Vegetation, Wildlife, and Aquatic Species Technical Report

Multltnomah County | Earthquake Ready Burnside Bridge Project

Portland, OR

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Earthquake Ready Burnside Bridge Vegetation, Wildlife, and Aquatic Species Technical Report

Prepared for

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Acronyms, Initialisms, and Abbreviations

ADA	American Disabilities Act
APHIS	Animal and Plant Health Inspection Service
API	Area of Potential Impact
BA	Biological Assessment
BMP	Best Management Practice
dB	decibels
dBA	A-weighted decibels
DPS	distinct population segment
DSL	Oregon Department of State Lands
EFH	essential fish habitat
EIS	environmental impact statement
EQRB	Earthquake Ready Burnside Bridge
ESA	Endangered Species Act
FHWA	Federal Highway Administration
GIS	geographic information system
I-5	Interstate 5
IPaC	USFWS Information Planning and Consultation System
IWWW	In-water work window
NOAA	National Oceanic and Atmospheric Administration
OAR	Oregon Administrative Rules
OHWM	Ordinary High Water Mark
OLWM	Ordinary Low Water Mark
ODFW	Oregon Department of Fish and Wildlife
ODOT	Oregon Department of Transportation
ORBIC	Oregon Biodiversity Information Center
SWH	Shallow Water Habitat
U.S.	United States
USFWS	U.S. Fish and Wildlife Service

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Executive Summary

As part of the Draft Environmental Impact Statement for the Earthquake Ready Burnside Bridge Project (Project), this technical report was prepared to identify and evaluate potential impacts to vegetation, wildlife, and aquatic species. The report identifies the existing conditions within the Project's Area of Potential Impact (API), outlines the regulations and required permits from multiple agencies that have jurisdiction over the Project, and summarizes each proposed alternative and its impacts to those resources. Impacts were assessed for pre-earthquake and post-earthquake scenarios, and include temporary, permanent, direct, indirect, and cumulative impact assessments.

Vegetation within the Project Area that could be affected by the Project includes riparian vegetation on both banks of the Willamette River, street trees along sidewalks on both sides of the river, and vegetation within Tom McCall Waterfront Park. No threatened or endangered plant species exist within the API. The existing riparian vegetation provides habitat for wildlife in the API. Although habitat connectivity is degraded, it is important for the species traveling through and using resources within the Project Area. Impacts to wildlife would be temporary and caused by construction activities, such as temporary loss of habitat and the creation of undesirable conditions due to noise. Most wildlife using the Project Area are species that have adapted to urban environments. No threatened or endangered terrestrial species are present in the API. Vegetation, and subsequently wildlife habitat, will be temporarily removed during construction, in the amount of approximately 1.1 to 1.3 acres of herbaceous and woodland vegetation, and between 89 and 127 trees, depending on the Build Alternative selected and whether or not a temporary bridge is used. Construction would last between 3.5 to 6.5 years, depending on the Build Alternative selected and whether or not a temporary bridge is used. After bridge construction is complete, compensatory mitigation will be implemented to restore vegetation and wildlife habitat.

Aquatic species present in the API include nearly 50 species of fish, some of which are listed under the Endangered Species Act as threatened or endangered, including Chinook Salmon, Coho Salmon, Steelhead, Eulachon, and Green Sturgeon. Other species include seals and sea lions, which are protected under the Marine Mammal Protection Act, and macroinvertebrates. The existing Burnside Bridge structure currently occupies approximately 0.35 acre of in-stream habitat, of which approximately 2,857 square feet is shallow water habitat. Shallow water habitat is critical to juvenile salmonids as it provides refuge and food sources, but has been extensively reduced over time from activities associated with development. Within the Project Area, the amount of existing shallow water habitat is approximately 3.4 acres. Both temporary and permanent impacts would occur to aquatic species from construction activities. Pile installation and removal causes hydroacoustic impacts that lead to fish injury and mortality. Other impacts include physical alteration of habitat, reduction in visibility, and reduction of available food sources. Permanent impacts to aquatic species would occur from structure placement in the river, including within shallow water habitat, and stormwater impacts. The total approximate loss of in-stream habitat ranges from 0.45 acre to 1.05 acres, depending on the Build Alternative and movable span option selected. Of this area, between 211 and 231 square feet of shallow water habitat would be permanently lost.

When considering all potential impacts to vegetation, wildlife, and aquatic species in a post-earthquake scenario, the No-Build Alternative would cause the largest impact because the bridge is expected to fail in the event of an earthquake, collapsing into the river and riparian area below. Of the Build Alternatives, the alternative with the least impact to vegetation and wildlife would be the Retrofit Alternative, due to the shortest construction schedule, smallest anticipated area of construction, and least amount of tree removal required. The Couch Extension Alternative would have the greatest impact on vegetation and wildlife due to the highest amount of tree removal required. For aquatic species, the Long-span Alternative (with a vertical lift) would have the least amount of permanent structure installed within the river and therefore less in-stream habitat loss, but would have the longest duration of pile driving, which creates hydroacoustic impacts. The Retrofit Alternative would lead to the largest impact based on in-stream habitat loss, but has the shortest pile driving duration. Mitigation measures would be implemented to avoid, minimize, reduce, or compensate for impacts to vegetation, wildlife, and aquatic species. Unavoidable actions, such as removal of artificial fill from the floodplain, will be mitigated through aquatic habitat and riparian restoration within the Lower Willamette River, which could include the purchase of mitigation bank credits. At the time of this report, the level of design was insufficient to determine the exact mitigation requirements, which will need to be determined through agency coordination at a later date.

1 Introduction

As a part of the preparation of the Environmental Impact Statement (EIS) for the Earthquake Ready Burnside Bridge (EQRB) Project, this technical report has been prepared to identify and evaluate vegetation, wildlife, and aquatic species within the Project's Area of Potential Impact (API).

1.1 Project Location

The Project Area is located within the central city of Portland. The Burnside Bridge crosses the Willamette River connecting the west and east sides of the city. The Project Area encompasses a one-block radius around the existing Burnside Bridge and W/E Burnside Street, from NW/SW 3rd Avenue on the west side of the river and NE/SE Grand Avenue on the east side. Several neighborhoods surround the area including Old Town/Chinatown, Downtown, Kerns, and Buckman. Figure 1 shows the Project Area.

1.2 Project Purpose

The primary purpose of the Project is to build a seismically resilient Burnside Street lifeline crossing over the Willamette River that will remain fully operational and accessible for vehicles and other modes of transportation following a major Cascadia Subduction Zone earthquake. The Burnside Bridge will provide a reliable crossing for emergency response, evacuation, and economic recovery after an earthquake. Additionally, the bridge will provide a long-term safe crossing with low-maintenance needs.

2 Project Alternatives

The Project Alternatives are described in detail with text and graphics in the draft *EQRB Description of Alternatives Report* (Multnomah County 2021d). That report describes the alternatives' current design as well as operations and construction assumptions.

Briefly, the DEIS evaluates the No-Build Alternative and four Build Alternatives. Among the Build Alternatives there is an Enhanced Seismic Retrofit Alternative that would replace certain elements of the existing bridge and retrofit other elements, and three Replacement Alternatives that would completely remove and replace the existing bridge. In addition, the DEIS considers options for managing traffic during construction. Nomenclature for the alternatives/options are:

- No-Build Alternative
- Build Alternatives:
  - Enhanced Seismic Retrofit (Retrofit Alternative)
  - Replacement Alternative with Short-span Approach (Short-span Alternative)
  - Replacement Alternative with Long-span Approach (Long-span Alternative)
  - Replacement Alternative with Couch Extension (Couch Extension Alternative)

- Construction Traffic Management Options
  - Temporary Detour Bridge Option (Temporary Bridge) includes three modal options:
    - Temporary Bridge: All modes
    - Temporary Bridge: Transit, Bicycles and Pedestrians only
    - Temporary Bridge: Bicycles and Pedestrians only
  - Without Temporary Detour Bridge Option (No Temporary Bridge)

3 Definitions

The following terminology will be used when discussing geographic areas in the EIS:

- **Project Area –** The area within which improvements associated with the Project Alternatives would occur and the area needed to construct these improvements. The Project Area includes the area needed to construct all permanent infrastructure, including adjacent parcels where modifications are required for associated work such as utility realignments or upgrades. For the EQRB Project, the Project Area includes approximately a one-block radius around the existing Burnside Bridge and W/E Burnside Street, from NW/SW 3rd Avenue on the west side of the river and NE/SE Grand Avenue on the east side.
- **Area of Potential Impact –** This is the geographic boundary within which physical impacts to the environment could occur with the Project Alternatives. The API is resource-specific and differs depending on the environmental topic being addressed. For all topics, the API will encompass the Project Area, and for some topics, the geographic extent of the API will be the same as that for the Project Area; for other topics (such as for transportation effects) the API will be substantially larger to account for impacts that could occur outside of the Project Area. The API for vegetation, wildlife, and aquatic species is defined in Section 5.1.
- **Project vicinity –** The environs surrounding the Project Area. The Project vicinity does not have a distinct geographic boundary but is used in general discussion to denote the larger area, inclusive of the Old Town/Chinatown, Downtown, Kerns, and Buckman neighborhoods.

4 Legal Regulations and Standards

4.1 Laws, Plans, Policies, and Regulations

The following rules and regulations were used to guide data collection for vegetation, wildlife, and aquatic species in the API.

4.1.1 Federal

- Endangered Species Act (ESA) Section 7 requires federal agencies to ensure that actions they authorize, fund, or carry out do not jeopardize the existence of any species listed under the ESA, or destroy or adversely modify designated critical habitat of any listed species.

- 50 CFR § 424.11 lists the factors for listing species under the ESA, and include the following:
  - The present or threatened destruction, modification, or curtailment of its habitat or range
  - Overutilization for commercial, recreational, scientific, or educational purposes
  - Disease or predation
  - The inadequacy of existing regulatory mechanisms
  - Other natural or manmade factors affecting its continue existence

- Migratory Bird Treaty Act (MBTA) protects migratory birds, making it illegal to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid Federal permit.
- Bald and Golden Eagle Protection Act protects two species of eagle through the prohibition of "take."
- Fish and Wildlife Coordination Act protects fish and wildlife by requiring consultation when a Federal agency modifies a body of water. It also provides the opportunity to evaluate impacts from development on fish and wildlife.
- Marine Mammal Protection Act prohibits the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.
- Magnuson-Stevens Fishery Conservation and Management Act is the primary law governing marine fisheries management in U.S. federal waters, which has coordination and findings requirements that will need to be met.
- Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act: 40 CFR Part 1502 guides the preparation of an EIS.
- Executive Order 13751: Safeguarding the Nation from Impacts of Invasive Species prevents the introduction of invasive species and provide for their control, and to minimize the economic, plant, animal, ecological, and human health impacts caused by invasive species.

4.1.2 State

- Oregon Administrative Rules (OAR) Division 412: Fish Passage prohibits the construction of artificial obstruction across any waters in the state and outlines fish passage requirements.
- Oregon Sensitive Species Rule (OAR 635-100-0040) focuses fish and wildlife conservation, management, and research on species that need conservation attention.

- Oregon's Statewide Planning Goals & Guidelines (OAR 660-015-0000); the most applicable goals include:
  - Goal 5: Natural Resources, Scenic and Historic Areas, and Open Spaces: protects natural resources and conserves scenic and historic areas and open spaces.
  - Goal 15: Willamette River Greenway: protects, conserves, enhances, and maintains the natural, scenic, historical, agricultural, economic, and recreational qualities of lands along the Willamette River as the Willamette River Greenway.

4.1.3 Local

- Multnomah County Comprehensive Plan Chapter 5: Natural Resources protects, conserves, and manages the county's natural resources.
- City of Portland Codes protect the health, safety, and welfare of Portland citizens; and contribute to vital neighborhoods.
  - Title 11 – Trees: enhances the quality of the urban forest and optimizes the benefits that trees provide.
  - Title 24 – Building Regulations: provides security of occupants and users of buildings and structures within the City.
  - Title 29 – Property Maintenance Regulations: prevents deterioration of existing housing and the exterior of non-residential structures.
  - Title 33 – Planning and Zoning: regulates land use and manages growth within the City.
- City of Portland Bureau of Environmental Services (BES) Best Management Practices
  - Protecting Nesting Birds: informs habitat management decisions and project timing, selection, design, and maintenance considerations.
  - Erosion and Sediment Control: provides guidance for temporary and permanent erosion prevention, sediment control, and control of other development activities.
  - Portland Plant List: provides lists of native plants to use for restoration as well as a nuisance list of invasive plants to remove when found.
- Metro Urban Growth Management Functional Plan Title 13: Nature in Neighborhoods conserves, protects, and restores a continuous ecologically viable streamside corridor system integrated with the upland wildlife habitat and the urban landscape.

4.2 Design Standards

The following federal, state, and local design standards were explored to guide data collection to reduce impacts to vegetation, wildlife, and aquatic species in the API:

- Oregon Department of Transportation (ODOT) and the Federal Highway Administration's (FHWA) Design standards in the current version of the Federal Aid Highway Program Programmatic User's Guide

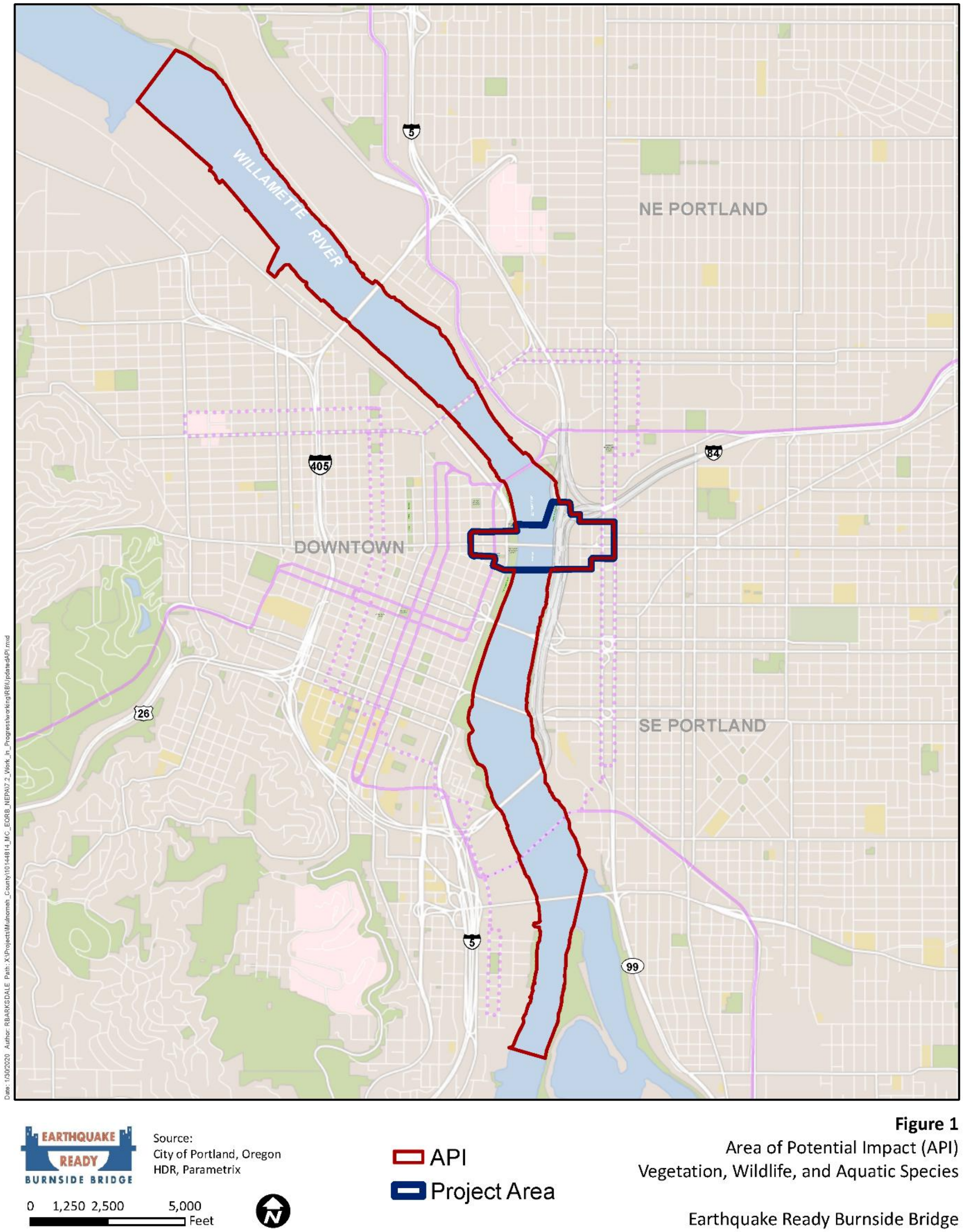
- ODOT Standard Specifications for Construction
- Multnomah County Design Standards, Section 5 (Drainage), and Section 8 (Landscape Treatments)
- City of Portland Erosion, Sediment, and Pollutant Control Plan (Title 10 Portland City Code)
- City of Portland Tree and Landscaping Manual

5 Affected Environment

5.1 Area of Potential Impact

The API for the vegetation, wildlife, and aquatic species analysis is larger than the Project Area. The API encompasses potential impacts beyond the Project Area in the Willamette River by approximately 12,000 feet upstream and approximately 15,000 feet downstream (Figure 1). This identified impact distance accounts for potential hydroacoustic impacts, which can travel beyond the immediate vicinity of the physical footprint impact taking place. Potential downstream impacts resulting from stormwater effects extending outside the API will be further addressed during consultation with NOAA Fisheries. The east-west boundaries of the API are the same as the Project Area.

Figure 1. Area of Potential Impact



5.2 Resource Identification and Evaluation Methods

5.2.1 Published Sources and Databases

The following sources were used to identify existing conditions of vegetation, wildlife, and aquatic species in the Project Area:

- Vegetation, Street Tree, and Heritage Tree geographic information system (GIS) datasets from the City of Portland
- Bathymetric data from the City of Portland
- Aerial photos from Google Earth
- Maps of Essential Salmonid Habitat from the Oregon Department of State Lands (DSL) and Essential Fish Habitat from NOAA Fisheries
- ESA-listed species and their critical habitat from the Oregon Biodiversity Information Center (ORBIC)
- Consultation data from NOAA Fisheries
- Reports and/or data from the Oregon Department of Fish and Wildlife (ODFW) and USFWS
- Natural Resource Inventory from the City of Portland
- Willamette River Natural Resources Protection Plan from the City of Portland
- Willamette River Greenway Inventory from the City of Portland
- Federal register notices for critical habitat locations from USFWS and NOAA Fisheries
- List of endangered species from the USFWS Information, Planning, and Consultation (IPaC) System

5.2.2 Field Visits and Surveys

HDR performed field surveys on June 7 and 19, 2019 to investigate the existing vegetation and wildlife presence, species, and distribution. To prepare for field work, HDR accessed data from the sources listed above to determine which protected or locally important species could be located within the API. An HDR biologist performed additional background research to select an appropriate time for field surveys based on expected species in the API. Field biologists documented findings with photos (Appendix A).

5.3 Existing Conditions

Baseline conditions of the vegetation, wildlife, and aquatic species determined to be present or having the potential to occur within the API are described below and were used to compare impacts of the Project Alternatives in Section 7.

5.3.1 Vegetation

Vegetation provides ecological functions to a variety of environments. It provides habitat and food sources for wildlife, improves air quality, provides in-stream shade, filters stormwater, and contributes to flood control. It also provides societal benefits by connecting people with nature and reducing stress (Talal and Santelmann 2019; Beyer et al. 2014). Even though the API is highly developed, the existing vegetation is providing important functions to the immediate surroundings, affecting natural resources.

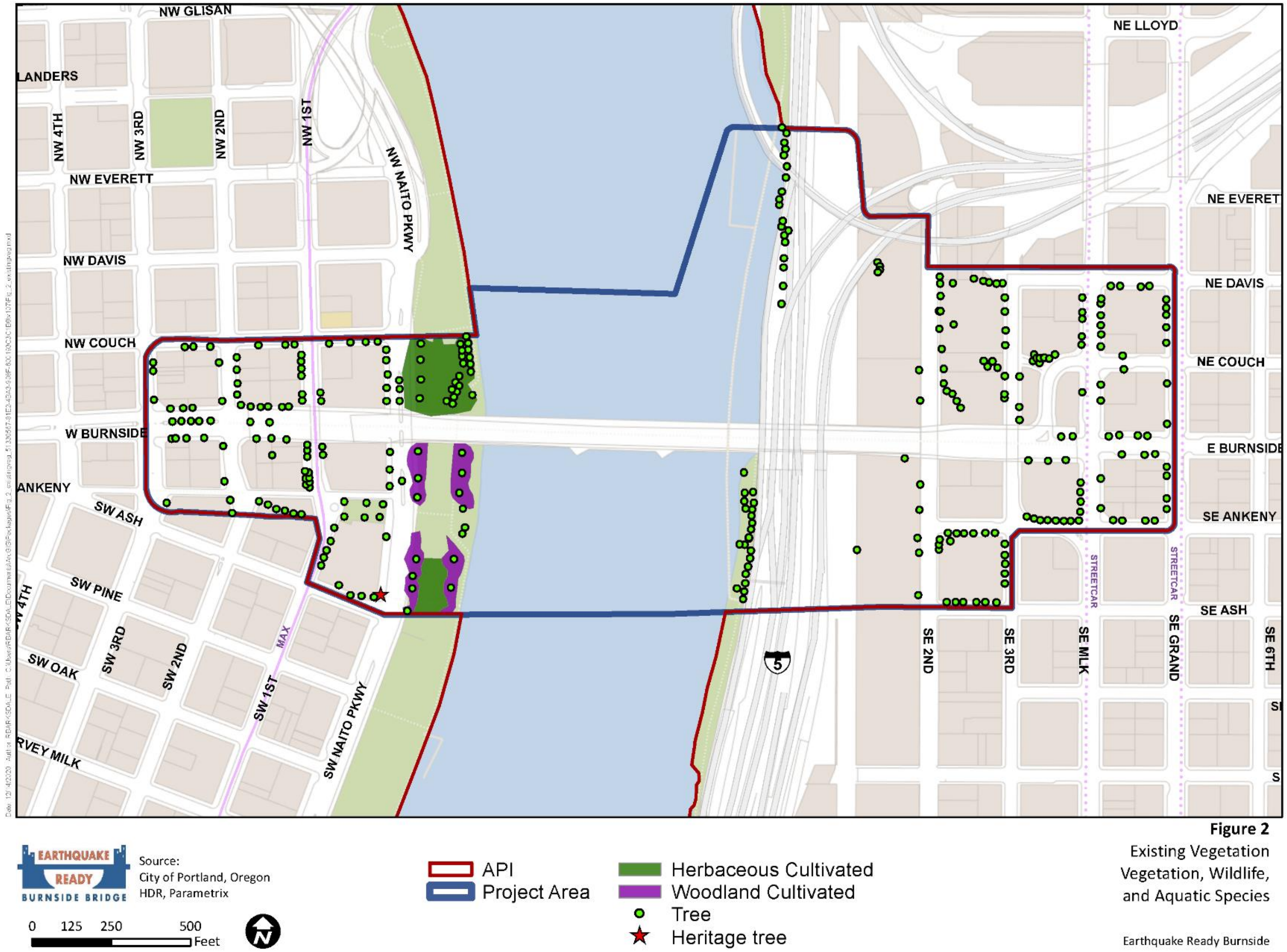
According to GIS data from the City of Portland (2019), two vegetation types exist within the API: woodland and herbaceous. Woodland vegetation is characterized as open stands of trees that generally form 25-60 percent cover. Herbaceous vegetation is characterized by a predominance of herbs less than 0.5 meters tall, generally forming at least 25 percent cover. The vegetation GIS data includes patches of vegetation that cover a minimum of 0.5 acres in the API. Per the City's mapping, on the west side of the river, south of the Burnside Bridge, there are two patches of woodland vegetation that include different varieties of ornamental oak and nonnative flowering cherry. North of the bridge on the west side, there is one patch of herbaceous vegetation dominated by nonnative grasses (Figure 2). No other patches exist in the API that are at least 0.5 acres in area.

