stream	Is Affected Stream Reach Fish-Bearing? (Yes/No)	Riparian Buffer Clearing Effects during Construction (acres)	Maximum Number of Trees Affected in the Riparian Buffer[a]
Unnamed Tributary to Fairweather Bay	Yes	~ 0.1[b]	Unknown[b]
Fairweather Creek	Yes	0	0
Cozy Cove Creek	Yes	0	0
Tributary to Cozy Cove Creek	No	0	0
West Tributary to Yarrow Bay Wetlands	Yes	0.5	2
East Tributary to Yarrow Bay Wetlands	No	<0.1	0
West Tributary to Yarrow Creek	Yes	0.3	1
Tributary of West Tributary to Yarrow Creek	No	0	0
Main Stem Yarrow Creek	Yes	1.3	20
East Tributary to Yarrow Creek	Yes	0	0
South Fork Yarrow Creek	Yes	0.7	47
Totals		**3.0**	**75**

[a] The numbers presented for effects on trees represent all trees within the affected area. The actual number of trees affected would likely be less, because tree clearing within construction or access areas would be avoided or minimized to the extent possible.

[b] Riparian buffer impacts for this stream were estimated, based on preliminary project design.

No Build Alternative

Because no construction would occur under the No Build Alternative, no effects to fish or other aquatic species and habitat would result.

How would operation of the project affect fish and aquatic habitat?

The proposed project would place new structures and/or maintain existing structures within or adjacent to the shorelines, open water, and stream habitats supporting fish species in the Lake Washington watershed. Where new structures would be constructed, the existing structures would be removed. These changes would be along the identified tributaries to Lake Washington and at several stormwater discharge points in Lake Washington. New fish-passable replacement culverts would be installed to convey numerous streams under the expanded roadway and some streams would be realigned.

Build Alternative

The primary potential effects of the Build Alternative on fish habitat in the study area would relate to replacement or removal of numerous existing culverts that cross under or adjacent to SR 520, the realignment of several streams within the study area, placement of new additional impervious surfaces (including altering the existing water quality and hydrologic regimes of the streams), and operational effects to riparian vegetation along streams. These effects would result primarily from the widening of the SR 520 roadway, construction of additional impervious surfaces, and construction of related stormwater treatment BMPs.

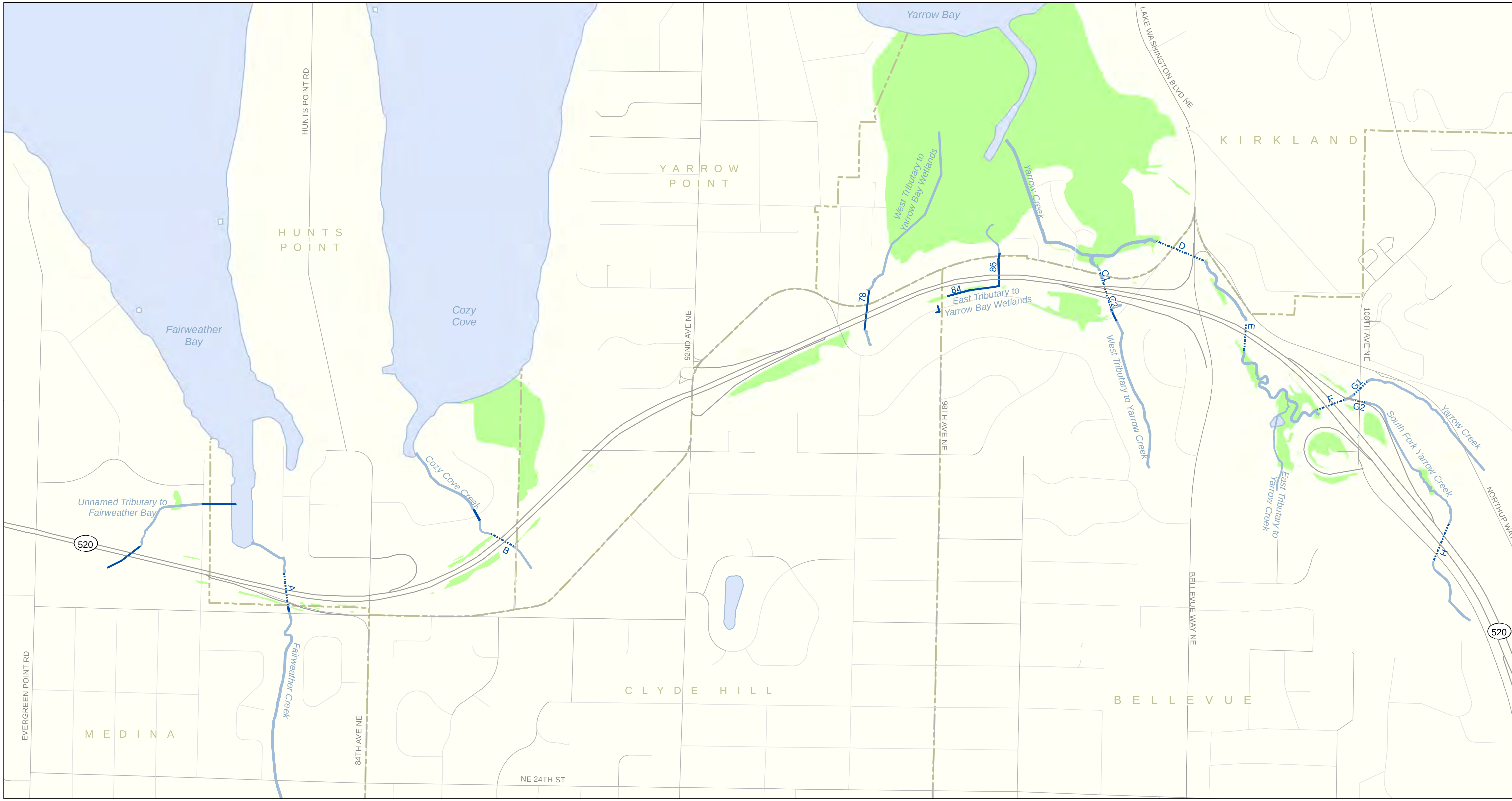
Culverts and Stream Realignments

The Build Alternative would remove, replace, or lengthen culverts on study area streams to accommodate widening of the roadway. Lengthening a culvert would require placing a currently open stream channel inside a culvert, while removing a culvert would add open channel to the stream. The Build Alternative would affect 17 existing stream crossings (Exhibits 20, 31, and 32). At six of these crossings, the existing culverts would be completely removed and open channel restored. At nine other crossings, the existing fish-passage barrier culverts would be replaced with fully fish-passable structures (proposed culverts are identified as Structures A through H). Design constraints and a lack of upstream habitat at the remaining two crossings (Structures 78 and 184/186) would require that these culvert crossings not be upgraded, and some stream channel fill would be necessary in these locations.

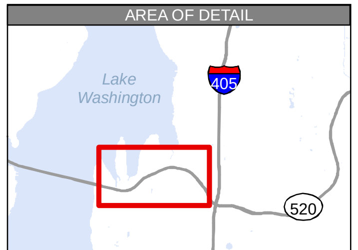
Exhibit 31. **Build Alternative Culvert Crossing Detail**

Stream Name	Structure ID Number	Structure Affected by Project? (Yes/No)	Proposed Project Action	Design Criteria for Replacement/ New Structures
Fairweather Creek	32	No	Remove culvert and install pedestrian bridge crossing as project mitigation	NA
	34	Yes	Replace with fully fish-passable culvert installed adjacent to existing structure	Stream simulation
Cozy Cove Creek	55	Yes	Replace with fully fish-passable culvert	Stream simulation
West Tributary to Yarrow Bay Wetlands	78	Yes	Extend in place and install outfall erosion protection	NA
East Tributary to Yarrow Bay Wetlands	84/86[a]	Yes	Extend culvert inlet in place resulting in fill of upstream channel	NA
West Tributary to Yarrow Creek	99/100[a]	Yes	Replace with two fully fish-passable culverts (separate culverts under SR 520 and NE Points Drive)	Stream simulation
Yarrow Creek	127, 128, 129, 130[a]	Yes	Replace all four pipes with a single fully fish-passable culvert	Stream simulation
	134	No	Remove structure and restore open channel as project mitigation	NA
	135	No	Remove structure and restore open channel as project mitigation	NA
	136	Yes	Replace with a fully fish-passable culvert	Stream simulation
	138	No	Remove structure and restore open channel as project mitigation	NA
	144	Yes	Replace with a fully fish-passable culvert	Stream simulation
	156	Yes	Replace with a fully fish-passable culvert	Stream simulation
	186	Yes	Replace with a fully fish-passable culvert	Stream simulation
South Fork of Yarrow Creek	170	Yes	Remove structure and restore open channel	Stream simulation
	174	No	Remove structure and restore open channel as project mitigation	NA
	177	Yes	Replace with a fully fish-passable culvert	Stream simulation

[a] Where two or more structures are listed under Structure ID number, it indicates that two or more in-line or adjacent culverts convey the stream across a single crossing point (e.g., a roadway).



AREA OF DETAIL



Z Proposed Culvert (Structure ID)

15 Existing Culvert (Structure ID)

Proposed Stream

Wetland

Jurisdictional Boundary

N

0 500 1,000 2,000 Feet

Source: Parametrix (2009) GIS Data (Wetland and Culvert), King County (2005) GIS Data (Stream and Street), City of Bellevue (1999) GIS Data (City Limits), and King County (2007) GIS Data (Waterbody). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 32. **Proposed Stream Alignments and Culvert Locations**

Medina to SR 202: Eastside Transit and HOV Project

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Outlet protection would be installed at Structure 78 to decrease or eliminate an existing scour and erosion problem. Five of the culvert removals listed above (Structures 32, 134, 135, 138, and 174) would not be required to accommodate the proposed design, so these structures would be removed as part of project mitigation (see *Fish Resources Mitigation* section). In cases where culvert lengthening would occur on perennial fish-bearing streams that contain suitable fish habitat upstream from the SR 520 crossing, the longer replacement culverts would be designed and constructed to be fully fish passable in accordance with WDFW guidelines (WDFW 2003).

