

Steigerwald Floodplain Restoration Project

Draft Environmental Assessment

January 2018



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ACRONYMS

7-DADMax	7-day average of the daily maximum temperatures
ACS	American Community Survey
ADA	Americans with Disabilities Act
APE	area of potential effect
BMP	best management practice
BNSF	Burlington Northern Santa Fe
BP	before present
BPA	Bonneville Power Administration
°C	degrees Celsius
CAA	Clean Air Act
CCP	Comprehensive Conservation Plan
CCS	cryptocrystalline silicate
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH ₄	methane
CLOMR	Conditional Letter of Map Revision
cmbs	centimeters below surface
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
Corps	U.S. Army Corps of Engineers
CRDT	Columbia River Dike Trail
CWA	Clean Water Act
dB	decibels
dBA	A-weighted decibels
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DO	dissolved oxygen
DPS	distinct population segment
EA	environmental assessment
Ecology	Washington Department of Ecology
EFH	Essential Fish Habitat
EIS	environmental impact statement

EPA	U.S. Environmental Protection Agency
ERTG	Expert Regional Technical Group
ESA	Endangered Species Act
ESU	evolutionarily significant unit
°F	degrees Fahrenheit
FCRPS	Federal Columbia River Power System
FDR	Flood Damage Reduction
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FMP	Fishery Management Plan
FONSI	finding of no significant impact
FR	Federal Register
ft.	feet
FWCA	Fish and Wildlife Conservation Act
g	The acceleration of gravity on the surface of the earth at sea level, which is 9.8 meters/second ²
GHG	greenhouse gas
GIS	Geographic Information Systems
H	horizontal
HIP	Habitat Improvement Program
HPA	Hydraulic Project Approval
HRA	Historical Research Associates
Land Trust	Friends of the Columbia Gorge Land Trust
lbs/day	pounds per day
LCEP	Lower Columbia Estuary Partnership
LCFRB	Lower Columbia Fish Recovery Board
LCR	Lower Columbia River
Leq	equivalent sound level
Lmax	maximum sound level
LOMR	Letter of Map Revision
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MMPA	Marine Mammal Protection Act
N ₂ O	nitrous oxide

NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO ₂	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
Northwest Power Act	Pacific Northwest Electric Power Planning and Conservation Act
NO _x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSA	National Scenic Area
NTU	Nephelometric Turbidity Unit
NWP	Nationwide Permit
NWR	National Wildlife Refuge
O&M	Operations and Maintenance
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
PCE	primary constituent elements
PGA	peak ground acceleration
pH	Measure of Acidity or Alkalinity
PM	particulate matter
PM ₁₀	particulate matter 10 micrometers or less in diameter, or fugitive dust
PM _{2.5}	particulate matter 2.5 micrometers or less in diameter
Port	Port of Camas-Washougal
Refuge	Steigerwald Lake National Wildlife Refuge
RM	River Mile
RMU	Recovery Management Unit
ROG	reactive organic gases
RPA	Reasonable and Prudent Alternative
SBU	survival benefit units
SDP	Substantial Development Permit
SO ₂	sulfur dioxide
SPCC	Spill Prevention Control and Countermeasures

SR14	Washington State Route 14
SWCAA	Southwest Clean Air Agency
SWPPP	Stormwater Pollution Prevention Plan
TDG	total dissolved gas
TMDL	total maximum daily load
USC	United States Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
V	vertical
WAC	Washington Administrative Code
WCRL	Washougal-Columbia River Levee
WDFW	Washington Department of Fish and Wildlife
WISAARD	Washington Information System for Architectural and Archaeological Records Data
WSDOT	Washington State Department of Transportation
WSEs	water-surface elevations

CHAPTER 1 INTRODUCTION

1.1 Background

The Bonneville Power Administration (BPA) is deciding whether to fund the Steigerwald Floodplain Restoration Project (project) at the Steigerwald Lake National Wildlife Refuge (Refuge) near Washougal, Washington (Figures 1-1 and 1-2). The project is co-sponsored by the Lower Columbia Estuary Partnership (LCEP) and the Port of Camas-Washougal (Port). The Refuge is owned and managed by the U.S. Fish and Wildlife Service (USFWS). A levee along the Columbia River at the Refuge is authorized by the U.S. Army Corps of Engineers (Corps) as part of the Washougal Flood Damage Reduction (FDR) Project; the Port owns the levee system, referred to as the Washougal Levee System, and is responsible for levee operation and maintenance. The Washougal Levee System has two segments, referred to as the Washougal-Columbia River Levee (WCRL) and the Washougal-Lawton Creek Levee. The 5.1-mile WCRL segment runs west to east directly along the Columbia River and provides flood protection to parts of the town of Washougal, the Port, and the Refuge. The Washougal-Lawton Creek Levee segment is approximately 1,800 feet (ft.) and runs north to south at the east end of the Refuge. The Washougal Levee System was built over naturally-occurring levees that formed as a result of Columbia River fluvial actions such as erosion and sediment deposition.

The project would involve reconnecting Gibbons Creek and the Steigerwald Lake floodplain to the Columbia River by breaching the WCRL as well as the naturally-occurring levee upon which the WCRL was constructed; constructing two new setback levees; removing a diversion structure, fish ladder, elevated channel, and water control structure; relocating the Refuge parking lot and bathrooms; reconfiguring refuge trails; enhancing wetland channels; and re-establishing the site's historic riparian vegetation. Goals of the project include restoring floodplain connectivity to the Columbia River; improving water quality and habitat to benefit fish; maintaining required levels of flood protection and reducing outputs of contamination to the Columbia River; eliminating the need to dredge the Gibbons Creek channel to maintain water flow capacity; and reducing annual costs associated with pumping water at the Port. BPA is the lead agency and prepared this draft environmental assessment (EA) pursuant to the National Environmental Policy Act of 1969 (NEPA) (42 United States Code [USC] 4321 et seq.) and its implementing regulations. NEPA requirements necessitate federal agencies to assess the effects of proposed actions on the environment. BPA is joined in this project by the Corps and USFWS, which are acting as cooperating agencies.

This EA was prepared to determine if the Proposed Action would be likely to significantly affect the environment, warranting preparation of an environmental impact statement (EIS), or whether it is appropriate to prepare a finding of no significant impact (FONSI).

This chapter describes BPA's need to take action and the purposes that BPA seeks to achieve in addressing this need. The chapter also provides project background information, identifies the entities involved in the development of this EA, and summarizes the public scoping process and comments received.





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1.2 Purpose and Need

BPA's decision is whether to fund the proposed Steigerwald Floodplain Restoration Project.

In meeting the need for action, BPA seeks to achieve the following purposes:

- Assist in carrying out commitments related to estuary habitat actions contained in the State of Washington's Memorandum of Agreement (Washington Fish Accord) to conserve salmon and steelhead through improvement of conditions in the estuary.
- Support efforts to mitigate for the effects of development and operation of the Federal Columbia River Power System (FCRPS) on fish and wildlife in the mainstem Columbia River and its tributaries, pursuant to the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act) (16 USC 839b (h)(10)(A)), in a manner consistent with the Northwest Power and Conservation Council's Fish and Wildlife Program.
- Secure and claim survival benefits to help fulfill BPA's commitments to implement the Reasonable and Prudent Alternative (RPA) No. 37 listed in the 2008 FCRPS Biological Opinion (FCRPS BiOp), as amended in 2010 and 2014 (NMFS 2008a; 2010; 2014), which directs BPA and the other FCRPS Action Agencies, which includes BPA, the Corps, and the Bureau of Reclamation¹, to develop projects that improve fish habitat quality and fish survival in the Columbia River estuary.
- Minimize adverse effects to the human environment, avoid jeopardizing the continued existence of Endangered Species Act (ESA)-listed species, and avoid adverse modification or destruction of designated critical habitat.
- Implement BPA's Fish and Wildlife Implementation Plan EIS and Record of Decision policy direction which calls for protecting weak stocks, such as ESA-listed salmon and steelhead, while sustaining overall populations of fish for their economic and cultural value (BPA 2003).

1.3 Background

1.3.1 Statutory Context

BPA is a federal power marketing agency under the U.S. Department of Energy. BPA's operations are governed by several statutes, including the Northwest Power Act, which directs BPA to protect, mitigate, and enhance fish and wildlife and their habitats affected by the development and operation of the FCRPS. To accomplish this, BPA funds fish and wildlife protection, mitigation, and enhancement actions consistent with the Northwest Power and Conservation Council's Fish and Wildlife Program. Under this program, the Northwest Power and Conservation Council makes recommendations to BPA about which fish and wildlife projects to fund. BPA implements its Northwest Power Act and ESA obligations through the

¹ While all three federal agencies are FCRPS Action Agencies for the FCRPS BiOp, BPA and the Corps have agreed to develop the survival benefits in the Columbia River estuary.

Fish and Wildlife Program, including funding projects to help fulfill its commitments under the FCRPS BiOp.

In the Columbia River estuary, the Northwest Power and Conservation Council's Fish and Wildlife Program includes strategies to protect, mitigate, and enhance salmon and steelhead spawning and rearing habitat. For example, the Northwest Power and Conservation Council recommends habitat restoration work to reconnect ecosystem functions, such as removing or lowering dikes and levees that block access to habitat, and protecting or restoring off-channel habitat. BPA's FCRPS BiOp commitments include providing for improved survival of listed salmon and steelhead species in the Columbia River estuary and focuses on current and future restoration project implementation over a wide range of site characteristics and sizes throughout the Columbia River estuary. Considerations in the selection of restoration sites include proximity to the mainstem Columbia River, size of the restored habitat, certainty that the restoration design would provide habitat benefits, and availability of the land for restoration.

1.3.2 Federal Columbia River Power System Biological Opinion

In addition to the Northwest Power Act obligations, BPA, as a federal agency, also must comply with the ESA. Under the FCRPS BiOp developed through interagency consultation with the National Marine Fisheries Service (NMFS), BPA and the other action agencies have committed to implementing actions to improve Columbia River estuary habitat for salmon and steelhead, as specified in RPA Action 37. Beneficial estuary habitat actions include increasing available rearing habitat, cover and forage opportunities, and high flow refugia habitat in the Columbia River estuary.

1.3.3 Project Review

The Proposed Action has been developed by LCEP. The Proposed Action has been reviewed by the Expert Regional Technical Group (ERTG), which evaluates restoration proposals to determine the amount each project would benefit the survival of ESA-listed salmon and steelhead. This group is also made up of regional scientists specializing in estuarine, riverine, and ocean ecology, fisheries biology, and restoration science. Based upon current knowledge of how juvenile salmon and steelhead use and transit through the estuary, the ERTG evaluates proposed restoration projects and evaluates the relative contribution each project makes toward improving the survival and production of juveniles, using a biological crediting tool referred to as a "survival benefit unit" or SBU. *The History and Development of a Method to Assign Survival Benefit Units* provides additional details on the history and development of the ERTG and its relationship to the agencies (ERTG 2010b).

The ERTG developed criteria for scoring three factors: certainty of success, potential benefit for habitat access/opportunity, and potential benefit for habitat capacity/quality. The *ERTG Scoring Criteria* provides additional details on the scoring criteria used to assign SBUs for independent project actions. The purpose of the *ERTG Scoring Criteria* is to provide standard criteria for the ERTG to apply when it scores projects as part of the process to assign biological credit to proposed restoration projects (ERTG 2010a). Scores were developed for ocean-type and stream-type habitat characteristics. The total project SBUs were 5.045 ocean-type and 1.611 stream-type.

1.4 Roles of Other Entities

1.4.1 U.S. Army Corps of Engineers

The Proposed Action involves alterations to a federally-authorized levee managed by the Port. Alterations to federally-authorized levees require Corps (Civil Works) review and approval under Section 14 of the Rivers and Harbors Act of 1899 (33 USC 408) (herein referred to as Section 408). The Corps may approve the alterations as long as they will not impair the usefulness of the project or be injurious to the public interest. Due to its responsibilities under the Section 408 process, the Corps is participating as a cooperating agency on this EA. The Corps also has jurisdiction over the project under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act. The Regulatory Branch of the Portland District is responsible for permitting under Sections 404, 408, and 10.

1.4.2 U.S. Fish and Wildlife Service

The Refuge is owned and managed by the USFWS. When the second powerhouse at Bonneville Dam was constructed in the 1970s and 1980s, the course of the Columbia River was altered and lowland habitat was lost. The Refuge was created in 1987 to mitigate for these impacts, and to create habitat for migrating and resident wildlife. USFWS staff actively manage habitat within the Refuge, and have been involved in the design of the Proposed Action. They also maintain facilities that would be affected by the Proposed Action, including a water diversion structure on Gibbons Creek near the State Route 14 (SR14) Bridge, an elevated canal that conveys Gibbons Creek flows across the floodplain, and a fish ladder on the south side of the WCRL. USFWS also has responsibilities for ensuring compliance with ESA. As a result, USFWS is participating as a cooperating agency on this EA.

1.4.3 Lower Columbia Estuary Partnership

The mission of LCEP is to improve the lower Columbia River by protecting and restoring ecosystems and enhancing clean water for current and future generations of fish, wildlife, and people. LCEP is operated as a nonprofit corporation representing the tidally influenced portion of the Columbia River, which extends 146 miles from Bonneville Dam to the Pacific Ocean. LCEP developed the concept and design for the Proposed Action and has applied to BPA for funding.

1.4.4 Port of Camas-Washougal

The Port is a co-sponsor of the Proposed Action. The Port's property is located adjacent to the west of the Refuge. Overflow over the Gibbons Creek diversion structure flows into the Port's property, and is then pumped to the Columbia to alleviate interior flooding. The Port is the designated owner of the WCRL at Steigerwald, and is responsible for its maintenance. The Port manages leases of its 430-acre industrial park, which is currently located within a FEMA mapped Special Flood Hazard Area and which was inundated during the 1996 flood. The Port is interested in reducing overall operations and maintenance expenses associated with pumping and levee maintenance.

1.4.5 Cities of Camas and Washougal

The cities of Camas and Washougal own a portion of the property in the study area. Although this land is undeveloped, the cities plan to construct a groundwater supply project to supply water to the cities. As a result, the cities have an interest in the design and operation of the Proposed Action. The City of Washougal's Waste Water Treatment Plant (WWTP) is located within the FEMA-mapped Special Flood Hazard Area.

1.4.6 Friends of the Columbia Gorge

Friends of the Columbia Gorge Land Trust (Land Trust) was created in 2005 to protect and enhance critical landscapes through acquisition and stewardship. A primary function of the Land Trust is to purchase or receive through donation properties within the Columbia River Gorge National Scenic Area (NSA), with the goals of protecting scenic and natural resources, as well as promoting recreational opportunities. The Land Trust has worked with a private landowner east of the Refuge to purchase a portion of this property. The proposed east setback levee would run along the eastern boundary of this acquired property.

1.5 Public Scoping and Key Issues

Formal public scoping for the Steigerwald Floodplain Restoration Project EA was initiated on December 28, 2015, and closed on January 27, 2016. BPA initiated the scoping period for the EA by mailing public letters and maps to interested parties and creating a project webpage (https://www.bpa.gov/efw/Analysis/NEPADocuments/Pages/Steigerwald_Floodplain_Restoration.aspx). A public meeting was conducted for the project in Washougal, Washington on January 14, 2016, with attendance from a total of 32 members of the public. Attending the public meeting were representatives from BPA, the Corps, the USFWS, LCEP, the City of Washougal, and the Land Trust. BPA also met with natural resources and tribal staff members of the Confederated Tribes of the Grand Ronde in Grand Ronde, Oregon on January 26, 2016. During the scoping period, BPA received 19 comments, either at the scoping meeting, electronically, or by mail. Comments are posted in their entirety at the project website above and are provided in the Scoping Summary Report (Appendix A).

Issues raised during the scoping process were generally divided into the following issue categories:

1.5.1 Fish

BPA received several comments on the anticipated effects of the project on fish species using Gibbons Creek and the Steigerwald Lake system. Certain commenters requested information on types of fish currently using the area, while others requested information on types of fish anticipated to use the area for refugia or spawning after project completion.

1.5.2 Wildlife

Commenters requested that BPA consider the impacts of the proposal on wildlife either currently within the project area or anticipated to return to the project area post-completion. Certain

commenters requested that surveys be conducted to determine population trends of various wildlife species both before and after the project.

1.5.3 Cultural/Tribal Resources

BPA had the opportunity to meet with and receive comments from the Confederated Tribes of the Grand Ronde. Interests of the tribe included ensuring that notification and consultation be completed for any cultural resources found in the area, and raising the possibility that the project could create new opportunities for partnerships.

1.5.4 Vegetation

Certain commenters requested evaluation of impacts of the project on existing vegetation and potential new vegetation within the Refuge.

1.5.5 Flood Risk/Flood Potential

Neighboring residents and landowners in the City of Washougal requested information on whether the project would lead to increased flood risk associated with the project.

1.5.6 Water Resources

Some commenters requested that the EA consider the impact of the project, both positive and negative, on water quality both in Gibbons Creek and in the Refuge. Additionally, comments raised issues regarding the project and the relationship to municipal water supplies.

1.5.7 Project Design

Commenters requested specific inclusions in the project design, both in terms of recreation and access and in terms of the floodplain and stream channel reconstruction. One commenter requested consideration of a new alternative that would maintain the existence of the Gibbons Creek elevated channel and the fish ladder.

1.5.8 Proposed Camas/Washougal Water Well Field

Comments submitted by the cities of Camas and Washougal indicated that they have purchased property that is proposed to be bisected by the western setback levee for the project. This property is the site of the future Steigerwald Well Field, which is a groundwater supply project intended to provide future water supply needs.

1.5.9 Other Comments

Members of the public also raised issues not falling into any of the categories described above. These comments reflected concerns about air quality, noise, costs to local communities, traffic, changes to zoning, visual resources, and relationship to other entities, lessons learned from other restoration projects, and potential effects to utilities.

All comments and additional details of the public scoping process appear in the Scoping Summary Report, which is provided in its entirety as Appendix A to this EA.

1.6 Issues Beyond the Scope of this EA

Some comments provided by the public during the scoping process presented issues that were beyond the scope of this EA, either because these comments raised issues not relevant to the Proposed Action, are outside of BPA's ability to address or modify, or are more appropriately addressed in separate forums. Issues considered beyond the scope of this EA included:

1. Potential effects in the context of broader goals associated with regional plans.
2. Insertion of PIT tags into outmigrating juvenile fish.
3. Pre- and post-construction wildlife surveys.
4. Questions or comments regarding specific plantings, access, or interpretive features associated with area tribes.
5. Development in the Gibbons Creek watershed.
6. Questions/comments regarding project design features.
7. Lessons learned from other restoration projects.

CHAPTER 2 ALTERNATIVES

This chapter describes the Proposed Action and the no action alternatives, and compares the alternatives by project purposes and their potential environmental consequences. This chapter also includes alternatives that were considered but eliminated from further study.

2.1 Proposed Action

Under the Proposed Action, BPA would fund the Steigerwald Floodplain Restoration Project. The Proposed Action would include restoring floodplain processes including provision of off-channel rearing habitat, flood storage, and increased habitat complexity in the Columbia River Estuary. Primary actions would include breaching natural and constructed levees on the Columbia River, developing floodplain channels, realigning Gibbons Creek, constructing setback levees, an emergency closure structure on SR14, and a floodwall, and revegetating with native riparian and wetland vegetation. Infrastructure associated with Gibbons Creek includes a structure that diverts water away from the historic Gibbons Creek channel, an elevated canal that carries water across the Steigerwald floodplain, and a fish ladder at the mouth of Gibbons Creek that would be removed. The trail network at the Refuge would be improved by reconfiguring and lengthening it by approximately 1 mile. The project would also include relocating infrastructure associated with USFWS management of the area, including the parking area and kiosk, and raising SR14 to 38.5 ft. North American Vertical Datum of 1988 (NAVD88), which would reduce flood risk to the SR14 base and roadway. All components of the completed project, other than the FDR system and SR14, would be owned by USFWS and maintained in a manner consistent with current Operations and Maintenance (O&M) practices. The levees and closure structure would be owned and maintained by the Port, which would update its O&M manual to reflect the changes to the FDR system. SR14 and all components of the road prism beneath it would continue to be owned and maintained by WSDOT.

2.1.1 Project Area

The project area encompasses 1,055 acres, which includes much of the Refuge. The Refuge is managed by USFWS as part of the Ridgefield National Wildlife Refuge Complex, which is comprised of four National Wildlife Refuges (NWRs) in southwestern Washington State – Steigerwald Lake, Ridgefield, Pierce, and Franz Lake. The Refuge occupies the north bank of the Columbia River approximately between River Miles (RM) 124 and 128. It is managed as habitat for migratory waterfowl, and is protected from Columbia River flood flows by the Corps-certified WCRL. Additional lands within the project area but outside of the area managed by USFWS include public and private lands that would either be acquired in fee or a flood easement would be obtained.

The project area is a historic floodplain dominated by grasslands and wetlands. Aerial photographs from 1935 show the lands between RMs 123 and 128 as a series of seasonally flooded open water areas surrounded by vegetated marsh and connected by meandering channels. Flood protection levees installed in the mid-1960s isolated Steigerwald Lake and the surrounding floodplain from periodic flooding and blocked fish access to these areas. Gibbons Creek is a perennial stream that flows through the site in an elevated and engineered channel built by the Corps in 1992 (Figure 2-1). It does not interact with the floodplain habitats except under high flow conditions.

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Source: LCEP 2017

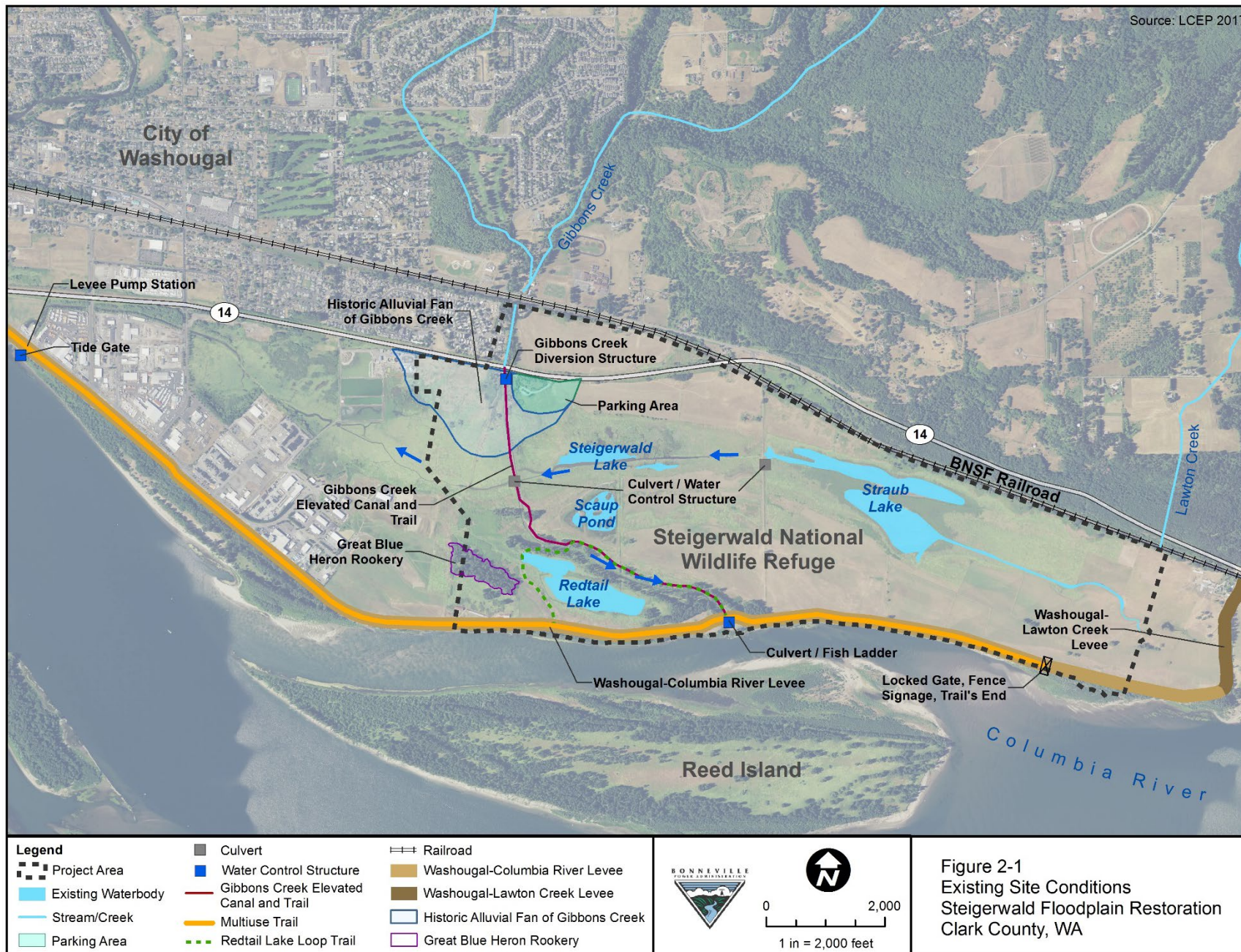


Figure 2-1
Existing Site Conditions
Steigerwald Floodplain Restoration
Clark County, WA

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Habitat value in the floodplain wetlands and ponds may be impaired by seasonally high water temperatures and minimal vegetative and structural diversity. Fish access from the Columbia River is highly impaired, with fish access to Gibbons Creek only through a fish ladder that does not meet Washington Department of Fish and Wildlife (WDFW) fish passage requirements.

The project area is located approximately 17 RMs downstream of Bonneville Dam, within the tidally-influenced stretch of the Columbia River. The tidal range at this location is relatively minimal, and generally fluctuates no more than 2 ft. The estuary in this reach is well upstream of the saline or brackish areas.

The primary influence on water-surface elevations (WSEs) in this reach are releases from Bonneville Dam. Prior to dam and levee construction, spring flows inundated up to 300,000 acres of the lower Columbia River floodplain. Regulation of the river has reduced peak flows from approximately 600,000 cubic feet per second (cfs) to about 350,000 cfs (Christy and Putera 1993).

Lands within the Refuge are managed primarily for waterfowl habitat, and the Refuge has signed on as a partner in the Pacific Northwest Goose Management Plan, which is designed to reduce depredation of geese on private agricultural lands. Under this partnership, the Refuge has agreed to maintain grasslands for geese. Habitat requirements for the target waterfowl species include shallow wetland areas and grasslands for forage, with access to upland refugia during high water events. The wetland components are found primarily throughout the center of the Refuge, in a complex of seasonal and permanent wetlands that includes Steigerwald Lake, Scaup Pond, and Straub Lake (Figure 2-1). Due to the low topographic relief found throughout much of the site, relatively minor changes in the WSEs of the lakes can produce substantial increases in wetland habitat area, resulting in the formation of approximately 617 acres of wetland habitat (LCEP 2016). 293 acres of the fields surrounding the wetlands are maintained by mowing and grazing for waterfowl grazing and upland refugia. Additional fields are unmanaged (USFWS 2005). The remainder of the Refuge lands consist of lesser amount of riparian forest, scrub-shrub, abandoned farm fields and outbuildings, infrastructure including part of the WCRL, and visitor facilities.

2.1.2 Project Elements

The primary proposed restoration elements associated with the Proposed Action are shown on Figure 2-2 and would include:

- Floodplain channel enhancement and creation,
- Removal of infrastructure including water diversions, an elevated canal, and fish ladder,
- Reconfiguring existing flood protection infrastructure and constructing new levees,
- Wetland enhancement and creation,
- Flood damage reduction,
- Revegetation, and
- Reconfiguration or replacement of recreational features.

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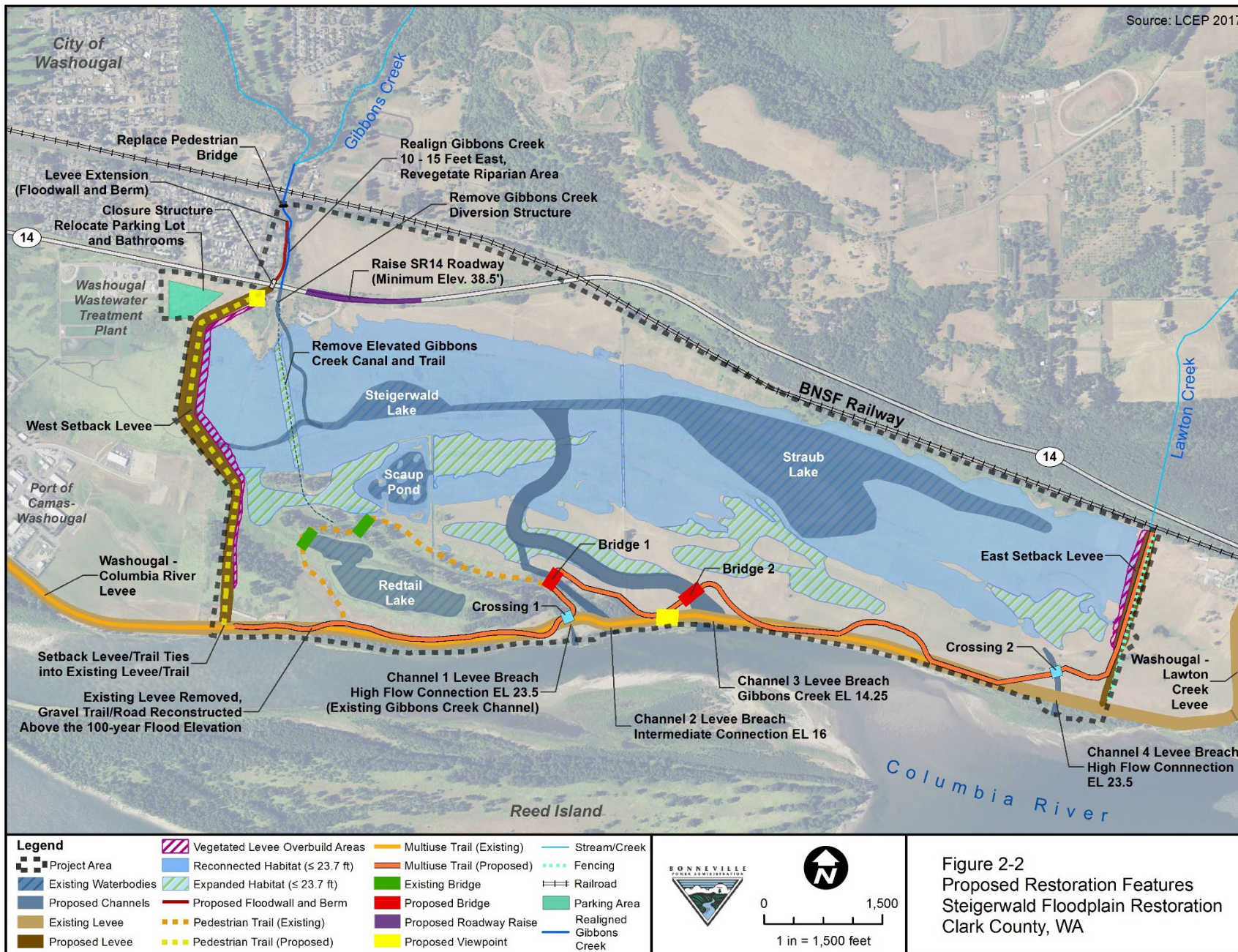


Figure 2-2
Proposed Restoration Features
Steigerwald Floodplain Restoration
Clark County, WA

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2.1.2.1 Floodplain Channels

Hydraulic connectivity between the Columbia River and the Refuge would be restored by completely removing 2.2 miles of the WCRL and excavating four deeper floodplain channels through the natural fluvial levee to the interior floodplain. Channel design was based on stream simulation design principals that consider hydraulic, sediment, and biological transport processes and functions.

The dimension and connection elevation of each channel varies with the intended function and purpose. The four channels are described below and the four breach locations illustrated on Figure 2-2. Proposed channel geometry is summarized in Table 2-1.

Table 2-1: Floodplain Channel Geometry

Floodplain Channel/ Connection Type	Connection Elevation (ft. NAVD88)	Bottom Width (ft.)	Slope Through Channel (%)	Slope at River Connection (%)	Total Length (ft.)	Notes
Channel 1 High Flow	23.0	15	Flat	2.0 – 3.5	3,400	Old Gibbons Creek outlet
Channel 2 Intermediate Flow	17.0	10	Flat	0.5 – 1.0	4,480	Connected during typical winter flows
Channel 3 (New Gibbons Creek Outlet)	14.5	15	Flat	1.0 – 2.0	5,000	Primary, perennial connection
Channel 4 High Flow	23.0	10	Flat	2.0 – 3.5	3,900	Upstream-most connection

2.1.2.1.1 Gibbons Creek Restoration (Channel 3)

The primary floodplain connection would be via Gibbons Creek, which, when completed, would become Channel 3 (Figure 2-2). Currently, Gibbons Creek discharges through Channel 1. Channel 3 would accommodate Gibbons Creek flows during periods when the Columbia River does not backwater into the Refuge. The channel is designed to accommodate natural geomorphic changes due to variations in:

- Rainfall-runoff hydrology of Gibbons Creek watershed and the Refuge
- Seasonal sand bedload transport conditions in the Columbia River
- Vegetation establishing within the floodplain channels and the adjacent sand flats

At 14.5 ft. NAVD88, this channel would have the lowest bottom elevation of any of the channels. This elevation is intended to replicate existing inundation depths and extents in Steigerwald and Straub Lakes during dry seasons, when Gibbons Creek would flow into these depressions, through this channel, and to the Columbia River. Channel 3 would also accommodate wide ranges in creek and floodplain processes: perennial drainage of Gibbons Creek under low Columbia River flows (stages), and backwatering (inflow/outflow) from the river during the spring freshet and winter flow events. The channel would have a 120-ft. wide floodplain, and a narrower 15-ft. wide inset channel at non-backwatered conditions. The connection reach would be a shallower gradient channel designed at a slope of less than half a percent through most of this reach. The channel gradient would increase at the confluence, with the final 600 ft. sloping to the river at slope of less than 2 percent.

2.1.2.1.1.1 Channel Geometry

The mouth of Channel 3 would be located at the inside of a Columbia River side channel meander bend which is an area that can be prone to sedimentation. Gibbons Creek is a perennial creek with substantial typical summer and winter flows. The morphology of the connection channel would be a result of the interaction of these two processes.

The following channel dimensions were determined for Gibbons Creek from the sediment balance results:

- Bed slope: 0.5 percent to 1.2 percent is in-line with the alluvial fan slope and thus would be consistent with historic channel slope.
- Channel bottom width: 18 – 20 ft.; Channel side slopes would be 3 ft. horizontal (H) to 1 ft. vertical (V) (3H:1V), which is similar to what was observed on Gibbons Creek upstream of SR14.
- Channel top width: 25 – 30 ft.; this top width coincides with the existing channel top widths upstream of the SR14 Bridge.
- Channel depth: 1 to 2 ft.; low channel depths as a conservative estimate intended to increase bank overtopping, floodplain inundation, and sediment deposition.
- Width to depth ratio: greater than 10.

Excavation of the new alignment could unearth alluvial deposits that would provide for an initially stable channel bed material. However, the potential to unearth sufficient alluvial deposits lessens with the channel downstream distance, as the new alignment extends to the edges of the alluvial fan. As needed, the realigned channel would be lined with coarser bed materials from the existing channel and remnant overflow channel. Additional stability would be added adjacent to the west setback levee and Gibbons Creek north flood protection berm by constructing cobble riffles to prevent damage to these critical pieces of infrastructure.

2.1.2.1.2 High Flow Connections (Channels 1 and 4)

Channels 1 and 4 would be high flow channels with a connection elevation of 23.0 ft. NAVD88 located along the northern side of the natural levee. These channels would provide additional floodplain connection at 2-year or greater flow events. Channel 1 would primarily consist of the

existing Gibbons Creek channel along Redtail Lake with a relatively small amount of grading at the breach to cross the natural levee. Channel 4 would connect to an existing low flow path that extends southeast of Straub Lake through low floodplain topography at a channel elevation of 23.0 ft. NAVD88. From this high point, the channel would slope towards the Columbia River, requiring channel grading through the final 1,200 ft. of natural levee. The majority of Channel 4 would be gently sloped (less than 1 percent) into the project site.

2.1.2.1.3 Intermediate Flow Connection (Channel 2)

Channel 2 would provide an intermediate connection to the Columbia River with a maximum channel elevation of 17.0 ft. NAVD88 located at Steigerwald Lake. This lower elevation would provide for an additional outlet for site drainage during intermediate Columbia River stages. The proposed channel alignment avoids Scaup Pond in order to preserve its current hydrology and reduce potential impacts to the waterbody.

2.1.2.1.4 Other Channel Elements

The following elements have been incorporated into the design to provide additional channel complexity:

- Pool and riffle morphology
- Wood habitat structures along the banks
- Live stake planting to increase channel bank stability
- Riparian vegetation planting as described in Section 2.1.2.6

Floodplain channels would cross the Columbia River riparian zone and would also have their own riparian zones, each of which would be planted with riparian, willow scrub, and native seed as appropriate. Proposed revegetation is discussed in more detail in Section 2.1.2.6.2. The restored riparian area is intended in part to create suitable beaver habitat and encourage dam building which would further improve the quantity and quality of off-channel fish and wildlife habitat. It is also intended to provide shade, organic matter input, and habitat for terrestrial species.

Wood habitat structures would be placed throughout the restored channels to increase cover habitat and channel/hydraulic diversity, and provide substrate and organic food source to support the food web. Up to 1,750 logs for wood habitat structures would be placed in areas where they would naturally occur in a manner that closely mimics natural accumulations for that particular habitat type.

Small one- and two-log structures would be constructed, with the top log keyed into the native subgrade to resist buoyancy and scour forces and secure the footer log in place. Pier logs would also be used to naturally anchor logs in place where scour risk is expected, particularly upstream of SR14. Habitat logs would also be placed throughout the expanded habitat areas for general enhancement of micro-habitat features. These logs would either have root wads attached or have limbs partially intact for additional habitat and organic input. It is anticipated that during construction of the project, all trees removed during clearing would be salvaged and incorporated into wood habitat structures.

2.1.2.2 Upstream Gibbons Creek Restoration

Realignment of the northern Gibbons Creek channel, which includes most of Gibbons Creek between Steigerwald Lake and Evergreen Highway, would be focused on providing for natural function while maintaining existing and proposed infrastructure. Review of historic photos and topographic maps (USGS 2015) from the 1930s to early 1960s indicated that the historic channel sinuosity north of SR14 was generally low, with sinuosity increasing closer to the connection with Steigerwald Lake. The proposed channel alignment has been designed to follow a similar pattern.

The new channel alignment north of SR14 would restore natural planform variation to the system while increasing floodplain storage along the western bank within the vicinity of the new floodwall. This would be accomplished by realigning a roughly 400-ft. stretch of Gibbons Creek by moving it approximately 10 ft. to the east of its current location and sloping the west bank at a gentler angle than is currently found there (Figure 2-2). The realigned stretch starts approximately 150 ft. north of the SR14 Bridge.

A new pedestrian bridge would be constructed over Gibbons Creek to replace two failing bridges on the northernmost private property, approximately 100 ft. south of Evergreen Highway. A 15-ft. roughened rock toe would be installed under it to prevent bed scour and provide velocity refugia for fish passage. Because the bridge and rock toe have been designed using WDFW stream simulation criteria, they would not restrict flood passage or alter the geometry of the streambed.

At the SR14 Bridge the straight channel alignment (approximately 150 ft. upstream and 200 ft. downstream of the bridge) would be maintained. Downstream of the SR14 crossing, the channel would meander towards Steigerwald Lake and would be constructed as a shallow inset channel with a low floodplain to mimic historic alluvial fan conditions.