In general, riparian areas can extend many feet laterally from the river. Within the API, there is some existing riparian vegetation on the west side of the river. Given the impervious surfaces and sea wall located immediately adjacent to the river, the riparian area is limited to the park vegetation, which provides some habitat and food resources to birds and wildlife (Appendix A, Photo 1). Besides ornamental park trees, street trees, and turf within Tom McCall Waterfront Park, the remaining existing vegetation includes scattered patches of disturbed, nonnative grasses in the API on the west side of the river. There is one existing heritage tree, a Yoshino cherry (*Prunus yedoensis*), within the API on the west side of the river, at the corner of SW Naito Parkway and SW Ash Street. South of the bridge, most of the existing trees within the park are large and mature, with a few young individuals. North of the bridge is a mix of younger, small trees towards the center of the park, and larger, mature trees lining the walking paths.

On the east side of the river, south of the bridge, there is a row of white ash (*Fraxinus americanus*) trees along the Vera Katz Eastbank Esplanade. The Willamette River bank is a steep slope dominated by invasive Himalayan blackberry (*Rubus armeniacus*; Appendix A, Photo 2). Saplings of Pacific willow (*Salix lasiandra*) and tree of heaven (*Ailanthus altissima*) are scattered among the herbaceous vegetation, as well as several black oak (*Quercus kelloggii*) seedlings. Few large trees are present within this patch of riparian vegetation that spans from the ordinary high water mark (OHWM) of the river, up to the Vera Katz Eastbank Esplanade. The largest trees present include single individuals of Pacific madrone (*Arbutus menziesii*), black cottonwood (*Populus trichocarpa*), and American elm (*Ulmus americana*). Many Douglas' spiraea (*Spiraea douglasii*) are mixed in with blackberry, as well as few individuals of sword fern (*Polystichum munitum*). Grasses, including common velvetgrass (*Holcus lanatus*) and brome (*Bromus* sp.), are present in small scattered patches. Weedy species commonly found in disturbed areas include the invasive bull thistle (*Cirsium vulgare*), poison hemlock (*Conium maculatum*), and nipplewort (*Lapsana communis*).

North of the bridge on the east side of the river underneath Interstate-5 (I-5), trees are scattered along the bank of the river. The riverbank is made up of gravel and cobble, with little to no herbaceous vegetation, except for sparsely scattered nonnative grasses and weed species east of I-5. The dominant tree species in this area is big leaf maple (*Acer macrophyllum*), which is a native species, American elm, which is not indigenous to the Pacific Northwest, and tree of heaven, an invasive species. A small number of Western sycamore (*Platanus racemosa*) and catalpa (*Catalpa* sp.) trees are present among the riparian vegetation in this location. Street trees, right-of-way medians, and green roofs are the only other existing vegetation in the API on the east side of the Willamette River. The total amount of existing vegetation in the API is approximately 2.5 acres and approximately 319 trees.

Figure 2. Existing Vegetation in the API



According to data from the Oregon Biodiversity Information Center (ORBIC), no ESA-listed threatened or endangered plant species are located within the API. A review of aerial photos dating back to 1952 show that the only change in vegetation is the growth of the trees that have been there since 1952.

According to IPaC data, the API is within range of several threatened and endangered flowering plants (Table 1). None of these were observed during field surveys conducted in early-to mid-June 2019. The targeted endangered plant species listed below are believed to be absent from the API, based upon surveys and site conditions.

Table 1. List of Threatened and Endangered Plant Species with a Potential Range in the API

Common Name	Scientific Name	Status	Range	Flowering Period
Bradshaw's desert-parsley	*Lomatium bradshawii*	Endangered	Willamette Valley, OR, Clark County, WA	April to early May
Kincaid's lupine[a]	*Lupinus sulphureus ssp. Kincaidii*	Threatened	Willamette Valley, OR, Lewis County, WA	Mid-April through June
Nelson's checker-mallow	*Sidalcea nelsoniana*	Threatened	Northwest OR, southwest WA	Mid-May through September
Water howellia	*Howellia aquatilis*	Threatened	Northern CA, Willamette Valley, OR, western and eastern WA, northern ID, western MT	May through August
Willamette daisy[a]	*Erigeron decumbens*	Endangered	Northwest OR	June through early July

Source: IPaC 2019, USFWS 2019a.
[a] Plants have designated final critical habitat outside of the API.

5.3.2 Wildlife

Wildlife Habitat

There are three general wildlife habitat types within the API: riparian, aquatic, and urban. Riparian habitat is the transitional area from rivers and streams to upland areas. Riparian areas provide important habitat and resources to birds and wildlife, even if in degraded conditions as are found in the API. The existing riparian area east of the river likely provides the most resources to wildlife within the API. However, it lacks diversity of vegetation, and is mostly made up of riprap and invasive plant species. The riparian area has been disturbed by the construction of the I-5 and I-84 freeway overpasses. The shade of the I-5 and I-84 overcrossing structures hinders vegetation growth. There are few trees in the riparian area north of the Burnside Bridge that provide food and cover resources for birds and wildlife. Dominant vegetation present is not native. South of the bridge, the east bank is lined with riprap but is partially vegetated. Most of the existing vegetation is invasive, but still could provide habitat and resources for those terrestrial species that have adapted to urban life.

Tom McCall Waterfront Park on the west side of the river, although separated from the river by the sea wall, can also provide habitat and other resources to wildlife. Trees, shrubs, and grasses make up the park vegetation, which can be used by urban-adapted birds and wildlife for foraging and habitat resources.

Beyond the riparian area (east side of the river) and the park (west side of the river), little wildlife habitat exists in the API. Due to the highly urbanized setting, habitat connectivity has been modified by the construction of streets, buildings, and other transportation facilities. Development reduces vegetation and food sources, thereby decreasing wildlife occurrence. Potential habitat used by urban-adapted species in the developed areas upland from the river includes bioswales, street trees, green roofs, and yards.

Terrestrial Species

The Willamette River corridor is part of the Pacific Flyway, which is used by more than 100 species of resident and migratory birds (City of Portland 2011). During the field visits, bird species observed in the API included Canada geese (*Branta Canadensis*; Appendix A, Photo 3), nonnative rock pigeons (*Columba livia*), a barn swallow (*Hirundo rustica*), a song sparrow (*Melospiza melodia*), and an American crow (*Corvus brachyrhynchos*). No nests were observed in the structures supporting the bridge or in vegetation where viewing was accessible.

According to IPaC data, there are three threatened birds with potential ranges that include the API, but their critical habitat is outside of the API (Table 2). The potential ranges are broad geographic ranges, such as “portions of Oregon” or “the Willamette Valley,” although there may not be suitable habitat in the entire range. For example, the northern spotted owl’s suitable habitat does not include urban environments; therefore, is not expected to be present within the Project Area, API, or Project Vicinity. Although the API does not include suitable habitat for the threatened bird species listed in Table 2, they were taken into consideration as part of the potentially affected environment in this report. During the field visits, none of the threatened bird species listed in Table 2 was observed.

Table 2. Threatened Bird Species with a Potential Range in the API

Common Name	Scientific Name	Status	Range
Northern spotted owl	*Strix occidentalis*	Threatened	Portions of CA, OR, WA, Canada
Streaked horned lark	*Eremophila alpestris strigata*	Threatened	Willamette Valley, OR, western WA
Yellow-billed cuckoo	*Coccyzus americanus*	Threatened	Western US, Canada, Mexico

Source: IPaC 2019, USFWS 2019a

Several migratory birds protected under the USFWS Migratory Bird Treaty Act may be present in the API. The birds listed in Table 3 are of particular concern because they are either designated as USFWS Birds of Conservation Concern or are protected by the USFWS Bald and Golden Eagle Act. No species listed in Table 3 were observed during the field visits.

Table 3. Migratory Birds of Particular Concern with a Potential Range (Continental U.S. and Alaska) in the API

Common Name	Scientific Name	Birds of Conservation Concern (BCC)	Bald and Golden Eagle Protection Act	Breeding Period
Bald eagle	*Haliaeetus leucocephalus*	No	Yes	January 1 – September 30
California thrasher	*Toxostoma redivivum*	Yes - Rangewide	Yes	January 1 – July 31
Golden eagle	*Aquila chrysaetos*	No	Yes	January 1 – August 3
Great blue heron	*Ardea Herodias fannini*	Yes - BCR	No	March 15 – August 15
Lesser yellowlegs	*Tringa flavipes*	Yes - Rangewide	No	Breeds elsewhere
Olive-sided flycatcher	*Contopus cooperi*	Yes – Rangewide	No	May 20 – August 31
Red-throated loon	*Gavia stellate*	Yes – Rangewide	No	Breeds elsewhere
Rufous hummingbird	*Selasphorus rufus*	Yes – Rangewide	No	April 15 – July 15
Semipalmated sandpiper	*Calidris pusilla*	Yes – Rangewide	No	Breeds elsewhere
Short-billed dowitcher	*Limnodromus griseus*	Yes – Rangewide	No	Breeds elsewhere
Western screech-owl	*Megascops kennicottii*	Yes - BCR	No	March 1 – June 30

Source: IPaC 2019
BCR: Bird Conservation Region

There are several raptor species that may be present within the API and use resources from within it. Although they are not known to nest on the Burnside Bridge, species that have known nesting sites in the Project vicinity include Peregrine falcons (*Falco peregrinus*), bald eagles (*Haliaeetus leucocephalus*), and osprey (*Pandion haliaetus*). Peregrine falcons have several known nests on the nearby Fremont and Marquam bridges. There are at least two known nesting sites of bald eagles in the Project vicinity: one to the west of the API in Forest Park and one to the south of the API on Ross Island (David Helzer [City of Portland], personal communication, September 13, 2019). Although these species are not nesting on the Burnside Bridge, they forage along the length of the Willamette River, likely utilizing resources from within the API or at least traveling through it. No raptor species were observed during the field visits.

According to ORBIC data, which is based on observation data, no ESA-listed threatened or endangered wildlife species are present in the API. The Townsend's big-eared bat (*Corynohinus townsendii*) is a State sensitive species that may use the bridge for roosting, but none were observed during the field visits.

Although the existing vegetation is limited, it potentially provides habitat for small mammals that have adapted to urban life, such as raccoons (*Procyon lotor*). Other common wildlife likely present within the API includes squirrels (*Sciurus griseus*), nutria (*Myocastor coypus*), rats (*Rattus norvegicus*), river otters (*Lutra Canadensis*), mink (*Mustela vison*), skunks (*Mephitis mephitis*), and opossums (*Didelphis virginiana*).

Amphibians and Reptiles

In general, most amphibians are not present in highly urbanized settings because of habitat modification, specifically a lack of wetlands (Johnson and O'Neil 2001). However, it is possible that amphibians are present in the API. There are potentially frog and turtle species that use resources from the Willamette River and its riparian areas. For example, the Oregon spotted frog (*Rana pretiosa*) was historically found in Multnomah County, and is listed as threatened under the ESA (OFWO 2019). The existing conditions of the API provide no suitable habitat for the frog. Table 4 lists other ESA-listed amphibians and reptiles that have a potential range in the API; none of which were observed during field visits.

Table 4. Species Status Amphibians and Reptiles with a Potential Range in the API

Common Name	Scientific Name	Threatened/Endangered Status
Northern red-legged frog	*Rana aurora*	Federal SoC
Oregon spotted frog	*Rana pretiosa*	Federal Threatened
Western pond turtle	*Actinemys marmorata*	Federal SoC

Source: OFWO 2018
SoC: Species of Concern

In addition to native species, there may also be nonnative amphibians present in the API. The American bullfrog (*Lithobates catesbeianus*) is an invasive species commonly found in Oregon. The red-eared slider (*Trachemys scripta elegans*) is an invasive turtle species commonly found throughout the state. According to Johnson and O'Neil (2001), the red-eared slider is the only exotic reptile that is closely or generally associated with high-density urban areas.

5.3.3 Aquatic Species

Fish

The Lower Willamette River provides habitat to nearly 50 species of fish, both native and nonnative. Fish species present in this reach of the river include resident fish such as Northern Pikeminnow (*Ptychocheilus oregonensis*), Largescale Sucker (*Catostomus macrocheilus*), and Prickly Sculpin (*Cottus asper*). There are nonnative nuisance fish present including Smallmouth Bass (*Micropterus dolomeiu*), Common Carp (*Cyprinus carpio*), and Yellow Perch (*Perca flavescens*; City of Portland 2019). Additional fish present include introduced game fish, anadromous salmonids, and non-salmonids, some of which are listed as threatened, endangered, or candidate species under the ESA.

Salmonids in the genus *Oncorhynchus* are known as Pacific salmon. Pacific salmon are anadromous, meaning they inhabit both saltwater and freshwater habitats. Born in freshwater, Pacific salmonids migrate to the ocean where they mature, then return to where they were born to spawn, concluding their life cycle (USFWS 2019b). Table 5 below lists resident fish species found in the Lower Willamette River.

Table 5. Lower Willamette River Fish Species

Common Name	Scientific Name	Native/ Nonnative	Threatened/Endangered Status
American Shad	*Alosa sapidissima*	Nonnative	-
Amur Goby	*Rhinogobius brunneus*	Nonnative	-
Banded Killfish	*Fundulus diaphanous*	Nonnative	-
Black Crappie	*Pomoxis nigromaculatus*	Nonnative	-
Bluegill	*Lepomis macrochirus*	Nonnative	-
Brook Lamprey	*Lampetra richarsoni*	Native	-
Brown Bullhead	*Ameiurus nebulosus*	Nonnative	-
Coastal Cutthroat Trout	*Oncorhynchus clarkii*	Native	-
Channel Catfish	*Ictalurus punctatus*	Nonnative	-
Chinook Salmon	*Oncorhynchus tshawytscha*	Native	Federal threatened
Chiselmouth	*Acrocheilus alutaceus*	Native	-
Coho Salmon	*Oncorhynchus kisutch*	Native	Federal threatened; State endangered
Common Carp	*Cyprinus carpio*	Nonnative	-
Cutthroat Trout	*Oncorhynchus clarkii*	Native	
Pacific Eulachon	*Thaleichthys pacificus*	Native	Federal threatened
Goldfish	*Carassius auratus*	Nonnative	-
Green Sturgeon	*Acipenser medirostris*	Native	Federal threatened
Green Sunfish	*Lepomis cyanellus*	Nonnative	-
Largemouth Bass	*Micropterus salmoides*	Nonnative	-
Largescale Sucker	*Catostomus macrocheilus*	Native	-
Longnose Dace	*Rhinichthys cataractae*	Native	-
Mountain Sucker	*Catostomus platyrhynchus*	Native	-
Mountain Whitefish	*Prosopium williamsoni*	Native	-
Northern Pikeminnow	*Ptychocheilus oregonensis*	Native	-
Oregon Chub	*Oregonichthys crameri*	Native	-
Oriental Weatherfish	*Misgurnus anguillicaudatus*	Nonnative	-
Pacific Lamprey	*Entosphenus tridentatus*	Native	State vulnerable; Federal Species of Concern

Table 5. Lower Willamette River Fish Species

Common Name	Scientific Name	Native/ Nonnative	Threatened/Endangered Status
Peamouth	*Mylocheilus caurinus*	Native	-
Prickly Sculpin	*Cottus asper*	Native	-
Pumpkinseed	*Lepomis gibbosus*	Nonnative	-
Redside Shiner	*Richardsonius balteatus*	Native	-
Reticulate Sculpin	*Cottus perplexus*	Native	-
Sand Roller	*Percopis transmontana*	Native	-
Smallmouth Bass	*Micropterus dolomieu*	Nonnative	-
Speckled Dace	*Rhinichthys osculus*	Native	-
Starry Flounder	*Platichthys stellatus*	Native	-
Steelhead/Rainbow Trout	*Oncorhynchus mykiss*	Native	Federal threatened
Threespine Stickleback	*Gasterosteus aculeatus*	Native	-
Walleye	*Sander vitreus*	Nonnative	-
Warmouth Sunfish	*Lepois gulosus*	Nonnative	-
Western Mosquitofish	*Gambusia affinis*	Nonnative	-
White Crappie	*Pomoxis annularis*	Nonnative	-
White Sturgeon	*Acipenser transmontanus*	Native	-
Yellow Bullhead	*Ameiurus natalis*	Nonnative	-
Yellow Perch	*Perca flavescens*	Nonnative	-

Source: City of Portland 2019; Farr and Ward 1993; Williams et al. 2014

ESA-listed Threatened and Endangered Species

The Endangered Species Act (ESA) protects threatened and endangered species through a Section 7 consultation, to ensure that proposed project-related actions are not likely to jeopardize the existence of any species (or a species' designated critical habitat) on the list. The ESA is led by USFWS and NOAA Fisheries. An endangered species is defined by the ESA as "any species which is in danger of extinction throughout all or a significant portion of its range" while a threatened species is defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (NOAA Fisheries 2019b).

Since settlement began in the region approximately 150 years ago, certain development actions have caused a steep decline in the number of salmonids, especially Chinook Salmon, Coho Salmon, and steelhead. Actions that have led to decreases in salmonids in the Willamette Basin include the construction of dams and reservoirs (that altered flow regimes), filling and diking within the floodplain, riverbank hardening, and channel dredging (City of Portland 2018).

Three Pacific salmon species within the Lower Willamette River are listed under the ESA: Chinook, Coho, and Steelhead (Table 6). These species have distinct population segments in the Lower Willamette River. A distinct population segment (DPS) is defined as "a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species" (NOAA Fisheries 2019b). The DPSs of salmon species in the Lower Willamette River are Lower Columbia River Chinook (*Oncorhynchus tshawytscha*), Upper Willamette River Chinook (*O. tshawytscha*), Lower Columbia River Coho (*O. kisutch*), Lower Columbia River steelhead (*O. mykiss*), and Upper Willamette River steelhead (*O. mykiss*) (Table 6). Each of the DPSs has designated critical habitat within the API. Critical habitat encompasses specific areas that contain essential physical or biological features necessary for conservation of the species. Once an area is designated as critical habitat for a listed species, NOAA Fisheries and/or the USFWS regulates proposed project related actions potentially affecting the critical habitat.

Non-salmonid listed species that inhabit the API are Pacific Eulachon (*Thaleichthys pacificus*), which is listed as threatened, and Pacific Lamprey (*Entosphenus tridentatus*), which is listed as a species of concern. Both species are of particular cultural importance to the Tribal community. Green Sturgeon (*Acipenser medirostris*) may be present in the API; the Southern DPS is ESA-listed as threatened but is not likely to occur in the API, while the Northern DPS is not ESA-listed or likely to be present in the API (Table 6). White Sturgeon (*Acipenser transmontanus*) may be present in the API and are considered an ODFW species of importance based on spawning locations in the Willamette River, but are not listed as threatened or endangered. Other species of interest that may be present in the API are Cutthroat Trout (*Oncorhynchus clarkii*), which is currently categorized as a federal candidate species, and coastal Cutthroat Trout (*Oncorhynchus clarkii clarkii*).

Table 6. ESA-listed Threatened and Endangered Fish Species in the Lower Willamette River

Species	Scientific Name	DPS	ESA Status	Designated Critical Habitat in API
Chinook Salmon	*Oncorhynchus tshawytscha*	Lower Columbia River; Upper Willamette River	Threatened	Yes
Coho Salmon	*Oncorhynchus kisutch*	Lower Columbia River	Threatened	Yes
Steelhead	*Oncorhynchus mykiss*	Lower Columbia River; Upper Willamette River	Threatened	Yes
Eulachon	*Thaleichthys pacificus*	Southern	Threatened	No
Green sturgeon	*Acipenser medirostris*	Southern	Threatened	No

Source: NOAA Fisheries 2019b; OFWO 2019

Because the Willamette River flows into the Columbia River, there may be additional ESA-listed fish species that stray into the Willamette River temporarily or while migrating. These species include the Columbia River Bull Trout (*Salvelinus confluentus*); Upper Columbia Spring Chinook (*O. tshawytscha*) and Upper Columbia Steelhead Trout (*O. mykiss*); Snake River Sockeye Salmon (*O. nerka*); Snake River Fall, Spring, and Summer Chinook Salmon (*O. tshawytscha*); Snake River Steelhead Trout (*O. mykiss*); Middle Columbia Steelhead Trout (*O. mykiss*); and Columbia River Chum Salmon (*O. keta*). These species use the Columbia River, and may use the Willamette River, as rearing habitat for juveniles migrating to the ocean and as migratory habitat for both juveniles and adults. Although they do not use the Willamette River as primary habitat, their presence during construction is possible.