All new culverts would be designed and constructed using the stream simulation method from WDFW. This method would ensure that the in-structure fish passage velocities were reduced substantially from existing conditions and that flow velocities would be suitable for all adult and juvenile fish species likely to inhabit the streams, including coho salmon and cutthroat trout. Stream simulation design incorporates natural substrate on the bottom of the structure to minimize loss of open stream channel. In addition, the stream simulation method (using an adequately sized box culvert) would result in the interior of the structure emulating many of the functions present in the open-water reaches of the stream (for example, natural substrate, hydraulic roughness, flood flow passage, and debris passage). Because of these culvert improvements, fish passage conditions in the overall study area would be substantially improved from existing conditions.

In most cases, the new fish passage structures would not be located in the same alignment as the existing configuration; therefore, some channel realignment at either end of the new structures would be required. In addition, as part of project mitigation (see *Fish Resources Mitigation* section), several existing reaches of Yarrow Creek would be lengthened and realigned.

Overall fish passage conditions would be improved on five streams. Project-wide, channel realignments and culvert removals and replacements would result in a gain of 980 linear feet of open-channel habitat within fish-bearing streams, and a reduction of 857 linear feet in the stream length confined in culverts (Exhibit 33). The overall results of the stream crossing improvements and the channel realignments would be a substantial net increase in both in-stream habitat quality and quantity within the study area. In addition, improved fish passage conditions downstream of the channel enhancements would result in greater fish use of these stream reaches.

Exhibit 33. **Effects of the Build Alternative on Eastside Culvert Crossings**

Stream	Is Affected Stream Reach Fish-Bearing? (Yes/No)	Net Change in Number of Culverts within Stream	Net Change in Length of Stream Confined in Culvert (Linear Feet)[a]	Net Change in Open Channel Length of Stream (Linear Feet)
Fairweather Creek	Yes	-1	-50	44
Cozy Cove Creek	Yes	0	-17	-31
Tributary to Cozy Cove Creek	No	0	0	-10
West Tributary to Yarrow Bay Wetlands	Yes	0	+67	-67
East Tributary to Yarrow Bay Wetlands	No	1	+125	-195
West Tributary to Yarrow Creek	Yes	1	-12	-76
Tributary of West Tributary to Yarrow Creek	No	1	0	-84
Main Stem Yarrow Creek	Yes	-4	-470	690
East Tributary to Yarrow Creek	Yes	0	0	0
South Fork Yarrow Creek	Yes	-1	-500	709
Totals		**-3**	**-857**	**980**

[a] Negative numbers indicate that the channel length confined to a culvert would decrease.

Unnamed Tributary of Fairweather Bay is not crossed by SR 520

Although the maintenance of fish passage barriers and loss of open-channel habitat could have a negative effect on fish habitat, the two culvert crossings (78 and 84/86) that would not be fully upgraded for fish passage are not fish-bearing upstream of SR 520 and contain only about 260 linear feet of low-quality habitat. Therefore, effects to this habitat would not be expected to have a substantial negative effect on fish populations within the study area. The overall improvements in habitat quality, habitat quantity, and fish passage proposed within the study area would more than compensate for these effects (see *Fish Resources Mitigation* section for more details).

To the extent possible, project design would seek to avoid and minimize loss of open stream channel, as well as upgrade all fish passage structures within the right of way that conveys streams. However, in the two cases where full replacement of the culverts to fish passage standards is not feasible from an engineering standpoint (Structures 78 and 84/86), the existing culverts would be extended, and outlet protection or other steps would be taken to minimize any erosion at the structures outlet. This would reduce downstream sedimentation and improve downstream substrate conditions.

The Build Alternative would result in a long-term improvement in fish passage and in-stream habitat conditions. These improvements would benefit fish and aquatic resources by creating additional rearing and migration habitat and by improving access to this area. All native fish species present within the study area would benefit, including salmonids such as cutthroat trout.

Stream Water Quantity

As discussed in the Water Resources Discipline Report (WSDOT 2009b), the Build Alternative would add approximately 22.3 acres of additional impervious surface to stream subbasins and would therefore affect stormwater discharge rates. This would be about a 51 percent increase in impervious surface area for the new roadway. However, under the Build Alternative, negative effects on stream hydrology would be expected to be minimal because of the following factors:

- Flow control (detention) would be included in all stormwater treatment facilities discharging to streams (Yarrow Creek). Stormwater detention facilities would be designed in accordance with the WSDOT *Highway Runoff Manual* (2008c). This would result in a reduction in discharge flow rates that would minimize the effect of the Build Alternative on the physical characteristics of study area streams.

- Stormwater that currently runs off into streams (Fairweather Creek and Cozy Cove Creek) would be collected and routed to Lake Washington, thereby reducing peak flows to those streams.

- During storms, the duration and magnitude of stormwater discharge into streams would decrease as compared with existing conditions.

- The percent increase in impervious surface would range between 0.1 and 2.5 percent of the total impervious surface within the individual stream subbasins. Therefore, runoff from new project-related impervious surface would contribute a relatively small portion of the overall streamflows.

Because there are no stormwater facilities in the study area today, the Build Alternative would have beneficial effects on the magnitude of peak flows within streams. In addition, because stormwater discharges from detention facilities to streams within the study area will be designed to mimic the natural flow regime, no negative effects on stream base flows would occur from the increase in impervious surface. It would not be possible to detect any change in measures of aquatic habitat and community health due to stormwater runoff flows from the SR 520, Medina to SR 202: Eastside Transit and HOV Project.

Stream Water Quality

Stormwater that runs off SR 520 in the study area is currently not treated before it is discharged into streams or ditches that eventually drain to Lake Washington. Under the Build Alternative, all stormwater entering streams would be treated for enhanced water quality before being discharged into streams. In addition, discharges into Lake Washington would be treated for basic water quality prior to release. Stormwater discharges to Eastside basins under the Build Alternative would comply with water quality regulations in accordance with WSDOT's *Highway Runoff Manual* (WSDOT 2008c).

Although some individual pollutant constituents show an increase in loading for some threshold discharge areas (TDAs), the total combined effect of the Build Alternative would be a net decrease in TSS, including total and dissolved zinc and copper, to the Lake Washington receiving environment. Therefore, stormwater discharge would not be expected to have a substantial negative effect on aquatic life within streams or Lake Washington. Any negative effects that might occur would be limited to the area immediately downstream or surrounding the discharge point of treated runoff. See the Water Resources Discipline Report (WSDOT 2009b), for further information about stormwater quality and pollutant loading.

Riparian Vegetation

Removing streamside vegetation to construct the expanded roadway would reduce the amount and quality of LWD recruited to streams, reduce stream shade that in turn could increase stream temperatures, and destabilize stream banks, thus adding to stream bank erosion. For the Build Alternative, the ecosystems analysts calculated operational riparian buffer effects by using the footprint of permanent structures.

Effects due to project operation on regulated riparian buffers would occur along three streams in the study area, totaling approximately 1.7 acres (Exhibit 34). However, some of this area is also classified as wetland, and those effects (and mitigation for those effects) are discussed in the *Wetlands* section of this discipline report.

Exhibit 34. **Riparian Buffer Effects on Streams from the Build Alternative during Project Operation**

Stream	Is Affected Stream Reach Fish-Bearing? (Yes/No)	Riparian Buffer Effects during Project Operation (acres)	Number of Riparian Buffer Trees Permanently Affected during Project Operation (acres)
Unnamed Tributary to Fairweather Bay	Yes	Approx 0.1[a]	Unknown[a]
Fairweather Creek	Yes	0	0
Cozy Cove Creek	Yes	0	0
Tributary to Cozy Cove Creek	No	0	0
West Tributary to Yarrow Bay Wetlands	Yes	0.2	0
East Tributary to Yarrow Bay Wetlands	No	0	0
West Tributary to Yarrow Creek	Yes	0.4	13
Tributary of West Tributary to Yarrow Creek	No	0	0
Main Stem Yarrow Creek	Yes	0.6	13
East Tributary to Yarrow Creek	Yes	0	0
South Fork Yarrow Creek	Yes	0.4	59
Totals		**1.7**	**85**

[a] Riparian buffer effects for this stream were estimated, based on preliminary project design.

Depending on the stream, the amount of permanent buffer that would be removed because of placement of fill would range from less than 0.1 acre to 0.6 acre under the Build Alternative. Clearing of vegetative material along affected stream corridors could reduce in-stream cover, which would have adverse effects on fish. Although the existing riparian conditions along the streams vary, the majority of streams have riparian buffers that are already moderately to severely degraded under existing conditions. Therefore, many of the functions that riparian vegetation provides (such as LWD recruitment, contribution of organic material, and regulation of stream temperatures) are already altered and would not be substantially affected compared with existing conditions. In streams where effects to riparian vegetation losses would be large, or involve removing trees or large shrubs that provide substantial shade, riparian buffer mitigation would occur where feasible (see the *Fish Resources Mitigation* section for details).

No Build Alternative

No physical changes to streams or Lake Washington would occur from the No Build Alternative. The amount of untreated stormwater runoff from SR 520 would remain unchanged and existing fish passage barriers within the stream would likely persist. However, traffic volume is expected to increase in the future, which could result in a corresponding increase in the release of stormwater pollutants into the aquatic environment. This could have a negative effect on water quality, although physical changes to in-stream fish habitat conditions are not expected to change substantially under the No Build Alternative.

How do the alternatives differ in their effects on fish and aquatic resources?

The Build Alternative would affect fish and aquatic habitat due to construction activities within streams and riparian areas. These short term effects could result in a small loss of riparian function, some increases in stream sedimentation, and a loss of habitat access due to stream diversions. However, applicable BMPs would be applied to minimize these effects, which would be relatively minor and of short duration. The scope and scale of these activities would not be expected to have a substantial negative effect on fish or overall in-stream or riparian habitat. The No Build Alternative would not involve construction effects to fish and aquatic resources.