Restoring the northern portion of Gibbons Creek would involve removing the diversion structure and elevated canal, and re-aligning portions of the creek. This approach would allow the stream to migrate across its historic alluvial fan, and it would eliminate the need for removal of creek deposits at the diversion (LCEP 2014; USFWS 2013b). It is designed to provide natural sediment transport while reducing flood and erosion risks for adjacent properties and infrastructure. Gibbons Creek would flow through Steigerwald Lake and out through Channel 3, having a direct connection to the Columbia River, thereby providing unimpeded fish passage. The new Gibbons Creek channel would be designed to meet the following design criteria:

- Fish passage – provide fish passage for all salmonid life stages at the full range of hydrologic conditions
- Habitat – improve in-stream habitat quality through the re-establishment of natural processes and active restoration, e.g., riparian plantings, placement of large wood, and restored floodplain connectivity
- Channel stability - maintain the integrity of the SR14 Bridge crossing by providing stable channel design within the vicinity of existing and proposed infrastructure.

- Channel mobility – restore the ability for the creek to meander across its alluvial fan at its connection to Steigerwald Lake
- Maintenance – Minimize or eliminate the need for stream maintenance, including dredging

The channel design is geomorphically appropriate and takes into account the existing and new infrastructure within this reach. This infrastructure includes the existing SR14 Bridge and embankments, adjacent properties, the railroad bridge and embankments, the proposed floodwall, and the proposed west setback levee. Consequently, the design of this reach involves developing a stable channel geometry and alignment near infrastructure, while maintaining the ability for the channel to move across its alluvial fan at its connection to Steigerwald Lake. The infrastructure protection design criteria are summarized in Table 2-2.

Table 2-2: Infrastructure Protection Design Criteria for the North Reach of Gibbons Creek

Infrastructure Concern	Hydraulic Criteria	Reference
Flooding	No increase to flood water levels up to the 500-year event for adjacent landowners	Corps of Engineers staff direction
Bridge flow passage	Meet existing or improve flow passage	Design team coordination with Washington State Department of Transportation (WSDOT) (WSDOT 2014a)
Bridge foundation scour	Gibbons Creek 100-year event flow	WSDOT Hydraulics Manual (WSDOT 2014b)
Floodwall bank protection	Gibbons Creek 100-year event flow	To be coordinated with Corps of Engineers
Levee bank protection	Gibbons Creek 100-year event flow	Federal Emergency Management Agency [FEMA] 44 Code of Federal Regulations [CFR] 65.10 (b)(3)

2.1.2.3 Wetland Enhancement and Creation

Restoring hydrologic connectivity between the Columbia River and its historic floodplain would reconnect existing low-lying regions of the Refuge land. Further excavation would create new wetland areas. Together, these reconnected and extended wetland habitats would provide high-velocity refuge, cover and an important food source for rearing juvenile salmonids, as well as other species of fish and wildlife.

Low elevation areas in the floodplain would be reconnected hydrologically to the Columbia River if the levees were breached, including all areas below 23.7 ft. NAVD88 in elevation. These areas would be inundated during the spring freshet, resulting in the enhancement of 455 acres of wetland (Figure 2-2).

Additional excavation and grading would create 115 acres of new wetland habitat, including the area covered by the creation of new floodplain channels. These are areas that are currently above 23.7 ft. NAVD88, which represents the elevation of the 2-year flow, but which would become seasonally inundated wetlands when excavated below that elevation. Proposed wetland areas are shown in Figure 2-2. Table 2-3 summarizes the proposed reconnected and expanded habitat areas.

Table 2-3: Summary of Expanded Habitat Areas

Description	Area (acres)	Notes
Reconnected Habitat Area	455	Existing areas below elevation 23.7 ft. NAVD88
Expanded Habitat Area	115	New area below elevation 23.7 ft. NAVD88 (Includes channel excavation)
Total	570	

To maximize expanded habitats and habitat connectivity, the proposed grading areas would be located immediately adjacent to existing low areas. Much of the existing low land is dominated by reed canarygrass cover and would benefit from excavation of surface vegetation. After excavation, expanded habitat areas would be densely seeded with a native wetland seed mix. In areas near proposed channels, revegetation could also include installation of willow scrub species. Revegetation is discussed in more detail in Section 2.1.2.6.

2.1.2.4 Public Access and Recreation

2.1.2.4.1 Existing and Proposed Public Access Facilities

Public access to the Refuge is provided from a parking lot south of SR14 and east of Gibbons Creek. The lot provides parking for 20 cars (2 Americans with Disabilities Act [ADA] parking spots) and 1 bus/RV. Facilities include a waterless restroom with two vault toilets, bike racks, kiosk and trailhead. The trailhead provides access to a pedestrian-only trail with a number of interpretive art elements that connects to the seasonally-closed Redtail Lake loop trail and a multi-use trail (pedestrians, dogs on-leash, bikes, and horseback riders), which follows along the top of the WCRL, formally called the Columbia River Dike Trail (CRDT). Maintenance vehicle access to the Refuge and WCRL is provided from this lot via a gated road along the Gibbons Creek elevated channel.

The restoration project would remove sections of the WCRL and the natural levee, the Gibbons Creek elevated channel, and an interior access road embankment. These actions would result in the removal of a portion of the CRDT and access road network as well as seasonal inundation of portions of the pedestrian trail and additional access road.

The proposed public access area is shown on Figure 2-2. The parking lot, bike parking, and trailhead would be relocated to the west side of the west setback levee, and the restroom would be relocated to Refuge property along the west setback levee. Relocation is prudent to prevent impacts from relatively rare Columbia River and Gibbons Creek floods, to allow more room for

Gibbons Creek alluvial fan restoration, and to concentrate development and maximize the contiguity of the restored area.

The trailhead provides access to a public pedestrian-only trail that also functions as a maintenance vehicle access road. Interpretive art elements would be relocated to this trail where appropriate. The trail connects to the CRDT where the west setback levee meets the existing WCRL.

The CRDT would be reconstructed at a lower elevation where the WCRL was removed and would meander across the broad natural fluvial levee. This trail would include at-grade crossings of Channels 1 and 4, and two bridges (Table 2-4) to allow users to cross Gibbons Creek (Channel 3) and Channel 2. The seasonally-closed Redtail Lake loop trail would not be impacted during construction. Access to this trail is provided from the CRDT. Bridge design would be refined in the next phase of the project.

Table 2-4: Preliminary Characteristics of Proposed Bridges

Bridge	Nominal Length (ft.)	Location	Low Chord Elevation (ft. NAVD88)	Type	Deck Elevation (ft. NAVD88)
Bridge 1	100	Channel 2	TBD	Pre-engineered clear span	30
Bridge 2	150	Gibbons Creek	TBD	Pre-engineered clear span	27

2.1.2.4.2 Public Access Design Intent and Criteria

The intent of the public access design is to provide similar site access and an improved and diversified visitor experience following restoration actions. The design criteria shown in Table 2-5 were established collaboratively with input from USFWS, LCEP, the Port, and other stakeholders. The parking lot and access trail would be moved to the west side of the west setback levee where it would be protected from seasonal flooding from the restored Gibbons Creek. This action would include increasing the number of available parking spaces from 20 (2 ADA accessible) to 30 (2 ADA accessible), maintaining parking for one bus or RV, and salvaging and relocating interpretive art components.

In addition to access features, features intended to enhance the visitor experience would be installed. A new overlook would be installed on the west setback levee to provide visitors with their first expansive views of the Refuge, including the restored Gibbons Creek alluvial fan. A second Columbia River overlook, similar to the existing one near the fish ladder, would be installed between the Channel 2 and Channel 3 crossings. New fences would be installed to replace old fences or to keep sensitive areas off limits. New and updated interpretive and wayfinding signs would be installed, and rock benches and bike racks would be relocated.

Table 2-5: Linear Access Element Design Criteria

Linear Access Feature	Width (ft.)	Surface	User	Max Slope	Min Radii (ft.)	Trail Elevation ¹ (ft. NAVD88)
Entrance Road	24	Gravel	Car, RV, Emergency Services, Tractor	NA	NA	NA
Maintenance Access Road	12	Gravel	Car, Emergency Services, Tractor (could be used as interior trail)	5%	40	Varies
Multi-Use CRDT	10	Gravel	Pedestrians, Horses, Bicycles, Dogs on-leash, Polaris-style maintenance vehicle	5%	36	33 - 38
CRDT Channel Crossing	10	Gravel	Pedestrians, Horses, Bicycles, Dogs on-leash, Polaris-style maintenance vehicle	5%	NA	23 Min.
CRDT Bridges	12	Timber or other Non-Slip Decking	Pedestrians, Horses, Bicycles, Dogs on-leash, Polaris-style maintenance vehicle	NA	NA	27 to 30
Interior Trails	6	Gravel	Pedestrians only	5%	--	Varies

¹Span and channel crossing elevations minimize periodic inundation. Based on a 10-year record, the CRDT crossing elevations of 23 ft. NAVD88 would be inundated an average of 12 days per year.

2.1.2.5 Flood Protection

2.1.2.5.1 Levees

Levees surrounding the Refuge provide greater than 1,000-year flood event protection. In order to provide the more frequent exchange of water in and out of the area while providing the same level of flood protection, the levees and infrastructure would be reconfigured as follows:

1. The 2.2 mile stretch of the WCRL between the east and west setback levees would be excavated by approximately 10 ft. to the approximate elevation of surrounding ground and the natural fluvial levee, which is generally close to the 100-year flood event level,
2. The natural fluvial levee beneath the WCRL would be excavated at four locations to allow for connection of floodplain channels to the Columbia River,
3. Two new setback levees would be constructed, one at the east end (crest elevation 46.3 ft. NAVD88) and one at the west end (crest elevation 45.7 ft. NAVD88) of the project area,
4. A floodwall and berm would be constructed on the west bank of Gibbons Creek upstream of Highway 14 (Figure 2-2) to form the northern portion of the west setback levee, and
5. A 1,200-ft. stretch of SR14 would be raised so that the entire affected portion of the road would be at or above the Columbia River's 500-year flood elevation of approximately 38.5 ft. NAVD88.

Design of the two setback levees was performed following the principles presented in the Corps manual *Design and Construction of Levees* (Engineering Manual 1110-2-1913) and other Corps

resources. Corps' guidelines recommend that levee designs consider and analyze: (i) underseepage and through seepage; (ii) slope stability; and (iii) settlement (i.e. loss of freeboard) of representative sections of the levee. These analyses were performed on eight levee sections that represent the various foundation conditions and embankment height combinations along the two levee alignments. Setback levee foundations would be constructed using borrow materials from the WCRL as one of the first construction actions in Year 2.

Setback levees constructed using 12-ft. wide crests with 4H:1V (horizontal:vertical) landward side slopes and 3H:1V riverward side slopes would satisfy the conditions of stability and seepage outlined by the Corps. The geotechnical investigations that were performed to verify these conclusions are described in the Geotechnical Investigations Report (CCI 2016).

Levee construction would include preparation of the levee foundation, placement of geogrid at the base of the levee fill, embankment and compaction of suitable levee fill material, and construction of a gravel access road on top of the levee.

2.1.2.5.2 Gibbons Creek Floodwall and Berm

The Gibbons Creek floodwall would align with the western levee and extend approximately 600 ft. upstream from SR14, on the west bank of Gibbons Creek. At this point, the floodwall would tie into an earthen berm that would be installed to extend approximately 180 ft. to the northern end of the project site (Figure 2-2). The proposed floodwall is a permanent, cast-in-place reinforced concrete structure that, in combination with the berm, would extend the project's flood protection from the north side of SR14 to the point where the existing natural ground has risen sufficiently to protect against flooding related to changes from this project. The top of wall would be the greater of the authorized flood elevation or 2 to 3 ft. above Gibbons Creek design flood elevation. The bottom of the wall is preliminarily designed to be 3 ft. below the invert of Gibbons Creek in order to provide the necessary "cutoff" and seepage barrier against flood events.

The bottom elevation of the wall would be 34 ft., 4 ft. below the ground surface elevation of 38 ft. at the downstream end. The top of the wall would be at 45.7 ft., making the wall almost 8 ft. tall at the downstream end and tapering to 2-3 ft. tall at the upstream end. The reinforced concrete wall has been designed to with landowner input to be visually appealing and meet the Columbia River Gorge NSA standards. The site of the floodwall would be cleared of vegetation, graded, and a 2-ft. wide trench between 3 and 8 ft. deep would be excavated for the floodwall foundation. Excavated materials would be used to construct the earthen berm or incorporated into the west setback levee. A gated gravel road approximately 10 ft. wide would be constructed between the floodwall and Gibbon Creek to allow access for maintenance and operations. The earthen berm is proposed to meet landowner preferences. The berm's crest elevation would be 45.3 to 46.0 ft. NAVD88, and would meet minimum required freeboard. It would be revegetated with dense native grasses, consistent with other habitat planting areas.

2.1.2.5.3 SR14 Modifications

Modifications to SR14 would include the construction of an emergency flood closure structure (closure structure) and roadway reconfiguration around the structure. Modifications would also

include raising a portion of SR14 to the Columbia River 500-year flood elevation of approximately 38.5 ft. NAVD88.

2.1.2.5.3.1 SR14 Closure Structure

The closure structure would connect the west setback levee, at the levee abutment wall, to the floodwall north of SR14 (Figure 2-2). The closure structure would be approximately 73 ft. long and 7.5 ft. to 8.5 ft. high above the roadway. The foundation has preliminarily been designed to be 5 ft. below the roadway to effectively limit groundwater seepage from the flood event below the wall. Steel sockets, or sleeves, would be cast into the foundation which would receive the temporary steel posts to be erected across and above SR14 in the case of flood. Pre-cast concrete panels would slide down between the posts and serve as the flood barrier. The panels would be stored nearby on Refuge property in a fenced gravel area located close to SR14. The above grade elements of the closure would be installed only when the Columbia River approached its 500-year flood stage, otherwise allowing SR14 traffic to pass unimpeded across the eventual flood protection line. Crews from the Port would be responsible for erecting the temporary and emergency portions of the structure in advance of the flood event. Temporary pieces have been sized for a maximum weight of 5,000 pounds, which the Port determined was the maximum pick weight for their equipment. A 25 ft. long Washington State Department of Transportation (WSDOT) standard concrete approach slab would be installed on each side of the closure structure along SR14. The approach slabs would be meant to minimize effects from foundation or roadway settlement and also help to reduce flood seepage rates around the wall.

2.1.2.5.3.2 SR14 Roadway Raising

The SR14 roadway would be raised at a point beginning approximately 300 ft. east of the Gibbons Creek Bridge. Approximately 1,200 linear feet of the roadway would be raised to a centerline elevation of approximately 38.5 ft. NAVD88, which is equivalent to the 500-year flood stage for the Columbia River. The Gibbons Creek Bridge itself would not need to be raised, as the elevation of the roadway surface on the bridge is already 38.5 ft. NAVD88. Raising the SR14 roadway would not require any alteration of the existing roadway prism. As a result, land immediately adjacent to SR14 to the north and south would not be impacted. Two existing 24-inch culverts in the roadway prism would require retrofit with backflow prevention valves, but would not otherwise require modification, as the roadway prism would remain unchanged. New fill and paving required to raise the height of the roadway would be contained on top of the existing prism. The change in elevation of the road surface would be at maximum 3.5 – 4 ft., and would average 1.5 ft. The anticipated duration of construction of the roadway raise would be 2 – 3 months, with 3 weeks of intensive material placement.

2.1.2.5.3.3 SR14 Roadway Improvements

Relocation of the visitor access parking lot and construction of the SR14 closure structure would require restriping of travel lanes on SR14 including new westbound left turn striping at 45th Street. At the closure structure, the main roadwork elements would include removal of asphalt and base rock, widening of the gravel shoulders to accommodate the closure structure, installation of guardrail, paving, and striping. Other miscellaneous items would include installation of access gates to the Gibbons Creek side of the floodwall and levee, centerline rumble strip, and pavement markers.

2.1.2.5.3.4 Traffic Control for SR14 Modifications

Traffic control would be substantial at times during construction, including partial or full road closure on SR14 during construction of the closure structure immediately west of the SR14/Gibbons Creek Bridge. A three-stage construction staging plan is proposed for construction of the closure structure across SR14. The staged construction is intended to keep one lane of traffic open in each direction at all times, while construction of the closure occurs in the other lane. WSDOT must concur that either 1-ft. wide shoulders or 10-ft. wide travel lanes would be acceptable during temporary traffic control since these widths are below their standards. If not acceptable to WSDOT, either a full closure of SR14 with detour or continuous flagging would be required during construction. If required, the construction detour would use the same route as required for the flood event detour (see section 3.12.2.1 for details). The detour route would be partially located inside the Washougal city limits and partially located within Clark County's boundary. Therefore, coordination with these jurisdictions and WSDOT would be required to obtain an agreement for the use of the detour route during the flood event and possibly during construction.

Construction associated with the roadway raise would occur one lane at a time. The existing roadway is 4-5 lanes wide through this stretch due to the presence of slow-down lanes. Traffic would be shifted into these additional lanes during construction in order to preserve one lane of travel in each direction for the 2- to 3-month construction period during the first construction season. Traffic control measures would include a speed reduction to 20 miles per hour, jersey and continuation barriers, and flaggers for construction vehicles and trucks entering or leaving the construction site. It is possible that the full roadway would need to be closed for short periods of time. To the extent feasible, these closures would be timed to occur during off-hours and would be limited to half-day periods. During such closures, traffic would be re-routed along the detour route planned for use with the proposed SR14 closure structure.

2.1.2.6 Revegetation

The intent of wetland and riparian revegetation on the Refuge is to restore historic native vegetation communities to the extent possible, while also considering long-term vegetation maintenance requirements established for the Refuge. Key historic vegetation communities include vegetated open water and wetland, dry and wet prairie, and riparian and wetland forest. Managed vegetation includes agricultural areas used as food and cover for migrating Canada and cackling geese.

2.1.2.6.1 Vegetation Community Composition

Though this project breaches the natural fluvial levee to reconnect the historic floodplain to periodic inundation, dam control would still moderate flood processes, removing the highest and lowest flows. As a result, it is anticipated that shallow backwater flooding would be the dominant post-project flood process, and would drive the formation of wetland and riparian plant communities. A revegetation plan that includes plantings and use of seed mixes that reflect the plant community composition that would be expected to form under the anticipated range of post-project hydrogeomorphic conditions is described in the Basis of Design Report (LCEP 2017).

Specific focal conservation targets for the Refuge are included in the Comprehensive Conservation Plan (CCP) for the Columbia Gorge NWRs (USFWS 2005). The focal conservation target objectives provided a useful point-of-reference for the revegetation types and areal extents, although the community composition could be adjusted upon completion of the project. Target plant community composition from the CCP is as follows:

- Wetland Complex
 - CCP Objective 1.1, maintain up to 237 acres of wetland
- Riparian System
 - CCP Objective 1.2, restore 122 acres of riparian bottomland forest
 - CCP Objective 1.3, restore 101 acres of riparian scrub-shrub
- Oak Woodland and Oak Savannah
 - CCP Objective 1.4, maintain 41 acres of oak woodland
 - CCP Objective 1.5, initiate planting of oak savannah on 93 acres of grassland
- Grasslands
 - CCP Objective 1.6, maintain short (3- to 6-inch) perennial grass as winter forage on 168 acres (71 acres as unmowed field)

Plantings and seed mix composition are described in the Basis of Design Report (LCEP 2017).

Active management at the Refuge would continue to be performed by Refuge staff, cooperative farmers, and friends groups. This management includes mechanical removal and herbicide application using boom and backpack sprayers as well as mowing, haying, and grazing. Large open areas would continue to be maintained to provide desired habitat conditions and facilitate ongoing management using large farm equipment.

2.1.2.6.2 Proposed Revegetation Priorities and Methods

The first revegetation priority is to plant or seed all areas on the site that would be temporarily disturbed during construction. Disturbance activities would include:

- Levee borrow excavation, expanded habitat excavation, and channel excavation;
- Road embankment, elevated channel, parking lot, and levee removal;
- Raising SR14;
- Constructing the Gibbons Creek floodwall;
- Levee and levee overbuild placement; and
- Construction-related disturbances from hauling.

The riparian communities would be planted along the fluvial levee of the Columbia River (including borrow areas) and along the deeper floodplain channels. This approach would help establish a wide riparian buffer along the Columbia and provide shade and a future source of large wood to newly constructed floodplain channels. These plantings would also be included on the Gibbons Creek alluvial fan.

Willow scrub communities would be planted along shallow floodplain channels and some areas that would be excavated to provide both levee construction materials and additional wetland habitat. These plantings would also occur along the overbuild section of the west setback levee. The remaining excavated areas would be planted with wetland seed. New levees would be seeded with an upland mix.

To reduce construction costs, plant material would be a combination of container plants, live stakes, bare root plants, and seed. Tractor aisles would be incorporated into the planting layout to facilitate mechanical maintenance where appropriate. The project sponsors would coordinate planting plans with USFWS staff to ensure compatibility with USFWS-trust resources and to improve the likelihood of successful plant establishment and set minimum survival rates. Sponsors would monitor vegetation for at least two years after initial plant installation to ensure that minimum survival rates were met. Survival rates below those set by the USFWS and sponsors could necessitate replanting.

2.1.2.6.3 Invasive Species Management

Prior to and after planting, invasive species, such as reed canarygrass and Armenian blackberry would be treated through mechanical and chemical means to reduce their densities. Increased inundation due to reconnection of the site to the Columbia River and localized scraping of reed canarygrass would further impede invasive cover and allow native plantings to establish.

2.1.3 Project Construction and Sequencing

Construction would occur under the authority of construction inspectors who would be able to stop work in cases where hazardous materials or other types of contaminants were released or encountered, or when sensitive or protected resources such as cultural artifacts were encountered. Prior to construction, staging areas, equipment and material storage sites, maintenance areas, and other components of the Spill Prevention Control and Countermeasures (SPCC) plan would be identified.

2.1.3.1 Construction Elements

2.1.3.1.1 Clearing and Grubbing

Clearing and grubbing would be required in many areas to remove vegetation and organic material from the top layer of excavated soil, prior to using excavated material for the levee embankment.

2.1.3.1.2 Stream diversions

Management of Gibbons Creek flows would be a critical element of project sequencing. The existing elevated canal provides a built-in stream bypass system that would remain in place until the new Gibbons Creek channel was completed. It would be necessary to divert Gibbons Creek into a temporary stream channel north of SR14 for construction of the new channel and flood wall. Additional work area isolation would likely be required when working in and around the channels and ponds within the Refuge.

2.1.3.1.3 Demolition

The largest items to be demolished would include the Gibbons Creek diversion structure near the SR14 Bridge and the Gibbons Creek fish ladder and culvert at the confluence with the Columbia River. This would include removal and disposal of the concrete and steel elements. Additional culverts would be removed while removing the elevated canal and mid-site berm/road.

Recyclable concrete, steel, and aluminum would be disposed of at area recycling facilities, and all other materials would be taken to a landfill.

2.1.3.1.4 Earthwork

Excavation activities would include channel excavation, habitat expansion grading, levee and berm removal, borrow excavation, and trail grading. Embankment activities would include levee construction, wave break embankment, trail grading, and restoring the borrow area. The vast majority of earthwork would be completed by large scrapers, with anticipated use of 2 sets of 6 scrapers each moving approximately 20,000 cubic yards (cy) of material per day. Finish grading of channels and slopes would be completed by bull dozers and backhoe excavators. All excavated soils are intended to be reused to construct the setback levees and earthen berm along Gibbons Creek.

2.1.3.1.5 Erosion and Sediment Control

Erosion and sediment control measures would include silt fence or straw wattles at the downslope sides of excavation areas where adjacent to wetlands, turbidity curtains installed at the channel connections to the Columbia River, and check dams on all new channels. Erosion seeding would be included on all excavation and fill areas.

2.1.3.1.6 Levee Construction

Levee construction would include preparation of the levee foundation, placement of geogrid at the base of the levee fill, embankment and compaction of suitable levee fill material, use of less suitable materials in the levee overbuild slopes adjacent to the levees to reduce the need for rip rap slope protection, and construction of a gravel access road on top of the levee.

2.1.3.1.7 Interior Drainage Structure

A drainage structure would be constructed within the eastern setback levee to provide drainage for the private property to the east. This structure would include a culvert pipe with tidegate, concrete wing walls, manual canal gate and gate vault, pump station, force main piping, and electrical power from a nearby utility pole on the adjacent private property or by an alternate route determined by Clark County Public Utilities.

2.1.3.1.8 Relocated Parking Lot, Visitor Facilities, Art

Relocating the existing parking lot, visitor facilities, and art installations would require substantial demolition and salvage operations. Relocated features would include the manual and automatic gates, decorative boulders, restrooms, interpretive signage and kiosks. The existing visitor center area has electrical and telecommunications service, which would be restored to the new visitor center area. Water service and irrigation would not be installed at the new visitor

center area. The existing visitor area and art trail includes numerous pieces of art and interpretive features that would require careful handling to remove, reinstall, or relocate to a designated USFWS location.

2.1.3.1.9 Pedestrian Trail and Bridges

After removal of the WCRL, a new gravel pedestrian trail would be constructed to replace the levee-top trail. Two bridges would be required to cross High Flow Channel #2 and the new Gibbons Creek channel. The existing Gibbons Creek channel and High Flow Connection Channel #4 would be crossed using at-grade stream fords to eliminate the need for bridges. The two proposed bridges would be prefabricated bridges with guardrails installed on concrete abutments.

2.1.3.1.10 Gibbons Creek Flood Wall North of SR14

The proposed flood wall would be a reinforced concrete T-type structure along the west side of Gibbons Creek, extending from the north end of the SR14 closure structure approximately 600 ft. north. The proposed wall height is elevation 45.7'.

2.1.3.1.11 Closure Structure across SR14

This closure structure would serve as the flood wall across SR14, extending 73 ft. between the levee abutment wall to the south and Gibbons Creek flood wall to the north. The structure would be a permanent concrete strip foundation, with steel sockets that would receive portable steel flange posts. Portable reinforced concrete panels would be erected prior to a flood event.

2.1.3.1.12 Civil/Roadway improvements

The SR14 roadway would be raised to a minimum elevation of approximately 38.5 ft. NAVD88 at the centerline. The roadway would be raised over a distance of approximately 1,200 ft. Other proposed improvements related to the SR14 roadway and right-of-way would include striping removal and painting, pavement planing, repaving with hot mix asphaltic concrete, centerline rumble strip, guardrails, impact attenuators, and installation of wire fencing and a gate near the SR14 Bridge.

2.1.3.1.13 Temporary work zone traffic control

During the construction period of up to three months, a two lane bypass would allow one lane of traffic to pass in each direction. The highway could be closed for short periods (2-3 days) up to 5 times during the construction period, during which time traffic would be diverted to Evergreen Highway. Traffic control would be extensive at times during construction, including partial road closure on SR14 during construction of the closure structure immediately west of the SR14/Gibbons Creek Bridge and the SR14 roadway raise. If full closure were required, a detour route would be utilized. Less extensive traffic control measures including signage and flaggers would be required for trucks entering the roadway and for construction equipment moving between work areas south and north of SR14.

2.1.3.2 Phasing

Construction would occur in two primary seasons during two consecutive years. Construction of the levees is planned for the second season, and would begin with building the levees so that the crests meet the Federal Emergency Management Agency (FEMA) standard for certification (3 ft. above the 100-year water surface elevation). The WCRL would be removed concurrently with construction of the new levee, and only down to the same FEMA elevation, thereby maintaining flood risk reduction at all locations during construction.

The main construction actions are listed in Table 2-6, along with the anticipated construction sequence. The key factors influencing the construction sequence are:

- Identifying work that only can be conducted within the in-water work window (June 1 – October 15)
- Ensuring that both the eastern and western setback levees are constructed in the same season as removal of the existing levee to maintain flood risk reduction levels for the surrounding communities,
- Obtaining sandy fill material from the upper several feet of the southern levee to provide ideal fill for use in the foundation lifts of the setback levees,
- Obtaining suitable levee fill material from channel excavation and habitat expansion grading areas,
- Completing the bulk of the excavation and fill activities during one season, utilizing large scrapers, to maximize efficiency and minimize excavation unit prices,
- Construction of the new Gibbons Creek channel and connection to the Columbia River almost completely prior to removing the elevated canal, and
- Minimizing Refuge closures and other interruptions to public use of the Refuge.

The work anticipated during the primary work seasons and a minor third season is outlined in Table 2-6.

2.1.3.3 Construction Access

The Refuge has a fairly extensive network of access roads. The contractor would likely utilize the access roads along the Gibbons Creek elevated canal and southern levee, as well as the north-south access road in the middle of the site. At the outset of the project, the contractor would establish a circuit to allow for efficient movement of the scraper excavators, excavating material from the channel and habitat expansion areas and transporting fill material to be placed at the setback levees.

Many of the existing and temporary access roads would be decommissioned at the end of construction. The setback levees would include a permanent gravel access road at the levee top. The southern levee access road/trail would be replaced with a new gravel road/trail along the Columbia River, including two bridge crossings. The bridges would be designed to pedestrian and equestrian loads and to accommodate light emergency access vehicles such as all-terrain vehicles.

Table 2-6: Construction Sequence for the Two Primary Construction Seasons and Minor Third Season

FIRST CONSTRUCTION SEASON (April – October of first year):
1. Construct new parking lot west of west levee
2. Construct levee test fills, and collect settlement data to guide levee construction in season 2.
3. Construct Gibbons Creek north of SR14 (pedestrian bridge, scour protection, flood wall and berm along the creek, and floodwall abutment north of SR14).
4. Construct closure structure near SR14 Bridge.
5. Raise, stripe, and pave SR14.
<i>(Note that order of work in first year could vary at contractor discretion.)</i>
SECOND CONSTRUCTION SEASON (April – October of second year):
1. Remove old Refuge parking and stockpile art elements for relocation. This allows use of the lot during the winter between seasons if desired.
2. Construct setback levee foundation using borrow from existing levee. Scrape down WCRL to elev. 39 ft. NAVD88 and use sandy fill material for setback levee foundations.
3. Stop borrow from existing WCRL when crest elevation is lowered to the FEMA standard. Maintain FEMA standard at all times during construction.
4. Construct habitat expansion areas, channels (including wood structures), and use suitable fill for levee construction.
5. Construct setback levees to FEMA standard. Complete all levee segments to this standard prior to building any individual segment higher.
6. Remove remainder of WCRL and continue construction of setback levees.
7. Divert Gibbons Creek from elevated canal to new channel.
8. Remove elevated canal and diversion structure, use material to finish levee overbuild or where otherwise needed.
9. Remove Gibbons Creek fish ladder and culvert, and excavate channel 1 breach after levee construction, allowing use of this crossing as a levee earthwork haul route.
10. Construct trails and bridges.
11. Demolish central access road.
<i>(Note that order of items 10 and 11 could vary at the contractor's discretion.)</i>
THIRD CONSTRUCTION SEASON (April – TBD of third year):
1. Survey levees for settlement and place fill to raise embankment to minimum grades if necessary.

2.2 No-Action Alternative

Under the no action alternative, BPA would not fund the Steigerwald Floodplain Restoration Project and LCEP would not construct the project. The Refuge would remain in its current state as a levee-protected floodplain, and USFWS would continue to manage the lands for wildlife habitat. The Port would continue to maintain the WCRL on the south side of the refuge, and operation of pumps at the west end of the floodplain would continue as needed to remove runoff from Gibbons Creek and overland sources. Fish access to Gibbons Creek would continue in its limited state, and maintenance associated with removal of sediments at the Gibbons Creek diversion structure would continue. Refuge facilities including the parking area, interpretive features, vault toilet, and boardwalk would remain in their current location, and SR14 would not be raised.

2.3 Alternatives Eliminated from Consideration

An alternative that would have included replacing the SR14 Bridge at Gibbons Creek was considered, but was eliminated from consideration due to anticipated costs and traffic impacts, and because there is not sufficient room to raise the bridge 7 ft. without substantially expanding the ROW and impacting private properties.

Various alignments of the west setback levee have been considered, but were eliminated in favor of the current alignment. The current alignment best meets the project objectives, provides a high level of flood protection, is the most cost-effective, facilitates the largest area of floodplain restoration, and would allow for development of the Camas-Washougal water supply well fields.

2.4 Comparison of the Alternatives

Table 2-7 compares the Proposed Action to the no action alternative, and provides a summary and comparison of the potential environmental consequences of each alternative. A more detailed summary of possible environmental consequences is provided in Table 2-8, and detailed analysis of environmental consequences is provided in Chapter 3.

2.4.1 Mitigation Measures

In order to minimize impacts to resources from the Proposed Action, the best management practices (BMPs) and mitigation measures described in Table 2-9 would be implemented during the design and construction of the project.

In addition to the mitigation measures described below, Habitat Improvement Program (HIP) III general conservation measures are applicable to all actions and include guidance for reducing impacts. General measures described in the construction drawings include those associated with site layout and flagging, temporary access and stream crossings, staging and stockpile areas, equipment use, erosion control, timing of in-water work, dust abatement, spill prevention and control, and invasive species management. Conservation measures from BPA's HIP III guidance that are applicable to this project are listed in Section 4.4.1, and the HIP III guidance document is attached as Appendix B.

Table 2-7: Comparison of Proposed Action to the No-Action Alternative

Purpose	Proposed Action	No Action Alternative
Assist in carrying out commitments related to estuary habitat actions contained in the State of Washington's Memorandum of Agreement (Washington Fish Accord) to conserve salmon and steelhead through improvement of conditions in the estuary.	Would help BPA to meet its commitments under the Washington Fish Accord.	Would not help BPA in meeting these commitments.
Support efforts to mitigate for the effects of the FCRPS on fish and wildlife in the mainstem Columbia River and its tributaries, pursuant to the Northwest Power Act.	Would help support the mitigation efforts called for in the Northwest Power Act by enhancing fish and wildlife habitat in the mainstem Columbia River.	Would not support BPA's efforts to enhance fish and wildlife habitat in the mainstem Columbia River.
Secure and claim survival benefits to help fulfill BPA's commitments to implement RPA No. 37 listed in the 2008 FCRPS Biological Opinion, as amended in 2010 and 2014.	Would help fulfill BPA's commitments to implement RPA No. 37 listed in the 2008 FCRPS BiOp.	Would not help fulfill BPA's commitments to implement RPA No. 37 listed in the 2008 FCRPS BiOp.
Minimize adverse effects to the human environment, avoid jeopardizing the continued existence of ESA-listed species, and avoid adverse modification or destruction of designated critical habitat.	<p>Would temporarily affect wetlands, riparian areas, and residents of adjacent areas, and would permanently affect an avian rookery. Would produce long-term benefits to ESA-listed fish species. Other benefits would include:</p> <ul style="list-style-type: none"> • Would reduce flood risk and potential contamination to the Columbia River by building a levee that removes 124 acres of Port and City property from Gibbons Creek's 100-year flood zone, including the City's wastewater treatment plant. • Would reduce flood risk to SR14 and adjacent residential development by removing Gibbons Creek's diversion structure. Removal of this structure would increase the bridge's hydraulic capacity by 35%, restore self-sustaining sediment transport processes and eliminate the need to dredge Gibbons Creek. • Would eliminate the Port, City, and USFWS's need for approximately \$5,000,000 in maintenance and capital improvement projects, 	Would avoid temporary construction impacts associated with proposed action, but would not produce benefits to ESA-listed fish species.

Purpose	Proposed Action	No Action Alternative
	<p>including dredging the interior drainage system to maintain its conveyance capacity, repairing (or replacing) the elevated channel and upgrading the Port's pump station.</p> <ul style="list-style-type: none"> • Would provide access and habitat for five species of ESA-listed salmonids that are documented as using adjacent floodplains in the Columbia River Gorge to rest and feed as they out-migrate to the ocean. • Would improve access and habitat conditions for three species of salmonids (coho salmon, steelhead and cutthroat trout) that are documented as spawning and rearing in the Gibbons Creek watershed. • Would eliminate trapping of state and ESA-listed salmonids behind the Steigerwald levee. • Would help recover lamprey, two species of which (Pacific and western brook) are documented as spawning and rearing in the Gibbons Creek watershed. • Would increase the acreage of Columbia River floodplain available to juvenile salmonids and lamprey in the lower Columbia River Gorge and Portland metro area by 14 percent. • 	
<p>Implement BPA's Fish and Wildlife Implementation Plan Environmental Impact Statement and Record of Decision policy direction which calls for protecting weak stocks, such as ESA-listed salmon and steelhead, while sustaining overall populations of fish for their economic and cultural value.</p>	<p>Would contribute to increased survival of Columbia Basin salmon and steelhead species, which are of cultural value and may provide economic benefits while at the same time protecting ESA-listed fish.</p>	<p>Would not contribute to the protection of Columbia Basin salmon and steelhead species, or sustain populations for economic and cultural values.</p>

Table 2-8: Summary and Comparison of Potential Environmental Impacts of the Alternatives

Resource Category	Proposed Action	No Action
Aesthetics/Visual Resources	<ul style="list-style-type: none"> • Temporary reduction in visual quality during construction to viewers from SR14, residential areas, and CRDT (moderate). • Permanent minor reduction in view into Refuge from locations north of SR14 due to road raise (low). • Long-term changes to visual landscape due to setback levees and lower surface elevation of WCRL, allowing vistas of Columbia River from numerous vantage points (low). • Long-term visual improvement due to reestablishment of site's historic riparian vegetation (low). • Obscured views of Gibbons Creek due to floodwall (moderate). • Enhanced viewshed from more frequent inundation (low). 	<ul style="list-style-type: none"> • There would be no short-term impacts to visual resources during construction.
Air Quality/Climate Change	<ul style="list-style-type: none"> • Construction vehicles would temporarily emit pollutants including carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), and particulate matter (PM). Emissions would not exceed threshold values, so impact would be low. • Construction vehicles would emit greenhouse gases (GHGs), which can contribute to climate change (low). • Dust would be generated during construction and use of unpaved access roads, but would be minimized by application of water (low). • Completed project would provide refuge to juvenile fish during the higher peak flows that are anticipated under climate change scenarios (moderate). • Completed project would provide flood storage and attenuate higher peak flows anticipated under climate change scenarios (moderate). • Completed project would increase the capacity of the SR14 Bridge, allowing it to pass Gibbons Creek's 500-year discharge projected for 2080. This would also protect adjacent residences from 500-year Gibbons Creek flows (moderate). 	<ul style="list-style-type: none"> • Peak flow refugia and attenuation of higher flood flows predicted under climate change scenarios would not occur (low). • There would be no construction-related emissions. Minor emissions from maintenance vehicles would continue to occur (low).
Cultural Resources	<ul style="list-style-type: none"> • Excavation for the Proposed Action would result in moderate impacts to one architectural resource, the WCRL. • No archaeological resources were found in locations where surface disturbance would occur, so potential for disturbance is low. 	<ul style="list-style-type: none"> • There would be no impacts to cultural resources.

Resource Category	Proposed Action	No Action
	<ul style="list-style-type: none"> Potential impacts related to inadvertent discovery of cultural resources would be low due to implementation of measures from BPA's <i>Inadvertent Discovery of Cultural Resources Procedure</i>, which requires that ground-disturbing actions must be discontinued in the event of discovery of cultural resources (low). 	
Fish	<ul style="list-style-type: none"> Project would increase habitat area, increase habitat diversity, improve channel complexity, improve water quality, and restore/increase access to wetland, floodplain, side channel, and stream habitat for spawning and juvenile salmonid rearing (moderate). Removal of Gibbons Creek diversion structure would eliminate need for maintenance dredging activities, resulting in improvements to fish habitat (moderate). Short-term impacts to fish could occur as a result of turbidity or accidental spills of contaminants (low). Short-term loss of riparian vegetation during construction could reduce cover and shading (low). Short-term loss of access to spawning areas in Gibbons Creek would occur if the fish ladder was removed or closed before the spawning period and the Gibbons Creek channel was not yet opened (low). Injury or mortality of fish would be possible during work area isolation and fish salvage (low). 	<ul style="list-style-type: none"> Benefits including access to off-channel habitats and improved access to Gibbons Creek spawning area would not occur (moderate). Possibility of fish stranding during overtopping of Gibbons Creek diversion structure would remain (high).
Geology and Soils	<ul style="list-style-type: none"> More natural sediment accretion processes would occur in the floodplain wetlands due to inundation of Columbia River waters and restoration of Gibbons Creek alluvial fan through removal of the diversion and elevated canal (low). Wind/wave impacts on the constructed levees would be mitigated by construction of vegetated levee overbuild sections (low). Temporary erosion at levee breach locations and other work areas during construction would cause localized turbidity or surface erosion. Erosion and sediment control measures would be implemented to mitigate this impact (low). Minor soil loss would likely occur when the natural levee was breached and the floodplain channels were initially inundated (low). 	<ul style="list-style-type: none"> Localized erosion would continue (low). Continued sediment deposition at Gibbons Creek diversion structure would require ongoing dredging (moderate).