In several Upper Willamette River (UWR) subbasins, more than five million juvenile Spring Chinook Salmon and summer steelhead have been released from hatcheries (NOAA Fisheries 2019a). Hatchery Chinook Salmon sub-yearlings are released from May through November in the UWR, while yearlings are released from January through March. Hatchery steelhead are released as smolts from March through April (NOAA Fisheries 2019a).

Fish Habitat and Migration

The Willamette River is mapped as Essential Salmonid Habitat by the DSL for fall and Spring Chinook Salmon, Coho Salmon, Chum Salmon, and summer and winter steelhead (DSL 2010). The Willamette River is also mapped as Essential Fish Habitat by NOAA Fisheries for Chinook and Coho Salmon (NOAA 1999).

The Willamette River has been repeatedly filled and dredged for development purposes. According to the City of Portland (2018), approximately 85 percent of the banks of the Willamette River in the central city reach (extending from north of the Fremont Bridge to Ross Island Bridge) are armored with seawalls, pilings, rock/fill, or riprap. Piers 1, 2, 3, and 4 of the existing Burnside Bridge occupy approximately 15,400 square feet (0.35 acres) of area within the river that could otherwise be used as habitat for fish.

Development within the Willamette River has decreased the amount of shallow water habitat, which is critical for migrating and rearing juvenile salmonids. Shallow water habitat is defined by the City of Portland as the area located between the ordinary high water mark (OHWM) and 20 feet below the ordinary low water mark (OLWM). It provides refuge from higher flows that are found in deeper waters, and provides rearing and feeding habitat for juvenile salmonids during migration (City of Portland 2017). Between 1888 and 2001, 79 percent of shallow water habitat in the Lower Willamette River was lost and 89 percent of off-channel habitat was lost due to activities associated with development, including floodplain fill, bank alterations, dredging, and channeling (Primozich and Bastasch 2004). Chinook Salmon, Coho Salmon, and Steelhead are particularly affected by low amounts of shallow water habitat within the Lower Willamette River during their migration (Primozich and Bastasch 2004).

Macroinvertebrates, which are important food resources for salmonids, can be found in shallow water habitat. During migration, juvenile salmonids feed and grow in shallow water habitat (Friesen 2005). Friesen (2005) found that shallow water habitat was of greater importance during winter than other times of the year for juvenile Chinook Salmon, which were highly associated with shallow water habitat in the Lower Willamette

River. In addition, Friesen (2005) suggests shallow water habitat is the preferred habitat type for juvenile Coho Salmon.

The majority of shallow water habitat, defined as the area from 20 feet below OLW up to OHW, within the API is located near the south waterfront on the west side, and under the Hawthorne Bridge on the east side of the Willamette River (City of Portland 2016). Within the Project Area, the existing amount of shallow water habitat is approximately 3.4 acres: 3.1 acres on the east side of the river and 0.3 acres on the west side (Figure 3). The extent of existing shallow water habitat within the Project Area was determined through GIS analysis using bathymetric survey data from the City of Portland. Within the API, the amount of shallow water habitat that currently exists is approximately 236 acres (Figure 4).

Figure 3. Existing Shallow Water Habitat in the Project Area

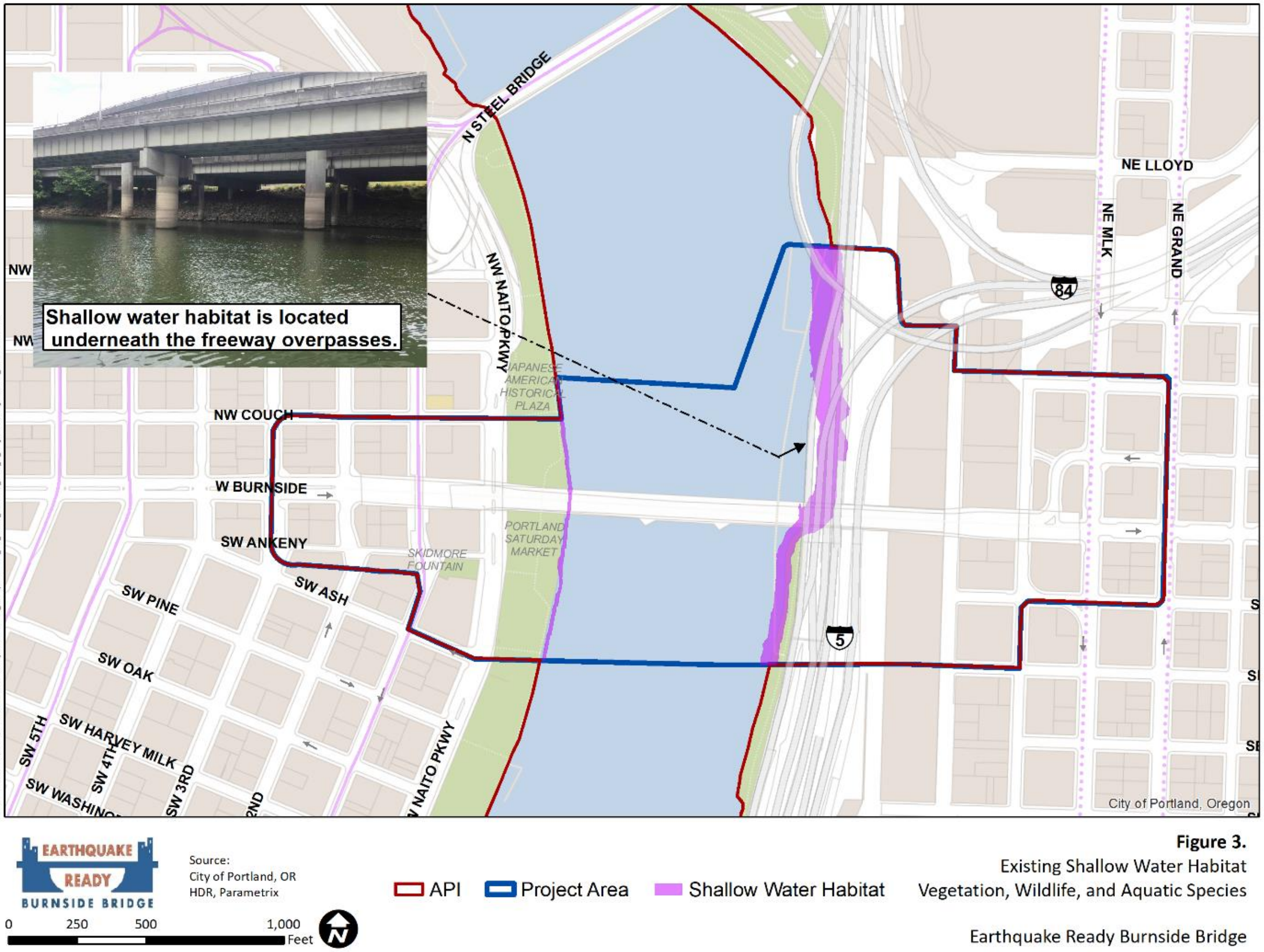
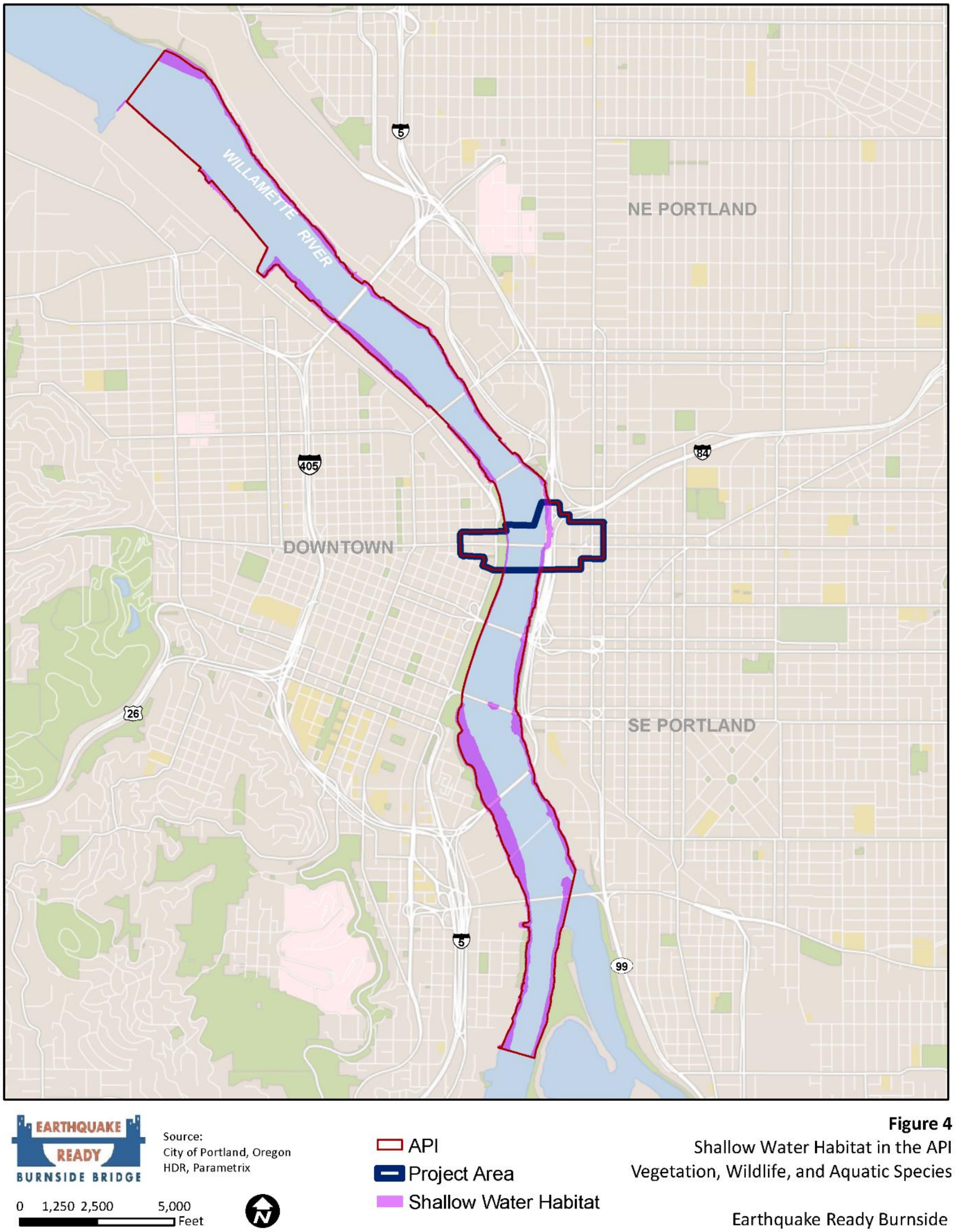


Figure 3.
Existing Shallow Water Habitat
Vegetation, Wildlife, and Aquatic Species

Earthquake Ready Burnside Bridge

Figure 4. Existing Shallow Water Habitat within the API



Anadromous salmonids in the API migrate to and from the ocean, via the Columbia and Willamette Rivers. A migration and habitat study on juvenile salmonids in the Lower Willamette River performed from 2000 to 2003 found presence of juvenile salmonids in every month during the survey (Friesen 2005). Weight and length data analysis led the authors to posit that the juveniles were growing during their migration downstream. Although it has been highly disturbed, ODFW suggests that the lower Willamette River contains valuable rearing habitat. Juvenile salmonids are present year-round in the Lower Willamette River, with peak abundance during winter and spring (Friesen 2005; City of Portland 2017). Migration rates varied between species and ranged from eight to fifteen kilometers per day for Chinook, Coho, and Steelhead, according to a study by Friesen (2005) from 2001 - 2003. Friesen (2005) also studied residence time of salmonids and found that the median range was 1.5 to 3 days, depending on species. The current in-water work window (IWWW) for the Lower Willamette River is from July 1 to October 31 (ODFW 2008). The restriction is in place to minimize potential impacts to sensitive fish species based on the timing of their life stages (migration, spawning, and rearing). The IWWW from July 1 to October 31 is based on the life cycle timing of the following fish species: Fall Chinook Salmon, Spring Chinook Salmon, Coho Salmon, winter steelhead, summer Steelhead, Cutthroat Trout, and various warm water game fish (ODFW 2008).

Additional Aquatic Species

Many ESA-listed fish species depend on macroinvertebrates for food. Macroinvertebrates are organisms without a backbone that are visible to the naked eye. They include a wide variety of animals, including insects, snails, flies, worms, and crayfish. Daphnia (*Daphnia spp.*) are planktonic crustaceans found in the lower Willamette River and are essential for juvenile Chinook and Coho salmon (Friesen 2005). A 2003 survey of aquatic invertebrates by Friesen (2005) found copepods, caddisfly, stonefly, and chironomids in the lower Willamette River among many different habitat types. They found that aquatic invertebrates were in the highest densities at nearshore, riprapped sites, and aquatic insects at floating structures. Both of these invertebrate habitat types are present within the API. Additionally, macroinvertebrates can be found within the substrate below the actively flowing channel up to several feet deep (Williams and Hynes 1974; Coleman and Hynes 1970).

Marine Mammals

Along with several fish species, California sea lions (*Zalophus californianus*) and Steller sea lions (*Eumetopias jubatus*; Eastern DPS) use the Willamette River within the API. Harbor seals (*Phoca vitulina*) have been observed in the Lower Willamette River, but their presence is rare with no known haul out sites (areas on land where marine mammals rest; Michael Brown [ODFW], personal communication, August 25, 2020).

Although they are not listed as threatened or endangered, sea lions are protected under the Marine Mammal Protection Act. No marine mammals were observed during the field surveys with no known haul out sites within the API. However, sea lions use the API as a migratory corridor. California sea lions are known to haul-out and feed on migrating salmon and steelhead at Willamette Falls, which is approximately 14 miles upstream from the Project Area. Sea lion presence and abundance is seasonal, with their arrival beginning in September after travelling from their breeding grounds in California, although they have been seen as early as August (ODFW 2020). Sea lions are present through May, with peak abundance occurring from March through May (Monica Blanchard [ODFW], personal communication, March 20, 2020). Sea lions have been increasingly present at Willamette Falls since the 1990s, leading to the creation of monitoring and management programs by ODFW.

Although protected by the Marine Mammal Protection Act, ODFW received authorization from NOAA Fisheries in 2018 to remove California sea lions at Willamette Falls due to their continued predation on salmon and steelhead. Monitoring takes place each year from January through May (ODFW 2020). In addition to salmon and steelhead, California and Steller sea lions prey on white sturgeon and lamprey in the Willamette River (ODFW 2020; NOAA Fisheries 2020).

6 Impact Assessment Methodology and Data Sources

The impacts analysis addresses the direct long-term, direct short-term, indirect and cumulative impacts to vegetation, wildlife, and aquatic species from the Project Alternatives, including the No-Build Alternative.

6.1 Long-Term Impact Assessment Methods

The analysis of direct long-term vegetation, wildlife, and aquatic species impacts considered:

- The effects of vegetation removal, damage, or replacement in terms of area and species diversity that may modify habitat for birds and wildlife
- Habitat connectivity modification and its effects on wildlife and aquatic species
- Stormwater impacts and their effects on aquatic species in the API
- Modifications to fish habitat

6.2 Short-Term Impact Assessment Methods

Short-term impacts include impacts to vegetation, wildlife, and aquatic species resulting from construction activities within the API. The analysis of direct short-term species impacts considered:

- Construction impacts to water quality and the effects on vegetation, wildlife, and aquatic species
- Ground disturbance effects to vegetation and wildlife
- Hydroacoustic impacts to fish from in-water work
- Bridge demolition and associated impacts to wildlife and aquatic species
- Temporary modifications to fish habitat

6.3 Indirect Impact Assessment Methods

Indirect impacts are reasonably foreseeable impacts that result from the project but occurring later in time or beyond the Project Area. Indirect impacts to vegetation, wildlife, and aquatic species caused by the project were assessed, considering the findings of the Land Use analysis of indirect impacts.

6.4 Cumulative Impact Assessment Methods

Cumulative impacts result from the incremental impact of a specific action when added to other past, present, and reasonably foreseeable future actions. The cumulative impacts analysis considers the long-term and short-term impacts of the Project Alternatives to vegetation, wildlife, and aquatic species. The analysis is based on the list of foreseeable transportation and other development projects that are anticipated to occur in the Project vicinity within the same time frame, as well as relevant past actions that have defined the Project vicinity. A qualitative analysis examined potential cumulative effects for vegetation, wildlife, and aquatic species. The analysis of potential cumulative vegetation, wildlife, and aquatic species impacts addresses both short-term construction effects, as well as long-term operational impacts.

7 Environmental Consequences

7.1 Introduction

The description of long-term Impacts is divided into (a) pre-earthquake impacts, and (b) impacts that would occur after the next Cascadia Subduction Zone earthquake (emergency response and longer-term recovery).

7.2 Pre-Earthquake Impacts

Direct and indirect impacts to vegetation, wildlife, and aquatic species would result from construction activities under any of the Build Alternatives. The Build Alternatives differ in the magnitude of impacts, such as the size of a cofferdam or the number of drilled shafts, as well as the duration and timing these impacts would occur. Construction activities that would affect vegetation, wildlife, and aquatic species, regardless of alternative, include the following:

- Construction access and staging
- Cofferdam installation (including fish salvage) and removal
- Installation of drilled shafts, steel pile, and sheet pile
- Fill and excavation, both on land and within the river
- Construction and removal of work bridges, including pile driving
- Barge use
- Structure demolition and removal

- Vegetation removal
- Ground improvements (jet grouting)

Best Management Practices (BMPs) would be used to reduce the amount of potential adverse impacts. For mitigation details, including BMPs, see Section 8. For detailed descriptions of construction methods and schedules for each Build Alternative, refer to the *EQRB Construction Approach Technical Report* (Multnomah County 2021b). While the impacts described below would take place temporarily during construction, DSL considers any impact within its jurisdiction that is not rectified within 24 months to be permanent. Many of the temporary construction activities described in this report will be considered permanent during the permitting process.

Vegetation

The vegetation that currently exists within the API is subject to removal, including trees, shrubs, and herbaceous vegetation. Clearing of vegetation for construction access and staging would be required. Vegetation adjacent to structures planned for removal, such as street trees and landscaping, would be removed.

Wildlife

The EQRB Project would impact wildlife through habitat disturbance and displacement. Although the existing birds and wildlife species present in the API are adapted to the highly urbanized environment, construction activities may create undesirable conditions. Wildlife habitat within the API would be heavily disturbed during construction from activities such as clearing, grading, and excavation. Vegetation removal would reduce the amount of habitat and foraging resources for birds and wildlife.

Most construction activities create noise above ambient levels that would likely cause wildlife to shift from areas within the API undergoing construction to seek refuge in a quieter habitat. The existing peak noise conditions range from 39 A-weighted decibels (dBA) to 75 dBA from vehicle and truck traffic within the API (*EQRB Noise and Vibration Technical Report* [Multnomah County 2021f]). Construction equipment such as backhoes, clam shovels, excavators, and jackhammers creates noise levels higher than ambient levels. Pile driving, as heard by wildlife on land and in the air, would be at noise levels of 101 dBA (FHWA 2017). Although pile driving would not be continuous throughout the construction period, its effects can create unfavorable conditions for wildlife. It is assumed that birds and terrestrial wildlife in the API would leave the area when construction begins due to visual and noise disturbances during construction. The habitat used by wildlife within the API would be temporarily and periodically undesirable until Project completion, shifting wildlife out of the API. This potential shift would likely be the largest direct impact on birds and wildlife from the Project.

Aquatic Species

Fish and other aquatic species, including marine mammals, may be affected through disturbance and occupancy of habitat from the installation of temporary pile, permanent drilled shafts, sheet pile, and cofferdams. Potential physical alteration to habitat may create sedimentation and scouring issues from temporary fill and removal below OHW. Pile driving during construction may directly affect fish through noise disturbance within the water, known as hydroacoustic impacts. Hydroacoustic impacts can result in fish injury, behavior modification, and death. There are certain thresholds at which behavior modification occur and that mortality can occur. NOAA Fisheries considers artificial sound of 150 decibel (dB) root mean squared to be the threshold for behavioral effects. The Fisheries Hydroacoustic Working Group (FHWG; 2008) established the following underwater noise criteria for onset of injury:

- 206 dB single strike peak sound pressure level for all fish > 2 grams
- 187 dB accumulated sound exposure level for all fish > 2 grams
- 183 dB accumulated sound exposure level for all fish < 2 grams

Hydroacoustic impacts can travel beyond the immediate vicinity of the physical impact taking place, both upstream and downstream. The API extends approximately 12,000 feet upstream and 15,000 feet downstream of the bridge within the river, as developed with input from NOAA Fisheries staff. This range is based on the presumption that sound waves produced by pile driving travel within the line of sight with the sinuosity of the river (NOAA Fisheries 2012). A Biological Assessment (BA) is concurrently being developed for the Project and determined an action area for the extent of behavioral disturbance and distance for onset of injury to fish using the NOAA Fisheries Pile Driving Calculations Worksheet. The onset of physical injury distance from hydroacoustic impacts was determined to be 1,500 feet, while the behavioral distance threshold was determined to be approximately 13,000 feet. Determination of the hydroacoustic effects action area is a subset of the entire action area for the Project, which will provide information relating to the extent of take.

In addition to fish, hydroacoustic impacts from pile driving can also affect marine mammals. Sound can cause a broad range of injuries and behavioral effects in marine mammals. Sound thresholds for sea lions are as follows: impulsive sound sources (impact pile drivers) peak sound pressure level is 232 dB, and the cumulative sound exposure level is 203 dB, and non-impulsive sound sources (vibratory pile drivers) cumulative exposure level is 219 dB (NOAA Fisheries 2018). The BA prepared for the Project will address potential impacts to marine mammals, including California and Steller sea lions. Construction activities are not expected to disturb or injure marine mammals due to their seasonal presence, which mainly occurs outside of the in-water work window when construction would take place. In addition, the few sea lion individuals that pass through the Project area are considered acclimated to anthropogenic activities, including sound.