Effects on fish and aquatic resources from the Build Alternative during project operation would generally be positive. Fish passage conditions through culverts would improve substantially, resulting in fish having greater downstream and upstream access to available habitat. In addition, the Build Alternative would substantially improve the in-stream and riparian habitats in the lower Yarrow Creek stream system. These improvements would result in an increase in the quality and quantity of aquatic habitats that support fish within these streams. Long-term riparian conditions in many of the riparian areas temporarily affected would also improve. These improvements would not occur under the No Build Alternative.

The Build Alternative would result in new impervious surfaces, but it would also treat all new and existing pollution-generating impervious surfaces within the SR 520 corridor for water quality. No such treatment would occur under the No Build Alternative. Also, runoff from all impervious surfaces draining to streams would undergo detention under the Build Alternative, resulting in an improved flow regime compared with the No Build Alternative.

Fish Resources Mitigation

What has been done to avoid or minimize potential negative effects on fish species or aquatic habitat?

The No Build Alternative would not require mitigation. WSDOT has designed the Build Alternative to include features that would minimize the operational and construction effects of the proposed alternative. Negative effects from project operation to in-stream habitat, riparian vegetation, fish passage conditions, and stream water quality and water quantity would be avoided through a design that includes fish passage upgrades, channel realignments and improvements, and inclusion of stormwater treatment facilities. Overall, these facilities would improve long-term in-stream habitat and fish passage conditions, and either maintain or reduce current pollutant loading levels to water bodies in the study area.

Negative effects on streams and fish during construction would be avoided or minimized by restricting all in-water work to authorized construction periods. These “work windows” would exclude periods when juvenile salmon were likely to be present in substantial numbers. Adherence to designated work windows, as identified by the appropriate agencies (WDFW, NOAA Fisheries, and USFWS), would also eliminate or reduce in-water interference during periods when returning adult salmon were present. WSDOT would restore temporarily cleared areas to preconstruction grades and replant the areas with appropriate native vegetation.

Potential effects on streams, including sedimentation during construction, would be minimized as follows:

- **Avoidance** – Use of permanent retaining walls to minimize effects to streams and riparian buffers by reducing the project footprint. Except where absolutely necessary, construction equipment will not enter below the ordinary high water mark of streams. Staging areas and stockpiling areas would be located well away from aquatic areas.

- **Prevention** – Use of appropriate BMPs to reduce the risk of erosion and reduce or minimize the chance of sediments entering project water bodies. Erosion and sediment control measures could include mulching, matting, and netting; filter fabric fencing; quarry rock entrance mats; sediment traps and ponds; surface water interceptor swales and ditches; and the placement of construction material stockpiles away from streams. In addition, a TESC plan for clearing or removing vegetation, grading, ditching, filling, excavating, and conducting embankment compaction will be prepared and implemented to minimize and control pollution and erosion from all vegetation or ground-disturbing activities. Erosion and sediment control BMPs would be properly implemented, monitored, and maintained during construction. No long-term water quality effects would be expected, although even with BMPs, some short-term water quality effects for sediment (such as increases in stream turbidity) would be possible, particularly during large storm events. However, the magnitude of these effects would be small, and not likely to adversely affect stream water quality.

Additional BMPs that WSDOT could use during construction include the following:

- Ensuring that the TESC plan details the risk of erosion in different parts of the project site and specifies BMPs to be installed prior to construction activities. The plan will be prepared by the contractor(s) selected to complete the final design of the project, as required by WSDOT Standard Specification 1-07.15(1).
- Using containment tarps or netting when working over water to retain fallen materials.
- Hydroseeding all bare soil areas after completing the grading.
- Clearly labeling streams and riparian buffers on construction plans and in the field.
- Demarcating clearing limits with orange barrier fencing wherever clearing is proposed in or near critical areas.
- Performing vehicle refueling and maintenance activities away from sensitive areas (i.e., streams and wetlands).

- Minimizing the duration of in-water work (below the ordinary high water mark) and strictly adhering to the appropriate fish work windows as identified by the appropriate agencies (WDFW, NOAA Fisheries, and USFWS).
- Preparing an SPCC plan for the project, to be submitted by the contractor to the Project Engineer prior to beginning construction, and maintaining a copy with any updates at the work site.
- Prohibiting disposal of waste and excess materials below the ordinary high water mark.
- Complying with Washington's surface water quality standards (Chapter 173-201A WAC), which specify a mixing zone beyond which water quality standards cannot be exceeded. Monitoring of water quality would occur during construction to ensure compliance with Ecology's standards to protect fish and aquatic life.
- Containing excavated sediment in Baker tanks or other appropriate containers to avoid discharge to surface water, and taking the sediments to an approved disposal site.
- Curing concrete before contact with surface water, as required by WAC 110-220-070(1)(g), to avoid higher pH levels that can occur when fresh concrete contacts water.
- Checking equipment regularly to prevent spills into surface water from fuel hoses, oil drums, or oil or fuel transfer valves and fittings.

How could the project compensate for unavoidable adverse effects on fish or aquatic habitat?

WSDOT will avoid and minimize the effects of constructing and operating the Build Alternative on fish and aquatic/riparian habitat to the extent feasible. However, short-term negative effects would still occur, although these would be relatively minor and fully compensated with the implementation of onsite project mitigation activities. The primary effects from project operation requiring mitigation would be as follows:

- Continued fish passage barriers remaining at two SR 520 cross culverts (13 other stream crossings across the study area will be upgraded for full passage of fish as part of the project).

- Approximately 1.7 acres of riparian buffer loss from expansion of the SR 520 alignment and associated stormwater facilities.
- The replacement of culverts requiring stream realignments at numerous stream crossings, resulting in construction effects and a potential temporal loss of in-stream habitat.

These effects on fish and aquatic habitat will be fully compensated during construction of the Build Alternative. In cooperation with resource agencies, WSDOT will develop plans for habitat improvements, including stream enhancements or restoration to mitigate the effects of project construction and operation. Specific plans would be included in permit applications for construction of the SR 520, Medina to SR 202: Eastside Transit and HOV Project.

WSDOT will address in-stream effects to satisfy the requirements of the regulatory agencies (including local critical areas regulations) and to enhance in-stream fish habitat to the maximum extent possible. Most of the streams affected by the project are associated with Yarrow Creek (and the Yarrow Bay wetlands) and all streams that would be affected drain into Lake Washington. Therefore, WSDOT will seek to conduct mitigation activities within the project corridor. This strategy will improve stream conditions over the entire affected basin area, with a primary focus on improving the quality and quantity of in-stream and riparian habitat in those streams and stream reaches that would have the greatest potential benefit to fish and other aquatic species.

WSDOT will concentrate in-stream and riparian mitigation efforts in the lower Yarrow Creek basin. The advantages of concentrating in-stream habitat and riparian improvements along restored stream reaches of Yarrow Creek and the South Fork of Yarrow Creek include the following:

- Mitigation will be concentrated along a stream where significant salmonid use is confirmed and where stream reaches have been identified as lacking in riparian vegetation, stream shading, LWD, or bank stability.
- Revegetation could cover sufficient area to improve important stream processes and functions (such as stream temperature, LWD recruitment levels, nutrient cycling, bank stabilization, and floodplain functions) in a meaningful and measurable way.

- Maintenance, monitoring, and adaptive management techniques would be more efficient and effective when concentrated within one or two large parcels rather than on multiple small parcels.

The goal of the mitigation plan is to fully compensate for effects to fish and aquatic habitat due to project operation. These compensations will provide a substantial increase in the quantity and quality of fish and aquatic habitat in the restored reaches, while ensuring the system remained relatively stable and supported the functions and processes to maintain properly functioning stream conditions.

The mitigation strategy is designed to compensate for unavoidable negative effects on fish and aquatic habitat by incorporating the following elements into the mitigation plan:

- Shorten replacement stream crossing structures to provide additional open channel, to the extent possible.
- Remove two culverts that are blocking fish passage, which are located outside of the project footprint, and restore an open stream channel within these areas.
- Remove the road fill associated with two abandoned SR 520 ramps, and restore daylight to Yarrow Creek at three existing culverts within these areas.
- Realign two reaches of Yarrow Creek (approximately 2,000 feet of stream channel) and 750 feet of the South Fork Yarrow Creek, resulting in a substantial increase in available fish habitat.
- Restore habitat complexity and stream functions within the realigned reaches to provide higher quality fish habitat than currently exists. Improvements will include improving channel morphology, connecting floodplains, and installing a large amount of LWD.
- Remove and regrade existing roadway fill within the realigned reaches along the main stem and South Fork of Yarrow Creek, and plant 2.1 acres with native riparian vegetation (trees and shrubs).

Stream crossings under SR 520 would be shorter than existing structures on five streams within the study area. In addition, WSDOT will completely remove five fish passage barriers (Structures 32, 134, 135, 138, and 174 on Fairweather Creek and the South Fork Yarrow Creek, respectively), which would not be otherwise affected by the project. The removal of these two structures on fish-bearing streams would allow increased access to approximately 3,000 linear feet of moderate quality upstream habitat. These fish passage improvements would more than offset the 325 linear feet of low quality habitat (upstream Structures 78 and 84/86) that would be filled or remain inaccessible due to the project.

The realigned channels would be substantially more sinuous than the existing channels and have added floodplain areas, which would be periodically inundated at high flows. Stream gravel (naturally occurring, rounded, well-sorted, and free of organic debris) will be placed in the bottom of the bankfull channels to form the substrate of the low-flow channel and gravel bars. The restored reaches would also incorporate bank stability measures, such as coir fabric and willow stakes, to improve habitat along the edge of the stream.

