2 May 2005

SR 520 Bridge Replacement and HOV Project Draft EIS

Appendix E

Ecosystems

Discipline Report

Washington State Department of Transportation

SoundTransit

U.S. Department of Transportation
Federal Highway Administration

SR 520 Bridge Replacement and HOV Project Draft EIS

Ecosystems

Discipline Report

Prepared for

Washington State Department of Transportation
Federal Highway Administration
Sound Transit

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Attachments

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Acronyms and Abbreviations

Arboretum	Washington Park Arboretum
BMPs	best management practices
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dBA	A-weighted decibels
dbh	diameter-at-breast-height
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	evolutionarily significant unit
GIS	Geographic Information System
GPS	Global Positioning System
HGM	hydrogeomorphic
HPA	Hydraulic Project Approval
mph	miles per hour
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service (now known as NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
PHS	Priority Habitat and Species
RCW	Revised Code of Washington
SEPA	State Environmental Policy Act
SMA	Shoreline Management Act
SMC	Seattle Municipal Code
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation

Introduction

Why are ecosystems considered in an EIS?

An ecosystem is a biological community along with the physical and chemical environment with which it interacts. Ecosystems are made up of living organisms, including humans, and the environment they inhabit. Understanding this relationship 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 that the effects of a proposed project on ecosystem structure, function, and process be evaluated in an EIS. This discipline report presents three important biotic resources—wetlands, fish, and wildlife. 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 as Appendix T, *Water Resources Discipline Report.*

This report is organized into sections by ecosystem resource (wetlands, fish resources, and wildlife and habitat). The 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 Bridge Replacement and HOV Project 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's Continued Operation Scenario would have the least effect on wetlands and buffers because no wetland or buffer areas would be filled or shaded. However, 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 resources located adjacent to and downstream of SR 520 and to Lake Washington and its tributary streams, where fish rear. Noise levels would increase over current conditions and could affect wildlife.

The 4-Lane and 6-Lane Alternatives would affect ecosystem conditions and functions in a number of ways. Some of the effects would be beneficial (e.g., removing unused highway ramps, providing stormwater treatment facilities, and adding sound walls). There would also be negative effects, such as filling and shading 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) policy for no net loss of wetland functions and values (WSDOT 2001). The key elements of the alternatives that have the potential to affect ecosystem resources in the project area are summarized in **Exhibit 1**.

Comparison of Permanent Wetland Effects of the 4-Lane and 6-Lane Alternatives in Seattle (in acres)

Type of Effect	Wetland	Wetland Buffer
Fill (4-Lane)	-0.2	-2.0
Fill (6-Lane)	-0.2	-3.8
Shade (4-Lane)	-4.5	-2.3
Shade (6-Lane)	-6.7	-2.2

Comparison of Permanent Wetland Effects for the 4-Lane and 6-Lane Alternatives on the Eastside (in acres)

Type of Effect	Wetland	Wetland Buffer
Fill (4-Lane)	-3.2	-5.5
Fill (6-Lane)	-6.4	-11.6
Shade	No permanent effect for either build alternative	

Some of the existing wetlands near the Washington Park Arboretum (Arboretum) and elsewhere along the corridor would be filled or shaded under the 4-Lane and 6-Lane Alternatives. In Seattle, the area of wetland fill would be small because the majority of the roadway is on a bridge; the fill footprint is primarily limited to the area of the individual support columns, as well as a stormwater facility and a trail. Most of the wetland effects in Seattle would be due to shading by the elevated roadway. The shaded wetlands would continue to function as wetlands, but low light levels underneath the bridge could limit or retard plant growth, which could change the type and/or quality of the habitat. To offset the potential adverse effects of shading, project engineers designed the new roadway to be considerably higher than the existing one through the Union Bay/Arboretum area.

On the Eastside, wetlands adjacent to the existing roadway would be partially or entirely filled under both the 4-Lane and 6-Lane Alternatives. The filled wetlands would lose their capacity to provide water quality functions, habitat for wildlife, and aesthetic value for local residents. There would be no wetland shading on the Eastside as a result of the project because the roadway is at grade.

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

Overall, the magnitude of these effects would be greater with the 6-Lane Alternative than with the 4-Lane Alternative because of the 6-Lane Alternative's larger footprint. WSDOT would compensate for wetland effects by restoring, creating, and/or enhancing replacement wetlands in the vicinity of the project.

Under the 4-Lane and 6-Lane Alternatives, temporary work bridges, work platforms, and a detour bridge would be installed over Portage Bay, Union Bay, and Lake Washington in the project right-of-way and in the area that would be affected by the proposed build alternatives. The installation of these structures during construction would have temporary effects on wetland resources from vegetation clearing for construction access or from shading of existing vegetation during the construction period. Clearing would remove branches and tree trunks but would generally leave the soil intact. Shading would block sunlight and rainfall, which could reduce plant growth and vigor. Implementing erosion and sediment control measures, spill prevention plans, and other best management practices (BMPs) would minimize temporary construction effects. After the construction of the project, the affected wetland areas would be restored by replanting with appropriate wetland vegetation.

The 4-Lane and 6-Lane Alternatives would affect individual habitat conditions for fish. Fish would benefit from the increased height of the new bridges over the shoreline crossings in Seattle. The higher bridges would allow more indirect light penetration than the existing structures, and there would be fewer bridge columns (although larger diameter [10 feet]) because of wider spacing (250 feet instead of the current 100 feet). In the Eastside project area, the project would replace or retrofit existing culverts to improve fish passage to habitats upstream of the SR 520 corridor, thus improving conditions for fish that use the tributary streams on the Eastside. Conversely, the proposed bridge operations facility and its dock could potentially reduce sockeye spawning at a spawning site immediately beneath the east highrise of the Evergreen Point Bridge.

The build alternatives would require construction activities that could temporarily affect fish behavior. These activities could produce noise and vibration from pile driving; temporary shading effects from the work bridges; and water turbidity and sedimentation from culvert lengthening, anchor placement, and column removal. Driving the piles for the temporary bridges could affect nearby fish behavior or potentially cause fish mortality because of high sound pressure levels from impact hammers when pile driving. Appropriate and available construction BMPs would be employed to minimize the effects of pile driving.

Compared to the 4-Lane Alternative, the 6-Lane Alternative would have slightly greater temporary and permanent effects on fish resources and habitat because of its larger footprint. Both the 4-Lane and 6-Lane Alternatives would require the same construction techniques and produce structures of the same nature. However, the 6-Lane Alternative would result in bridges and roadways about 30 to 50 percent wider than the 4-Lane Alternative and require about 40 more support columns. Operation of either build alternative would likely produce general effects on the natural environment that are indistinguishable from one another and an overall improvement compared to the No Build Alternative and existing conditions.

The 4-Lane and 6-Lane Alternatives would affect wildlife by permanently removing vegetation and wildlife habitat, increasing shading, adding noise disturbance from highway operations, and changing barriers to animal movement. Specific effects on wildlife would vary throughout the corridor. The new roadway would displace some high-quality wildlife habitat (including wetlands) in the Arboretum area, which would reduce cover, nesting, and foraging habitat for some species. However, the build alternatives include sound walls along the majority of the corridor, which would reduce disturbance in the adjacent habitats. Noise from construction activities and pile driving could affect bird species, including nesting and foraging bald eagles near the Arboretum. The levels of construction noise and the distance of the construction areas from bald eagle, heron, and red-tailed hawk nest sites (and other sensitive wildlife habitats) would be very similar for both of the build alternatives. However, because the 6-Lane Alternative would have a longer construction time than the 4-Lane Alternative, it would result in greater noise disturbance effects to wildlife.

In all cases where effects on wetlands, streams, wildlife, or habitat are unavoidable, a mitigation plan would be implemented to compensate for or replace the resources that are lost. This mitigation plan would also help to offset any construction-related negative effects on fish resources. Additionally, all areas disturbed during construction would be revegetated.

Exhibit 1. Key Elements and Potential Ecosystem Effects of 4-Lane and 6-Lane Alternatives

Project Element	What It Involves	How It Could Affect Ecosystems
Seattle		
Portage Bay and Evergreen Point bridges and approach structures	Widens the roadway. Increases height of the bridges across Portage Bay and Foster Island. Requires large-diameter columns (drilled shafts) to be installed. Increases most of the spacing between columns from 100 feet to 250 feet. Removes existing unused highway ramps (removes impervious surface). Adds sound walls along highway corridor.	Causes a net increase in impervious surface. Removes vegetation. Fills and shades wetlands and buffers. Shades open water areas, shorelines, and vegetated areas but allows more indirect light penetration under the structure because of increased height. Requires in-water work in Portage Bay, Union Bay, and Lake Washington. Removes foraging, rearing, and nesting habitat for wildlife in the vicinity of the Arboretum. Reduces impervious surface in one area of the Arboretum. Creates potential restoration opportunities in ramp removal areas near the Arboretum. Reduces noise effects, which benefits wildlife using the Arboretum.
Temporary work bridges, platforms, and detour bridges	Requires driving 1,800 temporary steel piles in wetlands, aquatic habitats, and open water areas of Portage Bay, Union Bay, and Lake Washington. Extends the project clearing limits outside the footprint of the proposed bridge – 30 feet north and south of the existing bridge at Portage Bay and 60 feet south of the existing bridge in Union Bay and Lake Washington. Uses barges in shallow and deep-water areas to stage construction. Involves use of materials, methods, and equipment that have the potential for spills, leaks, construction dewatering, etc.	Removes vegetation including potential perch trees for wintering bald eagles. Temporarily fills and shades wetlands and buffers, but piles would be removed after construction. Creates noise disturbance (from pile driving, etc.), which could affect the health and behavior of federally listed fish and wildlife species such as Chinook salmon and bald eagles. Temporarily displaces foraging, rearing, and nesting habitat for wildlife in the vicinity of the Arboretum. Creates additional temporary shading of open water areas, shorelines, and vegetated areas. Reduces water quality temporarily and creates risk to wildlife.

Exhibit 1. Key Elements and Potential Ecosystem Effects of 4-Lane and 6-Lane Alternatives

Project Element	What It Involves	How It Could Affect Ecosystems
Lake Washington		
Stormwater treatment facilities	Treats roadway runoff before discharging to Lake Union, Portage Bay, or Lake Washington (stormwater is currently not treated). Adds high-efficiency pavement sweeping and modified catch basins and creates a spill lagoon between the floating pontoons to treat, contain, and dilute runoff before it reaches Lake Washington.	Reduces sediment loads and treats metals in runoff water entering receiving waters, including wetlands, benefiting fish and aquatic organisms (Lake Union, Portage Bay, Union Bay, and Lake Washington). Fills portions of existing wetland and buffer.
Evergreen Point Bridge pontoons	Requires excavation and disturbance of lake bottom sediments to install anchors and cables to hold the bridge pontoons in place.	Produces temporary turbidity in deeper water areas of Lake Washington.
Eastside		
Eastside roadway widening	Widens the roadway. Requires culvert replacement and retrofit. Adds sound walls along corridor.	Increases impervious surface in the Eastside sub-basins. Removes riparian vegetation. Improves fish passage by replacing culverts. Reduces noise effects in the corridor, which benefits wildlife using adjacent habitats.
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 entering tributary streams or wetlands. Minimizes peak flow effects caused by undetained releases of runoff.
Bridge operations facility	Requires modification of shoreline habitat under the proposed bridge. Adds overwater structure (dock) along shoreline.	Requires in-water work. Replaces two existing residential docks with one WSDOT dock on the east shoreline of Lake Washington.
Eastside construction activity	Requires excavators and other large equipment to construct the additional lanes.	Creates temporary noise disturbance in bald eagle nesting territory.

What are the project alternatives?

The SR 520 Bridge Replacement and HOV Project area comprises neighborhoods in Seattle from I-5 to the Lake Washington shore, Lake Washington, and Eastside communities and neighborhoods from the Lake Washington shore to 124th Avenue Northeast just east of I-405. **Exhibit 2** shows the general location of the project. Neighborhoods and communities in the project area are:

- Seattle neighborhoods—Portage Bay/Roanoke, North Capitol Hill, Montlake, University District, Laurelhurst, and Madison Park
- Eastside communities and neighborhoods—Medina, Hunts Point, Clyde Hill, Yarrow Point, Kirkland (the Lakeview neighborhood), and Bellevue (the North Bellevue, Bridle Trails, and Bel-Red/Northup neighborhoods)

Exhibit 2. Project Vicinity Map

The SR 520 Bridge Replacement and HOV Project Draft EIS evaluates the following three alternatives and one option:

- No Build Alternative
- 4-Lane Alternative
  - Option with pontoons without capacity to carry future high capacity transit
- 6-Lane Alternative

Each of these alternatives is described below. For more information, see the *Description of Alternatives and Construction Techniques Report* contained in Appendix A of this EIS.

What is the No Build Alternative?

All EISs provide an alternative to assess what would happen to the environment in the future if nothing were done to solve the project's identified problem. This alternative, called the No Build Alternative, means that the existing highway would remain the same as it is today (**Exhibit 3**). The No Build Alternative provides the basis for measuring and comparing the effects of all of the project's build alternatives.

This project is unique because the existing SR 520 bridges may not remain intact through 2030, the project's design year. The fixed spans of the Portage Bay and Evergreen Point bridges are aging and are vulnerable to earthquakes; the floating portion of the Evergreen Point Bridge is vulnerable to wind and waves.

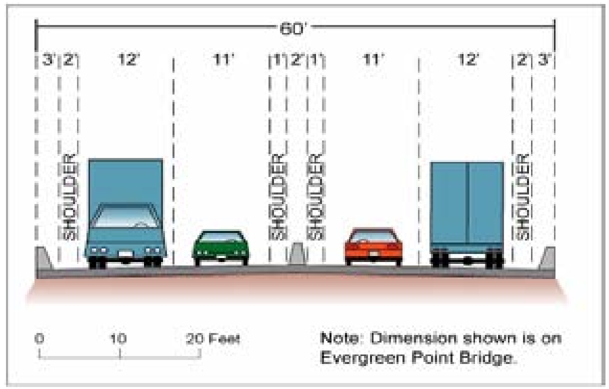


Exhibit 3. No Build Alternative

In 1999, the Washington State Department of Transportation (WSDOT) estimated the remaining service life of the Evergreen Point Bridge to be 20 to 25 years based on the existing structural integrity and the likelihood of severe windstorms. The floating portion of the Evergreen Point Bridge was originally designed for a sustained wind speed of 57.5 miles per hour (mph), and was rehabilitated in 1999 to withstand sustained winds of up to 77 mph. The current WSDOT design standard for bridges is to withstand a sustained wind speed of 92 mph. In order to bring the Evergreen Point Bridge up to current design standards to withstand at least 92 mph winds, the floating portion must be completely replaced.

The fixed structures of the Portage Bay and Evergreen Point bridges do not meet current seismic design standards because the bridge is supported on hollow-core piles. These hollow-core piles were not designed to withstand a large earthquake. They are difficult and cost prohibitive to retrofit to current seismic standards.

If nothing is done to replace the Portage Bay and Evergreen Point bridges, there is a high probability that both structures could fail and become unusable to the public before 2030. WSDOT cannot predict when or how these structures would fail, so it is difficult to determine the actual consequences of doing nothing. To illustrate what could happen, two scenarios representing the extremes of what is possible are evaluated as part of the No Build Alternative. These are the Continued Operation and Catastrophic Failure scenarios.

Under the Continued Operation Scenario, SR 520 would continue to operate as it does today as a 4-lane highway with nonstandard shoulders and without a bicycle/pedestrian path. No new facilities would be added and no existing facilities (including the unused R.H. Thompson Expressway Ramps near the Arboretum) would be removed. WSDOT would continue to maintain SR 520 as it does today. This scenario assumes the Portage Bay and Evergreen Point bridges would remain standing and functional through 2030. No catastrophic events (such as earthquakes or high winds) would be severe enough to cause major damage to the SR 520 bridges. This scenario is the baseline the EIS team used to compare the other alternatives.

In the Catastrophic Failure Scenario, both the Portage Bay and Evergreen Point bridges would be lost due to some type of catastrophic event. Although in a catastrophic event, one bridge might fail while the other stands, this Draft EIS assumes the worst-case scenario—that both bridges would fail. This scenario assumes that both bridges would be seriously damaged and would be unavailable for use by the public for an unspecified length of time.

What is the 4-Lane Alternative?

The 4-Lane Alternative would have four lanes (two general purpose lanes in each direction), the same number of lanes as today (**Exhibit 4**). SR 520 would be rebuilt from I-5 to Bellevue Way. Both the Portage Bay and Evergreen Point bridges would be replaced. The bridges over SR 520 would also be rebuilt. Roadway shoulders would meet current standards (4-foot inside shoulder and 10-foot outside shoulder). A 14-foot-wide bicycle/pedestrian path would be built along the north side of SR 520 through Montlake, across the Evergreen Point Bridge, and along the south side of SR 520 through Medina, Hunts Point, Clyde

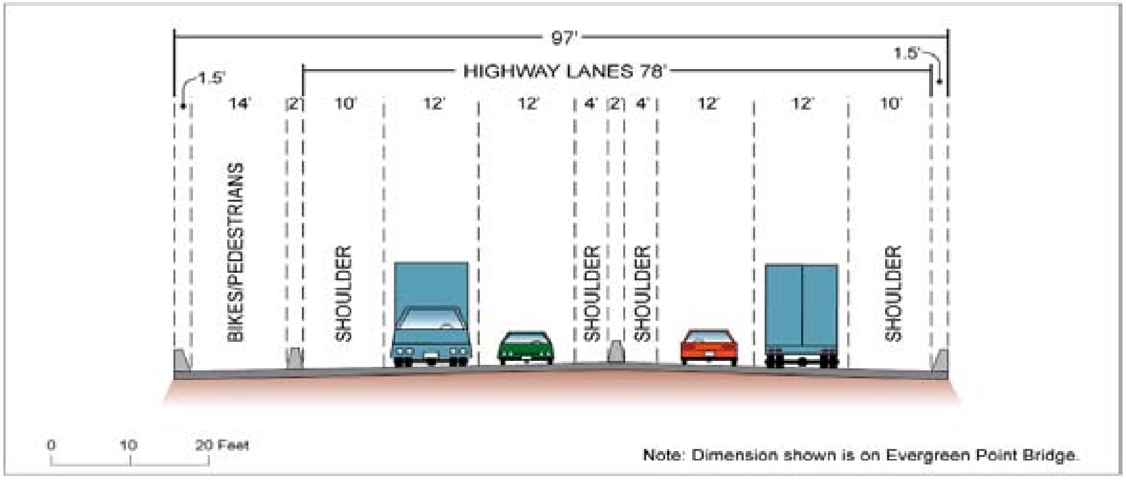


Exhibit 4. 4-Lane Alternative

Hill, and Yarrow Point to 96th Avenue Northeast, connecting to Northeast Points Drive. Sound walls would be built along much of SR 520 in Seattle and the Eastside. This alternative also includes stormwater treatment and electronic toll collection.

The floating bridge pontoons of the Evergreen Point Bridge would be sized to carry future high-capacity transit. An option with smaller pontoons that could not carry future high-capacity transit is also analyzed. The alternative does not include high-capacity transit.

A bridge operations facility would be built underground beneath the east roadway approach to the bridge as part of the new bridge abutment. A dock to moor two boats for maintenance of the Evergreen Point Bridge would be located under the bridge on the east shore of Lake Washington.

A flexible transportation plan would promote alternative modes of travel and increase the efficiency of the system. Programs include intelligent transportation and technology, traffic systems management, vanpools and transit, education and promotion, and land use as demand management.

What is the 6-Lane Alternative?