Multiple cofferdams would be installed for all alternatives. Standard installation techniques would be used to install and remove cofferdams for each alternative, but the type of cofferdam varies between alternatives. Sheet pile used to form cofferdams would be driven using a vibratory hammer. Seal courses would be permanently installed within the cofferdams to allow the cofferdams to be dewatered. A seal course is a thick concrete slab poured at the bottom of a cofferdam to prevent water from entering the cofferdam after it has been dewatered. Drilled shafts would be permanently installed within the limits of the cofferdams. Cofferdam installation and removal would take place during the approved IWWW. After the cofferdams are installed, work would occur within the cofferdam outside of the IWWW since it would be dewatered and isolated. Fish salvage would occur in isolated work areas (cofferdams). For more details on cofferdam installation, refer to the *EQRB Construction Approach Technical Report* (Multnomah County 2021b).

Other direct impacts to aquatic species from in-water work include barge use. Barges are used for transport and storage of equipment and materials, as well as during demolition. They are anchored in a specific location with vertical steel shafts known as spuds. The use of barges creates short-term impacts from spud installation, which can impact fish through a temporary reduction of habitat and water quality impacts during installation and removal. Spuds are typically pushed down into the substrate using the weight of the barge. Barges, if positioned in the same place for an extended period of time, create cover over the water that makes favorable foraging habitat for piscivorous fish. Piscivorous fish are those that feed on other fish. Northern Pikeminnow, Smallmouth Bass, and Largemouth Bass are present in the Willamette River and prey upon juvenile salmonids. Migrating salmon can become more vulnerable to predation by piscivorous fish when in-water structures are present (Friesen 2005; NOAA Fisheries 2012). Piscivorous fish use shallow water habitat and habitat around pilings and other structures within the river. Pribyl et al. (2004) conducted a study on native and exotic piscivorous fish in the Lower Willamette River and recommended minimizing installation of piling in future development. This would limit the amount of habitat favored by piscivoro us fish and reduce predation on juvenile salmonids. This is important when considering the location of barges and other in-water structures such as spuds or piling. If the in-water structures are located in areas of shallow water habitat where juvenile salmonids may be seeking refuge, the juvenile salmonids are more susceptible to predation by piscivorous fishes. Barges could be located anywhere in the river within the Project Area during construction, including over shallow water habitat.

At least partial bridge demolition would be required with each build alternative. For areas of demolition over water, a barge would be used to place demolished materials. Areas over water inaccessible by barge would be protected using fabric, road plates, or other materials to prevent demolished structure from falling into the river. Over-water structure demolition risks debris falling into the river which could affect aquatic species through turbidity and sedimentation impacts, however, containment measures would be implemented to prevent this, including the use of cofferdams within the water column.

Water quality is important to aquatic species and can be affected by stormwater runoff, both temporarily during construction and permanently, post-construction. Pollutants produced by vehicles can be carried from roadways during rainfall events, discharging into rivers and streams. Urban runoff pollutants from stormwater include heavy metals, phosphates, nitrates, pesticides, and bacteria. These pollutants can affect salmonids by inhibiting growth and development, reducing resistance to infection and disease, and causing direct mortality (Spence et al. 1996). Refer to the *EQRB Stormwater Technical Report* (Multnomah County 2021g) for more discussion of stormwater pollutants.

Impacts to stormwater caused by construction activities like vegetation removal, structure demolition, and excavation can affect aquatic species. In addition to pollutants, increases in sediment can affect aquatic species when suspended in the water column, including spawning and growth of salmonids (Bash et al. 2001). Turbidity is the blocking of light from suspended materials in the water column. When sediment and other materials are suspended, light is scattered, creating a decrease in visibility and clarity within the water. Similarly, total suspended solids are mineral and organic particles in the water column, which can be a measure of erosion (Bash et al. 2001). Turbidity and total suspended solids can affect salmonids through physiological effects, behavioral effects, and changes to habitat (Bash et al. 2001). Some of these impacts include gill abrasion, reducing food availability due to decreased primary productivity, decreasing macroinvertebrate abundance and diversity, and by reducing visibility when detecting prey (DEQ 2014; Kjelland et al. 2015). In addition to fish, turbidity can affect benthic macroinvertebrates through reduction of available food and species diversity (DEQ 2014; Spence et al. 1996). Because turbidity blocks incoming sunlight, photosynthesis also can be reduced, decreasing primary production of aquatic plants. Increased suspended sediments can reduce macroinvertebrate accessibility when sediments are deposited in interstitial spaces, causing embedment of existing cobbles and perhaps trap macroinvertebrates (Spence et al. 1996).

Ground improvements using jet grouting are anticipated with all Build Alternatives to reduce the effect of soil liquefaction during an earthquake. The Retrofit, Short-span, and Couch Extension Alternatives would provide ground improvements both below and above OHWM, while the Long-span Alternative would provide ground improvements above OHWM only. Jet grouting is the process of injecting a mixture of soil and cement deep into soils, creating permanent columns of stabilized materials. During a seismic event, these columns stabilize soils and reduce soil liquefaction. During construction, jet grouting would be performed after the foundations have been retrofitted or replaced, depending on Build Alternative. Jet grouting creates temporary impacts to vegetation, wildlife, and aquatic species, depending on the location of the ground improvement zone. Temporary impacts to vegetation and wildlife habitat would be caused by the temporary removal of vegetation in the work and access areas on land. In-water jet grouting would take place from a barge and would require construction of a temporary sheet pile cofferdam at Pier 1 specifically for jet grouting with the Short-span and Couch Extension Alternatives (the Retrofit Alternative requires a cofferdam at Pier 1 regardless of ground improvements, and the Long-span Alternative has no ground improvements below OHW). Cofferdam installation and removal would affect aquatic species and cause temporary habitat displacement. Jet grouting would occur at depths from the riverbed surface to approximately 120 feet underground, which would reduce habitat for macroinvertebrates and reduce availability of food for salmonids.

For direct impacts, the approximated magnitude and area of temporary impacts below OHW from work bridge pile installation are the same for all Build Alternatives, including approach span options and movable span options. The estimated areas of temporary cofferdams, and permanent structure below OHW differ between alternatives. For indirect impacts, the types of indirect impacts for each Build Alternative are the same, however, they differ in magnitude. Direct and indirect impacts for each Build Alternative are discussed in the subsections below.

Coho Salmon, Chinook Salmon, and Starry Flounder are the only species identified with essential fish habitat (EFH) in the API. Project EFH impacts will be addressed in the BA and include an EFH analysis of Pacific salmon fishery, federally managed ground fishes, and coastal pelagic fisheries managed by NOAA Fisheries and the Pacific Fishery Management Council under the Magnuson-Stevens Act. Habitat disturbance during critical life stages for salmonids and other native fish from Project activities may have an adverse effect on EFH, resulting in reduced feeding success, delayed migration, avoidance of the work area, and direct injury or mortality. Conservation measures and special provisions addressed in the BA will be implemented to avoid or minimize permanent adverse effects on EFH for these species to the extent practicable.

Future effects from climate change are predicted to affect aquatic species, however, the extent of climate change effects within the Project Area is unknown. According to the *EQRB Climate Change Technical Report* (Multnomah County 2021a), predicted climate change effects in Oregon include sea-level rise, additional runoff and associated flooding, and reduced summer streamflow. Other effects include increased winter streamflow, and increased peak rainfall events (over a short duration), which are predicted to increase urban flooding events and river levels. These effects can, in turn, affect fish through habitat modification, increased turbidity and sedimentation, and water quality. Additional effects such as increased river temperatures can directly result in mortality of migrating salmonids (Mote et al. 2019). Permanent impacts to aquatic species from the Build Alternatives may be exacerbated by climate change, however, these impacts are difficult to quantify. Additional discussion on climate change, including assessment of potential impacts from the Project, can be found in the *EQRB Climate Change Technical Report* (Multnomah County 2021a).

7.2.1 No-Build

Under the No-Build Alternative, existing conditions would remain unchanged. With no construction, there would be no new impacts to vegetation, wildlife, or aquatic species.

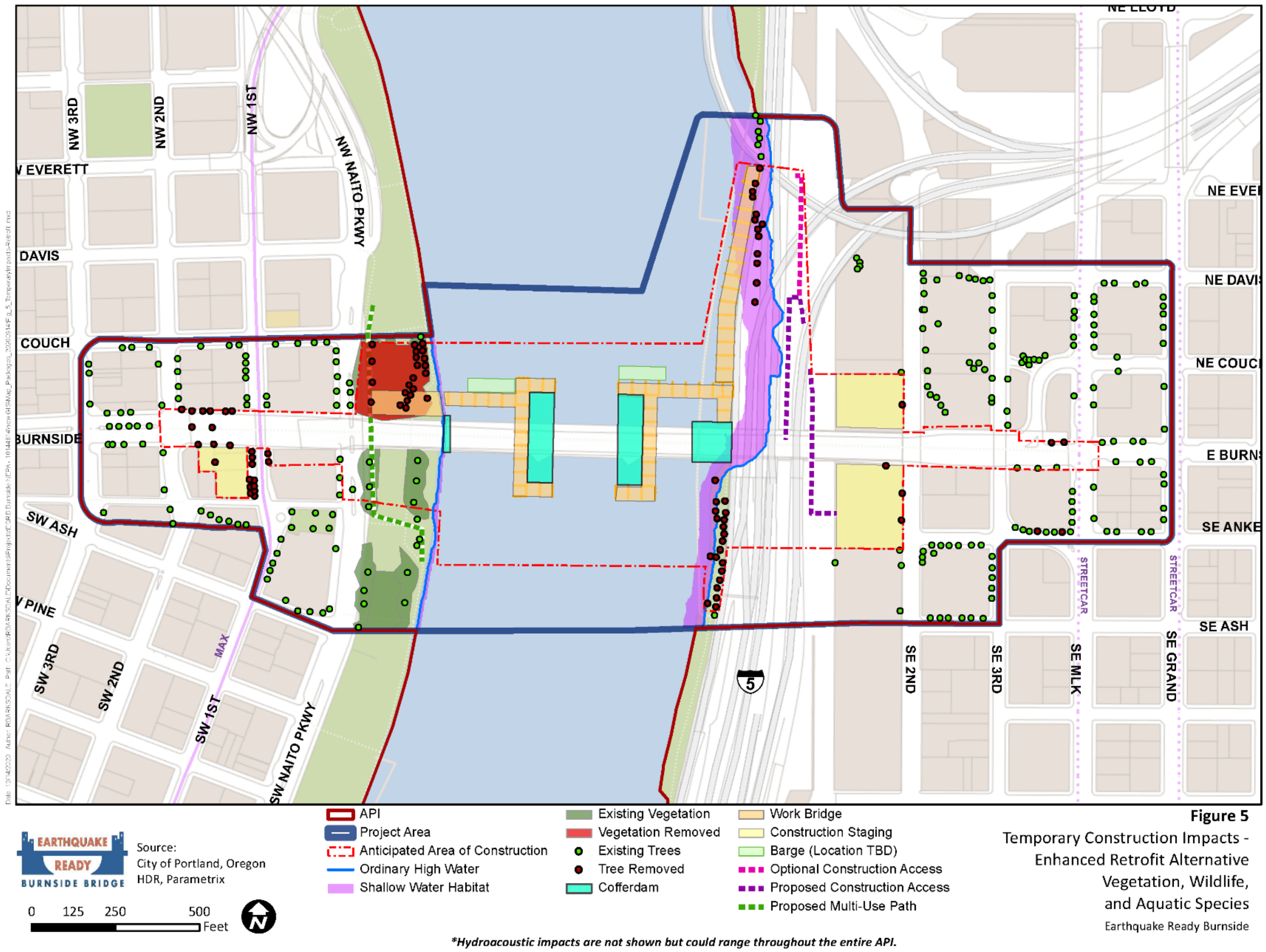
7.2.2 Enhanced Retrofit

Direct

Temporary Construction Impacts

Construction of the Retrofit Alternative would directly impact vegetation, wildlife, and aquatic species, both temporarily and permanently. The construction schedule for this alternative is the shortest compared to other alternatives, at approximately 3.5 years. The area in which temporary direct impacts from construction would occur for the Retrofit Alternative is approximately 29.5 acres.

Figure 5. Temporary Construction Impacts (Retrofit Alternative)



VEGETATION

Construction activities that may impact vegetation include excavation, fill, grading, demolition, staging, and access. This impact analysis assumes that all existing vegetation within the area of direct temporary construction impacts would be removed during construction.

Tree removal is anticipated in Tom McCall Waterfront Park on the west side of the bridge, and street tree removal on the east side. Other vegetation removal includes the existing riparian vegetation on the east side along the Vera Katz Eastbank Esplanade. A total of approximately 1.1 acres of existing vegetation and approximately 89 trees would be removed with the Retrofit Alternative (Table 7). Of these 89 trees, approximately 21 trees would be removed to accommodate construction of a proposed pedestrian ramp connection from the Vera Katz Eastbank Esplanade to the bridge, allowing bicycle, pedestrian, and American Disabilities Act (ADA)-compliant access. There is potential to spread invasive and nonnative plant species during clearing activities. BMPs would be implemented during construction to reduce this risk, including minimizing disturbance areas and treating invasive species before removal. Additional BMPs are outlined in Section 8, Avoidance and Mitigation Measures.

Although existing vegetation would be removed, it would all be replaced as part of mitigation implementation. The replacement vegetation might not be located in the exact area of removal, as discussed in Section 8 (Avoidance and Mitigation Measures), but would be compensated in other locations either within the API or off-site. In the long-term, this would result in a net benefit because the majority of existing riparian vegetation is invasive and would be replaced with native species. The Retrofit Alternative would remove the least amount of vegetation compared to all other alternatives. Additional trees south of the bridge in Tom McCall Waterfront Park would need to be removed with the Short-span and Long-span Alternatives. The Couch Extension Alternative would remove additional street trees on the east side of the river, but would have the same vegetation impact on the west side of the river as the Short-span and Long-span Alternatives.

WILDLIFE

The existing wildlife habitat within the anticipated area of temporary construction impacts would be heavily disturbed during construction from activities such as clearing, grading, and excavation. Vegetation removal would reduce the amount of habitat and food sources for birds and wildlife in the API. There are other patches of riparian habitat along the banks of the Willamette River both upstream and downstream from the Project Area in which that wildlife could seek refuge during construction. Additionally, there are vegetated patches and parks within the surrounding upland areas that could also provide habitat to affected wildlife. Noise disturbance from construction activities such as pile driving and bridge demolition would likely cause wildlife to shift habitat away from areas under construction to seek refuge in a quieter habitat. It is assumed that birds and terrestrial wildlife in the API would leave the area during construction due to visual and noise disturbances.

The impacts to wildlife from temporary loss of habitat and noise from construction activities are the smallest with the Retrofit Alternative, because it has a shorter construction schedule than the Replacement Alternatives (3.5 years compared to 4.5 years for Replacement Alternatives; Table 7), as well as smaller anticipated area of construction impacts. The Retrofit Alternative is estimated to have a shorter duration of pile driving compared to the other alternatives, by 10 to 30 days. As with vegetation impacts, once construction is complete and the required mitigation has been implemented, the areas with removed vegetation would be revegetated and restored; creating higher quality and likely more habitat after mitigation is implemented than currently exists within the API.

AQUATIC SPECIES

Implementation of the Retrofit Alternative could adversely affect the behavior, habitat, rearing, and migration of aquatic species, depending on the type of construction activities taking place. Most impacts from Retrofit construction would be temporary from in-water work. Temporary construction impacts include disturbance and physical alteration to ESA-listed fish habitat, including designated critical habitat.

Hydroacoustic impacts from pile installation would occur during construction of the Retrofit Alternative. A portion of the necessary in-water work would take place within cofferdams, but additional pile driving and extraction would occur outside of the cofferdams. This work would be conducted within the IWWW, which is based on seasonal presence of migrating salmonids. The ODFW-preferred pile driving window is from July 10 through October 15. Although this window is not during peak migration, fish presence is expected to occur, which may include both resident, native, and hatchery fish. Fish are affected by hydroacoustic impacts, which can modify their behavior, cause injury through tissue and organ damage, or cause death (National Academies 2011).

Fish have swim bladders that maintain buoyancy while swimming. The action of pile driving creates changes in pressure within the water, which can adversely affect fish through barotrauma (physical injury from rapid pressure changes), which can rupture the swim bladder, cause hemorrhage of eyes and internal organs like the liver, kidney, or heart; burst capillaries; cause internal and external hematoma; and deflation of swim bladders. These injuries lead to impacts such as internal bleeding, effects to swimming ability and buoyancy and reproductive success, ability to hear, and immediate death. Hearing damage can be temporary or permanent (NOAA Fisheries 2012). If barotrauma injuries do not lead to immediate death, impacts that change their behavior can increase vulnerability to predation (National Academies 2011). Many barotrauma injuries lead to mortality later on.

Temporary piles (approximately 160 to 220) would be installed below OHW to support the work bridge. The impacts from pile installation are the same for each Build Alternative, and include hydroacoustic impacts and temporary loss of in-stream habitat, including shallow water habitat. Piles can be driven into the ground using either a vibratory hammer or an impact hammer, both of which are likely to result in adverse effects to fish, including ESA-listed species, from hydroacoustic impacts (NOAA Fisheries 2012). With a vibratory hammer, piles are vibrated into the ground. An impact hammer repeatedly strikes piles to advance them into the ground. Both methods cause hydroacoustic impacts, however, use of a vibratory hammer causes less of a hydroacoustic impact when compared to an impact hammer. During construction, the contractor will first attempt to advance pile using a vibratory hammer, and then use an impact hammer to advance them into their final position. An impact hammer may also be used to advance pile if the substrate is not suitable for vibratory hammer use.

Installation of each pile would create changes in pressures, potentially affecting fish through the actions described above. Fish that are severely affected by barotrauma would likely not recover. NOAA Fisheries considers such effects as a take for purposes of ESA. Pile driving would occur during the ODFW preferred Lower Willamette pile-driving window, from July 10 through October 15. During the first pile driving IWWW of the construction period, pile driving would take place every day. The estimated duration in days of pile-driving for the Retrofit Alternative is 95 to 115 days during the entire construction period.

Two ground improvement zones are located below OHW (Figure 6). Cofferdam installation, barge use, and other activities associated with jet grouting are anticipated to affect aquatic species, including hydroacoustic impacts, increased predation from piscivorous fish, and increased turbidity and sedimentation. On the east riverbank, a ground improvement zone at Pier 4 is located below OHW and will require a cofferdam specifically for jet grouting.

Demolition of several parts of the existing bridge would be required, even with the Retrofit Alternative, including deck, bascule spans, portions of the east truss, portions of the substructure, and a portion of the harbor wall. Demolition of structure over water would require a barge in place below to catch and store falling debris before transporting and disposing offsite. Demolition of existing piers and bents would likely be confined within cofferdams, but barges would be required to support equipment needed for demolition and to transport the demolished structures. Use of barges can affect fish and aquatic species through increased sedimentation during spud installation and increased risk of predation by piscivorous fish.

Temporary, short-term increases in turbidity and sedimentation would occur during construction, potentially reducing the ability for fish to feed, hindering growth. Other impacts to fish caused by increased suspended sediments include gill abrasion and clogging of filtration and respiratory organs, which can lead to direct mortality. These impacts would be minimized by using BMPs including erosion control measures that would mitigate turbidity and sedimentation effects.

Four temporary cofferdams are anticipated to be installed for the Retrofit Alternative: two in the middle of the river surrounding Piers 2 and 3 (main river piers), one on the west side of the river around Pier 1, and one on the east side of the river at Pier 4. Work within the cofferdams would include footing expansion, which would consist of pouring seal courses, installing drilled shafts, partial demolition of the existing bridge substructure, and ground improvements. The total area that cofferdams would occupy is approximately 1.1 acres, which is the second smallest area after the Long-span Alternative. Table 7 shows the ranges of estimated numbers and area of temporary construction impacts within the river for the Retrofit Alternative.