Context-appropriate habitat features, such as pools and LWD, will be included in the design to provide immediate benefit to aquatic species. While these habitat features would be ephemeral (installed LWD would eventually biodegrade and the locations of pools would likely change over time), the stream design, coupled with associated riparian improvements, would use natural stream and riparian processes to ensure the persistence of features and functions that are important for fish and other aquatic species.

As a result, the restoration approach for the lower Yarrow Creek area would improve overall channel functioning, including (1) improving hydrologic connectivity with the floodplain and conditions within the channel and along stream banks; (2) increasing in-stream habitat diversity, including the creation of pools and placement of LWD; (3) increasing native riparian plants; and (4) creating channel meanders and stream slope widths and depths consistent with hydrologic and sediment conditions. Additionally, engineered structures such as LWD, vertical controls, and bioengineered stream banks would help ensure stream stability. Secondary benefits that would be expected to emerge over time include the development of native plant communities, as well as in-stream and riparian biological functioning.

In addition to in-stream improvements, the riparian zone of the realigned channels would be greatly enhanced from existing conditions. Existing riparian conditions in the mitigation stream reaches are severely degraded and dominated by reed canarygrass, a nonnative species. The functional lift achieved from installation of native trees and shrubs would be substantial. Although the area proposed for enhancement is somewhat smaller than the affected buffer area within the project footprint, the mitigation site would provide vastly increased functions and values compared with the affected riparian zones. The mitigation site would also substantially benefit salmonids. Many of the buffer areas in the study area that would be affected are in-stream reaches for which upstream and downstream fish passage is limited or nonexistent. Because the realigned portions of the Yarrow Creek system would be located in an area that would become fully accessible to fish due to downstream culvert removals and replacements, the functions that would be improved due to the riparian improvements would more directly benefit salmon and other fish. Furthermore, the vast majority of existing vegetation that would be replaced consists of grass or shrubs, with pervasive nonnative species present. Functionally, these riparian areas are providing only extremely limited amounts of nutrient recruitment and sediment filtration, bank stabilization, or habitat complexity in the form of overhanging vegetation; almost no stream temperature regulation; and no LWD recruitment. Post-mitigation conditions would immediately provide some of these functions. In the long term, post-mitigation would provide the full suite of these functions, including LWD recruitment that would naturally supplement the initial LWD loading achieved through in-stream enhancements (see above for details on in-stream enhancements).

The overall mitigation approach would largely maintain or improve fish habitat access and conditions within streams along the proposed project alignment, while substantially improving fish habitat and riparian quality on Yarrow Creek and the South Fork of Yarrow Creek.

Wildlife and Habitat

Wildlife and habitat are important components of ecosystem health and function. Some of the ways in which wildlife affect ecosystems include consuming vegetation, insects, or other wildlife; providing a source of prey and nutrients to other animals; and serving as a mechanism of seed dispersal.

Affected Environment

How was information on wildlife habitat and wildlife occurrence collected?

The ecosystems analysts generally looked for wildlife and wildlife habitat up to 0.25 mile from the proposed project alignment. The 0.25-mile boundary was chosen because the proposed project could affect wildlife and habitat within this area.

The ecosystems analysts identified basic landscape cover types and the specific wildlife habitats within each cover type within 0.25 mile of the project corridor. For example, ecosystems analysts identified Parks and Other Protected Areas as a cover type, and noted deciduous forest, coniferous forest, wetland, and other habitats within this cover type.

The analysts also reviewed reports from WDFW and other sources about the habitat associations and distribution of wildlife in the project vicinity. The WDFW Priority Habitats and Species (PHS) database provided information on specific locations of priority species and priority habitat. WDFW defines priority species as those species that are priorities for conservation and management. Priority species include state-listed endangered, threatened, sensitive, and candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. Priority habitats are those habitat types or elements with unique or significant value to a diverse group of species.

Ecosystems analysts reviewed USFWS information about known or expected occurrences of species listed or proposed for listing under the ESA, as well as federal species of concern in King County. Project analysts also conversed with federal, state, and local biologists to obtain additional species occurrence information. To supplement the existing data, the ecosystems analysts investigated field conditions, conducted surveys, and reviewed aerial photographs of the study area to categorize the cover types and to identify habitat within these cover types.

What are the landscape cover types and wildlife habitat characteristics in the study area?

The study area was categorized into three cover types based on similarities in landscape features (for example, presence of vegetation, buildings, and roads) and expected wildlife occurrence and use. The three cover types in the study area are (1) Urban Matrix, (2) Open Water, and (3) Parks and Other Protected Areas. Exhibit 35 shows the location of the existing cover types in the study area. Within these landscape cover types, various habitats are present, as described further in Exhibit 36.

Typical habitat in the Open Water cover type

Typical habitat in the Parks and Other Protected Areas cover type

Typical habitat in the Urban Matrix cover type

Urban Matrix

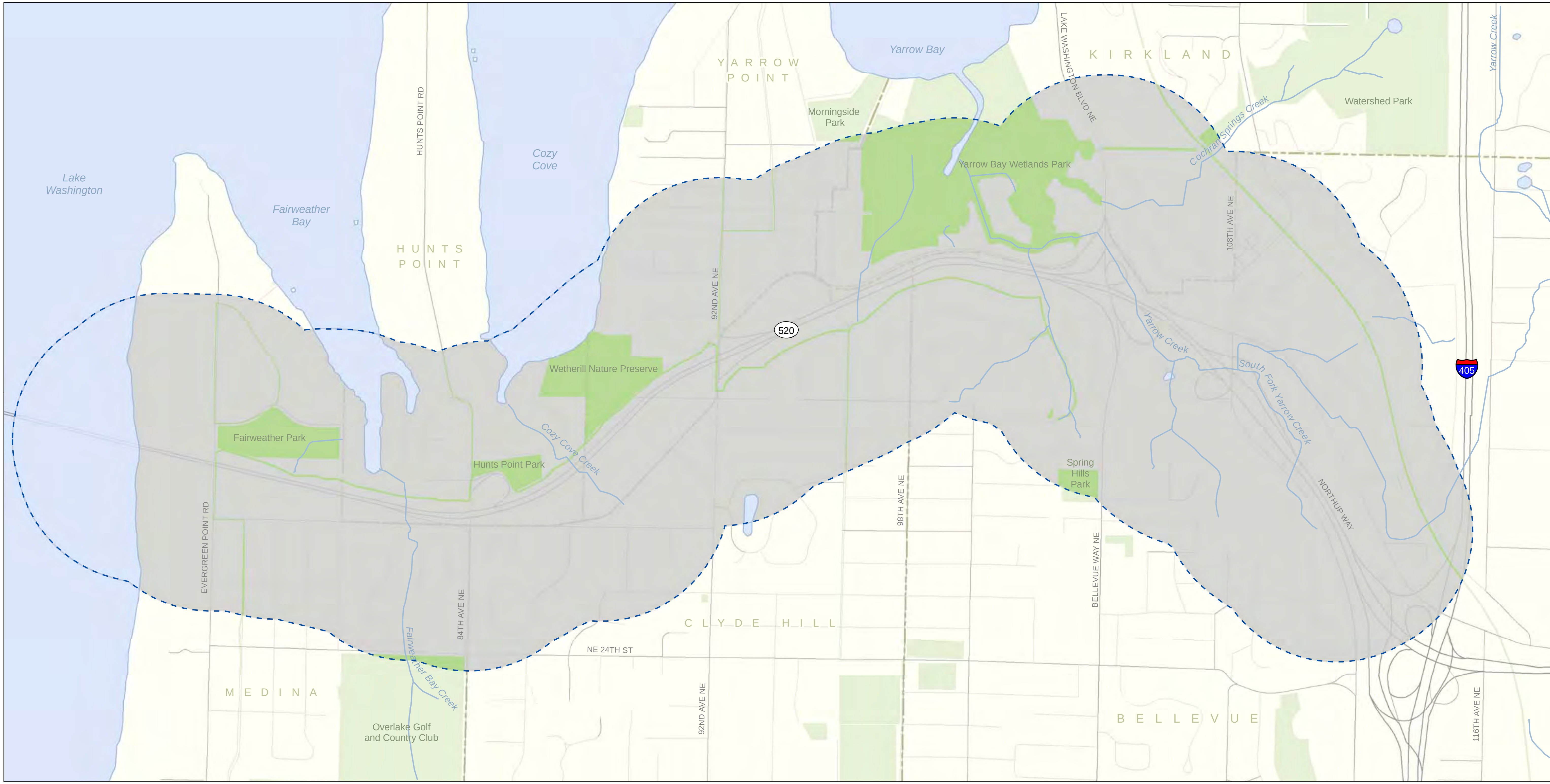
Commercial and residential areas with buildings, asphalt, ornamental gardens, lawns, and scattered trees.

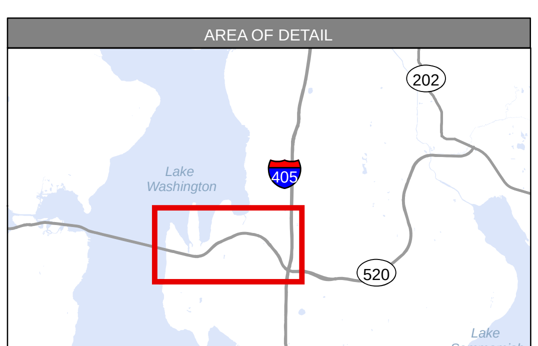
Open Water

Fairweather Bay, Cozy Cove, Yarrow Bay, and Lake Washington.

Parks and Other Protected Areas

Includes Fairweather Park, Wetherill Nature Preserve, and Yarrow Bay wetlands.