The 6-Lane Alternative would include six lanes (two outer general purpose lanes and one inside HOV lane in each direction; **Exhibit 5**). SR 520 would be rebuilt from I-5 to 108th Avenue Northeast in Bellevue, with an auxiliary lane added on SR 520 eastbound east of I-405 to 124th Avenue Northeast. Both the Portage Bay and Evergreen Point bridges would be replaced. Bridges over SR 520 would also be rebuilt. Roadway shoulders would meet current standards (10-foot-

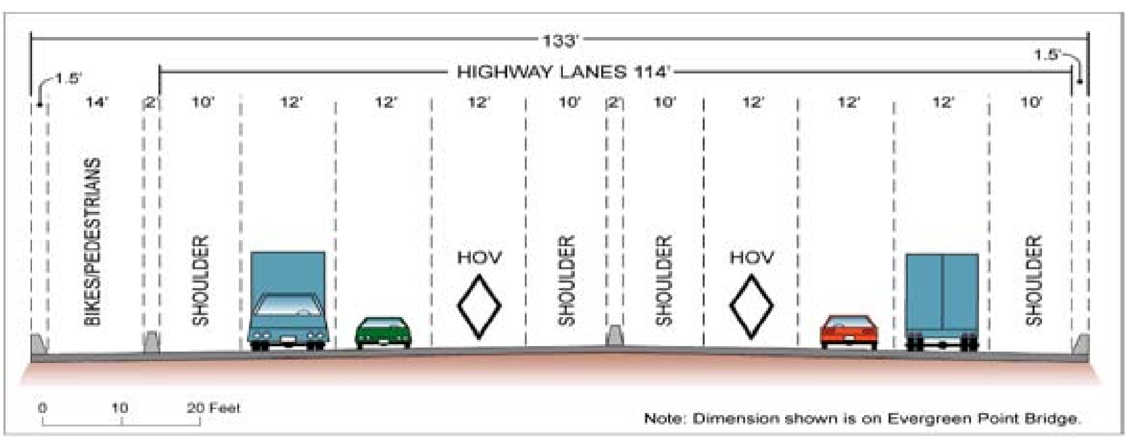


Exhibit 5. 6-Lane Alternative

wide inside shoulder and 10-foot-wide outside shoulder). A 14-foot-wide bicycle/pedestrian path would be built along the north side of SR 520 through Montlake, across the Evergreen Point Bridge, and along the south side of SR 520 through the Eastside to 96th Avenue Northeast, connecting to Northeast Points Drive. Sound walls would be built along much of SR 520 in Seattle and the Eastside. This alternative would also include stormwater treatment and electronic toll collection.

This alternative would also add five 500-foot-long landscaped lids to be built across SR 520 to help reconnect communities. These communities are Roanoke, North Capitol Hill, Portage Bay, Montlake, Medina, Hunts Point, Clyde Hill, and Yarrow Point. The lids are located at 10th Avenue East and Delmar Drive East, Montlake Boulevard, Evergreen Point Road, 84th Avenue Northeast, and 92nd Avenue Northeast.

The floating bridge pontoons of the Evergreen Point Bridge would be sized to carry future high-capacity transit. The alternative does not include high-capacity transit.

A bridge operations facility would be built underground beneath the east roadway approach to the bridge as part of the new bridge abutment. A dock to moor two boats and maintain the Evergreen Point Bridge would be located under the bridge on the east shore of Lake Washington.

A flexible transportation plan would promote alternative modes of travel and increase the efficiency of the system. Programs would include intelligent transportation and technology, traffic systems management, vanpools and transit, education and promotion, and land use as demand management.

What kind of policies and regulations exist to protect ecosystems?

Ecosystems are protected by federal, state, and local laws because of their ecological and social functions and values (**Exhibit 6**). The primary federal regulations or statutes that apply to wetlands, fish, streams, and wildlife in the project 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 6. Federal, State, and Local Regulations or Statutes Governing Ecosystems Potentially Affected by the SR 520 Bridge Replacement and HOV Project

Regulation/Statutes	Overseeing Agency	Regulated Resources/Areas
Federal		
Federal Endangered Species Act, 16 USC 1531-1534	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 USC 661-667	USFWS; NOAA Fisheries; Washington 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 USC 1251, Section 401	EPA, (Administered by the Washington State Department of Ecology [Ecology])	Waters of the United States, including wetlands
Clean Water Act, 33 USC 1344, Section 404	EPA, U.S. Army Corps of Engineers	Waters of the United States, including wetlands
Rivers and Harbors Act, Section 10, 33 USC 403, 407	U.S. Coast Guard	Navigable waters
Coastal Zone Management Act (CZMA), 6 USC 1451, 15 CFR 923-930	U.S. Army Corps of Engineers (or other federal permitting agency), Ecology	Coastal zones
Federal Migratory Bird Treaty Act, 16 USC 703-712	USFWS	Migratory birds
State		
Washington State Endangered Species Act, WAC 232-12-297	WDFW	All state-listed threatened and endangered species
Washington State Fish and Game Code, 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
Washington State Water Pollution Control Act, RCW 90.48	Ecology	Waters of the state
Hydrologic 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	State-owned aquatic lands

Exhibit 6. Federal, State, and Local Regulations or Statutes Governing Ecosystems Potentially Affected by the SR 520 Bridge Replacement and HOV Project

Regulation/Statutes	Overseeing Agency	Regulated Resources/Areas
Local		
Seattle Environmental Policies, SMC 25.05.675; Environmentally Critical Areas, 25.05.747, 25.05.908, 25.09.020, and 25.09.200	Seattle	SMC 25.05.675 establishes specific city guidelines including those related to protection of federal and state threatened and endangered species and special habitat types, which include, but are not limited to, wetlands and associated areas and feeding and nesting sites. SMC 25.05.747, 25.05.908, 25.09.020, and 25.09.200 provide for protection of wetlands, riparian corridors, and wildlife habitat conservation areas.
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.
Hunts Point Sensitive Areas Code, Chapters 16.05.330 and 16.15	Hunts Point	Chapter 16.05.330 provides that sensitive areas will be designated according to WAC 197-11-908; Chapter 16.15 designates the Wetherill Park as a sensitive area and provides protection for this area.
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.
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 wetland 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.

Exhibit 6. Federal, State, and Local Regulations or Statutes Governing Ecosystems Potentially Affected by the SR 520 Bridge Replacement and HOV Project

Regulation/Statutes	Overseeing Agency	Regulated Resources/Areas
Kirkland Zoning Regulations, Code 23.90.90	Kirkland	Protection of riparian habitats and establishment of stream buffer widths.
Bellevue Sensitive Area Overlay District, Ordinance 3775, Part 20.25H and Part 20.50 (Definitions)	Bellevue	Regulation of riparian and wetland habitats; no provision for specific protection of individual wildlife species.

Wetlands

Wetlands are transitional zones between aquatic environments and dry land. Their physical, chemical, biological, and social functions provide economic and 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 streambank 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 discipline team collected information on wetlands within the project area from a variety of reliable sources. We consulted numerous digital and paper maps to determine the location of known and potential wetlands. Digital sources examined include aerial photographs, National Wetland Inventory data, and current wetland mapping from local governments. Digital sources were supplemented with paper maps such as the King County Soil Survey. We further supplemented existing information with data collected from the field.

How were wetlands identified in the field?

Field investigators examined an area 200 feet on either side of the project footprint to verify the location of previously mapped wetlands and to locate wetlands not appearing on existing inventories. We identified wetlands in the project 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 soils, plants, and water are present.

Wetland vegetation is adapted to saturated conditions. We 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 1997).

The ecosystems discipline team also examined for evidence of wetland hydrology. Indicators of wetland hydrology are surface inundation, saturated soils, drainage patterns, watermarks on vegetation, water-stained leaves, and oxidized root channels.

Generally, an area must have hydric soils to be a wetland. 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 mottles of bright color (known as redoxymorphic 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 discipline team excavated soil pits and used Munsell color charts (Greytag Macbeth 1994) to describe soil colors.

The ecosystems discipline team recorded wetland boundaries using a handheld Global Positioning System (GPS) and saved this information for incorporation into GIS format. We supplemented these data with aerial photographs in order to interpret and map wetland boundaries in the project corridor.

For our analysis, we 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. For example, PBN-1 refers to the Portage Bay basin, on the north side of SR 520, wetland number 1.

How were the wetlands classified and rated?

Wetlands are generally classified according to their physical characteristics. For the purposes of this study, we used two wetland classification systems. The first system is 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 7** summarizes the Cowardin classification system, which is illustrated in **Exhibit 8**.

Exhibit 7. Overview of Cowardin Classification System for Wetlands in the Project 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 (m) (20 feet [ft]) 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 m tall or taller.
POW	As Above	Not applicable.	Open Water—Unvegetated, open water.
L1AB/L2AB	Lacustrine—Wetlands and deepwater habitats with all of the following characteri-stics: 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).

The second system used by the discipline team to classify wetlands in the project area considers landscape position, primary source of water, and the direction of water flow through the wetland. This classification system is referred to as hydrogeomorphic (HGM) classification, which is based on the methods defined in *A Hydrogeomorphic Classification for Wetlands* (Brinson 1993). **Exhibit 9** summarizes the HGM classification system, which is illustrated in **Exhibit 10**.

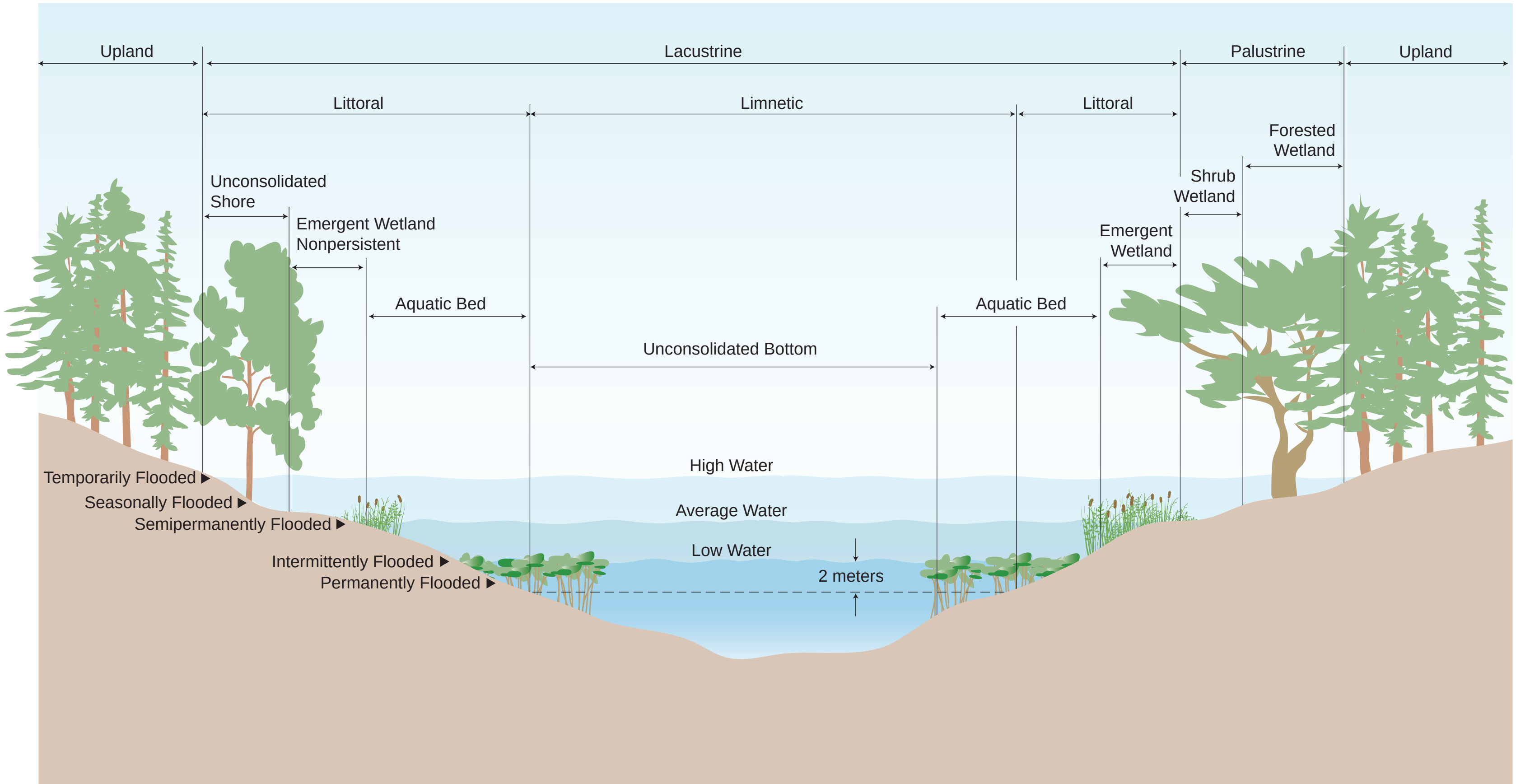


Exhibit 8. **Distinguishing Features and Examples of Habitats Using the Cowardin System**

SR 520 Bridge Replacement and HOV Project

Exhibit 9. Overview of Hydrogeomorphic Characteristics for Wetlands in the Project Area

HGM Class/Geomorphic Setting	Primary Water Sources	Water Flow Properties
Depressional Wetlands	Precipitation	Vertical fluctuations
Riparian Wetlands [a]	Groundwater discharge	Bidirectional flow
Fringe Wetlands	Groundwater discharge and lateral flow	
Slope	Precipitation, lateral flow, and groundwater	

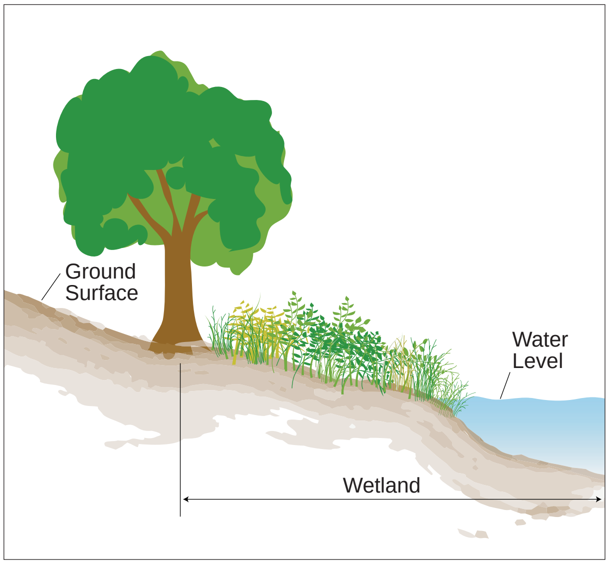
Note: Based on *A Hydrogeomorphic Classification of Wetlands* (Brinson 1993).

[a] The term "riparian" has been used to describe wetlands associated with streams in place of Brinson's "riverine." This change was made to avoid confusion with the Cowardin classification of "riverine," which refers to habitats contained within stream channels.

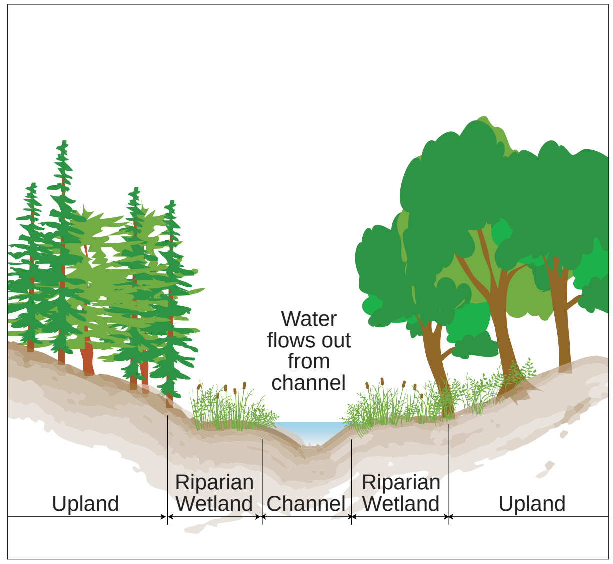
Resource agencies and regulatory jurisdictions rate or categorize wetlands according to their relative rarity or importance, and they also define buffer requirements and mitigation ratios for mitigation purposes. Numerous systems for rating wetlands exist, but all of these systems tend to focus on the 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 regulatory guidelines developed by Ecology (Ecology 1993). **Exhibit 11** summarizes these rating criteria and the corresponding buffer widths for each wetland category. The rating criteria and the corresponding buffer width recommendations for wetlands in western Washington were revised in August 2004 (Ecology 2004). The revised ratings may be applied to project area wetlands during the permitting phase of the project.

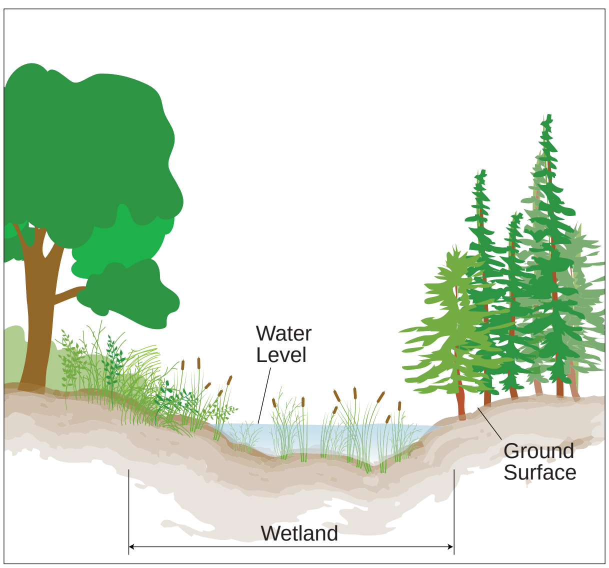
Local governments have also created systems for rating wetlands that allow them to prioritize wetland protection based on their own criteria, such as rarity within that jurisdiction. The rating systems and corresponding buffer requirements used by local governments within the project area are summarized in **Exhibit 12**.



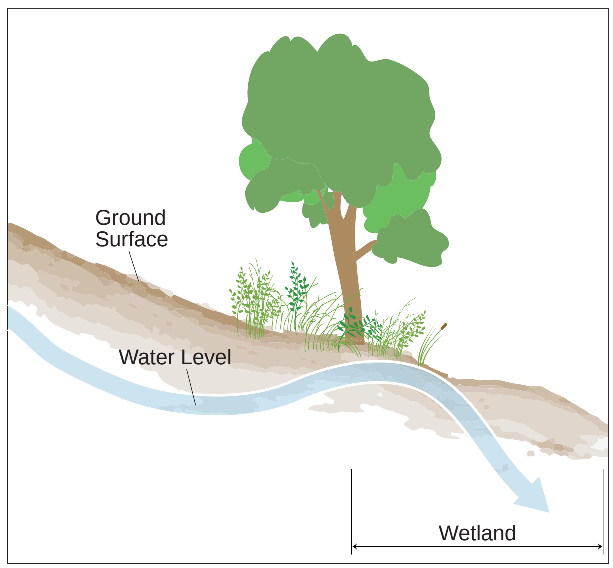
Fringe Wetland



Riparian Wetland



Depressional Wetland



Slope Wetland

Exhibit 10. **Illustration of the Hydrogeomorphic Classification System**

SR 520 Bridge Replacement and HOV Project

Exhibit 11. Criteria for Wetland Rating Categories Specified by Washington State Department of Ecology Based on 1993 Guidelines

Rating		Washington State Department of Ecology[a]	Buffer Width[b] (in feet)
Category I	a)	Have documented occurrence of federally or state-listed endangered or threatened animal, plant, or fish species; or	200 to 300
	b)	Consist of high-quality native wetland communities which qualify for inclusion in the State Natural Heritage Information System; or	
	c)	Are documented as regionally significant waterfowl or shorebird concentration areas; or	
	d)	Have irreplaceable ecological attributes; or	
	e)	Are documented wetlands of local significance.	
Category II	Satisfy no Category I criteria, and		100 to 200
	a)	Have documented occurrence of federally or state-listed sensitive animal, plant, or fish species; or	
	b)	Contain priority species or habitats recognized by state agencies; or	
	c)	Are wetlands with significant functions, which may not be adequately replicated through creation or restoration; or	
	d)	Are wetlands with significant habitat value of 22 or more points on the Field Data Form; or	
	e)	Are documented wetlands of local significance.	
Category III	a)	Are wetlands with significant habitat value of 21 points or less on the Field Data Form; or	50 to 100
	b)	Are documented wetlands of local significance.	
Category IV	a)	Are wetlands less than 1 acre and hydrologically isolated, with one vegetated class that is dominated (more than 80 percent areal cover) by one species considered alien and/or invasive; or	25 to 50
	b)	Are wetlands less than 2 acres and hydrologically isolated, with one vegetated class that is dominated (more than 90 percent areal cover) by any combination of species considered alien or invasive; or	
	c)	Are wetlands that are ponds excavated from uplands and are smaller than 1 acre without surface water connection to streams, lakes, rivers, or other wetlands.	

Note: Ecology revised the system for wetland ratings in August 2004. WSDOT may revise the wetland ratings, recommended buffer widths, and mitigation ratios during the permitting phase of the project.

[a] Ratings are based on Washington State Wetland Rating System for Western Washington (Ecology 1993).

[b] Buffer widths are Ecology (1993) recommendations and are not regulatory requirements.