Table 7. Retrofit Alternative Approximate Temporary Construction Activities Causing Impacts to Vegetation, Wildlife, and Aquatic Species

Temporary Impacts								
Number of Piles below OHW	Area of Piles below OHW (square feet)	Number of Piles in SWH	Area of Piles in SWH (square feet)	Cofferdam Area (acres)	Loss of Vegetation / Wildlife Habitat (acres)	Tree Removal (# of trees)	Duration of Construction (years)	Duration of pile driving (days)
160-220	500-700	25-35	80-110	1.1	1.1	89	3.5	95-115

OHW: ordinary high water
SWH: shallow water habitat

Permanent Impacts

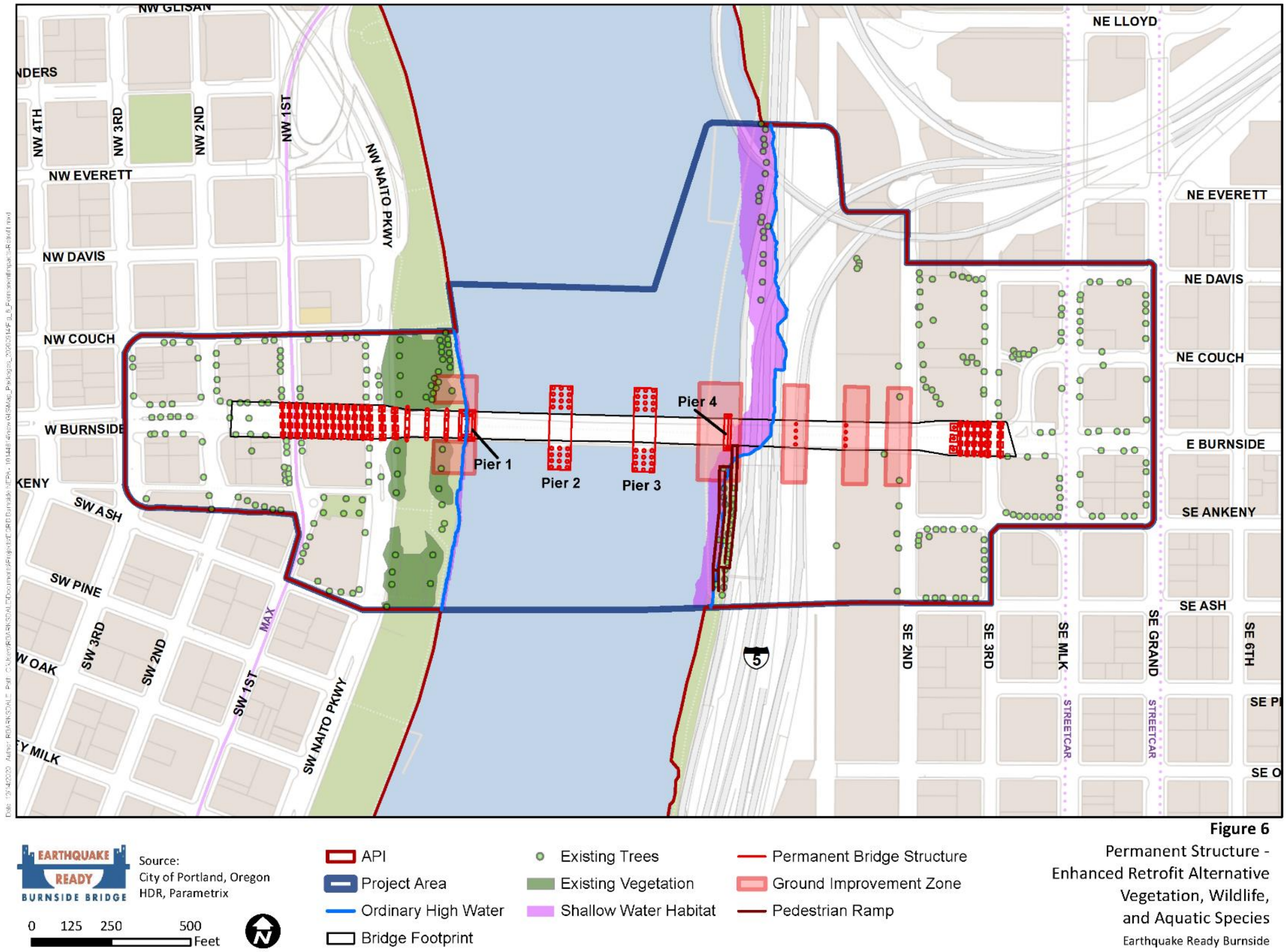
Permanent impacts from the Retrofit Alternative would be from a loss of habitat from the placement of structure. Permanent structure includes drilled shafts, bridge footings, seal courses, and permanent piling from a pedestrian ramp connection. On the east side of the river, an existing staircase from the south side of the bridge to the Vera Katz Eastbank Esplanade would be replaced with an ADA-accessible ramp connection and stairs. This new connection would be installed for all Build Alternatives, remain in place permanently, and require removal of riparian vegetation and installation of piling below OHW, which is also shallow water habitat. The area of shallow water habitat loss from the pedestrian ramp connection is approximately 98 square feet for the Retrofit, Short-span, and Long-span Alternatives (the Couch Extension Alternative has an additional 20 square feet of shallow water habitat loss). Another option would be to reconstruct the existing staircase and potentially add an elevator. This would avoid in-water and riparian impacts, but could lead to safety, security, and maintenance problems with the use of an elevator, or result in no improvement in ADA access without the use of an elevator.

The area of seal courses from cofferdams is included in its entirety, although only portions of seal courses are within the actual waterway. Most of a seal course within the river would be located below the riverbed. At the time of this report, the level of design was not advanced far enough to determine the exact area of seal courses that would be within the actively flowing channel above the riverbed. It was assumed the seal course footprints would be within the actively flowing channel. The area of permanent structure below OHW that could affect aquatic species from the Retrofit Alternative is approximately 1.4 acres (Table 8). The existing structure of the Burnside Bridge below OHW is approximately 0.35 acres, therefore, the net increase of permanent structure below OHW is approximately 1.1 acres. The area in which permanent structures would occupy decreases the amount of available in-stream habitat that resident and ESA-listed fish use for migration, spawning, and rearing. An increase of in-water structures could lead to an increased number of piscivorous fish, making juvenile salmonids more vulnerable to predation. Shallow water habitat, which provides food resources and refuge to juvenile salmonids, would decrease in area by approximately 211 square feet due to the installation permanent shafts. Placement of structures within shallow water habitat that reduces the physical amount of available habitat decreases connectivity between refuge areas, making migration more difficult on aquatic species.

The Willamette River within the API is mapped by NOAA Fisheries as EFH for Chinook and Coho Salmon. Permanent impacts from the seal courses associated with the Retrofit Alternative will be considered an adverse effect to EFH.

Additional permanent impacts affecting aquatic species could come from ground improvements. Jet grouting would occur during construction within cofferdams, but the areas of ground improvements would be permanent. All grout materials would be below the ground surface of the Willamette River, but could still cause impacts to aquatic species above. Macroinvertebrates are found on and below the ground surface within the sediment, which directly influences the distribution and abundance of populations through grain size and soil stability (U.S. Army Corps of Engineers 1998). Impacts from jet grouting could affect macroinvertebrate productivity, reducing availability of food resources for aquatic species, including ESA-listed fish. The amount of permanent impact from ground improvements was measured in terms of area below OHW and within shallow water habitat. The Retrofit Alternative ground improvement zone area below OHW is approximately 16,900 square feet, of which approximately 3,500 square feet is shallow water habitat (Table 8).

Figure 6. Retrofit Alternative Permanent Structure Impacting Vegetation, Wildlife, and Aquatic Species



Decreases in area of shallow water habitat may affect macroinvertebrate habitat, reducing availability of food sources to fish. Macroinvertebrates found in sediment would potentially be unable to migrate if there were a decrease in shallow water habitat. Connectivity of shallow water habitat is important to migrating salmonids, both juveniles and adults since it provides refuge from predators and high velocity flows, and provides feeding opportunities (City of Portland 2018). The availability of food within shallow water habitat impacts the growth rate and energy levels of juvenile salmonids (Groot et al. 1995). While migrating through the Willamette River, juvenile salmonids depend upon these pockets of habitat. If the existing areas of shallow water habitat are impacted, it could lead to energy depletion in juvenile salmonids, making them vulnerable to predation. More locations of refuge create better chances of successful migration, productivity, and survival of salmonids, especially when refuge areas are within close proximity to one another and create better connectivity (Groot et al. 1995; Sedell et al. 1990). In addition to migrating fish, because shallow water habitat areas provide food and refuge, they could also provide recovery areas for fish impacted by disturbances, such as barotrauma from pile driving (Sedell et al. 1990).

Although shallow water habitat is critical to juvenile salmonids, the permanent impacts from the Retrofit are minor when considering the amount of existing shallow water habitat in the Project Area (approximately 3.4 acres) and within the API (approximately 236 acres). This physical reduction in habitat would likely not affect fish long-term due to nearby areas of shallow water habitat located in and adjacent to the Project Area, both upstream and downstream. However, these impacts could be exacerbated in the long-term due to climate change. Changes to streamflow could shift areas of shallow water habitat, making it more important. While pile driving generates impacts to aquatic species, the number of temporary piles that would be installed is the same for all Build Alternatives, so the permanent impacts must be used to differentiate between alternatives. The Retrofit Alternative would place approximately 57 permanent shafts in the river, which would lead to a loss of habitat of approximately 5,853 square feet. Eight permanent shafts would be installed within shallow water habitat, leading to a loss of approximately 211 square feet, which is 0.14 percent of all shallow water habitat within the Project Area. These impacts would likely be minor to fish in the long-term due to the relatively small amount of physical habitat loss when compared with the size of the river, and there is contiguous shallow water habitat to the area of impact, rather than a single isolated area. The permanent impacts to shallow water habitat from the Retrofit Alternative are the same as the Short-span and Long-span Alternatives (also 211 square feet), and smaller than the Couch Extension Alternative (231 square feet).

An increase in impervious surface area would result from all Build Alternatives. The Retrofit Alternative would increase contributing impervious area by 815 square feet, which would affect the amount of pollutants discharging into the Willamette River through stormwater. Stormwater runoff from this area would be treated prior to discharge into the river. Impervious surfaces catch and route stormwater runoff, passing through different underground pipes and treatment areas, eventually discharging into rivers. The existing stormwater runoff contributes pollutants to the Willamette River, potentially adversely affecting aquatic species. A decrease in pollutants could improve fish survival, growth, and spawning. Only a portion of existing stormwater runoff from impervious surfaces in the API is treated for water quality. With the Retrofit Alternative, the contributing impervious area and existing impervious area that is reconstructed would require stormwater treatment. Because the Project would require stormwater treatment to current regulatory standards, overall water quality from stormwater runoff would improve. The *EQRB Stormwater Technical Report* (Multnomah County 2021g) provides a detailed discussion on stormwater treatment.

Table 8. Retrofit Alternative Approximate In-water Permanent Direct Impacts

Area of structure below OHW* (acres)	Number of shafts below OHW	Number of shafts in SWH	Area of shafts in SWH (square feet)	Ground Improvement (GI) zone area below OHW (square feet)	GI zone area within SWH (square feet)
1.4	57	8	211	16.900	3.500

*Area of structure below OHW includes drilled shafts, bridge footings, seal courses, and piles

Indirect

Vegetation

No indirect impacts to vegetation from the Retrofit Alternative are anticipated.

Wildlife

No indirect impacts to wildlife from the Retrofit Alternative are anticipated.

Aquatic Species

Potential indirect impacts to aquatic species from the Retrofit Alternative would include hydrological changes due to an increase in impervious surfaces. Because additional runoff would be discharged into the river, miniscule changes to flow could occur. Changes in flow could affect scour and sedimentation, which can lower water quality and thereby affect fish through behavioral and physiological changes (Kjelland et al. 2015). Increased suspended sedimentation effects can include changes in feeding behaviors and result in injury or death from gill abrasion (Kjelland et al. 2015). Increased sedimentation can reduce macroinvertebrate abundance and food availability, which, in turn, can affect fish that feed on macroinvertebrates (Spence et al. 1996). Larval lamprey can also be affected from scour and sedimentation by becoming trapped in the substrate (USFWS 2010). Due to the large size of the river and the requirement for detainment of runoff, impacts to flow from increased runoff would be negligible, difficult to measure, and likely not affect flow. No additional indirect impacts to aquatic species are anticipated from the Retrofit Alternative. Refer to the *EQRB Stormwater Technical Report* (Multnomah County 2021g) and the *EQRB Hydraulics Technical Report* (Multnomah County 2021e) for more detailed discussions of stormwater and hydrology impacts.

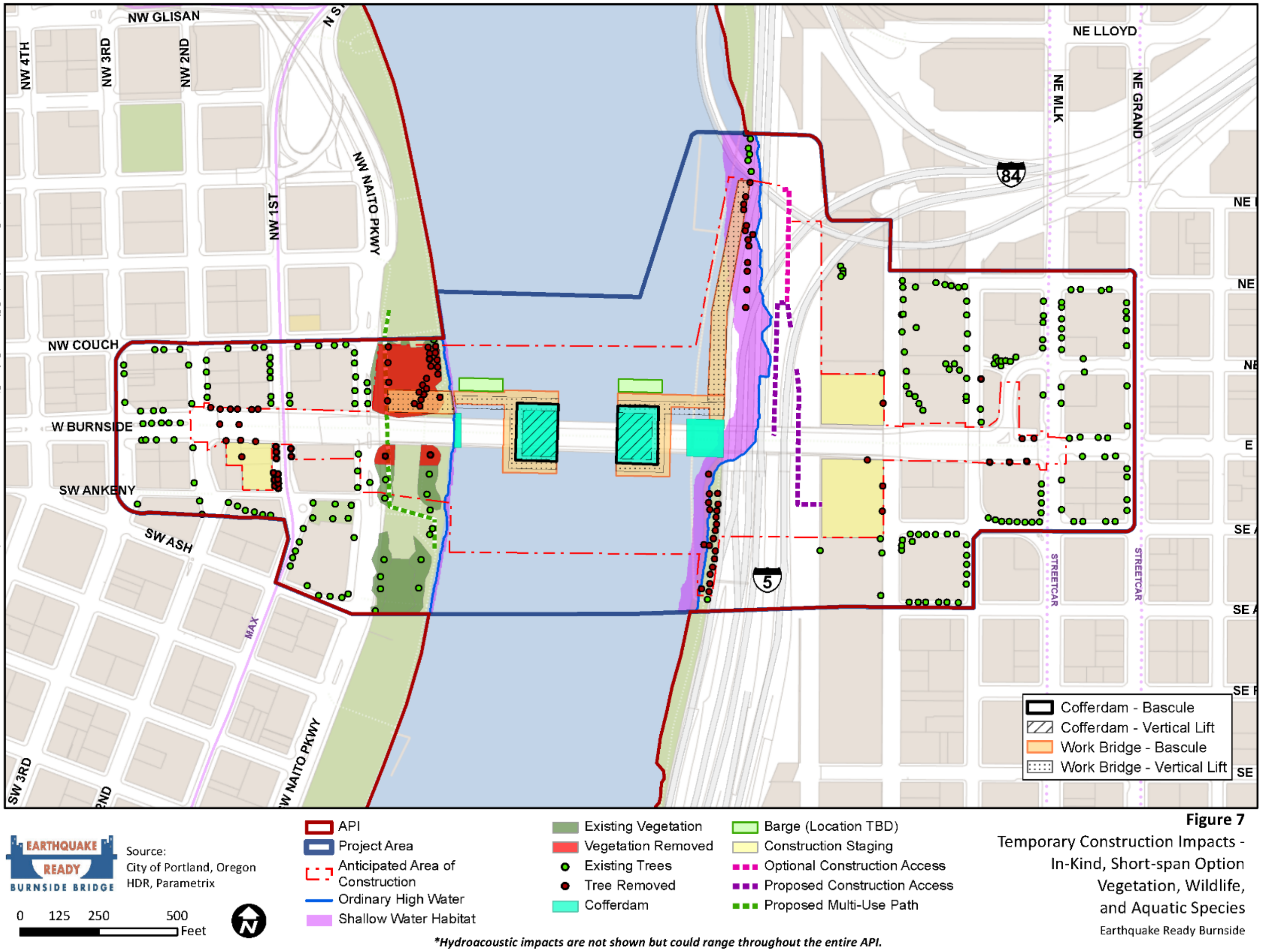
7.2.3 Replacement, Short-span

With the Short-span Alternative, like all Replacement Alternatives, the movable span options over the navigation channel would be Bascule or Vertical Lift bridge. Each option leads to different amounts of direct impacts to vegetation, wildlife, and aquatic species.

Direct

The anticipated area of temporary construction impacts for the Short-span Alternative is approximately 30.7 acres. The estimated construction period is 4.5 years. The estimated amount of direct impacts to vegetation, wildlife, and aquatic species differ between the movable span options (Bascule or Vertical Lift). Direct impacts also differ from the other Build Alternatives.

Figure 7. Temporary Construction Impacts Associated with the Short-span Alternative



Temporary Construction Impacts

VEGETATION

The impacts to vegetation from the Short-span Alternative are the same as the impacts from the Retrofit Alternative, but differ in magnitude. The anticipated area of temporary construction impacts for the Short-span Alternative is larger than the Retrofit Alternative by approximately 1.2 acres. Impacts include removal of approximately 1.3 acres of vegetation and 91 trees, which is an additional 0.1 acre and 2 trees when compared to the Retrofit Alternative. The additional two trees that would need to be removed are located south of the bridge in Tom McCall Waterfront Park. Of the 91 removed trees, 21 would be removed to accommodate the pedestrian connection to the Vera Katz Eastbank Esplanade (Figure 7).

WILDLIFE

The direct impacts to wildlife caused by construction of the Short-span Alternative from a temporal loss of habitat and construction disturbance would have the same type and magnitude as the Retrofit Alternative, but would last for one additional year. As with vegetation impacts, once construction is complete and the required mitigation has been implemented, the areas that would have been cleared of vegetation would be revegetated and restored, creating higher quality and likely more wildlife habitat than currently exists within the API.

AQUATIC SPECIES

Direct impacts from the Short-span Alternative are the same impacts associated with the Retrofit Alternative, but differ in magnitude. Four temporary cofferdams would be required, as with the Retrofit Alternative. The cofferdams would be located around the main river piers (Piers 2 and 3) and around Pier 1 and Pier 4 with the Short-span Alternative. Work within the cofferdams would include demolition of existing piers and replacement, including pouring seal courses and installing drilled shafts. Jet grouting would also occur within cofferdams, which would require a cofferdam specifically for jet grouting at Pier 1. The total area that cofferdams would occupy ranges from approximately 1.2 acres to 1.5 acres, depending on movable span option (Table 9). The Short-span Alternative would require more demolition of existing bridge structures than the Retrofit Alternative. Demolition of the main river piers would be required before construction of the new piers, but cofferdams would be installed prior to any demolition work. Table 9 provides the ranges of estimated quantities of construction elements within the river for the Short-span Alternative.

Demolition of the existing bridge would be required, and the methods of demolition for the Short-span Alternative would be the same as the Retrofit Alternative. However, more of the existing bridge would be demolished, which would include complete demolition of the river piers above the foundation. Demolition of structure over water would require a barge in place below to catch and store falling debris before transporting and disposing offsite. Demolition of existing piers and bents would likely be confined within cofferdams, but barges would be required to support equipment needed for demolition and to transport the demolished structures. Use of barges can affect fish and aquatic species through increased sedimentation during spud installation, physical reduction of in-stream habitat, and increased risk of predation by piscivorous fish.

Hydroacoustic impacts from pile driving would occur during construction from the Short-span Alternative. Construction activities resulting in hydroacoustic impact would occur from within and outside of cofferdams. In-water work activities not occurring from within cofferdams would be restricted to working during the IWWW. Work within cofferdams could occur at any time, including outside of the IWWW. The number of temporary piles installed below OHW is estimated at approximately 160 to 220 to support work bridges. The estimated number of temporary piles is the same for both the Bascule and Vertical Lift movable span options. The number of permanent shafts differs between the movable span options. Table 9 provides for estimated in-water construction impacts for the Short-span Alternative. The estimated pile driving duration ranges from 105 to 125 days throughout the entire construction period.

Table 9. Short-span Alternative Approximate In-water Temporary Construction Impacts

Movable Span Option	Temporary Impacts							
	Number of Piles below OHW	Area of Piles below OHW (square feet)	Number of Piles in SWH	Area of Piles in SWH (square feet)	Cofferdam Area (acres)	Loss of Vegetation/ Wildlife Habitat (acres)	Tree Removal (# of Trees)	Duration of Pile Driving (days)
Bascule	160-220	500-700	25-35	80-110	1.5	1.3	91	95-115
Vertical Lift	160-220	500-700	25-35	80-110	1.2	1.3	91	95-115

Permanent Impacts

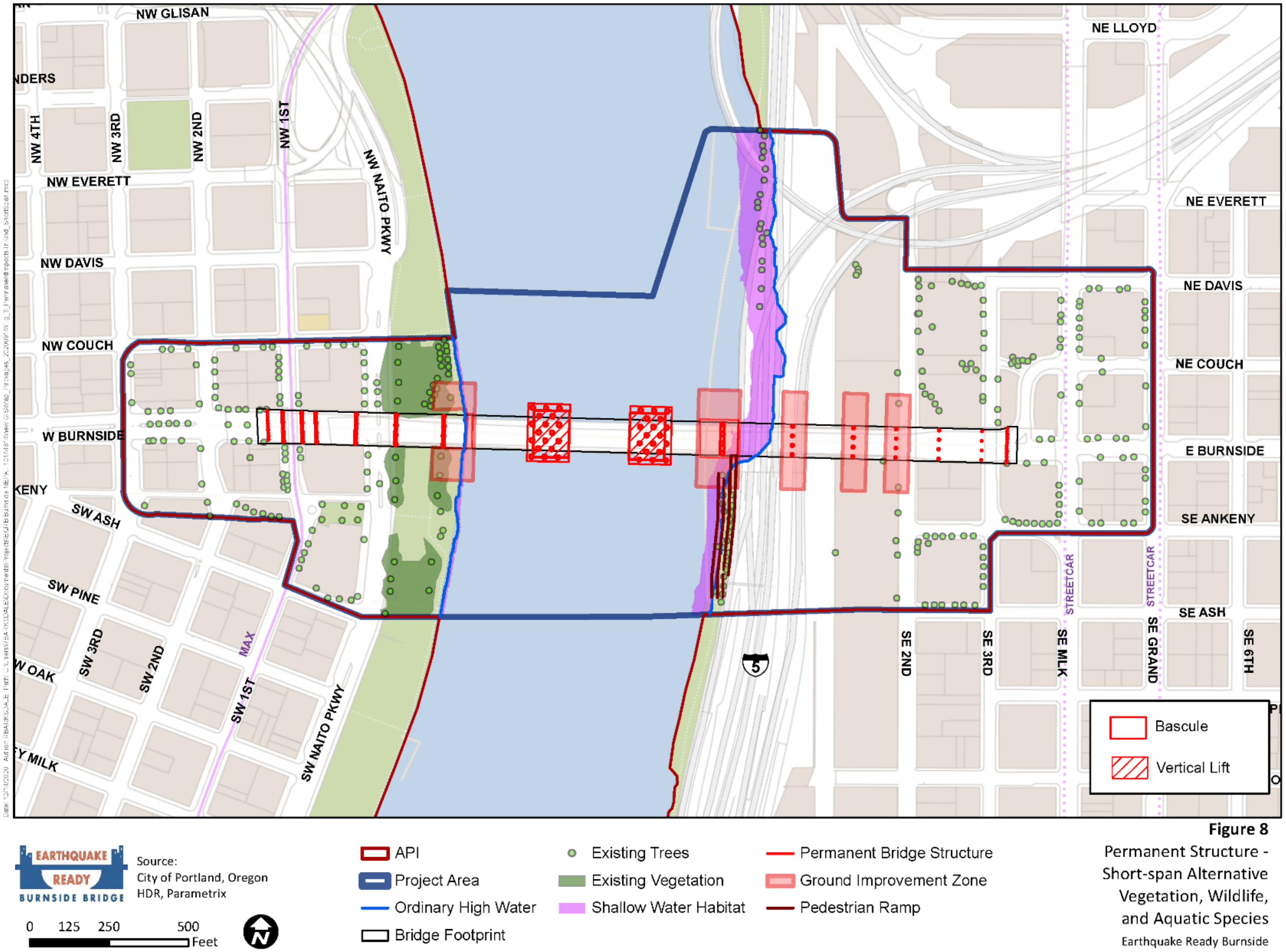
The Short-span Alternative would increase the amount of contributing impervious area by approximately 0.9 acre, affecting fish through the amount of pollutants entering the Willamette River. As with the Retrofit Alternative, stormwater runoff from new contributing impervious area and existing impervious area would be treated to current regulatory standards, which would lead to an improvement in water quality. A decrease in pollutants could improve fish survival, growth, and spawning.

