3.16 Ecosystems

Ecosystems comprise communities of organisms and the habitat that supports those communities. Ecosystems can exist at varying scales, including smaller systems within larger ones. Both natural and human factors can affect ecosystems, and ecosystem health can affect the quality of human life.

The information presented in this section is based on the Ecosystems Technical Report. In addition, Section 3.14, Water Quality and Hydrology, and Section 3.15, Wetlands and Waters, provide more information on the Modified LPA's effects on the study area's environment.

3.16.1 Changes or New Information Since 2013

The Columbia River Crossing (CRC) Final EIS and Record of Decision were completed in 2011, with refinements addressed in subsequent NEPA re-evaluations in 2012 and 2013. Since then, the following changes and new information have affected the potential impacts to ecosystems:

- Species of interest (SOI) lists have been updated with input from federal, state, and local resource management agencies and tribal resource staff.
- SOI life history and habitat requirements have been updated to reflect changes in best available science.
- Species' presence, associated habitat types, and baseline habitat conditions have been updated as applicable.
- Supplemental field surveys have been conducted to validate or update baseline assumptions.
- Federal, state, local, and tribal regulations and policies regarding ecosystem management, evaluation of effects, and compensatory mitigation have been updated.
- Changes to the design of the CRC project's LPA to develop a Modified LPA, including design options.

Table 3.16-1 compares the impacts and benefits of the CRC LPA as identified in the Final EIS (2011) to those of the Modified LPA and identifies the reasons for the differences. Based on the analysis in this section, the effects of the Modified LPA would be similar to those of the CRC LPA.

Table 3.16-1. Comparison of Columbia River Crossing LPA Effects and Modified LPA Effects

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA Effects as Identified in this Section	Explanation of Differences
Permanent benthic habitat displacement (shallow and deep-water habitat)	• Approximately 0.21 acres of benthic habitat displacement from new bridges. • Approximately 0.64 acres of benthic habitat restoration from bridge removal (benefit). • Net restoration of approximately 0.43 acres of benthic habitat (benefit).	• Approximately 0.91 acres of benthic habitat displacement from new bridges. • Approximately 1.04 acres of benthic habitat restoration from bridge removal (benefit). • Net restoration of approximately 0.13 acres of benthic habitat (benefit).	• Bridge design updates and refined assumptions regarding construction impacts. • Proposed removal of existing North Portland Harbor bridges would result in a greater quantity of benthic habitat restoration.

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA Effects as Identified in this Section	Explanation of Differences
Permanent water-surface level overwater shading	• Approximately 1.34 acres of new shading at the water surface. • Approximately 0.44 acre of surface-level shading removal (benefit). • Approximately 0.91 acre of net increase in surface-level shading removal (benefit).	• Approximately 1.04 acres of new shading at the water surface.	• Refined design of Columbia River bridge foundations. • CRC LPA included removal of a portion of the existing dock at the Port of Vancouver's Terminal 1, which is not part of the Modified LPA.
Permanent elevated overwater shading	• Not quantified.	• Approximately 19.87 acres of elevated overwater shading from new bridge decks. • Approximately 11.65 acres of elevated shading removal (benefit). • Net increase of approximately 8.22 acres of elevated overwater shading.	Elevated shading from bridge decks was not quantified for the CRC LPA.
New Contributing Impervious Area (CIA)	• Approximately 41.5-acre increase in CIA compared to the No-Build Alternative. • Treatment would be provided for all post-project CIA, most of which is currently untreated (benefit).	• Approximately 29.6-acre increase in CIA compared to the No-Build Alternative. • Treatment would be provided for all post-project CIA (including adjacent non-project CIA that contributes stormwater to CIA associated with the project), most of which is currently untreated (benefit).	Changes in design.
Permanent and Temporary Impacts to Sensitive Terrestrial Habitats	• Permanent and temporary impacts to approximately: – 33.7 acres of Priority Habitats in Washington – 117.7 acres of designated Critical Areas in the City of Vancouver – 52.6 acres of lands designated Habitat Conservation Areas by Title 13 of Metro's Urban Growth Management Functional Plan – 41.5 acres within City of Portland environmental zones (ezones)	• Permanent loss of terrestrial habitats and vegetation, including approximately: – 0.79 acres of riparian buffer in Washington – 0.15 acres of Biodiversity Area in Washington – Less than 0.01 acres of mapped oak woodland in Washington – 0.06 acres of wetland buffer in Washington – 0.58 acres of wetland in Oregon – 7.39 acres of wetland buffer in Oregon	• Changes in design and changes in regulatory classifications for terrestrial habitats. • CRC evaluated impacts by Metro's Title 13, which has been replaced by habitat designations in the City of Portland's NRI. • CRC did not quantify areas of temporary disturbance separately from areas of permanent displacement.

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA Effects as Identified in this Section	Explanation of Differences
		– 1.12 acres of area designated as "High" value riparian/wildlife habitat, and 6.20 acres of area designated as "Medium" value riparian/wildlife habitat in Oregon • Temporary disturbance of terrestrial habitats and vegetation, including approximately: – 1.15 acres of riparian buffer in Washington – 2.87 acres of Biodiversity Area in Washington – 0.03 acres of mapped oak woodland in Washington – 1.19 acres of wetland buffer in Washington – 2.56 acres of wetland in Oregon – 7.11 acres of wetland buffer in Oregon – 4.60 acres of area designated as “High” value riparian/wildlife habitat, and 5.70 acres of area designated as “Medium” value riparian/wildlife habitat in Oregon	
Temporary Impacts to Aquatic Habitats during construction	• Approximately 1.81 acres temporary benthic habitat displacement. • Approximately 9.04 acres temporary overwater shading. • Handling and disturbance of fish during in-water work area isolation activities. • Temporarily elevated turbidity, and potential for accidental introduction of pollutants or debris. • Temporarily elevated underwater and terrestrial noise levels.	• Approximately 2.06 acres temporary benthic habitat displacement. • Approximately 15.61 acres temporary overwater shading. • Handling and disturbance of fish during in-water work area isolation activities. • Temporarily elevated turbidity, and potential for accidental introduction of pollutants or debris. • Temporarily elevated underwater and terrestrial noise levels.	Changes in design and refined assumptions regarding construction means and methods.

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA Effects as Identified in this Section	Explanation of Differences
	• Overwater lighting. • Changes in avian predation pressure on juvenile salmonids.	• Overwater lighting. • Changes in avian predation pressure on juvenile salmonids.	

Note: Data are approximate and rounded.
CIA = Contributing Impervious Area; CRC = Columbia River Crossing; EIS = Environmental Impact Statement; LPA = Locally Preferred Alternative; Metro = Oregon Metro; NRI = Natural Resource Inventory

3.16.2 Existing Conditions

This evaluation includes a primary and a secondary study area. Figure 3.16-1 shows the ecosystem's primary study area, and Figure 3.16-2 shows the secondary study area. The primary study area includes all areas that could experience direct long-term effects from the Modified LPA. The secondary study area is larger and includes all areas where construction-related (temporary) effects and indirect effects could occur. Where the more general term "study area" is used, it refers to both study areas.

The primary and secondary study areas include portions of the mainstem Columbia River, associated tributaries, and nearby terrestrial habitats on the Oregon and Washington sides of the Columbia River. The secondary study area extends to include downstream portions of the Columbia River mainstem to the mouth, and offshore coastal waters between Northern California and Alaska. This section describes the condition of the study area's aquatic, terrestrial, and botanical resource habitats and the species that use these habitats.

Figure 3.16-1. Ecosystems Primary Study Area

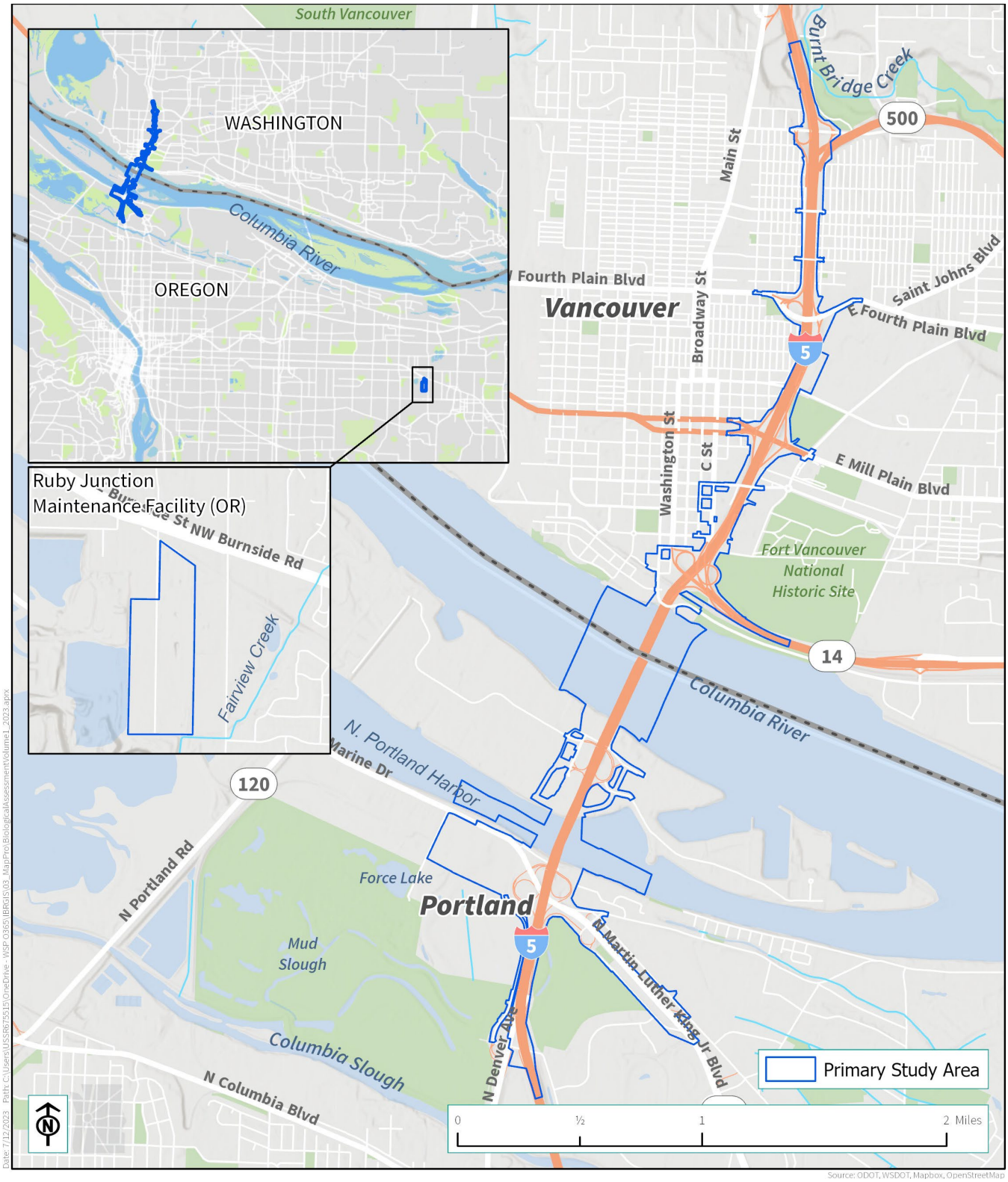
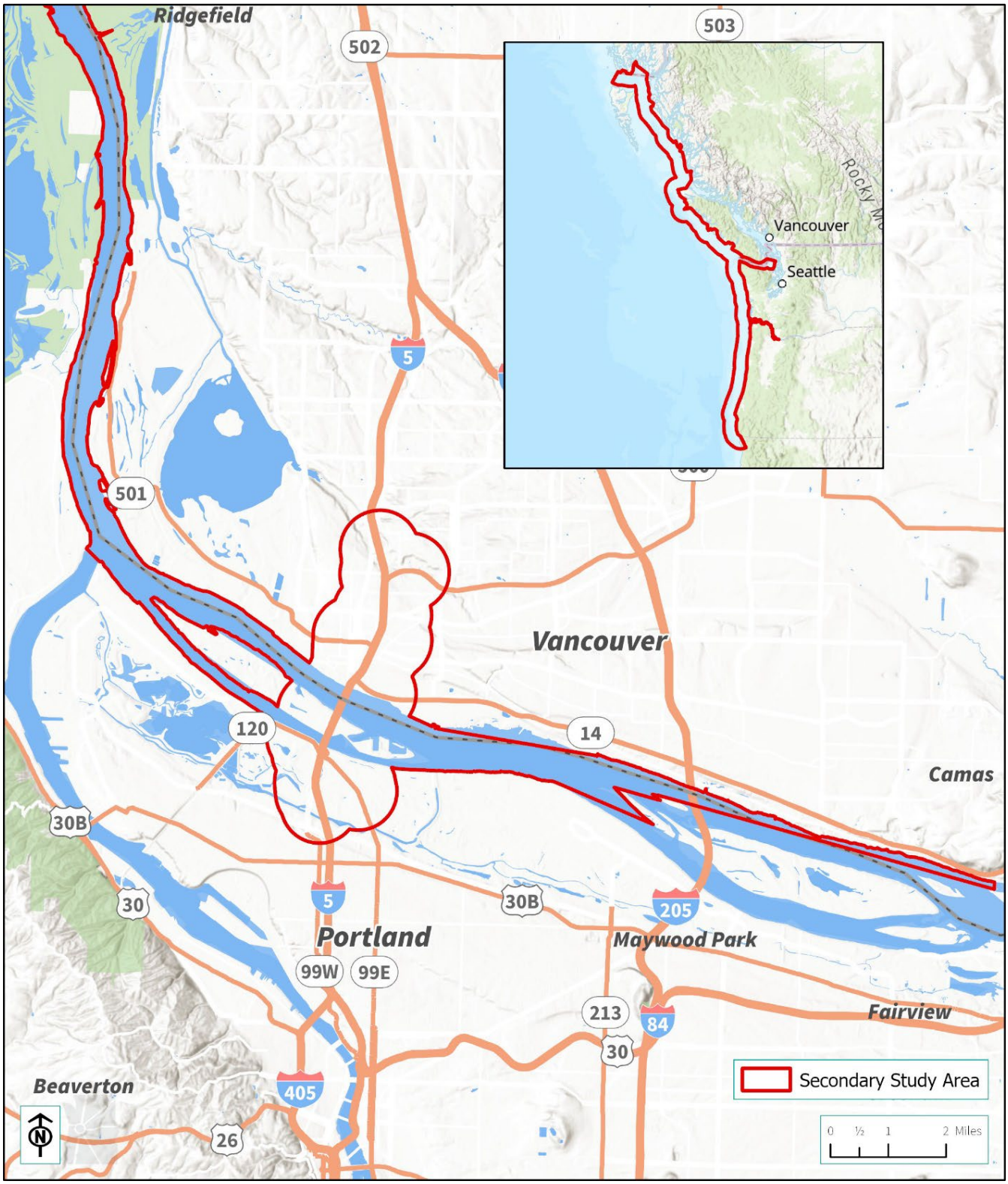