Exhibit 12. Summary of Local Wetland Rating Systems[a] and Buffer Requirements in the Project Area

Rating System	Ratings	Buffer Requirements (in feet)
Seattle		
One class.	All wetlands over 100 square feet and wetlands hydrologically connected to them	50
Medina		
No rating system.	All wetlands	25
Hunts Point		
No rating system; Chapter 16.05.330 Hunts Point Code provides that sensitive areas will 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 wetland and other riparian and wetland habitats as sensitive areas.	Type 1 Type 2 Type 3	75 to 100[b] 50 to 75[b] 25 to 50[b]
Bellevue		
Three wetland types based on size and association with regulated riparian corridors.	Type A Type B Type C	50 25 None

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

Ratings are used during the permit review process to establish buffer requirements, to determine allowable effects (i.e., some effects may not be allowed for Category I wetlands), and to determine the replacement ratios for compensatory mitigation. The individual wetland ratings provided in this report are based on preliminary data and would be refined (as appropriate) if local jurisdictions adopt new standards or if new information becomes available.

How were wetland functions assessed?

The ecosystems discipline team assessed wetland functions using *Wetland Functions Characterization Tool for Linear Projects* (WSDOT 2000). This tool provides a rapid qualitative assessment of wetland functions using best professional judgment. We summarized the functions for each wetland and assigned a rating of low, moderate, or high to each wetland function.

In identifying the functions and values of each wetland, we evaluated the capability and opportunity of the wetland to provide a particular function. For example, a wetland may have dense vegetation that could prevent erosion, but if the wetland is not located on the shore of a lake or stream, it has no opportunity to provide this function.

WSDOT's methodology (WSDOT 2000) groups wetland functions into hydrologic functions, biological functions, and cultural functions.

Hydrologic functions consist of flood flow alteration, removal of pollutants, and erosion control/shoreline stabilization. Performance of these functions is closely correlated to the size, shape, presence of pollutants, and position of the wetlands within the watershed.

Biological functions involve production and export of 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. Wetland invertebrates, a pivotal part of the wetland food web, feed on vegetation and microorganisms, serve as food for animals higher in the food web, assist in the decomposition of plants, and filter water (Mitsch and Gosselink 2000; Sheldon et al. 2003). 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).

There are approximately 59 species of reptiles and amphibians in Washington and Oregon. Two native turtles in Washington (western pond turtle and red-eared sliders) depend on wetland habitat. Turtles require open water habitat, dense vegetation for food and shelter, and logs or rocks as sunning locations. Many other reptiles may use wetlands but have less specific habitat needs.

Most amphibian species in Washington depend on wetlands for some portion of their life cycle. Amphibians prefer interspersed wetland vegetation and open water in which to lay their eggs. Amphibian egg masses must stay moist, so stable water levels during spawning and hatching are also important. Some amphibians are selective about the size and shape of plant stems where egg masses are anchored. For example, salamanders prefer certain stem shapes and sizes, and pay less attention to the plant species (Richter 1997). Amphibians also require connections to other wetlands and terrestrial habitats and the well-vegetated buffers (Sheldon et al. 2003).

Numerous bird species depend on wetlands for habitat, and others use wetland habitat occasionally. Wetland-dependent birds require access to wetlands and riparian corridors for some of their life needs, such as food, shelter, breeding, or resting (Sheldon et al. 2003). In the western United States, there are 23 species of wetland-dependent waterfowl, 14 species of waders (such as cranes, rails, and herons), and numerous shorebirds (Sheldon et al. 2003).

Factors that produce quality habitat for wetland-dependent birds include water of varying depths, bays and peninsulas to provide cover, nearby open water or large fields for foraging, mud flats, and snags or other nesting habitat (depending on the species). Dense tree canopy is not desirable because it restricts access to the wetland. The size and condition of wetland buffers also influences bird use (Sheldon et al. 2003).

Wetland-dependent mammals include beaver, muskrat, river otter, and mink. These species prefer habitats with stable water levels, food sources (plants, amphibians, or fish, depending on the species), vegetated corridors that allow young to disperse, and persistent emergent vegetation interspersed with open water. Relatively undisturbed wetland buffers are also important for these animals.

Numerous other mammals occasionally use wetlands but do not depend on them. Researchers in one study found 69 species of mammals in riparian wetlands in western Washington, approximately half of which used wetlands for foraging and breeding (Kauffmann et al. 2001).

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.

Where in the project 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.

Wetlands in the project 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 streams, on hill slopes, or in depressions. These wetlands receive water when streams overflow their banks, from subsurface flow where the water table is close to the surface, and/or directly from precipitation.

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.

The project 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 our 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 our 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. **Exhibit 13** summarizes the soil types in the project area.

Exhibit 13. Summary of Soil Types in the Project 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 project 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 shrub wetlands include various willows, Himalayan blackberry, red osier dogwood, hardhack, and salmonberry. Along Lake Washington and in wetlands with open water, cattails, rushes, horsetails, and various native and nonnative grasses dominate.

The following sections discuss wetlands in the Seattle and Eastside project areas. Wetlands associated with Lake Washington are discussed in the Seattle and Eastside sections according to which side of the lake they occur (west or east).

Seattle

The Seattle project area includes Portage Bay, the Lake Washington Ship Canal, and Union Bay. The ecosystems discipline team identified 10 wetlands, all associated with the shorelines of Portage Bay or Union Bay on Lake Washington. **Exhibit 14** describes these wetlands, along with their classifications and ratings. **Exhibit 15** shows the locations of these wetlands in Seattle.

Wetland Descriptions

Lake Washington serves as the primary source of water for all the wetlands in the Seattle project area. Water levels in Lake Washington are controlled by the U.S. Army Corps of Engineers (the Corps) at the Hiram M. Chittenden Locks (Ballard Locks). The Corps lowers the water level by approximately 2 feet each winter. This vertical fluctuation is the dominant hydrologic change in these wetlands, which otherwise have very stable water levels.

Two wetlands are located along Portage Bay. The northernmost wetland (PBN-1) is a small (0.3 acre) emergent wetland on the eastern shore of Portage Bay, immediately north of SR 520. The vegetation in this wetland is primarily composed of cattails.

Forested wetlands on Lake Washington

PBS-1 is a larger system (approximately 9 acres in size) that wraps around the entire southern shoreline of Portage Bay, and includes emergent, scrub/shrub, and forested and limnetic and littoral aquatic bed wetland communities. As in PBN-1, the emergent portion of PBS-1 is dominated by cattails. The portions of the scrub/shrub and forested wetland include willows and red alder. Aquatic bed wetlands are composed of Eurasian water-milfoil and white water lily.

Union Bay on Lake Washington is home to a large wetland complex that includes a portion of the University of Washington campus and the Washington Park Arboretum. We divided this wetland complex into eight separate areas (LWN-1 through LWN-4, and LWS-1 through LWS-4) to aid in classification and to allow a more rapid assessment of impacts.

Exhibit 14. Summary of Wetlands in the Seattle Project Area

Wetland Name by Watershed	HGM Class and Sources of Hydrology	Cowardin Classification [a]	Approximate Size (acres) [b]	Rating[c] Ecology/ Local	Dominant Vegetation	Soil Characteristics
Portage Bay						
PBN-1	Fringe/Lake Washington and runoff	Emergent	0.3	I/NA	Cattail	No soil sample taken (boundary mapped by aerial photograph interpretation).
PBS-1	Fringe/Lake Washington and runoff	Forested, Scrub-shrub, Emergent, Littoral aquatic bed, Limnetic-aquatic bed	9.0	I/NA	Red alder, willows, and cattail. Eurasian water-milfoil, white water lily.	No soil sample taken (boundary mapped by aerial photograph interpretation).
Lake Washington						
LWN-1	Fringe/Lake Washington and runoff	Forested, Scrub-shrub, Emergent, Littoral-aquatic bed	6.5	I/NA	Red alder, red-osier dogwood, willows, Himalayan blackberry, bittersweet nightshade, cattail, and white water lily.	High organic content; fibric loam over peaty muck (10YR 3/1 to 10YR 4/1).
LWN-2	Fringe/Lake Washington and runoff	Scrub-shrub, Emergent, Littoral-aquatic bed	6.9	I/NA	Red-osier dogwood, willows, Himalayan blackberry, bittersweet nightshade, cattail, yellow pond lily, white water lily, and Eurasian water-milfoil.	No soil sample taken due to limited accessibility (this wetland includes a small island immediately east of LWN-1). Soils are probably similar to the LWN-1/LWS-2 wetland complex.
LWN-3	Fringe/Lake Washington and runoff	Forested, Scrub-shrub, Emergent, Littoral-aquatic bed	6.1	I/NA	Red alder, paper birch, Oregon ash, red-osier dogwood, hardhack, and giant horsetail.	High organic content in surface layer of mucky loam (10YR 2.5/1 to 10YR 5/3) overlying gravelly silt loam with mottles.
LWN-4	Fringe/Lake Washington	Scrub-shrub, Emergent, Littoral-aquatic bed	9.8	I/NA	Willows, soft rush, cattail, clumping grasses, possibly including common reed, and Eurasian water-milfoil.	No soil sample taken (this island and the adjacent shoreline wetland are outside of the project footprint). Soils probably have high organic content.
LWS-1	Fringe/Lake Washington	Scrub-shrub, Emergent Littoral-aquatic bed	3.7	I/NA	Cattail dominates the area between the marinas, yellow pond lily, white water lily, and Eurasian water-milfoil.	No soil sample taken (wetland located outside of project footprint).
LWS-2	Fringe/Lake Washington and runoff	Forested, Scrub-shrub, Emergent, Littoral-aquatic bed, Limnetic-aquatic bed	22.6	I/NA	Red alder, red-osier dogwood, willows, Himalayan blackberry, bittersweet nightshade, cattail, yellow pond lily, white water lily, and Eurasian water-milfoil.	High organic content throughout (fibric loam over peaty muck 10YR 3/1 to 10YR 4/1)

Exhibit 14. Summary of Wetlands in the Seattle Project Area

Wetland Name by Watershed	HGM Class and Sources of Hydrology	Cowardin Classification [a]	Approximate Size (acres) [b]	Rating[c] Ecology/ Local	Dominant Vegetation	Soil Characteristics
LWS-3	Fringe/Lake Washington and runoff	Forested, Scrub-shrub, Limnetic-aquatic bed	16.9	I/NA	Red alder, paper birch, Oregon ash, red-osier dogwood, and hardhack, white water lily, and Eurasian water-milfoil.	High organic content in surface layer (mucky loam 10YR 2.5/1 to 10YR 5/3 with mottles) over gravelly silt loam with mottles.
LWS-4	Fringe/Lake Washington and runoff	Forested, Scrub-shrub, Emergent, Littoral-aquatic bed	3.9	I/NA	Red alder, black cottonwood, Pacific willows, hardhack, Himalayan blackberry, bittersweet nightshade, red-osier dogwood, white water lily, and Eurasian water-milfoil, with cattail along shoreline.	High organic content (duff overlying fibric muck (10YR 2/1).

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

[b] Wetland acreages have not been surveyed and are based on GPS field data and aerial photography.

[c] Ecology (1993). Seattle does not have a wetland class or rating; wetlands are either of exceptional value or degraded (City of Seattle Municipal Code, Title 25.09.420).

NA = not applicable

The Union Bay wetlands are divided into four zones. The first zone is located along the shoreline, and includes forest and shrub communities. The second zone is composed of emergent wetlands that extend outward from the shoreline, and the third and fourth (littoral and limnitic) zones consist of wetlands dominated by floating aquatic plants. The littoral zone extends from the edge of the emergent vegetation to water depths of 6.6 feet, and the limnitic zone extends from this point to the limits of the floating vegetation.

Vegetation in the forested communities (Wetlands LWN-3, LWS-3, and LWS-4) includes red alder, black cottonwood, paper birch, and Oregon ash. The shrub communities (LWN-2, LWN-4, and LWS-1) support Pacific and other species of willows, red-osier dogwood, and hardhack. Invasive species such as Himalayan blackberry and bittersweet nightshade are common in these communities. Cattails dominate the emergent communities (LWN-1 through LWN-4 and LWS-2 and LWS-4), and nonnative species like Eurasian water-milfoil and white water lily, as well as native yellow pond lily, dominate the lacustrine and limnitic zones (LWN-2, LWN-4, and LWS-1 through LWS-4).

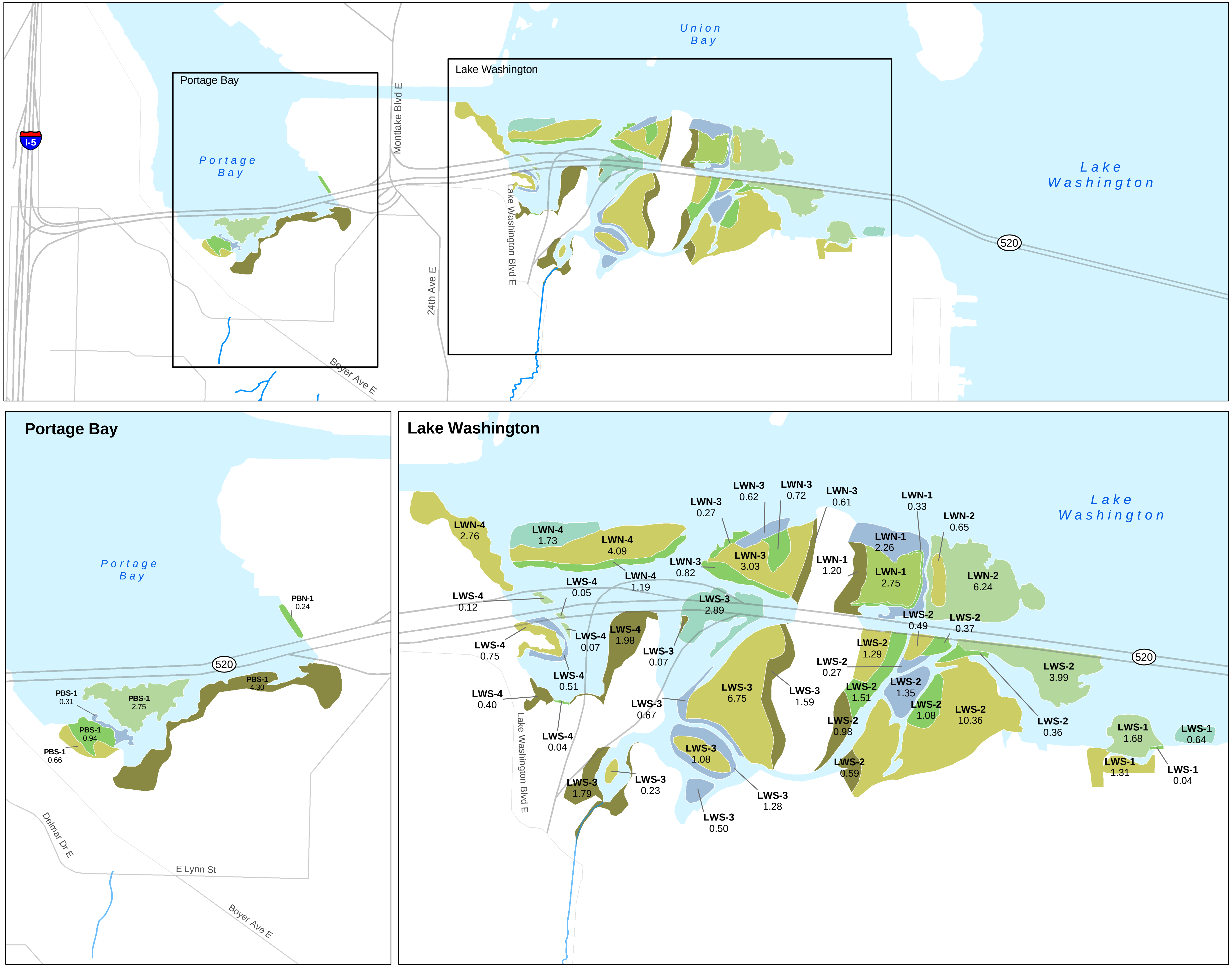

Forest, shrub, and emergent wetland

Eastside

The Eastside project area contains 36 wetlands. These wetlands include examples of all four HGM classifications: depressional, riparian, fringe, and slope. **Exhibit 16** describes these wetlands and summarizes their classification and ratings, and **Exhibit 17** shows them on a map.

Wetland Descriptions

Depressional wetlands form in closed topographic depressions where water accumulates. The Eastside project area contains 15 depressional wetlands. Four of these wetlands (FCN-1, FCN-3, FCS-1, and FCS-2) are in the Fairweather Creek watershed, three (CCN-2 and CCS-3 and CCS-4) are in the Cozy Cove watershed, five (YBN-2, YBS-2, YCN-3, YCN-4, and YCN-4A) are in the Yarrow Creek watershed, and three (KCN-2 and BNN-2 and BNN-3) are in the Kelsey Creek watershed. Eastside depressional wetlands support forest, shrub, and emergent communities.



Source: City of Seattle (2003) GIS Data (Wetlands); City of Bellevue (2003) GIS Data (Wetlands). Horizontal datum for all layers is NAD83(91), vertical datum is NADV88. Field updates by Parametrix, 2002-2004.

Note: Wetlands are labeled with wetland and acreage.

Exhibit 15. **Locations of Wetlands in the Seattle Project Area**

SR 520 Bridge Replacement and HOV Project

Exhibit 16. Summary of Wetlands in the Eastside Project Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification [a]	Approximate Size (acres) [b]	Rating Ecology/ Local [c]	Dominant Vegetation	Soil Characteristics
Fairweather Creek							
FCN-1	Hunts Point	Depressional/runoff	Emergent	<0.1	III/NA	Colonial bentgrass.	Gravelly silt loam (2.5Y 5/2 with mottles).
FC Park	Medina	Slope/groundwater	Scrub-shrub	0.2	I/NA	Western red cedar, Pacific ninebark, black twinberry, hardhack, and creeping buttercup.	No sample taken, wetland is far outside of the project footprint.
FCN-3	Hunts Point/ Medina	Depressional/runoff	Emergent	<0.1	III/NA	Creeping buttercup, tall fescue, and bentgrasses.	Very gravelly loam (2.5Y 4/2 with mottles).
FCS-1 and S-2	Hunts Point	Depressional/runoff	Forested, Scrub-shrub, Emergent	<0.1	III/NA	Western red cedar, black cottonwood, Pacific willow, red-osier dogwood, Himalayan blackberry, reed canarygrass, velvet grass, field horsetail, and creeping buttercup.	Silt loam over gravelly silt loam (10YR 4/2 with mottles).
FCS-3	Hunts Point	Slope/groundwater seep may be the result of the SR 520 roadcut.	Emergent	0.1	III/NA	Tall fescue and soft rush. Shore pine and paper birch probably planted.	Silt loam over gravelly silt loam (10Y 5/1 gleyed with mottles).
Cozy Cove							
CCN-1	Hunts Point, Yarrow Point	Fringe/Lake Washington	Forested, Scrub-shrub, Littoral-aquatic bed	8.4	I/I	Red alder, Pacific willow, bittersweet nightshade, salmonberry, and knotweeds.	Duff overlying clay to silty clay (2.5Y 6/1 with mottles).
CCN-2	Hunts Point	Depressional/runoff	Scrub-shrub, Emergent	0.3	III/NA	Red alder, Oregon ash, Himalayan blackberry, reed canarygrass, and soft rush.	Fine sandy loam over gravelly loam (2.5Y 4.5/1 with mottles and some compaction below 13 inches).
CCS-1	Hunts Point	Slope/groundwater	Scrub-shrub	0.2	III/NA	Himalayan blackberry, soft rush, field horsetail, reed canarygrass, red alder, Oregon ash, and black cottonwood.	Clay to clay loam (10GY 5/1 gleyed).