Cover Type

- Open Water
- Park or Other Protected Area
- Urban Matrix
- Stream
- Study Area
- Park Outside of Study Area
- Jurisdictional Boundary

N

0 500 1,000 2,000 Feet

Source: King County (2008) GIS Data (Stream and Street), King County (2007) GIS Data (Waterbody), City of Bellevue (1999) GIS Data (City Limits), and CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 35. **Existing Habitat Types in the Study Area**

Medina to SR 202: Eastside Transit and HOV Project

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Exhibit 36. Landscape Cover Types, Habitats, and Representative Associated Wildlife

Cover Type	Description	Habitat Occurrence and Representative Associated Wildlife	Other Notes
Urban Matrix	Commercial and residential areas with buildings, asphalt, ornamental gardens, lawns, and scattered trees	Limited wildlife habitat available. Roadside deciduous and coniferous trees provide some habitat for common birds (e.g., European starlings, American robins, American crows, black-capped chickadees). Ornamental and native trees and shrubs in residential lots provide habitat for additional species (e.g., Steller's jays, northern flickers, ruby-crowned kinglets, raccoons). Small scrub-shrub, emergent, and forested wetlands provide habitat for Pacific treefrogs, garter snakes, raccoons, song sparrows, bushtits, and other songbirds. Wildlife species diversity is generally expected to be greater in the larger and more structurally diverse wetlands. Riparian vegetation along Fairweather Creek and most of Cozy Cove Creek is dominated by ornamental lawns, Himalayan blackberry, and other nonnative vegetation. For this reason, these areas provide relatively low-quality wildlife habitat. Vegetation adjacent to a portion of Cozy Cove Creek near Cozy Cove, as well as most of Yarrow Creek and its tributaries are within the Urban Matrix cover type and includes riparian trees and shrubs and wetlands that provide habitat for a variety of riparian-associated wildlife.	Most abundant cover type distributed throughout the study area (971 acres). Approximately 83 percent of the study area is Urban Matrix.
Open Water	Fairweather Bay, Cozy Cove, Yarrow Bay, and Lake Washington	Provides habitat for a variety of freshwater-associated wildlife, including waterfowl, the most common of which are American coots, buffleheads, mallards, scaups, goldeneyes, widgeons, Canada geese, double-crested cormorants, pied-billed grebes, and western grebes. Other species present include bald eagles, great blue herons, belted kingfishers, river otters, beavers, Pacific treefrogs, and bullfrogs. Bat species forage over open water.	Approximately 8 percent of the study area is Open Water (93 acres).

Exhibit 36. Landscape Cover Types, Habitats, and Representative Associated Wildlife

Cover Type	Description	Habitat Occurrence and Representative Associated Wildlife	Other Notes
Parks and Other Protected Areas	Includes Fairweather Park, Wetherill Nature Preserve, and Yarrow Bay wetlands	These parks and other protected areas contain mostly upland deciduous forests (usually dominated by big leaf maple); riparian forests (dominated by cottonwoods and other riparian-associated deciduous trees); and forested, scrub-shrub, and emergent wetlands. Wetherill Nature Preserve contains forested areas dominated by Oregon ash. The Yarrow Bay Wetlands Park includes Yarrow Bay Creek and tributaries. The upland forests within the parks and other protected areas provide habitat for a variety of birds, including warblers and other songbirds, hairy woodpeckers, red-tailed hawks, Cooper's hawks, and band-tailed pigeons. Wildlife associated with the wetlands and riparian areas includes red-winged blackbirds, marsh wrens, great blue herons, belted kingfishers, beavers, mink, foraging bats (e.g., little brown bats and big brown bats), Pacific treefrogs, and garter snakes. Large cottonwood trees provide potential nesting, roosting, and perching sites for great blue herons, bald eagles, and other bird species. Great-horned owls and wood ducks are known to occur at Wetherill Nature Preserve (Audubon Society 1999).	Approximately 9 percent of the study area consists of Parks and Other Protected Areas (103 acres). Parks consisting solely of sports fields are not included because these areas do not provide valuable wildlife habitat.

Do any federally listed species occur in the study area?

USFWS (2007) identified five federally listed wildlife species (Canada lynx, gray wolf, grizzly bear, marbled murrelet, and northern spotted owl), one federally listed plant species (golden paintbrush), and two candidate wildlife species (Oregon spotted frog and yellow-billed cuckoo) as occurring or potentially occurring in King County. No suitable habitat and/or historical sightings of any of these species have been documented within the study area; therefore, these species are not addressed further in this analysis.

Do any federal species of concern occur in the study area?

USFWS (2007) identified five mammal species, four bird species, four amphibian species, one reptile species, three invertebrate species, and three plant species as federal species of concern that are known to occur or may occur in King County. Based on the presence of potentially suitable nesting and/or foraging habitat, two of these species (bald eagle and peregrine falcon) may occur in the study area and are discussed below.

Bald Eagle

The bald eagle, a federal species of concern, is protected under the Bald and Golden Eagle Protection Act. Bald eagles generally are found along shores of saltwater and freshwater lakes and rivers that support substantial prey densities (generally anadromous fish or waterfowl) (Livingston et al. 1990; Stalmaster 1987). Breeding bald eagles use large trees for nesting that are generally within a mile of and have an unobstructed view of water (Oregon Department of Fish and Wildlife [ODFW] 1996; Anthony and Isaacs 1989). Nest trees are usually found in old-growth or residual old-growth stands, but some nesting also occurs in riverine and lakeside forests dominated by cottonwood (ODFW 1996). Both breeding and wintering bald eagles forage over open water and use riparian trees (often cottonwoods) for perching. Suitable habitat for this species is found within the study area. The breeding territory of bald eagles near the study area is listed in Exhibit 37.

Exhibit 37. Bald Eagle Breeding Territories near the Study Area

Breeding Territory	Distance from Alignment	Nest Site and History
Hunts Point	Territory extends to approximately 600 feet south of project alignment.	Territory contains two nest sites. Nest at Yarrow Bay wetlands was active in 1996 (one young), 1997 (one young), and 1998 (two young), and inactive in 2009; the site is approximately 900 feet from the project alignment. The Hunts Point nest, which was active in 1999 (productivity unknown), 2000 (unsuccessful), and 2001 (one young), is approximately 2,400 feet from the project alignment. This nest site was not checked in 2002, 2003, or 2004, but was active in 2006. The foraging area for this territory is more than 1,000 feet from the project alignment.

Sources: WDFW (2008); Julie Stofel, Staff Biologist, WDFW, Mill Creek, Washington. March 8, 2004. Personal communication.

Peregrine Falcon

Peregrine falcons typically locate their nests (aeries) on cliffs at least 150 feet high (Hays and Milner 1999). The species has also been documented nesting on skyscrapers in urban areas (Smith et al. 1997). In winter and fall, peregrines spend much of their time foraging in areas with large shorebird or waterfowl concentrations, especially in coastal areas (Dekkar 1995). No peregrine falcon nests have been documented within 1 mile of the study area, and no observations of falcons have been recorded (WDFW 2008). However, wetland and open water habitats in the study area may provide suitable foraging habitat for this species.

Do any state-listed or other state priority wildlife species occur in the study area?

Two state-listed sensitive species, the bald eagle and the peregrine falcon, are known or expected to occur near the study area (WDFW 2008). Western grebe, a state candidate species, occurs on Lake Washington during winter. Other state-listed, state candidate, or state priority species that may occur in the study area include western grebe, common loon, great blue heron, cavity-nesting ducks (e.g., hooded merganser, wood duck), band-tailed pigeon, and pileated woodpecker. Bald eagles and peregrine falcons are addressed in the discussion of federal species of concern above. Exhibit 38 provides information on species that historically occurred or that may occur in the study area. Information on species that are known or likely to occur in the study area is provided in the subsections that follow.

Exhibit 38. Occurrence of Wildlife Species of Special Interest in the Study Area

Species	Status	Occurrence in the Study Area
Bald Eagle	Federal Species of Concern, State Sensitive	One bald eagle territory with two associated bald eagle nest sites (see Exhibit 37).
Peregrine Falcon	Federal Species of Concern, State Sensitive	No known occurrences. May prey on pigeons and waterfowl in wetland and open-water habitats in the study area.
Olive-sided Flycatcher	Federal Species of Concern	Potential breeding habitat may occur in the vicinity of the study area. Most sightings of this species in city parks and residential neighborhoods probably represent migrants rather than breeding individuals, however (Opperman et al. 2006).
Western Toad	Federal Species of Concern, State Candidate	Wetlands in the study area may provide suitable breeding habitat, but no sightings of this species have been recorded in the lowland areas of King County since 1984 (Hallock and McAllister 2005).
Western Pond Turtle	Federal Species of Concern, State Endangered	No known occurrences. Nearly extirpated from the Puget Sound area, largely due to habitat alteration and loss, disturbance from humans, and introduction of nonnative predators; individual western pond turtles occasionally sighted in Lake Washington are likely released pets (WDFW 1993a).
Western Grebe	State Candidate	Not present during breeding season. Several hundred western grebes occur on Lake Washington during winter (Opperman et al. 2006).
Common Loon	State Sensitive	No known occurrences. Only documented nesting in western Washington occurs on lakes and reservoirs with limited public access, indicating that nesting is not compatible with recreational boating or residential development (Opperman et al. 2006).
Great Blue Heron	State Priority	Forages in wetlands at Wetherill Nature Preserve and Yarrow Bay. Historical heron rookery with three nests occurred at the Yarrow Bay wetlands.[a]
Cavity-nesting Ducks	State Priority	Wood ducks probably nest at Wetherill Nature Preserve (Audubon Society 1999). In winter, hooded mergansers and wood ducks may occasionally occur in wetland and open-water habitats in the vicinity of Wetherill Nature Preserve and Yarrow Bay wetlands.
Band-tailed Pigeon	State Priority	May nest in forested portions of parks and other protected areas (e.g., Wetherill Nature Preserve and Yarrow Bay wetlands).
Pileated Woodpecker	State Candidate	May occasionally forage at the parks (e.g., Wetherill Nature Preserve). Nesting pileated woodpeckers are not expected in the study area.
Red-tailed Hawk	Locally Protected	An active red-tailed hawk nest site occurs at the Yarrow Bay wetlands.[b]

[a] The rookery was approximately 500 to 600 feet north of the proposed project alignment. The nests were first detected in February 2004. No nests were active as of March 4, 2009 and there were no signs of recent nesting activity.
[b] The nest site, which is approximately 700 feet from the proposed project alignment, was noted as active on March 4, 2009.