Resource Category	Proposed Action	No Action
	<ul style="list-style-type: none"> • Changes to topography would occur at levees and wetland creation areas (low). • Localized alteration of soil profiles would occur if soils were excavated and backfilled in borrow areas, but this would not substantially change soil composition (low). • Hydric soils would form over time in wetland creation areas (low). • A more free-flowing Gibbons Creek alignment would lead to reduced sedimentation at location of Gibbons Creek diversion structure (moderate). 	
Land Use and Recreation	<ul style="list-style-type: none"> • Primary visitor parking area at the Refuge would be closed from April through October of the first construction season. Part of the Refuge and part of the CRDT would be closed to recreational uses, including waterfowl hunting, from June to October 15 during the first construction season. All of the Refuge and part of the CRDT would be closed to recreational uses for the entirety of the second construction season (April-October) during the 2nd year. In the winter between the two primary construction seasons, the public would have full or near-full access to the Refuge, although the parking area would remain closed (moderate). • Up to 5 private parcels would be placed under flood protection easements (low). • Noise and visual impacts during construction could affect visitor experience (low). • Conversion of grassland to seasonal wetland could affect Prime Farmland (low). • Temporary construction of Gibbons Creek floodwall would occur on private lands, resulting in temporary loss of access (low). • Some access trails would be reconfigured but there would be no long-term net loss of hiking trails or access (low). • Benefit to trail network would be enhanced and lengthened by 1 mile (moderate). 	<ul style="list-style-type: none"> • No changes to land use or recreation would occur.
Noise	<ul style="list-style-type: none"> • Impacts from noise levels of up 82 A-weighted decibels (dBA) during construction would be a moderate but temporary impact to residents within 100 ft. of the construction area along Gibbons Creek and along SR14 west of Gibbons Creek (moderate). 	<ul style="list-style-type: none"> • Noise impacts would be limited to ongoing maintenance actions (low).

Resource Category	Proposed Action	No Action
	<ul style="list-style-type: none"> • Temporary noise impacts could occur if temporary flood barriers were installed on SR14 at the Gibbons Creek Bridge (low). 	
Hazardous Substances	<ul style="list-style-type: none"> • Accidental spills of fuels, lubricants or solvents used by equipment during construction could affect water quality, plants, or animals in the vicinity (low). • Possibility of releases of herbicides during maintenance would be the same as for the no action alternative (low). 	<ul style="list-style-type: none"> • Construction-related releases of hazardous materials would not occur. • Use of herbicides for pest plant control during maintenance could result in inadvertent spills of hazardous substances (low).
Public Health and Safety	<ul style="list-style-type: none"> • The potential for injury to workers during construction would increase for the duration of the construction period (low). • Larger inundated area could increase potential for mosquito outbreaks (low). • Temporary and minimal increase in emergency response times if traffic was impeded during construction on SR14 (low). • Current level of flood protection would be maintained or increased. Benefit of protection from Gibbons Creek flooding would be increased (moderate). 	<ul style="list-style-type: none"> • Potential construction-related impacts would not occur under this alternative. • Current vector control practices would continue to control mosquito populations. • There would be no changes to the configuration of flood control infrastructure.
Socioeconomics and Environmental Justice	<ul style="list-style-type: none"> • Likely short-term generation of small number of local construction jobs (low). • Some construction funds would likely be spent in the local area for equipment, supplies, and services, providing short-term stimulus for local businesses (low). • Short-term noise, dust, and traffic impacts to residents in an environmental justice Census tract that includes Gibbons Creek (low). • Long-term visual impacts and loss of direct access to Gibbons Creek in environmental justice Census tract (low). • Benefits to fisheries on Columbia River (moderate). • Increased level of protection from Gibbons Creek flooding through installation of Gibbons Creek floodwall and berm (low). 	<ul style="list-style-type: none"> • No socioeconomic or environmental justice impacts associated with construction would occur. • During operations, ongoing pumping needed to remove runoff from the west end of the site would continue, at public expense. This impact is moderate.
Transportation and Infrastructure	<ul style="list-style-type: none"> • Traffic would be restricted to 1 lane in each direction for the 4-month construction period for the closure structure and for the 2 to 3-month construction period needed to raise SR14, both of which are scheduled for the first construction season (moderate). 	<ul style="list-style-type: none"> • There would be no impacts to transportation facilities under this alternative.

Resource Category	Proposed Action	No Action
	<ul style="list-style-type: none"> • If temporary full closures were necessary during construction of the closure structure or construction to raise SR14, traffic would be detoured through Washougal city streets (moderate). • Traffic could be slowed by construction vehicles entering or leaving the construction area (low). • Future installation of temporary flood barriers on SR14 at the Gibbons Creek Bridge would delay traffic temporarily, requiring traffic to be re-routed along a detour through Washougal city streets. The barriers would only be installed during rare, large-scale flooding events (low). • The base of SR14 could experience erosion due to wind-wave action and would need to be monitored and maintained with dense vegetation (low). • Seasonal inundation of portions of the pedestrian trail and new access road would be expected (low). • Temporary loss of visitor parking at the Refuge (low). 	
Vegetation and Wetlands	<ul style="list-style-type: none"> • Short-term impacts to wetland and riparian vegetation during construction (low). • Non-native plant communities in restored areas would be replaced by native species, increasing habitat diversity and native plant cover (moderate). • Newly created wetlands would create additional habitat diversity (moderate). • Some riparian vegetation would be lost, including mature cottonwood forest that supports great blue heron rookery. The project would create more riparian areas than it would affect, so losses would be temporary (low). • Reestablishing a hydrologic connection to the Columbia River could increase the potential for establishment of aquatic invasive plant species currently found only within the Columbia River (low). 	<ul style="list-style-type: none"> • Existing plant communities, including extensive areas of reed canarygrass, would persist, limiting habitat diversity (moderate). • Recruitment of riparian species would likely be low due to competition from reed canarygrass (low). • No construction impacts would occur.
Water Resources	<ul style="list-style-type: none"> • Construction actions could lead to temporary increases in turbidity in floodplain wetlands and the Columbia River (low). • Increased exchange with the Columbia River could improve water quality within the floodplain lakes (low). • As new wetlands are inundated and vegetation decomposes, short-term reduction in dissolved oxygen (DO) and changes to pH could occur (low). • Decomposing vegetation could release nutrients including phosphorous and nitrogen on a short-term basis (low). 	<ul style="list-style-type: none"> • Moderate warming of surface waters in the floodplain lakes would likely continue (low). • Runoff would continue to flow to the Port and necessitate pumping to the Columbia River (low). • Possible increased gravel deposition if USFWS loses ability

Resource Category	Proposed Action	No Action
	<ul style="list-style-type: none"> • Restored riparian areas would provide shading of surface waters, and combined with restored wetlands would help to retain groundwater over a longer period of time (low). • Current level of flood protection would remain in place, but the level of protection from Gibbons Creek flooding would benefit by increasing substantially (moderate). • Substantially less pumping would be needed at the Port since flows into the restored area would discharge directly into the Columbia River (moderate). • USFWS would benefit by no longer needing to dredge sediments from Gibbons Creek at the SR14 Bridge (moderate). • Port and City would benefit by having infrastructure removed from FEMA-mapped interior flood zone (moderate). 	to dredge Gibbons Creek (moderate).
Wildlife	<ul style="list-style-type: none"> • Short-term displacement of terrestrial wildlife and avian species resulting from construction and potential long-term displacement due to inundation (low). • Permanent loss of portion of great blue heron rookery and loss of functionality of entire rookery during construction (moderate). • Long-term increase in riparian habitat for wintering waterfowl and nesting birds (low). • Beneficial increase in extent and diversity of habitat for aquatic wildlife (moderate). 	<ul style="list-style-type: none"> • Current management of wildlife resources would continue, and there would be no new impacts.

Table 2-9: Mitigation Measures

Resource Category	Mitigation Measures
Aesthetics/Visual Resources	<ul style="list-style-type: none"> • Reseed and plant disturbed areas with appropriate native species and control weeds immediately following construction. • Use water trucks to apply water, as needed, to the construction area for dust control. • Protect and retain native riparian/wetland vegetation, to the extent practicable, by avoiding construction activities in these areas. • Minimize the size of the disturbance area, to the extent practicable. • Clean-up site and remove equipment, as practical, during non-construction periods.
Air Quality/Climate Change	<ul style="list-style-type: none"> • Apply water from water trucks to excavation areas, access and haul roads, and staging areas as needed to control fugitive dust. • Set a low speed limit on access roads to reduce dust generation. • Restrict idling of construction vehicles and machinery to a maximum of 5 minutes.
Cultural Resources	<ul style="list-style-type: none"> • Mark known cultural resource sites as avoidance areas on construction drawings and flag as no-work areas in the field prior to construction. • Protect any unanticipated cultural resources discovered during construction as follows: <ul style="list-style-type: none"> ○ Stop all work; cover and protect the ‘find’ in place. ○ Notify Project Manager and BPA cultural resources specialist immediately. ○ Implement mitigation or other measures as instructed by BPA cultural resource specialist. • Complete research to determine eligibility of WCRL for listing in the National Register of Historic Places (NRHP).
Fish	<ul style="list-style-type: none"> • In fish-bearing waters, construct only during in-water work windows specified by WDFW and NMFS. • Seine all in-water work areas on the Columbia River and Gibbons Creek prior to excavating or isolating work areas. • A qualified fish biologist would conduct fish salvage after isolating work areas. • All fish would be handled according to NMFS protocols for handling listed fish. • Grade channels for positive drainage to avoid fish stranding. • Operate machinery used for in-water work from top of bank to the extent possible. • Preserve riparian vegetation to the extent possible during construction. • Implement all conservation measures relevant to listed anadromous fish and bull trout from HIP III. • Construction would occur under the authority of environmental inspectors who could stop work in the event that hazardous materials were encountered or released. • Monitor water quality in floodplain wetlands, particularly for temperature.*

Resource Category	Mitigation Measures
Geology and Soils	<ul style="list-style-type: none"> • Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) and an erosion control plan, consistent with National Pollutant Discharge Elimination System (NPDES) requirements and Section 401 consultation. • Create a Sediment Control Plan, include daily monitoring during in-water construction, regular inspection, and recording control measures.* • Use sediment barriers, such as silt fences, straw matting, and straw wattles. • Minimize the area of disturbance, use minimum areas for staging, clearing, and grubbing. • Use water trucks to apply water to control dust, as needed. • Apply mulch or straw, or reseed exposed soil areas to reduce erosion and dust after completing work within a given area. • Sequence construction to minimize soil exposure and erosion potential. • Decomact staging areas and decommissioned access roads through disking and replanting. • Continue monitoring channel formation and levee breaches, in particular, to ensure that functioning channels are experiencing sustainable levels of accretion and erosion.* • Use adaptive management measures to respond to unexpected erosion or accretion.*
Land Use and Recreation	<ul style="list-style-type: none"> • Maintain access to as much of the Refuge as possible during construction. • Install signs to inform the public of the lengths of closures and alternate locations of birdwatching, hiking, or river access.
Noise, Hazardous Substances, Public Health and Safety	<ul style="list-style-type: none"> • Construction near residences would be limited to the hours between 7:00 a.m. and 10:00 p.m. • Equipment would be fitted with best available sound muffling devices to the extent practicable, and mufflers would be regularly checked to ensure they are functioning properly. • Additional methods of sound dampening or shielding such as noise barriers would be evaluated during construction planning and implemented to the extent practicable. • Construction phasing would be reviewed to minimize the duration of particularly noisy activities and the overall duration of construction near residences. • A description of hazardous materials to be used, and handling procedures would be available on-site.* • Written procedures for notifying environmental response agencies would be posted at the work site.* • Spill containment kits with written instructions for cleanup and disposal adequate for the types and quantities of materials used at the site would be available at the work site. * • Workers would be trained in spill containment procedures and would be informed of the location of spill containment kits.* • Workers would wear protective clothing when working with potentially hazardous materials.* • Any waste liquids generated at the staging areas would be temporarily stored under an impervious cover until they could be properly transported to and disposed of at a facility that is approved for receipt of hazardous materials.

Resource Category	Mitigation Measures
Socioeconomics/ Environmental Justice	<ul style="list-style-type: none"> • Limit construction near residences or other sensitive receptors to hours specified in the General Plans of the City of Washougal and Clark County. • Work from the east side of Gibbons Creek to the degree possible. • Apply water to dirt surfaces as needed to control fugitive dust.
Transportation and Infrastructure	<ul style="list-style-type: none"> • Coordinate with WSDOT, the City of Washougal, and Clark County to obtain an agreement for the use of the detour route. • Use traffic controls such as flagging, reduced speed limits, signage, and barriers to route traffic through affected areas and at truck entry/exit points. • Prepare a traffic control plan to detail items such as traffic control measures to be used and how they would be implemented.
Vegetation and Wetlands	<ul style="list-style-type: none"> • Specimens of threatened and endangered plant species populations would be protected during construction. • Refuge staff would monitor the amount of managed and unmanaged grassland to ensure continued compliance with the Compatibility Determination for winter forage area for geese.* • Staging and refueling areas would be established at least 150 ft. away from wetlands and other waterbodies to the extent possible, and they would include containment measures. • To control spread of non-native species, construction equipment would be washed before it was mobilized to the Refuge. • Replanting with native seed mix would occur as rapidly as possible following the completion of construction. • Work would include developing a plan to monitor and maintain native plant communities and control non-native and invasive plants. It would include mechanical and chemical treatment methods for non-native species.*
Water Resources	<ul style="list-style-type: none"> • Water and sediment quality would be sampled during project planning to establish the environmental baseline and identify any pollutants that could be released during construction or operations. • Sediments for restoration activities would be obtained on-site to the degree possible. • Staging areas, storage sites (fuel, chemical, equipment, and materials), and potentially polluting activities would be identified and secured using methods identified in the SWPPP, and would be located 150 ft. or more from any natural water body or wetland, or on an adjacent, established road area in a location and manner that would preclude erosion into or contamination of the stream or floodplain. • A Spill Prevention Control and Countermeasures (SPCC) Plan would be developed. • Only use hydraulic fluids approved for work in aquatic environments. • Heavy equipment would be washed before delivery to project site to remove oils, fluids, grease, weed seeds, etc. • Heavy equipment would be regularly inspected and cleaned. • Pollution and control measures identified in the SWPPP would be implemented. • All non-emergency maintenance of equipment would be performed off-site.

Resource Category	Mitigation Measures
	<ul style="list-style-type: none"> • All waste (solid waste, hazardous materials, etc.) would be disposed off-site as regulated by the state. • All equipment, materials, supplies, and waste would be removed from project site when complete. • Activities would be scheduled and water flows and levels would be managed to provide dry working conditions as much as possible. • Prepare and implement a SWPPP and an erosion control plan, consistent with NPDES requirements and Section 401 consultation. • CWA permit-specific protection measures would be applied. • Erosion control measures would be applied to construction, staging, and access areas (e.g., silt fence or straw wattle along the entire length of levee removal along the Columbia River, turbidity curtains installed at the channel connections to the Columbia River). • BMPs for erosion and sediment control would be applied during operations. • In-water work areas would be isolated from the active river channel. • Levee breaching would be timed with Columbia River flows to minimize erosion. • Stockpiled soils would be covered if they would be inactive for more than a few days. • Machinery for in-water work would be operated from atop levees or within adjacent out of water areas as much as possible.
Wildlife	<ul style="list-style-type: none"> • Construction occurring during October would avoid primary cackling goose habitat by a minimum of 500 ft. • If possible, time construction to avoid disturbing the great blue heron rookery during the breeding season of January to August. • If it is not possible to avoid the great blue heron rookery during the breeding season, a hazing program should be implemented in January to discourage birds from establishing broods. • Trees to be removed between January 15 and September 1 would be surveyed for active nests. Trees with active nests would be avoided by 500 ft. to the degree possible. Alternatively, trees to be removed could be removed during the non-breeding season of September to January 15.

* Measures that are intended to address potential long-term impacts, and which would be implemented during both construction and operations.

CHAPTER 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter describes the environmental conditions in and around the project area that could be affected by the Proposed Action or the no action alternative, and evaluates the potential impacts that could arise from implementing either alternative. Impacts, both adverse and beneficial, are evaluated to determine whether they could cause significant impacts to the human environment. For each resource category, mitigation measures and BMPs are designed to reduce the level of impacts.

Impacts are described for both construction and operations. The impact levels are characterized as high, moderate, low, or no impact. High impacts are considered to be significant impacts, whereas moderate and low impacts are not. The impact levels are based on the analysis provided, which incorporates the considerations of context and intensity defined in the Council of Environmental Quality Regulations (40 Code of Federal Regulations [CFR] 1508.27). Mitigation measures and BMPs that would help reduce or avoid impacts are identified in Table 2-9 in Chapter 2.

3.2 Aesthetics and Visual Resources

Visual resources consist of natural and human-made features that give a particular environment its aesthetic qualities. To determine whether a Proposed Action would appear compatible with existing features or would contrast noticeably within the setting, the landscape character needs to be evaluated. Views are considered sensitive when they have high scenic quality and are experienced by relatively large numbers of people (i.e., views from publicly accessible areas). Scenic quality is a measure of the overall impression or appeal of an area created by the physical features of the landscape, such as natural features (landforms, vegetation, water, color, adjacent scenery, and scarcity) and human made features (roads, buildings, railroads, other built elements, and agricultural patterns).

Visual resources represent the aesthetic quality of the environment as perceived through the subjective visual sense only. As such, many people have differing definitions of what constitutes an aesthetically pleasing environment, and there are different methodologies for assessing the visual quality of a particular landscape and potential visual impacts on that landscape. Public lands agencies, such as the U.S. Bureau of Land Management, the U.S. Forest Service (USFS) and the Federal Highway Administration (FHWA), are responsible for managing public lands and public roadways. Part of these responsibilities also include ensuring that the scenic values of these lands are considered before allowing uses that could have negative visual impacts or impacts that contradict current management direction.

Sections 101 (42 USC §4331) and 202 (42 USC §4342) of NEPA mandate that federal agencies recognize the importance of visual resources and include a visual or aesthetic assessment and impact analysis of projects proposed on federal lands or projects supported by federal funds.

3.2.1 Affected Environment

The Refuge occupies the majority of a large, undeveloped floodplain that is readily viewable from a major highway. This landscape situation is rare in southern Washington. Because of its unique position where the Columbia River emerges from a deep gorge into a more open setting with longer views, the Refuge offers unique visual resources. The gently rolling topography and open setting offer a contrast to the more constrained and wooded environment found deeper in the gorge and to the more developed areas found west of the site.

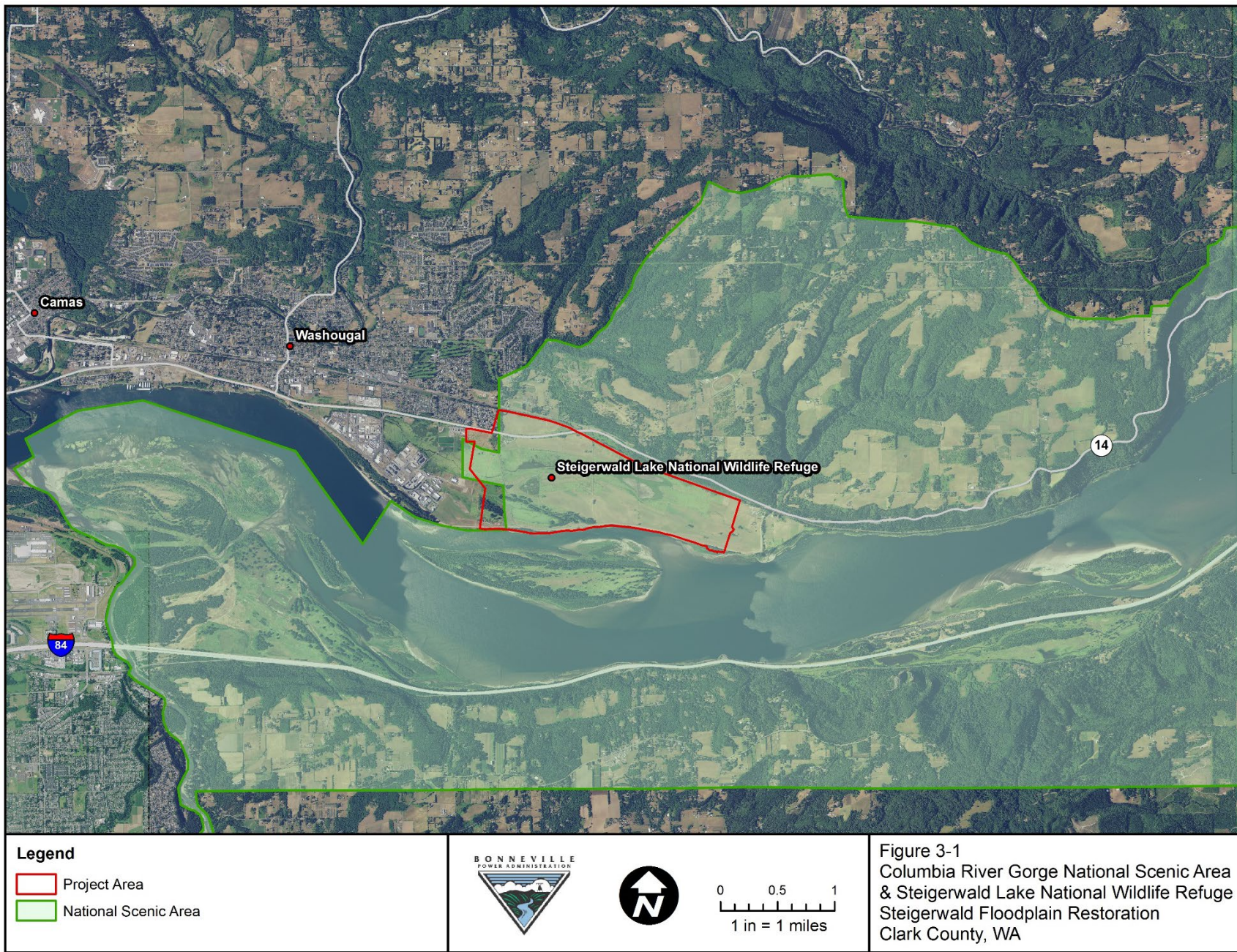
The Refuge lies partly within the Columbia River Gorge NSA (Figure 3-1) and has been designated as the location for a future "Gateway to the Gorge" visitor center. WSDOT has estimated that this facility may be used by as many as 100,000 visitors annually (Carver and Caudill 2013), and Refuge managers estimate that up to 90,000 people now visit the Refuge annually. The Columbia River Gorge NSA Management Plan sets guidelines and goals for new developments including statements that the expansion of an existing development shall be compatible with its landscape setting to the maximum extent practicable (CRGC 2004).

SR14 is managed by WSDOT as the Lewis and Clark Scenic Byway and is located along the north side of the study area. Because of its location at the gateway to the Columbia River Gorge NSA, the scenic byway action committee in the Lewis and Clark Scenic Byway Corridor Action Plan chose the Refuge to install interpretive elements. Goal 3 of this management plan is to design Highway 14 as a national attraction by protecting and enhancing scenic, natural, cultural and recreational resources within the highway corridor (WSDOT 1997). The objectives of that goal are managing highway improvements and vegetation without adversely affecting scenic resources and restoring views and vistas in a manner that does not adversely affect scenic values (WSDOT 1997).

The Clark County Comprehensive Plan states that a view and aesthetic goal is to ensure and protect, to the greatest extent feasible, the public's opportunity to enjoy the physical and aesthetic qualities of state's shorelines, including views of the water (Clark County 2004). The policies to achieve this goal include:

1. Identifying and encouraging the protection of scenic vistas and areas where the shoreline has high aesthetic value.
2. Encouraging development within the shoreline area that, provides visual and physical linkage to the shoreline, and enhances the waterfront.
3. Encouraging development design that minimizes adverse impacts on views enjoyed by a substantial number of residences.
4. Maintaining vegetated riparian areas to protect shoreline stability and shoreline ecological functions takes precedence over vegetation clearing to preserve or create views.

From adjacent residential and industrial elements to the open prairie and floodplain of the Refuge, the project site is a juxtaposition of various manmade and natural elements. The Columbia River Gorge is highly regarded for its scenic beauty. Landforms, stratigraphy, and rocks found in the Gorge reflect the collision of crustal plates, eruptions of innumerable volcanoes, enormous landslides and floods. Visitors to the Gorge can see the Columbia River slicing through these landforms and visualize these events (USFWS 1999).



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The Columbia River forms the southern boundary of the project site with Lewis and Clark Highway and Burlington Northern Santa Fe (BNSF) Railroad along the northern boundary. There are moderate and low-density residential areas and industrial land uses to the west of the site boundary. The highest concentration of residences are located along the northwestern boundary. There is also a private landowner east of the site. The Refuge's western boundary is adjacent to the Port Industrial Park.

The majority of the project site is low in elevation within the historic floodplain of the Columbia River. The site offers distant views of Mount Hood, Crown Point, Larch Mountain, and Pepper Mountain in Oregon. The site is visible from vistas on the Oregon side of the Columbia River, such as the pedestrian overlook near Crown Point and Vista House at Crown Point.

The Refuge consists of pastures (Figure 3-2), riverine floodplain habitat (Figure 3-3), permanent and semi-permanent wetlands (Figure 3-4), and cottonwood-dominated riparian corridors (Figure 3-5). There are two stands of undisturbed riparian woodlands on the Refuge consisting of large cottonwoods, red alder, willows, and red elderberry. One is located in the area surrounding Redtail Lake, and the other is located between the dike and the Columbia River west of the mouth of the realigned Gibbons Creek channel.



Figure 3-2: Pasture lands, eastern half of the Refuge



Figure 3-3: Floodplain wetlands looking north from Gibbons Creek High Rise Channel



Figure 3-4: Permanently ponded wetlands, Redtail Lake



Figure 3-5: Cottonwood riparian forest located in southwest portion of the Refuge. Great blue heron nests are visible in the tree canopy.

3.2.2 Environmental Consequences – Proposed Action

Visual resources impacts include short-term visual impacts associated with construction and long-term impacts associated with changes in the locations of levees, trails, and other features. The USFS's Scenery Management System was used to assess the potential visual contrast on the natural landscape from the Proposed Action. This system broadly defines visual contrast as the degree to which a project or activity affects scenic quality or visual resources as a measure of change to form, line, color, and textures of the existing and potentially modified landscape. Depending on the scale and scope of the Proposed Action, this method employs a contrast rating process. Visual resources in the landscape can vary greatly depending on location, time of year, and human influences. Landscape contrast is determined by the differences in form, line, color, texture, and landscape juxtaposition between the existing conditions and the Proposed Action.

3.2.2.1 Construction Impacts

The Proposed Action would include removing 2.2 miles of the built levee, excavating channels through the natural levee, constructing new setback levees and associated structures, removing the Gibbons Creek diversion infrastructure, expanding habitat areas, relocating various recreation and public access components, and revegetating with native species (Figure 2-2).

Impacts to visual resources would be moderate in the short term to viewers near restoration sites during construction. Moderate visual impacts would be expected for residential viewers at the northwest corner of the project area, where staging would occur. The staging area would be disturbed during construction, and surrounded by fencing, resulting in temporary, moderate impacts.

Construction activities would be visible from the highway and surrounding areas during the construction seasons. Within and adjacent to the project areas, the view would include construction vehicles, construction materials and fencing, and disturbed areas where project elements were being installed. Because the majority of construction would occur during two primary construction seasons (with minor work [e.g., settlement surveys] during a third season), the impacts on visual resources during construction would be temporary and moderate.

3.2.2.2 Operational Impacts

Long-term impacts on visual resources would occur by modifying, relocating, or removing infrastructure including SR14, the WCRL, the elevated canal, and the visitor's area; creating a new wetland areas; changing the location of trails; and constructing bridges, setback levees, and the Gibbons Creek floodwall, which would have a 10-ft. wide cleared area on either side. Changes would be localized and site-specific and would likely not be visible across the entire site or from further vistas during the long term. Due to the low elevation of the site, most changes would be subordinate to the overall scenic composition adjacent to the refuge. Changes would be visible from vistas within the Columbia Gorge, but at a distance – and when viewed with surrounding man-made elements – should not draw the attention of the casual observer.

Relocating the refuge parking lot and restrooms, reconfiguring refuge trails, enhancing wetland channels, planting vegetation on the levee overbuild sections, and re-establishing the site's historic riparian vegetation would have a low impact on the visual dynamic of the site and would be considered a visual improvement overall.

Raising SR14 would have a low impact on visual resources as it would result in a permanent minor reduction of the view into the Refuge from areas north of SR14.

Removing or altering levees and water control structures would alter the physical landscape by reducing the amount of infrastructure and create a channel through the site to connect Gibbons Creek directly to Steigerwald Lake. These actions would result in more frequent inundation and would help change the character of the site from a human-altered landscape to a more natural landscape, enhancing the viewshed and making the site more consistent with the natural landscapes surrounding it. Partial removal of the WCRL would also make the project area appear more natural and would allow uninterrupted visibility of the river from numerous vantage points. Impacts associated with these actions would be low.

The Gibbons Creek floodwall would align with the western levee and extend approximately 600 ft. upstream from SR14, on the west bank of Gibbons Creek. At that point, the floodwall would tie into an earthen berm that would be installed to extend to the northern end of the project site. The floodwall would be between 3 and 8 ft. high and would be topped by a fence that would be visually consistent with fencing used for viewing areas elsewhere in the Refuge. The floodwall has been designed to be aesthetically pleasing. Aesthetic features including pigmented sealant and a textured finish have been developed with landowner input, and are consistent with standards of the Columbia River Gorge NSA. However, the floodwall would be likely to obscure views of Gibbons Creek from neighboring residences to varying degrees depending on the height of the floodwall at a given location. In most places, viewers would be able to see over the top of the floodwall, although an interrupted view of the stream and riparian zone would constitute a moderate impact for some viewers closer to the downstream end of the floodwall.

The CRDT would be reconstructed at a lower elevation than the current trail, and it would appear as more of a natural landscape component. Two bridges would be constructed to allow users to cross Gibbons Creek. These structures would be designed to be low-profile, clear-span pedestrian bridges that would appear visually subordinate in the overall landscape composition. The project designs would be consistent with the historical, natural aesthetics of the site and would restore habitat diversity and native vegetation communities. The designs would result in visual conditions more typical of the historical landscape.

Upon completion of construction, the floodplain channels, disturbed ground, and new setback levees would be visible. Over time, as vegetation establishes and matures, the changes would resemble more natural features that occur along large river floodplains and would be consistent with the existing surrounding landscape. Although the setback levees would initially cause a substantial change to the viewshed, particularly from west of the project site, project contrast would reduce over time until the site achieves a more natural state. Consequently, the long-term impacts on visual resources would be low.

3.2.3 Environmental Consequences – No Action

Under the no action alternative, no construction would occur, and the project area would retain its current aesthetic values. Since vegetation is managed at the Refuge, the mix of habitat types would likely remain similar to existing conditions. The current array of infrastructure components, including the internal dikes, visitor facilities, and the levees along the Columbia River would remain the same, and the site would retain the characteristics of a levee-protected floodplain. There would be no impacts to visual resources.

3.2.4 Cumulative Impacts

Past actions that have affected visual resources in the vicinity of the Refuge include operation of upstream dams, logging, agriculture, road construction, and municipal and residential development. Inclusion of the project site in the Columbia River Gorge NSA restricts development projects that would have a substantial effect on the surrounding viewshed. Although some relatively small development projects are proposed on Port lands to the west of the Refuge, these projects are not anticipated to cause a high impact to visual resources in combination with the Proposed Action. Furthermore, by restoring an aquatic connection to the Columbia River, this project would be visually consistent with other restoration projects throughout the estuary and would restore the site's floodplain to a more natural condition. Therefore, cumulative impacts to aesthetic resources from the Proposed Action would be moderate and beneficial.

3.3 Air Quality and Climate Change

This section describes air quality and climate change and discusses potential impacts the Proposed Action could have on those resources. The air quality area of analysis is the air basin administered by the Southwest Clean Air Agency (SWCAA). Greenhouse gases (GHGs) and climate change are described at a regional or global scale.

3.3.1 Affected Environment

3.3.1.1 Air Quality

Ambient (outdoor) air quality standards exist to prevent air pollution from reaching levels that are harmful to public health and the environment. Ambient air quality standards are generally set at the federal and state levels, but at least one local clean air agency has also set a standard for its jurisdiction.

Under the Clean Air Act (CAA), 42 USC §§ 7401 *et seq.*, the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) to protect air quality and prevent air pollution from reaching levels that are harmful to public health and the environment (EPA 2016). These standards identify six criteria pollutants that are of particular concern for human health and the environment, including particulate matter (PM), carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), ozone, and lead.

The Washington Department of Ecology (Ecology) maintains a monitoring network that measures the levels of these pollutants. If an area's monitoring results do not exceed the NAAQS, the EPA designates this area an "attainment area." According to Ecology (Ecology 2016a), the project area and Clark County are designated as "attainment areas" for all six criteria pollutants.

The air monitoring stations nearest to the project site are in Vancouver, 10 miles or more from the project site. One site is monitored year-round for ozone, wind speed and direction, and temperature, and the other site is monitored for PM. Other criteria pollutants are not measured at these stations because they are not likely to exceed the NAAQS. Recent monitoring data from these stations, which are in a more developed area than the project site, confirm that the area is in attainment of the standards for ozone and PM (Ecology 2016a).

The SWCAA is responsible for enforcing federal, state, and local ambient air quality standards and regulations in Clark County and the other counties of southwest Washington.

GHGs are chemical compounds found in the earth's atmosphere that absorb and trap long-wave thermal radiation emitted by the land and ocean and radiate it back to earth. GHGs include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). No specific "ambient standards" exist for these pollutants. For context, total U.S. anthropogenic (human-caused) GHG emissions were 6,576 million metric tons CO₂ equivalent (CO₂e) in 2009, and 40 percent of these were from the electric power sector (EIA 2015). Unlike criteria pollutants and air toxics, GHG concentrations have been increasing over time and are continuing to increase. Increasing concentrations of GHGs could result in increases in the earth's average temperature by up to 7.2 degrees Fahrenheit (°F) by the end of the 21st century (EPA 2015a).

3.3.1.2 Climate Change

This section describes existing conditions related to climate and ongoing climate change and identifies potential impacts this project could have on climate change. It also discusses, on a qualitative level, the effect that climate change could have on the long-term success of the project.

Climate is governed by incoming solar radiation and the associated greenhouse effects that influence short-term, seasonal, and long-term weather patterns. Anthropogenic activities, such as the burning of fossil fuels and the clearing of forests, adds additional GHGs to the atmosphere, intensifying natural greenhouse effects, and ultimately causing changes to global, regional, and local climates.

Climate change is widely recognized as a critical issue with potentially wide-ranging impacts on water resources, fish and wildlife species and their habitats, and other natural resources. It has been suggested that the impacts of climate change will exacerbate temperatures; the timing and magnitude of stream flow; habitat loss, isolation and degradation; invasive species; and drought. According to the U.S. Global Change Research Program, the average regional air temperatures have increased by an average of 1.5°F over the last century (up to 4°F in some areas), with warming trends expected to continue into the next century (USGCRP 2009). There is less certainty about precipitation trends during the next century than temperature trends, but increased precipitation is likely to occur during October through March and less during summer, with more winter precipitation falling as rain rather than snow (ISAB 2007, USGCRP 2009).

The rate of change in global average surface temperature during the last century has not been consistent; each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850 (IPCC 2013). The period from 1983 to 2012 was likely the warmest 30-year period of the last 1,400 years in the Northern Hemisphere (IPCC 2013).

Long- and short-term climate fluctuations throughout history have caused natural variations in Columbia River flow. The Pacific Decadal Oscillation alternates between cold and warm phases approximately every 30 years (Fresh et al. 2005). The cold, rainy phase is typical of the Northwest and increases flows, while the warm phase is drier and decreases flows (Fresh et al. 2005). The El Niño/Southern Oscillation is a shorter, three- to seven-year phenomenon that similarly has cold and warm phases that may magnify or reduce the effects of the Pacific Decadal Oscillation.

Climate in the project area is characterized by relatively mild, rainy winters and hot, dry summers. During the long term, winter precipitation is expected to increase and summer precipitation is expected to decrease, accentuating the existing seasonal variations in precipitation (Mote and Salathé 2009; IPCC 2013). Temperatures are expected to rise during the long term, with expected effects including: more precipitation falling as rain rather than snow, diminished snow pack, increased peak flows, reduced dry season (April to September) flows, altered timing of flows, and continued increases in water temperatures.

3.3.2 Environmental Consequences – Proposed Action

3.3.2.1 Air Quality

Impacts to air quality could occur if the project obstructs implementation of an air quality plan, violates any state or federal air quality standard, result in a cumulatively considerable net increase of a criteria pollutant for which the project region is in non-attainment, expose sensitive receptors to substantial pollution concentrations, or create objectionable odors affect a substantial number of people. Air quality impacts arise from tailpipe emissions of equipment and vehicles used during construction, ongoing emissions of pollutants from stationary sources during

operations, or from excavation of soils or other materials whose exposure could cause objectionable odors.

3.3.2.1.1 Construction Impacts

Tailpipe emissions include criteria pollutants that are regulated by the EPA, which delegates some authority for regulating air quality to individual states. The states in turn manage air quality as a series of air quality regions or basins. The project area is within the air basin managed by the SWCAA. Consultation with SWCAA indicated that the air basin is in attainment for all criteria pollutants (Lamoreaux 2016).

Project construction could impact air quality in the project area as a result of the earth moving required to excavate wetlands and construct levees and other features, importing various construction materials or hauling excavated materials offsite, and emissions from employee vehicles. The SWCAA did not expect the Proposed Action to result in violations of regional or federal air quality standards, and did not require emissions modeling to estimate the impacts. However, in order to confirm this, a model was used to estimate emissions of criteria pollutants and CO₂ for all aspects of construction, including grading, earth moving both on and off the site, worker commuting, and round trips of trucks delivering or removing materials. The Road Construction Emissions Model, Version 7.1.5.1 (SMAQMD 2015), was used to estimate construction emissions and is viewed as an appropriate model for this purpose. The model automatically estimates fuel usage, fuel types, and other emissions factors, and relies on inputs of data based on the project description. Results of the model are included in Appendix C. The amount of fugitive dust (PM 10 micrometers or less in diameter [PM₁₀]) that could be generated on a daily basis was also estimated. As shown in Table 3-1, there would be no exceedances of federal or local air quality standards during construction of the project. Therefore, impacts would be low and would be further reduced by implementation of measures described in Section 2.4.1.

Table 3-1: Estimated Construction Emissions

Emissions Component	Pollutant Emissions				
	ROG	NO _x	PM ₁₀	PM _{2.5}	CO ₂
Estimated Construction Emissions	8.4 pounds per day (lbs/day) 0.6 ton	80.4 lbs/day 5.5 tons	8.6 lbs/day 0.6 ton	4.3 lbs/day 0.3 ton	10,562.5 lbs/day 714.4 tons
Federal Threshold	50 tons/year	50 tons/year	100 tons/year	n/a	25,000 tons/year
State Threshold	10 tons/year	10 tons/year	15 tons/year	15 tons/year	n/a
Above Threshold?	No	No	No	No	No

Source: Sacramento Metropolitan Air Quality Management District Road Construction Emissions Model, Version 7.1.1, modified for grading/excavation.