Figure 3.16-2. Ecosystems Secondary Study Area



Aquatic Resources

This section describes aquatic resources (aquatic species and their habitat) in the primary and secondary study areas, which include the Columbia Slough, the Columbia River and North Portland Harbor, Burnt Bridge Creek, Fairview Creek, and Pacific Ocean coastal waters.

Aquatic Habitat

Columbia Slough

The Columbia Slough is a slow-moving, low-gradient drainage canal that flows from Fairview Lake (east) to the Willamette River (west) and consists of upper, middle, and lower reaches. The study area includes a portion of the lower reach. The lower Columbia Slough habitat supports a variety of aquatic species, including juvenile salmonids and other native and non-native fish species, freshwater shrimp, and crawfish. Anadromous fish (those that migrate from salt water to fresh water to spawn) can access a portion of the lower Columbia Slough up to an impassable levee at river mile 8.3.

What are benthic organisms?

In freshwater biology, benthic organisms are organisms living along a river, stream, or lakebed. Types of benthic organisms found in the study area include some species of snails, shrimp, and crayfish.

The Columbia Slough is listed under 303(d) of the Clean Water Act for failing to meet water quality standards for aquatic weeds, high levels of iron, and biocriteria. In addition, water temperatures often exceed levels considered suitable for juvenile salmonids, particularly in summer. Channel alterations, water diversions, and upstream dams on the Willamette and Columbia Rivers have reduced the flow rate, resulting in excess sedimentation and high levels of heavy metal contaminants. The contaminated sediments impact the health and habitat of the benthic organisms living in and along the waterway, resulting in low biodiversity. Development has contributed to industrial and stormwater discharges, increased pollutant and turbidity levels, and decreased the oxygen available for fish within the waterway.

Columbia River and North Portland Harbor

The study area is located within the lower Columbia River subbasin. The Columbia River and its tributaries form the dominant aquatic system in the Pacific Northwest. The 1,214-mile-long Columbia River drains 259,000 square miles of the northwestern U.S. and southern British Columbia, Canada, into the Pacific Ocean. There are more than 250 reservoirs and around 150 hydroelectric projects in the Columbia River Basin, including 18 mainstem dams on the Columbia and its main tributary, the Snake River. Saltwater intrusion from the Pacific Ocean extends approximately 23 miles upstream from the Columbia River mouth at Astoria. Coastal tides influence the flow rate and river level up to Bonneville Dam at river mile 146.1.

Within the primary study area, the Columbia River is a highly managed waterbody whose flow is influenced primarily by upstream dams and also by Pacific Ocean tides. North Portland Harbor is a large side channel of the Columbia River located along the southern banks of Hayden Island. Developed uses of the river include commercial transport, power generation, irrigation, and recreation. The State of Washington, City of Vancouver, City of Portland, and Metro have designated the Columbia River and its shoreline as environmental zones subject to regulation.

Hydroelectric dams upstream impound water, raising the river's temperature and making fish passage more difficult by creating bottlenecks where predators have easy access to migrating salmon. Within the primary study area in Oregon, the Columbia River/North Portland Harbor waters are 303(d)-listed for toxic chemicals such as polycyclic aromatic hydrocarbons (PAHs); polychlorinated biphenyl (PCBs), dichlorodiphenyltrichloroethane (DDT) metabolites (DDE 4,4') and arsenic (DEQ 2020). Within the primary study area in Washington, the Columbia River is on the 303(d) list for temperature and PCBs (Ecology 2021). Within the primary study area, water depths in the Columbia River range between approximately 0 and 50 feet, with an average depth of approximately 27 feet. The Columbia River federally authorized navigation channel is dredged to an average depth of about 43 feet. Water depths in North Portland Harbor range between 0 and 20 feet, with an average water depth of approximately 14 feet.

Shallow-water habitat is present in the primary study area on both the Oregon and Washington sides of the river. It is influenced by flow and sediment input from tributaries and the mainstem river that eventually settles to form shoals and shallow flats. Juvenile salmonids in particular use this shallow-water habitat extensively for migrating, feeding, and holding. In general, rearing and outmigrating juveniles use shallow-water habitats more extensively, whereas adult fish rely on deeper-water habitats. The Columbia River also provides habitat for many non-anadromous native fish species, marine mammals, and benthic organisms, as well as substantial populations of non-native invasive species.

Burnt Bridge Creek

Burnt Bridge Creek flows through the city of Vancouver and is a direct tributary to Vancouver Lake, which drains into the lower Columbia River via Lake River. The creek drains one of the most heavily urbanized subbasins within Clark County and is 303(d)-listed within the study area for failing to meet water quality standards for temperatures, dissolved oxygen, fecal coliform bacteria, and pH (Ecology 2021). Physical habitat has been significantly modified throughout Burnt Bridge Creek, and habitat function has been diminished from historical conditions. The creek's upper reaches were historically a series of associated wetlands and marshes that have been filled, ditched, and drained. In addition, most of the tributary streams have been channelized or routed underground. However, the watershed has undergone significant restoration work in recent years to reconstruct side-channel wetland and floodplain areas and improve habitat. The creek provides suitable habitat for several salmonid species, as well as native resident fish species.

Fairview Creek

Fairview Creek is an urban creek that flows from spring-fed wetlands on the northeast side of Grant Butte in Gresham, Oregon, to Fairview Lake, a tributary to the eastern portion of the Columbia Slough. It passes close to the southeast corner of the Ruby Junction Maintenance Facility (Figure 3.16-1). The creek has been physically changed by the construction of dikes and levees, channelization, and historic gravel mining activity. These activities have altered the creek's hydrology, increased sedimentation, and reduced water quality. The waterway is 303(d)-listed for failing to meet water quality standards for biocriteria. In recent decades, some restoration of stream and riparian habitat has occurred through land acquisitions, conservation easements, riparian planting projects, and installation of large woody debris and boulders.

Anadromous salmonids are not currently present in Fairview Creek because there is an impassable barrier between the lower and middle sections of the Columbia Slough, approximately 10 miles downstream of Fairview Creek. In addition, high temperatures and other conditions within the creek limit habitat suitability for anadromous salmonids, although the creek likely provides suitable habitat for resident native and introduced fish.

Pacific Coastal Waters

The secondary study area includes marine waters off the Pacific coast where salmonid species from the Columbia River are available as prey for Southern Resident killer whales (SRKW), also known as orcas. This area encompasses the whale's entire coastal range from the mouth of the Columbia River and its plume, south as far as central California, and north as far as southeast Alaska. Effects on salmon and steelhead within the primary study area could in turn affect the SRKW prey base that occurs within these waters in the secondary study area. The diet of the SRKW is composed almost entirely of salmon, with adult male orcas needing approximately 325 pounds of salmon to meet their daily prey energy requirements. Although their diet tends to vary slightly throughout the year, including smaller amounts of salmon species such as coho, chum, and steelhead, about 80% of their total diet comes from Chinook salmon.

The abundance of salmon has declined significantly since the late 1800s and early 1900s due to the compounded effects of harvest, habitat modifications, water-quality and water-quantity impacts, predation, and impacts to their own prey base (SROTF 2018). The Southern Resident Orca Task Force has identified

impacts to prey availability—specifically, the availability of Chinook salmon—as a key threat to the recovery of the SRKW.

Aquatic Species of Interest

Approximately 20 aquatic SOI may be found within the primary and secondary study areas. The term "species of interest" is not a specific regulatory category, it refers to native species identified through tribal, local, state, and federal coordination as locally important due to their regulatory status, rarity, and/or special habitat considerations. This includes species listed under the federal Endangered Species Act (ESA), as well as other state and local designations. Table 3.16-2 presents a list of aquatic SOI that may occur within the primary and/or secondary study areas.

Table 3.16-2. Aquatic Species of Interest Potentially Occurring within the Study Area

	Species Common Name	Species Scientific Name	ESU or DPS [a]	Federal ESA Status [b]	State Status (OR) [c]	State Status (WA) [d]	Other Special Regulatory Status [e]
Fish	Chinook salmon	*Oncorhynchus tshawytscha*	Lower Columbia River (LCR) ESU	LT; Critical Habitat	SC	Not listed; PHS	EFH; SGCN-OR; SGCN-WA
			Upper Willamette River (UWR) ESU	LT; Critical Habitat	SC	Not listed; PHS	EFH; SGCN-OR; SGCN-WA
			Upper Columbia River (UCR) Spring-Run ESU	LT; Critical Habitat	SC	Not listed; PHS	EFH; SGCN-OR; SGCN-WA
			Snake River Spring/ Summer-Run ESU	LT; Critical Habitat	LT	Not listed; PHS	EFH; SGCN-OR; SGCN-WA
			Snake River Fall-Run ESU	LT; Critical Habitat	LT	Not listed; PHS	EFH; SGCN-OR; SGCN-WA
	Chum salmon	*Oncorhynchus keta*	Columbia River ESU	LT; Critical Habitat	S	Not listed; PHS	EFH; SGCN-OR; SGCN-WA
	Coho salmon	*Oncorhynchus kisutch*	LCR ESU	LT; Critical Habitat	E	Not listed; PHS	EFH; SGCN-OR; SGCN-WA
	Sockeye salmon	*Oncorhynchus nerka*	Snake River ESU	LE; Critical Habitat	Not listed	Not listed; PHS	EFH

	Species Common Name	Species Scientific Name	ESU or DPS [a]	Federal ESA Status [b]	State Status (OR) [c]	State Status (WA) [d]	Other Special Regulatory Status [e]
	Steelhead	*Oncorhynchus mykiss*	LCR DPS	LT; Critical Habitat	S	C; PHS	EFH; SGCN-OR; SGCN-WA
			UWR DPS	LT; Critical Habitat	S	Not listed; PHS	EFH; SGCN-OR; SGCN-WA
			Middle Columbia River DPS	LT; Critical Habitat	S	C; PHS	EFH; SGCN-OR; SGCN-WA
			UCR DPS	LT; Critical Habitat	S	C; PHS	EFH; SGCN-OR; SGCN-WA
			Snake River Basin DPS	LT; Critical Habitat	S	C; PHS	EFH; SGCN-OR; SGCN-WA
	Cutthroat trout	*Oncorhynchus clarki clarki*	Southwestern Washington/ Columbia River Coastal DPS	Not listed	S	Not listed; PHS	SOC (USFWS-WA) SGCN-OR; SGCN-WA
	Bull trout	*Salvelinus confluentus*	Columbia River DPS	LT; Critical Habitat	SC	C; PHS	SGCN-OR; SGCN-WA
	Pacific eulachon	*Thaleichthys pacificus*	Southern DPS	LT; Critical Habitat	Not listed	Not listed; PHS	SGCN-OR; SGCN-WA
	North American green sturgeon	*Acipenser medirostris*	Southern DPS	LT; Critical Habitat	SC	Not listed; PHS	SGCN-OR; SGCN-WA
	White sturgeon	*Acipenser transmontanus*	N/A	Not listed	S	Not listed; PHS	SGCN-OR; SGCN-WA
	Pacific lamprey	*Entosphenus tridentata*	N/A	Not listed	S	Not listed; PHS	SOC (USFWS-WA); SOC (USFWS-OR); SGCN-OR; SGCN-WA
	River lamprey	*Lampetra ayresi*	N/A	Not listed	Not listed	C; PHS	SGCN-WA