Great Blue Heron

Great blue herons are associated with both freshwater and saltwater wetlands, seashores, rivers, swamps, marshes, and ditches (WDFW 2003). This species feeds on aquatic and marine animals in shallow waters and occasionally preys upon mice and voles (Calambokidis et al. 1985; Butler 1995). Nests of these colonial breeders are usually constructed in the tallest trees available at a given site (WDFW 2003).

Cavity-nesting Ducks

WDFW's PHS list includes nesting individuals of the following species: wood duck, Barrow's goldeneye, common goldeneye, bufflehead, and hooded merganser. These species nest almost exclusively in tree cavities; as secondary cavity nesters, they use natural cavities or cavities created by large woodpeckers. In addition, several of these species will use artificial nest boxes, where available. Preferred nest trees are generally found near shallow wetlands and are greater than 24 inches diameter at breast height (dbh) (WDFW 2003).

Band-Tailed Pigeon

Band-tailed pigeons may occur in the study area during the breeding season (April to September). During this time, the birds nest in both coniferous and deciduous forests.

Pileated Woodpecker

The pileated woodpecker is generally associated with older forests that have large trees, snags, and coarse woody debris (Aubry and Raley 1993; Nelson 1988). These birds may also use younger forests for foraging, where snags are present (WDFW 2003). In addition, pileated woodpeckers are known to occasionally forage on suet feeders, utility poles, and fruit trees in suburban areas (WDFW 2003).

Do any other wildlife species of special interest occur in the study area?

Other species of special interest include those species that receive protection by county and/or city ordinances but are not federally or state-listed or considered state priority species. These locally protected species include raptors, particularly raptor nest sites. Raptor nests and eggs are also protected under the Federal Migratory Bird Treaty Act and the state Revised Code of Washington (RCW 77.15.130).

The study area contains a documented active red-tailed hawk nest site. The red-tailed hawk is primarily associated with forest and woodland edges (Shuford 1993). Nests of this species are usually in large trees within open woods or small woodlots that provide good views of surrounding areas (Shuford 1993; WDFW 1993b). Unobstructed access to the nest and isolation from disturbance are generally important nest site characteristics as well. However, active nests have been documented in areas with a high degree of disturbance, such as along the I-5 corridor (Smith et al. 1997).

How are these protected species distributed within the study area?

All of the protected species mentioned above potentially use one or more parts of the study area occasionally, if not frequently. Bald eagles, pileated woodpeckers, red-tailed hawks, and great blue herons are known to use Eastside habitats such as Wetherill Nature Preserve and/or Yarrow Bay wetlands. Exhibit 38 describes the occurrence of protected species within each portion of the study area.

Do WDFW priority wildlife habitats occur in the study area?

WDFW priority habitats within the study area include urban natural open space, riparian areas, and wetland areas (WDFW 2008). Urban natural open spaces are described under the Parks and Other Protected Areas cover type in Exhibit 36. The occurrence of riparian areas and wetlands are also described in the *Wetlands* and *Fish Resources* sections of this report.

Potential Effects of the Project

What methods were used to evaluate the project's potential effects on wildlife and habitat?

The ecosystems analysts evaluated the project's potential effects on wildlife and habitat using various methods and resources, including the following:

- GIS analysis and site reconnaissance to determine acreage, type, and location of affected habitat.
- Review of anticipated construction and highway traffic noise effects on raptor nest sites and other high-quality or sensitive habitat areas.

- Review of anticipated construction and highway traffic effects on water quality and quantity.
- Literature review of the effects of road construction and operation on wildlife and habitat.

How would construction of the project affect habitat and associated wildlife species?

Construction activity could affect habitat and/or wildlife through the following:

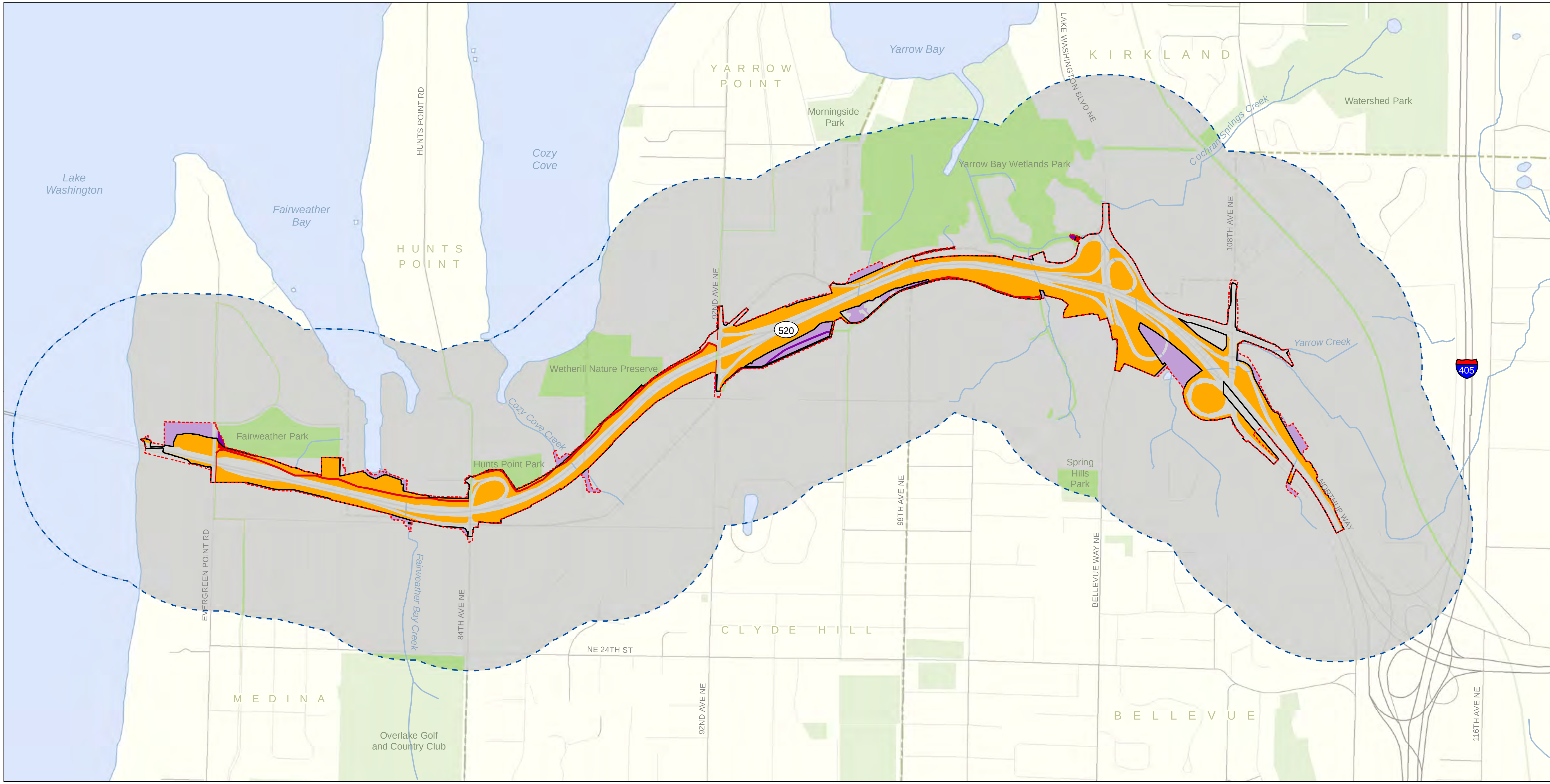
- Effects on vegetation.
- Water quality effects.
- Disturbance from noise and associated construction activity.

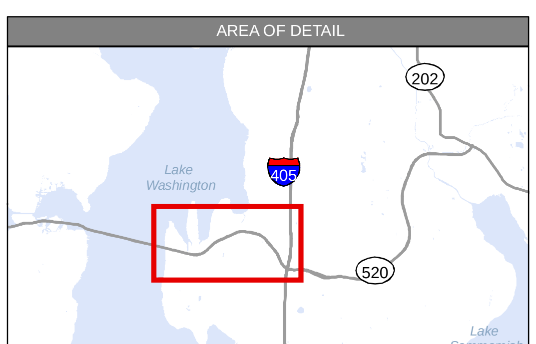
Because there would be no construction under the No Build Alternative, it would have no construction effects on habitat and wildlife.

How would vegetation clearing for construction affect wildlife and habitat?

Some minor clearing of vegetation for construction would occur in areas where stream channel alteration and rehabilitation were planned. The total amount of vegetation clearing for construction would be approximately 1 acre in the Parks and Other Protected Areas cover type and 13 acres in the Urban Matrix cover type (see Exhibit 39). This small amount would not likely produce any long-term effects on wildlife habitat or wildlife populations in the study area.

Construction activities would affect 1.6 acres of wetlands and 0.9 acre of wetland buffers. Because these are small amounts and would be temporary in nature, negligible effects on wildlife habitat and populations would be expected.





Cover Type

- Open Water
- Park or Other Protected Area
- Urban Matrix
- Park Outside of Study Area
- Limits of Construction
- Permanent Effect Footprint
- Permanent Park/Protected Area Effect
- Permanent Urban Matrix Effect
- Temporary Park/Protected Area Effect
- Temporary Urban Matrix Effect
- Stream
- Study Area
- Jurisdictional Boundary

N

0 500 1,000 2,000 Feet

Source: King County (2008) GIS Data (Stream and Street), King County (2007) GIS Data (Waterbody), City of Bellevue (1999) GIS Data (City Limits), and CH2M HILL (2008) GIS Data (Parks). Horizontal datum for all layers is NAD83(91); vertical datum for layers is NAVD88.