PM_{2.5} = PM 2.5 micrometers or less in diameter, NO_x = nitrogen oxides, ROG = reactive organic gases

In some cases, excavation of reduced wetland soils can release sulfidic odors that are commonly found to be objectionable. In instances where these soils are stockpiled for later reuse, this type of effect could be persistent for the duration of construction. In this instance, the wetland delineation (LCEP 2016) indicated few instances of gleyed soils or other hydric soil types that

would have high concentrations of sulfides or sulfates that could cause objectionable odors, and most excavation of wetland soils would occur at least one-half mile from the nearest residences. Therefore, this impact would be low.

Dust would likely be generated during excavation and transport of soils. In general, excavated soils would likely be moist as they would be excavated from lower-lying areas where moisture is most persistent, therefore dust from excavation would be minimal. Fugitive dust (PM₁₀) from movements of construction vehicles would be minimized by application of water from a water truck as needed, but at least once per day. Impacts from release of fugitive dust would be low.

3.3.2.1.2 Operational Impacts

There would be no stationary sources of pollutant emissions associated with operations of the Refuge after construction. Minor amounts of emissions would be generated by equipment used to maintain levees and other infrastructure, and to perform the general actions needed to maintain the Refuge. Although management requirements could be increased due to increased potential for invasive aquatic species, channel maintenance, and other considerations, emissions from maintenance equipment would be relatively minimal and this impact would be low.

3.3.2.2 Climate Change

Due to the breadth of the Corps' water-related projects, they have conducted extensive research and developed policy regarding the effects of climate change on their projects and on tidal and riverine projects in general. The Corps identified four categories of climate change effects with the potential to impact its national mission and operations in its 2013 Climate Change Adaptation Plan (Corps 2013). These four categories are: 1) increasing air temperature; 2) changing precipitation; 3) increases in extreme events; and 4) sea level change and associated tides, waves, and surges. The Corps' updated Climate Change Adaptation Plan (Corps 2015) addresses the following priority areas: modernizing Corps programs and policies to support climate-resilient investments, managing Corps lands and waters for climate preparedness and resilience, supporting State, local, and tribal preparedness, providing actionable climate information, tools, and projections, and international leadership provided by Corps supporting climate preparedness.

3.3.2.2.1 Construction Impacts

The Proposed Action would be unlikely to cause measurable impacts on the four categories of climate change during construction. Climate change impacts including changes to temperature and hydrology, and incidences of extreme weather events, will likely occur independent of the Proposed Action. Emission of CO₂ by construction vehicles would not exceed federal air quality standards (Table 3-1). Impacts to climate change associated with construction of the Proposed Action would be low.

3.3.2.2.2 Operational Impacts

The proposed restoration measures are designed to be functional and meet the project objectives under most conditions that are predicted to occur over the expected project lifespan of 50-75 years. The project has been designed with the following climate change adaptability criteria (LCEP 2017):

- Design the levee breach invert elevations to accommodate expected sea level rise over expected project lifespan (approximately 50 to 75 years).
- Design creek floodplain habitats that transition gently to higher elevations to accommodate higher tidal inundation expected from sea level rise.
- The restored creek channel design should accommodate lower flows and depths associated with decreases in spring and summer base flows, and accommodate higher flows and depths associated with increases in peak flows.
- Grading the floodplain with variable topography to enhance inundation in some areas and transition to higher and drier elevations in other areas for improved plant diversity and adaptability.
- Installing wood structures that encourage scour of deep pools for shaded, cold water refugia for overwintering salmonids and other aquatic species.
- Restoring a robust native plant community that adapts to variable hydrologic and groundwater regimes, especially drought conditions.

The Proposed Action would not be likely to affect air temperatures or precipitation patterns. However, it would respond to these changing conditions by increasing off-channel refugia for aquatic species during the high flood flows and increased tidal elevations that are predicted under most climate change models. Elevations of channels and floodplain wetlands developed for the Proposed Action would ensure functional habitat value under these climate change scenarios, as it is expected that wetland and riparian plant communities would respond to higher tidal elevations by forming at higher elevations in the floodplain. Furthermore, the elevations of the tops of the levees would be well above the 100-year flood elevations required for FEMA certification, and would provide flood protection under the predicted higher flows and higher tidal elevations. According to hydraulic models prepared for this project, the Proposed Action would reduce water surface levels during 500-year event flows in the Reed Island channel by roughly 0.1 ft. and would increase the capacity of the Gibbons Creek channel beneath the SR14 Bridge to pass projected 500-year flows (ESA 2015). Operational impacts on climate change would be moderate.

3.3.3 Environmental Consequences – No Action

Under the no action alternative, emissions of criteria pollutants during construction would not occur, but minor emissions from maintenance vehicles would continue. Impacts to air quality would be low. Emissions of GHGs during construction would also not occur. Although this alternative would avoid contributing GHGs, it would also not provide benefits related to climate change, including peak flow attenuation or high-flow refugia for juvenile fish. The impact of the no action alternative on climate change would be low.

3.3.4 Cumulative Impacts

The Proposed Action would result in short-term emissions of pollutants during construction, but would not include a stationary source of long-term emissions. Although the short-term construction emissions may combine with emissions from industrial sources in the nearby communities of Camas and Washougal, the areas' status of being in attainment for all pollutants

would not change as a result of these emissions. Therefore, the cumulative impact on air quality would be low.

Numerous human activities have contributed to elevated levels of GHGs globally in the earth's atmosphere and are expected to continue into the foreseeable future. Changes in climate conditions may result in less predictable stream flows than currently occur; however, the existing diversion system and fish ladder in the affected area are already overwhelmed by storm flow events. The Proposed Action could help alleviate some of the stresses on migrating and resident fish species that may occur as a result of changing climate patterns in the region by providing improved access to high quality spawning and rearing habitats. Fish have limited access to off-channel high-flow refugia in the lower Columbia River system, making accessibility to such habitat a highly important feature for Lower Columbia River (LCR) fish populations specifically. Therefore, in combination with other constructed or planned off-channel restoration projects in the estuary, the Proposed Action would cumulatively help to mitigate the impacts of climate change.

3.4 Cultural Resources

Cultural resources are locations of human activity, occupation, or use. They include expressions of human culture and history in the physical environment, such as pre-contact or historic archaeological sites, buildings, structures, objects, districts, or other places. Cultural resources can also include natural features, plants, and animals that are considered important to a culture, subculture, or community or that allow the group to continue traditional lifeways and spiritual practices. This section provides a summary of cultural resource identification efforts completed to date for the Proposed Action, including anticipated impacts on cultural resources under NEPA.

Historic properties, as defined by 36 CFR 800, the implementing regulations of Section 106 of the National Historic Preservation Act (NHPA; 54 USC § 300101 et seq.), are cultural resources that are eligible for inclusion in the National Register of Historic Places (NRHP). Historic properties may be districts, sites, buildings, structures, artifacts, ruins, objects, works of art, natural features important in human history at the national, state, or local level or properties of traditional religious and cultural importance to an Indian tribe.

3.4.1 Affected Environment

The project area is within approximately 1,055 acres of land along the Columbia River in Washington State. For the purposes of this analysis, the project area is considered the study area for cultural resources, although a 0.5-mile buffer was included for the cultural resource survey records search. The project area includes all surfaces and depths that would be affected by the Proposed Action. For the Proposed Action, the project area consists of all 1,055 acres of construction and restoration areas and extends to the maximum depth of disturbance, which would be up to 19 ft. in some areas. Ground-disturbing activities would occur in 260 of the 1,055 acres. The project area extends approximately 1 mile north-south and 2.3 miles east-west. The majority of the project area falls within the Refuge, but the Port owns a small parcel in the southwest corner, the land trust owns a large parcel in the southeast corner, and north of SR14 the project area extends into several small parcels that are privately owned (HRA 2017a).

3.4.1.1 Cultural Resources Setting

The earliest regional evidence of pre-contact populations was documented in the Willamette Valley, located south and west of the project site, and consists of fluted projectile points that are presumed to be associated with Clovis cultures. Clovis cultures have been documented in other parts of the Northwest Coast and are known to have been present between 12,800 and 13,000 calibrated years before present (BP). Much of the archaeological record along the Columbia River Basin was destroyed by the massive Missoula floods that occurred between 19,000 and 13,000 BP. Human occupation following the Missoula floods is better documented, with the earliest evidence of human activity following the floods from approximately 7950 BP. Early artifacts are simple tools and points. Around 3750 BP, sea-level rise tapered off, and more stable societies began to develop. Artifacts from this point forward become increasingly complex and diverse, reflecting the growth of cultural systems and refinement of tools (Ames and Maschner 1999, as cited in HRA 2017a).

The project area falls within the territory of the Cascades people, which extended from Washougal, Washington to just west of White Salmon, Washington, along both sides of the Columbia River (French and French 1998, as cited in HRA 2017a). The subsistence practices and material cultural of the Cascades people were centered on fishing. Fish served as the bulk of their diet, and was supplemented with plant resources and, to a lesser extent, with the meat of large and small mammals. Trade items included fish surpluses, animal skins, nets and baskets woven from plant materials, and dentalia shells. Transportation up and down the Columbia River was achieved by means of canoes crafted from single cedar logs. The Cascades people occupied permanent villages located in the vicinity of rivers during the winter months. The closest established village to the project area was a Cascades village called *Waxix* near the mouth of the Washougal Basin, located roughly 2 miles northwest of the project area. Throughout the early part of the 18th century, Chinookan society (including the Cascades people) became more complex as settlements flourished. In the 1770s, however, the regional Native American population was decimated by smallpox, which is estimated to have killed 30% of the regional population (Boyd 1985 and 1990, as cited in HRA 2017a).

The first Euroamericans to approach the project area were those under the command of Lieutenant William R. Broughton, who was sent by Captain George Vancouver in 1792 to explore the Columbia River. According to the records, Broughton's ship sailed up the Columbia approximately as far as the project area. This voyage established a British claim to the Columbia River region. The project area was next approached by Euroamericans in November 1805 when the Lewis and Clark Expedition passed on its way west. On the return trip east, the party camped in the prairie near the project area, and used the encampment as a base for hunting and for exploration of the Willamette River and the Sandy River. The Lewis and Clark Expedition spread knowledge of the Pacific Northwest, and drew settlers to the region. The mouth of the Sandy River served as a point of debarkation for settlers coming down the Columbia River, but early development in the vicinity of the project area was slow, largely as result of the substantial spring floods generated by spring snowmelt, which made cultivation and travel difficult in lowlands adjacent to the Columbia River. During this time, the society of the Cascades people was shaped by the introduction of Euroamerican trade items such as glass beads, ceramics, musket balls and shot, knives, brass kettles, metal fishhooks, and tobacco. In the 1830s, however, disease again led to major loss of life amongst Native Americans, as outbreaks of malaria killed

approximately 75 to 90% of the remaining native population in the region (French and French 1998, as cited in HRA 2017a).

Beginning in 1850, the project area was settled for small-scale farming, and by the late 19th century the nearby community of Washougal was well established (Caldbeck 2010, as cited in HRA 2017a). The region was supported by the agricultural and textile industries, and trade was facilitated by the construction of the railroad along the Columbia River beginning in 1882. In 1909, the completed Spokane, Portland, and Seattle railway (today known as the BNSF Railroad) connected Washougal and the project area with the Pacific Coast and eastern Washington. The rail line passed through the northern portion of the project area. Around this time, car travel began to take off nationwide. In response to the need for more improved roads, the Washington State Highway and Transportation Department was created in 1905. One of the first roadways to be incorporated was State Road 8, which ran from Washougal, Washington to Lyle, Washington, and which later became SR14. By the early 20th century, a number of the original land claims within the project area had been subdivided into smaller farms and orchards. During the second half of the 20th century, the construction of levees, a diversion dam, and other water control features, such as culverts and earthen berms, stabilized the floodplain and facilitated further human development. By 1961 all of the original claims had been subdivided into smaller 30 – 120 acre lots (Metsker Maps 1961, as cited in HRA 2017a).

3.4.1.2 Cultural Resources Identification Efforts

BPA initiated surveys of the project area (HRA 2017a and 2017b). The Washington Information System for Architectural and Archaeological Records Data (WISAARD) was searched in order to identify previous cultural resource surveys conducted within the project area or within 0.5 of the project area. In all, 20 previous cultural resources surveys were identified. The majority of those conducted within the project area itself were conducted in the western half of the project area in the vicinity of USFWS facilities. Others were conducted in support of the Clark County predetermination process. One was conducted in support of an earlier phase of the Steigerwald Lake Restoration Project. The WISAARD records search indicated that 12 archaeological resources have been documented within 1 mile of the project area (HRA 2017a). These resources are generally pre-contact lithic materials, and were found near streams and creeks. According to WISAARD, no archaeological resources have been documented within the project area. However, a 1985 pedestrian survey not listed in WISAARD did identify two isolated pre-contact resources within the western half of the project area (Minor and Beckham 1985, as cited in HRA 2017a). Further investigation was conducted by auguring in the vicinity of the finds, but no additional resources were found. As a result, the two pre-contact resources were determined to be secondary deposits that originated outside the project area. The survey also identified one historical resource within the project area, but this resource was determined to be not eligible in 2002 (Minor and Beckham 1985, as cited in HRA 2017a).

In support of the current project, Historical Research Associates (HRA) conducted a site-specific archaeological field investigation. The primary field surveys were conducted from May 23 – June 2, 2016 and February 14 – 24, 2017 (HRA 2017a) and a supplemental survey of the Gibbons Creek area north of SR14 occurred on August 24, 2017 (HRA 2017b). The surveys were conducted as pedestrian surveys along east-west transects that were spaced 20 meters apart. Inundated areas and areas of impassible vegetation were not surveyed. Shovel probe excavations were performed as allowed by surface geology, slope, and disturbance in areas where ground-

disturbing activities are proposed for the Proposed Action or in order to delineate found resources. The shovel probes were excavated to a minimum depth of 70 centimeters below surface (cmbs), and every fourth probe was augured to 200 cmbs to investigate for potential deeply buried deposits. Any prehistoric or historical cultural material that was identified was recorded following standard procedures, and the area in the vicinity of the find was surveyed thoroughly in order to delineate the boundary of the resource. All found resources were evaluated for eligibility to be listed in the NRHP using standard guidelines established by the National Park Service, which require significance to be established by specific criteria (HRA 2017a). HRA's initial findings and conclusions are presented below.

The initial survey identified five archaeological resources within the project area. Three (45CL1268, 45CL1269, and 45CL1270) were discovered on the surface, and two (45CL1266 and 45CL1267) were discovered through subsurface sampling. Three of the five (45CL1268, 45CL1269, and 45CL1270) were located in portions of the project area where the ground would not be disturbed (HRA 2017a). Brief summaries of the resources are below:

Site 45CL1266: This site contained three pre-contact artifacts: one cryptocrystalline-silicate (CCS) flaked cobble tool and two CCS flakes. All of the artifacts were identified below the surface using shovel probes. In their initial report, HRA recommended the site as not eligible for listing in the NRHP, as the site did not convey significance under any of the criteria. The site is located in an area where ground disturbance is proposed (HRA 2017a).

Isolate 45CL1267: This resource is a pre-contact CCS flake, which was discovered in a below surface shovel probe. No other artifacts or cultural materials were found in the vicinity. In their initial report, HRA recommended the site as not eligible for listing in the NRHP, as the site did not convey significance under any of the criteria. The site is located in an area where ground disturbance is proposed (HRA 2017a).

Site 45CL1268: This site contained historic period debris such as transferware fragments, earthenware fragments, square nails, and glass fragments. It also contained a single pre-contact artifact – a chalcedony exhausted core or core fragment. 20 of the 21 total artifacts were found below the surface. In their initial report, HRA recommended the site as not eligible for listing in the NRHP, as the site did not convey significance under any of the criteria. Although this site is not in an area where ground disturbance is proposed (HRA 2017a), it is in an area that may be inundated at the most extreme flows in the Columbia River.

Site 45CL1269: This site contained artifacts associated with a historic period homestead. The found artifacts were aqua glass canning jar fragments, a milk glass lid liner fragment, amber glass, yellowware fragment, flat glass, whiteware, brick fragments, a ceramic marble fragment, a possible toilet or chamber pot fragment, metal fragments including a possible fuse box door, sheet metal, wire nails, a railroad bridge construction spike, and scattered chunks of concrete. There were also structural remnants. In their initial report, HRA did not evaluate the site's eligibility for listing in the NRHP since the site is not in an area where ground disturbance is proposed (HRA 2017a).

Isolate 45CL1270: This isolate is a pre-contact fine-grained volcanic flaked cobble tool. It was identified on the surface. Investigation of the surrounding area and subsurface did not identify any additional artifacts or cultural resources. In their initial report, HRA recommended the site as

not eligible for listing in the NRHP, as the site did not convey significance under any of the criteria. The site is not in an area where ground disturbance is proposed (HRA 2017a).

During the supplemental survey, one additional site was identified in the vicinity of Gibbons Creek. This site, 2523-07, contained two small stone flakes that appeared to have modified edges. Investigation of the surrounding area did not identify any additional artifacts or cultural resources, and HRA recommended the site as not eligible for listing in the NRHP, as it did not convey significance under any of the criteria.

The survey also identified four above-ground historic-period resources within the project area. One of these resources, the USFWS Refuge facilities, had previously been assessed in a separate 2002 survey, and was determined to be ineligible for listing in the NRHP. Another was part of site 45CL1269 and was not evaluated by HRA, but is not within an area where ground disturbance is proposed. A third, a barn and corral, was evaluated by HRA, and was recommended as not eligible for listing in the NRHP. The final historic-period resource, the WCRL, remains undetermined, but is assumed eligible for listing in the NRHP for the purposes of the Proposed Action (HRA 2017b).

As a result of changes to the project design which required additional geotechnical investigations, HRA performed a third survey in 2017 (HRA 2017c). This investigation focused on a previously unsurveyed area along the route of the proposed west setback levee. No new resources were found in this area, and the additional geotechnical investigations were performed in summer of 2017.

3.4.2 Environmental Consequences – Proposed Action

3.4.2.1 Construction Impacts

Although sites containing archeological resources listed in or eligible for listing in the NRHP have been identified within the project area, none are found in locations where surface disturbance would occur. Therefore, the potential for disturbance of archaeological resources is low. Although consultation with DAHP is ongoing, BPA's preliminary conclusion is that archaeological resources would not be affected by construction. However, excavation or other ground-disturbing activities would have the potential to unearth previously unrecorded or unknown cultural resources. If any cultural resources were encountered during construction, including archeological artifacts or human remains, excavation activities would immediately cease at that location until the artifacts were evaluated by a cultural resources professional, in accordance with BPA's Inadvertent Discovery Protocols (BPA 2015) and in coordination with the SHPO, as needed. As a result, potential impacts related to inadvertent discovery of cultural resources would be low.

Following review of architectural resources on site, one architectural resource, the WCRL, remains undetermined, but is assumed eligible for the purpose of the undertaking. Excavation for the Proposed Action would affect the WCRL. Mitigation measures described in Section 2.4.1 would ensure that impacts to architectural resources would be moderate.

3.4.2.2 Operational Impacts

Although sites containing archeological resources listed in or eligible for listing in the NRHP have been identified within the project area, none are found in locations where new O&M actions would be necessary as a result of the Proposed Action. Although consultation with DAHP is ongoing, BPA's preliminary conclusion is that eligible or potentially eligible resources would not be affected during operations. Operations would be limited to ongoing vegetation management and maintenance of the levees and other infrastructure. As described for the excavation period, any personnel that discovered potential cultural resources during operations would cease activity and notify USFWS archeological staff. Therefore, impacts to cultural resources during operations would be low.

3.4.3 Environmental Consequences – No Action

Under the no action alternative, there would be no excavation or deposition; therefore, there would be no impacts to cultural resources.

3.4.4 Cumulative Impacts

The Proposed Action would have no impact on known archaeological or historic resources, and mitigation measures would be implemented to avoid adverse impacts on previously undiscovered cultural resources should they be discovered during construction. Although past development in the towns of Washougal and Camas and at the nearby Port may have affected cultural resources, past land uses of the Refuge were primarily grazing and hay production and would not have caused extensive sub-surface disturbance, so buried cultural resources at the Refuge are likely to be relatively intact. Although other ongoing or planned construction projects in the area such as the proposed wellfields expansion and the City of Washougal bus maintenance yard have a similar potential to affect previously undiscovered archeological or historic resources, it is assumed that mitigation measures are in place to avoid impacts to them. As much of the surrounding area is undeveloped forest and farmland, past impacts to archeological or historic resources are assumed to be low compared to more highly developed areas. Therefore, cumulative impacts to archeological or historic resources would be low.

The proposed project would have a moderate impact on the WCRL, which is assumed to be eligible for listing in the NRHP. No other proposed or ongoing projects in the vicinity of the Refuge seem to be affecting or have the potential to affect eligible architectural resources, and no past actions are known to have substantially affected such resources; therefore, the cumulative impact is low.

3.5 Fish

This section describes general and special-status fish species that may reside or migrate through the study area. It also addresses potential impacts on fish from construction and operations.

3.5.1 Affected Environment

The Refuge is located along the Columbia River floodplain from RM 124 to 128, and consists primarily of wetlands, pasture lands, and wooded areas. It also includes the lower portion of Gibbons Creek, a perennial stream that is a tributary to the Columbia River and flows into the

Refuge from the north. The Refuge historically provided rearing and spawning habitat for numerous salmon and other fish species; however, after construction of a flood protection levee in 1966, fish access from the Columbia River to Gibbons Creek and the surrounding floodplain was largely diminished (USFWS 2005). When SR14 was constructed in 1971, Gibbons Creek was channelized and realigned to flow into Steigerwald Lake. In 1992, the creek was further realigned as part of a mitigation requirement for the construction of a second powerhouse at the Bonneville Lock and Dam on the Columbia River, between 1974 and 1983, which resulted in the loss of 1,122 acres of floodplain habitat on the Washington side of the Columbia River. Gibbons Creek was directed to flow through a diversion structure/flood gate into an elevated channel, culverts, and a fish ladder prior to flowing into the Columbia River on the south side of the WCRL. Gibbons Creek flattens out at the diversion structure, and much of its sediment load settles out and accumulates at this location. Ongoing maintenance dredging of the elevated channel and diversion structure is required to remove these sediments, and during moderate and high flows, the diversion structure lacks the capacity to pass the entire flow of the stream. At these times, Gibbons Creek jumps its western bank, flowing over a concrete spillway and through a relict overflow channel downstream to the floodplain.

The mitigation efforts implemented in 1992 only partially restored fish access to the upper Gibbons Creek watershed. The elevated channel is capable of passing fish (except Chum salmon) at normal flows only, estimated to be at or above the 50 percent flow (USFWS 2005). Dredging often occurs during the fall and winter when salmonids may be migrating or spawning, or their eggs may be present in the gravel and are highly susceptible to this type of disturbance (USFWS 2011). Furthermore, overflow of Gibbons Creek into the floodplain can result in fish stranding and mortality of both juvenile and adult salmonids and other fish, as the floodplain is no longer connected to the channel, provides poor habitat quality, and is subject to high seasonal water temperatures (Brandt et al 2003). The fish ladder sits approximately 2 to 3 ft. above the low stage levels of the Columbia River. This change in elevation impedes access by migrating adult fish, and the fish ladder includes hydraulic drop heights of approximately 12 inches, which exceeds current standards for juvenile and adult fish passage (NMFS 2008b).

Within the project area, fish habitat includes the lower portion of Gibbons Creek, Steigerwald Lake, associated wetlands, and other waterbodies. These waterbodies are connected, to varying extents, by a combination of natural and excavated channels. The wetland habitat within the study area has been altered by past efforts to drain the land and make it more suitable for grazing. Gibbons Creek produces fewer fish than would be expected for a watershed of its size (USFWS 2005). Factors thought to contribute to lower production include habitat fragmentation, fish passage barriers (both in culvert crossings and a partial anadromous barrier at the mouth), loss of riparian vegetation, simplification of the stream channel, and loss of large wood (contributing to loss of habitat complexity) (USFWS 2005). In the lower reaches of Gibbons Creek, the channel bottom consists primarily of fine sediments (Ecology 2010). The Water Resource Inventory Area 28 Salmon and Steelhead Limiting Factors report identifies excess fine sediment as a limiting factor for salmon habitat in Gibbons Creek (Ecology 2010). Instream habitat consists of pools and riffles with few to no side channels, and average pool depths are shallow, ranging from 1 to 3 ft. (Ecology 2010). Large wood is lacking throughout the Gibbons Creek basin, and when present, consists of predominantly smaller pieces (Ecology 2010). Riparian habitat is poor along the creek with few to no trees shading the stream channel across the diked floodplain south of SR14 (Ecology 2010).

The study area is located along the Columbia River, which provides habitat for numerous fish species. While estimates vary slightly, the Columbia River system is thought to support nearly a hundred fish species, including native and non-native species. Of the native species in the basin, there are both resident and anadromous fishes. In the Columbia River Basin, there are two species of resident fish, 13 runs of anadromous salmonids, and two species of non-salmonid anadromous fishes that are listed as threatened or endangered under the ESA. For the purposes of this EA, “special status” refers herein to species listed under the federal ESA as threatened or endangered, or species of concern².

Federal protection of fish within the study area also includes management of marine fisheries by the Pacific Fishery Management Council and NMFS under the Magnuson-Stevens Fishery Conservation and Management Act. This Act was passed to prevent overfishing, rebuild fish populations, and conserve essential fish habitat (EFH). EFH is defined as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC § 1802(10)). NMFS manages EFH for species identified in regional fishery management plans. The project area falls within NMFS-designated EFH for Chinook and coho salmon and for groundfish (NMFS 2017). Chum and steelhead are not managed by NMFS because these species are rarely harvested in ocean fisheries.

Other important native game and tribal species that are not federally protected include species such as burbot (*Lota lota*), westslope cutthroat trout (*O. clarki lewisi*), rainbow trout (*O. mykiss*), Columbia River Redband trout (*O. mykiss*), Pacific lamprey (*Lampetra tridentata*), western brook lamprey (*Lampetra richardsonii*), mountain whitefish (*Prosopium williamsoni*), and northern pikeminnow (*Ptychocheilus oregonensis*). There is limited research on fish use within the project area, which includes Gibbons Creek and the Refuge’s wetlands. Chinook and Chum salmon were documented as having used Gibbons Creek and its floodplain for rearing prior to the construction of the flood control levee in the 1960s (USFWS 2005). The USFWS documented 17 species of fish in the lower reaches of Gibbons Creek between 1997 and 1999 while surveying fish utilization after installation of the fish ladder (Brandt et al. 2003). Coho (*Oncorhynchus kisutch*), steelhead (*Oncorhynchus mykiss*), and Chinook (*Oncorhynchus tshawytscha*) were documented, although Chinook were only noted in incidental numbers with one adult and two fry observed. These were all assumed to be part of the LCR evolutionarily significant unit (ESU) or distinct population segment (DPS) fish (Brandt et al 2003). One dead adult Eulachon (*Thaleichthys pacificus*) was also documented in the lower reaches. Pacific Lamprey, which are considered a species of concern² and brook lamprey were also observed during the survey. Ten other fish species were recorded using the lower reaches of Gibbons Creek, three of which were identified as being non-native species (Brandt et al. 2003).

There are conflicting reports of river lamprey (*Lampetra ayresi*) using the Refuge, despite not being regularly observed in the Columbia River. The Federal Register (FR) notice for preparation of the CCP/EA for Pierce, Franz Lake, and Steigerwald NWRs (65 FR 52121) indicates river lamprey using the Refuge; however, in other reports, the USFWS stated that River Lamprey have not been detected in the Columbia River system since the 1980s (USFWS 2005, Brandt et al. 2003). Though not specific to the Refuge, more recent research, involving stomach

² A species of concern is an informal term, not defined in the ESA. The term commonly refers to species that are declining or appear to be in need of concentrated conservation actions.

contents of pikeminnow (Weaver and Kostow 2011) indicates river lamprey presence within the Columbia River system. This research recorded three occurrences of river lamprey within the Columbia River system between 2008 and 2010 (Weaver and Kostow 2011).

Bull trout (*Salvelinus confluentis*) are known to occur in the mainstem Columbia River but have not been documented using habitat within the project area (USFWS 2005). Bull trout are considered unlikely to access Gibbons Creek as they require colder water than is found there.

Table 3-2 identifies fish species that have been observed in Gibbons Creek, as well as those that may be present within or adjacent to the project area. Special status fish species and designated or proposed critical habitat³ are also noted in the table.

Very little data is available regarding surveys of fish presence in Steigerwald Lake and nearby wetlands. However, reports indicate the presence of peamouth, torrent and riffle sculpin, three-spine stickleback, long-nosed dace, carp and pikeminnow, in those areas (USFWS 1993). Carp and Pikeminnow were indicated as being detrimental to fisheries resources (USFWS 1993).

Table 3-2: Fish species observed in Gibbons Creek and/or species potentially present within or adjacent to (within nearby portions of Columbia River) the project area.

Species	Federal Status	Critical Habitat Status
Chinook salmon (<i>Oncorhynchus tshawytscha</i>)		
Lower Columbia River	Threatened 70 FR 37160	Designated 70 FR 52630
Snake River spring/summer	Threatened 70 FR 37160	Designated 58 FR 68543
Snake River fall	Threatened 70 FR 37160	Designated 58 FR 68543
Upper Columbia River spring	Endangered 70 FR 37160	Designated 70 FR 52685
Upper Willamette River	Threatened 70 FR 37160	Designated 70 FR 52685
Steelhead trout (<i>O. mykiss</i>)		
Lower Columbia River	Threatened 71 FR 834	Designated 70 FR 52630
Snake River	Threatened 70 FR 37160	Designated 70 FR 52685
Upper Columbia River	Threatened 74FR 42605	Designated 70 FR 52685
Middle Columbia River	Threatened 57 FR 14517	Designated 70 FR 52685
Upper Willamette River	Threatened 62 FR 43937	Designated 70 FR 52685
Chum salmon (<i>O. keta</i>)		
Columbia River	Threatened 70 FR 37160	Designated 70 FR 52685
Coho salmon (<i>O. kisutch</i>)		
Lower Columbia River	Threatened 70 FR 37160	Proposed 78 FR 2726
Pacific eulachon (<i>Thaleichthys pacificus</i>)	Threatened 75 FR 13012	Designated 76 FR 65323
Southern DPS	Threatened 75 FR 13012	Designated 76 FR 65324
Bull trout (<i>Salvelinus confluentis</i>)		

³ A term defined in the ESA that refers to a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection.

Species	Federal Status	Critical Habitat Status
Columbia River DPS	Threatened 63 FR 31647	Designated 75 FR 63898
Pacific lamprey (<i>Lampetra tridentata</i>)	Species of Concern	None
Coastal cutthroat trout (<i>O. clarki clarki</i>)	Species of Concern	None
Cutthroat trout (<i>O. clarkia</i>)	NA	NA
Brown trout (<i>Salmo trutta</i>) ¹	NA	NA
Western brook lamprey (<i>Lampetra richardsonii</i>)	NA	NA
Reticulate sculpin (<i>Cottus perplexus</i>)	NA	NA
Prickly sculpin (<i>C. asper</i>)	NA	NA
Largescale sucker (<i>Catostomus macrocheilus</i>)	NA	NA
Peamouth (<i>Mylocheilus caurinus</i>)	NA	NA
Longnose dace (<i>Rhinichthys cataractae</i>)	NA	NA
Speckled dace (<i>R. osculus</i>)	NA	NA
Pumpkinseed sunfish (<i>Lepomis gibbosus</i>) ¹	NA	NA
Eastern banded killifish (<i>Fundulus diaphanous</i>) ¹	NA	NA
Three-spined stickleback (<i>Gasterosteus aculeatus</i>)	NA	NA

¹Species is not native within the project area

While there is only limited information on fish use of the Refuge, additional studies have been conducted at similar habitats within the vicinity, which suggest that juvenile salmonids would utilize habitats within the project area. Sagar et al. (2011) found juvenile Chinook, coho, and chum were utilizing Franz Lake, Mirror Lake, and Campbell Slough for rearing during their migration downstream. While species abundance varied among sites, juvenile Chinook were the most abundant species found overall, making up approximately 90 percent of all salmon captured (Sagar et al. 2011). Studies found that juvenile chum salmon were present in April and May, with juvenile Chinook and coho salmon being present at some sites from April through August (Sagar et al. 2011).

Another study by Johnson et al. (2011) was conducted in tidal freshwater portions of the lower Columbia River between Longview, Washington, and Bonneville Dam from 2007 to 2010. One of Johnson's study sites was directly across the river at the Sandy River Delta. This study found that juvenile salmon were present in the system year-round, demonstrating multiple life-history strategies. Overall, Chinook densities varied by season, with the highest observed in the spring and the second highest in winter. Unmarked fish were present year-round but marked fish mostly appeared as a peak in spring, suggesting a possible correlation with hatchery releases (Johnson et al. 2011). This study concluded that restoration of shallow tidal freshwater habitats in the lower Columbia River would aid in the recovery of wild fish populations.

Table 3-3 shows the general life-history timing of anadromous species in the tributary habitats of the Columbia River between the Sandy River and Herman Creek (study area; ODFW 2003). While not specific to the Refuge or Gibbons Creek, this information provides approximate timing of anadromous fish usage of nearby tributary habitat and an indication of when those species may utilize habitats within the affected area.

Table 3-3: Run timing table for Columbia River tributaries from Sandy River to Herman Creek

Life Stage/Activity/Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Upstream Adult Migration												
Winter Steelhead	█	█	█	█	█	█					█	█
Spring Chinook salmon	█	█	█	█	█	█						
Fall Chinook salmon								█	█	█	█	█
Coho salmon, N Type - Late	█	█								█	█	█
Coho salmon, Early Run								█	█	█	█	█
Chum salmon								█	█	█	█	
Adult Spawning												
Winter Steelhead		█	█	█	█	█						
Spring Chinook salmon								█	█	█		
Fall Chinook salmon										█	█	█
Coho salmon, N Type - Late											█	█
Coho salmon, Early Run	█	█									█	█
Chum salmon										█	█	█
Adult Holding												
Winter Steelhead	█	█	█	█	█	█						
Spring Chinook salmon			█	█	█	█	█	█	█	█		
Fall Chinook salmon										█	█	█
Coho salmon, N Type - Late											█	█
Coho salmon, Early Run	█									█	█	█
Chum salmon										█	█	█
Egg Incubation through Fry Emergence												
Winter Steelhead		█	█	█	█	█	█					
Spring Chinook salmon	█	█	█	█	█	█	█	█	█	█	█	█
Fall Chinook salmon	█	█	█	█	█	█	█	█	█	█	█	█
Coho salmon, N Type - Late	█	█	█	█	█	█	█	█	█	█	█	█
Coho salmon, Early Run	█	█	█	█	█	█	█	█	█	█	█	█
Chum salmon	█	█	█	█	█	█	█	█	█	█	█	█
Juvenile Rearing												
Winter Steelhead	█	█	█	█	█	█	█	█	█	█	█	█
Spring Chinook salmon		█	█	█	█	█	█	█	█	█	█	█
Fall Chinook salmon								█	█	█	█	█
Coho salmon, N Type - Late												
Coho salmon, Early Run	█	█	█	█	█	█	█	█	█	█	█	█
Chum salmon		█	█	█	█	█	█	█	█	█	█	█
Downstream Juvenile Migration												
Winter Steelhead		█	█	█	█	█	█	█	█	█	█	█
Spring Chinook salmon		█	█	█	█	█	█	█	█	█	█	█
Fall Chinook salmon								█	█	█	█	█
Coho salmon, N Type - Late												
Coho salmon, Early Run		█	█	█	█	█	█	█	█	█	█	█
Chum salmon		█	█	█	█	█	█	█	█	█	█	█

█ Peak use
 █ Less than peak use
 █ Uniform use or level undesignated

Source: ODFW 2016d

3.5.1.1 *Special Status Fish and Habitat within Affected Area*

Previous studies in Gibbons Creek noted the presence of currently ESA-listed fish species, including Chinook and coho salmon and steelhead trout, all of which were assumed to be part of the LCR ESU or DPS (Brandt et al. 2003). This section provides additional information about species life-history, timing, and habitat for those runs specifically, as well as eulachon, Pacific lamprey, cutthroat trout (all species of concern), and western brook lamprey.

3.5.1.1.1 *Lower Columbia River Chinook*

The LCR Chinook ESU historically contained three runs: fall, late-fall, and spring. Fall populations are “ocean-type” with juveniles migrating downstream at one to four months of age, making extensive use of river and estuary habitats before entering the ocean. Late-fall and spring populations are “stream-type,” with juveniles rearing in fresh water for approximately one year prior to migrating to the ocean. Returning spring Chinook also generally spawn higher up in larger subbasins than fall Chinook (NMFS 2013b). Only two of the 32 populations of LCR Chinook are considered viable, with most (26 of the 32 populations) having very low probability of persisting in the next 100 years (NMFS 2013b).

Gibbons Creek is located in the Lower Columbia Gorge Tributaries subbasin (LCRFRB 2010), which includes all tributaries between Bonneville Dam and the City of Vancouver, except for Salmon Creek and the Washougal River, which are managed as separate subbasins. The Lower Columbia Gorge Tributary population of fall Chinook is a contributing population for ESU recovery, currently at “very low” status. Floodplains have been substantially altered or disconnected in this population’s range, which includes highly developed areas where flood protection is a key concern (NMFS 2013b). Riparian conditions, channel structure and form, side-channel and wetland conditions, and floodplain conditions are primary limiting factors for tributary habitat in the Lower Gorge. Critical habitat for LCR Chinook includes the Columbia River adjacent to the study area but does not include the Refuge lands other than Gibbons Creek.

3.5.1.1.2 *Columbia River Chum*

Although Chum (*Oncorhynchus keta*) have not been officially documented in Gibbons Creek, anecdotal evidence indicate that chum have historically occurred in the creek. Critical habitat has been designated (2005) from the mouth of the creek upstream to the crossing of SR14. Columbia River Chum salmon primarily spawn in the lower Columbia River and its tributaries; however, populations used to extend as far as the Walla Walla River (NMFS 2013b). Almost all adult Chum returning to the Columbia River are now fall-run fish, which enter the river from mid-October through November and spawn from early November to late December (NMFS 2013b). Fry emerge from March through May and generally migrate downstream to the estuary soon after emergence (NMFS 2013b).

For Chum in the Lower Columbia Gorge Tributary subbasin, habitat and estuary factors make up more than half of the potentially manageable factors affecting the population (LCRFRB 2010). Habitat degradation is considered a primary limiting factor for these fish (NMFS 2013b). Access to side-channel habitat, accessible wetlands, channel structure, habitat complexity and diversity, and estuary conditions are all considered primary limiting factors for Columbia River Chum salmon (NMFS 2013b), while water quality (contaminants and temperature) is considered a secondary limiting factor (NMFS 2013b).

3.5.1.1.3 Lower Columbia River Coho

LCR Coho salmon (*Oncorhynchus kisutch*) have two general life-history patterns, categorized as early-returning (Type S) and late returning (Type N). Adults in Type S stocks enter the Columbia River in mid-August and begin entering tributaries in early September. Peak spawning occurs from mid-October to early November. Adults in Type N stocks are in the Columbia River from late September through December and enter tributaries from October through January. Peak spawning is between November and January but can occur as late as March. Juveniles in this ESU generally rear in freshwater for over a year (NMFS 2013b). The Lower Gorge Tributary populations are generally late-returning stock, or Type N.