Exhibit 16. Summary of Wetlands in the Eastside Project Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification [a]	Approximate Size (acres) [b]	Rating Ecology/ Local [c]	Dominant Vegetation	Soil Characteristics
CCS-2	Hunts Point	Slope/groundwater	Scrub-shrub	<0.1	III/NA	Red alder, Oregon ash, Himalayan blackberry, red-osier dogwood, and giant horsetail.	Clay loam over clay (5Y 6/1 with mottles).
CCS-3	Hunts Point	Depressional/runoff, may have groundwater component	Emergent	<0.1	III/NA	Tall fescue, giant horsetail, creeping buttercup, and soft rush. Himalayan blackberry, Oregon ash, and red alder also present.	Silt overlying gravelly silt loam (2.5Y 5/1 with mottles).
CCS-4	Yarrow Point	Depressional/ groundwater and runoff	Scrub-shrub, Emergent	<0.1	III/III	Red alder, willow sp., reed canarygrass, and some floating aquatics (possibly duckweed).	No sample taken—wetland is outside of project footprint.
Yarrow Bay							
YBN-1	Kirkland	Fringe and riparian/ Lake Washington and Yarrow Creek; culverts convey runoff from the south and east.	Forested, Scrub-shrub, Emergent	75.2	I/1	Red alder, black cottonwood, paper birch, Himalayan blackberry, salmonberry, reed canarygrass, Japanese knotweed, ladysthumb, Watson willowherb, and field horsetail. Also mannagrass ssp., skunk cabbage, water-cress, and water parsley.	Organic layer over sand (5B 5/1 gleyed).
YBN-2	Kirkland	Depressional/runoff	Emergent	<0.1	IV/3	Red alder, Himalayan blackberry, and field horsetail.	Gravelly loam with fill.
YBS-1	Bellevue	Slope/groundwater	Forested, Emergent	2.1	III/A	Red alder and reed canarygrass. Creeping buttercup, black twinberry, and birdsfoot trefoil present in the shaded areas.	Fine sandy silt (5Y 3/1).
YBS-2	Clyde Hill, Bellevue	Depressional/runoff and possibly groundwater	Forested	0.4	III/NA/B	Red alder, Himalayan blackberry, and giant horsetail.	No soil sample, not accessible.
YBS-3A/B	Clyde Hill	Slope/groundwater	Forested, Emergent	3.7	III/NA	Red alder, black cottonwood, Himalayan blackberry, reed canarygrass, tall fescue, colonial bentgrass, and soft rush.	Gravelly loam (10GY 5/1 to 5B 5/1 gleyed).

Exhibit 16. Summary of Wetlands in the Eastside Project Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification [a]	Approximate Size (acres) [b]	Rating Ecology/ Local [c]	Dominant Vegetation	Soil Characteristics
Yarrow Creek							
YCN-1	Bellevue	Riparian/Yarrow Creek	Scrub-shrub, Emergent	<0.1	III/A	Reed canarygrass, Himalayan blackberry.	Fine sandy loam (2.5Y 3/1 with mottles).
YCN-2	Bellevue	Riparian/Yarrow Creek	Emergent	0.3	III/A	Reed canarygrass.	Silt loam (5Y 4/2 with mottles).
YCN-3	Bellevue	Depressional/runoff	Emergent	0.2	III/C	Reed canarygrass, skunk cabbage, and cutleaf blackberry.	Silty clay (5Y 5/2 with mottles).
YCN-3A/3B	Bellevue	Riparian/Yarrow Creek	Emergent	0.3/0.1	III/A	Reed canarygrass, mowed grasses.	Gravelly sandy loam to clay (10GY 5/1 gleyed with mottles).
YCN-4	Bellevue	Depressional/runoff	Scrub-shrub	<0.1	III/C	Himalayan blackberry and reed canarygrass.	Silty loam (10YR 3/2 with mottles).
YCN-4A	Bellevue	Depressional/runoff	Forested	0.3	III/B	Red alder and salmonberry. Himalayan blackberry and bracken fern also present, mostly in the buffers.	Gravelly sandy loam (10YR 4/2 with mottles).
YCS-1	Bellevue	Riparian/Yarrow Creek	Scrub-shrub, Emergent	1.2	II/A	Red alder, willows, red-osier dogwood, soft rush, and reed canarygrass,	Silt loam (10YR 2.5/2 with mottles).
YCS-2	Bellevue	Riparian/Yarrow Creek, groundwater	Forested, Scrub-shrub, Emergent	2.7	III/A	Red alder, Himalayan blackberry, and reed canarygrass.	Gravelly sand (2.5Y 3/2 with mottles).
YCS-3	Bellevue	Riparian/Yarrow Creek tributary, groundwater	Emergent	0.2	III/B	Reed canarygrass and hardhack.	Silt loam (10YR 2/2 with mottles).
YCS-4 / YCS-4A	Bellevue	Riparian/Yarrow Creek tributary, groundwater	Emergent	<0.1/0.3	II/C	Reed canarygrass.	High organic content, loam to muck (10YR 2/1).
YCS-5	Bellevue	Riparian/Yarrow Creek tributary, groundwater	Emergent, Scrub-shrub	0.1	III/C	Pacific willow, hardhack, cattail, tule, and reed canarygrass.	Silt loam (10YR 2/1).
Kelsey Creek West Tributary							
KCN-1	Bellevue	Slope/runoff	Emergent	0.1	III/C	Soft rush, reed canarygrass, and fescues.	Gravelly sand (10Y 5/1 gleyed).
KCN-2	Bellevue	Depressional/runoff	Emergent	<0.1	III/C	Soft rush, reed canarygrass, and fescues.	No sample taken.

Exhibit 16. Summary of Wetlands in the Eastside Project Area

Wetland Name by Watershed	Jurisdiction	HGM Class and Sources of Hydrology	Cowardin Classification [a]	Approximate Size (acres) [b]	Rating Ecology/ Local [c]	Dominant Vegetation	Soil Characteristics
KCS-1	Bellevue	Slope/runoff	Emergent	0.5	III/B	Soft rush, reed canarygrass, and fescues.	Sandy loam over impermeable clay (5Y 4/1).
BNN-1	Bellevue	Slope/groundwater	Forested, Emergent, Open Water	0.7	III/B	Red alder, willows, hardhack, cattail, and giant horsetail.	No sample taken - outside of footprint.
BNN-2	Bellevue	Depressional/ groundwater, runoff	Forested	0.2	III/B	Red alder, black cottonwood, and Himalayan blackberry.	No sample taken - outside of footprint.
BNN-3	Bellevue	Depressional/ groundwater, runoff	Forested	0.4	III/B	Red alder, salmonberry, and lady fern.	Silt clay loam (5Y 4/2 with mottles).

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

[b] Wetland acreages have not been surveyed and are based on GPS field data and aerial photography.

[c] Ecology (1993); see Exhibit 12 for additional information on local wetland ratings.

NA = not applicable

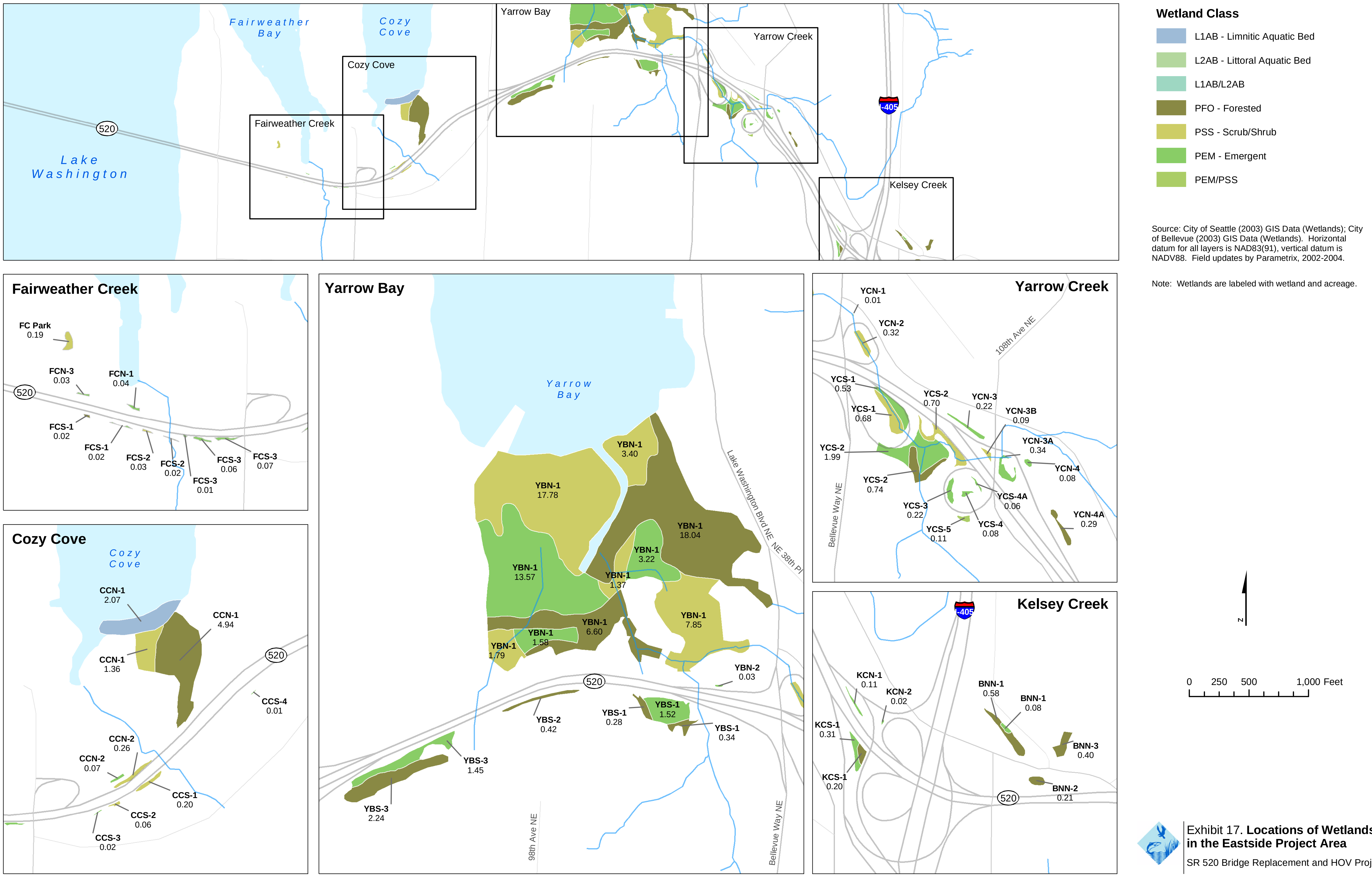


Exhibit 17. **Locations of Wetlands in the Eastside Project Area**

SR 520 Bridge Replacement and HOV Project

The forested communities have a canopy of red alder and a relatively disturbed understory, which may include giant horsetail, lady fern, and Himalayan blackberry. The shrub communities include various willows, red-osier dogwood, and Himalayan blackberry. Emergent depressional wetlands in the Eastside project area include reed canarygrass, bentgrass, fescue, and soft rush. Creeping buttercup is also common in many of these wetlands.

Forested wetland

Eastside riparian wetlands form in a narrow zone along streams and rivers that receive overbank flows from the stream. The eight riparian wetlands in the Eastside project area are all located along Yarrow Creek; they range in size from less than 0.1 acre to almost 3 acres (see **Exhibit 17**). These wetlands include forest, shrub, and emergent communities, and species present include red alder, various willow, hardhack, Himalayan blackberry, cattails, and reed canarygrass.

Shrub wetland

Fringe wetlands in the project area are found along the shores of Yarrow Bay and in Wetherill Park. Water levels in Lake Washington are the driving hydrologic influence for these wetlands. The two fringe wetlands in the Eastside project area (CCN-1 and YBN-1) are relatively large (approximately 8.4 and 75 acres, respectively) and include forest, shrub, and emergent communities. A greater number of plant species are present in these wetlands than in other wetlands in the project area (see **Exhibit 17**). In addition to the alder and cottonwood found in most wetlands on the Eastside, these two large wetlands also support western red cedar and paper birch. The shrub communities are predominantly willow and salmonberry, although Himalayan blackberry is also present. Emergent communities include mannagrass, skunk cabbage, watercress, and water parsley.

Emergent wetland

Slope wetlands typically occur in steeper areas where the groundwater table meets the ground surface. Nine wetlands of this type were found in the project area—two in the Fairweather Creek watershed, two in the Cozy Cove Creek watershed, two in the Yarrow Bay watershed, and three in the Kelsey Creek West Tributary watershed. These wetlands range from less than 0.1 acre to just over 3 acres in size. Forest, shrub, and emergent communities are all 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 project area wetlands provide?

Seattle

Wetlands in the Seattle project area provide a number of valuable functions (**Exhibit 18**).

Exhibit 18. Summary of Wetland Functions in the Seattle Project Area

	Wetland Functions[a]					
Wetlands	**Flood Flow Alteration**	**Sediment, Nutrient, and Toxicant Removal**	**Erosion Control and Shoreline Stabilization**	**Production/ Export of Organic Matter**	**Habitat Suitability**	**Social Values**
PBN-1	Low	Moderate	High	Moderate	Moderate	Moderate
PBS-1, LWN-1 through N-4, LWS1-S-4	Low	Moderate	High	High	High	High

Note: All of the wetlands in the Seattle project area are lacustrine fringe; therefore, this exhibit does not provide a breakdown by HGM class.

[a] Functions rated using the WSDOT BMP method; this information is available upon request.

All of these wetlands help to improve water quality; however, their location in the lower watershed limits their potential to alter flood flows or store flood waters . The dense vegetation in these wetlands retains sediments and nutrients, which enter as runoff from adjacent upland areas and paved roads. This vegetation also protects the shoreline of Lake Washington from erosion, which is a particularly important feature because of the heavy recreational boat traffic in the area.

The dense vegetation also contributes fine organic material and woody debris to Lake Washington; the larger wetlands (LWN-1 through N-4 and LWS-1 through LWS-4) provide more organic material than the smaller ones.

The Seattle project area wetlands also provide habitat for a variety of wildlife, from invertebrates to mammals. Stable water levels, dense emergent and shrub vegetation, snags and floating logs, and relatively undisturbed forested and shrub buffers all contribute to the habitat suitability of these wetlands.

Great blue heron at Foster Island

Red-eared slider turtles can often be seen sunning at Foster Island, and Pacific treefrogs are present in the associated wetlands. Garter snakes and lizards as well as salamanders likely use the nearby buffers and uplands. Numerous waterfowl use these wetlands, including American coots, buffleheads, mallards, scaups, goldeneyes, widgeon, and Canada geese. Great blue herons and kingfishers hunt here and in the nearby waters. Wetland-using birds are also present, including many generalist species such as European starlings, American robins, red-winged blackbirds, American crows, sparrows, finches, and towhees. Stellar jays may also be present in the Arboretum area. Predator species present include bald eagles and other raptors such as red-tailed and Cooper's hawks. Wetland-dependent mammals in these wetlands include river otters and beaver, as well as more casual wetland users such as opossums, raccoons, mice, moles, and voles.


Active and passive recreation at the Arboretum

Because of their proximity to Seattle, and to the Washington Park Arboretum and University of Washington in particular, these Seattle project area wetlands provide opportunities for both educational and recreational use. Wetland PBS-1 and the Lake Washington wetlands provide greater social value than PBN-1 because they are larger and more complex.

Eastside

Wetlands in the Eastside project area perform a variety of water quality, biological, and social functions. **Exhibit 19** summarizes these functions according to hydrogeomorphic class.

Exhibit 19. Summary of Wetland Functions in the Eastside Project Area

Wetlands by HGM Class	Wetland Functions[a]					
	Flood Flow Alteration	Sediment, Nutrient, and Toxicant Removal	Erosion Control and Shoreline Stabilization	Production/ Export of Organic Matter	Habitat Suitability	Social Values
Depressional						
FCN-1 and FCN-3; FCS-1 and FCS-2; CCN-2, CCS-3, and CCS-4; YBN-2 and YBS-2; YCN-3, YCN-4, and YCN-4A; KCN-2; BNN-2 and BNN-3	Low	Moderate	N/A	N/A	Low to Moderate	Low
Riparian						
YCN-1, YCN-2, YCN-3A/3B, YCS-1 through YCS-5	Low to Moderate	Moderate	Moderate to High	Moderate	Moderate	Moderate
Fringe						
CCN-1 and YBN-1	Low	Low	High	High	High	High
Slope						
FC Park and FCS-3, CCS-1 and CCS-2, YBS-1 and YBS-3A/3B, KCN-1, KCS-1, and BNN-1	N/A	N/A	N/A	Low	Low to Moderate	Low

[a] Functions rated using the WSDOT best professional judgment method; this information is available upon request.

N/A = This function not performed by wetland.

Depressional wetlands in the Eastside project area are located in the lower reaches of the affected watersheds, limiting their ability to reduce flood flows. However, because these wetlands are closed systems, they are able to trap pollutants in runoff, which can improve water quality in downstream areas.

The Eastside project area depressional wetlands are relatively small (typically less than 0.4 acre), but they provide valuable habitat for invertebrates, birds, amphibians, and other animals. Studies of amphibian habitats have found little evidence that the size of a wetland limits species diversity for amphibians (Sheldon et al. 2003). The Eastside project area wetlands have sufficient ponding and appropriate vegetation and cover to provide habitat for bullfrogs, Pacific treefrogs, and possibly other amphibians. In addition, most of these wetlands (except Wetland BNN-1) do not have standing water throughout the year, and they are unlikely to provide habitat for turtles.

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). Bird species using the Eastside depressional wetlands are likely to include disturbance-tolerant species. Wetland BNN-1 may also provide habitat for a small number of waterfowl.

Depressional wetlands do not provide the necessary habitat for wetland-dependent mammals. However, species such as raccoons, mountain beavers, opossums, squirrels, moles, and voles may use these areas from time to time. The depressional wetlands in the Eastside project area are not publicly owned; therefore, they are relatively difficult to access, which limits their educational and recreational uses.

Riparian wetlands in the Eastside project area can provide storage for overbank flows in Yarrow Creek, and their vegetation can trap pollutants. For these reasons, riparian 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.

Eastside project area riparian 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 riparian wetlands may provide suitable habitat for invertebrates. Side channels and inundated areas adjacent to the stream also may provide habitat for frogs. Because of their confined nature and dense tree and shrub cover, riparian wetlands in the project 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.

Riparian wetlands in the Eastside project area are located mainly on private land, and some are relatively difficult to access. These factors limit their educational and recreational uses.

Fringe wetlands in the Eastside project area have functions similar to those in Seattle. These wetlands have a limited ability to control flood flow because of their lakeshore location. They can, however, remove pollutants in runoff from upslope areas (especially YBN-1), and their vegetation protects the shores of Lake Washington from erosion.

Like the fringe wetlands in the Seattle project area, the habitat value of these wetlands is high because of their size and diversity. Wood ducks use these wetlands, as do other species similar to those found in the Seattle project area wetlands. 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.

The two fringe wetlands in the Eastside project area have protected status—CCN-1 is in Wetherill Park and YBN-1 is a designated sensitive area. These wetlands are located near homes and businesses, allowing many opportunities for passive and active recreational use.

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 Eastside project area cannot trap 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 Eastside slope wetlands.

Because the slope wetlands in the Eastside project area are located on private land and are generally inaccessible, educational or research opportunities are limited. The exception is Wetland FC Park in Fairweather Park, which does provide opportunities for recreation and educational uses.

Potential Effects of the Project on Wetlands

What methods were used to evaluate potential effects on wetlands?

The GIS team calculated the physical effects of the proposed project by overlaying the permanent and temporary construction limits onto the wetland and buffer mapping to determine the extent and location of fill and clearing under the build alternatives. The GIS team also calculated the area of wetland and buffer that would be shaded by sections of elevated roadway (bridges and approach structures). The ecosystems discipline team used the GIS data and other information to evaluate project effects on wetland functions and values. The calculations of wetland and buffer fill and shading are based on preliminary engineering and are approximate. The following sections describe the effects of the project by location and by alternative.

How would the project permanently affect wetlands?

The build alternatives for the SR 520 Bridge Replacement and HOV Project would construct new bridges, 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, shade some areas that are currently exposed, 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 **permanent effects** is used to distinguish the effects associated with the installation of permanent facilities such as the new roadway and bridges from construction activity (which are **temporary effects**). Characterizing these effects as permanent does not mean they would not be offset through appropriate mitigation actions. All effects of the project, whether permanent or temporary, would be appropriately mitigated.

WSDOT would mitigate for the effects of the 4-Lane or 6-Lane Alternatives by revegetating areas under the new structures; restoring the areas occupied by the existing structures after they are removed; and creating, restoring, and/or enhancing replacement wetlands in accordance with federal, state, and local laws. With either of the build alternatives, the goal of the mitigation would 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).

Seattle

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

No Build Alternative

Under the No Build Alternative scenarios, no new roadways or bridge structures would be constructed, and therefore would not likely affect wetlands or buffers. If the existing bridges or roadway were to fail during an earthquake or similar event, the debris would likely fill a portion of wetlands PBN-1, PBS-1, LWS-2, LWS-3, and LWS-4, and their respective buffers. Due to the unforeseen nature of these events, the area of wetland that might be affected is impossible to quantify.