Exhibit 39. **Effects of the Build Alternative on Cover Types in the Study Area**

Medina to SR 202: Eastside Transit and HOV Project

\\SIMBA\PROJ\PARAMETRIX\180171\GIS\MAPFILES\EA\ECOSYSTEMS\EA_DR_ECOS_HABITATEFFECTS.MXD 7/7/2009

How would wildlife be affected by construction effects on water quality?

The Build Alternative could affect wildlife and habitat through construction-related effects on water quality. Specific effects that could occur include the following:

- Increased mortality of Pacific treefrog eggs due to sedimentation.
- Poisoning or otherwise injuring waterfowl, beavers, and other aquatic wildlife through spills of oil, gasoline, concrete, and other toxic substances.

Measures to avoid or minimize these effects to wildlife will include using erosion control barriers and implementing other BMPs.

How would noise and associated construction activity affect wildlife?

Project construction would occur over approximately 4 years. Noise and associated construction activity can disturb wildlife. The degree of disturbance would depend on noise level, timing, and duration of construction activities, as well as the sensitivity of the individual animals. In general, most wildlife in areas adjacent to the study area are adapted to urban conditions and highway noise. However, loud construction activities could temporarily displace some animals or prevent them from using adjacent habitats. In extreme cases, birds could abandon their nests in response to noise disturbance.

During project construction, average noise levels near wildlife habitat along SR 520 (i.e., within 100 feet of construction activities) would rise from the current levels (60 to low 70s decibels on an A-weighted scale [dBA], depending on the location) to approximately 94 dBA during construction of the new road surface. Noise levels would decrease with distance from the construction area. In most cases, noise levels at distances of 750 to 1,000 feet from areas of active construction would be similar to existing ambient noise levels.

Lighting associated with nighttime highway construction could also disturb wildlife. Disturbance would be expected to be greatest in areas where existing light levels are relatively low and in areas with minimal vegetation or other structures to block the light.

How would the project construction affect federally listed species and federal species of concern?

The effects of most construction activities on eagles in the Hunts Point nesting territory would be expected to be negligible under the Build Alternative. The two documented nest sites for the territory are 900 feet and 2,400 feet, respectively, from the proposed construction area. At these distances, noise produced by most construction activities would be similar to ambient noise levels. If the nearer nest site (Yarrow Bay wetlands, where no use has been documented since 1998) became occupied noise could disturb eagles using the nest. The more distant nest site (Hunts Point) is separated from the location of proposed construction activities by a substantial distance (2,400 feet) and dense vegetation in Wetherill Nature Preserve. Noise from any construction activities would be reduced due to distance from the nest and the dense vegetation. As a result, eagles using the Hunts Point site are unlikely to be disturbed.

The foraging area for the Hunts Point territory is more than 1,000 feet from the proposed project construction area; it is unlikely that construction-related noise would be audible at that distance. Areas near the roadway in the study area do not provide roosting habitat for wintering bald eagles; consequently, no construction effects on wintering eagles would occur in this area.

How would the project construction affect other state-listed or other state priority species?

Noise from construction activities might be audible at the site of the historical great blue heron rookery in the large wetland complex at Yarrow Bay. If herons resume nesting at this site, they might be subject to disturbance from construction activities. Potential rookery locations are approximately 500 to 900 feet from the proposed project alignment. Areas where great blue herons have been observed foraging are along the shoreline of Yarrow Bay, farther away from the project alignment than the historical nesting area. Peak noise levels from construction activities would be only about 5 dBA above existing ambient noise levels. For these reasons, construction effects on nesting or foraging great blue herons would not be expected.

No nests of band-tailed pigeons or cavity-nesting ducks are known to occur in the study area. If band-tailed pigeons or cavity-nesting ducks were present near construction activities, disturbance could affect the birds' nesting success and cause possible nest abandonment, depending on the location of the nest relative to the project alignment.

Pileated woodpeckers may also use forested habitats in the study area. However, the fragmented nature and relatively young age of tree cover in the vicinity makes it unlikely that the birds are there. If pileated woodpeckers foraged near the roadway, construction could displace the birds to undisturbed habitats. Given the low anticipated use by the birds and relatively small area of effect, the likelihood of displacement would be expected to be low.

How would the project construction affect other species of special interest in the study area?

An active red-tailed hawk nest near Yarrow Bay is approximately 700 feet from the proposed project construction area. Suitable foraging habitat is generally located farther from the project construction area. Construction noise would not be expected to affect the hawks because noise at distances greater than 750 to 1,000 feet from the construction area would not be likely to exceed existing ambient noise levels.

How would operation of the project affect habitat and associated wildlife species?

The project has the potential to affect habitat and/or wildlife through the following:

- Vegetation effects from direct removal and changes in hydrology.
- Water quality effects from changes in stormwater.
- Noise disturbance or changes in traffic volume.
- Changes in obstructions to animal movement.

The likelihood and anticipated magnitude of these potential effects are described below for each alternative. Effects from wildlife habitat fragmentation would be negligible because the area is already fragmented by existing roadways. Detailed information on wetland effects are described in the *Wetlands* section. Effects on fish resources are described in the *Fish Resources* section.

How would vegetation removal affect wildlife habitat?

Build Alternative

The Build Alternative would remove a total of 65 acres of wildlife habitat, approximately 6 percent (61 acres) of Urban Matrix that is currently not part of the existing SR 520 footprint, and 4 percent (4 acres) of Parks and Other Protected Areas in the study area (Exhibit 39). For both cover types, the amount of area affected would be relatively small compared with the total amount available within and adjacent to the study area. In addition, the habitat quality in the Urban Matrix cover type (where most vegetation removal would occur) is generally low, so effects on wildlife populations and distribution in the project are not expected.

In the affected Urban Matrix cover type, existing habitat consists primarily of a narrow band of upland conifer trees and shrubs that line the roadway. Because of the fragmented nature of the vegetation in this area, the lack of structural diversity and forage diversity, and location next to the existing highway, effects on wildlife from the loss of upland trees and shrubs would be limited to a loss of forage and cover for urban-adapted species, including American robins, house sparrows, black-capped chickadees, and opossums. Affected animals may find adequate habitat adjacent to the affected area or may be displaced to areas away from the roadway. Affected species are common and abundant in the study area and adverse effects on the larger populations of these animals in the project vicinity would not occur.

While most of the affected vegetation occurs in areas of low-quality habitat, approximately 7.0 acres of wetland habitat would be removed, as well as 1.7 acres of wetland buffer habitat throughout all cover types. Depending on existing habitat quality in each affected area, remaining wetland, and proximity to other wetland habitats, wildlife could be displaced to other areas. Species that could be affected include garter snakes, songbirds such as marsh wrens and warblers, and Pacific treefrogs.

Because of the low mobility of garter snakes and treefrogs relative to birds, they may have less success (or could be unsuccessful) in migrating to unaffected areas with suitable habitat. If they are unable to move to other appropriate habitat, affected animals could die. A more detailed account of individual wetlands and effects is presented in the *Wetlands* section of this report.

Potential changes in vegetation and habitat could also occur because of changes in hydrology from increases in impervious surface and changes in stormwater runoff. Wetlands are the most likely habitat type to be affected by changes in hydrology; wetland plants require more specific soil moisture than upland vegetation. In the most extreme scenario, changes in hydrology could cause wetland loss, with a shift in wildlife use from wetland-adapted species (e.g., garter snakes, Pacific treefrogs, and marsh wrens) to more generalist and upland-adapted species (e.g., American robins and black-capped chickadees). However, a more likely scenario is that minor changes in hydrology would have no effect or an insignificant effect on vegetation and wildlife. See the *Wetlands* section of this report for additional information on the effects of changes in wetland hydrology in the study area under the Build Alternative.

No Build Alternative

The No Build Alternative would not affect vegetation and consequently, no changes to wildlife habitat would occur.

How would changes in water quality affect wildlife?

Build Alternative

The Build Alternative would treat stormwater runoff in the study area. Sediment loads in roadway runoff would be reduced in all basins of the study area. Metal loading would increase in some basins and decrease in others. Effects on water quality within specific basins can be found in the Water Resources Discipline Report (WSDOT 2009). It is unknown if changes in water quality would be substantial enough to affect survivorship and reproductive success of individual animals.

No Build Alternative

The quality of stormwater runoff could decline due to the anticipated increased roadway traffic over time because stormwater is untreated under the No Build Alternative and existing conditions. See the Water Resources Discipline Report (WSDOT 2009) for more detailed information on anticipated effects of the alternatives on water quality. Reduction in water quality could increase contaminant levels in wetlands and aquatic areas where wildlife (e.g., waterfowl and great blue herons) forage on plants, invertebrates, and fish. Depending on overall pollutant levels, the long-term health and reproductive success of some animals could be reduced.

What types of wildlife disturbances would occur as a result of the project?

Build Alternative

Under the Build Alternative, noise levels would be lower than existing conditions because noise walls would be installed along both sides of the roadway. Consequently, disturbance to wildlife would be expected to be slightly lower than existing conditions. In most areas, wildlife species are adapted to an urban environment, so small reductions in noise disturbance would likely have a negligible effect. However, in areas of higher-quality habitat, such as Wetherill Nature Preserve, the reduction in noise levels could result in greater wildlife use, particularly for birds that are more sensitive to noise.

No Build Alternative

Under the No Build Alternative, no changes in disturbance to wildlife would occur, other than those associated with increased roadway traffic over time.

How would the project affect barriers and obstructions to animal movement?

Build Alternative

Under the Build Alternative, 17 existing culverts would be removed and replaced with open stream channel or larger, bottomless culverts. The new culverts would be fully fish-passable structures. Removal of existing, undersized culverts and installation of larger culverts with a natural substrate would increase the opportunities for wildlife to cross the highway without facing the risk of being struck by vehicles on the roadway. Actual wildlife passage through the wider culverts would depend on the size and behavior of individual wildlife species. Species most likely to benefit include small and medium-sized mammals such as raccoons, opossums, and possibly squirrels; some amphibian species might also benefit. The culverts likely would not be sized to allow for passage of large mammals such as deer. Under the Build Alternative, fencing along the bicycle/pedestrian trail and noise walls would create more barriers to animal movement than exist today, but would also deter animals from entering the roadway, where they would be at risk of collisions with vehicles. The lid over the highway near Evergreen Point Road might serve as a corridor for wildlife movement across the roadway.