Critical habitat for LCR Coho was designated within Gibbons Creek in February of 2016 from the mouth of the creek to the crossing of SE Hans Nagel Road, a distance of approximately 4.25 stream miles (NMFS 2013b). In general, floodplain habitats have largely been disconnected within the range of Lower Columbia Gorge Tributary Coho. Removal of fish passage barriers and reconnection of floodplains are identified as focus areas in recovery planning documents (NMFS 2013b).

3.5.1.1.4 Lower Columbia River Steelhead

LCR Steelhead can demonstrate both anadromous and resident (which are typically referred to as Rainbow or Redband Trout) life-history strategies (NMFS 2013b). In addition, they can spawn more than once, referred to as iteroparity (NMFS 2013b). Steelhead are the anadromous form of *O. mykiss* and display two distinct timing patterns: summer and winter runs. Summer-run Steelhead enter freshwater between May and October, generally spawning between late February and early April. Winter-run Steelhead generally enter freshwater between December and May, with peak spawning occurring between late April and early May. Fry emergence occurs from March to July, with peak emergence between April and May (NMFS 2013b). Juveniles rear in fresh water for one to four years, with most smolting at approximately two years of age (NMFS 2013b). Smolt outmigration occurs from March to June, peaking in April or May. Winter-run Steelhead are present in the Lower Columbia Gorge tributaries.

Primary limiting factors for the Lower Gorge populations include riparian conditions, channel structure and form, side channel and wetland conditions, and floodplain conditions. Water quantity and water quality (contaminants) are considered secondary limiting conditions (NMFS 2013b). Although critical habitat for LCR Steelhead is not designated within the project area, it is designated in the Columbia River adjacent to the project area.

3.5.1.1.5 Pacific Eulachon

The southern DPS for Pacific Eulachon was listed as threatened on March 18, 2010 (75 FR 13012), with critical habitat designated on October 20, 2011 (76 FR 65324). Pacific Eulachon are small anadromous fish (also called candlefish and smelt) that spend two to five years in the ocean before migrating up rivers to spawning grounds. Upon emerging, juveniles migrate directly out to sea. Pacific Eulachon are found in ocean waters ranging from the nearshore down to nearly 1,000 ft. in depth. Spawning areas are often in the lower sections of large snowmelt-fed rivers. Eulachon typically require water temperatures ranging from 39°F to 50°F for spawning (NMFS 2013c). As with other fish species, they require clean, cool water, clean substrate of suitable size, and sufficient food resources to be successful through their various life stages.

These fish occur only in the eastern Pacific Ocean, with the majority of production in the U.S. coming from the Columbia River (NMFS 2013c). Similar to other anadromous species, Eulachon are highly susceptible to habitat loss and degradation. Dam construction has hindered access to historical spawning areas and reduced the quality of spawning substrates available. Flow management, altered transport of coarse sediments, and siltation have all been attributed to habitat impacts. Although critical habitat for Eulachon is not designated within the study area, it is designated in the Columbia River.

Upstream migration generally occurs between December and June. Spawning occurs over sand or coarse gravel, with eggs incubating for three to eight weeks (NMFS 2013c). The primary factors causing population decline and leading to the listing of the southern DPS were stated as “the destruction, modification, or curtailment of habitat and inadequacy of existing regulatory mechanisms” (75 FR 13018). Key threats in the Columbia River include climate impacts on ocean and freshwater conditions, dams/water diversions, and Eulachon by-catch in other fisheries (NMFS 2013c).

3.5.1.1.6 *Pacific Lamprey*

Although not an ESA-listed fish species, Pacific lamprey are considered a species of concern by USFWS. While Pacific lamprey are anadromous like salmonids, they spend a greater portion of their life cycle in freshwater streams, with nearly half their lives spent as filter-feeding larvae, or ammocoetes. Lamprey filter water and mud to find food, so they are particularly sensitive to pollutants in the water column and sediments. Additionally, they require cool water to support their food supply. Lamprey depend on low gradient habitats with slow water and muddy bottoms during the juvenile stage, and they require gravel-rich habitats, including pool tail-outs and low gradient riffles for spawning. The habitat needs of lamprey are very specific, making them highly susceptible to habitat modification and loss, as well as altered stream flow regimes (PSMFC 1997).

Like other native anadromous species in the Columbia River Basin, lamprey are susceptible to many of the same threats posed by dams and other fish passage barriers within the region. Limited access to suitable spawning and rearing habitat, degradation of water quality and habitat conditions, mortality of emigrating juveniles at dam facilities, and predation have all been linked with the decline of Pacific Lamprey in the basin. In addition, fish passage facilities designed for salmon and other species do not necessarily function well for providing lamprey passage.

In the vicinity of the project area, Pacific lamprey are in the Lower Columbia/Willamette Recovery Management Unit (RMU) and would be considered to be in the Lower Cowlitz sub-unit (USFWS 2015). This RMU is considered to be at lower risk than most other RMUs within the Columbia River Basin (USFWS 2012). Key threats in this area are dewatering and flow management, tributary passage, stream and floodplain degradation, and degraded water quality (USFWS 2015).

3.5.1.1.7 *Coastal Cutthroat Trout*

Coastal cutthroat trout (*O. clarkia*) are listed as a species of concern under the ESA (Table 3-2). Cutthroat were observed in the lower reaches of Gibbons Creek by the USFWS during 1997 and 1999 (Brandt et al. 2003). Unlike all other species of trout, coastal cutthroat trout have numerous small-to-medium irregular spots, and do not develop the typical coloration (USFWS 2017). The

life-history forms of cutthroat trout are complex and malleable, but are generally grouped into three forms: non-migratory, which reside in small, headwater streams; freshwater-migratory, which migrate only within freshwater reaches and lakes; and saltwater-migratory, which migrate from freshwater to marine habitats in the spring, and return to fresh water in the winter to spawn. Fish can switch from one form to another within their lifespan. Typically, all forms of coastal cutthroat trout spawn between December and June. When in freshwater habitat, cutthroat prefer deeper pool habitat and cover. They occupy a wide range of freshwater environments, from small to large streams, estuaries, ponds, lakes, and sloughs. Historically, the primary factors that have contributed to species decline have been estuary degradation, urban and industrial development, agriculture, loss of riparian area due to forest management practices, and the installation of dams and other fish barriers. However, cutthroat populations in the Pacific Northwest appear to be relatively resilient to the impacts of these activities on stream habitat, and continue to be present in densities comparable to those observed in other regions. As a result, the species is not listed as threatened or endangered at this time (USFWS 2017).

3.5.1.1.8 *Western Brook Lamprey*

Western brook lamprey (*Lampetra richardsonii*) were also documented in the lower reaches of Gibbons Creek during the 1997-1999 USFWS surveys (Brandt et al. 2003). Western brook lamprey are not listed. Like Pacific lamprey, western brook lamprey are anadromous, but spend the majority of their lives in freshwater streams, where they require gravel habitat for spawning and silty backwater habitat for rearing of ammocetes. In addition, they require good water quality, as they remain burrowed and relatively immobile as ammocetes. These requirements make them susceptible to decline if water quality deteriorates or their habitat is lost as a result of habitat degradation. Western brook lamprey are also declining in number as a result of predation by non-native species.

3.5.2 Environmental Consequences – Proposed Action

The environmental consequences of the Proposed Action have been evaluated in this section as they relate to fish within the affected area. As used below, the term “fish” refers collectively to all fish in the affected area, including those listed in Table 3-2. Likewise, the term “habitat” includes general fish habitat as well as any designated critical habitat in the affected area.

3.5.2.1 *Construction Impacts*

Fish and fish habitat can be directly or indirectly impacted by the activities included as part of the Proposed Action. The extent of potential direct and indirect impacts from these activities is dependent on the duration of the activity and the types of protective measures used to minimize impacts. These impacts could include:

- Injury or mortality during work-area isolation and fish salvage
- Short-term loss of access for fish to Gibbons Creek
- Disruption of spawning, rearing, or foraging activities
- Construction-related turbidity
- Construction-related vegetation removal

- Changes in water quality
- Increased habitat area and access (including wetland, floodplain, side channel, and stream habitat) available for juvenile salmonid spawning and rearing

While the Proposed Action could have limited, short-term negative impacts on individual fish or fish habitat, the overall action would result in a net benefit to not only individual fish, but fish populations, and fish habitat. The goals of the Proposed Action are to benefit fish by restoring floodplain connectivity and physical processes, provide access to restored habitats for native fish species, and increase habitat quality of restored stream channels, floodplains and wetland habitats.

Table 3-4 summarizes the activities related to the Proposed Action and the potential impacts of each as they relate to fish and fish habitat. The following sections describe these impacts in more detail.

Table 3-4: Potential impacts to fish and fish habitat resulting from the Proposed Action

Activity Related to Proposed Action	Types of Impacts									
	Adverse				Beneficial					
	<i>Injury/mortality</i>	<i>Short-term loss of access</i>	<i>Disruption of spawning, rearing, or foraging activities</i>	<i>Turbidity</i>	<i>Veg removal/conversion</i>	<i>Restore/improve hydrology</i>	<i>Increased habitat area and diversity</i>	<i>Fish Passage</i>	<i>Water quality</i>	<i>Sediment Transport</i>
Work area isolation/fish salvage	•	•	•	•						
Remove/breach levee		•	•	•	•	•	•	•	•	•
Remove water control structures and elevated canal		•	•	•		•	•	•		•
Restore wetland and riparian native plant communities					•	•	•		•	
Increase number of wood habitat structures		•	•	•		•	•			
Create additional and improved floodplain habitats		•	•	•	•	•	•			•

The Proposed Action would likely result in some impacts to fish and fish habitat. These would include short-term impacts related to construction, including turbidity resulting from excavation of channels, removal and breaching of the WCRL and natural levee, removal of water-control structures, fish ladder, and culverts, floodplain and channel re-contouring, and other similar actions. Construction-related turbidity could cause fish to temporarily avoid the affected area altogether, alter behaviors such as foraging or breeding, or could affect egg survival. Turbidity-related impacts would be minimized by implementing the appropriate BMPs and adhering to applicable regulatory requirements and permit conditions, and would therefore be low. Work would be conducted during the approved in-water work window to minimize the likelihood of

fish being present during construction. Construction activities would comply with an erosion control plan to keep sediment from entering waterbodies. Temporary and permanent erosion and sedimentation control BMPs (Table 2-9) could include, but would not be limited to, turbidity curtains, straw bales, coir wattles, sediment fencing, check dams, coir matting, and erosion control blankets.

Construction equipment (excavators, bulldozers, dump trucks, etc.) pose a risk for accidental spills of fuel, engine fluids, and other contaminants. Additionally, construction-related discharges could occur during vehicle washing, pumping for work-area isolation, or other purposes. Discharge could carry sediments or contaminants to active water bodies, floodplains, wetlands, or riparian areas, potentially exposing fish and fish habitat to contaminants. However, BMPs would be maintained during construction to avoid or minimize potential impacts to fish from accidental spills and/or discharges. These would include, but would not be limited to: maintaining an emergency spill containment kit onsite during all construction activities, developing and adhering to a SPCC Plan, conducting machinery maintenance, staging, and refueling in designated areas away from waterbodies or sensitive areas or in fully contained areas, and conducting regular checks of machinery for leaks prior to starting work. As a result, potential impacts to fish related to accidental spills of contaminants would be low.

In-water construction activities would be required for the Proposed Action, including activities such as the removal/breaching of the levees, removal of water control structures and the elevated canal, channel and floodplain re-contouring and others. In an effort to minimize the impacts to fish and their habitats, the work area would be isolated, and fish salvage would be performed prior to in-water construction. Work area isolation and fish removal would be carried out by qualified personnel in accordance with federal and state fish salvage guidelines and all necessary permits. Methods could include the use of cofferdams, screened pumps, seine and dip nets, minnow traps, and/or electrofishing units. These activities could lead to incidental injury or even death of fish within the affected area; however, because the Proposed Action would adhere to limits set by various regulatory permits and guidelines, including incidental take allowed under HIP III, and all fish handling would be conducted by an experienced fish biologist, impacts to fish would likely be low.

As part of the Proposed Action, in some areas, riparian vegetation would be affected. The Proposed Action could reduce the quality of fish habitat in the near term by removing cover elements, and it could lead to localized increases in water temperatures due to reduced shading of the stream channel. Additionally, cleared areas would be more susceptible to erosion and increased runoff into waterbodies or wetlands. Implementing appropriate BMPs in cleared areas could include site stabilization, hydroseeding, or replanting, which would minimize the likelihood and duration of impacts to fish and their habitat, and the impact would be low.

The Proposed Action could result in short-term loss of fish access to spawning areas in Gibbons Creek and adjacent habitats. Passage into Gibbons Creek is currently limited, however, and by conducting work within the approved in-water work window, impacts to fish would be essentially avoided and can be considered low.

As discussed in Section 3.5.1, the area designated as EFH for Chinook salmon, coho salmon, and groundfish includes the Columbia River adjacent to the project area. Because the Proposed Action is intended to improve fish habitat, it would not be expected to have a long-term adverse

impact on EFH. Although temporary impacts in the form of turbidity and noise would occur during construction, implementation of mitigation measures and BMPs described in Section 2.4.1 and conservation measures required under HIP III would ensure that these impacts are low.

3.5.2.2 Operational Impacts

The Proposed Action would benefit fish and fish habitat. It could lead to improvements in productivity, abundance and life history diversity within and nearby the affected area. Benefits would include improved passage for all fish species in the affected area, which could result in re-establishment of historic fish populations into the area. It could also allow for increased access to floodplain rearing areas and enhanced off-channel habitat quality.

Reconnecting Gibbons Creek to the floodplain and reconnecting the floodplain to the Columbia River would provide access and passage for native fish species of all life stages. In addition, the quality, diversity, and function of fish habitat within the action area would benefit from the Proposed Action by improving and increasing off-channel habitat for outmigrating juvenile salmonids in need of rearing and overwintering habitat. It would also provide spawning habitat for adult salmonids in the lower Columbia River. By restoring connectivity and function within the action area, hydrologic exchange and processes would improve and provide fish habitat. These operational impacts would be moderate.

Removing the Gibbons Creek diversion structure would result in a moderate impact to fish and fish habitat by eliminating the need for maintenance dredging activities in Gibbons Creek. It would greatly improve fish passage, reducing flood risk and fish mortality during overflows, and generally improve the quality of fish habitat.

As described by Ecology (Ecology 2010), the Lower Columbia Fish Recovery Board (LCFRB) has identified key restoration priorities for salmon recovery in Gibbons Creek, including actions such as protecting stream corridor structure and function, protecting and restoring hillslope processes, providing for adequate in-stream flows, restoring riparian conditions, restoring floodplains and channel migration processes, restoring water quality, and restoring access to habitats blocked by artificial barriers (Ecology 2010). Additionally, projects that breach or lower levees within the floodplain of the Columbia River are well recognized as providing valuable access to off-channel habitats and providing increased foraging opportunities and access to refugia for outmigrating juvenile salmonids (NMFS 2008a). Furthermore, NMFS has noted that restoration projects that remove passage barriers and improve access, increase channel complexity, and improve water quality contribute to overall habitat improvements for stream-type juvenile salmonids (NMFS 2008a). The Proposed Action incorporates many of these elements and would contribute to long-term benefits for fish and fish habitat in the region.

3.5.3 Environmental Consequences – No Action

Under the no action alternative, the Proposed Action would not be constructed, and the benefits to anadromous and resident fish would not be realized. Gibbons Creek would remain largely inaccessible to fish passage under most flows, and juvenile fish would not have access to floodplain wetlands during their outmigration. These impacts would be moderate. In addition, sediment deposition would continue to occur at the Gibbons Creek diversion structure, causing overflow into the floodplain and stranding of the few fish that are in the system. Because it could result in take of listed fish species, this impact would be high.

3.5.4 Cumulative Impacts

Past, present and reasonably foreseeable actions most likely to cause cumulative impacts to fish include: ongoing operations of the FCRPS dams, construction of levees, ongoing hatchery operations, climate change, and aquatic restoration projects throughout the estuary. Although operations of the FCRPS dams have been adjusted over time to reduce impacts on anadromous fish, they will continue to provide a barrier to unrestricted fish passage in the Columbia River and maintain highly modified habitat conditions (i.e. reservoirs). The impacts of climate change are projected to include increases in average water temperatures as well as altered flow patterns.

Completed, ongoing, and planned aquatic restoration actions provide improved habitat for numerous species of fish and wildlife. Considered on a regional basis, these projects, in combination with the Proposed Action, would constitute a beneficial cumulative impact to habitat quality for fish and wildlife in the Columbia River estuary. This project would substantially increase the amount of off-channel rearing habitat for outmigrating juvenile salmonids and improve ecosystem functions including the export of nutrients from wetlands into the greater estuary. Such off-channel wetland projects also help reduce competition amongst juvenile fish as an increasing number of hatchery fish are released from upstream hatcheries in efforts to bolster the Columbia River fishery. This project would help to incrementally reverse some of the impacts of past and ongoing actions, improve survival rates of salmon and steelhead, increase the carrying capacity of the estuary, and improve habitat for wildlife, including thousands of migratory birds that visit the estuary on their seasonal migrations. This impact would be moderate.

3.6 Geology and Soils

This section describes topography, geology, unique physical land features, potential geologic hazards, and soils data, including erosion and compaction risk, for the project area.

3.6.1 Affected Environment

3.6.1.1 Topography

Elevations in the study area range from 5 to 50 ft. NAVD88 (LCEP 2016). Slopes are generally low (0 to 3 percent) with the steepest slopes on the sides of the WCRL. From the Columbia River normal winter water surface elevation of approximately 15 ft., the levees slope upward to 45 ft. at the crest. Terrain on the inboard side of the levees gently undulates from elevations of 15 to 25 ft. through the study area, until reaching higher elevations where the railroad and levees bound the north and east. Around Straub and Steigerwald Lakes, elevations range from 15 to 25 ft. The adjacent railroad is at an elevation of about 50 ft., and the levee crest is at an elevation of 45 to 47 ft. Elevations in the developed Port industrial park, located southwest of the project area, generally range from 20 to 30 ft. The City of Washougal maintains a series of wastewater treatment ponds to the west of the study area. The ponds are protected by berms, with the lowest berm at an elevation of 20 ft.

An unusual feature of the area is the modified Gibbons Creek, which has been diverted into a perched aqueduct that conveys flows over Steigerwald Lake. The aqueduct is connected to the Columbia River through the WCRL via an open, 72-inch culvert. Fifteen “v-shaped” weirs with

1-ft. steps are located below the culvert and are designed to allow adult salmonid passage into Gibbons Creek at higher flows of the Columbia River.

In addition, there are three dikes within the study area, generally running north-south. The westernmost dike is a road connecting the wastewater ponds and the Port, with a crest elevation of about 20 ft. A second dike acts as the aqueduct for Gibbons Creek and has an elevation of about 35 ft. The easternmost dike crests at about 25 ft. and provides the multiuse trail mentioned above. All three dikes have culverts that allow water to move through the study area.

3.6.1.2 Geology

The study area is located within the Portland Basin, which is part of the Coastal Lowland that separates the Cascade Range from the Oregon Coast Range (Evarts et al. 2013). It is part of the Puget-Willamette Lowland physiographic region, which is a forearc basin of the Cascadia Subduction Zone.

The Refuge is underlain by the gravel facies deposited during the Missoula Floods between 16,000 and 12,000 years ago (CCI 2016). These cataclysmic glacial-outburst floods poured through the Columbia River Gorge, building coarse-grained bars and depositing sand and silt on upland surfaces (Evarts et al. 2013). Younger geologic deposits include alluvium of the Columbia River floodplain and channel (Qac) deposited in the Holocene (last 11,500 years to the present), and tributary stream alluvium (Qa) deposited during the Holocene and Pleistocene (Evarts et al. 2013). Holocene alluvium deposits (Qac) are unconsolidated fine sand, silt, and clay that underlies the historic floodplain of the Columbia River at elevations of less than 30 ft. These deposits are composed primarily of quartz, feldspar, and conspicuous muscovite. Tributary stream alluvial deposits (Qa) include unconsolidated sand, gravel, and organic-rich mud of less than 30 ft. Gibbons Creek alluvium (Qa) overlies Columbia River alluvium (Qac) along the creek and consists of a medium-dense to dense mixture of gravel, rock fragments, and silty sand (CCI 2016).

Recent geotechnical investigations determined the depths of geologic deposits (CCI 2016). Columbia River alluvium varied from 100 ft. to about 20 ft. thick and Gibbons Creek alluvium varied from 15 ft. to 30 ft. in thickness. Underlying the Holocene alluvium deposits was a conglomerate of dense subrounded gravel and cobbles in a matrix of slightly cemented sand, considered to be part of the Troutdale Formation (Evarts et al. 2013). The conglomerate was encountered at depths of 20 to 80 ft. below the ground surface at the north and south ends of the setback levees (CCI 2016).

Geologic hazards resulting from earthquake activity could include ground shaking, soil liquefaction and landslides. According to mapping done in 2013, there are no faults passing directly beneath the study area. However, the Lacamas Lake fault is shown to reach along the center of the Columbia River offshore of the study area (Evarts et al. 2013). This fault may have experienced strike-slip motion in the past, though the most recent activity is estimated to have occurred prior to the Missoula Floods (USGS 2002). Two other unnamed faults are reported by Evarts et al. (2013) to extend northward from Oregon, reaching approximately to the south shore of Reed Island. These unnamed faults are not included in the Quaternary Fault and Fold Database of the U.S., and their status is unknown (USGS 2006). Ground shaking potential associated with earthquakes is estimated to be moderate in the study area (WDNR 2016), while liquefaction potential is moderate to high (Palmer et al. 2004). The National Earthquake Hazards

Reduction Program has classified soils in the study area as Site Class D, which are considered moderately to highly susceptible to liquefaction (Clark County 2016c).

3.6.1.3 Soils

Soils were identified using the online Web Soil Survey 3.1, covering the total area of the Refuge as shown in Table 3-5 (NRCS 2013). Soils found in the study area are primarily comprised of silt loams, with smaller areas of gravelly loams, silty clay loams, and cobbly soils (NRCS 2013). Loams in the study area are characteristically poorly drained hydric soils typically associated with wetlands and floodplains.

Table 3-5: Soils of the study area (NRCS 2013)

Map Unit Symbol	Map Unit Name	Acreage
HoA	Hillsboro silt loam, 0-3% slopes	27
HoB	Hillsboro silt loam, 3-8% slopes	20
LgB	Lauren gravelly loam, 0-8% slopes	15
LrF	Lauren gravelly loam, cemented substratum, 20-55% slopes	2.3
NbA	Newberg silt loam, 0-3% slopes	113
NbB	Newberg silt loam, 3-8% slopes	214
Rc	Riverwash, cobbly	2.7
SmA	Sauvie silt loam, 0-3% slopes	455
SnA	Sauvie silt loam, sandy substratum, 0-3% slopes	164
SpB	Sauvie silty clay loam, 0-8% slopes	15
WgB	Washougal gravelly loam, 0-8% slopes	1

Soils in the area have the potential to erode as a result of Gibbons Creek or Columbia River flows. Along the Columbia River shoreline, steep slopes and abrupt cutbanks result in erosion of soils into the river (BPA 2016a). Much of the shoreline along the study area has been armored with large riprap rocks to prevent further erosion. No detailed studies have been made of erosion rates along the Columbia River in the study area (USFWS 2005). Gibbons Creek levels out and flows slow as it reaches the study area, resulting in deposition of sediment and not scour or erosion of the creek bed. Historically, the Columbia River would seasonally scour and deposit sediment along its shorelines, creating and shaping mudflats, estuaries, backwaters, and side channels. Drainage and diking of the study area has altered the influence the river has on these processes. However, deposition of river sediment into the area is still possible at flood flows exceeding the levee height.

Soil subsidence occurs when groundwater levels are lowered and soil particles compact. The overall effect is the loss of ground elevation, which corresponds to the lowering level of the water table. Historically, the study area was more often inundated and likely had a consistently higher water table. Study area drainage through the 1900s has reduced the natural exchange of flood waters, thereby potentially subjecting soils to compaction and subsidence. However, no studies have been conducted in the area to determine if the water table has receded as a result of drainage and levees or if there is evidence of subsidence. Because recent wetland delineations show that much of the project area still has wetland hydrology, it is not likely that there has been an increase in soil subsidence with a reduced exchange of flood waters.

No landslide hazards are identified in the lower reach of Gibbons Creek (Ecology 2010). The Clark County Department of Assessment and Geographic Information Systems (GIS) prepared a map showing active, historical, or potential unstable slopes, and none were found to occur in the study area (Clark County 2011). North of SR14, a number of historical or potential unstable slopes are found along Gibbons or Lawton creeks (Clark County 2011).

3.6.2 Environmental Consequences – Proposed Action

Project construction would have temporary impacts resulting from increased soil erosion, soil compaction and mixing of soil horizons. These impacts would be mitigated through use of mitigation measures that would reduce impacts below a significant level. Operation of the project would allow water circulation and inundation that more closely resembles natural function, including sedimentation and erosion.

3.6.2.1 Construction Impacts

Construction and operation of the Proposed Action could result in changes to soils and geological features within the Refuge. Construction activities would include earthwork intended to lower levees, breach levees, and realign Gibbons Creek. Once construction was complete, operation of the newly restored Refuge lands could also potentially impact soils and geology. Impacts could include:

- Temporary increases in erosion or sediment deposition within floodplains, channels and the Columbia River
- Localized changes in water circulation patterns, velocity, or flows
- Alterations to natural sedimentation or erosion processes
- Fugitive dust generated during construction
- Increased groundwater exchange that changes soil properties

During construction, up to 1.23 million cy of materials would be excavated at the site. Suitable excavated materials would be used to construct the setback levees and other features and remaining soil would be used to restore borrow pit areas. Earthwork would result in a temporary increase in soil erosion, compaction, and mixing of soil horizons. Soil disturbance would result from excavation to lower the existing WCRL elevation, an action that would span the length of the project area along the margin between the Refuge and the Columbia River. Soil disturbances would also result from breaching the WCRL in four locations, channel excavation, setback levee construction, excavating new wetland habitats, relocating the visitor's area, and installing the floodwall.

Removal of the top portion of the WCRL would temporarily expose soils, but the soils would be stabilized by compacting them, topping with gravel, and recontouring the crest of the remaining levee segment to discourage erosion from runoff. Silt fences would be used to prevent soils from eroding into the water column, and other erosion and sediment control measures described in Section 2.4.1 would be used to control temporary soils loss, reduce sediment delivery to the river, and minimize turbidity. Similarly, interior portions of the Refuge would be scraped of vegetation and excavated to desired depths, leaving temporarily exposed soils where new wetlands and floodplain channels are created. In this case, little erosion would occur during

construction, since these areas are flat and found at low elevations, therefore they would not experience much water circulation until the levees were breached and operation begins. Prior to levee breaching, newly excavated wetland areas would be seeded with native wetland plant species and be given ample time to establish vegetation cover that would reduce soil erosion. Nonetheless, minor soils loss would likely occur upon breaching of the natural levee and initial inundation of the floodplain channels. Excavation of Gibbons Creek (Channel 3) on the south (river) side of the WCRL would occur in the dry, ensuring that erosion would be minimized. With implementation of the erosion control measures discussed above, impacts to soils and geology as a result of these construction actions would be temporary and low.

Excavated soils would be used to build the new east and west setback levees. This would not represent a substantial change in soil composition, since human and livestock use of the area over the past century have already resulted in disturbance, and also because soils throughout the Refuge are derived from similar parent materials. Relocation of soils from the WCRL and mid-refuge to the new east and west levees would not substantially change the soil conditions in the project area. Impacts to soil composition would be low.

Additional soils impacts would result from clearing and grubbing construction and staging areas, relocating the visitor center, constructing the control structure and associated modifications to SR14, realigning pedestrian trails and bridge construction, and constructing setback levees and the floodwall. Each of these elements would be constructed on dry land and could result in temporary increases in erosion at exposed sites. Mitigation measures and implementation of a Stormwater Pollution Prevention Plan (SWPPP) would ensure that erosion impacts associated with these actions would be low and less than significant.

3.6.2.2 Operational Impacts

Upon completion of construction, restoration of floodplain habitat through levee breaching would result in changes to the local water circulation patterns, water flows and velocity, and duration of inundation. These changes, in turn, could potentially impact soils and localized topography by changing bedload movement, sediment transport and patterns of accretion and erosion. However, as described in Section 2.1.2.1, the channels and breach locations were designed to result in stable channel beds and banks, and to minimize the potential for erosion. As designed, levee breaches would minimize erosion while allowing adequate water exchange during outflow and flood events. Revegetation of levee cuts would also ensure that erosion was minimized, and the long-term impacts would likely include long-term benefits to soils retention and formation from stabilized banks and revegetated wetlands and riparian areas. In addition, wind/wave impacts along the constructed levees would be mitigated by the construction of vegetated levee overbuild sections. Impacts to erosion and topography would be low.

Levee breaching would restore the hydrologic connection between the Columbia River and the Refuge floodplain. This would reestablish conditions resembling the historic floodplain connections that were lost when levees were constructed. This flood water exchange would allow for seasonal inundation of wetlands, formation of additional areas of hydric soils, and the natural accretion and erosion of sediment throughout the newly connected channels. Impacts to soils and geology as a result of these geomorphic changes would be low.

Construction of setback levees would be likely to result in settlement of up to 3.5 ft. due to compression of soils in the levee footprint (CCI 2016). To account for this, the setback levees

have been designed with adequate freeboard to allow for the desired level of protection once the settlement has occurred. Additionally, the levees would be re-topped in year 3 to address areas of settlement, as needed. Impacts to soils and geology would be low.

Removal of the Gibbons Creek diversion structure would allow for more efficient sediment transport through the stream reach just below SR14. The restored streambed alignment would create a more free-flowing current, which would distribute sediments more evenly throughout the floodplain, reducing the extensive sedimentation that occurs at the diversion structure under current conditions. Because this action would greatly reduce maintenance associated with sediment removal, and would eliminate the need for periodic permitting and consultation that now occurs, the impact would be moderate.

Although the proposed setback levee locations were not evaluated for stability during earthquakes, peak ground acceleration (PGA) was calculated using USGS's ground-motion parameter calculator (CCI 2016). This method is considered acceptable under the National Flood Insurance Protection Program if the 100-year return period earthquake produces PGA of less than 0.10 g, where g is the acceleration of gravity on the surface of the earth at sea level (9.8 meters/second²). The calculator indicated that a 100-year plus earthquake at this site would produce a PGA value of approximately 0.07g, well below the 0.10g threshold. Impacts associated with seismic risk would be minimal.

3.6.3 Environmental Consequences – No Action

Under the no action alternative, no construction would occur. Ongoing sedimentation at the Gibbons Creek diversion structure would persist, and would require yearly maintenance including dredging. This would result in moderate impacts. Localized erosion control would be undertaken as needed by Refuge managers, so impacts from erosion would be low.

3.6.4 Cumulative Impacts

Cumulative impacts of construction include minor and temporary increases in erosion and mixing of soil horizons at other construction projects in the area. It is assumed that for each construction project, a SWPPP would be created and followed, and erosion, sedimentation, and fugitive dust emissions would be minimal from each project. When combined with the past, present, and reasonably foreseeable future actions, these impacts would not result in an increase in natural floodplain sedimentation in the long-term, as these actions would reestablish a more natural hydrologic connection to floodplain habitat. Additionally, there would be an incremental improvement toward functioning wetland habitat resulting from natural inundation of historical wetland areas and formation of hydric soils. This impact would be low.

3.7 Land Use and Recreation

This section describes land use and recreation and the possible impacts of the Proposed Action on these resources. The land use area of analysis is generally restricted to the project footprint and any easements that could be needed for the project, while the recreation area of analysis includes the Refuge and lands around the Refuge where recreational opportunities may be linked.

3.7.1 Affected Environment

The Refuge is located in Clark County adjacent to the town of Washougal. Most of the Refuge lies within the Columbia River Gorge NSA (Figure 3-1), with a relatively small portion located south and west of the adjacent wastewater treatment plant falling outside of the NSA. The Refuge is located 17 miles east of downtown Portland, and is located within the Portland-Vancouver-Hillsboro Metropolitan Statistical Area, home to 1.5 million people. The Refuge's approved boundary includes 1,406 acres, 75 percent of which is owned by the USFWS (USFWS 2005). Private lands comprise part of the eastern end of the Refuge's approved boundary and are used for farming or as part of a conservation trust (Figure 3-6). Surrounding land uses include residential and transportation to the north and west, industrial and infrastructure to the west and southwest, and agricultural to the east (Figure 3-6).

3.7.1.1 Land Use

Land uses in and around the project area are subject to management by various planning agencies. Relevant land use plans are described below.

3.7.1.1.1 Clark County Comprehensive Plan

Clark County's Comprehensive Growth Management Plan (Clark County 2004) designates lands within the project area as "Gorge Small Woodland 40" and as "Open Space." The zoning code provides for the same designations within the Columbia River Gorge NSA.

The Clark County Unified Development Code, Section 40.240, contains the County's regulations specific to the Columbia River Gorge NSA. The regulations are designed:

"...to protect and provide for the enhancement of the scenic, cultural, recreational, and natural resources of the Columbia River Gorge, and to protect and support the economy of the Columbia River Gorge by allowing future economic development in a manner that enhances the scenic, cultural, recreational, and natural resources of the Gorge."

The regulations specify that:

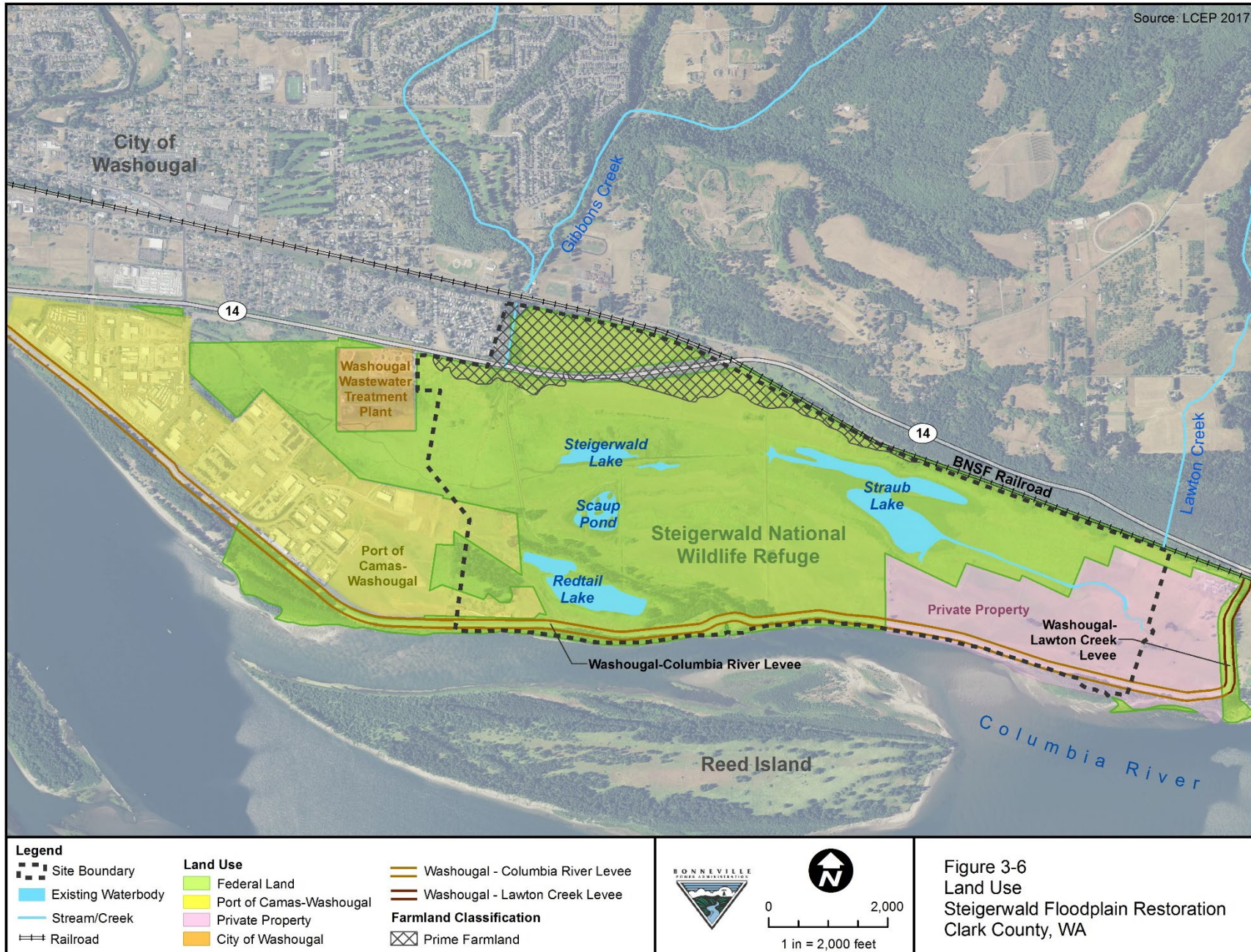
"No building, structure or land shall be used and no building or structure shall be hereafter erected, altered or enlarged, including those proposed by state or federal agencies, in the Clark County portion of the Columbia River Gorge NSA except for the uses listed in this chapter, when considered under the applicable procedural and substantive guidelines of this chapter."

Section 40.240.610 stipulates that the following uses, among others, may be allowed on all lands zoned Gorge Management Area Open Space subject to County review: "Low-intensity recreation, fish and wildlife management uses conducted by federal, state or tribal resource agencies."

Within Gorge Small Woodland sites, Section 40.240.510 states that the following may be allowed subject to County review: "Resource enhancement projects for the purpose of enhancing scenic, cultural, recreation and/or natural resources. These projects may include new structures (e.g., fish ladders, sediment barriers) and/or activities (e.g., closing and revegetating unused roads, recontouring abandoned quarries)."

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Source: LCEP 2017



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3.7.1.1.2 Columbia River Gorge Management Plan

The Columbia River Gorge NSA Act called for the creation of the Columbia River Gorge Commission. The Commission has 13 members: three appointed by each of the governors of Oregon and Washington, one appointed by each of the six Gorge counties, and one (non-voting) representative from the USFS.

The Commission sets policy for protecting the non-federal lands in the Gorge through the Scenic Area Management Plan; serves as an appeals board for land use decisions issued by a county or by the Commission's Executive Director and challenged by another party; works with Gorge counties who administer the land use ordinances that implement the Management Plan; and certifies grants and loans by Oregon and Washington's Investment Boards to encourage economic growth in the Gorge (CRGC 2016a).

The Columbia River Gorge Management Plan established designations for all property within the Scenic Area (CRGC 2016b). The rules governing the comprehensive plan designations are not in effect in counties where the county comprehensive plan designations and policies are found consistent with the Commission plans and policies. Such is the case in Clark County.

3.7.1.1.3 Comprehensive Conservation Plan for the Columbia Gorge Refuges

The USFWS prepared a CCP for managing three Refuges in the Columbia River Gorge, including Franz Lake, Pierce, and Steigerwald Lake NWRs (USFWS 2005). The Vision Statement for the (Steigerwald Lake) Refuge states, in part:

“The Service will actively protect, restore and enhance wetland, riparian, and upland habitats on the Refuge to benefit a diversity of native wildlife and plants. ... The Refuge will provide opportunities for quality, compatible, wildlife-dependent recreation, education, and interpretation to enhance public appreciation, understanding, and enjoyment of the Gorge Refuges.”

The CCP includes specific management goals for the Refuges. Goal 1 is to “protect, restore, and enhance the natural diversity of floodplain, upland forest, and grassland habitats representative of the Lower Columbia River Ecosystem.” To meet this goal, a series of objectives with specific elements related to the Steigerwald Refuge were established. These objectives include:

- The restoration, enhancement, and maintenance of up to 237 acres of emergent wetland habitat with Steigerwald Lake, Redtail Lake, and Scaup Pond for waterbirds and other conservation targets
- The restoration of an additional 198 acres of historic riparian bottomland forest
- Provision of 101 acres of high-quality riparian scrub-shrub habitat
- Maintenance of 41 acres of oak woodland habitat
- Initiate restoration of 93 acres of grassland, and
- Maintenance of 168 acres of perennial grass to provide winter forage for Canada geese (USFWS 2005).