4-Lane Alternative

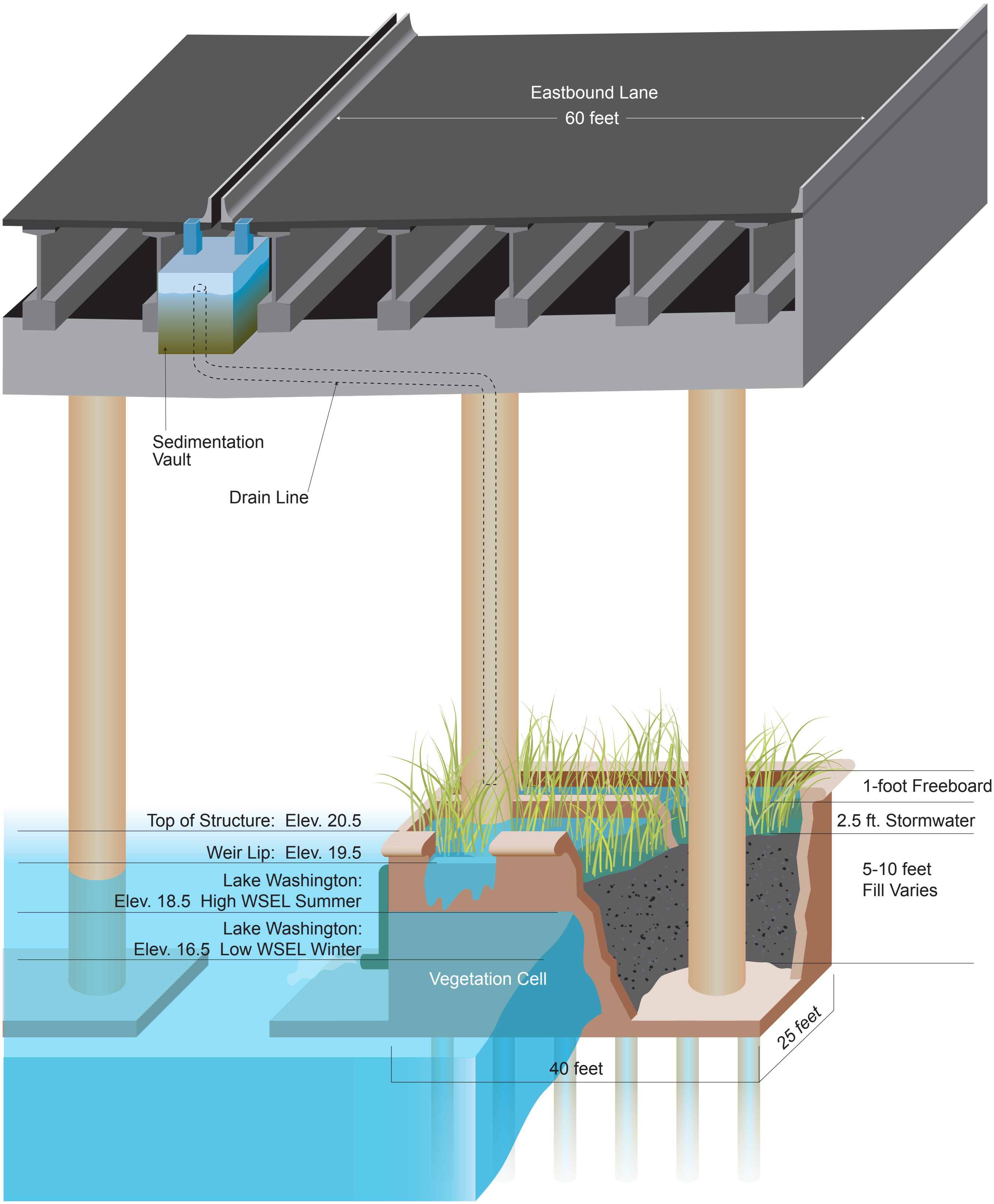
Elements of the 4-Lane Alternative that would affect wetlands in the Seattle project area include replacing two bridges, building new highway ramps, improving and adding bicycle/ pedestrian paths, and constructing two new stormwater treatment facilities. In addition, three existing ramps near the Arboretum would be removed. One stormwater treatment wetland would be built near the on-ramp at Lake Washington Boulevard, and the other would be built in East Montlake Park north of the existing Evergreen Point Bridge. Additional treatment wetlands would be constructed at the bridge columns in Union Bay to just beyond the east edge of Foster Island in Lake Washington. These column treatment wetlands would be located in shallow water outside of vegetated wetlands and would have two (or more) treatment cells (**Exhibit 20**).

Permanent Wetland Effects for the 4-Lane Alternative in Seattle (in acres)

Type of Effect	Wetland	Wetland Buffer
Fill	~0.2	~2.0
Shade	~4.5	~2.3

The 4-Lane Alternative would directly affect approximately 4.7 acres of wetland in the Portage Bay area and in Lake Washington at Union Bay/Foster Island. This would include 0.7 acre of forested wetland, 1.0 acre of shrub wetlands, 0.6 acre of emergent wetland, and 2.4 acres of lacustrine/littoral wetland plus their buffers. The affected wetlands would be PBN-1, LWN-1, LWN-2, LWN-3, LWN-4, and LWS-3 and LWS-4 (see **Exhibit 21**). Approximately 0.2 acre of the total area would be affected by fill, and 4.5 acres would be affected by shading. All of the affected wetlands in Seattle are Category I wetlands. The 4-Lane Alternative would also fill 2.0 acres of wetland buffer and clear or shade 2.3 acres of buffer. Of the total affected wetland area, roadway improvements would cause most of the fill and shading effects, but

Areas of wetland effect noted in this report are approximate values based on preliminary engineering. The estimates are rounded to the nearest one-tenth of an acre. These values may be revised upward or downward as the project design becomes more refined.



WSEL = Water Surface Elevation

Note: Elevation is based on North American Vertical Datum 1988 (NAVD88).

Exhibit 20. **Stormwater Treatment Wetland at Bridge Column**

SR 520 Bridge Replacement and HOV Project

stormwater facilities would affect 0.05 acre of the total wetland area and 0.5 acre of the total buffer area.

The fill effects would be limited to the areas within the footprint of the new roadway (such as the new Lake Washington Boulevard ramps or other areas where the roadway is at-grade), the new bridge support columns (where the roadway is elevated), the bicycle/pedestrian facilities, and the stormwater treatment facilities. The new bridges at Portage Bay and Union Bay/Foster Island would be built north of the existing bridges and would be supported by a series of supports consisting of approximately 10-foot-diameter concrete columns. The columns would likely be drilled shafts that constitute localized areas of wetland fill. Removing the three existing ramps near the Arboretum would offset some of the additional fill. These ramps are mainly over upland or open water areas as opposed to vegetated wetlands, but their removal would expose 0.2 acre of previously shaded aquatic bed, emergent, and forested wetlands.

The shaded areas reported in this document represent the entire area under the new elevated roadways. Some of the wetland area within the shaded zone would also be filled (removed) when the support columns are installed, so the filled area is a small subset of the overall shaded area. Also since the existing structures would be removed, areas that are currently shaded by the roadway would be exposed and allowed to revert to natural conditions. These areas and the areas under the proposed structures would be replanted to compensate for the effects of shading.

Where the new bridges are elevated over existing wetlands and buffers, we have classified the effects as shading. However, the replacement bridges would be substantially higher than the existing bridges (approximately 5 to 15 feet higher at Portage Bay and 10 to 40 feet higher at Foster Island/Union Bay) (**Exhibit 22**). This would allow more light to penetrate to the ground surface compared to the existing bridges. However, under the 4-Lane Alternative, the new bridge would be considerably wider (30 to 86 feet) than the existing bridge, so the benefits of the increased height in terms of light penetration might be partially offset.

Areas under the center of the bridge would likely not provide optimal conditions for plant growth (because of moisture and light limitations), but areas near the edges of the bridge would probably support well-developed plant communities, including shrubs and small trees. WSDOT would replant the areas under the structures to facilitate revegetation and mitigate effects on wetland plant communities.

AFFECTED WETLAND

Wetland Name	Acres
LWN-1	1.36
LWN-2	0.79
LWN-3	1.01
LWN-4	0.12
LWS-3	1.19
LWS-4	0.14
PBN-1	0.07
TOTAL	4.68

AFFECTED BUFFERS

Wetland Name	Acres
LWN-1	0.44
LWN-3	0.46
LWN-4	1.31
LWS-3	0.05
LWS-4	1.83
PBS-1	0.20
TOTAL	4.28

4-Lane Footprint

Wetland Class

- L1AB - Limnitic Aquatic Bed
- L2AB - Littoral Aquatic Bed
- L1AB/L2AB
- PFO - Forested
- PSS - Scrub/Shrub
- PEM - Emergent
- PEM/PSS
- Wetland Buffer
- Affected Wetland
- Affected Wetland Buffers

Note: Wetlands are labeled with wetland name and affected wetland (W) and buffer (B) acreage.

Source: City of Seattle (2003) GIS Data (Wetlands); City of Bellevue (2003) GIS Data (Wetlands). Horizontal datum for all layers is NAD83(91), vertical datum is NADV88. Field updates by Parametrix, 2002-2004.

N

0 250 500 Feet

Exhibit 21. **Effects of the 4-Lane Alternative on Wetlands in the Seattle Project Area**

SR 520 Bridge Replacement and HOV Project

Exhibit 22. Approximate Height of Bridges Over Water (Distance in Feet from Bottom of Bridge to Water/Ground Surface)

Location	Existing (No Build)	4-Lane and 6-Lane Alternatives
Portage Bay		
West end	60	66
Mid-span	11	27
East end	9	12
Arboretum Area		
West end	4	14
East end	7	48

The 4-Lane Alternative would also fill some open water areas of Portage Bay and Union Bay/Lake Washington. Approximately 54 10-foot-diameter (78.5 square feet) columns would be placed in Portage Bay and 122 columns would be placed in Union Bay/Lake Washington. The open water area affected by these bridge columns would be approximately 4,200 and 9,600 square feet, respectively. The existing 4-foot-diameter (12.6 square feet) bridge columns (approximately 530 columns), or 6,700 square feet, in these areas would be removed. Therefore, the difference between existing conditions and the 4-Lane Alternative would be a reduction in the overall number of columns to 354, which would result in an increase of 7,100 square feet (0.2 acre) of columns on the lake bottom of open water areas.

Bridge Support Columns Effects for the 4-Lane Alternative in Seattle

	No Build		4-Lane	
	Columns (No.)	Square Feet	Columns (No.)	Square Feet
Portage Bay	76	960	54	4,240
Union Bay/Lake Washington	454	5,720	122	9,580
Total	530	6,680 (~6,700)	176	13,820 (~13,800)

As noted above, some of the columns in Portage Bay and Lake Washington would support stormwater treatment wetlands. There would be approximately 15 column treatment wetlands with the 4-Lane and 6-Lane Alternatives. The estimated size of the column treatment wetlands range from approximately 500 to 1,500 square feet; the combined footprint of all these column treatment facilities would be approximately 0.2 acre. This effect would occur in open water areas; the area was counted as a shading effect.

6-Lane Alternative

Elements of the 6-Lane Alternative that would affect wetlands in the Seattle project area are similar to the 4-Lane Alternative, except that the 6–Lane Alternative would affect more area because of the wider roadway and the larger stormwater treatment facilities (to accommodate more runoff).

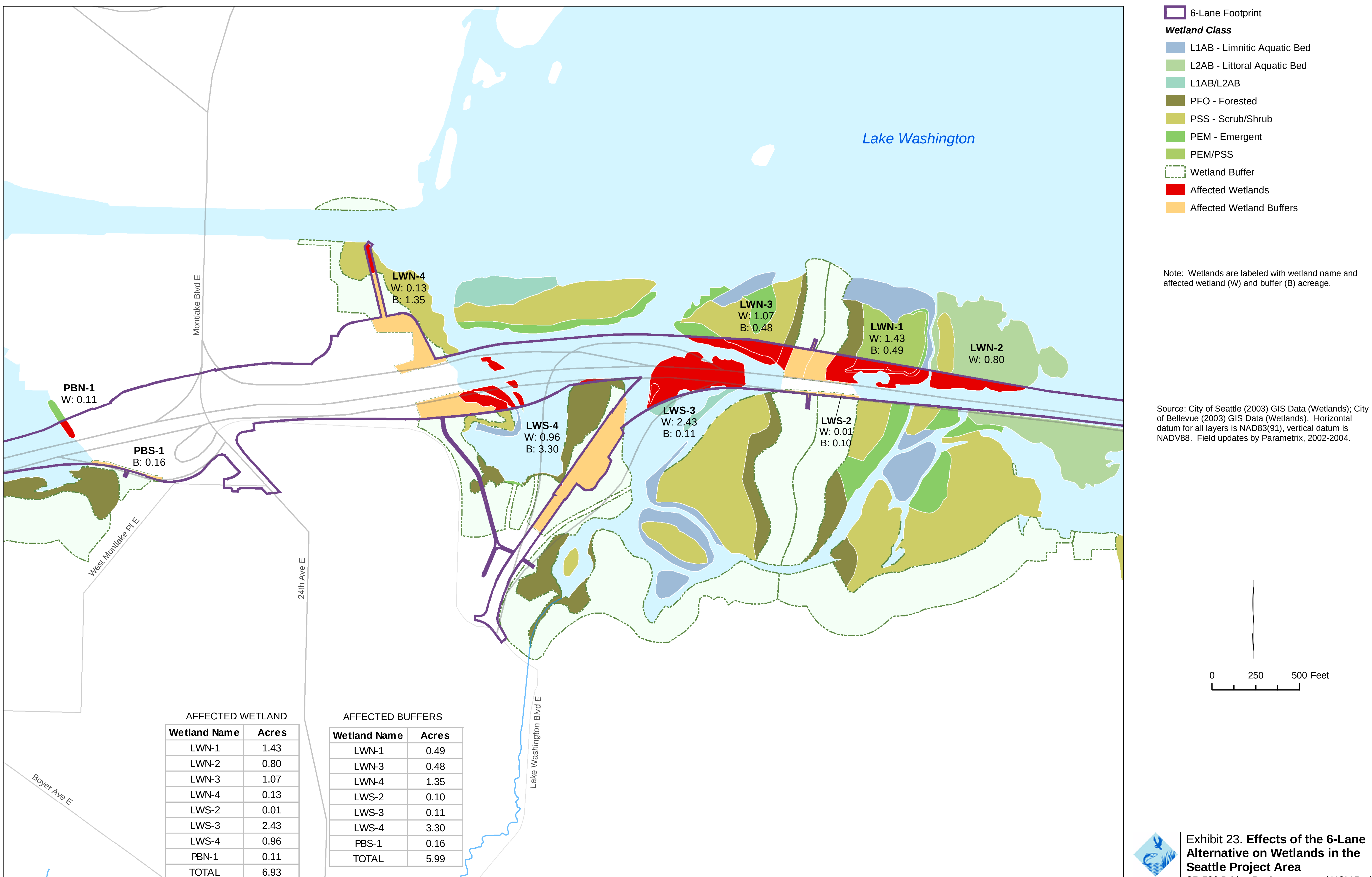
Permanent Wetland Effects for the 6-Lane Alternative in Seattle (in acres)

Type of Effect	Wetland	Wetland Buffer
Fill	~0.2	~3.8
Shade	~6.7	~2.2

The 6-Lane Alternative would affect approximately 6.9 acres of wetland in Portage Bay and in Lake Washington at Union Bay/Foster Island. This would include 0.8 acre of forested wetland, 1.3 acres of scrub/shrub wetlands, 0.7 acre of emergent wetland, and 4.1 acres of lacustrine/aquatic bed wetland plus their buffers. The affected wetlands would be PBN-1, LWN-1 though LWN-4, and LWS-2, through LWS-4 (see **Exhibit 23**), all of which are Category I wetlands. Approximately 0.2 acre of the total area would be affected by fill and 6.7 acres would be affected by shading. The 6-Lane Alternative would also fill 3.8 acres of wetland buffer and shade 2.2 acres of buffer. Of the total affected area under the 6-Lane Alternative, roadway improvements would cause most of the fill and shading effects, but stormwater facilities would affect approximately 0.1 acre of the total wetland area and 0.7 acre of the total buffer area.

Construction of the bicycle/pedestrian path would affect a small area of wetland buffer on the north side of the existing roadway (the buffer would be excavated and the path constructed in its place). Removing the three existing ramps near the Arboretum would offset some of the additional fill. These ramps are mainly over upland or open water areas as opposed to vegetated wetlands, but their removal would expose 0.2 acre of previously shaded aquatic bed, emergent, and forested wetlands.

Under the 6-Lane Alternative, Portage Bay Bridge would expand north of the existing bridge. The new Evergreen Point Bridge west approach over Union Bay/Foster Island would be located directly over and to the north of the existing bridge. A series of 10-foot-diameter columns would support the new bridges. Where it crosses Portage Bay, the new bridge would be approximately 66 feet above the water at the west end and approximately 12 feet above the existing ground/water surface at the east end. At Union Bay/Foster Island, the bridge would be from about 14 to 48 feet above the ground/water surface. Raising the bridge decks would allow more light to penetrate indirectly, but the new



AFFECTED WETLAND

Wetland Name	Acres
LWN-1	1.43
LWN-2	0.80
LWN-3	1.07
LWN-4	0.13
LWS-2	0.01
LWS-3	2.43
LWS-4	0.96
PBN-1	0.11
TOTAL	6.93

AFFECTED BUFFERS

Wetland Name	Acres
LWN-1	0.49
LWN-3	0.48
LWN-4	1.35
LWS-2	0.10
LWS-3	0.11
LWS-4	3.30
PBS-1	0.16
TOTAL	5.99

Exhibit 23. **Effects of the 6-Lane Alternative on Wetlands in the Seattle Project Area**
SR 520 Bridge Replacement and HOV Project

bridges would be between 140 and 198 feet wide, depending on location.

Areas under the center of the bridge would likely not provide optimal conditions for plant growth (because of moisture and light limitations), but areas near the edges of the bridge would probably support well-developed plant communities, including shrubs and small trees. WSDOT would replant the areas under the structures to facilitate revegetation and mitigate adverse effects on wetland plant communities.

Bridge Support Columns Effects for the 6-Lane Alternative in Seattle

	No Build		6-Lane	
	Columns (No.)	Square Feet	Columns (No.)	Square Feet
Portage Bay	76	960	54	4,240
Union Bay/ Lake Washington	454	5,720	162	12,720
Total	530	6,680 (~6,700)	216	16,960 (~17,000)

Similar to the 4-Lane Alternative, the 6-Lane Alternative would place approximately 54 permanent columns in the open waters of Portage Bay. The total area of fill in Portage Bay would be approximately the same as the 4-Lane Alternative (about 4,200 square feet). Approximately 162 additional columns would be required in the open water portions of Lake Washington. These columns would fill approximately 12,700 square feet of the lakebed. As with the 4-Lane Alternative, the existing bridge columns (approximately 530 columns) would be removed, resulting in fewer columns than today, with an increase of 10,300 square feet (0.02 acre) of columns on the lake bottom. In addition, stormwater treatment wetlands at the bridge columns would affect 0.2 acre of lake bottom. Similar to the 4-Lane Alternative, these effects were counted in the area shaded by the bridge because the effects would occur in unvegetated areas under the bridge.

How would the project affect the hydrologic functions of Seattle wetlands?

No Build Alternative

The Continued Operation Scenario would not affect the quantity or quality of water entering wetlands in the project area. Currently, runoff from the existing structures discharge directly to Portage Bay and Union Bay, and runoff is not treated before being discharged. This untreated runoff carries pollutants from automobiles (such as petroleum products and metal from tires and brake linings). Under the Catastrophic Failure Scenario, catastrophic failure of the existing bridges would temporarily increase sediments but likely would not permanently affect water quality. If the bridges were to fail, there would no longer be untreated roadway runoff entering the lake at this location, but pollutant loading in runoff from other roadways might increase because traffic would likely shift to other roadways.

4-Lane Alternative

Although the 4-Lane Alternative would increase the amount of impervious surface in the project area, it would not likely have a measurable effect on the hydrology of wetlands in the Seattle project area. Lake Washington controls the wetland hydrology in the shoreline wetlands. Since the project area includes only a small portion of the Lake Washington watershed, the relatively small changes in impervious surface would not substantially affect the amount of water in these wetlands, or the length of time the wetlands are saturated/inundated.

The 4-Lane Alternative would reduce the area of wetland available for providing water quality functions, but the proposed water quality treatment facilities at the Museum of History and Industry (MOHAI), near the Arboretum, and at the bridge columns would compensate for this effect to a large degree. In addition, WSDOT would provide replacement wetlands through creation, restoration, and/or enhancement to ensure no net loss of functions.