No Build Alternative

Under the No Build Alternative, wildlife movement under the highway at the stream crossings in the study area would remain severely impeded because of undersized culverts. Fencing and other existing roadside barriers would also remain as barriers to the movement of terrestrial wildlife.

How would operation of the project affect federally listed species and federal species of concern?

Build Alternative

One bald eagle nesting territory, the Hunts Point territory, occurs in the study area. Of the two nest sites associated with this territory, one (Yarrow Bay wetlands) is 900 feet from the roadway and is not currently in use. The other (Hunts Point), where nesting activity was last documented in 2006, is 2,400 feet from the roadway. The foraging area for the Hunts Point bald eagle territory is more than 1,000 feet from the proposed Build Alternative alignment. Highway noise at these distances would be expected to be obscured by other ambient noise. For these reasons, no effects on the Hunts Point bald eagles would be expected. Areas adjacent to the roadway in the study area do not provide roosting habitat for wintering bald eagles; consequently, no operational effects on wintering eagles would occur.

No Build Alternative

One known occurrence of a federal species of concern (the bald eagle) has been documented in the study area; no wildlife species listed under the ESA are known to occur in the area. Under the No Build Alternative, bald eagle use of the study area would remain unaffected. SR 520

How would operation of the project affect state-listed or other state priority species?

Build Alternative

Vegetation would not be removed in areas that provide habitat for state-listed and priority species. In areas where suitable habitat for these species was located near the highway (e.g., Wetherill Nature Preserve), a decrease in noise levels would slightly reduce the potential for noise disturbance to these species.

No Build Alternative

No highway-related changes in disturbance or habitat would occur under the No Build Alternative; consequently, these species would not be affected.

How would the project affect other species of special interest that occur in the study area?

Build Alternative

The active red-tailed hawk nest is approximately 700 feet from the roadway. At this distance there would be no measurable difference in noise levels between existing conditions and those of the Build Alternative. The Build Alternative would not remove large trees that provide suitable hawk nest sites.

No Build Alternative

Disturbance to the hawks under the No Build Alternative would remain unsubstantial.

How would the alternatives differ in their effects on habitat and wildlife?

Exhibit 40 summarizes the differences in operational effects on habitat and wildlife. The Build Alternative would reduce the acreage of suitable wildlife habitat in the study area by a small amount compared with the No Build Alternative. Opportunities for wildlife movement under the highway at the stream crossings in the study area would increase under the Build Alternative due to the new open stream channel and retrofits of the undersized culverts. Please refer to the *Fish Resources* section for more details. In addition, sediment loads would likely be reduced under the Build Alternative, improving overall water quality.

Under the Build Alternative, noise associated with construction activities might displace some animals from their habitat. Activities that took place during the breeding season might cause some species to abandon breeding sites, possibly resulting in decreased reproductive success. Such effects would be construction-related, but would not be expected to result in long-term population declines. The known current or historical breeding sites for bald eagles, great blue heron, or red-tailed hawks would be screened from construction-related noise by distance, vegetation, and topography.

Because of the long construction period, the risk of wildlife effects from spills of oil, gasoline, or other toxic substances would be greater under the Build Alternative.

Exhibit 40. Summary of Operational Effects on Wildlife and Habitat by Alternative

Type of Operational Effect				
Vegetation/ Habitat Loss	**Changes in Aquatic Wildlife Health from Change in Water Quality**	**Disturbance from Highway Operations**	**Changes in Barriers to Animal Movement**	**Effects on Federal Species of Concern (Bald Eagle)**
No Build Alternative				
No change.	Possible decline in aquatic wildlife health in basins over time with deterioration of water quality because of increasing traffic load.	No change.	No change.	No change.
Build Alternative				
Loss of wildlife habitat area and quality.	Sediment loads of runoff would be reduced.	Noise walls would reduce noise levels and effects on wildlife.	Replacement of undersized culverts with larger culverts would reduce barriers to animal crossings.	No effects on suitable habitat. Distance to likely nesting and foraging sites would be great enough that disturbance would be unlikely.

Wildlife and Habitat Mitigation

What would be done to avoid or minimize negative effects to wildlife and wildlife habitat?

Measures to avoid or minimize effects on wildlife and habitat include the following:

- Limiting construction to a relatively small area immediately adjacent to the existing roadway to minimize vegetation clearing.
- Following BMPs and other safety measures to minimize erosion and sedimentation and to minimize the risk of spilling contaminants.
- Replanting areas affected by construction with native vegetation.
- Improving culverts relative to existing conditions to increase the likelihood that terrestrial animals would be able to pass under the highway at creek crossings.

- Increasing overall stream lengths by 980 linear feet, creating habitat that might be used by wildlife.
- Mitigating negative effects on wetlands by rehabilitating degraded wetlands elsewhere that could be used as wildlife habitat.

How could the project compensate for unavoidable adverse effects on wildlife or wildlife habitat?

WSDOT will mitigate any adverse affects to wildlife using the measures described above. No unavoidable adverse effects would be expected.

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Attachment 1

Habitat Conditions and Salmonid Distribution in Surveyed Reaches of Streams Crossing the Proposed Project Corridor

Attachment 1. Habitat Conditions and Salmonid Distribution in the Surveyed Reaches of Streams Crossing the Proposed Project Corridor

Stream Name[a]	Reach Location	Surveyed Distance (feet)	Average BFW[b] (feet)	Average wetted width at BFW[b] (feet)	Percent Riffle (by length)	Percent Pool (by length)	Percent Culvert (by length)	Percent Other (by length)	Percent Dry (by length)	Number of Functional Pools	Pool Riffle Ratio by Length (X:1)	Percent Hydromodified Bank	Percent Unstable Bank	Number of LWD Pieces	Pieces of LWD per mile	Dominant Riffle Substrate	Riffle Substrate Median Diameter (D[50])	% Riffle Surface Fines (from pebble count)	Average % Fines in Pool Tailouts (grid method)
Fairweather Creek	Upstream of SR 520	504	9.7	6.2	41	4	0	55	0	1	0.1	49	4	0	NA	Coarse Gravel	28 mm	5	28
	Downstream of SR 520	558	11.2	6.9	37	4	1	55	0	1	0.1	31	1	0	NA	Coarse Gravel	28 mm	8	NA
Cozy Cove Creek	Upstream of SR 520	541	8.5	4.3	87	8	0	5	0	4	0.1	3	10	2	20	Very Coarse Gravel	40 mm	8	8
	Downstream of SR 520	439	13.8	6.1	48	3	22	28	0	1	0.1	58	0	0	NA	Very Coarse Gravel	40 mm	5	NA
Tributary to Cozy Cove Creek	Upstream of SR 520	166	4.0	0.9	0	0	0	15	85	0	NA	0	0	0	NA				NA
West Tributary to Yarrow Bay Wetlands	Upstream of SR 520	141	NA	2.7	29	0	0	71	0	0	NA	0	0	0	NA	Medium Gravels	20 mm	14	NA
	Downstream of SR 520	379	8.2	4.3	98	0	0	2	0	0	NA	0	4	10	139	Coarse Gravels	20 mm	6	NA
West Tributary to Yarrow Creek	Upstream of SR 520	550	9.7	3.5	91	0	7	1	0	0	NA	3	0	7	67	Medium Gravels	14 mm	13	NA
	Downstream of SR 520	141	23.2	3.5	71	0	0	17	0	0	NA	0	0	0	NA				NA
Tributary of West Tributary to Yarrow Creek	Downstream of SR 520	82	3.3	1.6	100	0	0	0	0	0	NA	0	0	0	NA				NA
West Tributary to Yarrow Bay Wetlands	Upstream of SR 520	196	10.3	2.5	100	0	0	0	0	0	NA	0	0	0	NA				NA
	Downstream of SR 520	161	5.8	1.7	64	0	0	36	0	0	NA	0	0	0	NA				NA

Attachment 1. Habitat Conditions and Salmonid Distribution in the Surveyed Reaches of Streams Crossing the Proposed Project Corridor

Stream Name[a]	Reach Location	Surveyed Distance (feet)	Average BFW[b] (feet)	Average wetted width at BFW[b] (feet)	Percent Riffle (by length)	Percent Pool (by length)	Percent Culvert (by length)	Percent Other (by length)	Percent Dry (by length)	Number of Functional Pools	Pool Riffle Ratio by Length (X:1)	Percent Hydromodified Bank	Percent Unstable Bank	Number of LWD Pieces	Pieces of LWD per mile	Dominant Riffle Substrate	Riffle Substrate Median Diameter (D^{50})	% Riffle Surface Fines (from pebble count)	Average % Fines in Pool Tailouts (grid method)
South Fork Yarrow Creek	Upstream of SR 520	490	7.0	3.6	53	6	0	40	0	0	0.1	0	0	0	NA	Coarse Gravels	20 mm	13	NA
	Downstream of SR 520	654	10.7	3.8	68	5	0	27	0	1	0.1	3	3	2	129	Very Coarse Gravels	40 mm	8	3
Yarrow Creek	Upstream of SR 520 at 108th SE	830	9.6	6.0	9	2	27	62	0	1	0.2	12	1	9	57	Coarse Gravels	28 mm	23	NA
	Between Lake Washington Boulevard and 108th Avenue SE	1016	11.5	6.1	5	0	19	76	0	0	NA	2	0	1	5	Medium Gravels	10 mm	11	NA
	Between Lake Washington Boulevard and 108th Avenue SE	901	9.3	8.9	0	4	86	10	0	2	NA	1	0	0	NA				NA

[a] Unnamed Tributary to Fairweather Bay was not surveyed.

[b] bankfull width