3.7.1.1.4 City of Washougal Urban Growth Area Comprehensive Plan

The City of Washougal Urban Growth Area Comprehensive Plan (City of Washougal 1994) covers several parcels on the western edge of the Refuge that lie within the urban growth boundaries of Washougal, though outside the formal city limits. These properties, in or adjacent to the project area, are designated as parks/open space or heavy industrial (part of the Port).

3.7.1.1.5 Farmland

Under the Farmland Protection Policy Act, federal agencies are directed to minimize the extent to which their programs result in the unnecessary and irreversible conversion of farmland to non-agricultural uses. Additionally, the Act seeks to ensure that federal programs are compatible with state, local, and private policies to protect farmlands. Under this Act, NRCS classifies farmlands as either prime farmland, unique farmland, or land of statewide or local importance, based on soils associations. Soil associations are used to classify areas according to their ability to support different types of land uses, including urban development, agriculture, and silviculture. Most of the lands in the Refuge are mapped as “Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season” or “Prime farmland if protected from flooding or not frequently flooded during the growing season” (Clark County 2016a). A very small portion of the Refuge, located along the southern edge of SR14, is classified as “Prime Farmland”.

3.7.1.1.6 Developments in Project Vicinity

A search of Clark County, City of Washougal, and Port websites showed two new or proposed developments near the Refuge. The first is the Jemtegaard School Redevelopment. The site, located at 35300 SE Evergreen Way, 0.5 mile north of the Refuge, was recently redeveloped as an elementary and middle school. The project includes two gymnasiums, common areas, administrative space, classrooms, improved recreation facilities for multiuse football and soccer fields, and an elementary school playground. Total building size is 122,000 square ft., with a footprint of 75,000 square ft. Construction began during the summer of 2016 and the Columbia River Gorge Elementary and Jemtegaard Middle School buildings were completed in August 2017 (Washougal School District 2016; Camas-Washougal Post-Record 2017).

The second project is the Washougal School District Bus Maintenance Facility. The school district is proposing to construct a school bus maintenance facility, approximately 1,000 ft. west of the Jemtegaard School project, discussed above. No schedule has been set for this project’s development.

3.7.1.2 Recreation

The Refuge is part of a series of wildlife refuges along the Columbia River. It is also the westernmost boundary of the Columbia River Gorge NSA. The NSA encompasses 292,500 acres, running from the mouth of the Sandy River, Oregon to the mouth of the Deschutes River, Oregon and spanning southern Washington and northern Oregon (USFS 2016).

The Refuge is open from dawn to dusk throughout the year. A parking lot and restrooms are located at the entrance to the Refuge. The 2.75-mile-long Gibbons Creek Wildlife Art Trail includes a variety of habitats and wildlife viewpoints. Natural features and man-made art are

seen along the trail. Three overlooks are provided along the trail: the Columbia River Gorge Overlook, at the parking lot and trailhead; the Steigerwald Lake Overlook, located on the north-south trail along the elevated canal; and the Columbia River Overlook, located at the fish ladder. A seasonal spur allows for a circuit of Redtail Lake and includes the Columbia River Overlook. The spur is closed October 1 through April 30 to protect wildlife. The latter overlook can also be accessed from the CRDT. Bird watching is a major draw for visitors to the Refuge. More than 200 bird species have been observed at the Refuge (USFWS 2005). Hunting and fishing are not allowed in the Refuge.

The CRDT follows the Columbia River from Steamboat Landing Park to the eastern end of the Refuge, a total length of 3.2 miles. Along the way, there are views of the river and Mount Hood. Access is provided from trailheads located off the Refuge, as well as from the Gibbons Creek trail and spur. The Port owns a right-of-way to operate and maintain the dike for flood control purposes. The USFWS has management responsibility for other uses of the dike, including public uses where the dike crosses Refuge land.

The USFWS has not conducted a systematic survey of recreational use of the CRDT. However, informal surveys of public use can provide a “snap-shot” of the types of uses occurring on the trail. Observations by C. Dugger reflecting 72 visits during a 12-month period beginning in March 2002, generally in the afternoon or evening, showed that of observed users, 66 percent were hiking, while 17 percent each were bicycling or jogging (Dugger 2003, USFWS 2005).

Reed Island is located immediately south of the Refuge, in the Columbia River, and is home to Reed Island State Park. Owned and managed by Washington State Parks, Reed Island State Park is a 510-acre marine park offering bird watching, boating, beach walking, camping, and picnicking. The park has two primitive campsites and two picnic sites and is part of the Columbia River Water Trail. Reed Island features a heron rookery on the southwest section of the island. Access to the park is by boat only. Access from the Steigerwald Refuge is unlikely since there are no boat put-in sites within the Refuge (Washington State Parks 2016).

The Columbia River Gorge Interagency Recreation Strategy Team issued an Interagency Recreation Report in 2014 to address the challenges of balancing recreational opportunities and resource management (CRGC 2014). While there were no specific recommendations concerning the Refuge, the report did make several overall recommendations:

- Create a common vision for recreation in the Columbia River Gorge
- Clarify roles and identify the strengths and focus areas of each agency
- Practice working collaboratively toward recreation sustainability
- Develop management strategies to address increasing demand, unmanaged recreation and the capacity needs to meet current and future demand, and
- Increase citizen stewardship.

3.7.1.2.1 Recreation - Developments in Project Vicinity

The Port has prepared and is implementing the Port of Camas-Washougal Waterfront Trail Master Plan. The Port is currently constructing the “Washougal Waterfront Park,” part of what will eventually be an 18.5-mile waterfront trail that will link Vancouver, Camas, Washougal, and

the Columbia Gorge, including passing through the Refuge (Port of Camas-Washougal 2014a, 2016).

Steigerwald Lake Refuge is the proposed site for the Gateway Center to the western entrance of the Scenic Area on the Washington State side. A highway turnout with acceleration and deceleration lanes has been constructed to permit future access to the Gateway Center. Projected annual use of the Gateway Center is 125,000 visitors. Construction of the Gateway Center and interpretive trail is awaiting funding. As designed, the Gateway Center would be situated immediately east of Gibbons Creek and south of SR14. The facility would integrate exhibit galleries, elevated viewing decks, interpretative displays, classrooms, and administrative space, and would be fitted tightly into the landscape.

3.7.2 Environmental Consequences – Proposed Action

Impacts associated with land use could include converting maintained upland habitat managed for migratory waterfowl to periodically-inundated wetland habitat, construction of a levee through the site of the proposed Camas/Washougal wellfields, and installation of a floodwall and berm on private lands adjacent to Gibbons Creek north of SR14.

Impacts to recreation during construction could include temporarily reduced access to the Refuge, which would be a moderate impact. Long-term impacts would include changes to site access, parking, and trail network due to the new project components, and would be low.

3.7.2.1 Land Use

3.7.2.1.1 Construction Impacts

Construction impacts on land use would include use of Refuge roads for construction access, possible use of the parking area for staging, and construction on private lands west of Gibbons Creek and north of SR14. Construction staging would occur within the Refuge, and would not encroach onto lands outside the Refuge. Construction of the Gibbons Creek floodwall and berm would occur on private lands, and would constitute a temporary change in land use and loss of access affecting up to 10 residences that border Gibbons Creek. Construction in this area would occur only after the terms of a flood protection easement were developed with the landowners, and the impact would be low.

3.7.2.1.2 Operational Impacts

The land in the Refuge is mapped as “Prime Farmland”, “Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season” or “Prime farmland if protected from flooding or not frequently flooded during the growing season.” Since the USFWS purchased the property on which the Refuge is located (USFWS 2005), some of the land has been managed for livestock grazing and hay production. Conversion of up to 115 acres of unmaintained and maintained grassland to seasonal wetland would not be likely to substantially change this land use, as some of the seasonal wetland would likely be recolonized by grass species that could be grazed or used for hay, and because the converted area would likely only be inundated for a relatively short time during the spring freshet and during high-flow events occurring in the winter and spring. The Refuge is not grazed to capacity, so reduction in livestock grazing numbers would not be needed. Because grazing and haying would still occur,

impacts to the livelihood of area farmers or farmworkers would not be likely to occur, therefore impacts associated with changes to Prime Farmland would be low.

Portions of up to five surrounding private real estate parcels (four private, one public) would be placed under flood protection easements. The Port owns the levee so there would be no need for a legal agreement for them to access the levee on their land. Also, a franchise agreement would authorize construction and operation of the levee on WSDOT's ROW. BPA would complete this process prior to construction. No land acquisitions are anticipated and there are no proposed or anticipated changes to zoning ordinances as a result of the Proposed Action, therefore this impact would be low. The Gibbons Creek floodwall and berm would be constructed on land west of the creek, and adjacent to a residential community. The floodwall would be situated within 20 ft. of the creek, which would be shifted to the east, possibly requiring removal of some trees and other vegetation. The impacts would be low, as there would be minimal impact to residences. Prior to construction, the Port and BPA would negotiate easements with any affected landowners, which would specify the amount of land that would be needed for construction, operation, maintenance, and flooding of land located outside the levee system, including the floodwall and berm. The easements would be held by the Port.

No homes or businesses would need to be relocated. Owners of any private property needed for the floodwall and berm would be compensated in a manner consistent with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. Other than for properties for which the Port and BPA would negotiate easements, the Proposed Action would not affect zoning, access to surrounding lands, or land uses outside of the restoration area.

3.7.2.2 Recreation

3.7.2.2.1 Construction Impacts

Primary construction would occur over two construction seasons, with minor work (settlement surveys) to be completed in a third season. Work would occur from April to October of each year. During the entirety of the construction period, the public would have access to a portion of the Refuge along the seasonal Redtail Lake loop trail, but the primary parking lot would be closed. During the first year of construction, the primary entrance to the Refuge would be closed from April through October due to SR14 modifications, and some trails in the Refuge could be closed between June 1 and October 15 to allow for construction of some of the channels. Visitors to the Refuge during this time would have to access the Refuge along the CRDT. In the winter between the two primary construction seasons, the public would have the same access to the Refuge as described for the Year 1 construction period, and the new parking lot would not be available for public use. During the second year of construction, the entire Refuge would be closed up to seven months. After the second season, full access to the Refuge would be restored. During the third season, the entire Refuge would be open, although closures of the west setback levee of up to 1 month could occur if levee top-off was required. Overall, impacts to recreational access would be moderate and temporary.

During the full construction period, there would be visual and noise impacts that could temporarily lessen the visitor experience. The impact of noise on bird behavior, in particular, could result in fewer birds and/or fewer bird species for birders to observe during construction. Overall, visual and noise impacts would have a low impact on recreation.

Work occurring adjacent to or on SR14 could result in slower traffic conditions as vehicles approach the Refuge. If one lane were open, flaggers or other means of regulating traffic would be in place. If total closure was needed for a short period of time, a detour route would be implemented. Either of these options could result in slower traffic conditions and traffic congestion for recreationalists traveling to or from the Refuge. Overall, temporary impacts to recreation during construction would be moderate.

3.7.2.2.2 Operational Impacts

During operations, public access to the Refuge would be fully restored. The access/parking lot would be relocated west of its current location. Parking would be expanded from 20 to 30 spaces (2 ADA accessible) and continue to provide for one bus or RV. Restrooms, bicycle parking, and the trailhead would also be moved to the new location.

Removal of portions of the WCRL, the Gibbons Creek elevated channel, and an interior access road embankment would alter the trail network. The reconfigured trail network would connect to the CRDT where the west setback levee meets the existing WCRL. Interpretive art elements would be relocated to this trail where appropriate. East of the west setback levee's intersection with the WCRL, the CRDT would be reconstructed at a lower elevation (where the WCRL would be removed) and would cross the broad natural fluvial levee. Two bridge crossings would connect various trail segments. The two bridge crossings would be located at approximately the 25-year flood stage, providing year-round access except during extreme flood events. The seasonal Redtail Lake loop trail would remain in its current location. This reconfiguration would have a low impact on recreation use and access.

While there would be modifications to the trails, the overall trail network linking parking with the Columbia River, along the river, and in the Redtail Lake area would not be reduced in length or quality. In fact, the trail would be lengthened by 1.0 miles and would pass through a much more diverse set of habitats, including interior Refuge wetlands, the Gibbons Creek corridor, more than 2 miles of restored riparian forest, and areas with views of the Columbia River. Portions of the pedestrian trail could be seasonally inundated during spring floods, but this impact would be temporary and other quality walking and bird viewing areas would remain available. With the overall improvements, long-term impacts to habitat, birding, walking, access, and educational activities would be beneficial and moderate.

3.7.3 Environmental Consequences – No Action

There would be no short-term or long-term impacts to land use or recreation under the no action alternative. The proposed project would not be built, current land uses would remain the same, and recreational trails, viewpoints, art, and access would be unchanged; therefore there would be no impacts under this alternative.

3.7.4 Cumulative Impacts

Past, current, and reasonably foreseeable future projects that may impact land use and recreation include expansion of municipalities, conversion of open space and agricultural lands to commercial and residential development, and other habitat restoration projects. Although many restoration projects can continue to allow multiple land uses to continue, some may convert agricultural lands to wetlands that are unsuitable for grazing or hay production. Under the

Proposed Action, the current land uses including provision of habitat for migratory waterfowl, limited agricultural use, and recreation would continue, although limited conversion of land used on the Refuge for hay production may occur. However, since most of the lands used for hay production and grazing are above the areas that would be inundated under most conditions, this impact would be low.

Recently completed or ongoing projects in the area include the Jemtegaard School Redevelopment and the Washougal School District Bus Maintenance Facility. Both of these projects resulted or would result in very minor changes to existing land uses, although the overall nature of the land uses in these locations would not change. The primary foreseeable projects in the area may include the wellfields project and expansion of Port facilities east of their currently-developed area. The wellfields project would result in the installation of several small wellheads and limited above-ground pipes and pumps to convey water over the proposed west setback levee, but would have very little effect on the area's use as habitat for waterfowl or for grazing. Possible expansion of the Ports' facilities near their current facilities west of the project area could convert several acres of grasslands to developed uses, but this area is not used for agriculture and is of limited value as wintering habitat for migratory birds. Therefore, in combination with the Proposed Action, this cumulative impact would be low.

Facilities planned as part of the Port of Camas-Washougal Waterfront Trail Master Plan would still connect to the trail network within the Refuge via the CRDT, so there would be no long-term cumulative impacts. Temporary closure of all or portions of the trail network within the Refuge during construction could affect connectivity of the trail network. The relocation of the parking lot and access point of the refuge to west of Gibbons Creek would affect the potential location of the Gateway Center, which had considered a location adjacent to the current location of the parking lot and Refuge access point. The future location of this facility could be moved to the proposed new parking area. The cumulative impacts on land use and recreation would be low.

3.8 Noise

This section describes baseline conditions related to noise. This section also discusses potential impacts related to noise within the analysis area. This discussion includes any area that could be affected by construction noise.

3.8.1 Affected Environment

Noise is the intrusion of a new sound inconsistent with and above the background level of the existing soundscape. Sound is measured in decibels (dB) on a logarithmic scale. Therefore, a change in sound level of 3 dB or less is barely perceptible by the human ear, while a 10 dB increase or decrease in sound level is perceived as a doubling or halving of sound level (FHWA 2016). The sound levels of some common activities are shown in Table 3-6.

The existing soundscape of the project area is dominated by natural sounds such as flowing water, small waves, wind through vegetation, and wildlife such as birds. Development surrounding the project site influences the existing soundscape. Sound from travel along SR14 is audible in the project site's northern portion. Other sounds from activities on surrounding lands that could be audible on the project site include sounds from railroad travel, agricultural activity, river navigation, and residential or commercial/industrial human activity.

Table 3-6: Example Sound Levels

Sound Level (dB)	Activity
120	Plane take-off
105	Rock concert
100	Lawn mower
70-80	Traffic noise
60-65	Office
35	Library
10	Breathing

Source: Ecology 2016b

Sensitive receptors, as defined by the EPA, are facilities such as hospitals, schools, daycare facilities, elderly housing and convalescent facilities where occupants are more susceptible to noise impacts than the general population. The nearest sensitive receptor is Jemtegaard Middle School, located approximately 1,600 ft. north of the entrance to the Refuge. Residences, which are not normally considered sensitive receptors, are located within 50 ft. of the project site west of Gibbons Creek.

Noise is regulated at the state, county, and city level. Washington Administrative Code (WAC) Section 173-60-050 allows construction noise between the hours of 7:00 am and 10:00 pm. Clark County and the City of Washougal have additional noise regulations; these regulations are in accordance with the state construction noise regulations.

3.8.2 Environmental Consequences – Proposed Action

Noise associated with construction would have temporary, moderate impacts on residences near Gibbons Creek. Mitigation measures described in this section would be implemented to minimize impacts on those residents. Noise from construction in other parts of the Refuge would generally occur far enough away from residences and sensitive receptors. Noise would be relatively similar to ambient noise levels, so impacts would be low. During operation and maintenance, the noise environment would be similar to current conditions, so impacts would be low.

Construction of the Proposed Action would temporarily increase noise in the action area. Increased noise levels could disturb residents along Gibbons Creek and along SR14 near Gibbons Creek. During operation and maintenance, the noise environment would be similar to current conditions.

3.8.2.1 Construction Impacts

Construction activities would result in temporary increases in noise levels. The majority of intensive construction would occur in portions of the Refuge that are relatively far from residences and sensitive receptors. Sound attenuates (lessens) over distance and when it encounters obstacles such as terrain or trees. The majority of construction would occur far enough away from residences and sensitive receptors that noise levels would be relatively similar to ambient noise levels at these receptors. For example, at Columbia River Gorge Elementary

and Jemtegaard Middle School, which are 1,600 ft. from the action area, construction noise would be relatively similar to ambient noise levels.

During the first construction season, construction would occur near residences along Gibbons Creek and along SR14. Construction of the floodwall and berm along Gibbons Creek, construction on SR14, and construction of the parking lot and associated infrastructure would be close to these residences. Residents would experience elevated noise levels during construction. Work would be within 50 ft. of residences along Gibbons Creek and within 100 ft. of residences along SR14 near Gibbons Creek. Consistent with allowable construction periods identified in Clark County's General Plan (Clark County 2016a), construction activities near residences would be limited to the hours between 7:00 a.m. and 10:00 p.m., unless there was an emergency. Construction of the Gibbons Creek floodwall and berm is anticipated to last for three months during the first working season. Work associated with SR14 would also be completed during the first work season.

During the second construction year, the majority of construction activities would occur south of SR14, in the main Refuge area, and lower levels of noise would be audible in areas surrounding the Refuge. In addition, because construction equipment would be dispersed over a relatively large area, sound levels would be similar to ambient levels for the majority of the second construction season. As during the first construction season, any work conducted in the vicinity of residences would occur between the hours of 7:00 a.m. and 10:00 p.m., unless there was an emergency.

A mathematical model based on the Federal Transit Administration and FHWA noise modeling and impact assessment methods was used to estimate noise levels associated with project construction near residences (FHWA 2006, FTA 2006). Table 3-7 presents the estimated noise levels associated with construction activities at the two applicable reference distances, 50 ft. and 100 ft. Noise is reported as A-weighted decibels (dBA), with both the maximum sound level (Lmax) of each piece of construction equipment and the composite equivalent sound level (Leq) of all construction equipment reported. In order to provide an upper bound of impacts, the model assumes no equipment mufflers or other sound dampening or shielding effects.

Table 3-7: Estimated Construction Sound Levels Near Residences

Construction Equipment	Count At Peak	Usage Factor (%)	Noise Level at 50 ft., dBA Lmax	Composite Noise Level at 50 ft., dBA Leq	Noise Level at 100 ft., dBA Lmax	Composite Noise Level at 100 ft., dBA Leq
Air Compressor	1	30	80	88	74	82
Backhoe	1	70	80		74	
Bulldozer	1	20	85		79	
Dump Truck	2	30	84		78	
Excavator	1	30	85		79	
Fork Lift	1	20	85		79	
Front End Loader	1	40	80		74	
Fuel Truck	1	10	85		79	
Generator	1	40	82		76	
Water Pump	1	50	77		71	
Water Truck	1	30	82		76	

Source: FHWA 2006; FTA 2006; Tetra Tech staff analysis

Residences within 100 ft. of Gibbons Creek would experience noise impacts of up to 82 dBA during construction (Table 3-7). These impacts would be temporary and would be reduced to moderate with implementation of the mitigation measures described in Table 2-9. In addition, the majority of construction in this vicinity would be limited to the first of the two primary construction seasons. As a result, the impact would be moderate during the first primary season, and low during the second and third seasons.

Workers at the construction site would also experience increased noise levels. Workers would wear adequate hearing protection as appropriate and in accordance with the project health and safety plan and applicable occupational health and safety regulations, so impacts would be low.

3.8.2.2 Operational Impacts

During operation, the noise environment would be similar to current conditions, so impacts would be low. Current noise sources that would continue during operation and maintenance include natural sounds such as wildlife, water, and wind, and intermittent noise from maintenance activities such as operating landscaping equipment or maintenance vehicles. Low noise impacts could occur if temporary flood barriers were deployed on SR14 at the Gibbons Creek Bridge, but these impacts would be limited to a maximum of up to 2 hours while the structures were being installed or removed, and the impact would be low.

3.8.3 Environmental Consequences – No Action

Under the no action alternative, the project would not be implemented. The noise environment would be unchanged, and limited to ongoing maintenance actions. Impacts would be low.

3.8.4 Cumulative Impacts

The primary past action that contributes to ongoing, cumulative noise impacts is the construction of SR14. Traffic noise from SR14 is the main contributor to ambient noise levels in the study area. Other contributions to cumulative noise levels come from area businesses, local traffic, and industrial activities at the Port. Although reasonably foreseeable actions including construction of additional commercial facilities at the Port would likely involve construction activities that would temporarily elevate nearby noise levels, the cumulative impact would likely be low. These projects are located at a long distance from each other, and each would be expected to implement BMPs to minimize noise impacts. It is not likely that construction of the proposed action would coincide with another project in time and physical proximity such that cumulative impacts would occur; therefore, this impact would be low.

3.9 Hazardous Substances

This section describes baseline conditions related to hazardous substances including hazardous materials and hazardous waste. This section also discusses potential impacts related to hazardous materials within the analysis area. This discussion includes any area that could be affected by releases of hazardous substances.

3.9.1 Affected Environment

Multiple sites where hazardous materials are stored, hazardous waste is generated, or releases of hazardous substances have occurred are located in the vicinity of, but outside of, the project site, primarily in the more developed areas to the west (EDR 2016a). Contaminants have been detected in the Gibbons Creek remnant channel, west and outside of the project area, and a remnant channel that flows from Steigerwald Lake. Gibbons Creek receives stormwater runoff from upstream urban areas, is on the CWA 303(d) list, and reports elevated levels of nitrates and phosphorous, among other impairments (USFWS 2005).

Historically, the remnant channel was the receiving water body for wastewater from multiple industrial facilities in the vicinity that use a variety of hazardous substances, including wood-preserving facilities. Although many of these sources may have been remediated, contaminants that have been detected in stormwater sewers feeding into the remnant channel include trace amounts of pentachlorophenol, other phenolic compounds, nitrosamines, phthalates, and elevated concentrations of metals (arsenic, chromium, copper, zinc, cadmium, and lead). Water or sediments in channel could contain low levels of these or related contaminants. The volatile compounds detected in the remnant channel are similar to those detected at the Burlington Environmental clean-up site approximately 1 mile west of the project area (USFWS 2005).

Shallow groundwater in the area generally flows east and is intercepted by a utility trench where contaminated water can be collected and treated; however, some water may bypass this trench and flow into the Refuge, although outside of the project area. Contamination has been found in at least one monitoring sample collected at the Refuge but located outside of the project area (USFWS 2005).

The lower Columbia River is known to be impacted by several hazardous substances including dioxins, furans, polychlorinated biphenyls (PCBs), and dichlorodiphenyldichloroethylene (DDE) at concentrations that could affect wildlife (Tetra Tech 1996). However, it is not likely that Columbia River flows near the Refuge would contain detectable concentrations of these substances.

Although part of the project area is still used for agriculture, historical aerial photographs show that additional portions of the project site were used for agriculture from the 1940s until the 1990s (EDR 2016b). Pesticides may have been applied to crops in these areas, and residual pesticides may be present in site soils, including now-banned pesticides such as dichlorodiphenyldichloroethane (DDD), DDE, and dichlorodiphenyltrichloroethane (DDT).

3.9.2 Environmental Consequences – Proposed Action

Construction and operation of the Proposed Action would have low impacts related to hazardous materials and waste. During construction and maintenance, BMPs would be implemented to ensure safe handling and disposal of hazardous materials and petroleum products. The BMPs also ensure prompt responses to spills or releases, so impacts would be low. Residual pesticides, fecal coliform bacteria, and metals could be present in site soil or water and could be encountered during construction and maintenance activities. Although these materials would not be likely to be present at concentrations that would affect workers or the public, BMPs would be implemented to minimize direct worker contact with soil and water. The public would not be exposed to these materials during routine activities such as hiking, biking, and sightseeing.

Construction and maintenance of the Proposed Action would involve the use of common hazardous materials and petroleum products and could generate some waste. Handling and use of these materials must be done safely and in compliance with regulatory requirements. Use of these materials could result in accidental spills or releases that would have to be promptly stopped and cleaned up. Previous on- and off-site contributions from stormwater runoff, contaminant migration in surface or groundwater, or pesticide application associated with past agricultural uses could have contaminated soil or water. Impacts could arise from:

- Improper handling, use, and disposal of hazardous materials and petroleum products
- Accidental spill or releases
- Encountering contaminated soil or water
- Flood events

3.9.2.1 Construction Impacts

During construction, petroleum products and hazardous materials such as fuels, oils, and lubricants would be present onsite, primarily in vehicles and construction equipment. Use of these materials as well as uncured concrete increases the risk of accidental discharge into riparian areas or directly into water bodies, resulting in habitat degradation as well as injury or mortality of aquatic species.

To manage petroleum products and hazardous materials and respond to spills and releases, construction would employ mitigation measures. Workers would be trained so they were aware of petroleum products and hazardous materials onsite and would know how to properly handle and dispose of these materials. The construction contractor would be required to have a written hazardous materials and SPCC Plan to ensure that accidental discharge of hazardous materials and petroleum products would be contained quickly and remediated thoroughly. Workers would be trained on these procedures. With these mitigation measures and other appropriate BMPs in place, the potential impact would be low.

As described in Section 3.14.1, site soil could contain residual levels of pesticides from historical agricultural use, and water could contain fecal coliform bacteria and metals. While levels could be sufficient to make water or soil unfit for drinking, they would not be expected to be present at sufficient concentrations to present an exposure risk. As described in Section 2.4.1, workers would wear gloves and appropriate clothing as part of typical construction site safety practices, and fugitive dust controls would be implemented during construction, which would further minimize potential for exposure.

In the unlikely event that soil or water suspected to be contaminated was encountered, work would stop in that area, a designated manager would be contacted, and work would not resume in the area until appropriate actions were taken to minimize any risks. Appropriate actions could include additional personal protective equipment, such as respirators or additional protective clothing; sampling air, soil, or water to determine contaminant levels; and excavation or *in situ* remediation of contaminants.

For the most part, construction would be expected to occur in dry conditions. However, some in-water work would be necessary to breach the WCRL and natural levee and stabilize the banks of the newly constructed floodplain channels. Any construction equipment that would be used in in-

water areas would be cleaned and inspected for leaks of fuels, solvents, or hydraulic fluids before it was deployed. If any leaks of these substances were detected, machinery would be shut down until the leak was remedied.

3.9.2.2 Operational Impacts

During operation and maintenance, it would not be likely that increased amounts of hazardous materials or petroleum products would be routinely stored onsite. Small amounts of hazardous materials or petroleum products such as cleaning products, paint, fuels, oils, and lubricants, would be used at the site during maintenance activities. Workers using these products would be trained in their proper use and disposal. As with construction, maintenance activities would include written procedures for spill response and other accidents involving these materials. Workers would be trained on these procedures. With the implementation of these or other appropriate BMPs for hazardous materials and waste, impacts would be low.

As described in Section 3.9.2, residual pesticides, fecal coliform, and metals could remain in Refuge soil or water during operation. Relatively minor amounts of herbicides approved for use in aquatic areas might be used to control particular infestations of weeds. This ongoing impact would occur even if the project was not constructed, and it would not be worsened by the Proposed Action. Workers that could have extended contact with soil or water would employ BMPs such as wearing gloves and dust masks when working, so impacts would be low. The public would not be likely to be exposed to these materials during routine activities such as hiking, biking, and sightseeing, so there would be no impacts.

3.9.3 Environmental Consequences – No Action

Under the no action alternative, construction-related release of hazardous materials would not occur. Current uses of petroleum products and hazardous materials during operation and maintenance would be unchanged. These practices could include use of herbicides for control of pest plant populations, which could allow for inadvertent releases of such substances into sensitive wetland areas. Due to ongoing BMPs which are designed to reduce the potential for inadvertent releases to the extent possible, this impact would be low. Low levels of contaminants potentially present in site soil or water as described in Section 3.9.2 would be unchanged.

3.9.4 Cumulative Impacts

Most of the past, present, and reasonably foreseeable actions likely involve construction and maintenance activities that use hazardous materials and petroleum products and could generate some waste. These actions would be expected to implement BMPs and mitigation measures to safely manage hazardous materials and waste and minimize impacts. Due to the nature of the action, actions such as logging, mining, and roadway projects may have greater impacts with respect to hazardous materials and waste compared to the Proposed Action. Projects such as restoration and water quality improvement activities may have long-term beneficial impacts. Construction of the Proposed Action would make a low contribution to cumulative impacts on hazardous materials and waste. It would not be likely that construction of the Proposed Action would coincide with another project in time and physical proximity such that cumulative impacts would occur. Likewise, construction activities within the Refuge would be physically separate from other areas such that there would be no cumulative impacts.

Herbicides might be applied during construction and operations to manage invasive vegetation. When combined with herbicide use at other habitat preserves, forestry and agricultural areas, and along transportation rights of way, applications at the Refuge could contribute to cumulative impacts to fish and wildlife, water quality, and public health and safety. This cumulative impact would be expected to be low, as it is assumed that all applications of herbicides would be consistent with guidelines for use in and around aquatic areas and would follow state, manufacturer, and EPA instructions.

3.10 Public Health and Safety

This section describes baseline conditions related to public health and safety. This section also discusses potential impacts related to public health and safety within the analysis area. This discussion includes any area where impacts to public health and safety could occur.

3.10.1 Affected Environment

There are few existing risks to public health and safety on the project site. Although water and soil may contain low levels of contaminants, these are not expected to pose a risk to public health and safety under normal conditions. The area is used by the public for recreation and contains open water, so risks include slips, trips and falls; exposure to the elements (e.g., heat and cold); bites or stings from mosquitoes, snakes, or other wildlife; and water-related accidents such as drowning. Although traffic on SR14 travels at highway speeds, ingress and egress to the site from SR14 is facilitated by turn lanes and merge lanes, so traffic risks are relatively low.

Law enforcement and emergency services at the site are provided by the USFWS law enforcement staff, Clark County Sheriff's Department, City of Washougal Police Department, and the City of Washougal Fire Department. USFWS currently provides law enforcement staff on a regional basis, but is scheduled to station a law enforcement officer at the Refuge beginning in June, 2016. This officer would serve the entire Ridgefield National Wildlife Complex, which includes Ridgefield, Steigerwald, Franz Lake, and Pierce NWRs.

3.10.2 Environmental Consequences – Proposed Action

Construction of the Proposed Action could present typical construction site safety risks to workers and the public. Operation and maintenance of the Proposed Action would reduce public health and safety risks relative to current conditions, since operations would be comparable to those occurring at the Refuge under current management but the level of flood protection would be increased. Impacts could include:

- Construction accidents
- Impeded emergency response
- Incidents requiring emergency response, including construction accidents or traffic accidents associated with construction equipment or road construction
- Seasonal inundation
- Flood events

3.10.2.1 Construction Impacts

During construction, construction site safety BMPs would be employed. Construction sites would be fenced and signed to prevent public access. A health and safety plan would be developed and implemented. The potential for injury to workers would increase for the duration of the construction period, but workers would practice construction safety measures, such as holding daily safety briefings and wearing appropriate protective footwear, gloves, clothing, and hearing and eye protection. In the unlikely event that contaminated soil or water was encountered, work would stop in that area, a designated manager would be contacted, and work would not resume in the area until appropriate actions were taken to minimize any risks to health and safety. Impacts to worker health and safety would be low.

During construction, regional emergency response times could increase if traffic along SR14 were impeded. However, impacts to traffic flow on SR14 would be temporary and limited in duration, and passage of emergency response vehicles would be addressed and prioritized in the traffic control plan. This impact would be low.

The presence of equipment entering, exiting, or being used on SR14 could increase the potential for traffic accidents during construction. The potential for impacts to public health and safety from traffic accidents related to construction would be mitigated by preparation of a traffic management plan. The plan would include use of flaggers, lights, signs, speed limits, detours, and other methods to control traffic in and around the construction area. This impact would be low.

During construction, the required level of flood protection would be maintained. Construction of the setback levees would begin with building the levees so that the crests meet the FEMA standard for certification (3 ft. above the 100-year water surface elevation). The WCRL would be removed concurrently with construction of the new levee, and only down to the same FEMA elevation, thereby maintaining flood protection levels at all locations during construction. Therefore, there would be no change in flood protection, and there would be no impacts related to flood safety during construction.

With the implementation of these or other appropriate construction site safety BMPs, construction impacts on public health and safety would be low.

3.10.2.2 Operational Impacts

During normal operation, risks to public health and safety would decrease because, although Columbia River flood risk would remain unchanged, the risk that Gibbons Creek would flood the Port, the City's wastewater treatment plant, and private residences would decrease substantially. The project is being designed to provide the same level of flood protection that is provided under existing conditions. Because the setback levees and elevated foundation of SR14 would provide the same level of flood protection as the existing levee, and the floodwall and berm on Gibbons Creek would offer increased flood protection, once the WCRL was breached, there would be an increase in the flood protection level provided to the surrounding community. This increase in flood protection would be a moderate, beneficial impact.

Any emergency 911 calls from the Refuge would be routed to Washougal Emergency Management System for initial response. The channel crossings on the CRDT would provide

year-round vehicle response for emergencies except the 12 days per year, on average, when the crossings would be submerged. During extreme flood events, the trail would likely be closed to public use, leaving a small annual window when vehicle access would be precluded. In these limited circumstances, the bridge and trail system would need to serve as the conduit for pedestrian emergency response. This approach is consistent with other trails in the Gorge that do not have motorized vehicle access. The entrance road and maintenance access road could be used by emergency response vehicles, similarly to current conditions, so there would be no reduction in access to emergency providers. Access to other areas would be by trail on foot. This impact would be low.

During operation, seasonal inundation would be likely in some areas, including the CRDT trail. Trail access would be limited during these times and during any potential flood events. Similar to current practices, signage and other closure methods would be implemented as appropriate to warn the public against accessing potentially affected areas.

The larger inundated area could increase mosquito habitat and the potential for mosquito outbreaks. However, the project would increase circulation within the floodplain water bodies, which would discourage mosquito breeding. Also, fluctuation of water levels in the floodplain due to tidal range and variations in discharge from upstream dams would help to offset this impact. USFWS would monitor mosquito populations and work with the local vector control district in the event of increased outbreaks. This impact would be low.

Potential public health and safety impacts related to flood risk would either remain the same or be reduced during operations. The setback levees would offer the same or greater level of flood protection as under current conditions, and the floodwall along Gibbons Creek would offer increased flood protection to residential areas found west of Gibbons Creek. Overall operations impacts related to public health and safety would be low.

3.10.3 Environmental Consequences – No Action

Under the no action alternative, the project would not be implemented and construction-related impacts would not occur. There would be no changes to flood infrastructure or to vector control practices. Public health and safety risks would be unchanged, so there would be no impacts.

3.10.4 Cumulative Impacts

Cumulative impacts of past, present, and reasonably foreseeable actions include commonplace risks to the public and workers such as slips, trips and falls; exposure to the elements (e.g., heat and cold); bites or stings; and water-related accidents such as drownings. Although these types of risks would be associated with most projects, they are relatively discrete, so overall cumulative impacts of this nature would be low.

Cumulative impacts are also associated with broader types of risks, such as changes to traffic safety and flood protection. There are no other ongoing or reasonably foreseeable future actions in the vicinity that would combine with the slightly increased risk of traffic accidents identified above to cause a cumulatively significant impact to public health and safety. Likewise, because the Proposed Action would reduce flood risk, it would not contribute to a cumulative impact related to flooding.

3.11 Socioeconomics

This section describes socioeconomic conditions in the project area. Typical socioeconomic indicators include population and demographics, housing, employment and income, taxes and government revenue, and environmental justice. The socioeconomic resources relevant to the Refuge are further described by considering community character and traditions, especially with regard to sport, commercial, and subsistence fisheries.

3.11.1 Affected Environment

Demographic data used in this section was obtained from the U.S. Census Bureau. The American Community Survey (ACS) program continually collects survey data and publishes an updated dataset annually. The 2010-2014 ACS 5-Year dataset represents data collected during 60 months, ending December 31, 2014, and is considered the most reliable source of information for analysis of small populations (U.S. Census Bureau 2015a).

The Refuge is located in the southeast corner of Clark County, Wash., and about 20 miles from the Portland-Vancouver metro area. The Port borders the Refuge to the west, and the town of Washougal to the northwest. The Refuge itself is contained by Census tract 405.07, though tract 405.08 shares a boundary with the portion of the Refuge which contains Gibbons Creek. Both of these tracts were chosen to be study area tracts in this analysis and were compared to countywide totals for Clark County to provide regional context. Figure 3-7 illustrates the location of the project area and the two tracts.