The 4-Lane Alternative would implement stormwater treatment facilities and water quality BMPs to treat and remove pollutants. Sediment loads to receiving waterbodies, including wetlands, would be reduced in all basins of the Seattle project area. Metals loading would either decrease or increase, depending on the individual basin. Stormwater discharges would comply with federal and state water quality regulations. Effects on water quality within specific basins is presented in Appendix T, *Water Resource Discipline Report*.

6-Lane Alternative

As noted for the 4-Lane Alternative, lake levels control wetland hydrology in the Seattle project area. The project area comprises only a small portion of the Lake Washington watershed; therefore, the relatively small increases in impervious surface would not affect the water levels or duration of saturation/inundation in these wetlands.

The 6-Lane Alternative would construct the same stormwater treatment facilities described in the 4-Lane Alternative. The land-based facilities would be in the same location as the 4-Lane Alternative, but would be larger in size. The size and number of column treatment wetlands would be approximately the same as for the 4-Lane Alternative.

As discussed under the 4-Lane Alternative, the stormwater treatment facilities and replacement wetlands would mitigate for water quality functions currently provided by the project area wetlands. Water quality effects for the 6-Lane Alternative would be similar to the 4-Lane Alternative.

How would the project affect the habitat functions of Seattle wetlands?

No Build Alternative

Noise disturbance would be the primary effect of the No Build Alternative on the habitat functions of existing wetlands. If the existing bridge were to remain in operation until 2030, traffic volumes would increase by about 5 percent over 2002 levels (from 98,022 cars per day to 103,269 cars per day). This small increase would not likely raise noise levels and would not affect wetland habitat functions. If either the Portage Bay Bridge or Evergreen Point Bridge were to collapse due to a catastrophic event, noise levels in the project area would decrease and wetland-associated wildlife would likely experience less disturbance.

4-Lane Alternative

The 4-Lane Alternative would reduce the availability and quality of wetland habitat for invertebrates, amphibians, birds, and mammals compared to existing conditions and the No Build Alternative. Removal or reduction of woody vegetation associated with filling and shading could reduce the amount of small and large woody debris entering the habitats associated with Lake Washington, which would reduce food and cover for wildlife. These effects could be offset through revegetation of areas under the bridge structures and other mitigation, as described at the end of the Wetlands section of this report.

The Evergreen Point Bridge would shade the shallow areas near Foster Island (some areas are already shaded by the existing bridge, but the new bridge would be to the north of the existing bridge). Less than 1 acre of forested wetland would be shaded. This shading would reduce the amount of forage and resting habitat for Pacific treefrogs, red-eared sliders, and waterfowl in these areas. Herons, kingfishers, and beavers could also be affected by the shoreline alteration near Foster Island. Generalist species such as songbirds and most small mammals would be less affected by the loss of wetland habitat because they do not depend on specific types of wetland habitats and are accustomed to human intrusion.

Throughout most of the Seattle project area, the roadway would be higher above the water than the existing bridge. Elevating the roadway (especially through the Portage Bay and Foster Island areas) and installing sound walls in many areas could affect wildlife movement.

Passerine birds would generally not be affected by changes in the roadway elevation because the roadway is mostly located over open water, away from passerine habitat. For terrestrial wildlife, wildlife passage between the north and south portions of Foster Island would improve relative to existing conditions. Under existing conditions, the at-grade SR 520 roadway and adjacent fencing are a barrier to wildlife movement. The only passage available for terrestrial wildlife is through the pedestrian tunnel under the highway. The 4-Lane Alternative would elevate the highway over Foster Island, and the existing at-grade roadway and fencing would be removed. In the remainder of the Seattle and Lake Washington project areas, the highway would be elevated, as under existing conditions. Consequently, terrestrial wildlife passage in those areas would be the same as under existing conditions.

Noise from the 4-Lane Alternative would be less than under existing or No Build conditions (because of the addition of sound walls throughout the project corridor), so there could be a slight improvement in the quality of wildlife habitat in the project area. See the *Wildlife and Habitat* section of this report for more detailed information about noise, obstruction, or barrier effects on wildlife.

6-Lane Alternative

The 6-Lane Alternative would have similar shading effects on wetland habitat as the 4-Lane Alternative, although the affected area would be greater because of the larger width of the roadway. Despite the revegetation and other mitigation measures, this shading would reduce the potential sources of woody debris and remove some food sources and nesting/denning sites. Similar to the 4-Lane Alternative, the majority of the effects would be shading, but filling of wetlands and buffers would remove some wildlife habitat. The species affected by the habitat alteration would be similar to those described under the 4-Lane Alternative; generalist species would not likely be greatly affected by the 6-Lane Alternative.

The 6-Lane Alternative's effects on wildlife would be similar to the 4-Lane Alternative. Both alternatives would improve terrestrial wildlife passage between the north and south portions of Foster Island.

The sound walls associated with the 6-Lane Alternative are expected to reduce noise levels near the Arboretum, similar to the 4-Lane Alternative (see Appendix M, *Noise Discipline Report*). Therefore, the 6-Lane Alternative could result in a slight improvement to the quality of wetland-dependent wildlife habitat in the vicinity of the project. See the *Wildlife and Habitat* section of this report for more information on the effects of noise, obstruction, or barriers on specific animals.

Lake Washington

The floating portion of the Evergreen Point Bridge would be built over deep, open water where bridge columns are not feasible. In the Lake Washington project area, open water habitats are not considered wetlands because they are not vegetated. However, they are considered Waters of the U.S. and are regulated under sections of the Clean Water Act and the Rivers and Harbors Act, among others. Wetlands along the shorelines of Lake Washington are discussed under the *Seattle* and *Eastside* sections of this report.

The effects of construction of the west approach to the Evergreen Point Bridge is included in the Seattle project area discussion.

How much lakebed area would be affected as a result of the project?

No Build Alternative

The No Build Alternative would not require construction in Lake Washington. In the event that the bridge were to sink or collapse, the structure would likely be left in place because removing it from deep water would be too difficult.

4-Lane Alternative

The 4-Lane Alternative would fill some open water areas of Lake Washington. Approximately eight 10-foot-diameter columns would be placed in Lake Washington, which would affect approximately 600 square feet of lakebed. The existing 4-foot-diameter bridge columns (approximately 14 columns), comprising 200 square feet of lakebed, would be removed. The overall number of columns would decrease by six under the 4-Lane Alternative but result in an increase of 400 square feet (< 0.01 acre) of columns on the lakebed compared to existing conditions.

The 4-Lane Alternative would construct a replacement Evergreen Point Bridge on floating pontoons, which would be anchored to the lake bottom to hold the bridge in place like the existing floating bridge. The existing anchors would likely be left in place when the bridge is removed. Two main types of anchors would be used: gravity anchors in harder, dense lakebed materials and flukes in the soft bottom sediments of the lake. The gravity anchors would consist of large concrete blocks or boxes stacked on one another. Fluke anchors would be installed below the mud line by a combination of their own weight and water or air jetting. The anchors would be connected to the floating pontoons with steel cables. Approximately 22 anchors would be required on the north side of the replacement Evergreen Point Bridge, and an additional 22 anchors would be required on the south side. When installed, it is expected that these anchors would soon be covered with lake bottom sediments and would have little permanent effect on the lakebed.

6-Lane Alternative

Similar to the 4-Lane Alternative, the 6-Lane Alternative would place eight permanent columns in the open waters of Lake Washington. The total area of fill would be approximately the same as the 4-Lane Alternative (about 600 square feet). As with the 4-Lane Alternative, the existing bridge columns (approximately 14 columns) would be removed, resulting in fewer columns than today but an increase of 400 square feet (<0.01 acre) of columns on the lakebed.

The 6-Lane Alternative Evergreen Point Bridge would also be built on floating pontoons anchored to the bed of Lake Washington. The same types and number (44 total) of anchors as described for the 4-Lane Alternative would be used. Additional information on this topic can be found in Appendix H, *Geology and Soils Discipline Report*.

Eastside

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

No Build Alternative

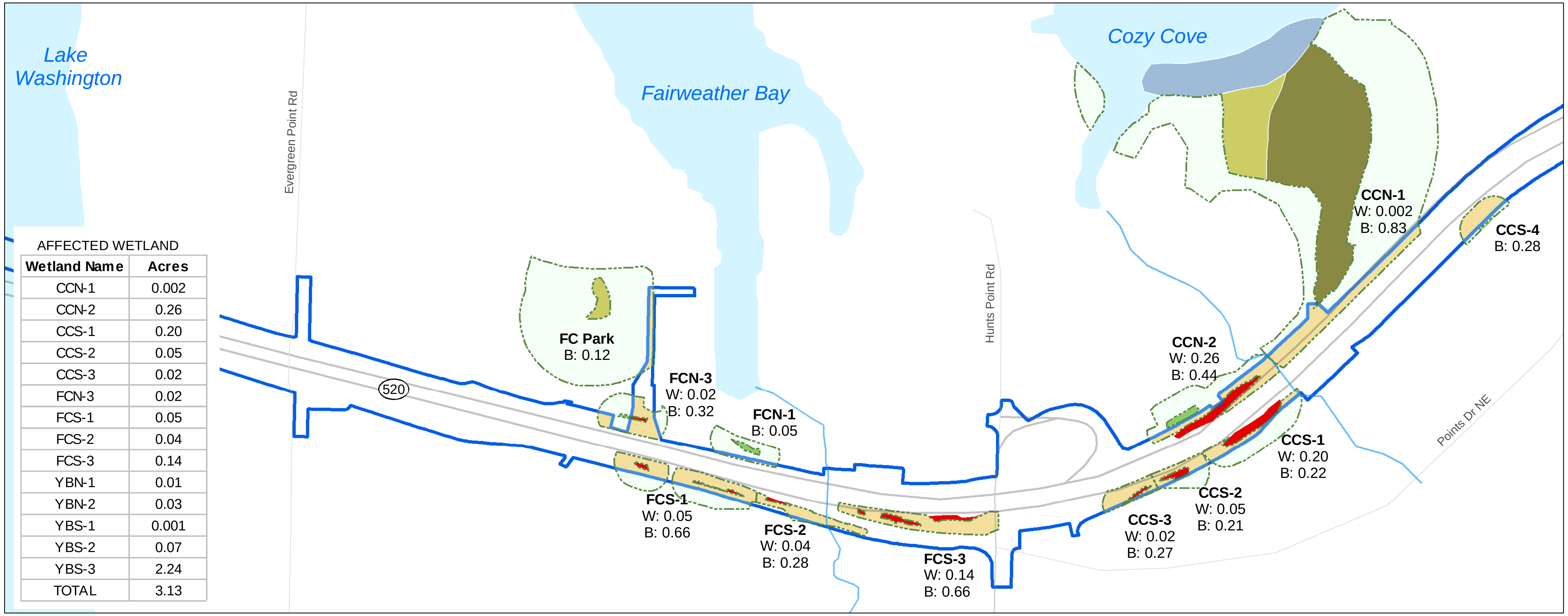
The No Build Alternative would not fill wetlands on the Eastside. There are no wetlands along the eastern shoreline of Lake Washington, so loss of the Evergreen Point Bridge in a storm or earthquake would not affect wetlands.

4-Lane Alternative

The 4–Lane Alternative would widen the roadway surface, improve existing on- and off-ramps, replace existing bridges, and add stormwater facilities at seven locations to treat runoff from existing and new road surfaces. These activities would fill approximately 3.2 acres of wetlands in the Eastside project area, including 0.1 acre of Category I wetland; 3.1 acres of Category III wetland (0.9 acre forested, 0.5 acre scrub/shrub, and 1.7 acres emergent); and less than 0.1 acre of Category IV emergent wetland. The 4-Lane Alternative would also fill approximately 5.5 acres of wetland buffer. Affected wetlands are shown in **Exhibit 24**. No shading of wetlands or their buffers would occur on the Eastside for either build alternative.

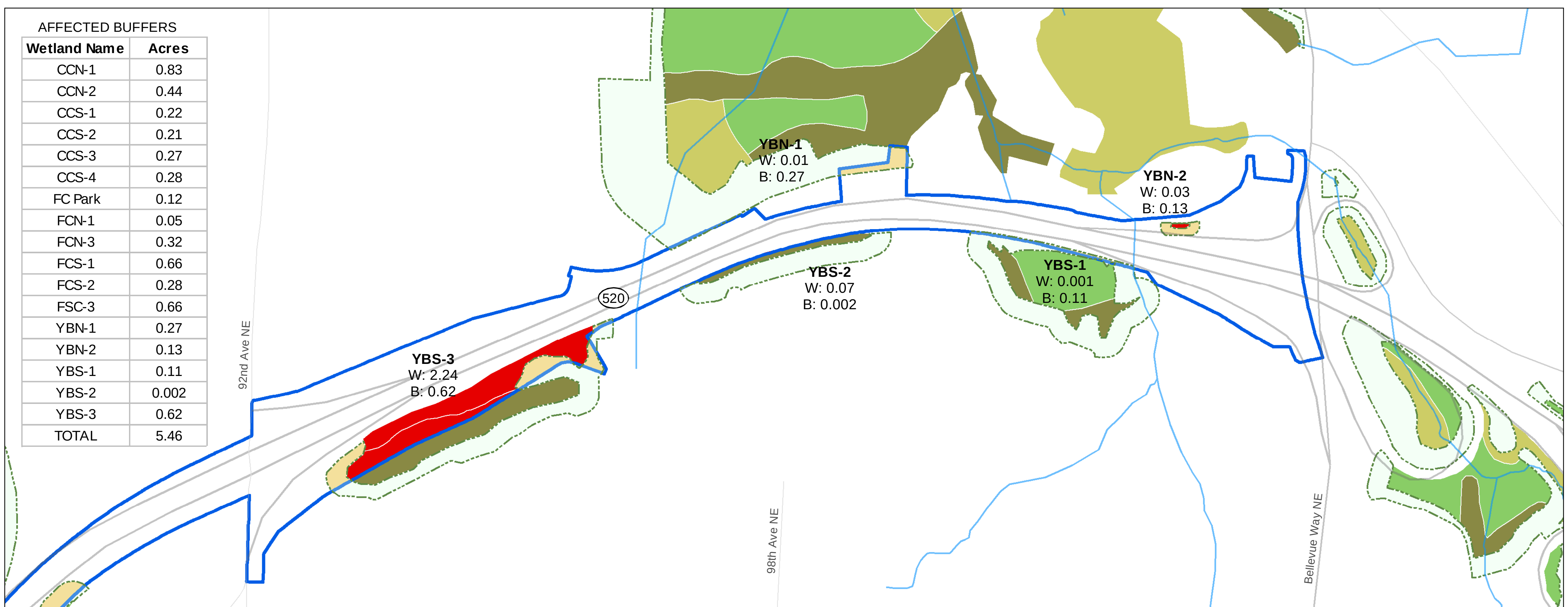
Permanent Wetland Effects for the 4-Lane Alternative on the Eastside (in acres)

Type of Effect	Wetland	Wetland Buffer
Fill	~3.2	~5.5



AFFECTED WETLAND

Wetland Name	Acres
CCN-1	0.002
CCN-2	0.26
CCS-1	0.20
CCS-2	0.05
CCS-3	0.02
FCN-3	0.02
FCS-1	0.05
FCS-2	0.04
FCS-3	0.14
YBN-1	0.01
YBN-2	0.03
YBS-1	0.001
YBS-2	0.07
YBS-3	2.24
TOTAL	3.13



AFFECTED BUFFERS

Wetland Name	Acres
CCN-1	0.83
CCN-2	0.44
CCS-1	0.22
CCS-2	0.21
CCS-3	0.27
CCS-4	0.28
FC Park	0.12
FCN-1	0.05
FCN-3	0.32
FCS-1	0.66
FCS-2	0.28
FSC-3	0.66
YBN-1	0.27
YBN-2	0.13
YBS-1	0.11
YBS-2	0.002
YBS-3	0.62
TOTAL	5.46

4-Lane Footprint

Wetland Class

- L1AB - Limnitic Aquatic Bed
- L2AB - Littoral Aquatic Bed
- L1AB/L2AB
- PFO - Forested
- PSS - Scrub/Shrub
- PEM - Emergent
- PEM/PSS
- Wetland Buffer
- Affected Wetlands
- Affected Wetland Buffers

Note: Wetlands are labeled with wetland name and affected wetland (W) and buffer (B)acreage.

Source: City of Seattle (2003) GIS Data (Wetlands); City of Bellevue (2003) GIS Data (Wetlands). Horizontal datum for all layers is NAD83(91), vertical datum is NADV88. Field updates by Parametrix, 2002-2004.

N

0 250 500 Feet

Exhibit 24. **Effects of the 4-Lane Alternative on Wetlands in the Eastside Project Area**
SR 520 Bridge Replacement and HOV Project

The 4-Lane Alternative would completely (or nearly completely) fill six small wetlands (FCS-2, FCS-3, CCS-1 through CCS-3, and YBN-2). Wetlands FCS-2, CCS-3, and YBN-2 are depressional wetlands less than 0.1 acre in size. The remaining three wetlands (FCS-3, CCS-1, and CCS-2) are slope wetlands 0.2 acre or less in size.

The 4-Lane Alternative would also fill half or more of five wetlands (FCN-3, FCS-1, FCS-2, CCN-2, and YBS-3). Four of these wetlands are depressional wetlands that are less than 0.3 acre in size, and the fifth (YBS-3) is a slope wetland approximately 3.7 acres in size. Effects on the remaining wetlands represent a smaller percentage of the overall wetland size.

Summarizing the fill effects by HGM class, the 4-Lane Alternative would fill 2.6 acres of slope wetland, 0.5 acre of depressional wetland, and ~0.01 acre of fringe wetland. WSDOT would provide mitigation to compensate for the adverse effects of the 4-Lane Alternative on Eastside wetlands.

6-Lane Alternative

The 6–Lane Alternative would widen the roadway surface to 6 lanes, improve existing on- and off-ramps, replace existing bridges, and add or expand stormwater facilities at eight locations to treat runoff from existing and new road surfaces. These activities would fill approximately 6.4 acres of wetlands in the Eastside project area. This would include less than 0.1 acre of Category I forested wetland; ~0.7 acre of Category II scrub/shrub wetland; 5.7 acres of Category III wetlands (1.4 acres forested, 1.2 scrub/shrub, and 3.1 emergent); and less than 0.1 acre of Category IV emergent wetland. The 6-Lane Alternative would also fill approximately 11.6 acres of wetland buffer. Affected wetlands are shown in **Exhibit 25**.

Permanent Wetland Effects for the 6-Lane Alternative on the Eastside (in acres)

Type of Effect	Wetland	Wetland Buffer
Fill	~6.4	~11.6

The 6-Lane Alternative would completely (or nearly completely) fill 13 small wetlands (FCN-1, FCN-3, FCS-1 through FCS-3, CCS-1 through CCS-3, YBN-2 and YBS-2, YCN-2, YCN-3B, and YCS-1). Nine of these wetlands are depressional wetlands, each less than 0.5 acre in size. Three (FCS-3, CCS-1, and CCS-2) are slope wetlands 0.2 acre or less in size. The remaining three wetlands (YCN-2, YCN-3B, and YCS-1) are riparian wetlands along Yarrow Creek. The 6-Lane Alternative would also fill half or more of three wetlands (CCN-2, YBS-1, and YBS-3). Wetland CCN-2 is a depressional wetland approximately 0.3 acre in size. The remaining two wetlands are slope wetlands ranging from 2.1

to 3.7 acres in size. The fill in the remaining wetlands represents a small percentage of the overall wetland size.

Summarizing the fill effects by HGM class, the 6-Lane Alternative would fill 3.6 acres of slope wetland, 1.9 acres of riparian wetland, 0.9 acre of depressional wetland, and less than 0.1 acre of fringe wetland. WSDOT would provide mitigation to compensate for the adverse effects of the 6-Lane Alternative on Eastside wetlands.

How would the project affect the hydrologic functions of Eastside wetlands?

No Build Alternative

The Continued Operation Scenario would not change the amount of impervious surface in the project area, and no changes to wetland hydrology are expected. Currently, water runs off SR 520 directly into streams and wetlands. This runoff is untreated and carries pollutants from the road surface to the streams and wetlands.

Under the Catastrophic Failure Scenario, collapse of the existing Evergreen Point Bridge would likely eliminate much of the traffic and associated pollutant loading onto pavement in the Eastside project area. Pollutant loading would decrease because only local traffic would use the Eastside roadways between Lake Washington and I-405. Pollutant loading would presumably shift to other parts of the highway system.