	Species Common Name	Species Scientific Name	ESU or DPS [a]	Federal ESA Status [b]	State Status (OR) [c]	State Status (WA) [d]	Other Special Regulatory Status [e]
Marine Mammals	Leopard dace	*Rhinichthys falcatus*	N/A	Not listed	Not listed	C; PHS	SGCN-WA
	Killer whale	*Orcinus orca*	Southern Resident DPS	LE; Critical Habitat	Not listed	LE; PHS	MMPA; SGCN-OR; SGCN-WA
	Steller sea lion	*Eumetopias jubatus*	Eastern DPS	Not listed	Not listed	Not listed; PHS	MMPA; SGCN-OR
	California sea lion	*Zalophus californianus*	N/A	Not listed	Not listed	Not listed; PHS	MMPA
	Harbor seal	*Phoca vitulina*	N/A	Not listed	Not listed	Not listed; PHS	MMPA; SGCN-OR
Invertebrates	Western ridged mussel	Gonidea angulata	N/A	Under review	Not listed	Not listed	SGCN-OR; SGCN-WA
	California floater	*Anodonta californiensis*	N/A	Not listed	Not listed	C; PHS	SGCN-OR; SGCN-WA

a DPS = distinct population segment; ESU = evolutionarily significant unit; N/A = not applicable
b ESA = Endangered Species Act; Federal status: LT = Listed Threatened, LE = Listed Endangered, Not listed = No status designated; Critical Habitat = designated critical habitat (NOAA Fisheries n.d.; USFWS 2021a).
c Oregon State status: LT = Listed Threatened, S=Sensitive; SC = Sensitive Critical, Not listed = No status designated; (OCS 2016; ODFW 2021a; 2021b).
d Washington State status: C = Candidate, Not listed = No State Status; PHS = WDFW priority habitats and species (WDFW 2022, 2023).
e Other Special Regulatory Status: EFH = Essential Fish Habitat designated; SOC=Federal Species of Concern; MMPA = Marine Mammal Protection Act; SGCN-OR = Species of Greatest Conservation Need in Oregon (OCS 2016); SGCN-WA = Species of Greatest Conservation Need in Washington (WDFW 2015)

Terrestrial Resources

This section describes "terrestrial resources" in the study area, which includes non-aquatic habitats and wildlife species that these habitats support, including birds, mammals, amphibians, reptiles, and insects.

Terrestrial Habitat

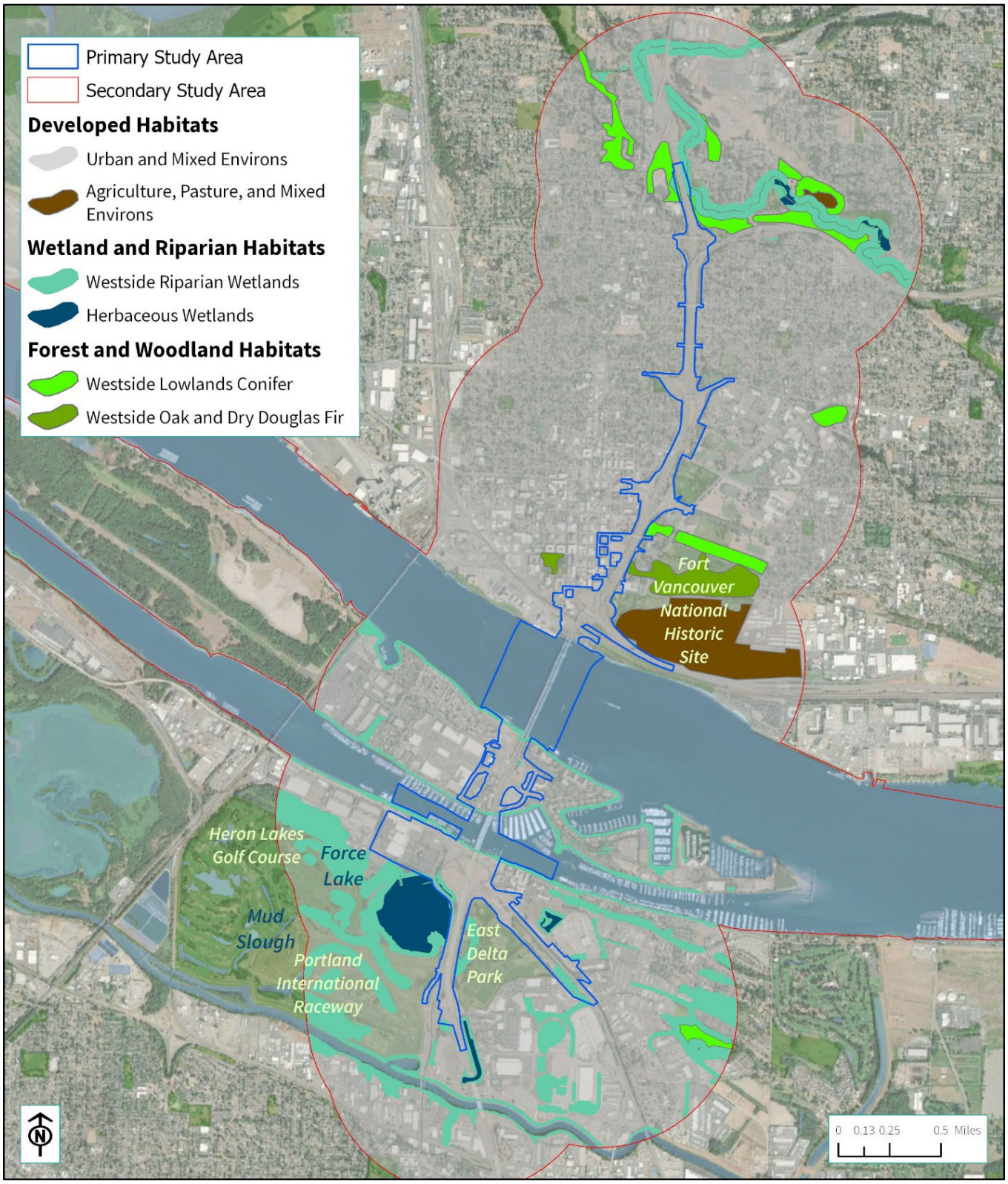
Terrestrial habitats within the study areas are generally small and fragmented and have been modified from their historical conditions. Nevertheless, these areas provide habitat for various native mammals, birds, amphibians, and reptiles.

Table 3.16-3 lists approximate acreages of terrestrial habitat types within the study areas. Figure 3.16-3 shows the approximate extent and location of these habitat types. The predominant habitat type is the "Urban and Mixed Environs" classification, interspersed with small, isolated patches of wetland or forest habitats. The most intact terrestrial habitat areas adjoin the Vanport wetland in the south and the Burnt Bridge Creek Greenway in the north. The Ruby Junction Maintenance Facility is not shown on Figure 3.16-3 because the area is entirely developed and classified as "Urban and Mixed Environs."

Table 3.16-3. Acres of Terrestrial Habitat Classification within the Primary and Secondary Study Areas

Habitat Classification	Primary Study Area (acres)	Secondary Study Area (acres)	Total Area (acres)
Urban and Mixed Environs	396	4,518	4,914
Agriculture, Pasture, and Mixed Environs	0.3	141	141
Westside Riparian – Wetlands	17	608	625
Herbaceous Wetlands	0.3	74	74
Westside Lowlands Conifer – Hardwood Forest	1.3	122	123
Westside Oak and Dry Douglas Fir Forest and Woodlands	<0.1	53	53
Total	**415**	**5,516**	**5,930**

1 **Figure 3.16-3. Habitat Classifications within the Primary and Secondary Study Areas**



Urban and Mixed Environs

Although urban environments are usually considered to provide relatively low-quality habitat, some terrestrial wildlife species have adapted to these conditions. For example, bridges and other structures can provide nesting and perching habitat for certain migratory bird species. Examples of SOI associated with this habitat type include bald eagle, peregrine falcon, other migratory bird species, *Myotis* bats, Townsend's big-eared bat, and monarch butterfly. Because the study area is highly urbanized, suitable habitat for wildlife is fragmented, and passage is restricted. I-5 and other roads serve as barriers to passage and are unsuitable and dangerous corridors for most terrestrial wildlife.

Agriculture, Pasture, and Mixed Environs

The south end of the Fort Vancouver National Historic Site and the west end of the Pearson Airport is a mowed/maintained pasture that falls more closely within the "Agriculture, Pasture, and Mixed Environs" habitat type. This habitat type includes unimproved pastures, predominantly grassland sites and often abandoned fields that have little or no active management such as irrigation, fertilization, or herbicide applications (Johnson and O'Neil 2001). The "Agriculture, Pasture, and Mixed Environs" habitat type is used by a wide diversity of native species, particularly birds and small mammals. These areas also provide excellent foraging opportunities for raptors and other birds of prey. They are also prone to invasion by exotic species, due to their relatively high level of disturbance.

Examples of SOI associated with this habitat type include streaked horned lark, bald eagle, peregrine falcon, other migratory birds, *Myotis* bats, and Townsend's big-eared bat (Johnson and O'Neil 2001).

Wetland and Riparian Habitat

Wetland and riparian habitats within the study area are fragmented and disturbed from their natural condition, though they continue to provide habitat functions. There are narrow bands of riparian habitat adjacent to surface waters, including the Columbia River, North Portland Harbor, Columbia Slough, Burnt Bridge Creek, and Fairview Creek.

Herbaceous wetlands are present in the Vanport wetland system south of the Expo Center, immediately surrounding the open water pond/wetland system east of I-5 near Delta Park and east of I-5 along Whitaker Road. Herbaceous wetlands provide many habitat functions that are similar to forested and shrub-dominated wetlands. In general, they provide habitat for a variety of wildlife adapted to wetlands and riparian areas within an urban environment, including a variety of small mammals, amphibians, reptiles, migratory birds, waterfowl, and raptors. Examples of SOI associated with this habitat type include bald eagle, peregrine falcon, purple martin, other migratory birds, *Myotis* bats, Townsend's big-eared bat, pond turtles, painted turtles, and northern red-legged frog.

Forest and Woodland Habitat

Within the study area, the "Westside Lowlands Conifer – Hardwood Forest" habitat type is limited to small, isolated patches associated with Burnt Bridge Creek. These areas provide limited habitat function due to their isolated and fragmented nature. However, the habitat may provide for migratory birds' nests, and raptors may perch and use these areas for foraging in adjacent habitats. Examples of SOI associated with this habitat type include the bald eagle, peregrine falcon, other migratory birds, *Myotis* bats, and Townsend's big-eared bat.

The "Westside Oak and Dry Douglas Fir Forest and Woodlands" habitat type occurs in two small patches within the study area, one in the northern portion of Esther Short Park and one at the Fort Vancouver National Historic Site. These areas generally provide a similar suite of habitat functions as "Westside Lowlands Conifer – Hardwood Forest" habitats. However, oak woodlands can provide some unique functions due to their relative rarity in the landscape and their different structural composition.

Terrestrial Species of Interest

Table 3.16-4 presents a list of terrestrial SOI, including birds, mammals, amphibians/reptiles, and insects, that may occur within the study areas, along with their regulatory status.