The area of permanent structure below OHW that could affect aquatic species by decreasing available habitat from the Short-span Alternative ranges from approximately 0.8 acres to 1.2 acres depending on movable span options (Table 10), which would be a net increase of 0.5 acre to 0.9 acre when considering the 0.35 acre of existing structure. Approximately 37 to 45 drilled shafts would be permanently installed below OHW for the Short-span Alternative. This includes permanent structure associated with the pedestrian ramp connection to the existing staircase, which would result in a loss of 98 square feet of shallow water habitat. If the option to add an elevator instead of a staircase, or to reconstruct the existing staircase is chosen for the project, the 98 square feet of shallow water habitat would not be permanently lost. As with the Retrofit Alternative, it was assumed the area of the seal course footprints would be within the actively flowing channel for purposes of calculating permanent impacts. The approximate area of permanent structure below OHW includes the 6 shafts within shallow water habitat, which would occupy approximately 211 square feet. Although there are two fewer shafts placed within shallow water habitat than with the Retrofit Alternative, the shafts used for the Short-span, Long-span, and Couch Extension Alternatives are larger than the shafts that would be used with the Retrofit Alternative, affecting the same area. The area of permanent ground improvements associated with the Short-span Alternative is equal to approximately 14,400 square feet below OHW, and 3,500 square feet of shallow water habitat (Table 10; Figure 8). The permanent impact amounts are below the ground surface, affecting macroinvertebrates which are an important food source for many fish species. The ground improvement area below OHW for the Short-span Alternative is smaller than the Retrofit Alternative, and the amount of shallow water habitat impact area is the same.

Table 10. Short-span Alternative Approximate In-water Permanent Direct Impacts

Movable Span Option	Permanent Impacts					
	Area of structure below OHW* (acres)	Number of shafts below OHW	Number of shafts in SWH	Area of shafts in SWH (square feet)	GI Zone Area below OHW (square feet)	GI Zone Area within SWH (square feet)
Bascule	1.2	45	6	211	14,400	3,500
Vertical Lift	0.8	37	6	211	14,400	3,500

Figure 8. Permanent Impacts Associated with the Short-span Alternative



Indirect

The indirect impacts anticipated from the Short-span Alternative are the same as the indirect impacts from the Retrofit Alternative, but differ in magnitude.

Vegetation

No indirect impacts to vegetation are anticipated from the Short-span Alternative.

Wildlife

No indirect impacts to wildlife are anticipated from the Short-span Alternative.

Aquatic Species

Indirect impacts to aquatic species from the Short-span Alternative are the same as the indirect impacts from the Retrofit Alternative, but at a larger magnitude. An increase in impervious surfaces from the Short-span Alternative would be approximately 0.9 acres. Because additional runoff would be discharged into the river, miniscule changes to flow could occur. Changes in flow could affect scour and sedimentation, which can lower water quality and thereby affect fish through behavioral and physiological changes (Kjelland et al. 2015). Increased suspended sedimentation effects can include changes in feeding behaviors and result in injury or death from gill abrasion (Kjelland et al. 2015). Increased sedimentation can reduce macroinvertebrate abundance and food availability, which, in turn, can affect fish that feed on macroinvertebrates (Spence et al. 1996). Larval lamprey can also be affected from scour and sedimentation by becoming trapped in the substrate (USFWS 2010). Due to the large size of the river and the requirement for detainment of runoff, impacts to flow from increased runoff would be negligible, difficult to measure, and likely not affect flow. No additional indirect impacts to aquatic species are anticipated from the Retrofit Alternative. Refer to the *EQRB Stormwater Technical Report* (Multnomah County 2021g) and the *EQRB Hydraulics Technical Report* (Multnomah County 2021e) for more detailed discussions of stormwater and hydrology impacts.

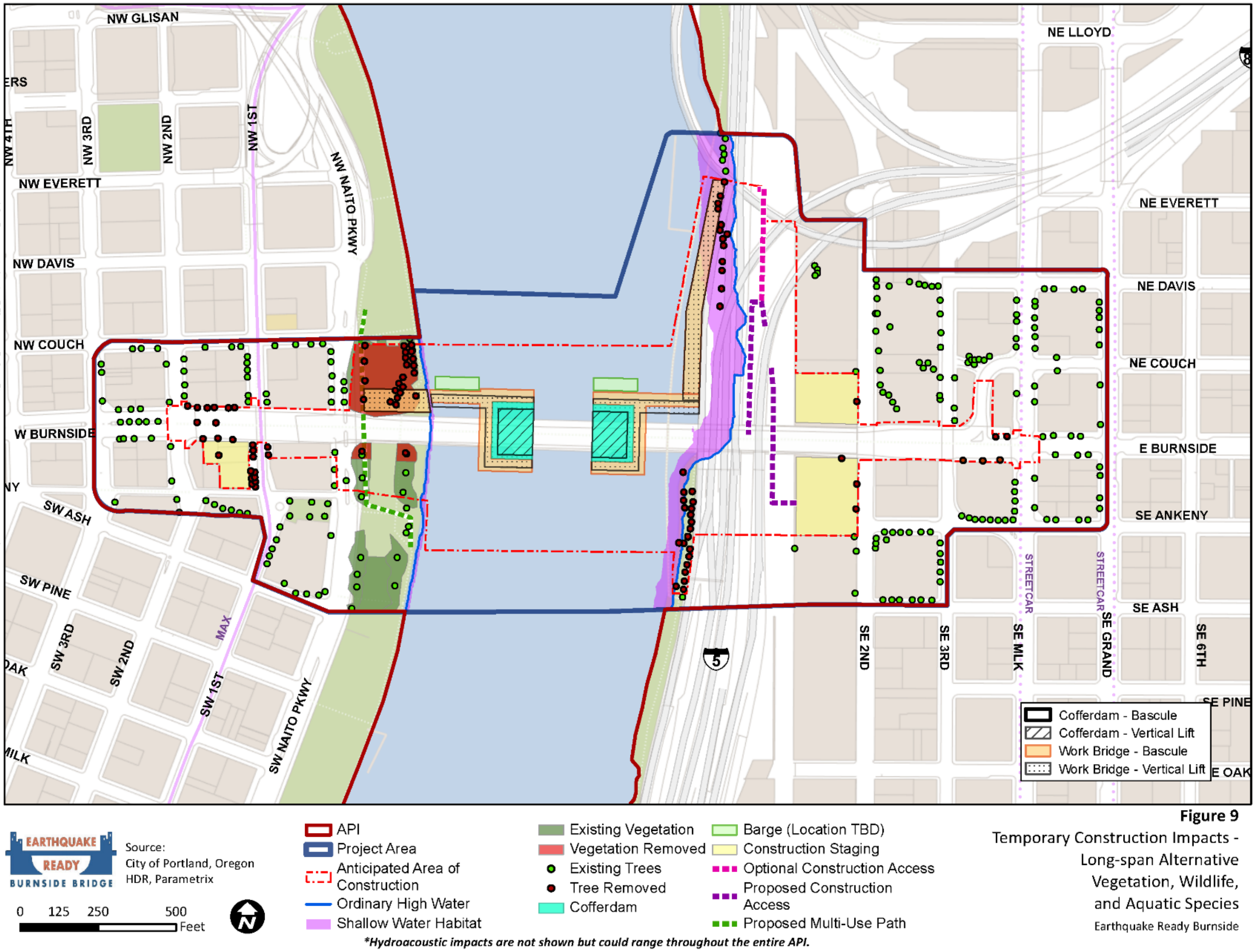
7.2.4 Replacement, Long-span

The Long-span Alternative would have two movable span options (Bascule or Vertical Lift), similar to the Short-span Alternative. These options lead to different amounts of direct impacts to vegetation, wildlife, and aquatic species.

Direct

The anticipated area of temporary construction impacts for the Long-span Alternative is approximately 30.7 acres. The estimated construction period is 4.5 years. The estimated direct impacts to vegetation, wildlife, and aquatic species differ in magnitude between the movable span options (Bascule or Vertical Lift). Direct impacts also differ in magnitude from the other Build Alternatives.

Figure 9. Temporary Construction Impacts Associated with the Long-span Alternative



Temporary Construction Impacts

VEGETATION

The anticipated area of temporary construction impacts for the Long-span Alternative is approximately 30.7 acres in area, which is the same as the Short-span Alternative, and larger than the Retrofit Alternative by approximately 1.2 acres. Vegetation removal estimated to occur is approximately 1.3 acres and 91 trees (Table 11). The amount of vegetation and tree removal impacts are the same as the Short-span Alternative, which is an additional 0.1 acre of vegetation and 2 trees more than the Retrofit Alternative (Figure 9). The same 21 trees that would be removed to accommodate the pedestrian connection to the Vera Katz Eastbank Esplanade for the Retrofit and Short-span Alternatives would also be removed for the Long-span Alternative.

WILDLIFE

The direct impacts to wildlife caused by construction of the Long-span Alternative from a temporal loss of habitat and construction disturbance would have the same type and magnitude as the Short-span Alternative. As with vegetation impacts, once construction is complete and the required mitigation has been implemented, the areas that would have been cleared of vegetation would be revegetated and restored, creating higher quality and likely more wildlife habitat than currently exists within the API.

AQUATIC SPECIES

Direct impacts from the Long-span Alternative are the same impacts associated with the Short-span and Retrofit Alternatives, but differ in magnitude. Two temporary cofferdams would be required, which would be located around the main river piers (Piers 2 and 3). Work within the cofferdams would include demolition of existing piers and replacement, including pouring seal courses and installing drilled shafts. No jet grouting below OHW would be required for the Long-span Alternative, making the impacts to aquatic species the smallest when compared to the other Build Alternatives. The total area that cofferdams would occupy ranges from approximately 0.8 acres to 1.1 acres, depending on movable span option (Table 11). Similar to the Short-span Alternative, the Long-span Alternative would require more demolition of existing bridge structures than the Retrofit Alternative. Table 11 provides the ranges of estimated quantities of construction elements within the river for the Long-span Alternative for the two movable span options.

Demolition of the existing bridge would be required and the methods of demolition for the Long-span Alternative would be the same as the Short-span Alternative. Demolition of structure over water would require a barge in place below to catch and store falling debris before transporting and disposing offsite. Demolition of existing piers and bents would likely be confined within cofferdams, but barges would be required to support equipment needed for demolition and to transport the demolished structures. Use of barges can affect fish and aquatic species through increased sedimentation during spud installation, physical reduction of in-stream habitat, and increased risk of predation by piscivorous fish.

Hydroacoustic impacts from pile driving would occur during construction from the Long-span Alternative. Construction activities resulting in hydroacoustic impacts would occur both from within and outside the cofferdams. In-water work activities occurring outside cofferdams would be restricted to working during the IWWW. Work within cofferdams could occur at any time, including outside of the IWWW. The number of temporary piles that would be installed below OHW is estimated at approximately 160 to 220 piles to support work bridges. The estimated number of temporary piles is the same for both the Bascule and Vertical Lift movable span options. The number of permanent shafts differs between the movable span options. The total estimated duration of pile driving ranges from 125 to 145 days throughout the entire construction period. Table 11 provides estimated in-water construction impacts for the Long-span Alternative.

Table 11. Long-span Alternative Approximate In-water Temporary Construction Impacts

Movable Span Option	Temporary Impacts							
	Number of piles below OHW	Area of piles below OHW (square feet)	Number of piles in SWH	Area of piles in SWH (square feet)	Cofferdam area (acres)	Loss of vegetation/ wildlife habitat (acres)	Tree removal (# of trees)	Duration of pile driving (days)
Bascule	160-220	500-700	25-35	80-110	1.1	1.3	91	125-145
Vertical Lift	160-220	500-700	25-35	80-110	0.8	1.3	91	125-145

Permanent Impacts

The Long-span Alternative would increase the amount of contributing impervious area by approximately 0.9 acre, affecting fish through the amount of pollutants entering the Willamette River. As with the Retrofit and Short-span Alternatives, stormwater runoff from new contributing impervious area and existing impervious area would be treated to current regulatory standards, which would lead to an improvement in water quality. A decrease in pollutants likely would improve fish survival, growth, and spawning.

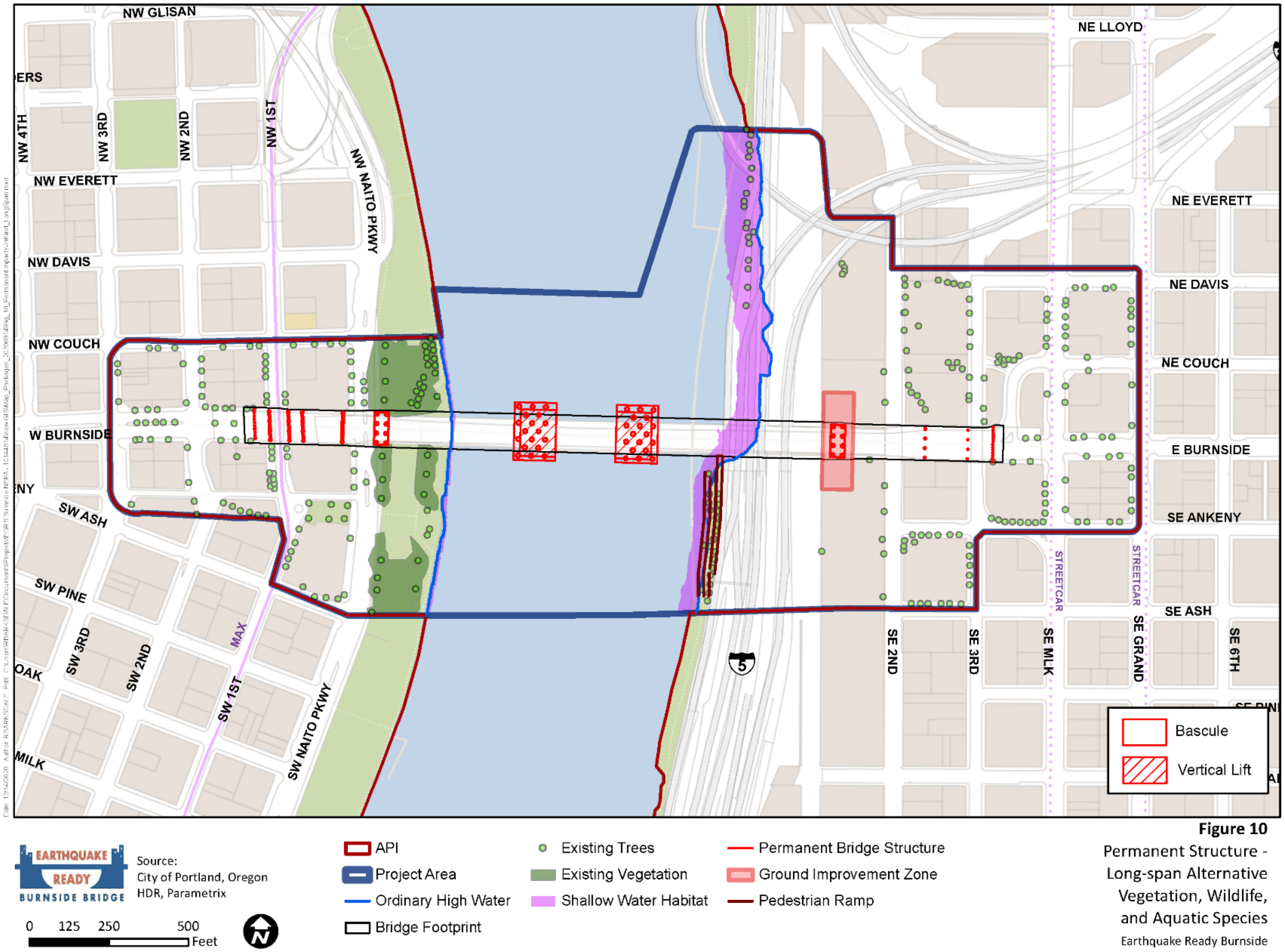
The area of permanent structure below OHW that would affect aquatic species by decreasing available habitat from the Long-span Alternative ranges from approximately 0.8 acre to 1.1 acres depending on movable span options (Table 12), which would be a net increase of 0.5 acre to 0.8 acre when considering the 0.35 acre of existing structure. Approximately 33 to 41 drilled shafts would be permanently installed below OHW for the Long-span Alternative. This includes permanent structure associated with the pedestrian ramp connection to the existing staircase, which would result in a loss of 98 square feet of shallow water habitat. If the option to add an elevator instead of a staircase, or to reconstruct the existing staircase is chosen for the Project, the 98 square feet of shallow water habitat would not be permanently lost. As with the Retrofit and Short-span Alternatives, it was assumed that the area of the seal course footprints would be within the actively flowing channel for purposes of calculating permanent impacts. The approximate area of permanent structure below OHW includes the six shafts within shallow water habitat, which would occupy approximately 211 square feet. The

Long-span Alternative eliminates most ground improvements, including the area below OHW and within shallow water habitat (Table 12; Figure 10). When considering all permanent impacts, the Long-span Alternative has the least amount of all the Build Alternatives.

Table 12. Long-span Alternative Approximate In-water Permanent Direct Impacts

Movable Span Option	Permanent Impacts					
	Area of Structure below OHW* (acres)	Number of Shafts below OHW	Number of Shafts in SWH	Area of Shafts within SWH (square feet)	GI Zone Area below OHW (square feet)	GI Zone Area within SWH (square feet)
Bascule	1.1	41	6	211	0	0
Vertical Lift	0.8	33	6	211	0	0

Figure 10. Permanent Impacts Associated with the Long-span Alternative



Indirect

The indirect impacts anticipated from the Long-span Alternative are the same as the indirect impacts from the Short-span Alternative, but differ in magnitude.

Vegetation

No indirect impacts to vegetation are anticipated from the Long-span Alternative.

Wildlife

No indirect impacts to wildlife are anticipated from the Long-span Alternative.

Aquatic Species

Indirect impacts to aquatic species from the Long-span Alternative are the same as the indirect impacts from the Short-span Alternative, but at a smaller magnitude. An increase in impervious surfaces from the Long-span Alternative would be approximately 0.9 acre. Because additional runoff would be discharged into the river, miniscule changes to flow could occur. Changes in flow could affect scour and sedimentation, which can lower water quality and thereby affect fish through behavioral and physiological changes (Kjelland et al. 2015). Increased suspended sedimentation effects can include changes in feeding behaviors and result in injury or death from gill abrasion (Kjelland et al. 2015). Increased sedimentation can reduce macroinvertebrate abundance and food availability, which, in turn, can affect fish that feed on macroinvertebrates (Spence et al. 1996). Larval lamprey can also be affected from scour and sedimentation by becoming trapped in the substrate (USFWS 2010). Due to the large size of the river and the requirement for detainment of runoff, impacts to flow from increased runoff would be negligible, difficult to measure, and likely not affect flow. No additional indirect impacts to aquatic species are anticipated from the Retrofit Alternative. Refer to the *EQRB Stormwater Technical Report* (Multnomah County 2021g) and the *EQRB Hydraulics Technical Report* (Multnomah County 2021e) for more detailed discussions of stormwater and hydrology impacts.

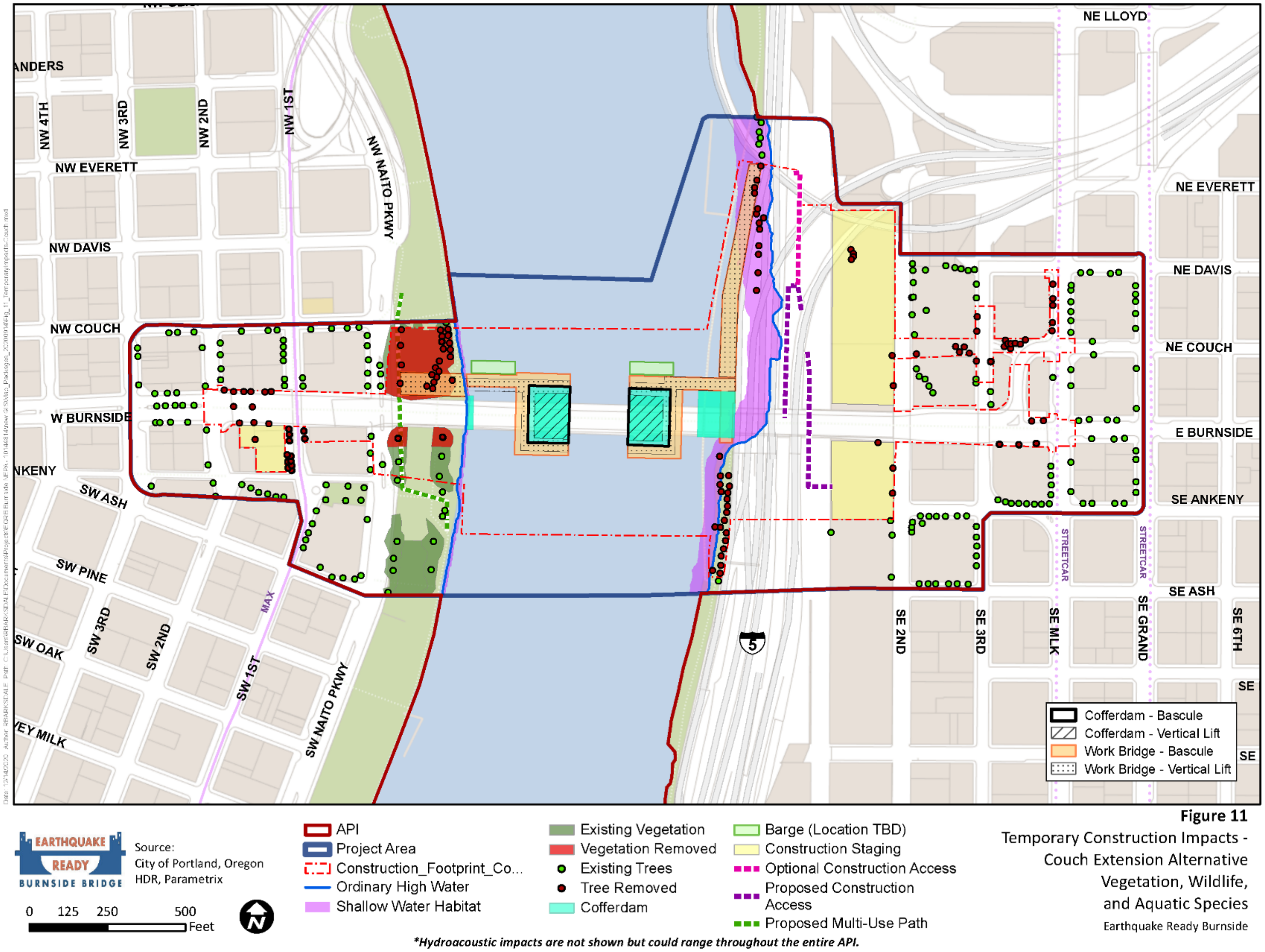
7.2.5 Replacement with Couch Extension

The Couch Extension Alternative is similar to the other Replacement Alternatives in that it has the same movable span options (Bascule or Vertical Lift). Impacts to vegetation, wildlife, and aquatic species from the Couch Extension Alternative are discussed below.