4-Lane Alternative

The 4-Lane Alternative would increase the impervious surface of the roadway by 37 to 62 percent in the Eastside project area. The increases would vary depending on the basin (CH2M HILL and Parametrix 2004). The design would include seven new stormwater facilities (two wet ponds and five wet vaults) to treat and detain the stormwater from the existing and new road surfaces. The increase in impervious surface combined with the reduction in wetland area due to fill could affect the hydrology of some wetlands along SR 520 by altering surface and subsurface hydrologic patterns and reducing the water storage capacity of these wetlands. Because the wetlands receive water from various sources and the magnitude of an effect depends on the wetlands' landscape position (whether it has an inlet or outlet and how much of its drainage basin is removed), the overall effect of increased impervious surface would be difficult to gauge without a detailed hydrologic assessment of each wetland. This assessment could be conducted during the permitting phase of the project.

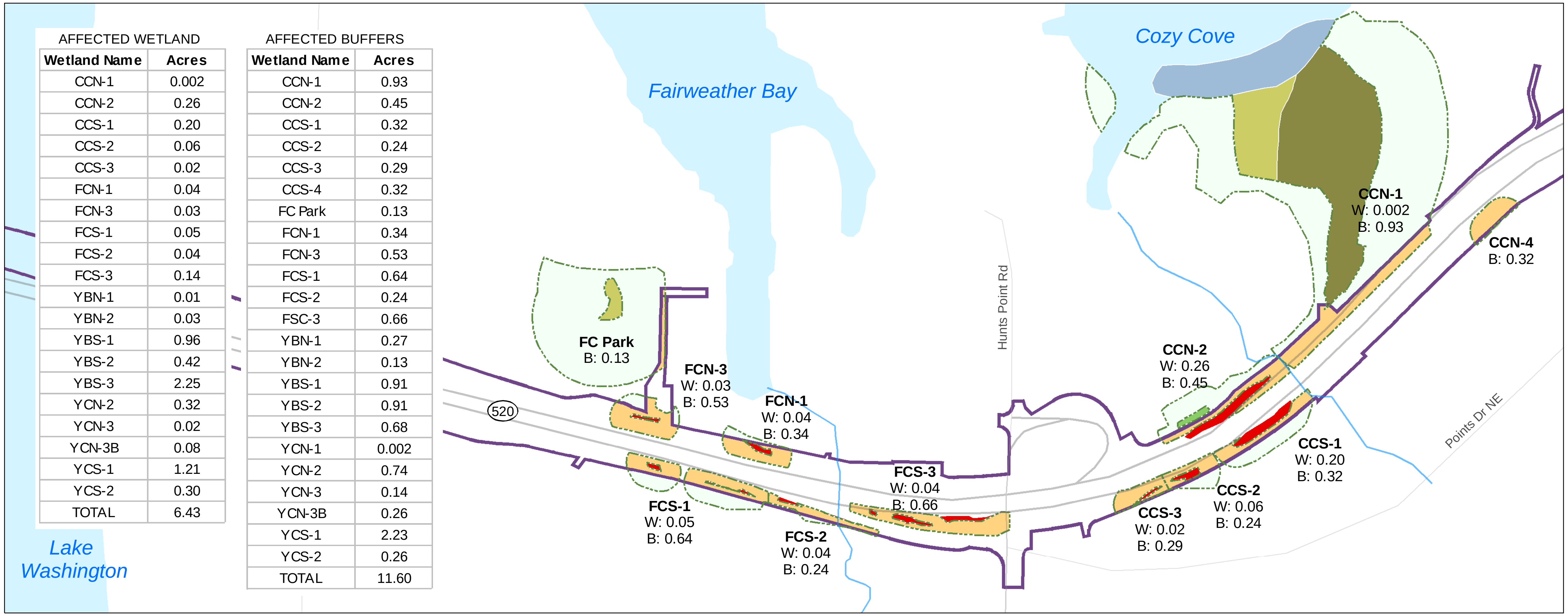
The 4-Lane Alternative would reduce the amount of wetland area available to provide water quality functions. However, new stormwater

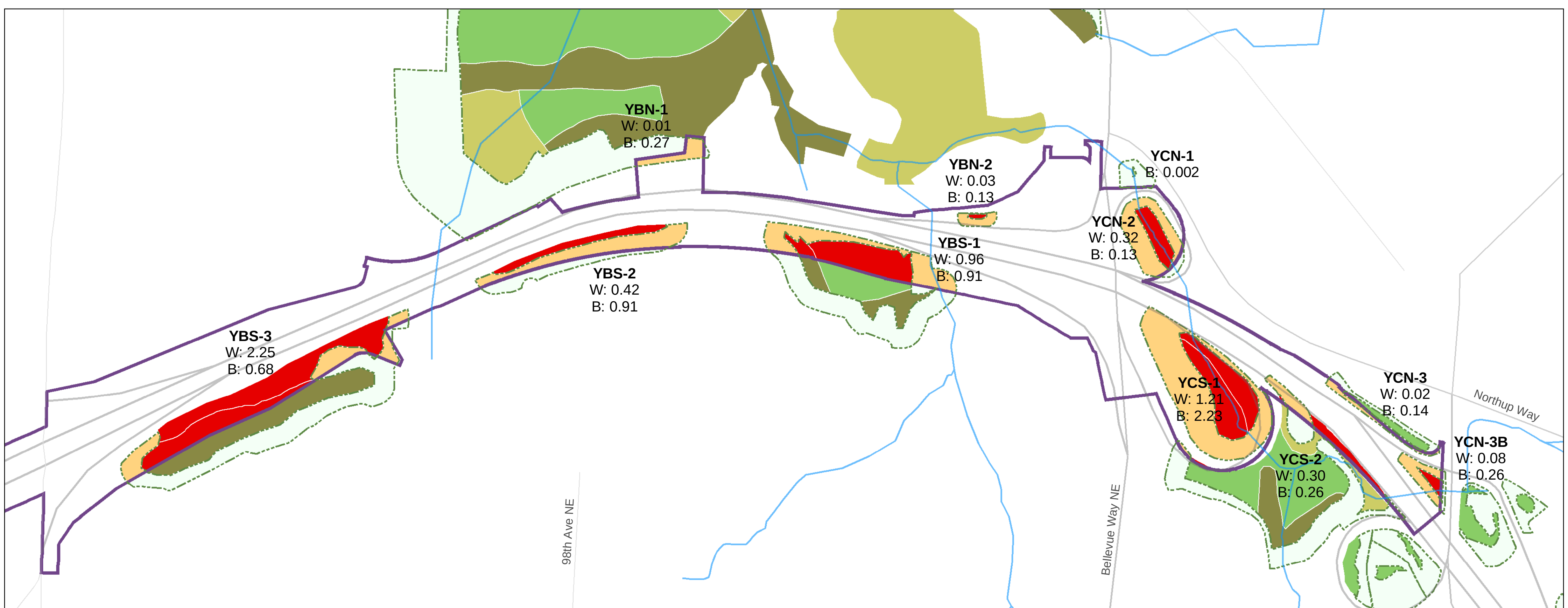
AFFECTED WETLAND

Wetland Name	Acres
CCN-1	0.002
CCN-2	0.26
CCS-1	0.20
CCS-2	0.06
CCS-3	0.02
FCN-1	0.04
FCN-3	0.03
FCS-1	0.05
FCS-2	0.04
FCS-3	0.14
YBN-1	0.01
YBN-2	0.03
YBS-1	0.96
YBS-2	0.42
YBS-3	2.25
YCN-2	0.32
YCN-3	0.02
YCN-3B	0.08
YCS-1	1.21
YCS-2	0.30
TOTAL	6.43

AFFECTED BUFFERS

Wetland Name	Acres
CCN-1	0.93
CCN-2	0.45
CCS-1	0.32
CCS-2	0.24
CCS-3	0.29
CCS-4	0.32
FC Park	0.13
FCN-1	0.34
FCN-3	0.53
FCS-1	0.64
FCS-2	0.24
FSC-3	0.66
YBN-1	0.27
YBN-2	0.13
YBS-1	0.91
YBS-2	0.91
YBS-3	0.68
YCN-1	0.002
YCN-2	0.74
YCN-3	0.14
YCN-3B	0.26
YCS-1	2.23
YCS-2	0.26
TOTAL	11.60





6-Lane Footprint

Wetland Class

- L1AB - Limnitic Aquatic Bed
- L2AB - Littoral Aquatic Bed
- L1AB/L2AB
- PFO - Forested
- PSS - Scrub/Shrub
- PEM - Emergent
- PEM/PSS
- Wetland Buffer
- Affected Wetlands
- Affected Wetland Buffers

Source: City of Seattle (2003) GIS Data (Wetlands); City of Bellevue (2003) GIS Data (Wetlands). Horizontal datum for all layers is NAD83(91), vertical datum is NADV88. Field updates by Parametrix, 2002-2004.

Note: Wetlands are labeled with wetland name and affected wetland (W) and buffer (B) acreage.

N

0 250 500 Feet

Exhibit 25. **Effects of the 6-Lane Alternative on Wetlands in the Eastside Project Area**

SR 520 Bridge Replacement and HOV Project

treatment ponds, vaults, and wetlands would be constructed to mitigate water quality functions in this portion of the watershed. Sediment loads in roadway runoff would be reduced in all basins of the Eastside project area. Metals loading would increase or decrease depending on the individual basin. Effects on water quality within specific basins can be found in the Appendix T, *Water Resources Discipline Report*. Effects on hydrology functions for each wetland type are discussed further below. Mitigation in the form of wetland creation, restoration, and enhancement would be provided to offset and compensate for these effects.

Depressional Wetlands

In the Eastside project area, depressional wetlands could be susceptible to hydrologic alterations caused by increases in impervious surface. The likelihood and magnitude of these types of effects depends 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 will be filled under the 4-Lane Alternative are small (less than 0.4 acre), and they would not likely play a substantial role in improving water quality because of the limited surface area available for sediment trapping and biofiltration. The water quality treatment provided by the proposed stormwater facilities should offset the functional loss of these depressional wetlands to a large degree, but additional wetland mitigation would be provided to compensate for the effects.

Riparian Wetlands

Because the 4-Lane Alternative would not extend beyond the west side of Bellevue Way, it would not affect any of the riparian wetlands associated with Yarrow Creek and would not reduce the drainage area of these wetlands. The stormwater facility at Bellevue Way that would be constructed to collect and treat water from the eastern portion of SR 520 would discharge into Yarrow Creek, so the amount of water entering the riparian component of YBN-1 would not be substantially reduced.

Fringe Wetlands

Water levels in the fringe wetlands (Wetlands CCN-1 and YBN-1) reflect the water levels in Lake Washington. Since the 4-Lane

Alternative would only affect a small percentage of the Lake Washington watershed, it would not affect water levels in the wetlands or the length of time these areas are wet.

Fringe wetlands may perform some water quality functions, such as trapping sediments, but the efficacy of these wetlands in terms of improving water quality is not well known (Sheldon et al. 2003). It is unlikely that the loss of approximately 0.01 acre of fringe wetlands would affect water quality. Flow spreaders (typically wood or rock check dams placed at a discharge outfall to disperse flows) at Wetlands CCN-1 and YBN-1 would reduce potential erosion at the new discharge locations.

Slope Wetlands

Groundwater seeping at the slope surface is the primary source of water for slope wetlands. Because most of the slope wetlands are upslope of SR 520, the 4-Lane Alternative would not affect the quantity or quality of water entering these wetlands. Slope wetlands do not provide substantial water quality functions because they do not impound water, so loss of these types of wetlands would not measurably affect water quality.

6-Lane Alternative

The 6-Lane Alternative would increase the impervious surface of the roadway by 11 to 115 percent, depending on the basin (CH2M HILL and Parametrix 2004). Six new stormwater facilities (two wet ponds and four wet vaults) would be constructed to treat and detain stormwater runoff from the existing and new road surfaces.

In the Eastside project area, the 6-Lane Alternative would reduce the amount of wetland area available to provide water quality functions. However, new stormwater treatment ponds and vaults and replacement wetlands would be constructed to mitigate water quality functions in this portion of the project area. Compared to existing conditions, the 6-Lane Alternative would add stormwater treatment facilities along the roadway where none currently exist. Water quality effects from the 6-Lane alternative would be similar to the 4-Lane Alternative. Effects of the 6-Lane Alternative on hydrology functions for each wetland type are discussed further below. Wetland creation, restoration, and enhancement would be provided to offset and compensate for these effects.

Depressional Wetlands

Most of the depressional wetlands in the Eastside project area would be filled (either completely or nearly so) under the 6-Lane Alternative. Filling these wetlands could reduce the water storage capacity of the affected sub-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 (redirect) flows to other wetlands and streams in the Eastside project area. Effects on water quality function would be similar to those described for the 4-Lane Alternative.

Riparian Wetlands

The 6-Lane Alternative would reduce the amount of surface water entering riparian wetlands along Yarrow Creek by capturing the stormwater, treating it, and discharging it downstream from the wetlands. Because these wetlands receive most of their water directly from Yarrow Creek, redirecting the stormwater would likely have a relatively small effect.

Riparian wetlands can store additional water during flood events, so they can be important for reducing downstream flooding. However, wetlands in the Eastside project area are relatively small and located in the lower reaches of their respective watersheds. These factors limit their ability to reduce downstream flooding, so filling these wetlands would not likely affect flooding or erosion downstream.

Fringe Wetlands

As discussed under the 4-Lane Alternative, water levels in Lake Washington control water levels in the fringe wetlands (Wetlands CCN-1 and YBN-1). These water levels would not be affected by the relatively small changes in impervious surface. Effects on water quality functions under the 6-Lane Alternative would be the same as described for the 4-Lane Alternative.

Slope Wetlands

As discussed under the 4-Lane Alternative, the slope wetlands in the Eastside project area are mostly upslope of SR 520. Effects of the loss of these wetlands under the 6-Lane Alternative would be similar, but greater, than under the 4-Lane Alternative because of the wider footprint.

How would the project affect the habitat functions of Eastside wetlands?

No Build Alternative

The No Build Alternative would not fill wetlands or buffers, so no wetland habitat would be lost. Catastrophic failure of the Evergreen Point Bridge would likely reduce traffic on the portion SR 520 just east of the lake. Overall, reducing traffic would likely benefit wildlife by reducing noise disturbance to the wetland habitats along SR 520.

4-Lane Alternative

The 4-Lane Alternative would fill wetlands with different hydrogeomorphic characteristics; the effects on habitat function would vary according to the HGM class. Mitigation would be provided to compensate for adverse effects on habitat functions in the Eastside project area.

Depressional Wetlands

Although the depressional wetlands in the Eastside project area are relatively small (typically less than 1 acre), they provide valuable habitat for wildlife (Sheldon et al. 2003). Filling these areas under the 4-Lane Alternative would reduce food, cover, and foraging and breeding habitat for invertebrates; amphibians (bullfrogs and Pacific treefrogs, and possibly other species); disturbance-tolerant birds; and mammals that are casual wetland users (e.g., raccoons, opossums, squirrels, moles, and voles).

Riparian Wetlands

The 4-Lane Alternative would not fill riparian wetlands in the Eastside project area, so there would be no habitat loss in these wetlands.

Fringe Wetlands

Fringe wetlands in the Eastside project area provide high-quality habitat because of their size and diversity. However, the 4-Lane Alternative would affect a small portion of the available wetland habitat (less than 0.1 acre) and 1.1 acres of upland buffer. The 4-Lane Alternative would affect these areas near the outer edge, where there is already disturbance from the existing SR 520 highway. This alternative would not affect the amount or quality of waterfowl habitat in the open water and shoreline portions of wetland CCN-1 and YBN-1, but some nest/den trees for common birds and cover for casual wetland users (e.g., raccoons and opossums,) might be removed.

Slope Wetlands

Slope wetlands in the Eastside project area provide small areas of seasonal inundation/saturation that can serve as habitat for invertebrates and possibly other animals. The 4-Lane Alternative would fill a relatively large area (2.2 acres) of Wetland YBS-3. However, the wetland is currently mowed and has been disturbed by previous construction, so the quality of the affected habitat is low.

6-Lane Alternative

The 6-Lane Alternative would affect many of the same wetlands and wetland classes as described under the 4-Lane Alternative. However, the affected area would be generally larger, which would affect habitat functions to a greater degree. The 6-Lane Alternative mitigation provided to offset the habitat effects would also be greater. Wetland mitigation to offset habitat area and function is described at the end of this section.

Depressional Wetlands

The 6-Lane Alternative would affect small depressional wetlands throughout the Eastside project area. Most of these wetlands have low to moderate habitat functions because of their limited size and relatively homogenous structure. Nevertheless, this alternative would reduce the amount of food, cover, and nesting and foraging habitat for invertebrates, amphibians, some (nonwetland) birds, and mammals that occasionally use these wetlands.

Riparian Wetlands

In contrast to the 4-Lane Alternative, the 6-Lane Alternative would affect riparian wetlands associated with Yarrow Creek. These wetlands provide suitable habitat for many species of birds and invertebrates, and Yarrow Creek and its side channels may provide habitat for amphibians. The tree and shrub cover in the riparian corridor provides some connectivity to other wetlands up 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 6-Lane Alternative could decrease the food, cover, and nesting/breeding habitat available to the species mentioned above.

Fringe Wetlands

The habitat value of the fringe wetlands in the Eastside project area is high because of their size and diversity. The effects of the 6-Lane Alternative on habitat would be similar to those discussed under the 4-Lane Alternative, but slightly more upland buffer would be filled. The removal of fringe wetland buffer vegetation could potentially expose waterfowl and other species using these areas to increased noise disturbance or human intrusion.

Slope Wetlands

The 6-Lane Alternative would affect slightly more slope wetland habitat than the 4-Lane Alternative, and therefore would have a somewhat greater influence on habitat functions for casual wetland users and disturbance-tolerant species. Species affected by filling this habitat would be similar to those described for the 4-Lane Alternative.

How would project construction temporarily affect wetlands?

To build the replacement bridges and other project-related facilities, some construction would take place outside of the footprint of the permanent infrastructure but within the permanent right-of-way. To safely construct either the proposed 4-Lane Alternative or 6-Lane Alternative, WSDOT would build temporary work bridges along the Portage Bay Bridge and a detour bridge in the Arboretum area to allow vehicular traffic and construction activity to occur simultaneously in the project corridor. A portion of the temporary work area (which includes the temporary work bridges/detour bridges and proposed finger piers that extend from the temporary bridge to the individual support columns) would be located within the footprint of the proposed build alternatives. In other cases, the construction limits would extend beyond the area affected by the permanent structure, increasing the type and amount of wetland alteration. After construction of SR 520 is complete, the areas affected by construction would be restored and replanted with appropriate vegetation.

Seattle

How much additional wetland area would project construction affect?

4-Lane Alternative

The temporary construction facilities would clear or shade approximately 3.6 acres of wetlands and 1.3 acres of buffer. Of this total, 1.8 acres is Category I palustrine and lacustrine wetlands, and less than 0.5 acre of this affected area is forested wetland.

Trees and shrubs would be cleared in certain areas to facilitate bridge and ramp construction. Clearing limits would be marked prior to construction to minimize vegetation removal. Clearing would generally be limited to the removal of branches and tree trunks. Soil disturbance would be minimized so the effect would be similar to shading (the soil would still be available for replanting, but the vegetative parts would have been removed). In addition, construction of the 4-Lane Alternative would clear some trees and shrubs along portions of the shoreline under the bridge structure, which could expose these areas to increased erosion. Most of the affected shoreline is not highly exposed to wave action from boats using the Montlake Cut, so the effects would be low. WSDOT would revegetate the affected areas after construction and stabilize any exposed shoreline areas to minimize adverse effects. A temporary erosion and sedimentation control plan would be implemented to minimize effects on water quality from clearing and construction activities.

At Portage Bay, the temporary work bridges would be 30 feet wide and located on the north and south sides of the existing bridge. The Union Bay/Arboretum temporary detour bridge would be 60 feet wide and located on the south side of the existing bridge. This temporary bridge would be a detour route for traffic using the existing bridge. The existing bridge would then be used for work access and as a work platform. These temporary structures would remain in place and would shade vegetation for approximately 4 years, depending on the location.

Rows of steel piles spaced at about 30-foot intervals would be installed to support the temporary bridges. Approximately 1,600 temporary steel piles would be needed for the temporary structures. All temporary bridge support structures would be removed if possible, or cut off below the mud line at the end of the construction period, and the areas would be restored.

Some heavy equipment would be needed to install the temporary piles. While much of the work would be done from the work bridge, it is possible that some work (particularly tree felling) would need to occur on the ground. Where heavy equipment would be needed, steel plates and/or mats would be used to reduce soil compaction.