Table 3.16-4. Terrestrial Species of Interest Potentially Occurring within the Study Area

	Species Common Name	Species Scientific Name	Federal Status [a]	State Status (OR) [b]	State Status (WA) [c]	Other Special Regulatory Status [d]
Birds	Streaked horned lark	*Eremophila alpestris strigata*	LT; Critical Habitat	SC	LE; PHS	MBTA; SGCN-OR; SGCN-WA
	Bald eagle	*Haliaeetus leucocephalus*	Not listed	Not listed	Not listed	BGEPA; MBTA; SGCN-WA
	Peregrine falcon	*Falco peregrinus anatum*	Not listed	S	Not listed	MBTA; SGCN-OR; SGCN-WA
	Purple martin	*Progne subis*	Not listed	SC	Not listed	MBTA; SGCN-OR; SGCN-WA
	Willow flycatcher	*Empidonax traillii*	Not listed	SC	Not listed	MBTA; SGCN-OR;
	Common loon	*Gavia immer*	Not listed	Not listed	S; PHS	MBTA; SGCN-WA
	Great blue heron	*Ardea Herodias*	Not listed	Not listed	PHS	MBTA
	Other migratory birds	Multiple Species	N/A	N/A	N/A	MBTA
Mammals	Columbian white-tailed deer	*Odocoileus virginianus ssp. Leucurus*	LT	S	LT; PHS	SGCN-OR; SGCN-WA
	Long-legged myotis	*Myotis volans*	Not listed	S	Not listed; PHS [e]	SGCN-OR
	Fringed myotis	*Myotis thysanodes*	Not listed	S	Not listed; PHS [e]	SGCN-OR
	Long-eared myotis	*Myotis evotis*	Not listed	Not listed	Not listed; PHS [e]	SGCN-OR
	Townsend's big-eared bat	*Corynorhinus townsendii*	Not listed	SC	C; PHS	SGCN-OR; SGCN-WA
	Silver-haired bat	*Lasionycteris noctivagans*	Not listed	S	Not listed; Candidate	SGCN-OR; SGCN-WA

	Species Common Name	Species Scientific Name	Federal Status [a]	State Status (OR) [b]	State Status (WA) [c]	Other Special Regulatory Status [d]
Reptiles and Amphibians	Western pond turtle	*Actinemys marmorata*	Not listed	S	LE; PHS	SGCN-OR; SGCN-WA
	Painted turtle	*Chrysemys picta*	Not listed	SC	Not listed	SGCN-OR; SGCN-WA
	Northern red-legged frog	*Rana aurora*	Not listed	S	Not listed	SGCN-OR; SGCN-WA
Insects	Monarch butterfly	*Danaus plexippus*	C	Not listed	Not listed	N/A

a Federal ESA status: LT = Listed Threatened, LE = Listed Endangered, C = Candidate, Not listed = No status designated; Critical Habitat = designated critical habitat (NOAA Fisheries 2021; USFWS 2021a).
b Oregon State status: LT = Listed Threatened, LE = Listed Endangered, S=Sensitive, SC = Sensitive Critical, Not listed = No status designated (ODFW 2021a, 2021b).
c Washington State status: LT = Listed Threatened, LE = Listed Endangered, S=Sensitive, C=Candidate, PHS = WDFW priority habitat species; (WDFW 2022, 2023).
d Other Special Regulatory Status: SOC=Federal Species of Concern; PHS = Priority Habitats and Species; BGEPA = Bald and Golden Eagle Protection Act; MBTA = Migratory Bird Treaty Act; SGCN-OR = Species of Greatest Conservation Need in Oregon (OCS 2016); SGCN-WA = Species of Greatest Conservation Need in Washington (WDFW 2015); N/A = Not Applicable
e Roosting concentrations of *Myotis* bats are considered Priority Species by WDFW, where they occur.

Botanical Resources

Botanical Species of Interest

Table 3.16-5 lists the botanical SOI, their protection status, and suitable habitat that may occur in the primary study area. Most habitats within the study area have low suitability for these species, and they have not been documented in the primary study.

Table 3.16-5. Botanical Species of Interest Potentially Occurring within the Primary Study Area

	Species Common Name	Species Scientific Name	Federal Status [a]	State Status (OR) [b]	State Status (WA) [c]	Habitat Suitability in Primary Study Area	Typical Flowering Window
Vascular Plants	Golden paintbrush	*Castilleja levisecta*	T	E	T	Low – Agriculture, Pasture and Mixed Environs	April–June
	Kincaid's lupine	*Lupinus oreganus*	T	T	T	Low – Agriculture, Pasture and Mixed Environs	April–June
	Nelson's checkermallow	*Sidalcea nelsoniana*	T	T	E	Low – Agriculture, Pasture and Mixed Environs	Late May–July

	Species Common Name	Species Scientific Name	Federal Status [a]	State Status (OR) [b]	State Status (WA) [c]	Habitat Suitability in Primary Study Area	Typical Flowering Window
	Willamette Daisy	*Erigeron decumbens*	E	E	Not listed	Low – Agriculture, Pasture and Mixed Environs	June–July
	Tall bugbane	*Actaea elata var. elata*	Not listed	Not listed	S	Low – Westside Riparian – Wetlands and Westside Lowlands Conifer – Hardwood Forest	May–August
	Small-flowered trillium	*Trillium albidum ssp. Parviflorum*	Not listed	Not listed	S	Low – Westside Riparian – Wetlands and Westside Lowlands Conifer – Hardwood Forest	March–May
	Western ladies-tresses	*Spiranthes porrifolia*	Not listed	Not listed	S	Low – Herbaceous Wetlands and Westside Riparian – Wetlands	May–August
	Columbia cress	*Rorippa columbiae*	Not Listed	C	T	Low – Herbaceous Wetlands and Westside Riparian – Wetlands	April–October

a Federal Endangered Species Act status: C = Candidate; E = Endangered; Not listed = No status designated; P = Proposed; SOC = Species of Concern; T = Threatened (USFWS 2021b).
b Oregon State status: E = Endangered; Not listed = No status designated; T = Threatened, S=Sensitive; SC = Sensitive Critical (ORBIC 2021).
c Washington State status: C=Candidate; E = Endangered; PHS = Washington State priority species; S=Sensitive; T = Threatened, (WNHP 2021)

Noxious Weeds

Table 3.16-6 identifies 14 species of noxious weeds known or expected to occur within the primary study area. Noxious weeds are defined at the state level by the Oregon State Weed Board and the Washington State Noxious Weed Control Board. No noxious weeds designated under state law as requiring eradication are known or expected to occur within the primary study area.

Table 3.16-6. Noxious Weed Species Occurring within the Primary Study Area

Botanical Name	Common Name
Centaurea × gerstlaueri (*Centaurea pratensis)*	Meadow knapweed
Cirsium arvense	Canada thistle
Cirsium vulgare	Bull thistle
Clematis vitalba	Old man's beard
Conium maculatum	Poison hemlock
Convolvulus arvensis	Field bindweed
Cytisus scoparius	Scotch broom
Daucus carota	Wild carrot
Geranium robertianum	Herb-Robert's
Hedera helix	English ivy
Hypericum perforatum	St. John's wort
Phalaris arundinacea	Reed canarygrass
Fallopia japonica	Japanese knotweed
Rubus armeniacus	Himalayan blackberry

Federal, State, and Local Habitat Designations

Federal, state, and local regulatory frameworks designate important and/or protected habitat for ecosystem resources within the study areas. Table 3.16-7 summarizes these designations. Note that many of these designated areas overlap. For example, the open water habitat within the Columbia River is designated critical habitat for several species of ESA-listed fish, essential fish habitat for Pacific salmon, a Washington Department of Fish and Wildlife (WDFW) priority habitat, a designated Critical Area in the city of Vancouver, and a Portland environmental overlay zone (ezone).

Table 3.16-7. Federal, State, and Local Habitat Designations within the Study Areas

	Agency	Limits of Jurisdiction	Resource Designation	Description
Federal	NOAA Fisheries and USFWS	U.S.	Critical Habitat for ESA-listed species	Specific geographic areas contain features essential to the conservation of an endangered or threatened species and may require special management and protection.
	NOAA Fisheries	U.S.	Essential Fish Habitat	Waters and substrate that are necessary to fish for spawning, breeding, feeding, or growth to maturity. EFH has been designated for three categories of fish: Pacific salmon, groundfish, and coastal pelagic species.

	Agency	Limits of Jurisdiction	Resource Designation	Description
Oregon	Oregon DSL and ODFW	Oregon – Statewide	Habitats of Conservation Concern	Habitats of conservation concern within Oregon that provide important benefits to OCS Strategy Species. 11 Strategy Habitats have been designated.
	City of Portland	City of Portland	Environmental Overlay Zones	Establishes Environmental Protection zones and Environmental Conservation zones in Portland to protect important natural resource areas.
	Metro	Multnomah, Clackamas, and Washington Counties	Habitat Conservation Areas	Classifies regionally significant fish and wildlife habitat as Habitat Conservation Areas. Separate categories exist for Riparian and Upland Wildlife habitats.
Washington	WDFW	Washington – Statewide	Priority Habitats	Specifically designated habitat types that have been determined to have unique or significant value. WDFW has designated 20 priority habitats within the state.
	Ecology	Washington - Statewide	Shoreline Management Areas	The Shoreline Management Act defines certain waterbodies as "Shorelines of the State," and local jurisdictions establish shoreline management areas in which development activities are regulated.
	City of Vancouver	City of Vancouver	Critical Areas Ordinance	The Growth Management Act requires all cities and counties in Washington to adopt regulations protecting "critical areas" to preserve the natural environment, wildlife habitat, and sources of fresh drinking water. Five categories are defined, including fish and wildlife habitat conservation areas (FHWCAs). The City of Vancouver has a CAO that defines and regulates development activities within FHWCAs.

CAO = Critical Areas Ordinance; DSL = Department of State Lands; Ecology = Washington Department of Ecology; EFH = essential fish habitat; ESA = Endangered Species Act; Metro = Oregon Metro; NOAA Fisheries = North American Oceanic and Atmospheric Administration Fisheries Service; ODFW = Oregon Department of Fish and Wildlife; USFWS = U.S. Fish and Wildlife Service; WDFW = Washington Department of Fish and Wildlife

3.16.3 Long-Term Effects

No-Build Alternative

Under the No-Build Alternative, the existing Interstate Bridge, North Portland Harbor bridges, and I-5 interchanges would remain. Regular and intermittent maintenance activities would continue to be required, which have the potential to disturb aquatic and terrestrial species and habitats, including potential impacts to birds nesting on the existing Interstate Bridge. Stormwater from impervious surfaces within the primary study area would continue to enter aquatic habitat surface waters largely untreated. If a major earthquake event occurred, that resulted in the existing Interstate Bridge over the Columbia River failing or collapsing, fish and wildlife species in the immediate vicinity and in aquatic habitats both upstream and downstream could be struck by falling debris and injured or killed. Fallen debris would also diminish habitat suitability and

contribute chemical contaminants that could affect aquatic species and habitats upstream and downstream of the bridge.

Modified LPA

The subsections below describe the long-term impacts that would occur with the Modified LPA. As described in Chapter 2, several design options are being evaluated as part of the Modified LPA. Where impacts would differ associated with a design option, a comparison of the impacts associated with each design option is provided. The with or without C-Street ramp option, I-5 mainline westward shift or centered option, and the park and ride site options evaluated as part of the Modified LPA would not result in different levels or types of long-term effects to ecosystem resources and are, therefore, not specifically addressed further.

Aquatic Resources

Under the Modified LPA, bridge removal and replacement would result in direct permanent impacts to sensitive aquatic habitats in the Columbia River and North Portland Harbor. These impacts would include physical alteration of benthic habitat and changes in overwater shading. The Modified LPA would not directly impact or displace aquatic habitat in Burnt Bridge Creek, the Columbia Slough, or Fairview Creek. Table 3.16-8 summarizes the permanent aquatic habitat impacts associated with the Modified LPA.

Table 3.16-8. Shallow and Deep Water Permanent Aquatic Habitat Impacts Summary

Impact to Columbia River and North Portland Harbor	Double-Deck Fixed-Span Bridges (acres)	Single-Level Fixed-Span Bridges (acres)	Single-Level Movable-Span Bridges (acres)	Restored Area from Removal of Existing Bridges (acres)	Total Net Change (acres)
Benthic Habitat Loss	0.91	1.07	1.11	-1.04	• Double-deck fixed-span: -0.13 • Single-level fixed-span: +0.03 • Single-level movable-span: +0.07
Overwater Shading (Water Surface)	1.04	1.41	1.58	0.00	• Double-deck fixed-span: +1.04 • Single-level fixed-span: +1.41 • Single-level movable-span: +1.58

Impact to Columbia River and North Portland Harbor	Double-Deck Fixed-Span Bridges (acres)	Single-Level Fixed-Span Bridges (acres)	Single-Level Movable-Span Bridges (acres)	Restored Area from Removal of Existing Bridges (acres)	Total Net Change (acres)
Overwater Shading (Elevated Deck) [a]	19.87	24.13	24.13	-11.65	• Double-deck fixed-span: +8.22 • Single-level fixed-span: +10.78 • Single-level movable-span: +10.78

a The addition of a second auxiliary lane in each direction would increase the amount of elevated overwater shading by approximately 4.8 acres compared to one auxiliary lane.