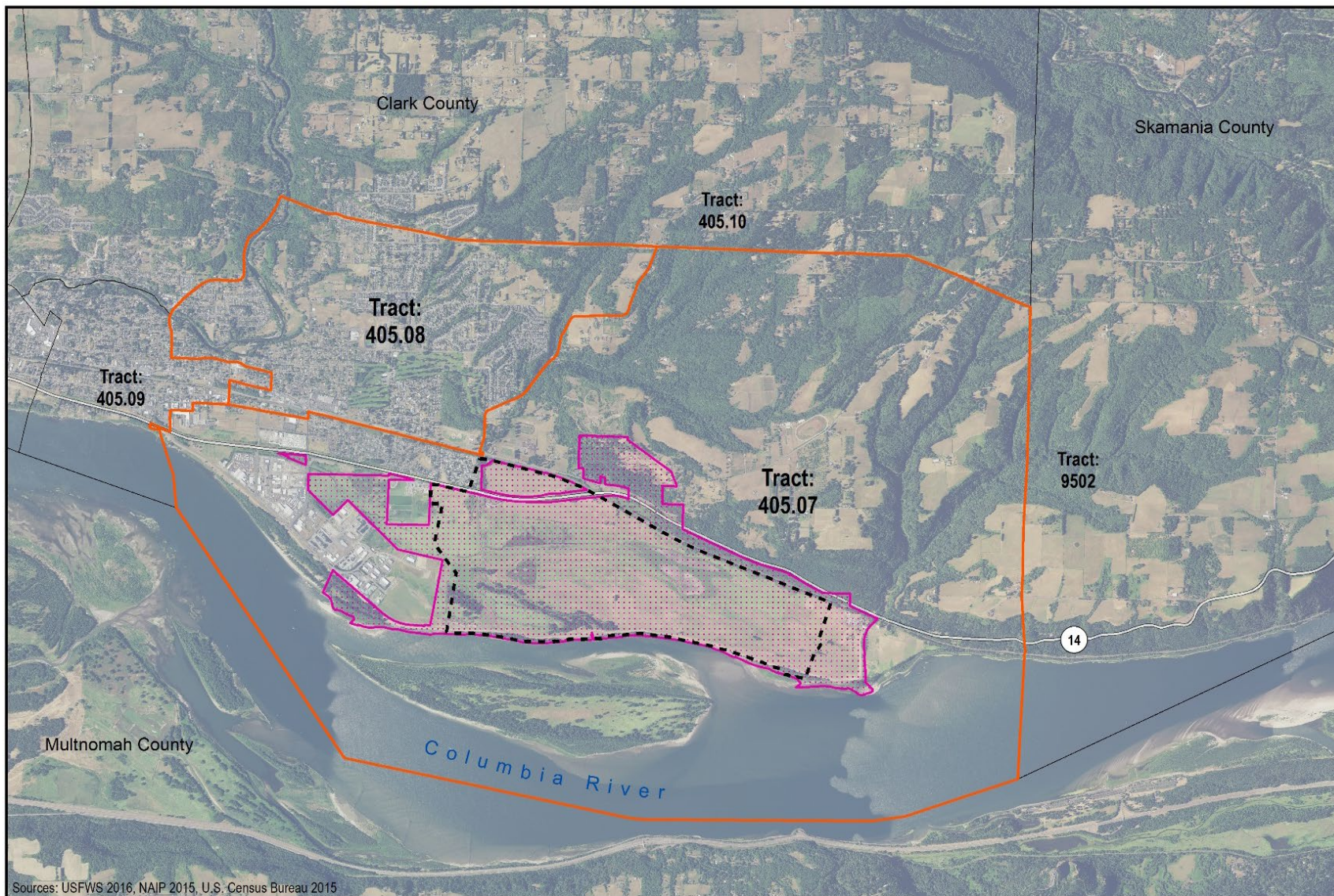
3.11.1.1 *Community Character*

Washougal is situated at the interface of the Portland-Vancouver Metropolitan area and the Columbia River Gorge corridor and maintains a small-town feel despite its proximity to Portland-Vancouver. The history of Washougal is rooted in industrial and manufacturing sectors such as pulp and paper processing, shipbuilding, and the historical Pendleton Woolen Mill. More recently, the community has also attracted professional and service sector tenants to local business parks. The community is a hub and jumping-off point for outdoor recreation and related tourism in the Gorge, including boating, fishing, windsurfing, hiking, camping, skiing, and more. The community places emphasis on providing safe and clean public parks and community spaces and fostering local business success (Port of Camas-Washougal 2014b).

3.11.1.2 *Population, Demographics, and Housing*

Clark County population is concentrated in and around the City of Vancouver, and the County's population history and forecast are largely tied to the Portland Metropolitan Area economy. At the eastern edge of the county, growth in the study area is expected to be linked the growth of the overall county, though it would likely not grow as quickly as central Vancouver. Clark County was the second fastest growing county in Washington in 2015, growing by about 2 percent (U.S. Census Bureau 2015b). Growth is expected to continue at around 1 percent per year based on the 2040 population forecast from the Washington State Office of Financial Management, 2012 Growth Management Population Projections (State of Washington 2012).

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Sources: USFWS 2016, NAIP 2015, U.S. Census Bureau 2015

<p>Legend</p> <ul style="list-style-type: none">  Project Area  Study Area Tracts  Other Tracts 	<ul style="list-style-type: none">  Steigerwald Lake National Wildlife Refuge  State Route 		  <p>1 in = 4,000 feet</p>	<p>Figure 3-7 Census Tracts Steigerwald Floodplain Restoration Clark County, WA</p>
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The two study area tracts represent about 2 percent of the total current county population, and tract 405.08, which includes a substantial portion of the town of Washougal, is nearly three times as populous as tract 405.07, which includes a residential area, the Port, the Refuge, and other rural lands. Table 3-8 presents a series of demographic characteristics for the two study area tracts, and compares their combined attributes to Clark County as a whole.

Table 3-8: Demographic Characteristics

Item	Tract 405.07	Tract 405.08	Study Area	Clark County
Population	2,352	6,530	8,882	438,272 ⁽¹⁾
Median Age	34.5	37.6	36.8 ⁽²⁾	37.2
Minority Population ⁽³⁾	15%	8%	10% ⁽²⁾	19%
Households	823	2,261	3,084	160,492
Average Size	2.86	2.89	2.88 ⁽⁴⁾	2.71
Median Income	\$45,750	\$77,772	\$69,227 ⁽⁴⁾	\$59,551
% One-Unit Structures	43%	94%	81% ⁽⁴⁾	73%
% Two-or-More Units	21%	5%	9% ⁽⁴⁾	22%
% Mobile Home and Other	36%	1%	10% ⁽⁴⁾	5%
Median Home Value	\$121,700	\$237,300	\$206,451 ⁽⁴⁾	\$228,400
Poverty Rate ⁽⁵⁾	17%	4%	7% ⁽⁵⁾	12%
Unemployment Rate ⁽⁶⁾	15%	9%	10% ⁽⁶⁾	10%
With Bachelor's Degree or Higher ⁽⁷⁾	10%	23%	20% ⁽²⁾	27%
With Health Insurance ⁽⁸⁾	81%	90%	87%	88%

Source: U.S. Census Bureau 2015a. (1) Clark County population in this table was sourced from the ACS dataset for consistency with the tract level data. (2) Average of tract-level statistics, weighted by population. (3) The minority population includes all persons of Hispanic or Latino ethnicity (of any race) and all other persons who identify their race as Black or African-American, American Indian and Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Some Other Race, or Two or More Races. (4) Average of tract-level statistics, weighted by number of households. (5) Poverty rate for all people based on U.S. Census Bureau poverty thresholds. (6) Unemployment rate is the number of unemployed people as a percentage of civilian labor force, as defined by the Census. Combined study area rate is the average of the tract-level statistics, weighted by civilian labor force population. (7) Percentage of the population over 25 having with educational attainment of bachelor's degree or higher. (8) Percentage of the civilian non-institutionalized population with health insurance coverage.

When the study area tracts are taken together, as shown in the column of weighted averages in the table, the study area appears to be similar to the County at large, but with a slightly lower minority population, higher median income, and lower poverty. Overall, the study area tracts can be generally described as a fairly typical suburban community in the Portland Metropolitan Area. However, as shown in Table 3-8, the two study area tracts do differ from one another.

Tract 405.08 represents 74 percent of the total study area population and carries the most weight when calculating study area averages, while Tract 405.07 is only 26 percent of the study area population. Both tracts have a lower proportion of minority residents than the County as a whole, but Tract 405.07 has nearly double the number of minority residents as Tract 405.08. In terms of median household income, Tract 405.07 has a median income that is 23 percent lower than the

County's, while Tract 405.08 is 31 percent higher than the County. Rates of poverty and unemployment are above county-wide levels for Tract 405.07, while they are not for Tract 405.08. Similarly, educational attainment and health insurance coverage are below county rates for Tract 405.07 but above county rates for Tract 405.08.

In general, the Census data indicates that Tract 405.07 is a less affluent residential neighborhood, while Tract 405.08 includes higher than average affluence. This is corroborated by the housing unit type and median value information in the table. It shows that over 50 percent of the housing units in Tract 405.07 are in multi-unit or mobile homes, whereas for Tract 405.08, 94 percent of units are single unit. Similarly, the median home value in Tract 405.07 is 47 percent below the County median, and the median value in Tract 405.08 is four percent above the County median. Many of the mobile home units are located in the Gibbons Creek Mobile Home Park, located just across the Gibbons Creek from Refuge lands between SR14 and the railroad.

3.11.1.3 *Employment and Income*

The largest employment center within Clark County is the City of Vancouver. The City of Portland, on the Oregon side of the Columbia River, is the largest employment center is the greater Portland Metropolitan Area. Within the two study area tracts, the ACS estimates a total active labor force (civilian employed population 16+ years old) of 3,984 people (928 in Tract 405.07 and 3,056 in Tract 405.08). Table 3-9 summarizes the employment by industry for workforce living in the study area and compares it to Clark County.

Table 3-9: Employment by Industry for Study Area Residents

Industry	Study Area		Clark County	
	%	Rank	%	Rank
Educational services, and health care and social assistance	17.8%	1	21%	1
Retail trade	12.5%	2	12%	3
Manufacturing	11.4%	3	13%	2
Construction	9.3%	4	7%	7
Transportation and warehousing, and utilities	9.0%	5	8%	6
Prof., scient., and management, and admin. and waste manag. services ⁽¹⁾	8.2%	6	10%	4
Finance and insurance, and real estate and rental and leasing	7.5%	7	6%	8
Arts, entertainment, and recreation, and accomm. and food services ⁽²⁾	7.3%	8	8%	5
Wholesale trade	5.5%	9	3%	11
Public administration	4.9%	10	4%	10
Other services, except public administration	4.1%	11	5%	9
Agriculture, forestry, fishing and hunting, and mining	1.2%	12	1%	13
Information	1.2%	13	2%	12

Source: U.S. Census Bureau 2015a. (1) Professional, scientific, and management, and administrative and waste management services. (2) Arts, entertainment, and recreation, and accommodation and food services.

As shown in Table 3-9, the top five industries in which study area residents are employed include education and health care (18 percent), retail (13 percent), manufacturing (11 percent),

construction (9 percent), and transportation and warehousing (9 percent). Compared to the county as a whole, the study area is mostly similar, with the largest differences seen in the proportion of people working in the education and health care, construction, professional services, and wholesale trade. As shown in Table 3-8 and discussed previously, median income for the study area as whole is higher than that of the county but varies substantially for the two tracts comprising the study area.

While the ACS data refers to people who are employed and live in the study area, the Census' *On The Map* web application (U.S. Census Bureau 2016) allows generation of a Work Area Profile for each study area tract. This profile estimates the number of primary jobs (generally equivalent to the number of workers) whose place of work was in the tract (though does not estimate place of residence for these workers). The dataset estimated 1,113 jobs located in Tract 405.07, and 373 jobs located in Tract 405.08. Together, the study area tracts account for about 1.1% of Clark County's 129,284 estimated jobs. As shown in Table 3-10, the top five industries for jobs located in the study area include manufacturing; construction; wholesale trade; retail trade; and arts, entertainment, recreation, accommodation and food services. These jobs are concentrated along the highway at the western edge of the study area tracts.

Table 3-10: Employment by Industry for Persons Working in the Study Area

Industry	Study Area		Clark County	
	%	Rank	%	Rank
Manufacturing	48.5%	1	10.2%	4
Construction	13.6%	2	6.5%	6
Wholesale trade	9.5%	3	5.0%	7
Retail trade	8.9%	4	11.5%	3
Arts, entertainment, and recreation, and accomm. and food services ⁽¹⁾	6.9%	5	8.6%	5
Educational services, and health care and social assistance	4.8%	6	27.1%	1
Prof., scient., and management, and admin. and waste manag. services ⁽²⁾	4.4%	7	13.1%	2
Transportation and warehousing, and utilities	1.3%	8	3.8%	10
Other services, except public administration	1.0%	9	3.0%	11
Finance and insurance, and real estate and rental and leasing	0.9%	10	4.8%	8
Public administration	0.1%	11	3.9%	9
Information	0.1%	11	2.2%	12
Agriculture, forestry, fishing and hunting, and mining	0.0%	13	0.5%	13

Source: U.S. Census Bureau 2016. Values may not add due to rounding. (1) Arts, entertainment, and recreation, and accommodation and food services. (2) Professional, scientific, and management, and administrative and waste management services.

3.11.1.4 Environmental Justice

Executive Order 12898 (1994), Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, was issued with the goal of achieving environmental protection for all communities. It focuses on identifying and addressing disproportionately high

and adverse human health impacts on minority and low-income populations. Consideration of environmental justice acknowledges that our environment quality affects the quality of our lives, and that minority and low-income populations should not suffer disproportionately. The Executive Order directs federal agencies to identify and address any disproportionately high and adverse impacts from federal actions on environmental justice communities, and it provides minority and low-income populations with access to public information and public participation in the federal planning process (EPA 2015b).

The characterization of environmental justice in the study area considered both Tract 405.07 and 405.08. Tract 405.08 includes 74 percent of the study area population. Thus, most of the population in the study area is generally more affluent and less diverse than Clark County as a whole, and Tract 405.08 is not considered an environmental justice community. However, the small population in Tract 405.07, while not a minority population, is characterized by lower-than-average income, higher-than-average unemployment and poverty, and relatively low home values. Tract 405.07 may be considered an environmental justice community. To ensure that there are no disproportionate adverse project impacts on residents of this tract, any decisions on project actions should be made with recognition of environmental justice issues in this area.

3.11.1.5 Sport, Commercial, and Subsistence Fisheries

Historically, and before levee construction, the floodplain that contains Steigerwald Lake was an important stopover for juvenile anadromous fish that were migrating downstream. By offering off-channel rearing and refugia habitat as well as floodwater attenuation, and by contributing to the food chain, the floodplain provided numerous benefits to aquatic species habitat. These benefits, and benefits from other off-channel habitat areas, were manifested by large numbers of juvenile fish moving out to the ocean, maturing, and returning to the Columbia River as breeding adults.

The Columbia River supports a thriving sport and commercial fishery, and subsistence fishing occurs along much of its length. Although anglers are not generally found on the banks of the Columbia River at the Refuge, as part of the sport fishery, fish are caught from boats offshore of the Refuge and throughout the lower Columbia River. For fisheries management purposes, the 292-mile stretch of the Columbia River that creates the border between Washington and Oregon is divided into six zones. Zones 1 to 5 are found between the mouth of the river and Bonneville Dam, located at RM 146. These zones are managed by Oregon and Washington, which must set their harvest in Zones 1 to 5 to leave enough fish for harvest in Zone 6. The Zone 6 fishery, which is found between Bonneville Dam and McNary Dam (RM 292), is an exclusive commercial fishing area for the four Columbia River treaty tribes (Yakama, Umatilla, Warm Springs, and Nez Perce). Fishing regulations in Zone 6 are enforced by the Columbia River Intertribal Fish Commission, which also operates 31 fishing access sites set aside for the exclusive use of anglers from the four treaty tribes. Non-commercial sports anglers may still fish in this stretch of the river (CRITFC 2016).

A common economic measure for commercial fisheries is ex-vessel value, i.e. the price per pound paid to fishers upon delivery of their catch multiplied by the total catch weight. For 2015, the commercial ex-vessel value for mainstem Columbia River salmon was approximately \$3.5 million dollars, and Select Area (off-channel) commercial ex-vessel value was an additional \$1.6 million dollars, for a total ex-vessel value of about \$5.06 million dollars (ODFW 2016c). The

Oregon Department of Fish and Wildlife (ODFW) non-treaty commercial catch reports totaled 2.06 million pounds, including chinook (88 percent), coho (11 percent), smelt (1 percent), shad (<1 percent), sockeye (<1 percent), and pinks (<1 percent) for 2015 (ODFW 2016a). Dividing the total ex-vessel value by the total catch weight results in an estimated value of \$2.45 per pound across all catch species. Not including smelt, for which only weight is reported, there were 160,823 fish caught, which is approximately \$31.48 per fish.

The recreational fishery in 2015 included 441,300 angler trips below Bonneville Dam (including Buoy 10 anglers at the mouth of the Columbia). Total sport harvest was 103,500 chinook, 37,900 coho, 4,600 steelhead, and 950 sockeye (ODFW 2016c). The economic value of recreational fishing can be estimated in terms of a willingness to pay for participation. A 2009 ODFW report estimated that of expenditure by anglers, about 56 percent goes towards equipment, 34 percent toward travel, and 10 percent towards spending locally near the recreation site. On average, anglers spent about \$149 dollars per trip, in 2008 prices (ODFW 2009). This value was updated to 2015 prices (BLS 2016), resulting in an estimated angler-trip value of \$164 dollars. Applied to the 441,300 angler trips below Bonneville Dam in 2015, the resulting estimated value of the recreational fishery is \$72.6 million dollars.

Treaty fishing in Zone 6 in 2015 included a total catch of 316,199 fish including Chinook (86.8 percent), sockeye (7.3 percent), steelhead (4.7 percent), coho (0.7 percent), sturgeon (0.4 percent), and walleye (0.02 percent) (ODFW 2016b).

3.11.2 Environmental Consequences – Proposed Action

The Proposed Action could have both short-term and long-term socioeconomic impacts. Short-term impacts would be those related to construction, including increased demand for construction materials; patronage of local restaurants, hotels, and other types of services; employment opportunities; traffic disruptions and other lifestyle disruptions. Short-term impacts related to sport, subsistence, and commercial fisheries are not expected to occur, therefore they are not addressed in Section 3.11.2.1.

Because the operations of the restored area would not change substantially from current conditions, long-term impacts related to community character, population and housing, employment, income, and environmental justice are not expected to occur, and are not addressed in Section 3.11.2.2. Long-term impacts would be primarily related to support for sport, subsistence, and commercial fisheries.

3.11.2.1 Construction Impacts

3.11.2.1.1 Population and Housing

Construction would occur for up to six months during each of two primary construction periods. Settlement surveys would be conducted in a third, limited season. Construction activities would employ up to 30 workers at any given time. Construction crew members from outside the area (assumed to be approximately half of the crew) would likely return to their homes between construction periods, so the Proposed Action would not be likely to result in a permanent population increase in the project area. Short-term increases in rentals of spaces at recreational vehicle parks, apartments, or hotels would be likely, but there are sufficient facilities in the

surrounding area to accommodate a relatively small and temporary increase in demand. Therefore, there would be a low impact on population and housing due to construction.

3.11.2.1.2 Employment and Income

The Proposed Action would likely generate a small number of temporary jobs for area residents during the construction period. This number of jobs and the income associated with those jobs would likely represent only a small percentage of the jobs and income in the study area. Therefore, although this impact would be beneficial to those workers who did gain employment, the overall impact would likely be low.

Construction of the Proposed Action is estimated to cost up to \$19 million. Some of the construction funds would likely be spent directly in the Camas/Washougal area. Workers would likely spend some of their income on dining, accommodation, entertainment, and other services during the two work period. The project itself would likely include local purchases of equipment and materials, providing a short term stimulus to businesses that provide these items. Although this impact would be beneficial, it would likely be low in terms of the overall economy of the study area.

3.11.2.1.3 Environmental Justice

Most construction impacts, including increases in traffic, noise, and emissions, would occur well away from sensitive receptors. However, construction of the proposed floodwall along the west side of Gibbons Creek would require excavation, construction vehicle access, and installation of infrastructure in close proximity to homes in a mobile home park. As indicated in Section 3.11.1, this Census tract is considered to be an environmental justice community due to higher unemployment rates, lower incomes, and lower home values than the community at large. Construction impacts would last for up to two months in any given part of the floodwall construction area, and would include increased noise, dust, and traffic disruption caused by ingress and egress of construction equipment. These impacts would be temporary, and would be mitigated by implementing measures described in Section 2.4.1. The overall impact would be low.

3.11.2.2 Operational Impacts

3.11.2.2.1 Environmental Justice

Long-term impacts would include visual impacts associated with the presence of the floodwall and increased height of SR14, and diminished access to Gibbons Creek. Fewer than ten residences would be directly affected by the presence of the floodwall and raised roadway in this way. The floodwall height would obscure views from some residences at the south end of the floodwall, but the long-range viewshed would remain intact. Also, Gibbons Creek in this reach is a swiftly flowing transport reach, and offers minimal recreation value. In this instance, there is no alternative to placing the floodwall in its proposed location, as it is needed to provide the same level of flood protection that would be provided by the setback levees and temporary floodgates on SR14. The floodwall would be installed only after an easement was developed with the property owners, and construction would follow the terms of the easement. In addition, the presence of the floodwall would comprise a low, beneficial impact to this community by

reducing the risk of flooding from Gibbons Creek and ensuring flood protection up to the 50-year flood event. The reduction in access and visual resources would therefore not be disproportionate and the overall impact would be low.

3.11.2.2 Fisheries

As a habitat restoration project proposed with the goal of increasing off-channel habitat for anadromous fish, this project would help to offset historical losses of such habitat and the commensurate impacts to fish populations. Although it is not possible to quantify the number of fish that would benefit from the Proposed Action, this would be one of the most important floodplain restoration projects in the upper Columbia River estuary, therefore it would be likely to make an important contribution to survival rates of juvenile anadromous fish that are outmigrating from upstream. Indirectly, this would be likely to have a moderate impact on subsistence, sport, and commercial fisheries, particularly on the Zone 6 fishery, which begins a short distance upstream of the Refuge and which would likely see increased escapement of anadromous fish as a result of higher survival rates of juveniles.

3.11.3 Environmental Consequences – No Action

Under the no action alternative, there would be no construction and therefore there would be no construction-related socioeconomic or environmental justice impacts. The Port would continue to operate pumps to remove runoff from the west end of the site, at considerable annual expense to the public, resulting in a moderate impact from operations.

3.11.4 Cumulative Impacts

No other projects in the study area have been identified that would cause a substantial cumulative impact to socioeconomic or environmental justice in combination with the Proposed Action. However, this project, in combination with other fish habitat restoration projects in the estuary would likely have a moderate beneficial cumulative impact on populations of anadromous fish, which would have an indirect but beneficial cumulative impact on recreational, commercial, and subsistence fisheries.

3.12 Transportation and Infrastructure

This section discusses traffic, transportation facilities, rights of way, and utilities in the project area, and it identifies potential impacts that could occur from implementing the alternatives.

3.12.1 Affected Environment

The primary ground transportation features in the area are SR14, the BNSF Railroad, and roads and streets for residential, agricultural, and business use. Within the Refuge, there are unpaved roads and trails used for maintenance and recreation. South of the project area, the Columbia River provides a travel corridor for large ships and smaller vessels. The site is accessible via Gorge West End Transit, which stops at the visitor's parking lot on the south side of SR14.

SR14, also known as the Lewis and Clark Highway, divides the project area and is the primary thoroughway in the vicinity. In this area, it has two lanes of travel, one in either direction.

Dedicated right- and left-turn lanes are provided at the entrance to the Refuge parking area. The highway contains two bridges in this area, one over Gibbons Creek and another over the railroad.

WSDOT's annual average daily traffic volumes for SR14 in this area are 5,001 to 10,000 vehicles west of the intersection with 45th Street (just east of the wastewater treatment plant) and 2,501 to 5,000 vehicles east of this intersection (WSDOT 2016). The approximate percentages of truck traffic in this area are 5 to 6 percent single unit trucks, 4 to 7 percent double unit trucks, and 1 percent triple unit trucks (WSDOT 2016). The Southwest Washington Regional Transportation Council has traffic count data for several intersections near the project area, as shown on Figure 3-8 and as summarized in Table 3-11. Southeast Evergreen Way is classified as an arterial while the other streets in Table 3-11 are minor collectors.

Table 3-11: Average Daily Traffic Count Data

Intersection	North Leg	South Leg	East Leg	West Leg
SR14 / 32 nd Street	921	NA	4063	0
SE Evergreen Way / 32 nd Street	8,314	12,145	10,530	9,408
SE Evergreen Way / 34 th Street	0	NA	0	8,229
SE Evergreen Way / 39 th Street	5,255	NA	0	8,707
SE Evergreen Way / SE Sunset View Rd	2,648	NA	0	4,386
SR14 / 45 th Street	1,815	NA	4,727	6,332
SR14 / SE Evergreen Boulevard	9,827	1,256	6,230	16,800

Source: Southwest Washington Regional Transportation Council 2016

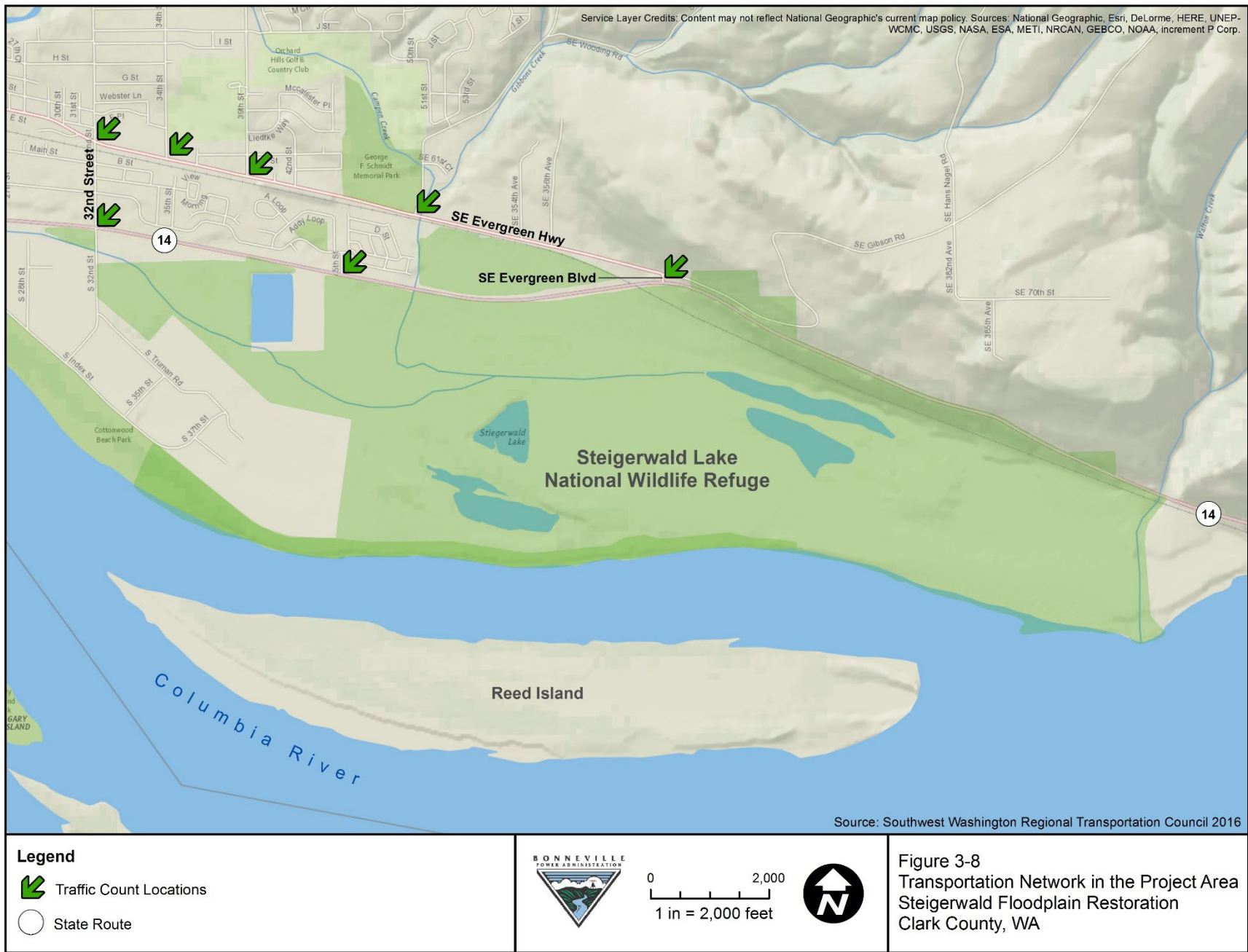
Notes: Data are from the most recent year available and are reported as the total number of vehicles over a 24-hour period in both directions.

NA = Not applicable; Rd = Road; SE = Southeast

In the project area, SR14 is designated as a National Scenic Byway and Washington State Scenic Byway. The portion of SR14 in the project vicinity is referred to as both the Columbia River Gorge Scenic Byway (an 80-mile route) and the Lewis and Clark Trail Scenic Byway (a 572-mile route). SR14 is also designated by WSDOT as a Highway of Statewide Significance, meaning that it is needed to connect major communities in the state.

In addition to the aforementioned roadways, railroad, and bridges, infrastructure in the project area includes the WCRL, Gibbons Creek diversion structure, Highline Canal, a culvert and fish ladder, signage, restroom facilities, gates, and pedestrian bridges and walkways. The Washougal Wastewater Treatment Plant is located adjacent to the Refuge but is outside of the project area. Additional infrastructure including shipping, storage, and light manufacturing facilities are located at the Port, southwest of the project area. A corral and barn located at the southwest end of the Refuge, adjacent to the WCRL, are used by ranchers who graze their cattle on Refuge lands on a seasonal basis.

Future planned infrastructure includes development of a well field for drinking water on lands owned by the cities of Camas and Washougal. These lands would be bisected by the proposed west setback levee. Six wellheads would be installed east of the west setback levee, and 4 would be installed west of the levee.



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The portion of the Refuge where the primary restoration actions would occur is not served by public utilities such as natural gas or sanitary sewer. Telecom and power are delivered to the existing parking lot from west of the project area, and water for irrigation is provided from a well east of the existing access road. There are no major overhead utilities such as transmission lines in the project area. Utilities are located in or near the 140-ft. right-of-way for SR14 as follows (KPFF 2016):

- **Underground Cable** - There is a buried cable line approximately 25 ft. south of and parallel to the SR14 right of way line. Markers and/or pedestals were found at approximately the same offset from the new driveway location (south of 45th Street) to the existing driveway. Pedestals were found at Gibbons Creek and at the existing access.
- **Light Pole and Conduit** - There is a light pole located just east of the proposed driveway on the south side of SR14 and another one approximately 350 ft. to the west of the proposed driveway. There is likely an underground conduit between the poles.
- **Storm Manhole and Storm Line** - A storm manhole is located just south of SR14 and just east of the proposed driveway. There is a marked storm line entering the manhole from the center of 45th Street.

3.12.2 Environmental Consequences – Proposed Action

Construction and operation of the Proposed Action could result in impacts to transportation and infrastructure. Construction activities would include work in roads and rights of way on SR14 near Gibbons Creek and redesign of transportation features and infrastructure within the Refuge, including the parking area and maintenance vehicle access roads. Once construction was complete, impacts would be realized from transportation and infrastructure improvements. Impacts could include:

- Full or partial closures of roads and parking areas
- Traffic detours
- Increased travel times
- Increased traffic on local roads in Washougal and Clark Counties
- Increased construction traffic
- Erosion of infrastructure
- Reduced potential for flooding on SR14

3.12.2.1 Construction Impacts

Project construction would have temporary moderate impacts resulting from partial and full closures of SR14.

Partial closure of SR14 would be necessary for up to four months during the first construction season during construction of the closure structure immediately west of the SR14/Gibbons Creek Bridge. A three-stage construction staging plan is proposed for construction of the closure structure across SR14. The staged construction is intended to keep one lane of traffic open in each direction at all times, while construction of the closure occurs in the other lane. WSDOT

must concur that either 1-ft. wide shoulders or 10-ft. wide travel lanes would be acceptable during temporary traffic control since these widths are below their standards. If not acceptable to WSDOT, either a full closure of SR14 with detour or continuous flagging would be required during construction. If a full closure were needed, SR14 traffic would be rerouted along the proposed detour route as shown in Figure 3-9. The detour would use local roads in Washougal and Clark County. Traffic would travel approximately 0.3 mile on 32nd Street, 1.9 miles on Evergreen Way and less than 0.1 mile on SE Evergreen Boulevard. Traffic controls such as signs, barriers, and, if necessary, flagging, would be used to route traffic through the affected area. The detour route would pass residences, businesses, and the Jemtegaard Middle School. Drivers on the affected roads would experience increased travel time and delays, especially during peak travel times.

BPA would coordinate with WSDOT, the City of Washougal, and Clark County to obtain an agreement for the use of the detour route. BPA would prepare a traffic control plan to describe the use and implementation of traffic control measures. Mitigation measures described in Section 2.4.1 would be implemented to reduce the impacts of a partial or full closure of SR14 to moderate.

Partial closure of SR14 would also be required to allow a 1,200-ft. stretch of SR14 to be raised to a centerline elevation of approximately 38.5 ft. NAVD88 (see section 2.1.2.5.3.2 for details). Construction associated with the roadway raise would occur one lane at a time. The existing roadway is 4-5 lanes wide through this stretch due to the presence of slow-down lanes. Traffic would be shifted into these additional lanes during this construction phase in order to preserve one lane of travel in each direction for the 2- to 3-month construction period during the first construction season. Traffic control measures would include a speed reduction to 20 miles per hour, jersey and continuation barriers, and flaggers for construction vehicles and trucks entering or leaving the construction site. Drivers on SR14 would experience increased travel time and delays, especially during peak travel times. It is possible that the full roadway would need to be closed for short periods of time. To the extent feasible, these closures would be timed to occur during off-hours and would be limited to half-day periods. In general, it is expected that such closures would occur for no more than 2-3 days at a time and would occur no more than 5 times during the construction period. During such closures, traffic would be re-routed along the detour route planned for use with the proposed SR14 closure structure. Neither partial nor full closure is anticipated for the second primary construction season or third minor construction season. The overall impact to transportation and infrastructure associated with raising SR14 would be moderate.







Traffic impacts during construction could result from increased numbers of construction vehicles on SR14. Based on the construction plans, construction activities would add a maximum of 20 round trip truck trips per day and 30 round trip worker vehicle trips per day for the duration of the work period. This would be a less than 1 percent increase in daily traffic, so impacts would be low.

Trucks and construction equipment would need to enter and exit SR14 at the construction area and move between the work areas south and north of SR14. Trucks would move slowly relative to other traffic on SR14, which has a speed limit of 55 miles per hour in the project area. The volume of such truck and equipment movements would be relatively low and signage and flaggers would be used to minimize impacts of these movements. Impacts would be low.



Service Layer Credits: Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Source: Southwest Washington Regional Transportation Council 2016

<p>Legend</p> <ul style="list-style-type: none">  State Route  Proposed Detour Route  Proposed Closure Structure 	 <div style="text-align: center;">  <p>1 in = 2,000 feet</p>  </div>	<p>Figure 3-9 Proposed Detour Route Steigerwald Floodplain Restoration Clark County, WA</p>
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The parking area and associated infrastructure (restroom, bike parking, and trailhead) would be relocated and would be closed during its relocation. However, public access to the Refuge would generally not be permitted during construction to ensure public safety, so the temporary parking closure would have a low impact.

3.12.2.2 Operational Impacts

Operation of the project could result in rare impacts to travel on SR14 if temporary flood barriers were installed at Gibbons Creek. During rare flooding events (i.e. 500-year events), the barriers would be installed and traffic would be rerouted along the proposed detour route shown in Figure 3-9. Traffic controls such as signage, barriers, and, if necessary, flagging, would be used to route traffic through the affected area. Drivers on the affected roads would experience increased travel time and delays, especially during peak travel times. Because this impact is considered unlikely to happen under most circumstances, it is low.

Because SR14 would be raised to the 500-year flood elevation, it would not flood under most circumstances and travel on SR14 would not be affected. However, a section of SR14 between Gibbons Creek and the BNSF railway would become more exposed to water level and wind-wave action. Although overtopping of SR14 would not be a concern as it would be raised, the lowest section of the roadway is at approximately 35 ft. NAVD88, and relatively frequent erosion would be possible. This impact would be mitigated to low by installing gradual slopes on the roadway base, and because flooding at this elevation is relatively infrequent. A vegetated levee overbuild would be installed at the base of the west setback levee, which would be vulnerable to wind-wave erosion (LCEP 2017). This impact would be low.

The City of Washougal's WWTP is currently located within the FEMA-mapped Special Flood Hazard Area, as is the Port's industrial park property. The proposed changes to the WCRL would result in protection of the WWTP and the Port's industrial park, and both areas would be removed from the Special Flood Hazard Area following revision of FEMA flood mapping.

Transportation and infrastructure elements at the Refuge would be reconfigured or relocated during construction. Elements that would be relocated include the parking area and associated infrastructure, visitor facilities, gates, decorative boulders, restrooms, interpretive signage, and kiosks. The new parking area would have 30 parking spaces, which is an increase of 10 spaces over the existing parking area, and would maintain parking for one RV or bus. Maintenance vehicle access roads, trails, and pedestrian bridges would be reconfigured. Some maintenance vehicle access roads would be decommissioned at the end of construction. Seasonal inundation of portions of the pedestrian trail and new access road would be expected, but the impact would be low. Transportation and infrastructure design features would be expected to provide similar site access and visitor experience following restoration actions, so impacts would be minor. Operation of the project would result in increased parking at the Refuge, allowing the parking area to accommodate more visitors. Overall impacts resulting from these changes would be low.

The drinking water well fields proposed by the cities of Camas and Washougal are assumed to remain feasible. Agreements regarding land use of this area are being coordinated among the Port, BPA, USFWS, and the cities of Camas and Washougal. If the project proponents decide to implement this project, they will create design plans and separate environmental documentation.

3.12.3 Environmental Consequences – No Action

Under the no action alternative, no construction would occur. Transportation conditions and infrastructure would be unchanged, so there would be no impacts.

3.12.4 Cumulative Impacts

Cumulative impacts of past, present, and reasonably foreseeable actions may include temporary traffic detours, increased travel times during construction projects, and increased traffic as population in the region increases. These impacts may be offset by transportation and infrastructure improvement projects implemented on area roadways, rail lines, bridges, pipelines, and utilities. The Proposed Action would make a minor contribution to cumulative impacts on transportation and infrastructure during construction, but the impact would be low. As no other large construction projects are foreseen during the construction period for the Proposed Action, it would be unlikely that construction of the Proposed Action would coincide with another project in time and physical proximity such that substantial cumulative impacts would occur. Likewise, construction activities within the Refuge would be physically separate from other areas such that cumulative impacts would be low.

3.13 Vegetation and Wetlands

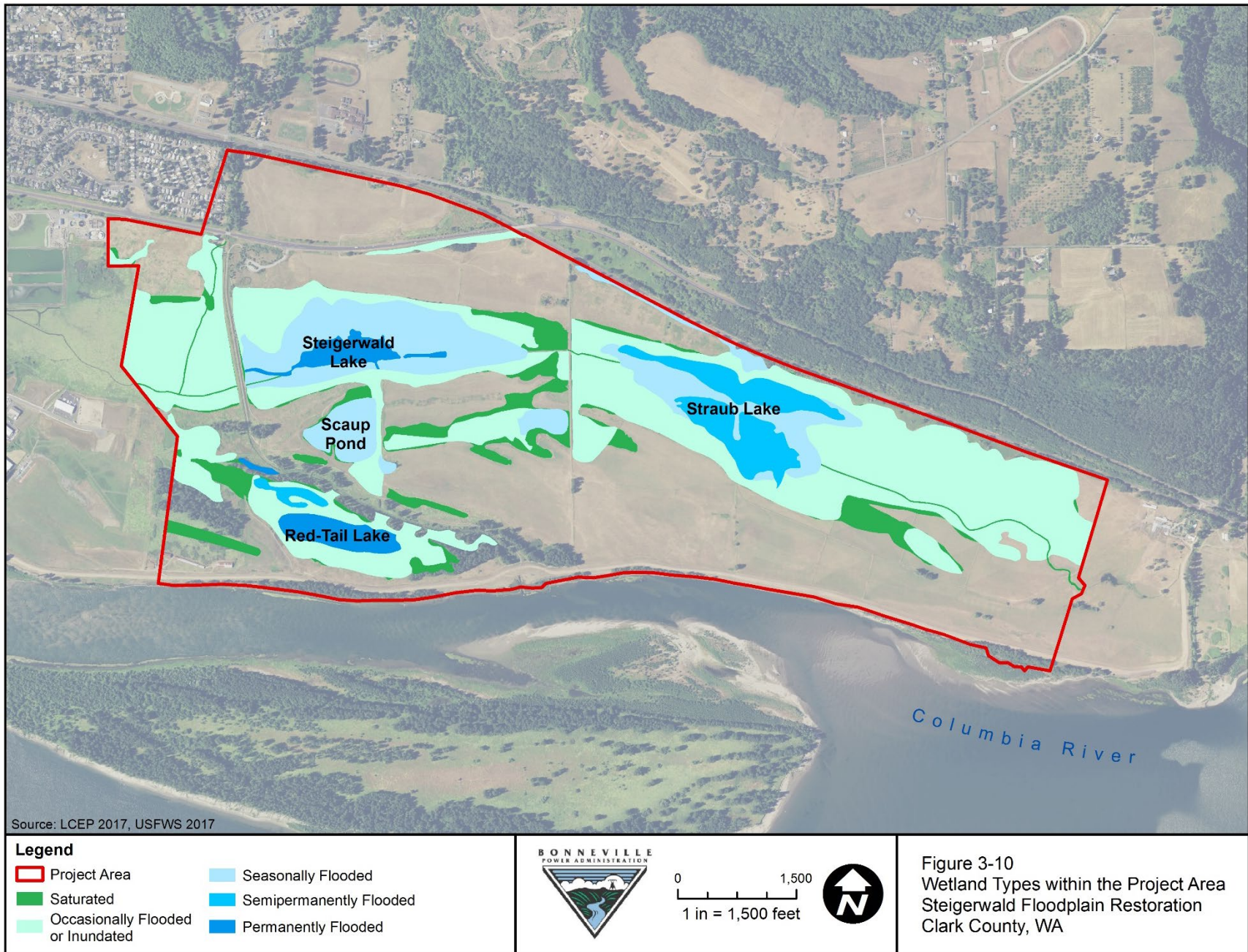
Vegetation in the study area includes a variety of wetland, riparian, and upland plant communities. Populations of two plant species listed as threatened or endangered under the ESA have been planted by USFWS staff. Non-native invasive plant species have become established throughout much of the study area.