Other potential short-term construction effects could include spills of hazardous materials (for example, oil and gasoline), chemical contaminants, or other materials. Control of hazardous materials is a standard provision in construction contracts and permits and would be addressed with BMPs. Servicing and refueling of vehicles would not occur within 100 feet of wetlands to reduce potential spills of petroleum and hydraulic fluids in sensitive areas. The contractor would be required to submit a spill prevention and control plan prior to the commencement of work.

Although the temporary structures would be in place for only a relatively short time for the Portage Bay area (28 months in Portage Bay and 4 years for the west approach to the Evergreen Point Bridge) and shaded and cleared areas would be revegetated following construction, the effects of the construction activity on the wetlands in the Arboretum area would be evident for many years. Lacustrine wetlands would revert to preconstruction conditions relatively quickly. However, trees, shrubs, and emergent plants in the palustrine wetlands would take time to reestablish, which could affect the habitat functions and reduce the aesthetic value of the wetlands. In the 0.5 acre of affected forested wetlands, functions that require mature tree cover may not be replaced for decades.

The equipment used to construct the 4-Lane Alternative would produce additional noise that could affect wildlife in the nearby wetlands. See the *Fish Resources* and *Wildlife and Habitat* sections in this report for a more detailed discussion about the effects of noise on fish and wildlife.

6-Lane Alternative

The 6-Lane Alternative would be constructed similarly to the 4-Lane Alternative and require the use of temporary bridges, work platforms, and a detour bridge over Portage Bay, Union Bay, and Lake Washington. However, construction in these areas could take up to 5 years.

Construction of these temporary structures could necessitate clearing and shading approximately 2.9 acres of palustrine and lacustrine Category I wetland (0.5 acre forested, 0.5 acre scrub/shrub, 0.4 acre emergent, and 1.5 acres lacustrine) and 0.8 acre of buffer. Approximately 1,800 temporary piles would be used.

Similar to the 4-Lane Alternative, the effects of construction activity under the 6-Lane Alternative would extend beyond the construction period. Trees, shrubs, and emergent plants would take time to reestablish, during which time the affected wetlands would function at lower levels than they currently do. Some functions might not be fully restored for decades.

Lake Washington

See the *Seattle* and *Eastside* discussions for wetlands along the shoreline of Lake Washington.

How would project construction affect the Lake Washington lakebed?

4-Lane Alternative

The project would install both block and fluke anchors for the floating portions of the bridge. Excavating the lakebed for the block anchors and jetting or vibrating in the flukes would suspend sediments and reduce water clarity in the affected portions of the Lake Washington lakebed. Sediments generated during construction would rapidly cover the anchors, so the duration of these effects would be relatively short.

6-Lane Alternative

The 6-Lane Alternative would have construction effects similar to those of the 4-Lane Alternative.

Eastside

How much additional wetland area would project construction affect?

4-Lane Alternative

In the Eastside project area, construction contractors would not need to use additional land outside of the permanent road footprint to construct the new roadway. As a result, no additional wetland or buffer areas would be affected by construction.

In the Eastside project area, the area affected by construction has been included in the estimate of "permanent" effects. This is because WSDOT included in the project footprint an additional 5 feet beyond the outer edge of the road surface or retaining wall to account for temporary construction clearing and disturbance.

6-Lane Alternative

As noted for the 4-Lane Alternative, no additional wetland or buffer areas would be affected during construction.

How would the alternatives differ in their effects on wetlands?

Areas of wetland fill or alteration under each build alternative are summarized in **Exhibit 26**, and functional effects are summarized in **Exhibit 27**.

Exhibit 26. Summary of Wetland and Buffer Effects by Alternative (in acres)

Wetland Category[a]	No Build Alternative		4-Lane Alternative				6-Lane Alternative			
			Wetland		Buffer		Wetland		Buffer	
	Wetland	Buffer	Fill	Shade	Fill	Shade	Fill	Shade	Fill	Shade
Permanent Effects										
I	No fill or shading in wetlands or buffers.		0.3	4.5	3.2	2.3	0.3	6.7	3.8	2.2
II			0	0	0	0	0.7	0	1.3	0
III			3.1	0	4.1	0	5.7	0	10.1	0
IV			<0.1	0	0.1	0	<0.1	0	0.1	0
Total			~3.4	~4.5	~7.5	~2.3	~6.7	~6.7	~15.4	~2.2
Construction Effects[b]										
I	No fill, clearing, or shading in wetlands or buffers.		0	3.6	0	1.3	0	2.9	0	0.8
II			0	0	0	0	0	0	0	0
III			0	0	0	0	0	0	0	0

Exhibit 26. Summary of Wetland and Buffer Effects by Alternative (in acres)

Wetland Category[a]	No Build Alternative		4-Lane Alternative				6-Lane Alternative			
			Wetland		Buffer		Wetland		Buffer	
	Wetland	Buffer	Fill	Shade	Fill	Shade	Fill	Shade	Fill	Shade
Permanent Effects										
IV			0	0	0	0	0	0	0	0
Total			0	3.6	0	1.3	0	2.9	0	0.8

Note: Affected areas were calculated using GPS data gathered in the field, aerial photography, National Wetland Inventory maps, and local wetland inventories. Affected area estimates based on preliminary design information and subject to change. Totals may not add up due to rounding.

[a] Ecology (1993).
[b] Construction effects include clearing and shading.

Exhibit 27. Summary of Effects on Wetland Functions

Flood Flow Alteration	Sediment, Nutrient, and Toxicant Removal	Erosion Control and Shoreline Stabilization	Production/ Export of Organic Matter	Habitat Suitability	Social Values
No Build Alternative					
No effect on existing wetland functions.					
4-Lane Alternative					
Filling wetlands in the Eastside project area would reduce the capacity of these wetlands to provide flood storage.	Less wetland area reduces the potential to remove pollutants; stormwater treatment would generally reduce pollutant loading downstream.	Less shoreline vegetation in some areas could increase shoreline erosion until vegetation becomes re-established.	Removal of organic matter production due to vegetation clearing and reduced wetland area.	Removal of wildlife habitat area and quality, especially in the Seattle project area.	Minimal reduction of educational or recreational use from this alternative.
6-Lane Alternative					
More wetland area would be filled, which would reduce the capacity of wetlands in the Eastside project area to provide flood storage.	Less potential to remove pollutants; stormwater treatment would generally reduce some pollutant loading downstream.	Removal of shoreline vegetation in some areas could increase shore-line erosion until vegetation becomes re-established. Area of potential effect would be larger because of larger project footprint.	Less organic matter production due to clearing and reduced wetland area; also larger area would be affected because of larger project footprint.	Greater removal of wildlife habitat area. Riparian wetlands would be affected.	Minimal reduction of educational or recreational use from this alternative.

Note: Functions were rated using WSDOT method (2000); this information is available upon request.

The No Build Alternative would have the least effect on wetlands and buffers when compared to current conditions. No wetland or buffer areas would be filled or cleared by this alternative, and there would be no change to existing wildlife habitat functions. However, the No Build Alternative does not treat runoff from the roadway, which has a continuing negative effect on water quality downstream from SR 520.

The 6-Lane Alternative would affect more wetland and buffer area than the 4-Lane Alternative, and would have a correspondingly larger effect on the wetland functions than the 4-Lane Alternative. These effects would be mitigated to result in no-net-loss of wetland area and function. Wetlands mitigation is described in the following section.

Construction would temporarily clear wetland and upland vegetation in the Seattle project area, and temporary pilings would place temporary fill in wetlands and buffers. Construction of the 6-Lane Alternative would temporarily affect a smaller area than the 4-lane Alternative and would therefore have a lesser temporary effect on wetland functions and values. Construction would last longer, extending the effects on habitat quality. As with the 4-Lane Alternative, the forested areas would be most affected by the clearing activity and the emergent and lacustrine areas least affected.

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 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 impacts;
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, both of the build alternatives would have unavoidable effects on wetlands and buffers.

What has been done to avoid or minimize negative wetlands effects?

WSDOT has designed the project to minimize the permanent and temporary effects of the proposed alternatives. Specific aspects of the design that have been incorporated to avoid and minimize effects on wetlands include the following:

- The bridge alignment in Portage Bay was moved north of the existing bridge to minimize effects on wetlands.
- Retaining walls would 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.
- Sound walls would be installed along the majority of the SR 520 corridor to minimize noise disturbance, which would benefit wildlife using the wetland habitats adjacent to the roadway.
- Bridge heights would be increased to allow more light under the elevated roadway sections, which would improve opportunities to restore and maintain wetland and buffer plant communities in underlying areas.
- Stormwater treatment facilities would be constructed to treat roadway runoff before discharging to downstream aquatic habitat. This would improve water quality in the project area.
- Existing roadway ramps would be removed to offset some of the effects of new impervious surface and create areas for habitat restoration.
- The spacing of the columns for the bridge structures would be increased and bridge spans would be longer to reduce the number of columns in wetlands and open waters and their buffers.

During bridge construction, contractors would use BMPs to avoid unintentional fill from column excavation, and bibs would be used to contain falling debris during construction of the new bridge decking and demolition of the existing decking. Other BMPs could 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. Contractors would restore cleared areas to preconstruction grades and replant the areas with appropriate native herbaceous and woody species.

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

Compensatory mitigation would be a component of both the 4-Lane and the 6-Lane Alternatives. It would be used to replace the area of wetland and buffer filled or shaded and to offset the permanent and temporary loss of wetland and buffer functions. The goal of the compensatory mitigation would be to achieve no net loss of wetland functions and values.

WSDOT is required to create or restore wetland area and function at a minimum ratio of 1:1 (replacement area to affected area) as identified in Governor's Executive Order 90-04 (Protection of Wetlands: "No Net Loss" Order) and WSDOT Directive 31-12 (Protection of Wetlands Action Plan). Additional mitigation may be required to satisfy the requirements of the local critical areas regulations and Ecology's mitigation guidelines as defined by the *Implementing Agreement between the WSDOT and the Washington State Department of Ecology Concerning Wetlands Protection and Management* (WSDOT 1993).

The implementing agreement recognizes the high degree of difficulty in restoring or creating Category I wetlands. The mitigation ratios for Category I wetlands are high to compensate for many of the lost functions associated with Category I wetlands. There would be a net loss of Category I wetlands under both of the build alternatives. The agreement, therefore, calls for the replacement of Category I wetlands at a 4:1 ratio, Category II wetlands at a 2:1 ratio, and Category III wetlands at a 1.0 to 1.5:1 ratio, when restoring or creating new Category II wetlands. Creation or restoration of Category III wetlands would replace Category I wetlands at a 6:1 ratio, Category II wetlands at a 3:1 ratio, and Category III wetlands at a 1.5 to 2:1 ratio (**Exhibit 28**). Typically, Ecology requires wetland enhancement ratios to be twice those of wetland creation/restoration. Wetland preservation is typically credited at a 10:1 (0.10) ratio. Ecology recently recommended increased replacement ratios, which could increase the amount of mitigation required for the proposed project (Ecology 2004).

Exhibit 28. Preliminary Estimate of Wetland Mitigation Requirements by Alternative

Ecology Rating	Approximate Mitigation Ratio[a]	4-Lane Alternative: Affected Area (acres)	4-Lane Alternative: Required Mitigation (acres) Create Category II	4-Lane Alternative: Required Mitigation (acres) Create Category III	6-Lane Alternative: Affected Area (acres)	6-Lane Alternative: Required Mitigation (acres) Create Category II	6-Lane Alternative: Required Mitigation (acres) Create Category III
I	4-6:1	4.8	19.2	28.8	6.9	27.6	41.4
II	2-3:1	-	-	-	0.7	1.4	2.1
III	1-2:1	3.1	3.1-4.65	4.65-6.2	5.7	5.7-8.55	8.55-11.4
IV	0.75-1.25:1	<0.1	<0.1	<0.1	<0.1	-	-
Total		7.9	22.3-23.85	33.45-35.0	13.3	34.7-37.55	52.05-54.54

[a] The ratios shown in this table reflect restoration or creation of replacement wetlands based on WSDOT (1993). Actual ratios may be slightly higher or lower, depending on the regulations in effect at the time of permitting. Mitigation ratios for wetland enhancement would be approximately twice those shown for restoration or creation. Preservation of existing wetlands may be used to reduce the creation/restoration ratio to a minimum of 1:1. Enhancement of existing wetlands may be used to reduce the creation/restoration ratio to a minimum of 2:1.

Compensatory mitigation would be designed to meet applicable requirements for replacing affected wetlands. The estimates provided in **Exhibit 28** are based on the total area of affected wetlands, which includes both fill and shading effects using current replacement ratios. The actual amount of mitigation provided could vary because filled wetlands might be mitigated at a different ratio than shaded wetlands (filled wetlands constitute a loss of wetland area, while shaded wetlands continue to provide some functions but at a different level). Federal and state agencies do not require mitigation for wetland buffers, but some local governments do. Proposed mitigation would be designed in consultation with local governments to address their requirements.

WSDOT would consult with federal, state, and local governments to select appropriate mitigation sites. Some potential mitigation options in the Seattle area include:

- Restoring/creating wetlands at Magnuson Park. This could include removing fill and planting native trees and shrubs on areas near or adjacent to the lakeshore to provide habitat for birds, wetland-dependent mammals, and amphibians, as well as organic export functions.

- Restoring WSDOT right-of-way just west of the Arboretum by removing existing highway ramps, excavating fill material, and replanting with native trees, shrubs, and herbs.
- Replanting wetlands and buffers within the footprint of the existing SR 520 roadway with native species when the roadway and columns are removed.
- Removing aquatic weeds and other invasive wetlands plants in the vicinity of the Arboretum to improve the functions and values (including aesthetics and recreation) of the existing palustrine and lacustrine wetlands.

Any of these Seattle-area mitigation options could provide educational opportunities for local residents, especially if interpretive trails and signage were to be provided.

Mitigation opportunities on the Eastside would be investigated in consultation with federal, state, and local governments and in conjunction with the watershed-based analysis being done by WSDOT.

After construction of the SR 520 Bridge Replacement and HOV Project is complete, the areas temporarily affected by construction would be restored and replanted with appropriate vegetation.

4-Lane Alternative

Construction of the 4-Lane Alternative would require approximately 22 to 35 acres of wetland mitigation. Compensatory mitigation requirements would be met with a combination of wetland creation/restoration and wetland and buffer enhancement and preservation. As described for the general mitigation approach, WSDOT would select sites by consulting with federal, state, and local governments and would coordinate mitigation efforts with other WSDOT projects. In addition to the potential mitigation that would apply to both alternatives, there would be an opportunity for further wetland mitigation under the 4-Lane Alternative not available under the 6-Lane Alternative. Since the replacement bridge at Union Bay would be located to the north, when the existing structure was removed, an area crossing Foster Island could potentially be restored. This area is within the existing WSDOT right-of-way and would not need to be purchased. Previously filled areas along the edge of Foster Island could be restored to wetland, and the nearby buffer areas could be enhanced.

6-Lane Alternative

Mitigation requirements for the 6-Lane Alternative are larger than those of the 4-Lane Alternative (approximately 35 to 55 acres). Compensatory mitigation requirements would be met with a combination of wetland creation/restoration and wetland and buffer enhancement and preservation similar to those selected for the 4-Lane Alternative.

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 basin has occurred over the last 100 years, adversely affecting local fish populations. The fish resources of Lake Washington and the Lake Washington Ship Canal may be further affected in different ways by the alternatives being proposed for the SR 520 Bridge Replacement and HOV Project. This report assesses these resources to provide the foundation for evaluating the potential effects of each project alternative on fish resources.

All anadromous salmonids (fish that migrate to the ocean) produced in the Lake Washington watershed travel under or adjacent to the Portage Bay and Evergreen Point bridges. Therefore, the project alternatives have the potential to either positively or negatively affect the substantial salmonid production within the Lake Washington watershed, including the threatened population of Chinook salmon, and rearing and migration of bull trout.

Is the project within a recognized tribal fishing area?

The project area is within the “usual and accustomed” fishing areas of several federally recognized Indian Tribes, including the Muckleshoot Tribe. Their usual and accustomed fishing area includes the Ship Canal and Lake Washington.

The Muckleshoot and other tribes harvest adult salmon from the project area 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.[1]

The Muckleshoot Tribe has a staff of fisheries biologists and takes an active role in managing salmonids within the project area. Tribal fishing can occur at multiple and variable locations within the Ship Canal and Lake Washington. WSDOT is coordinating with the Muckleshoot Tribe because the proposed project could potentially affect access to their affirmed treaty fishing area.

The Suquamish Tribe's usual and accustomed fishing area in the project vicinity is the marine waters of central Puget Sound, which includes Elliot Bay and Salmon Bay, where salmonids produced in the Lake Washington basin are harvested. See the Indian Fishing Rights section in Appendix D, *Cultural Resources Discipline Report*, for more information.

Affected Environment

How was the information on streams and fish resources collected?

Biologists on the ecosystems discipline team collected documented information on fish species and their distribution and habitat within the project area by reviewing available literature, such as peer-reviewed articles in scientific journals, technical reports, and data from various state, county, and city agencies. They also inspected habitat conditions within Lake Washington and the Eastside streams that cross the project area.

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

Biologists surveyed and characterized the instream habitats of the following Lake Washington tributary streams where they cross the project alignment: Fairweather Creek, Cozy Cove Creek, Yarrow Creek, and a tributary of Yarrow Bay. We used stream habitat survey procedures that generally follow the current King County Level I

[1] 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).

(Basic) stream survey methods and guidelines (King County 1991). The habitat survey measured or described instream habitat features, riparian vegetation, streambank stability, substrate composition, and fish passage obstructions up to about 500 feet upstream and downstream of the SR 520 corridor. Fish usage was determined, in part, from existing data and by contacts with local resource agency representatives. Additionally, visual sightings of fish in the creeks and spot-checking with a backpack electroshocker were conducted. Stream survey efforts and spot electroshocking of the study reaches occurred in May 2002. Resource agency representatives and the ecosystems discipline team inspected the aquatic and riparian habitat along the SR 520 corridor on three occasions during development of the project alternatives.

What are the general habitat characteristics of Portage Bay, Union Bay, and Lake Washington?

Portage Bay, Union Bay, Lake Washington, and the entire SR 520 project area are within the Lake Washington watershed (Water Resource Inventory Area [WRIA] 8). See Appendix T, *Water Resources Discipline Report*, for information on water quality within the project area. The Lake Washington watershed comprises 13 major drainage sub-basins and numerous smaller drainages, totaling about 656 miles of streams, 2 major lakes, and numerous smaller lakes (**Exhibit 29**). Within the Lake Washington watershed, the Ship Canal and the west side of the Lake Washington shoreline are in Seattle. The eastern Lake Washington shoreline is on the Eastside in Medina, Hunts Point, Yarrow Point, Bellevue, and Kirkland. There are tributaries supporting important fish resources in all of the Eastside communities (**Exhibit 30**). Information on tributaries to Lake Washington is provided in Attachment 1.

The shoreline of Lake Washington is bordered primarily by landscaped yards of private residences, multifamily residences, and parks. Approximately 50 percent of the shoreline is bordered by single-family residences. The shoreline in the project area has large expanses of shallow water occupied by extensive beds of aquatic vegetation. On the Eastside, there are private residences on either side of the SR 520 corridor along Lake Washington.

Lake Washington's shoreline is an important fish resource that generally supports juvenile salmonid rearing and migration, and sockeye spawning at some locations. When they enter Lake Washington, young Chinook 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. The natural gravelly substrate exists next to many public 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, bullheads, 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. Vegetated shallows with silty substrates in Portage Bay and Union Bay provide favorable habitat to species that prey on or compete with young salmonids. The extensive aquatic vegetation in these areas makes much of the shallow water habitat unsuitable for juvenile salmonids.

The Ship Canal (Portage Bay and Union Bay) is part of a highly urbanized watershed that has a high percentage of impervious surface (**Exhibit 31**). Historically, Lake Union was separated from Lake Washington and discharged directly to Puget Sound through Salmon Bay (Weitkamp and Ruggerone 2000). Construction of the Ship Canal diverted the discharge from Lake Washington and produced a new migration route for juvenile anadromous salmonids produced in the Lake Washington watershed.

Portage Bay has the Queen City Yacht Club with boat moorage on the west side of the Portage Bay Bridge, and the Seattle Yacht Club with boat moorage and the NOAA Northwest Fisheries Science Center on the east shoreline. South of the existing Portage Bay Bridge are vegetated shallows with a fringe marsh along the shoreline. Water lilies and Eurasian milfoil are the dominant aquatic vegetation in Portage Bay. This nonnative aquatic vegetation covers much of the SR 520 corridor on the west side of Union Bay and the shallow area on both sides of the west approach to the Evergreen Point Bridge in Union Bay.