Direct

The anticipated area of temporary construction impacts for the Couch Extension Alternative is approximately 34.0 acres (Figure 11), which is 4.5 acres larger than the Retrofit Alternative and 3.3 acres larger than the other Replacement Alternatives. The Couch Extension Alternative has an estimated construction schedule that would last 4.5 years. This is the same length of time as the Short-span and Long-span Alternatives, and one year longer than the Retrofit Alternative. Direct impacts to vegetation, wildlife, and aquatic species are anticipated from the Couch Extension Alternative.

Figure 11. Temporary Construction Impacts Associated with the Couch Extension Alternative



Temporary Construction Impacts

VEGETATION

The direct impacts to vegetation from the Couch Extension are the same as the Replacement and Retrofit Alternatives, except in greater magnitude. Because the Couch Extension Alternative has the largest anticipated area of temporary construction impacts, the potential direct impacts to vegetation are the greatest among the Build Alternatives. The additional area of construction impacts would result in additional street tree removal of approximately 27 trees compared to the Retrofit and Short-span Alternatives, and 29 trees compared to the Long-span Alternative, all on the east side of the Willamette River between I-5 and NE Martin Luther King Jr. Boulevard. This would bring the total number of trees removed to approximately 118 trees, 21 of which would be removed to accommodate the pedestrian connection to the Vera Katz Eastbank Esplanade. Vegetation removed is the same as the Build Alternatives at approximately 1.3 acres.

WILDLIFE

The same direct impacts to wildlife from the Retrofit and Replacement Alternatives are anticipated with the Couch Extension Alternative, but on a larger scale. Vegetation removal may reduce the amount of connectivity and available habitat for birds and wildlife, as well as foraging resources. The additional tree removal associated with the Couch Extension Alternative would decrease habitat and food sources for birds and wildlife compared to the other Build Alternatives. As with vegetation impacts, once construction is complete and the required mitigation implemented, the areas cleared of vegetation would be revegetated and restored, creating higher quality and likely more habitat than currently exists within the API.

AQUATIC SPECIES

Direct impacts from the Couch Extension Alternative are the same impacts associated with the Retrofit, Short-span, and Long-span Alternatives, but differ in magnitude. The number of cofferdams required for the Couch Extension Alternative is the same as the Retrofit and Short-span Alternatives. Cofferdams would be located around the main river piers (Piers 2 and 3) and at Piers 1 and 4. The total area that cofferdams would occupy would range from approximately 1.3 to 1.6 acres, depending on lift option. Jet grouting would take place within cofferdams from a barge. The cofferdam at Pier 1 would be required specifically for jet grouting.

Demolition of the existing bridge would be required and the methods of demolition for the Couch Extension Alternative would be the same as the Short-span and Long-span Alternatives. Demolition of structure over water would require a barge in place below to catch and store falling debris before transporting and disposing offsite. Demolition of existing piers and bents would likely be confined within cofferdams, but barges would be required to support equipment needed for demolition and to transport the demolished structures. Use of barges can affect fish and aquatic species through increased sedimentation during spud installation, physical reduction of in-stream habitat, and increased risk of predation by piscivorous fish.

Hydroacoustic impacts from pile driving and drilled shaft installation would occur during construction for the Couch Extension Alternative. The number of temporary piles that would be installed below OHW is estimated at approximately 160 to 220 piles to support the work bridges. The estimated duration of pile driving ranges from 105 to 125 days throughout the entire construction period. Table 13 provides estimated temporary construction impacts.

Table 13. Couch Extension Alternative Approximate In-Water Temporary Construction Impacts

Movable Span Option	Temporary Impacts							
	Number of Piles below OHW	Area of Piles below OHW (square feet)	Number of Piles in SWH	Area of Piles in SWH (square feet)	Cofferdam Area (acres)	Loss of Vegetation/ Wildlife Habitat (acres)	Tree Removal (# of trees)	Duration of pile driving (days)
Bascule	160-220	500-700	25-35	80-110	1.6	1.3	118	105-125
Vertical	160-220	500-700	25-35	80-110	1.3	1.3	118	105-125

Permanent Impacts

The Couch Extension Alternative would increase impervious surfaces by approximately 2.2 acres, affecting fish through the amount of pollutants entering the Willamette River. As with the other Build Alternatives, stormwater treatment would be triggered by the Project, resulting in treatment of new contributing impervious areas and existing impervious areas that are reconstructed. Stormwater runoff would be treated to current regulatory standards, which would lead to an improvement in water quality. A decrease in pollutants could improve fish survival, growth, and spawning.

The approximate area of permanent structure below OHW from the Couch Extension Alternative ranges from 0.8 acres for the Bascule option to 1.2 acres for the Vertical Lift span option (Table 14). Because the existing structure below OHW is 0.35 acre, the net increase of permanent structure below OHW is approximately 0.5 acre to 0.9 acre, which is the same as the Short-span Alternative. Approximately 38 to 46 drilled shafts would be permanently installed below OHW, with 7 located within shallow water habitat (approximately 231 square feet in area; Figure 12). The pedestrian ramp connection on the east side of the river, south of the bridge, would result in 118 square feet of permanent structure within shallow water habitat, which is higher than the other Build Alternatives. If the option to add an elevator instead of a staircase, or to reconstruct the existing staircase is chosen for the Project, the 118 square feet of shallow water habitat would not be permanently lost. The approximate amount of permanent structure that would physically alter in-water habitat of aquatic species under the Couch Extension Alternative is less than the Retrofit Alternative, the same as the Short-span Alternative, and more than the Long-span Alternative. Ground improvement areas for the Couch Extension Alternative are the same as the Short-span Alternative, which would be approximately 14,400 square feet of area below OHW, 3,500 square feet of which are located within shallow water habitat.

Figure 12. Permanent Impacts Associated with the Couch Extension Alternative

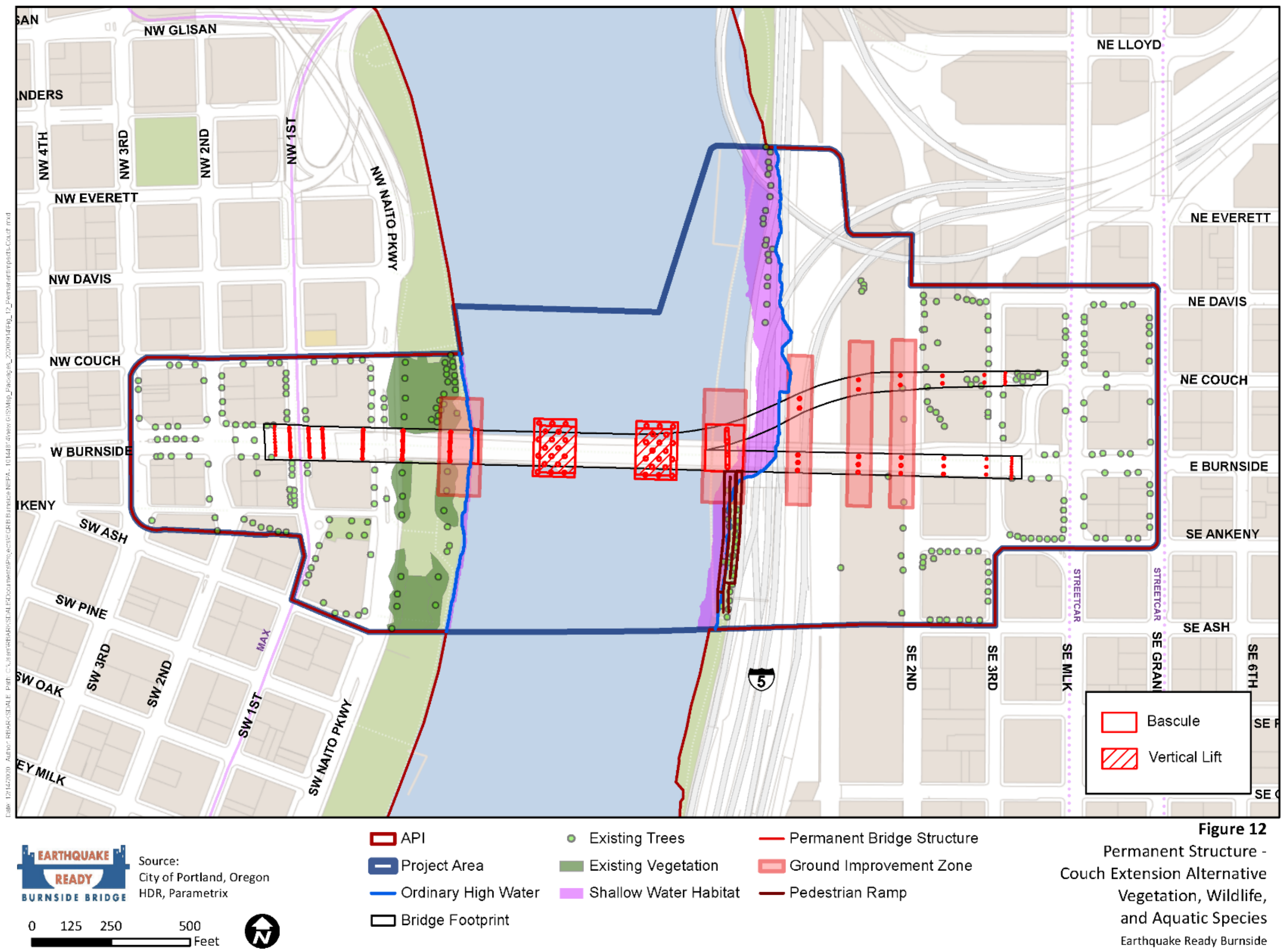


Table 14. Couch Extension Alternative Approximate In-Water Permanent Impacts

Movable Span Option	Permanent Impacts					
	Area of structure below OHW* (acres)	Number of shafts below OHW	Number of shafts in SWH	Area of shafts within SWH (square feet)	GI Zone Area below OHW (square feet)	GI Zone area within SWH (square feet)
Bascule	1.2	46	7	231	14,400	3,500
Vertical	0.8	38	7	231	14,400	3,500

*Area of structure below OHW includes drilled shafts, bridge footings, and seal courses

Indirect

Vegetation

No indirect impacts to vegetation are anticipated from the Couch Extension Alternative.

Wildlife

No indirect impacts to wildlife are anticipated from the Couch Extension Alternative.

Aquatic Species

Indirect impacts to aquatic species from the Couch Extension Alternative are the same as the indirect impacts from the Retrofit and other Replacement Alternatives, but at a larger magnitude. An increase in impervious surfaces from the Couch Extension Alternative would be approximately 2.2 acres. Because additional runoff would be discharged into the river, miniscule changes to flow could occur. Changes in flow could affect scour and sedimentation, which can lower water quality and thereby affect fish through behavioral and physiological changes (Kjelland et al. 2015). Increased suspended sedimentation effects can include changes in feeding behaviors and result in injury or death from gill abrasion (Kjelland et al. 2015). Increased sedimentation can reduce macroinvertebrate abundance and food availability, which, in turn, can affect fish that feed on macroinvertebrates (Spence et al. 1996). Larval lamprey can also be affected from scour and sedimentation by becoming trapped in the substrate (USFWS 2010). Due to the large size of the river and the requirement for detainment of runoff, impacts to flow from increased runoff would be negligible, difficult to measure, and likely not affect flow. No additional indirect impacts to aquatic species are anticipated from the Retrofit Alternative. Refer to the *EQRB Stormwater Technical Report* (Multnomah County 2021g) and the *EQRB Hydraulics Technical Report* (Multnomah County 2021e) for more detailed discussions of stormwater and hydrology impacts.

7.3 Post-Earthquake Impacts

7.3.1 No-Build

Under the No-Build Alternative, if an earthquake occurred it would directly affect vegetation, wildlife, and aquatic species. For vegetation, potential impacts would include loss of riparian vegetation due to soil liquefaction on the banks of the Willamette River. The banks likely would collapse into the river, moving the vegetation with them. The collapse of the bridge likely would lead to portions of the structure falling in the river, occupying areas of shallow water habitat that could otherwise be used by fish and other aquatic species. An increase in turbidity would be expected from pieces of the bridge structure entering the river and stirring up sediments, reducing visibility and blocking light. Bridge collapse could also result in contaminated sediment suspension in the water column, affecting water quality for aquatic species. Birds present on the bridge structure likely would fly away at the onset of shaking. Mammals and other small wildlife in the riparian areas below the bridge could possibly be crushed by falling debris.

In addition to impacts initiated by the earthquake itself, other impacts to vegetation, wildlife, and aquatic species could result from post-earthquake emergency cleanup including dredging within the river and increased use of boats up and down the channel. Dredging can disturb habitat of aquatic species by affecting nutrient inputs and increasing sedimentation (Spence et al. 1996). Increased use of boats from emergency services, transportation across the Willamette River, and cleanup would increase underwater noise disturbance, cause direct mortality to fish eggs, increase sedimentation due to erosion from wake, and increase the potential for pollution if fuel were to leak (Spence et al. 1996; Sutherland and Ogle 1975; Castro and Reckendorf 1995; Whitfield and Becker 2014).

7.3.2 Enhanced Retrofit

Direct

Under the Retrofit Alternative post-earthquake scenario, there would be no direct impacts to vegetation, wildlife, or aquatic species from the bridge, because the bridge would have undergone improvements proposed from the project. The Burnside Bridge would not collapse nor contribute to loss of these resources. In the area of the API outside of the anticipated area of temporary construction impacts, soil liquefaction likely would occur where soil improvements (jet grouting) were not performed leading to loss of riparian vegetation and increased turbidity within the river. This would result in a decrease of wildlife habitat, decrease in aquatic species habitat quality, and a direct loss in the amount and diversity of vegetation.

Indirect

Because the bridge would be able to withstand an earthquake after Project completion, no indirect impacts to vegetation, wildlife, or aquatic species are anticipated under the Retrofit Alternative, post-earthquake.

7.3.3 Replacement, Short-span

Direct

Under the Short-span Alternative, post-earthquake impacts would be the same as the Retrofit Alternative post-earthquake impacts. However, the Short-span Alternative would have less subsurface soil stabilization, which, post-earthquake, would lead to more soil liquefaction than with the Retrofit Alternative.

Indirect

Because the bridge would be able to withstand an earthquake after Project completion, no indirect impacts to vegetation, wildlife, and aquatic species are anticipated under the Short-span Alternative, post-earthquake.

7.3.4 Replacement, Long-span

Direct

Under the Long-span Alternative, post-earthquake impacts would be the same as the Retrofit and Short-span Alternatives post-earthquake impacts. However, because the Long-span Alternative would have the least amount of subsurface soil stabilization, it would lead to the most soil liquefaction when compared to the other Build Alternatives.

Indirect

Because the bridge would be able to withstand an earthquake after Project completion, no indirect impacts to vegetation, wildlife, and aquatic species are anticipated under the Long-span Alternative, post-earthquake.

7.3.5 Replacement with Couch Extension

Direct

Direct impacts under the Couch Extension Alternative would be the same as the Short-span, Long-span, and Retrofit Alternatives due to the seismic upgrade from the Project.

Indirect

Because the bridge would be able to withstand an earthquake after Project completion, no indirect impacts to vegetation, wildlife, and aquatic species are anticipated under the Couch Extension Alternative, post-earthquake.

7.4 Construction Impacts

7.4.1 Without Temporary Bridge

Section 7.2 (Pre-Earthquake Impacts) describes direct and indirect impacts of construction of each of the Build Alternatives in a scenario without a temporary bridge.

7.4.2 With Temporary Bridge

Use of a temporary detour bridge during construction would lead to additional impacts to vegetation, wildlife, and aquatic species. Impacts would be the same under each of the Build Alternatives. Impacts from the Temporary Bridge would result from installation and removal of the bridge, and be limited to the area the bridge would occupy. The anticipated area of construction impacts of the Temporary Bridge is larger by 1.1 acres than with no Temporary Bridge (Figure 13). The Temporary Bridge would require an additional 1.5 years of construction time. Table 15 provides design features associated with a temporary detour bridge.

There are three modal options for the Temporary Bridge: one that would maintain vehicular, pedestrian, and bicycle traffic ("All Modes"), one that would maintain pedestrian and bicycle traffic only ("Bicycles and Pedestrians only"), and one that would maintain transit, bicycle, and pedestrian traffic ("Transit, Bicycles, and Pedestrians only"). The Temporary Bridge would be located south of the existing Burnside Bridge, occupying space in Tom McCall Waterfront Park on the west side, and over I-5, I-84, and the existing Union Pacific Railroad on the east side. If a temporary bridge is selected, the first construction activity for the Project would be to install the temporary pilings for the bridge during the first IWWW. Removal of the Temporary Bridge would be the last phase of construction.

Figure 13. Temporary Detour Bridge Option Layout

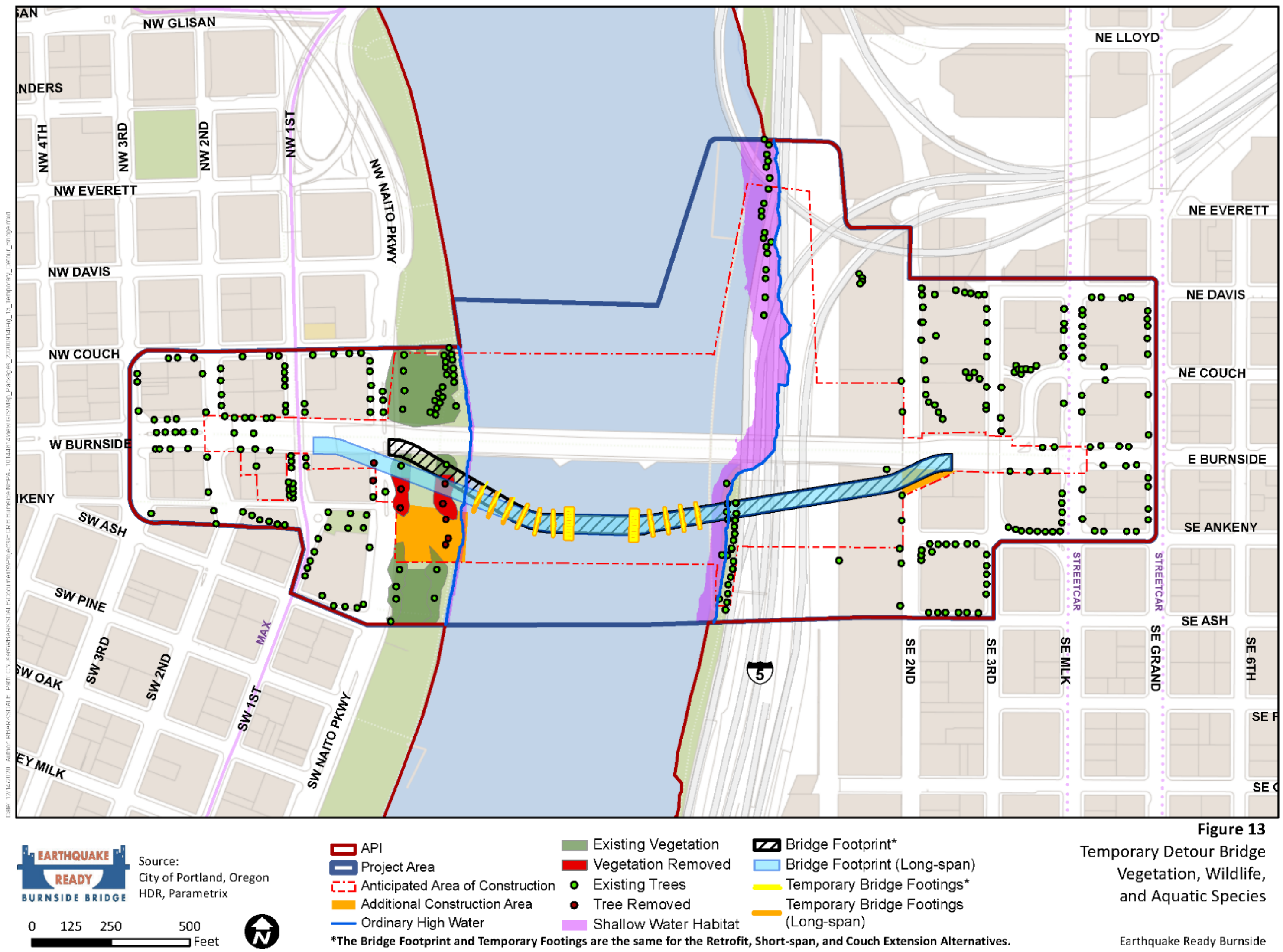


Table 15. Additional Approximate Temporary Construction Impacts with Use of Temporary Bridge

Bridge Type	Area of Piles below OHW (square feet)	Number of Piles below OHW	Area of Piles in SWH (square feet)	Number of Piles within SWH	Loss of Vegetation/ Wildlife Habitat (acres)	Tree Removal (# of trees)
All Modes	410-570	130-180	32	10	0.4	9-10
Transit, Bicycles, and Pedestrians Only	410-570	130-180	32	10	0.4	9-10
Bicycles and Pedestrians Only	220-290	70-90	32	10	0.4	9-10

The Temporary Bridge would create approximately 1.7 acres of impervious surfaces during its 1.5-year duration in place, which can indirectly affect fish. An increase in stormwater runoff would affect water quality through pollutants from roadway surfaces discharging into receiving waters. Temporary stormwater management for a temporary detour bridge would be required, thereby mitigating water quality and quantity impacts.