Benthic Habitat Impacts

For the Modified LPA with the double-deck fixed-span configuration, in-water piers to support the new Columbia River and North Portland Harbor bridges would displace approximately 0.91 acres of benthic habitat. Removal of the existing bridges, including their underwater support structures, would result in the restoration of approximately 1.04 acre of benthic habitat. Thus, the Modified LPA with the double-deck fixed-span bridge configuration would result in a net restoration of approximately 0.13 acres of benthic habitat. The Modified LPA with the single-level fixed-span configuration would require 24 more drilled shafts than the double-deck fixed-span bridge, which would result in a greater benthic impact of 1.07 acres and a 0.03-acre net reduction in benthic habitat. The Modified LPA with the single-level movable-span configuration would require 36 more drilled shafts than the double-deck fixed-span bridge, resulting in a total benthic impact of 1.11 acres and a 0.07-acre net reduction in benthic habitat.

Changes to benthic habitats could affect a variety of aquatic species, including:

- Adult and juvenile salmon, steelhead, and bull trout
- Adult green sturgeon, white sturgeon, Pacific eulachon, Pacific lamprey, and river lamprey
- Adult and juvenile native resident fish (e.g., sculpins, threespine sticklebacks, dace, and suckers)
- Freshwater invertebrates

However, the extent of the effect would be minor, given the relatively small area that would be affected and the net area that would be restored by the Modified LPA.

The addition of a second auxiliary lane in each direction would not change the amount benthic habitat impact compared to the one auxiliary lane option.

Overwater Shading Impacts

In addition to affecting benthic habitat, the Modified LPA's new bridges would increase the area of shading over the Columbia River and North Portland Harbor. Shading from overwater structures can affect the growth of aquatic vegetation, reduce habitat suitability for salmon and other native fish, and create habitat for species that prey on juvenile salmonids. The amount and duration of the effects can vary with the height of the overwater structures (increased structure height diminishes the intensity of shading by providing a greater distance for light to diffuse and refract around the bridge deck); the orientation of the structure (a north–south-oriented structure creates a shadow that moves throughout the day); the density of piling or

drilled shafts supporting the structure (an open structure supported by widely-spaced drilled shafts allows light to penetrate beneath the structure); and the material and reflectivity of the structure (concrete and steel are lighter and more reflective of ambient light than darker materials such as timber piles).

The structures with the greatest potential for overwater shading at the water's surface are the shaft caps for the new Columbia River bridges. The Modified LPA with the double-deck fixed-span configuration would result in a total of approximately 1.04 acres of shading at the Columbia River water surface. The Modified LPA with the single-level fixed-span bridge configuration would require larger drilled shaft caps and would result in an increase of approximately 1.41 acres of shading at the Columbia River water surface. The Modified LPA with the single-level movable-span bridge configuration would also require larger drilled shaft caps and would result in an increase of approximately 1.58 acres of shading at the Columbia River water surface. For all bridge configurations, these shaded areas would be small relative to the amount of available habitat in the vicinity, and salmonids and other aquatic species would have access to suitable habitats outside the shaded areas. Therefore, the increased shading is not expected to have an appreciable effect on habitat function. The North Portland Harbor bridges would not have shaft caps at the water's surface.

The replacement bridges would also result in new overwater shading from the elevated bridge decks, and removal of elevated shading from the existing bridge decks. The new Columbia River and North Portland Harbor bridges with the Modified LPA with the double-deck fixed-span bridge configuration would have a total of approximately 19.87 acres of new elevated overwater shading, and the removal of the existing bridges would reduce overwater coverage by approximately 11.65 acres, for net increase of approximately 8.22 acres of elevated overwater coverage. Compared to the Modified LPA with the double-deck fixed-span bridge configuration, the Modified LPA with the single-level fixed-span bridge configuration would increase elevated overwater shading by 4 acres and the Modified LPA with the single-level movable-span bridge configuration would increase elevated overwater shading by approximately 5 acres. With any of the bridge configurations, the height of the bridge decks would minimize the potential for reduced habitat function.

The addition of a second auxiliary lane in each direction would not change the amount of surface-water shading, but would increase the amount of elevated overwater shading by approximately 4.8 acres compared to the one auxiliary lane option.

Floodplain Fill

Removal or placement of material within a floodplain can affect aquatic habitat by affecting peak and base flow conditions. While the Modified LPA would require both removal and placement of material below the 100-year floodplain elevation, its location on the Columbia River, where flows are regulated in part by upstream dams, makes the potential for changes in flow less pronounced. While specific volumes have not yet been calculated, it is anticipated that the net change in fill within the regulatory floodplain would be relatively small. The City of Portland's zoning code requires balanced cut and fill within floodplains. The cities of Fairview and Vancouver also regulate cut and fill activities within the floodplain through their environmental approval process.

The Modified LPA would also require both removal and placement of material within the functional floodplain, which is the portion of the regulatory floodplain that is below the ordinary high-water mark (OHWM). Specific quantities have only been estimated at this time and would depend substantially on final design and permitting details. It is estimated that the Modified LPA would install up to approximately 62,400 cubic yards of new material within the functional floodplain of the Columbia River and North Portland Harbor, and would remove approximately 13,250 cubic yards of existing material from within the functional floodplain. It is estimated, therefore, that the Modified LPA would result in a net increase of up to approximately 55,000 cubic yards of material within the functional floodplain. Most of this volume would be associated with the shaft caps for the Columbia River bridge, which are approximately 20 feet thick, and most of which would be below the OHWM elevation. Despite this increase, the Modified LPA would fully comply with

applicable requirements to maintain floodplain function as described above, and would maintain floodplain function and hydrologic processes at the site.

Given the limited extent of functioning floodplain at the project site, and the likely small quantity of net change in fill within the regulatory floodplain, the effects on floodplain function from construction of the Modified LPA is expected to be minimal.

Hydraulic Shadowing

Piers and other structures in the water can create areas of reduced water velocity immediately downstream of the structure. This phenomenon is referred to as a hydraulic shadow. Hydraulic shadowing may affect habitat suitability for native fish by creating low-velocity eddies that have the potential to increase exposure to predation, interfere with movement patterns, and alter sediment transport. Increased hydraulic shadowing may also benefit some fish by creating areas where they can rest during periods of high flow.

The Modified LPA, with any of the Columbia River bridge configurations, would create a hydraulic shadow extending up to approximately 1,600 feet downstream of each pier, with velocities in the range of 0 to 3 feet per second. The hydraulic shadow of the North Portland Harbor bridges would extend up to approximately 400 feet downstream of each pier, with velocities ranging from 0 to 2 feet per second. Although the length of the hydraulic shadow would increase compared to the existing conditions, the change to aquatic habitat suitability for native fish would be minor. In both cases, the range of water velocities found in the hydraulic shadow are within the range fish encounter in the natural environment.

Stormwater Effects

The Modified LPA would install new impervious surfaces and rebuild existing impervious surfaces, which could contribute pollutants to stormwater and affect water quality and water quantity in the Columbia River, North Portland Harbor, Columbia Slough, Fairview Creek, and Burnt Bridge Creek. Stormwater runoff from roads and highways contains pollutants that can be toxic to aquatic life, even at very low concentrations. Pollutants commonly occurring in stormwater runoff include suspended solids, nutrients, oil and grease, agricultural chemicals, dissolved metals, and other organic chemicals. There is emerging research related to 6PPD-quinone, a chemical in tires, which has been linked to mortality of coho salmon under certain conditions (Tian et al. 2021), and may also be negatively affecting other aquatic species including Chinook salmon and steelhead (Brinkmann et al. 2022; Lo et al. 2023). However, among the Pacific salmonid species, coho salmon are the most sensitive to 6PPD-quinone and the most exposed to pollutants in urban stormwater runoff, given their habitat preference for small, lowland streams (Ecology 2022).

Table 3.16-9 compares the increase in contributing impervious area (CIA), which could potentially increase the amount of pollutants entering stormwater, for each bridge configuration of the Modified LPA. The Modified LPA with the double-deck fixed-span configuration would add approximately 29.6 acres of CIA but would treat or infiltrate 207.2 acres of CIA. The Modified LPA with the single-level fixed-span and single-level movable-span bridge configurations would increase the CIA by 32.9 acres (an increase of approximately 3.3 acres compared to the double-deck configuration). The addition of a second auxiliary lane in each direction would increase the amount of post-project CIA by approximately 3.9 acres under each bridge design option compared to the one auxiliary lane option.

Water quality treatment would be provided for all post-project CIA, including approximately 156.4 acres of existing impervious area that is currently untreated. This would represent treatment of over six times the area of net new CIA associated with the Modified LPA. The net effect on water quality and aquatic habitat would be a substantial net improvement for all design options compared to the No-Build Alternative. See Section 3.14, Water Quality and Hydrology, for additional information.

Table 3.16-9. Post-Project Increase in Contributing Impervious Area

	Double-Deck Fixed-Span Bridges (acres)	Single-Level Fixed-Span Bridges (acres)	Single-Level Movable-Span Bridges (acres)
Increase in Contributing Impervious Area [a]	29.6	32.9	32.9

a The addition of a second auxiliary lane in each direction would increase the amount of post-project CIA by approximately 3.9 acres under each bridge design option compared to the one auxiliary lane option.

The Modified LPA with the single-level movable-span bridge configuration would also require grease and other lubricants for the maintenance and operation of the lift span, which poses a potential risk that these substances could enter surface waters. However, the bridge would be operated in a manner that is compliant with applicable state water quality standards, and appropriate best management practices (BMPs) would be employed to maintain compliance with these requirements.

Overwater Lighting

Artificial light sources on overwater structures can affect fish and other aquatic species, including delayed migration and increased exposure to predation. The Modified LPA would install permanent lighting on the replacement bridges and would remove a source of overwater lighting on the existing bridges. The Modified LPA, with any of the bridge configurations, is not expected to result in an increase in the amount of light on the water's surface. Permanent lighting for the bridge decks would use directional, shielded lighting to control glare and direct light onto the bridge deck to the extent practicable. The bridge decks with the Modified LPA would also be a solid surface, which would reduce the amount of light illuminating the water's surface compared to the existing bridges.

Avian (Bird) Predation

Avian (bird) predation of juvenile salmonids is a limiting factor for salmon recovery in the Columbia River Basin. Other species subject to avian predation include adult and juvenile Pacific eulachon and lamprey. The existing Columbia River and North Portland Harbor bridges provide perching opportunities for fish-eating birds such as Caspian terns, double-crested cormorants, and various gull species, though there is no evidence these species use the bridges extensively. The Modified LPA, with any of the bridge configurations, may reduce the potential for avian predation. While the steel superstructure of the existing Interstate Bridge provide opportunities for birds to perch, the new Columbia River bridges would likely provide relatively fewer overhead perching opportunities. However, this would depend in part on the final design of the superstructure. Perching opportunity on the replacement North Portland Harbor bridges would be comparable to that associated with the existing North Portland Harbor bridge, though it could be slightly higher given the increase in the total number of structures.

Terrestrial Resources

As summarized in Table 3.16-10, the Modified LPA would result in the loss of small quantities of sensitive terrestrial habitats. The habitat designations shown in Table 3.16 overlap and are not cumulative. The amount of terrestrial habitat loss would be the same with one or two auxiliary lanes and all of the bridge configurations.

The Modified LPA would also restore terrestrial areas that are currently displaced by existing infrastructure (the existing bridges and roadways). While a specific restoration plan has not yet been developed, these areas would be restored consistent with federal, state, and local regulatory requirements, and would provide new terrestrial habitat function.

Table 3.16-10. Permanent Loss of Sensitive Terrestrial Habitats

Sensitive Terrestrial Habitat (Oregon)	Permanent Loss of Sensitive Terrestrial Habitat (acres)
"High" wildlife/riparian value habitats	1.12
"Medium" wildlife/riparian value habitats	6.20
Wetlands	0.58
Wetland Buffers	7.39
Sensitive Terrestrial Habitat (Washington)	
Riparian Buffers	0.79
Biodiversity Areas	0.15
Oak Woodlands	<0.01
Wetlands	0
Wetland Buffers	0.06

Oregon

In Oregon, the Modified LPA would result in a permanent loss of approximately 7.32 acres of terrestrial habitats identified as having a "high" or "medium" combined wildlife/riparian value in Portland's Natural Resource Inventory (NRI). Most of the impacts would occur within disturbed terrestrial riparian habitats on the shorelines of Hayden Island, on the south shoreline of North Portland Harbor, near the Vanport wetland, and in a partially forested area south of Martin Luther King, Jr. Boulevard. The Modified LPA would also result in approximately 0.58 acre of permanent wetland fill, and approximately 7.39 acres of wetland buffer impact in Oregon, within areas designated as having "high" or "medium" wildlife/riparian value in Portland's NRI.

The Modified LPA would require the removal of trees. Tree removal reduces habitat complexity, can affect water temperature, and reduces the potential for large woody debris (an important component of fish habitat) to accumulate. Riparian areas adjacent to the Columbia River and North Portland Harbor in Oregon are armored with riprap and provide little riparian function. The Modified LPA would likely require removal of some trees that have established along the riprapped banks. Some tree removal would also be required in areas mapped as having "high" or "medium" combined wildlife/riparian value in Portland's NRI, primarily associated with wetlands and adjacent buffer areas. Tree removal would be conducted consistent with the City's Title 11 Tree Ordinance.

Washington

In Washington, permanent loss of sensitive terrestrial habitats would be minimal, as Modified LPA improvements would occur largely within a developed transportation corridor. In addition, the Modified LPA has been designed to avoid encroaching into sensitive resources, to the extent practicable.

The Modified LPA would result in a permanent loss of approximately 0.79 acres of riparian buffers, 0.15 acres of a designated biodiversity area, 0.01 acres of area mapped as oak woodland, and 0.06 acres of wetland buffer in Washington. Most of the loss would occur within terrestrial riparian habitat associated with Burnt Bridge Creek. While this riparian habitat is mostly disturbed vegetation on a sloping embankment between I-5

and NE Leverich Park Way some tree removal adjacent to Burnt Bridge Creek would be required. Some of this riparian buffer may be able to be restored and/or enhanced, and net unavoidable impact would be offset through compensatory mitigation.

Nesting Bird and Roosting Bat Habitat

The Modified LPA would require the removal of both natural features (trees and vegetation) and human-made structures (the existing bridges) that provide documented or potentially suitable habitat for nesting birds and roosting bats.

Activities with the potential to disturb nesting migratory birds, such as nest removal, would be conducted consistent with the provisions of the Migratory Bird Treaty Act (MBTA), which requires that nests of migratory birds be removed only when nests are inactive. However, the loss of a specific nesting structure could still be significant, particularly if similar replacement structures are not available.

The Modified LPA would require the removal of the existing Interstate Bridge, which has been a peregrine falcon nest site since 2001. Its removal would eliminate a suitable nesting structure and, while there are likely alternate nesting sites in the vicinity, could appreciably disrupt peregrine breeding, foraging, and/or nesting activity. Peregrines that use the existing Interstate Bridge would be forced either to find alternative nesting structures in the vicinity of the bridge or move outside of the study area. Providing an alternate nesting structure would greatly reduce the potential nesting impact.

Terrestrial Wildlife Passage

Terrestrial wildlife passage is severely limited in the primary study area due to the highly developed urban setting. The existing shoreline and riparian areas are narrow and provide limited suitable passage and habitat function for terrestrial species. Under the Modified LPA, landside piers for the Columbia River bridges may continue to obstruct wildlife movement along the shoreline, though this may be offset by the removal of the existing landside bridge piers. Options for improving wildlife passage are limited, given the developed nature of the corridor. Design efforts to avoid and minimize impacts to riparian habitat, would likely maintain or improve terrestrial wildlife passage in the long term.

Botanical Resources

The Modified LPA would have limited permanent vegetation removal, as construction activities would primarily occur within disturbed areas adjacent to existing roadway infrastructure. The Modified LPA would permanently remove native vegetation within a few relatively small areas of functioning riparian and wetland habitats. This removal would be avoided and minimized to the extent practicable through project design, and consistent with federal, state, and local regulations. Compensatory mitigation would offset the net loss in habitat function. The net result is expected to increase habitat quality for botanical resources.

No botanical SOI are known or expected to occur within the areas that would be permanently disturbed. Therefore, the Modified LPA would not impact botanical SOI species.

3.16.4 Temporary Effects

No-Build Alternative

The No-Build Alternative would not have construction-related temporary effects.

Under the No-Build Alternative, the existing Interstate Bridge and roadways would continue to require regular, intermittent maintenance activities, which have the potential to disturb aquatic and terrestrial species and habitats. Potential impacts from maintenance activities include temporarily impaired water quality, temporary underwater and/or terrestrial noise, and temporary vegetation impacts.

Maintenance activities could potentially impact birds nesting on the existing Interstate Bridge or within the vicinity. Activities with the potential to impact nesting migratory birds, such as nest removal, would be conducted consistent with the provisions of the MBTA which requires that nests of migratory birds be removed only at times when nests are inactive. Active nests (those with live eggs and/or viable chicks) are to be left undisturbed until they are no longer active.

Typical construction BMPs would likely be implemented during maintenance activities to minimize impacts to fish and wildlife species and habitats.

Modified LPA

The subsections below describe the short-term impacts that would occur associated with the Modified LPA. As described in Chapter 2, several design options are being evaluated as part of the Modified LPA. Where impacts would differ associated with one or more of the design options, the subsections below provide a comparison of the impacts associated with each design option.

Certain design options that are being evaluated as part of the Modified LPA (the C-Street ramp options, I-5 mainline westward shift options, and the two park and ride site options) would not result in different levels or types of short-term effects to ecosystem resources, and these design options are not specifically addressed further in this section.

Aquatic Resources

In-water construction activities within the Columbia River and North Portland Harbor could temporarily affect aquatic species and their habitats. This could include temporary disturbance of benthic habitat, overwater shading from work structures, work area isolation and fish salvage, water-quality impairment from turbidity or contaminants, overwater construction lighting, hydroacoustic events, and disturbance or displacement of individuals.

In-Water Work Timing

To minimize impacts to aquatic species and their habitats, certain work within the Columbia River and North Portland Harbor would have defined timing restrictions. Between 2005 and 2011 a set of project-specific in-water work timing restrictions were developed for the CRC LPA through extensive coordination with regulatory agencies, tribal partners, and other interested parties. For the Modified LPA, these work timing restrictions were reviewed with agencies, tribes, and other interested parties in several meetings between 2022 and 2023. Based on the outcome of these discussions, it was concluded that the timing restrictions that were developed for the CRC LPA would be appropriate to apply to construction of the Modified LPA. The following timing restrictions would therefore apply to the construction of the Modified LPA.

- Impact pile driving would be confined to September 15 through April 15 of each year.
- In-water debris removal with a bucket dredge would be confined to November 1 and February 28 of each year.

All other in-water and overwater construction activities would be conducted year-round and in compliance with permit conditions.

Temporary Benthic Habitat Impacts and Overwater Shading

In the Columbia River and North Portland Harbor, temporary impacts to benthic habitat and temporary overwater shading would result from the installation of temporary work platforms, bridges and piers, temporary isolation systems, cofferdams, casings, barges, and temporary piles associated with these structures. These temporary features are necessary to support construction and would be designed by a

contractor after a contract is awarded. Table 3.16-11 provides a summary of these temporary aquatic habitat impacts.

In the Columbia River, the Modified LPA with the double-deck fixed-span bridge configuration would temporarily displace approximately 1.52 acres of benthic habitat, with about 86% of these effects from cofferdams during construction and demolition. The Modified LPA with the single-level fixed-span and single-level movable-span bridge configurations would have similar temporary effects, with the exception of approximately 0.42 acres more benthic in-water area temporarily displaced within cofferdams. This increase in acreage of benthic habitat impact would not result in a different effect on ecosystems compared to the Modified LPA with the double-deck fixed-span bridge configuration. Overwater shading in the Columbia River is estimated to temporarily affect approximately 7.89 acres, with approximately half of these temporary effects resulting from temporary work platforms, bridges, and piers, and half resulting from barges.

In North Portland Harbor, approximately 0.40 acres of benthic habitat would be temporarily displaced, with approximately 60% of these effects resulting from drilled shaft isolation casings. Overwater shading in North Portland Harbor would temporarily affect approximately 7.72 acres, of which 62% would be due to temporary work platforms, bridges, and bents.

Table 3.16-11. Temporary Aquatic Habitat Impacts Summary

Temporary In-Water and Overwater Work Elements	Columbia River Temporary Benthic Impact (acres)	Columbia River Temporary Overwater Shading (acres)	North Portland Harbor Temporary Benthic Impact (acres)	North Portland Harbor Temporary Overwater Shading (acres)
Work Platforms/ Bridges/Piers and Associated Piles	0.18	4.23	0.13	4.78
Other Temporary Piles	0.01	0	0.01	0
Suspended Shaft Cap Isolation System	0	0.25	-	-
Sheet Pile Cofferdams (Construction)	0.44	0	-	-
Sheet Pile Cofferdams (Demolition)	0.86	0	-	-
Drilled Shaft Isolation Casings	-	-	0.24	0
Barges and Barge Mooring Piles (Construction)	0.01	2.75	0.02	2.41
Barges and Barge Mooring Piles (Demolition)	0.01	0.65	0.01	0.53
Total	**1.52**	**7.89**	**0.40**	**7.72**

Work Area Isolation and Fish Salvage

Certain in-water work activities would need to be isolated from the active flow of the Columbia River and North Portland Harbor, either for construction purposes or to reduce potential effects on fish and aquatic habitats. Areas that would be isolated in this manner include drilled shaft isolation casings and temporary sheet pile cofferdams. Sheet pile cofferdams for construction of Piers 2 and 7, and the drilled shaft isolation casings in North Portland Harbor, would be dewatered to provide a work area for construction. Sheet pile cofferdams for demolition of the existing Columbia River bridges (if used), would not be dewatered.

Fish salvage would be conducted both during and after the installation of the sheet pile cofferdams to remove fish from within the isolated work area. Since the drilled shaft isolation casings would be screened prior to installation, fish salvage would not be required within these structures prior to dewatering. These fish salvage operations would involve capture, direct handling, and transporting of fish, resulting in some risk that the process may harass, injure, or kill individual fish. Similarly, mortality is likely if a fish remains trapped in an isolated work area during construction.

Temporary Impacts to Water Quality

Water quality can be temporarily affected during both in-water and upland construction activities such as by contamination through the accidental release of construction materials or wastes or disturbing sediment and generating turbidity. Upland ground-disturbing activities can also lead to erosion, causing turbidity in adjacent waterbodies.

Construction of the Modified LPA, with any of the bridge configurations, would likely result in temporary, localized turbidity during in-water work in the Columbia River and North Portland Harbor from activities such as pile installation and removal, drilled shaft casing installation and removal, upland ground improvements, cofferdam installation and removal, and barge operations. Construction of the Modified LPA, with any of the bridge configurations, has the potential to result in chemical and/or debris contamination of surface waters from sources such as overwater construction work, concrete installation, spills of fuels or other chemicals, upland ground improvements, and demolition of the existing bridge.

The Modified LPA would require avoidance and minimization measures, including a spill prevention, control, and countermeasures plan, pollution control plan, and an erosion and sediment control plan. A Water Quality Protection and Monitoring Plan would also be required to satisfy 401 Water Quality Certifications monitoring and reporting requirements. Construction of the Modified LPA would comply with permit requirements.

Temporary water quality impacts during construction could result in behavioral responses from fish or other aquatic species, including temporary avoidance and reduced foraging abilities. These types of responses have been documented in fish at very low turbidity levels. Since construction activities may occur year-round, all species and life stages of fish in the Columbia River and North Portland Harbor could be exposed to reduced water quality conditions. The extent and duration of exposure to elevated levels of turbidity are expected to be limited and short term, and the minimization measures identified in Section 3.16.5 that would be implemented would be sufficient to minimize effects.

Temporary Overwater Lighting

Temporary overwater lighting would be required throughout construction and demolition to provide adequate lighting for barges, work platforms/bridges, construction of the replacement bridge decks, and demolition of the existing structures. Overwater lighting associated with temporary work structures may affect migratory movement and/or increase predation pressure within the study area for adult and outmigrating juvenile salmon, steelhead, and bull trout. Temporary lighting would not constitute a complete barrier to migrating juvenile fish; however, migrating juvenile salmonids, Pacific eulachon, Pacific lamprey, river lamprey, and other native resident fish that gather under light sources could be exposed to a higher risk of predation. Overwater lighting is not known to affect green or white sturgeon, given their preference for

deep-water habitats. Similarly, seals and sea lions are not expected to significantly alter their behavior or movement in response to temporary overwater lighting.

Elevated Underwater Noise

Temporarily elevated underwater noise can alter behavior, physical injury or increase mortality in aquatic species, depending on the intensity and characteristics of the sound, the distance from the noise source, the location in the water column, and other factors. The primary sources of underwater noise associated with the Modified LPA are impact pile driving, vibratory pile driving, drilled shaft oscillation, and noise from vessels.