Enhanced Retrofit

By adding a temporary detour bridge, the overall construction period would increase to 5 years, rather than 3.5 years without the Temporary Bridge. All of the impacts described for the Build Alternatives in Section 7.2 would be the same using a temporary bridge, but would differ in magnitude. Installation of the Temporary Bridge would require additional in-water work and noise disturbance, affecting vegetation, wildlife, and aquatic species in the same manner as with the construction impacts of the Build Alternatives.

The anticipated area of temporary construction impacts would increase by approximately 1.1 acres to accommodate the Temporary Bridge, compared to the anticipated area of temporary construction impacts without a temporary bridge (Figure 13). In this additional area, approximately 0.4 acre of vegetation would be removed, which includes 10 additional trees within Tom McCall Waterfront Park and on SW Naito Parkway. Wildlife likely would be affected by additional noise from construction while installing and removing the bridge. Once construction is completed and cleared areas are revegetated, wildlife likely would return to the API.

Pile driving affects aquatic species through hydroacoustic impacts (Section 7.2). Additional in-water work would be required to install the Temporary Bridge. The bridge would be supported by approximately 130 to 180 steel piles, 10 of which may be placed in shallow water habitat. The duration of pile driving would increase by an additional 50 days.

Replacement, Short-span

Use of a temporary bridge with the Short-span Alternative would have the same impacts as the Retrofit Alternative with use of a temporary bridge, except one fewer tree would need to be removed, for a total of nine trees.

Replacement, Long-span

Use of a temporary bridge with the Long-span Alternative would have the same impacts as the Short-span Alternative, except the duration of pile driving would only be 40 days (10 fewer days) with use of a temporary bridge.

Replacement with Couch Extension

Use of a temporary bridge with the Couch Extension Alternative would have the same impacts as the Short-span Alternative with use of a temporary bridge.

7.4.3 Potential Off-site Staging areas

The construction contractor likely would use one or more off-site staging areas outside the bridge study area to store and and/or assemble materials that would then be transported by barge to the construction site. Off-site staging could occur with any of the alternatives. Whether, where, and how to use such sites will be the contractor's choice and therefore the actual site or sites is unknown at this time. Given this uncertainty, detailed analysis of impacts is not possible at this time, but the project has identified four possible sites that represent a much broader range of potential sites where off-site staging could occur. While the contractor might choose to use one of these or any other site, it is assumed that because of regulatory and time constraints, any site the contractor chooses would need to be already developed with road and river access. It is also assumed that the contractor will be responsible for any relevant permitting and/or mitigation required for their chosen use of a site. The Draft EIS is identifying the types of impacts that could occur from off-site staging, based on the above assumptions. This analysis is not intended to clear any specific site, but rather to disclose general types of impacts based on the sample sites.

Based on the four sample sites identified (Figure 14), the types of impacts that could occur from off-site staging include temporary vegetation removal (and thereby wildlife habitat removal), disruption from construction noise, and impacts to aquatic species from barge use. If vegetation is present at an off-site staging area, it would likely be removed to make room for assembling and storing materials. Because any potential off-site staging areas would be previously developed, the likelihood of having a large vegetated area is low. Riparian areas are more likely to be affected if accessed by barge. If vegetation removal is required, mitigation to compensate for that removal would also be required. Wildlife could be affected by the use of an off-site staging area through temporary habitat displacement and reduction of food sources if vegetation is removed. Certain species could also be disturbed by construction noise from assembling or moving materials in the staging area. If a barge is used to transport materials and equipment from the staging area to the Project Area, aquatic species could be affected in the same ways described in Section 7.2. Potential impacts from barge use include temporary reduction of habitat, impacts to water quality, and increased vulnerability to predation.

If a contractor chooses to use an off-site staging area, the same local, state, and federal regulations that would apply to the Project could also apply. Table 18 in Section 7.6 provides a list of permits, authorizations, and compliances that could apply to an off-site staging area.

Figure 14. Potential Off-Site Staging Areas

7.5 Cumulative Effects

Cumulative effects result from the incremental impact of the Project when added to other past, present, and reasonably foreseeable future actions. Past actions to the natural environment that have affected vegetation, wildlife, and aquatic species within the Project Area began in the 1800s. Past actions to the built environment began in the early 1900s. The *EQRB Cumulative Impacts Approach Memorandum* (Multnomah County 2021c) lists and describes past actions and trends that have shaped the current built, natural, and cultural environment in the study area, as well as lists the City of Portland transportation projects that are reasonably foreseeable.

Construction of bridges, docks, the existing sea wall, and buildings have altered the lower Willamette River through excavation, fill, and structure placement. The Willamette River has been repeatedly dredged during previous development, highly altering in-water habitat for aquatic species. Roadway construction has altered the riparian and upland areas surrounding the river. Dams upstream from the API have contributed to streamflow alteration, increases to in-stream temperatures, and degraded water quality. The combination of these impacts over time have degraded habitat contributing to the listing of certain species as threatened or endangered, including the species discussed in Section 5.3 (Existing Conditions). Critical habitat also has been designated for certain species (Chinook Salmon, Coho Salmon, and Steelhead) which includes the API. Development will continue in the area in the future, regardless of the alternative advanced for this Project.

7.5.1 No-Build Alternative

Under the No-Build Alternative, cumulative effects would include the effects of past development actions and planned future transportation projects that have affected vegetation, wildlife, and aquatic species. Under a No-Build Alternative, the cumulative effects would be the same as those described for the No-Build, post-earthquake scenario discussed in Section 7.3.1.

7.5.2 Build Alternatives

Removal of trees and other vegetation is required for all Build Alternatives. However, the estimated amount of vegetation removal is incremental when considering the overall amount that has been removed due to previous development in the area. Continuous vegetation removal has greatly affected habitat connectivity, especially in riparian areas along the Willamette River. What used to be a continuous corridor is now highly fragmented, leaving patches scattered throughout the Project vicinity. A decrease in available habitat has shifted out wildlife unable to adapt to urban environment. The effects from any of the Build Alternatives would be minor when compared to all past vegetation and habitat removal, but when adding impacts from the Project to all previous vegetation and habitat impacts, the results cause an even larger cumulative impact. Although the Project would create further impacts, most of the impacts can be mitigated. Because mitigation will restore and/or enhance riparian vegetation and habitat, the overall impact to vegetation and wildlife habitat would be beneficial through removal of invasive species and restoration of native species contributing to higher quality habitat than currently exists and that would be affected by the Project.

The Build Alternatives would have in-water impacts affecting aquatic species, adding to the cumulative impacts in the API. The impacts associated with the Project are mostly temporary, caused by construction activities. The proposed construction period ranges from 3.5 to 6.5 years, depending on the alternative. Besides in-water work, ambient noise is generated constantly in the API from motorized boat traffic, which is present year-round, operational bridge lifts, and underwater sound generated by the I-84 Bridge. In-water work such as pile driving, paired with noise generated on a normal daily basis can exacerbate impacts to fish. Many aquatic species have become acclimated to ambient noise, including migrating sea lions, which are not likely to be disturbed by anthropogenic activities. Once construction was completed, there would be no in-water activities affecting aquatic species, however, the daily ambient anthropogenic sound in the API would remain, and future development and maintenance projects requiring in-water work would occur. Permanent structure would be located within in-stream habitat from the build alternatives, adding to the total amount of permanent structure located in the Willamette River in the API both upstream and downstream. Development activities occurring since the 1900s have affected shallow water habitat through a reduction in area and quality. Beyond the API, many other structures are located below OHW, including bridges, piling, and docks that have permanently affected aquatic species by reducing their habitat. Shallow water habitat would be permanently lost due to the Build Alternatives. Avoidance and mitigation measures discussed in Section 8 can help minimize and compensate for impacts to threatened and endangered species, but overall, the Project would contribute to further loss of habitat in the API, the Willamette River, and the Willamette River watershed.

7.6 Conclusion

Overall, the alternative with the greatest impacts to vegetation, wildlife, and aquatic species is the No-Build Alternative, because the Burnside Bridge is expected to fail in the event of an earthquake, leading to a collapse of the structure into the river and riparian area below. Of the Build Alternatives, the Couch Extension Alternative (either movable span option) would have the greatest direct impact on vegetation, based on the number of trees required for removal. The Retrofit, Short-span, and Long-span Alternatives would remove fewer trees than the Couch Extension Alternative, with the Retrofit Alternative requiring removal of the least number of trees. No permanent impacts to vegetation or wildlife would occur due to mitigation that would restore vegetation to riparian and upland areas.

In terms of impacts to wildlife, the physical loss of habitat based on vegetation is the largest impact with the Couch Extension Alternative. The anticipated area of temporary construction impacts is the largest out of all Build Alternatives and would require additional tree removal compared to the Retrofit and other Replacement Alternatives, which would reduce available habitat or resources for wildlife. Because impacts to vegetation and wildlife are temporary, the duration must be considered. The Replacement Alternatives would be under construction for the same amount of time, 4.5 years without a temporary bridge or 6.5 years with a temporary bridge. Construction during this time frame would affect vegetation and wildlife for the longest duration, through removal of vegetation and creation of noise disturbance. The Retrofit Alternative would require the least amount of tree removal.

The longest estimated construction period would come from the Replacement Alternatives using a temporary detour bridge, having the longest duration of impacts to vegetation, wildlife, and aquatic species. The estimated time frame for construction of the Replacement Alternatives is 6.5 years. The construction period is the shortest for the Retrofit Alternative (without the temporary detour bridge), affecting vegetation, wildlife, and aquatic species for a duration of 3.5 years. Table 16 provides estimated construction periods for each alternative, both with and without the use of a temporary detour bridge Table 15 for additional construction footprints associated with the various temporary bridge type modes).

Table 16. Estimated Temporary Construction Physical Impacts and Duration for all Alternatives

Alternative	Temporary Construction Area (acres)		Loss of Vegetation/ Wildlife Habitat (acres)		Loss of Trees (quantity)		Number of Piles below OHW		Pile Driving Duration (total days)		Years of Construction	
	NTB	TB	NTB	TB	NTB	TB	NTB	TB	NTB	TB	NTB	TB
No-Build	0	0	0	0	0	0	0	0	0	0	0	0
Enhanced Retrofit	29.5	30.6	1.1	1.5	89	99	160-220	230-400	95-115	145-165	3.5	5
Replacement, Short-span	30.7	31.8	1.3	1.8	91	100	160-220	230-400	105-125	155-175	4.5	6.5
Replacement, Long-span	30.7	31.8	1.3	1.8	91	100	160-220	230-400	125-145	165-185	4.5	6.5
Replacement with Couch Extension	34.0	35.1	1.3	1.8	118	127	160-220	230-400	105-125	155-175	4.5	6.5

NTB: No Temporary Bridge
TB: Temporary Bridge

Permanent impacts include habitat loss for aquatic species. The Retrofit Alternative has the greatest impact on aquatic species through permanent loss of habitat below OHW. Ground improvements for the Retrofit also are the largest, permanently affecting macroinvertebrate habitat and productivity and reducing available food sources for fish. The alternative with the least permanent impact area is the Long-span Alternative with a Vertical Lift. This alternative has the least amount of physical loss of in-stream habitat compared to all other Build Alternatives, and no impact on macroinvertebrates because no ground improvements would occur below OHW. Table 17 provides the estimated net permanent in-water impacts for all alternatives. Impacts from in-water work are described in Section 7.2. The existing structure below OHW was subtracted from the total impacts below OHW to determine the net Project impacts.

Table 17. Estimated Net Permanent Impacts to Vegetation, Wildlife, and Aquatic Species

Alternative	Movable Span Option	Loss of In-Stream Habitat (acres)	Loss of SWH (square feet)	Loss of Macroinvertebrate Habitat (square feet)
No-Build	-	0	0	0
Enhanced Retrofit	-	1.05	211	16,900
Replacement, Short-span	Bascule	0.85	211	14,400
	Vertical Lift	0.45	211	14.400
Replacement, Long-span	Bascule	0.75	211	0
	Vertical Lift	0.45	211	0
Replacement with Couch Extension	Bascule	0.85	231	14,400
	Vertical Lift	0.45	231	14,400

7.7 Compliance with Laws, Regulations, and Standards

Project actions would comply with all federal, state, and local laws and regulations triggered by the Project's construction activities. Permits would be applied for and acquired before Project construction begins. Table 18 lists permits required for the Project regardless of Build Alternative.

Table 18. Required Permits, Compliance, and Authorizations Related to Vegetation, Wildlife, and Aquatic Species

Permit Type	Jurisdiction	Notes
Section 7 Consultation/Biological Opinion	NOAA Fisheries and USFWS	Required for impacts to ESA-listed species. A Biological Opinion will be written specifically for the Project.
Magnuson Stevens Act Essential Fish Habitat Consultation	NOAA Fisheries	Required for impacts to designated EFH, which is present in the API
Marine Mammal Protection Act	NOAA Fisheries and USFWS	Compliance required due to marine mammal potential occurrence
Fish and Wildlife Coordination Act	USFWS	Compliance required due to modification of the Willamette River
Bald and Golden Eagle Protection Act	USFWS	Compliance required due to potential of species occurrence
Migratory Bird Treaty Act	USFWS	Compliance required to do potential of species occurrence
Section 404	USACE	Triggered by removal or fill in waters of the United States

Permit Type	Jurisdiction	Notes
Removal-Fill	DSL	Triggered by removal or fill in waters of the State
Oregon Endangered Species Act	ODA and ODFW	Potential impacts to species listed as threatened or endangered
Oregon Fish Passage Plan	ODFW	Triggered by projects with major structural upgrades
Title 11 – Tree Permit	City of Portland	All trees that would be disturbed or removed need a tree removal permit
Title 33 – Greenway Review	City of Portland	Requires review for impacts within greenway overlay zone
Title 33 – River environmental zone	City of Portland	Mitigation required for all impacts within River environmental zone

8 Avoidance and Mitigation Measures

Mitigation measures would be implemented to avoid, minimize, reduce, or compensate for impacts to natural resources such as vegetation, wildlife, and aquatic species that would result from a Build Alternative. During construction, BMPs would be implemented to minimize impacts and disturbance to vegetation, wildlife, and aquatic species. These measures would address impacts from in-water work, disturbance to vegetation, erosion control, and containment of construction materials. The following documents, manuals, and resources would be used to implement construction BMPs to comply with the legal requirements outlined in Section 4:

- ODOT Oregon Standard Specifications for Construction (2018)
- ODOT Hydraulics Design Manual (2014)
- City of Portland Stormwater Management Manual (2016)
- Federal Aid Highway Program Programmatic User's Guide (2016)
- City of Portland Protecting Nesting Birds (2018)
- ODOT Erosion Control Manual (2019)
- NOAA Fisheries/USFWS Section 7 Consultation (Biological Opinion - forthcoming)

These BMPs would help minimize adverse effects to vegetation, wildlife, and aquatic species during construction. Protecting and conserving vegetation when possible helps retain habitat for birds and wildlife. To comply with the MBTA, coordination will occur with the U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) staff prior to initiating activities that may result in "take" of any species protected by the MBTA. APHIS will apply for a Migratory Bird Depredation Permit from the USFWS for "take" of birds under the MBTA and will conduct nesting bird management activities under this permit for the Project. Bird management activities may include measures to prevent birds from nesting or removal of successful nests from the construction area that may be affected by construction. If the construction contractor is responsible for bird management activities, construction activities would avoid “take” of species protected by the MBTA.

Actions including minimizing disturbance areas and cleaning plant materials from equipment and gear help would reduce the spread of invasive plant species. Riparian vegetation removed for construction would be replaced. Trees to be preserved in the API would be flagged during construction or have temporary fencing placed around them. Trees to be removed could potentially be preserved off-site during construction, with the possibility of being replanted on-site once construction has been completed. Although this approach would not be feasible for all trees anticipated for removal, it could be an option for some trees, pending further analysis.

Cofferdams isolate specific work areas within the river, reducing exposure of fish to high levels of underwater sound caused by pile driving. Bubble curtains are used during pile driving outside of cofferdams to minimize in-water sound pressure levels. NOAA Fisheries requires fish salvage to avoid and minimize take by physically removing fish from construction areas and releasing them downstream. For each Build Alternative, fish salvage would occur to remove fish from within cofferdams. Conducting in-water construction work during the IWWW minimizes potential impacts to migrating salmonids when their presence is expected to be lowest.

Because all of the Build Alternatives would increase the amount of contributing impervious area, stormwater treatment would be required, improving water quality from stormwater runoff currently untreated and discharged into the river. The use of stormwater management facilities would reduce the levels of pollutants, thereby mitigating new impervious surface area added from the Project. Stormwater would be treated to current regulatory standards for more area than is currently treated, affecting water quality and aquatic species through improved water quality. Prior to construction, an erosion prevention and sediment control plan would be required to outline measures to take during construction. Measures such as sediment trapping and surface roughening would prevent sediment from entering the water, which would otherwise adversely impact aquatic species as described in Section 7.2. Additional stormwater management BMPs and mitigation measures are described in the *EQRB Stormwater Technical Report* (Multnomah County 2021g).

Once an alternative is selected, specific mitigation measures would be developed in coordination with the City of Portland, NOAA Fisheries, USFWS, and ODFW. Once a mitigation action is implemented, monitoring would occur to confirm success of the action. Mitigation measures addressing water quality are discussed in the *EQRB Stormwater Technical Report* (Multnomah County 2021g), and compensatory mitigation for impacts to waters are discussed in the *EQRB Wetlands & Waters Technical Report* (Multnomah County 2021h).

Unavoidable impacts to vegetation, wildlife, and aquatic species would be mitigated through aquatic habitat and riparian restoration within the Lower Willamette River, as approved by regulating agencies, and may include the purchase of mitigation bank credits. Exact compensatory mitigation locations, amount, and actions would be determined through agency coordination at a later date. Compensatory mitigation requirements are typically based on the impact area and mitigated at a specific ratio (e.g., 1:1 or 1.5:1), but varies depending on jurisdiction, type of impact, and location.

Because regulating agencies have different mitigation requirements, substantial coordination would be required to determine a mitigation plan that would satisfy all agency requirements and meet Project needs. The mitigation plan for the Project would provide proportional mitigation to the area of impact and replace similar types of resources or functions. The City of Portland Zoning Code would require mitigation for both temporary and permanent impacts from bridge construction. Activities that would require mitigation may include cofferdam installation and removal, Temporary Bridge construction, ground improvements, excavation and fill below OHW, and stormwater management. Depending on which overlay zone the impact is in, different amounts or types of mitigation may be required. In addition to the option of restoration for mitigation, another opportunity would be to purchase mitigation credits from an existing mitigation bank. This would satisfy mitigation requirements for the Project through mitigation activities implemented off-site and before Project construction began.

The mitigation measures outlined above apply to all Build Alternatives, including the option of using a temporary bridge. The differences between alternatives are from the amount of required mitigation, which will be determined at a later date.

9 Contacts and Coordination

Project work will include an extensive public involvement and agency coordination effort including local jurisdictions and neighborhoods within the Project Area.

At the appropriate time, agencies and organizations will be notified of the intent to prepare an EIS through the Federal Register and other Project outreach activities. Interested organizations will have the opportunity to review and comment on the vegetation, wildlife, and aquatic species analysis through the course of the Project, including during the public comment period for the Draft EIS.

During the impacts analysis, the following agencies were contacted for data and other information related to vegetation, wildlife, and aquatic species:

Organization	Name
NOAA Fisheries	Tom Lovnes
ODFW	Monica Blanchard
ODOT	Devin Simmons
City of Portland BES	Kaitlin Lovell

10 Preparers

Name	Professional Affiliation [firm or organization]	Education [degree or certification]	Years of Experience
Rachel Barksdale	HDR	M.E.M., Environmental Management B.S., Natural Resources	6

Name	Professional Affiliation [firm or organization]	Education [degree or certification]	Years of Experience
Carol Snead	HDR	M.S., Geology B.S., Geology	30
Brian Bauman	HDR	B.S., Natural Resources Management	24
Taya MacLean	Parametrix	M.S., Biology B.S., Forestry and Natural Resources Management	21

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2021e EQRB Hydraulics Technical Report. https://multco.us/earthquake-ready-burnside-bridge/project-library

2021f EQRB Noise and Vibration Technical Report. https://multco.us/earthquake-ready-burnside-bridge/project-library

2021g EQRB Stormwater Technical Report. https://multco.us/earthquake-ready-burnside-bridge/project-library

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Appendix A. Site Photographs

Photo 1. View of Tom McCall Waterfront Park from the Willamette River, Facing West

Source: Google 2019

Photo 2. Riparian area with the largest area of vegetation cover within the API (east bank of the Willamette River, south of the Burnside Bridge). Shallow water habitat is visible.

Source: HDR 2019

Photo 3. Canada Geese and sparse vegetation on the east bank riparian area of the Willamette River, north of the Burnside Bridge. Shallow water habitat is visible up to the OHW mark.

Source: HDR 2019

Photo 4. Shaded riparian area with riprap and trees visible. View from the Vera Katz Eastbank Esplanade, north of the Burnside Bridge. Riprap banks and riparian vegetation visible.

Source: HDR 2019