Impact Pile Driving

Impact pile driving is the loudest potential underwater noise source that would be required for construction of the Modified LPA. The Modified LPA has been designed to minimize the likelihood of impacts resulting from pile installation activities. Pile installation would be performed to the greatest extent possible using a vibratory hammer, though piles may need to be driven to final tip elevation or proofed, as necessary, with an impact hammer. Proofing is the process of striking piles with an impact hammer to verify their load-bearing capacity. A bubble curtain would be implemented during all in-water impact pile driving to reduce the extent of underwater noise generated.

NOAA Fisheries has established specific decibel level thresholds for injury and disturbance from underwater noise associated with impact pile driving. Injury thresholds have been established for noise from a single pile strike (peak thresholds) and for exposure to noise from multiple strikes over a period of time (cumulative thresholds). A disturbance threshold has also been established for levels of underwater noise during impact pile driving that could cause disturbance but would not result in injury.

Impact pile driving during construction of the Modified LPA would result in noise levels that would temporarily exceed these injury and disturbance thresholds within portions of the Columbia River and North Portland Harbor, and exposed fish may have an increase in lethal and sublethal injuries. The extent of the injury would depend on several factors, including the size of the fish, duration of exposure, proximity to the source (the pile being driven), and size of the pile.

All species and life stages of salmon, steelhead, eulachon, lamprey, green sturgeon, white sturgeon, and other resident fish would be subject to potential injury and disturbance if present during impact pile driving. Bull trout are not expected to be present in the area where construction-related underwater noise could occur, and would not be affected by impact pile driving.

Impact pile driving can also affect marine mammals. Steller and California sea lions and harbor seals could potentially be exposed to elevated noise levels during pile driving. However, to avoid exposing marine mammals to levels of underwater noise that could result in injury, a marine mammal monitoring plan would be developed that would establish injury protection zones for marine mammals.

Vibratory Pile Driving and Drilled Shaft Oscillation

Noise generated during vibratory pile driving and drilled shaft oscillation does not generally result in injury to fish but can result in behavioral effects such as startling, momentary disruption in feeding, or avoidance of the area. Depending on site conditions, behavioral effects may be more significant, with consequences for survival and reproduction. For example, avoidance of the study area could cause delays in feeding or migration that could in turn affect spawning or outmigration success.

All species and life stages of salmon, steelhead, eulachon, lamprey, green sturgeon, white sturgeon, and other resident fish that use aquatic habitats within the Columbia River and North Portland Harbor could be exposed to these effects when they are present in the portion of the primary and secondary study areas where underwater noise would be elevated during vibratory pile driving and drilled shaft oscillation. Bull trout are

not expected to be present in the area where construction-related underwater noise could occur, and would not be affected by vibratory pile driving and drilled shaft oscillation.

Adult and/or juvenile fish present within the area where underwater noise would be temporarily elevated during vibratory pile driving, pile removal, and drilled shaft oscillation may be exposed to levels of underwater noise that could result in behavioral disturbance. This activity is unlikely to injure fish or significantly interfere with behaviors such as migration, rearing, or foraging. Thus, vibratory pile driving, pile removal, and drilled shaft oscillation are not likely to adversely affect these species.

Vibratory pile driving and drilled shaft oscillation can also affect marine mammals; more frequently this noise results in a lesser degree of harassment that does not result in injury. Harassment of marine mammals is regulated under the Marine Mammal Protection Act. Steller and California sea lions and harbor seals could be exposed to elevated noise levels that would result in harassment during vibratory pile driving. However, a marine mammal monitoring plan would be developed that would avoid exposure to injury.

Vessel Noise

Various types of vessels, including barges, tugboats, and small craft, would be present during construction. These vessels would move and operate within the Columbia River and North Portland Harbor on a year-round basis. Such vessels already use this portion of the study area in relatively high numbers; therefore, the vessels to be used in the construction of the Modified LPA do not represent a new noise source, only a potential increase in the frequency and duration of this type of activity.

Avian Predation

Construction of the Modified LPA is not expected to have an appreciable effect on avian predation pressure on juvenile salmonids, Pacific eulachon, lamprey, or other native fish. Temporary overwater structures are not likely to attract large concentrations of avian predators, compared to such features as nesting islands, water impoundments, or dam tailraces. However, avian predators are known to congregate on overwater structures, and construction of the Modified LPA would temporarily increase the number of available perches. It is therefore possible that avian predation pressure could temporarily increase to some extent within the primary study area.

Terrestrial Resources

Construction activities associated with the Modified LPA would result in temporary disturbance of terrestrial habitats in Oregon and Washington. This could include vegetation removal, grading, or other forms of temporary access and construction activities. Table 3.16-10 summarizes the approximate area of each resource that may be temporarily disturbed. The habitat designations overlap and are not cumulative.

Table 3.16-10. Temporary Disturbance of Sensitive Terrestrial Habitats

	Terrestrial Habitat	Temporary Disturbance of Sensitive Terrestrial Habitat (acres)
Oregon	“High” riparian/wildlife value habitats	4.6
	“Medium” riparian/wildlife value habitats	5.7
	Wetlands	2.56
	Wetland Buffers	7.11

	Terrestrial Habitat	Temporary Disturbance of Sensitive Terrestrial Habitat (acres)
Washington	Riparian Buffers	1.15
	Biodiversity Areas	2.87
	Oak Woodlands	0.03
	Wetlands	0
	Wetland Buffers	1.19

Oregon

In Oregon, construction of the Modified LPA would result in temporary disturbance of approximately 2.56 acres of wetland, 7.11 acres of wetland buffer, and approximately 10.3 acres of habitat identified as having a "high" or "medium" combined wildlife/riparian value in Portland's NRI, and approximately 2.56 acres of wetland. This would occur primarily within disturbed terrestrial riparian habitats on the shorelines of Hayden Island, on the south shoreline of North Portland Harbor, near the Vanport wetland, and in a partially forested area south of Martin Luther King Jr. Boulevard.

Construction of the Modified LPA would include revegetating temporarily disturbed riparian areas and other sensitive habitats in Oregon consistent with federal, state, and local regulations, for no net loss of habitat function.

Washington

In Washington construction of the Modified LPA would result in temporary disturbance of approximately 1.15 acres of riparian buffers, approximately 2.87 acres of a designated biodiversity area, approximately 0.03 acres of priority oak woodland habitat and approximately 1.19 acres of wetland buffer in Washington. This would primarily occur within terrestrial riparian habitat associated with Burnt Bridge Creek, which provides only moderate habitat function, as it is immediately adjacent to I-5. Construction of the Modified LPA would also disturb a small portion of an area designated as priority oak woodland habitat. However, the only area affected would be a grassy shoulder adjacent to I-5. No mature oak trees would be affected.

Construction of the Modified LPA would include revegetating temporarily disturbed riparian areas and other sensitive habitats in Washington consistent with federal, state, and local regulations, for no net loss of habitat function.

Terrestrial Noise and Disturbance

Terrestrial noise, lights, vegetation removal, and other roadway and transit construction disturbances could negatively affect the breeding, foraging, and dispersal of terrestrial species such as raccoons, bats, reptiles, and other terrestrial wildlife. Temporarily elevated noise can result in a range of potential wildlife reactions, which can include altered vocal behavior, changes in vigilance and foraging behavior, and changes in body condition. These responses could in turn result in increased energy expenditure or movement into less desirable locations with potentially greater exposure to predation. Lights used for nighttime work could disturb nocturnal animals such as owls or bats or disrupt the flight patterns of night-migrating birds.

To minimize impacts to migratory birds, all activities would be conducted consistent with the MBTA. Although the existing Interstate Bridge does not provide ideal roosting habitat for bats, several bat species that may pass near and use them for temporary roosting could be affected by construction disturbance. Short-term effects on raccoons, bats, reptiles, and other terrestrial wildlife could also result from temporary vegetation clearing.

Terrestrial Wildlife Passage

Construction equipment mobilization, storage, and use on or near riverbanks may temporarily affect wildlife passage. Wildlife species could alter their behavior to avoid construction activities, which in turn could increase the risks of human-wildlife conflicts and wildlife mortality.

Botanical Resources

Temporary vegetation disturbance associated with the construction of the Modified LPA are expected to be relatively minor and to occur primarily within disturbed areas adjacent to existing roadway infrastructure. The Modified LPA would temporarily disturb native vegetation within a few relatively small areas of functioning riparian and wetland habitats. Disturbance would be avoided and minimized to the extent practicable through project design and consistent with applicable federal, state, and local regulations. Compensatory mitigation would offset the net loss in habitat function.

No botanical SOI are known or expected to occur within the areas that would be temporarily disturbed. Therefore, botanical SOI are not expected to be impacted by the construction of the Modified LPA.

3.16.5 Indirect Effects

No-Build Alternative

No indirect effects are anticipated to result from the No-Build Alternative.

Modified LPA

Changes in Land Use

Transportation system changes can have different types and degrees of effects on land use, including induced growth, and changes in land use patterns. These effects can result in indirect effects on ecosystem resources, by increasing the amount, rate, or location of development.

In accordance with local land use plans, the Modified LPA could indirectly influence development or redevelopment near the proposed light rail stations in downtown Vancouver and Hayden Island. These areas are within a highly developed corridor, where habitat for terrestrial species is of limited quantity and quality. The Modified LPA is expected to encourage more compact development and/or redevelopment within existing urban areas that could accommodate future growth more efficiently, reducing potential loss of habitat and impervious surface throughout the region.

The Modified LPA also has the potential to affect how traffic moves through the study area. The tolling program could cause some drivers to seek an alternate crossing at the I-205 bridge. If enough vehicles were to divert to an alternate route, this could result in effects such as changes in the distribution of stormwater pollutants. A regional travel demand model was run for both the No-Build Alternative and the Modified LPA, which indicates that the Modified LPA would result in an approximately 2% shift in the relative distribution of crossings at the I-205 bridge. The model also indicates that improvements in transit would likely result in an approximately 1% decrease in the total number of vehicle miles travelled per weekday in the Portland Metropolitan region. These relatively minor changes would not result in measurable indirect effects on ecosystem resources.

Applicable federal, state, and local environmental regulations would minimize impacts from any such development or redevelopment activities. Local regulations require the avoidance and minimization of impacts to sensitive resources, including shorelines, wetlands, and riparian habitats. As such, indirect changes in land use patterns are not expected to result in adverse effects to ecosystem resources.

Prey Base for Southern Resident Killer Whales

Impacts on juvenile and adult salmon and steelhead and their habitat resulting from the Modified LPA could indirectly affect the food source for the ESA-listed SRKW. However, given the large numbers of fish in the Columbia River, the temporary nature of effects on individual fish, and the long-term beneficial effects on fish habitat that are anticipated because of mitigation and conservation measures, construction of the Modified LPA is not expected to have measurable effects on the distribution or abundance of potential food sources for the SRKW.

Federal Navigation Channel Dredging

Within the vicinity of the Interstate Bridge, there are four federally authorized navigation projects on the Columbia River: three federally authorized navigation channels that pass beneath the Interstate Bridge (the primary navigation channel, barge channel, and alternate barge channel) and the federally authorized Upper Vancouver Turning Basin located immediately downstream of the Interstate Bridge.

The federal navigation projects will be maintained with the Modified LPA. However, the primary navigation channel will be swapped with the existing barge channel which will move the primary navigation channel closer to the center of the river than its current location. No changes are proposed to authorized or maintained channel depths, and no dredging is proposed or reasonably certain to occur as a result of the Modified LPA. The existing bathymetry at the location of the proposed channels provides sufficient depth.

Federal Levee Modifications

The construction activities associated with the Modified LPA would likely require both temporary and permanent modifications to portions of the Portland Metro Levee System, which is a system of federal flood control levees located along the south bank of the Columbia River within the primary study area. The specific design of any such modifications have not yet been developed, but would likely include restoration of any temporarily disturbed portions of the levees, or permanent modifications where proposed infrastructure would intersect with the existing levee, or where access would change as a result of reconfiguration of the roadways. Modifications may also include improvements to existing levee function, if such improvements are requested or required by the U.S. Army Corps of Engineers or others. Any modifications or improvements would also be coordinated for consistency with the planned future condition of the levees under the Levee Ready Columbia project.

3.16.6 Potential Avoidance, Minimization, and Mitigation Measures

The design of the proposed Columbia River bridges has been modified to avoid and minimize impacts. Examples of these modifications include reducing the number of in-water piers, in-water timing restrictions, enhancement of the proposed stormwater treatment to exceed regulatory minimums, and configuration changes to avoid and minimize impacts to sensitive aquatic and terrestrial habitats. Construction methods have also been refined to avoid long-term impacts, such as developing an alternative shaft cap isolation system for four of the Columbia River Bridge piers, which would avoid the need for cofferdams and concrete seals in these locations.

Long-Term Effects

Regulatory Requirements

- Provide stormwater quality and quantity treatment that meets or exceeds applicable regulatory requirements for all post-project CIA.

Project-Specific Mitigation

- Avoid and minimize long-term impacts to ecosystem resources in final design to the extent practicable.
- Provide compensatory mitigation for unavoidable impacts to ecosystem resources, consistent with applicable federal, state, and local regulatory requirements.
- Prepare a compensatory mitigation plan that satisfies applicable federal, state, and local regulatory requirements, and that demonstrates no net loss of function of ecosystem resources.
- Provide an alternate nesting structure, either on the new Columbia River bridges or within the vicinity, to offset removal of an existing peregrine falcon nest from demolition of the existing Interstate Bridge.

Temporary Effects

Regulatory Requirements

The following impact avoidance and minimization measures would be implemented as regulatory requirements to avoid and minimize potential effects to ecosystem resources.

General Measures and Conditions

- Perform all work according to the requirements and conditions of the regulatory permits that are issued for the Modified LPA.
- Contractor prepare a Water Quality Protection and Monitoring Plan (WQPMP) to satisfy the monitoring and reporting requirements of the 401 Water Quality Certifications that are ultimately issued for the project. The WQPMP would be provided to NOAA Fisheries for review and approval prior to implementation. The WQPMP would identify the timing and methodology for water-quality sampling during construction of the Modified LPA, as well as methods of implementation and reporting. If, in the future, a standard water-quality monitoring plan is adopted by ODOT and/or WSDOT, this plan, with the agreement of NOAA Fisheries, may replace the contractor plan.
- In compliance with WSDOT and ODOT policy and construction administration practice in Oregon and Washington, have one or more department of transportation inspectors on site during construction. The role of the inspector(s) would be to monitor compliance with contract and permit requirements.
- If in-water dredging is required outside of a cofferdam, use a clamshell bucket. Dredging and handling and disposal of dredged materials shall be conducted consistent with the requirements and conditions of the regulatory permits issued for the Modified LPA.
- Prohibit work barges from grounding out.
- Dispose of excess or waste materials in an appropriate manner consistent with applicable local, state, and federal regulations; do not dispose of or abandon waste materials waterward of the OHWM or allow them to enter waters of the state.
- All pumps must employ a fish screen that meets the following specifications:
  - An automated cleaning device with a minimum effective surface area of 2.5 square feet per cubic foot per second and a nominal maximum approach velocity of 0.4 feet per second, or no automated cleaning device, a minimum effective surface area of 1 square foot per cubic foot per second and a nominal maximum approach rate of 0.2 feet per second; and
  - A round or square screen mesh that is no larger than 0.094 inches (2.38 millimeters [mm]) in the narrow dimension, or any other shape that is no larger than 0.069 inches (1.75 mm) in the narrow dimension; and

  - Each fish screen must be installed, operated, and maintained according to NOAA Fisheries fish screen criteria.

Spill Prevention/Pollution Control Measures

- Contractor prepare a spill prevention, control, and countermeasure (SPCC) plan and pollution control plan (PCP) prior to beginning construction. These plans would be provided to NOAA Fisheries for review and approval. The SPCC plan and PCP would identify the appropriate spill containment materials; as well as the means and methods of implementation, response, and reporting. All elements of the SPCC plan and PCP would be available at the project site at all times. For additional detail, consult ODOT Standard Specification 00290.00 to 00290.90.
- Contractor designate at least one employee as the erosion and spill control (ESC) lead. The ESC lead would be responsible for the implementation of the SPCC plan and PCP.
- Maintain applicable spill response equipment and material designated in the SPCC plan and PCP at the job site.
- With the exception of barges and stationary large equipment (cranes, oscillators) operating from barges or work platforms, fuel and maintain equipment at least 150 feet from the OHWM of any waterbody using secondary containment to minimize potential for spills or leaks entering the waterway.
- Clean and inspect all equipment to be used for construction activities prior to arriving at the project site, to ensure no potentially hazardous materials are exposed, no leaks are present, free of noxious weeds, and the equipment is functioning properly. Daily inspection and cleanup procedures would be identified.
- Should a leak be detected on heavy equipment used for the project, immediately remove the equipment from the area and do not use again until adequately repaired. Where off-site repair is not practicable, the SPCC plan and PCP would document measures to be implemented to prevent and/or contain accidental spills in the work/repair area to ensure no contaminants escape containment to surface waters and cause a violation of applicable water-quality standards.
- Operate construction equipment from on top of floating barges, from the decks of temporary work bridges and platforms, the decks of the existing or replacement bridges, or from portions of the streambank above the OHWM. Barges and support vessels would be operated in the water.
- Provide suitable containment measures for all equipment (including barges, work decks, stationary power equipment, and storage facilities in the SPCC plan and PCP to prevent and/or contain accidental spills to ensure that no contaminants escape containment to surface waters and cause a violation of applicable water-quality standards.
- Design and install temporary work bridges and platforms, cofferdams, and drilled shaft isolation casings consistent with the ODOT Hydraulics Manual, which establishes criteria to avoid these structures being overtopped during high water events.
- Process water generated on site from construction, demolition or washing activities would be contained and treated to meet applicable water-quality standards before entering or reentering surface waters.
- Do not conduct paving, chip sealing, or stripe painting activities during periods of rain or wet weather.
- In the SPCC plan and PCP, establish a concrete truck chute cleanout area to properly contain wet concrete as part of ODOT Standard Specification 00290.30(a).

Site Erosion/Sediment Control Measures

- Contractor prepare and implement an erosion and sediment control plan (ESCP) to minimize impacts associated with clearing, vegetation removal, grading, filling, compaction, or excavation. The BMPs

identified in the ESCP would be used to control sediments from all vegetation removal or ground-disturbing activities. Additional temporary control measures may be required beyond those described in the ESCP if it appears pollution or erosion may result from weather, nature of the materials or progress on the work. For additional detail, consult ODOT Standard Specifications 00280.00 to 00280.90.

- As part of the ESCP, delineate clearing limits with orange barrier fencing wherever clearing is proposed in or adjacent to a stream/wetland or its buffer and install perimeter protection/silt fence as needed to protect surface waters and other critical areas. Location would be specified in the field, based upon site conditions and the ESCP. For additional silt fence detail, consult ODOT Standard Specification 00280.16(c).
- Contractor designate at least one employee as the ESC lead. The ESC lead would be responsible for the implementation of the SPCC plan and PCP and would also be responsible for ensuring compliance with all local, state, and federal erosion and sediment control requirements.
- All ESCP measures would be inspected and maintained as required by applicable permit requirements. Contractor would also conduct maintenance and repair of ESCP measures as described in ODOT Standard Specifications 00280.60 to 00280.70.
- For landward construction and demolition, locate project staging and material storage areas a minimum of 150 feet from surface waters, in currently developed areas such as parking lots or managed fields, unless a site visit by an ODOT/WSDOT biologist determines (and an ODOT/NOAA Fisheries liaison confirms) that the topographic features or other site characteristics allow for site use closer to the edge of surface waters.
- Complete excavation activities under dry or dewatered conditions where practicable. All surface water flowing toward the excavation would be diverted through utilization of cofferdams and/or berms. Cofferdams and berms must be constructed of sandbags, clean rock, steel sheeting, or other non-erodible material.
- Limit bank shaping to the extent as shown on the approved grading plans. Minor adjustments made in the field would occur only after engineer's review and approval.
- Install biodegradable erosion control blankets on areas of ground-disturbing activities on steep slopes (1V:3H or steeper) that are susceptible to erosion and within 150 feet of surface waters. Areas of ground-disturbing activities that do not fit the above criteria would implement erosion control measures as identified in the approved ESCP. For additional erosion control blanket detail, consult ODOT Standard Specification 00280.14I.
- Cover erodible materials (material capable of being displaced and transported by rain, wind or surface water runoff) temporarily stored or stockpiled for use in project activities to prevent sediments from being washed from the storage area to surface waters. Temporary storage or stockpiles must follow measures as described in ODOT Standard Specification 00280.42.
- Stabilize all exposed soils as directed in measures prescribed in the ESCP. Hydro-seed all bare soil areas following grading activities and revegetate all temporarily disturbed areas with native vegetation indigenous to the location. For additional details, consult ODOT Standard Specifications 01030.00 to 01030.90
- Where site conditions support vegetative growth, plant native vegetation indigenous to the location in areas temporarily disturbed by construction activities. Revegetation of construction easements and other areas would occur after the project is completed. Trees would be planted when consistent with highway safety standards. Riparian vegetation would be replanted with species native to geographic region.

Planted vegetation would be maintained and monitored to meet regulatory permit requirements. For additional detail, consult ODOT Standard Specifications 01040.00 to 01040.90.

Pile Installation and Removal Best Management Practices

- Use a vibratory hammer to drive steel piles to the maximum extent practicable, to minimize noise levels.
- Conduct impact pile driving below the OHWM between September 15 and April 15. Vibratory pile installation and removal (as well as certain other in-water construction activities) may occur on a year-round basis, provided they are conducted in compliance with all regulatory approvals.
- No more than two impact pile drivers would be operated simultaneously within the same waterbody channel.
- Employ a bubble curtain or other similarly effective noise attenuation device during all impact pile driving conducted in water depths greater than 2 feet (0.67 meters).
- Develop and implement a hydroacoustic monitoring plan, based on the template developed by the Fisheries Hydroacoustic Working Group, in coordination with FHWA and FTA to confirm the effectiveness of the noise attenuation devices and that predicted noise levels adequately capture the area of the potential onset of injury. The plan would be provided to NOAA Fisheries for review and approval prior to any impact pile-driving activity commencing.
- Install cones or other anti-perching devices on open-ended pipe piles to discourage perching by piscivorous birds.
- Remove temporary piles with a vibratory hammer, or by direct pulling, and prohibit intentionally breaking by twisting or bending.
- In the event that a temporary pile cannot be removed, cut or press the pile 3 feet below the mudline. At locations where hazardous materials are present or adjacent to utilities, temporary piles may be cut off at the mud line with underwater torches, if such activity wouldn't conflict with navigation elements.

Work Area Isolation and Fish Salvage Best Management Practices

- Develop a temporary water management plan, consistent with the requirements of ODOT Special Provision Section 00245.03, and provide to NOAA Fisheries for review and approval prior to any work area isolation of fish salvage activities.
- Install cofferdams and isolation casings in a manner that minimizes fish entrapment. Sheet piles would be installed from upstream to downstream, lowered slowly until contact with the substrate.
- Screen drilled shaft isolation casings at the bottom, to minimize potential for fish entrapment during installation. Screen shall have maximum openings of approximately 3/32 inch (2.38 mm) measured on a diagonal (NOAA Fisheries 2022).
- Conduct fish salvage according to the best practices established in the biological opinion for ODOT's Federal Aid Highway Programmatic consultation.
- Have a qualified fishery biologist[1] would conduct and supervise fish capture and release activity to minimize risk of injury to fish.
- Prepare a fish salvage report and submit to NOAA Fisheries.

[1] The qualified biologist shall have a bachelor's degree in biology, fisheries, or equivalent and a minimum of 2 years of experience identifying northwest fish and aquatic species. If electrofishing is required, the lead biologist shall be competent with electrofishing procedures and have completed at least 100 hours of fish salvage following NOAA Fisheries, USFWS, ODFW, and/or WDFW fish salvage/fish removal protocols.

- U.S. Fish and Wildlife Service (USFWS), Oregon Department of Fish and Wildlife (ODFW), and WDFW following project completion.
- Make a reasonable effort to capture ESA-listed fish known or likely to be present in an in- water isolated work area using methods that minimize the risk of injury. Attempts to seine and/or net fish would precede the use of electrofishing equipment.
- If electrofishing must be used, conduct consistent with NOAA Fisheries "Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act" (NOAA Fisheries 2000), or most recent version.

Work Area Lighting BMPs

- Conduct construction activities consistent with local, state and federal permit restrictions for allowable work hours. If work occurs at night, temporary lighting may be required to provide better visibility for driver and worker safety. If temporary lighting is required, contractor would use directional lighting with shielded luminaries to control glare and direct light onto work area, not surface waters.

Project-Specific Mitigation

- Avoid and minimize short-term impacts to ecosystem resources in final design to the extent practicable.
- Restore temporarily disturbed terrestrial habitats consistent with applicable regulatory requirements.
- Provide compensatory mitigation for unavoidable impacts to ecosystem resources, consistent with applicable federal, state, and local regulatory requirements.
- Conduct activities with the potential to impact nesting migratory birds, such as nest removal, consistent with the provisions of the MBTA, which requires nests of migratory birds to be removed only at times when nests are inactive.