3.13.1 Affected Environment

3.13.1.1 Wetlands

Wetland and riparian communities along the Columbia River have been changing since the beginning of large-scale alteration of the river for navigation, hydropower, agricultural development, and urbanization. Between 1956 and 1993, it is estimated that diking and drainage efforts within the study area reduced the amount of emergent wetlands by 112 acres, riparian forest by 82 acres, and scrub-shrub wetlands by 60 acres (USFWS 2005). Water control structures such as dikes, levees, and tide gates prevent natural water circulation in the study area and reduce the availability of and access to wetlands and seasonal floodplains for fish and wildlife. Hydropower dams on the Columbia River have changed the timing, duration, magnitude, and frequency of seasonal flows, thereby altering the natural processes of sedimentation, accretion, and erosion necessary to maintain wetlands and floodplain habitat (BPA 2016a).

A wetland delineation was recently conducted on the Refuge, and a total of 617.1 acres of wetlands were found in 10 distinct wetland areas within the study area (Figure 3-10, Table 3-12, LCEP 2016). Total acreage includes a 4-acre wetland mapped by the National Wetland Inventory, which was not investigated in the field. The overall area of wetland investigation was larger than the proposed project footprint. Plant communities associated with wetlands are detailed below.



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Table 3-12: Wetlands within the study area (LCEP 2016)

Wetland Name	Area (acres)	HGM	Cowardin Class	Wetland Rating
Straub Lake 1.0	219.2	Depressional	PEM	II
Steigerwald Lake 2.0	103.1	Depressional	PEM	I
Steigerwald Lake 2.1	24.3	Slope	PEM	II
Steigerwald Lake 3.0	112.7	Depressional	PEM	II
Steigerwald Lake 4.0	76.4	Depressional	PEM	II
Scaup Pond 5.0	19.3	Depressional	PEM	III
Wetlands 6.0 and 7.0	3.1	Slope	PEM	III
Redtail Lake	44.0	N/A	PEM	II
Wetland 9.0	6.7	Depressional	PEM	III
Wetland 10.0	4.3	Depressional	PEM	III
Total Acreage	617.1			

3.13.1.1.1 Straub Lake

Straub Lake is a depressional, emergent, palustrine wetland. The USFWS manages the water level of Straub Lake for waterfowl habitat using flashboards mounted to culverts that pass water through the internal dikes. The dominant species within and surrounding this wetland is the non-native and invasive reed canary grass (*Phalaris arundinacea*). Native species around the lake included soft rush (*Juncus effusus*), swamp smartweed (*Persicaria hydropiperoides*), fox sedge (*Carex vulpinoidea*), and narrow-leaf bur-reed (*Sparganium angustifolium*). Other non-native species along the wetland boundary included birds-foot trefoil (*Lotus corniculatus*), Canada thistle (*Cirsium arvense*), field horsetail (*Equisetum arvense*), common velvet grass (*Holcus lanatus*), false ryegrass (*Schedonorus arundinaceus*), and Armenian blackberry (*Rubus armeniacus*).

3.13.1.1.2 Steigerwald Lake

Steigerwald Lake is comprised of a series of depressional, emergent, palustrine wetlands (Wetlands 2.0, 2.1, 3.0, and 4.0) which are also overwhelmingly dominated by reed canary grass, with pockets of English plantain (*Plantago lanceolata*), black cottonwood (*Populus trichocarpa*), soft rush, birds-foot trefoil, field horsetail, blackberry, false ryegrass, and swamp smartweed.

3.13.1.1.3 Scaup Pond

Scaup Pond is a depressional, emergent, palustrine wetland dominated by soft rush and reed canary grass, with substantial areas of native wapato (*Sagittaria latifolia*) in the deeper water areas and scattered stands of broad-leaf cattail (*Typha latifolia*).

3.13.1.1.4 Redtail Lake

Redtail Lake is an emergent, palustrine wetland dominated by reed canary grass with smaller areas of stinging nettle (*Urtica dioica*) and swamp smartweed.

3.13.1.1.5 Other Wetlands on Site

Two small slope, emergent, palustrine wetlands (Wetlands 6.0 and 7.0) were located south of Scaup Pond. The dominant species was reed canary grass, along with false ryegrass, and there were smaller areas of bearded wild rye (*Elymus caninus*) and Douglas spirea (*Spiraea douglasii*).

Wetlands 9.0 and 10.0 are small depressional, emergent, palustrine wetlands dominated by reed canary grass, with lesser amounts of false ryegrass and a small stand of black cottonwood.

3.13.1.2 Vegetation

3.13.1.2.1 Gibbons Creek Vegetation Communities

Gibbons Creek has both stream and wetland characteristics, with areas where flows are imperceptible during portions of the year. Much of the Gibbons Creek alignment is dominated by reed canary grass. Smaller areas of western touch-me-not (*Impatiens noli-tangere*) were also present. Recent plantings of native woody species including willows (*Salix* sp.) and black cottonwood (*Populus trichocarpa*) have been completed along lower Gibbons Creek.

3.13.1.2.2 Riparian Vegetation Communities

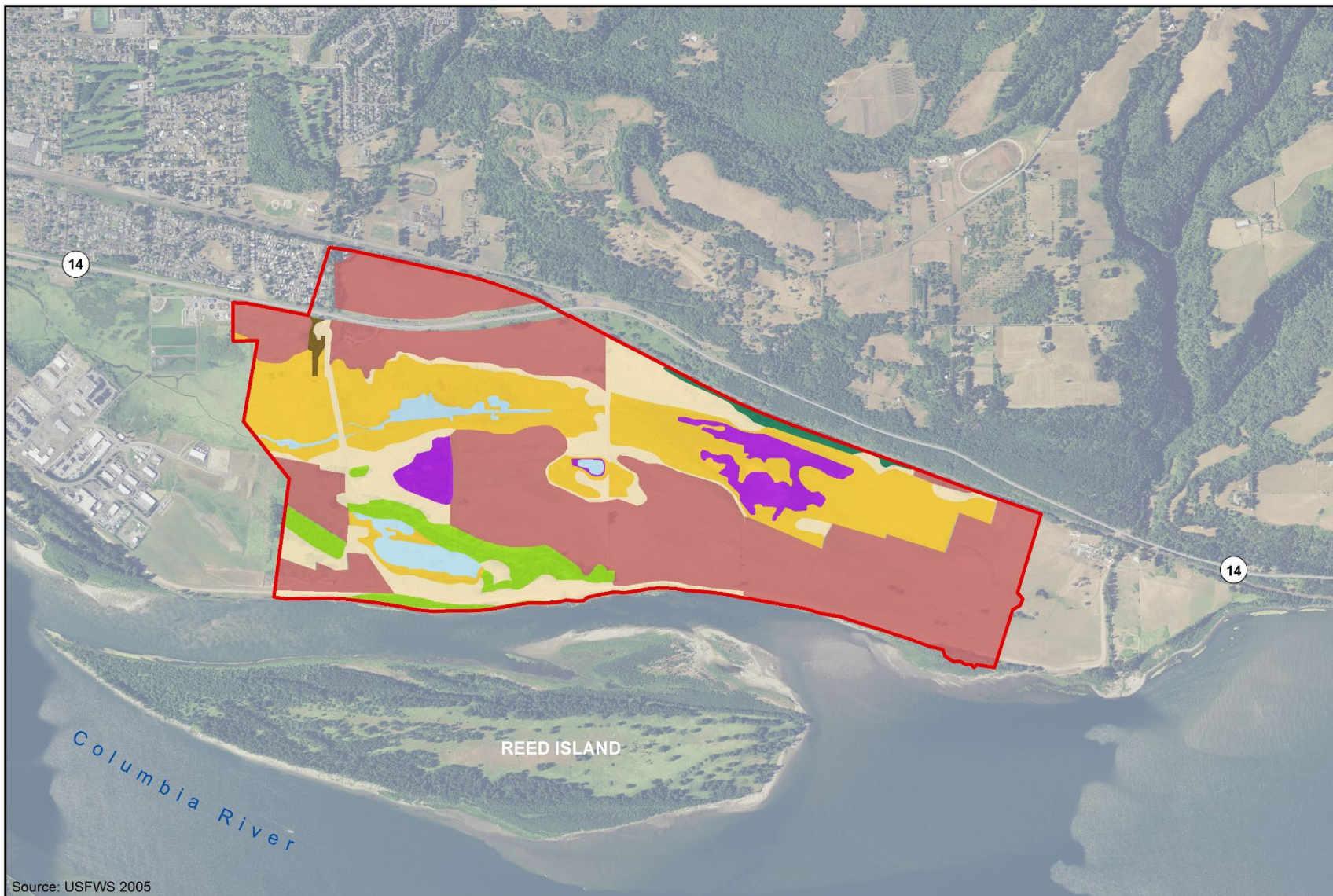
Riparian vegetation communities include those that occur along the Columbia River and form the boundary between wetlands and uplands. Riparian communities include mature cottonwood-ash gallery forests and scrub-shrub dominant communities. The total estimated acres of cottonwood-ash forest at the Refuge is 47 acres (USFWS 2005). Scrub-shrub vegetation communities comprise an estimated 30 acres (USFWS 2005). Figure 3-11 shows vegetation communities mapped as part of USFWS's CCP (USFWS 2005).

The forested cottonwood-ash riparian areas occur along the shoreline of the Columbia River and in areas around Redtail Lake. Mature black cottonwood trees dominate the tree canopy, while blackberry, Scouler's willow, and Pacific willow (*Salix scouleriana* and *S. lasiandra*) are dominant in the mid-story (USFWS 2005, LCEP 2016). Reed canary grass, thistle and common teasel (*Dipsacus fullonum*) are present in the herb layer. Oregon ash (*Fraxinus latifolia*) is also characteristic of the riparian communities in the area and occurs in both the shrub and canopy layer. These riparian forests are small, fragmented, and interspersed with non-native species (USFWS 2005).










Scrub-shrub riparian communities include woody vegetation less than 20 ft. tall, including true shrubs and young trees. Plant species present typically include red alder (*Alnus rubra*), snowberry (*Symphoricarpos albus*), red-osier dogwood (*Cornus sericea*), willows, blackberry, and nettles (USFWS 2005).

3.13.1.2.3 Upland Vegetation Communities

Two primary upland vegetation communities are present within the Refuge, including a very rare Oregon white oak community, as well as the grasslands maintained for the Grazing and Haying Cooperative Land Management Program (shown as "managed fields" in Figure 3-11). Approximately 50 acres of the managed fields are grazed by cattle between May and October, a practice that would continue during project operations. The grazing area is fenced from the rest of the Refuge.



Source: USFWS 2005

Legend					
	Project Area		Scrub-Shrub		Reed Canarygrass
	Cottonwood Ash-Forest		Managed Field		Emergent Wetland
	Oak Woodland		Old Field		Water / Riverine Wetland

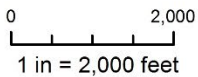


Figure 3-11
Vegetation Communities
Steigerwald Floodplain Restoration
Clark County, WA

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The Oregon white oak community is comprised of Oregon white oak (*Quercus garryana*), oval-leaf viburnum (*Viburnum ellipticum*), and poison oak (*Toxicodendron diversilobum*) (Chappell 2006). In 2003, the Washington State Department of Natural Resources (WDNR) adopted the 976-acre Washougal Oaks Natural Resource Conservation Area and Natural Area Preserve, located north of the eastern end of the Refuge. Within this preserve is the largest Oregon white oak community in western Washington and one of fewer than 20 total occurrences in the world (USFWS 2005). A very small piece of this community occurs within the project area where it extends south of the railroad track (Figure 3-11). This assemblage is recognized as a globally critically imperiled community because of the small number of occurrences, small global range, and high threats. Other shrub species that may occur within the white oak assemblage include snowberry, oceanspray (*Holodiscus discolor*), serviceberry (*Amelanchier alnifolia*), Indian plum (*Oemleria cerasiformis*), tall Oregon grape (*Mahonia aquifolium*), trailing blackberry (*Rubus ursinus*), and baldhip rose (*Rose gymnocarpa*) (Chappell 2006). Douglas fir (*Pseudotsuga menziesii*) may also occur in the canopy (Chappell 2006).

Under a Compatibility Determination included in the CCP (USFWS 2005), a portion of the Refuge is maintained in short (3 to 6 inches tall), perennial grass through mowing, grazing, and haying. The purpose of this land use agreement is to provide food in the form of short grasses for wintering western Canada geese and cackling Canada geese, a population that averages 2,000 birds each winter (USFWS 2005). Ongoing bird surveys determine the number of birds visiting each winter and the areas that are used. To provide habitat for nesting birds and other wildlife, fields that appear to have minimum foraging use have been taken out of short grass management efforts and left undisturbed. The Refuge currently has 293 acres of managed fields and 215 acres of unmanaged fields (“Old Fields”) (Figure 3-11), (USFWS 2005).

The managed fields are maintained through mowing and host a mix of pasture grasses and invasive herbs such as rough bentgrass (*Agrostis scabra*), red fescue (*Festuca rubra*), reed canary grass, velvet grass, and various bulrushes (*Juncus* sp.). Areas that are unmaintained appear to be overwhelmingly dominated by reed canary grass. During the wetland delineation, upland plots were assessed for vegetation characteristics and confirmed typical species composition (LCEP 2016). Reed canary grass remained the dominant plant species and other herbs and pasture grasses present included Canada thistle (*Cirsium arvense*) nightshade (*Solanum dulcamara*), bentgrass (*Agrostis* sp.) tall fescue (*Schedonorus arundinaceus*), sweet vernal grass (*Anthoxanthum odoratum*), English plantain, and blackberry.

3.13.1.2.4 Special Status Plant Species

Three ESA-listed plant species may occur in the project area, including Bradshaw’s lomatium (*Lomatium bradshawii*), golden paintbrush (*Castilleja levisecta*), and Nelson’s checkermallow (*Sidalcea nelsoniana*) (USFWS 2016a). The project area is within the historic range of golden paintbrush and Nelson’s checkermallow. Two plant populations have been established in the Refuge area, including golden paintbrush and Nelson’s checkermallow.

Bradshaw’s lomatium is a perennial herb listed as endangered on September 30, 1988 (53 FR 38448). There is no critical habitat designated for this plant. Its range extends from southern Clark County in Washington to Lane County in Oregon. This is a spring blooming plant reproducing exclusively through seeds. Bradshaw’s lomatium was formerly common in native prairies of the Willamette Valley and Puget Trough and likely occurred in or near the

Steigerwald Lake study area (USFWS 2005). It is not known to occur in the study area (USFWS 2016a).

Golden paintbrush is a perennial herb listed as threatened on June 11, 1997 (62 FR 31740). There is no critical habitat designed for this species. Its range historically included southwest Washington and northwestern Oregon, though most populations are now presumed extirpated from the area. Introduced populations are in Polk and Benton counties in Oregon. This plant does not occur naturally within the study area but USFWS has introduced it into the Refuge.

Nelson's checker-mallow was listed as threatened on February 12, 1993 (58 FR 8235 8243). There is no critical habitat designated for this species. Known populations occur in Clark County, Wash. and several counties in northwestern Oregon. This plant does not occur naturally within the study area but USFWS has introduced it into the Refuge.

3.13.1.2.5 Invasive Vegetation

A 2011 review of the study area notes that invasive plants occurring at the Refuge include reed canary grass, Armenian blackberry, and common teasel (Tetra Tech 2011). Each of these species are reported to be present in high densities. Reed canary grass is dominant and often forms a monoculture. Reed canary grass and blackberry are the most common invasive species and are most dense along wetland edges and riparian zones. Common teasel is found in unmaintained upland areas. Canada thistle was also found during wetland delineations (LCEP 2016).

A number of additional invasive species that occur throughout the lower Columbia River, and which have the potential to occur in the study area, are listed in the Refuge CCP (USFWS 2005). They include Japanese knotweed (*Reynoutria japonica*), indigo bush (*Amorpha fruticosa*), Scotch broom (*Cytisus scoparius*), purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), and gorse (*Ulex europaeus*). Other invasive species known to occur in the lower Columbia River region include yellow flag iris (*Iris pseudacorus*), shiny geranium (*Geranium lucidum*), false indigo (*Baptisia australis*), garlic mustard (*Alliaria petiolate*), and black locust (*Robinia pseudoacacia*). Invasive aquatic plant species, such as hydrilla (*Hydrilla verticillata*), Brazilian elodea (*Egeria densa*), and Eurasian milfoil (*Myriophyllum spicatum*) also occur throughout the lower Columbia River. Table 3-13 shows the known and potentially occurring non-native invasive plant species in the study area.

The state of Washington recognizes three classes of noxious weeds, each with varying requirements for management (Clark County 2016b). Class A noxious plants are those whose distribution is still limited; preventing new infestations and eradicating existing infestations are the highest priority and management is required for each of these species. Class B noxious plants are limited in portions of the state and are designated for required control in regions only where they are not yet widespread. Class C noxious plants are those that are typically widespread; the decision to require control of these species is delegated to the county. Table 3-13 shows the Noxious Weed Class for each species known to occur in the study area or which has the potential to occur, along with Clark County's specific determination for management requirements.

Reed canary grass is managed at the Refuge by mowing, while Armenian blackberry and common teasel are removed in localized areas through mechanical and chemical means.

Additional efforts to control Canada thistle have been undertaken with herbicide treatment (Tetra Tech 2011).

Table 3-13: Noxious weeds that are known in the study area or that have the potential to occur (Clark County 2016b)

Noxious Plant Common Name	Noxious Plant Scientific Name	Class	Management
Reed canary grass	<i>Phalaris arundinacea</i>	C	Not Required
Armenian blackberry	<i>Rubus armeniacus</i>	C	Not Required
Common teasel	<i>Dispacus fullonum</i>	C	Not Required
Scotch broom	<i>Cytisus scoparius</i>	B	Not Required
Japanese knotweed	<i>Reynoutria japonica</i>	B	Required in Clark County
Canada thistle	<i>Cirsium arvense</i>	C	Required in Clark County
Purple loosestrife	<i>Lythrum salicaria</i>	B	Required in Clark County
Indigo bush	<i>Amorpha fruticosa</i>	B	Required in Clark County
Hydrilla	<i>Hydrilla verticillata</i>	A	Required in Clark County
Brazilian elodea	<i>Egeria densa</i>	B	Required in Clark County
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	B	Required in Clark County

3.13.2 Environmental Consequences – Proposed Action

During construction, vegetation would be cleared to establish staging areas and access roads and to install new project features. During operations, vegetation would be maintained to control invasive plant species and provide wintering habitat for migratory waterfowl. Impacts to vegetation could include:

- Disturbance and/or removal of riparian, wetland, and upland vegetation
- Removal of non-native and/or invasive plant species
- Disturbance and/or removal of agricultural crops used for Canada and cackling geese forage and cover
- Conversion of wetland vegetation communities to floodplain channel
- Conversion of upland habitat to wetland habitat
- Conversion of upland pasture habitat to riparian forest

3.13.2.1 Construction Impacts

During construction, vegetation would be cleared where construction activities are proposed, such as in areas where levee modifications and channel creation would occur and at borrow areas, access roads and staging areas. These actions would result in temporary disruption and loss of wetland and riparian plant communities and could allow for introduction of non-native plant species, which thrive in disturbed areas. When construction was completed, these areas would be restored to native vegetation communities through seeding or by planting with plugs,

as described below. Other mitigation measures identified in Section 2.4.1 would ensure that impacts to wetland and riparian plant communities during construction would be low.

Although introduced plant populations are not subject to the same protections as naturally occurring threatened or endangered species, they would be preserved during construction. In the case of Nelson's checker mallow or golden paintbrush, surveys would be conducted prior to construction to ensure that neither species was present in construction areas. If any individuals were identified in the construction footprint or in the area that would be regularly inundated, a qualified biologist would oversee relocating some of the populations of each plant to an alternative and suitable site in numbers sufficient to restore the population at another location.

In some cases, the type of vegetation community could be converted to a different habitat type. In areas where the floodplain channels are proposed, the existing wetlands, dry prairie or agricultural land would become permanently converted to seasonally inundated and partially vegetated channel habitat. This conversion would lead to aquatic plant growth within the channels, and riparian vegetation communities would be planted along the margins of the channels. The overall footprint of the area that would be reconnected to the Columbia River would be 455 acres, and the expanded wetland habitat area would be approximately 115 acres. Throughout these areas, wetland and riparian habitat would be actively restored or would be expected to form over time, and the impact would be moderate.

Where new wetlands are proposed to be excavated, vegetation would be temporarily removed. Though this action could require removing wetland plants, it would largely result in removing non-native reed canarygrass. Once wetland excavation was complete, reseeded and plantings would promote restoration of native wetland vegetation communities.

Revegetation efforts would occur wherever plants have been removed, as quickly as possible after grading and other work has been completed. Immediate reseeded with native species would occur on temporarily disturbed ground, including sites of levee borrow excavation, expanded habitat excavation, road embankments, parking lot relocation, levee excavation and setback, and where disturbances have resulted from hauling.

Reseeded and plantings would promote reestablishing riparian communities along the Columbia River and newly created floodplain channels, including Gibbons Creek. Gibbons Creek north of SR14 would be revegetated with a combination of Oregon ash, black cottonwood, dogwood, stinging nettle, and associated shrubs. Willow scrub communities would be planted along floodplain channels. Wetland plant communities would be reestablished through clearing of reed canarygrass and then native plant seeding. In all restored areas, the increased connectivity to seasonal flood flows resulting in increased inundation and water circulation would be expected to promote native species growth/survival. It would also be expected to result in more diverse, native wetland and riparian vegetation communities.

During construction, Refuge managers would continue to meet the Compatibility Determination requirements. Areas under the cooperative agreement would continue to be controlled for weeds and mowed to provide winter forage for Canada geese. The Refuge currently has 293 acres of managed fields and 215 acres of unmanaged fields ("Old Fields") (Figure 3-11) (USFWS 2005). The objective for grasslands at the Refuge is to maintain at least 168 acres in short perennial grasses.

Construction impacts including disruption of plant communities, direct removal of vegetation, and dewatering would be temporary, and would be low. Impacts would be reduced with implementation of mitigation measures identified in Section 2.4.1 and additional measures described in BPA's HIP III handbook (BPA 2016b).

3.13.2.2 Operational Impacts

Following completion of the Proposed Action, replacement of non-native vegetation with native species would result in an increase in native plant cover and habitat diversity. This would be a moderate impact. Reestablishing a hydrologic connection to the Columbia River would increase the area of functional floodplain wetlands and riparian habitats. The restored connection could increase the potential for establishment of aquatic invasive plant species currently found only within the Columbia River, but this impact is expected to be low. Overall, restoration of a mosaic of floodplain-connected wetland and riparian plant communities would support a greater abundance of fish and wildlife species. There would be an increase in the area and availability of off-channel, shallow water habitat for juvenile salmon and other species. Expansion and diversification of wetland habitats would increase the availability of cover, nesting, and forage for wildlife species. This impact would be moderate. Some riparian vegetation would be lost, including mature cottonwood forest that supports great blue heron rookery. The project would create more riparian areas than it would affect, so losses would be temporary and the overall impact would be low.

A monitoring and maintenance plan would be developed to evaluate the success in reestablishing native wetland and riparian plant communities, as well as for controlling invasive species. Continued maintenance targeted towards non-native invasive species would occur through mechanical and chemical control measures. The maintenance would also prevent additional non-native plant species from becoming established, particularly those that could enter the site through the newly connected floodplain channels.

3.13.3 Environmental Consequences – No Action

Under the no action alternative, no construction impacts would occur. Vegetation communities within the Refuge would remain dominated by non-native species, with continued likely decline in cover and diversity of native plants. Wetland areas would need continual maintenance to control reed canarygrass and other non-native and invasive species. Riparian areas that are low in native tree diversity, age composition and cover might need to be augmented with plantings. Recruitment of riparian species would likely be low due to competition from reed canarygrass. Ongoing maintenance and revegetation projects would be expected to continue for these purposes. These impacts would be moderate.

Refuge staff would continue to manage invasive plant species to the degree possible. However, due to the large area of the Refuge and lack of resources, many invasive plant communities would persist. Maintenance actions would focus on maintaining specific habitat areas related to the Refuge's primary mission of providing winter foraging habitat for migratory waterfowl. Eradication of invasive plant communities would not likely be possible. If a new species of invasive plant were found within the Refuge, managers would work aggressively to ensure it does not become established. Localized invasive species control projects would be implemented

to maintain vegetation communities' composition and their benefits to native fish and wildlife species. Impacts of these projects would be low.

3.13.4 Cumulative Impacts

Numerous large federal agencies, watershed groups, and local agencies have made wetland restoration in the Columbia River estuary a priority. Recently completed wetland restoration projects in the vicinity include Sandy River Delta, several projects on Sauvie Island, within the lower Willamette River, Steamboat Slough, and Woodward Creek. A large off-channel fish enhancement project at Oaks Bottom in Portland has been fully designed and permitted, and is scheduled to be constructed in summer of 2018. Other projects are planned at Deer Island and Columbia Stock Ranch. The Proposed Action, when combined with those projects, would be expected to incrementally reverse losses of native wetland and riparian vegetation communities in the Columbia River estuary. Restoration measures implemented under this project and other projects either planned or constructed at Sauvie Island, Ridgefield NWR, Columbia Stock Ranch, and the Sandy River Delta would reduce populations of non-native vegetation and increase populations of native wetland, riparian, and upland vegetation communities. The measures would have an overall beneficial impact by increasing native floodplain habitat communities. By definition, the cumulative impact of restoring numerous native habitats and ecological function would ultimately be high and beneficial to listed fish in the Columbia River.

Cumulative impacts could occur if reconnecting numerous diked floodplains to the rivers and streams in the Columbia River estuary reduced the incidence of perennially-flooded floodplain lakes. Many floodplain lakes are incidentally maintained as perennial water bodies by the presence of dikes that contain the interior lakes, a condition that allows a particular plant and animal community to develop there. Plants that are reliant on perennially-inundated or saturated floodplain lakes may include sago pondweed (*Stuckenia pectinata*), wapato (*Sagittaria latifolia*), spikerush (*Eleocharis palustris*), and water smartweed (*Polygonum amphibium*). These plants and the communities that form around them might not be able to survive seasonal dry periods if water surface levels of contributing water bodies such as the Columbia River were lower than the level needed to maintain inundation or saturation. This impact is considered to be low.

3.14 Water Resources

This section describes water resources and water quality in the project area and nearby areas where the Proposed Action could affect hydrology or water quality. It also discusses the potential impacts the Proposed Action could have on water resources. The area of analysis includes the Proposed Action footprint, the Gibbons Creek watershed, the Columbia River in the vicinity of the project, and the balance of the Refuge outside of the project footprint.

3.14.1 Affected Environment

3.14.1.1 Hydrologic Characteristics

Surface water in the Steigerwald Lake complex typically flows from east to west. Across the project area are three north-south dikes, which each have a culvert that allows water to pass to the west. A tidegate is located west of the project area on Port lands. Water from Steigerwald Lake is conveyed to the Columbia River via pumps located in a channel west of the project area.

These pumps are operated by the Port. Surface water sources include Gibbons Creek, a small perennial stream with headwaters north of the project site; direct precipitation; seasonal groundwater; and diverted flow from Lawton Creek, at the east end of the floodplain. Gibbons Creek flow estimates range from a base flow of less than 10 cfs to an estimated flow up to 1,140 cfs under the 100-year discharge (USGS 2015 cited in ESA 2015). Gibbons Creek was diverted from its original course in 1992 and now conveys water over Steigerwald Lake in an elevated and engineered channel, referred to variously as the “Highline Canal” or the “Aqueduct.” Once water is conveyed over Steigerwald Lake via the Highline Canal, it enters a more natural channel, which meanders through a riparian area and then out into the Columbia River via the Steigerwald fish ladder. During moderate and high flow conditions, Gibbons Creek may overflow its banks near the diversion structure found immediately downstream of SR14, flow overland into the floodplain area located west of the elevated canal, then flow west to the Port facilities, where it is pumped into the Columbia River. The remnant Gibbons Creek channel now serves as the receiving waterbody for industrial facilities and stormwater runoff to the west of the project area.

Other important water bodies on the Refuge or which influence hydrologic conditions in the Refuge include the following:

- Lawton Creek, a perennial tributary to the Columbia River, is found east of the levee that encompasses the Refuge, outside of the Refuge. Lawton Creek typically flows south into the Columbia River but part of the flow is diverted by the adjacent landowner into a stock pond that drains into the Steigerwald Lake wetland complex.
- Steigerwald Lake is a complex of interconnected perennial wetlands that collectively cover approximately 312 acres. Sources of hydrology for Steigerwald Lake include precipitation, subsurface drainage from the nearby hillslopes, occasional overflow from Gibbons Creek, and stormwater runoff (LCEP 2016).
- Straub Lake is a depressionnal, emergent, palustrine wetland that covers approximately 219 acres in the eastern portion of the study area. To foster waterfowl habitat, the USFWS manages the water level of Straub Lake by placing flashboards across the channel from late summer to early spring (LCEP 2016). Hydrologic input to Straub Lake comes from precipitation, seasonal groundwater, and diverted flow from Lawton Creek.
- Scaup Pond is a depressionnal, emergent, palustrine wetland that covers approximately 19 acres south of Steigerwald Lake (LCEP 2016). A ditch connects Scaup Pond to Gibbons Creek and allows overflow to drain to the creek.

No public drinking water sources or surface water intakes are known to occur within the project area.

3.14.1.2 Floodplains

In 1965-1966, the Corps constructed the 5.5 mile long levee as part of the Washougal FDR Project. This levee disconnected approximately 1,800 acres of floodplain from the Columbia River, and allowed for development of commercial, residential, and industrial facilities within the former floodplain. In 1992, the Corps constructed the Gibbons Creek diversion structure, elevated canal, and fish ladder, which effectively disconnected Gibbons Creek from the site.

Levees that are maintained or certified by the Corps provide flood protection to at least the 100-year flow elevation, with at least 3 ft. of freeboard above that elevation. A 95-percent level of certainty that this flood protection would be provided is necessary to meet standards of FEMA’s National Flood Insurance Program. This standard is exceeded by the WCRL. The Washougal levee system was inspected by the Corps in 2010, and found to be intact, functional, and well maintained. No levee safety issues were identified that threaten the levee’s ability to function as authorized (Tetra Tech 2010).

Flooding along the lower Columbia River occurs both in the winter and spring. Storm runoff is the primary cause of winter flooding. Spring flooding occurs from snow melt and is often referred to as the “spring freshet”. Spring floods are of very long duration, typically 30 to 60 days, with the peak occurring in late May to the first week in July. Spring floods historically had the highest peak flows; however, winter floods now produce higher peak flows because of highly effective reservoir control of spring floods higher in the system. Flows in the Columbia River at the project site are largely driven by discharge from Bonneville Dam. Water surface elevations in the river fluctuate by up to 2 ft. during low water periods at this location in response to tidal influence (Tetra Tech 2010). The floodplain at the Refuge has been cut off from Columbia River flows since the levees were installed in the 1960s.

Prior to flood protection levee installation in the mid-1960s, Steigerwald Lake and the surrounding lands were characterized by extensive floodplain habitat connected by meandering channels. Presently, water from Gibbons Creek only interacts with the surrounding floodplain habitat if it overflows its banks during high flow conditions. The historic floodplain is protected from greater than 500-year (0.2 percent annual exceedance) Columbia River floods by the levees on the south and east sides of the site. The approximate levee elevation of 45.3-ft. NAVD88 is 9.9 ft. higher than the 100-year (1-percent annual exceedance) flood elevation of 35.4-ft. NAVD88 (FEMA 1980, as cited in Tetra Tech 2010). Table 3-14 summarizes WSEs that correspond to various flood flows at this location.

Table 3-14: Water-Surface Elevations (WSEs) Reported in the Flood Insurance Study for the 1-Percent Annual Exceedance Probability Flood.

Feature	Data
RM	123.42
Approximate Levee Elevation (ft. NAVD88)	45.3*
50-Percent Annual Exceedance Probability WSE (ft. NAVD88)	23.7*
1-Percent Annual Exceedance Probability WSE (ft. NAVD88)	35.4**
0.2-Percent Annual Exceedance Probability WSE (ft. NAVD88)	38.0*
Freeboard above 1-Percent Annual Exceedance Probability WSE (ft.)	9.9**

* Source: ESA 2015 **Source: FEMA 1980, as cited in Tetra Tech 2010

3.14.1.3 Groundwater

Piezometers have been installed at the proposed locations for the setback levees to gather groundwater level data for ongoing geotechnical investigations in support of the project designs (CCI 2016). Groundwater levels at the west setback levee location were found to be between 4.1

ft. and 9.7 ft. below ground surface. Groundwater levels along the east setback levee location were found to be between 11.6 ft. and 20.0 ft. below ground surface.

There are no sole source aquifers in the project area under the Protection Program authorized by Section 1424(e) of the Safe Drinking Water Act of 1974 (Public Law 93-523, 42 USC 300 et. seq) (Ecology 2016c). There are three well types in the project area: a water well is located south of SR14 and the railroad track, north of Steigerwald Lake; a resource protection well is located on the west side of the project area; and a decommissioned well is located on the east side of the project area (Ecology 2016c). These wells include temporary wells installed by LCEP to monitor surface water conditions.

Groundwater contamination has not been found within the project area, and the site's historic uses are not of the type that would lead to contamination. As part of an Ecology water quality study of the Gibbons Creek remnant channel located west of the project area, sediment samples were collected from the remnant channel below Steigerwald Lake. Results from the site farthest downstream, approximately 1.5-miles downstream of the project area, indicated elevated metal concentrations, specifically arsenic, chromium, copper, zinc, cadmium, and lead. Surface water samples from the ditch indicated exceedances of state water quality criteria for pH, temperature, FC, turbidity and dissolved oxygen (DO) (Ecology 1996). Although sources of emissions no longer exist, and despite substantial soil excavations in this area, groundwater monitoring from 2005 indicated continued contamination from two facilities. From this site, groundwater travels east toward the project area, and some of it is intercepted by a utility trench where contaminated waters are treated (USFWS 2005). A portion of the water bypasses the trench and moves into the Refuge west of the project area. Contamination was found in one monitoring sample, taken outside of the project area, but within the Refuge (USFWS 2005).

3.14.1.4 Water Quality

3.14.1.4.1 Designated Beneficial Uses

Designated beneficial uses refers to the benefits that may be derived from a water body and provide for the protection of public water supplies, fish, shellfish, wildlife and well as recreational, agricultural, navigation and aesthetic purposes. Table 3-15 identifies the designated beneficial uses of the Columbia River identified by the state of Washington in the vicinity of the project area, specifically from the mouth of the Columbia River to the Washington-Oregon border (Ecology 2012a).

Table 3-15: Columbia River Beneficial Uses

Specific Uses	Miscellaneous Uses
Aquatic Life (Spawning/Rearing)	Wildlife Habitat
Recreation (Primary Contact)	Fish Harvest
Water Supply (Domestic, Industrial, Agricultural, Stock)	Commerce/Navigation
	Boating
	Aesthetics

3.14.1.4.2 Aquatic Life Criteria

The State of Washington developed aquatic life criteria to protect designated beneficial uses. Criteria for temperature, DO, and pH are provided for salmonid rearing and migration for the entire length of the Columbia River stretching from its mouth to Grand Coulee Dam (RM 596.6) (Table 3-16).

Table 3-16: State of Washington Aquatic Life Criteria for Salmonid Rearing and Migration

Parameter	Description	Criteria
Temperature	Measured as the 7-day average of the daily maximum temperatures (7-DADMax)	63.5°F (17.5 degrees Celsius [°C]) ¹
DO	Measured as the 1-day minimum DO	6.5 milligrams per liter (mg/L) ²
pH	Within the range of 6.5 to 8.5	Human caused variation shall be less than 0.5 units, and maintain pH values within the range of 6.5 to 8.5

Notes:

¹If the natural conditions of a water body cause water temperatures to exceed this criteria, then cumulative human actions may not cause the 7-DADMax to increase more than 0.54°F (0.3°C).

²If the natural conditions of a water body cause DO to be lower than a value of 6.5 mg/L for salmonid rearing and migration, then cumulative human actions may not cause the DO to decrease by more than 0.2 mg/L.

3.14.1.4.3 Clean Water Act

Under the CWA, Ecology and Oregon Department of Environmental Quality (ODEQ) are regularly required to assess the quality of the state's waters and report conditions to the EPA. As required in Section 303(d) of the CWA, Ecology and ODEQ identify those waters that do not meet water quality standards. Where data are available, Ecology and ODEQ also identify specific water quality limitations and impairments for the state's waters. From this determination, a 303(d) list is developed and submitted to the EPA for approval. Waterbodies listed as Category 5 impaired on the 303(d) list require that a total maximum daily load (TMDL) be developed, and Category 4A impaired waters have an approved TMDL in place. A TMDL is a numerical value that represents the highest amount of pollutant a designated surface water can receive while meeting state and national water quality standards.

The Columbia River is on Oregon and Washington's 303(d) lists for a number of Category 5 and Category 4A pollutants. In Oregon, the Columbia River in the vicinity of the project area (RM 123.0 to 128.0) is listed for DDE, a breakdown product of DDT, dioxin, PCBs, pH, polynuclear aromatic hydrocarbons (PAHs), temperature, and total dissolved gas (TDG) (ODEQ 2012). In Washington, the Columbia River is also listed as impaired for dioxin, DO, pH, temperature, and TDG (Ecology 2012b, 2015). An EPA-approved TMDL is available for TDG for that reach of the Columbia River from its confluence with the Snake River to the mouth at the Pacific Ocean (ODEQ and Ecology 2002). A TMDL has also been approved for dioxin for the entire length of the Columbia River (EPA 1991).

Gibbons Creek is listed as Category 4A impaired for fecal coliform bacteria where it enters the project area (Ecology 2002). Land uses in the upper watershed of Gibbons Creek, particularly

failing septic systems and livestock, have contributed to elevated fecal coliform bacteria counts (Ecology 2005). Concentrations of fecal coliform bacteria found in Gibbons Creek between October 1991 and September 1992 averaged 230 colonies per 100 milliliters (Ehinger 1993). A subsequent study in 1994 and 1995 of Gibbons Creek, tributary Campen Creek, and two other unnamed tributaries found fecal coliform bacteria criteria exceedances and led to the inclusion of Gibbons Creek on the state's 1996 303(d) list. A TMDL for fecal coliform bacteria was issued by Ecology, resulting in pollution control measures and reduction targets that were developed in an effort to improve water quality in Gibbons Creek (Ecology 2002, 2005). Water quality conditions are improving as a result of adaptive management of the contamination (Ecology 2011); however, recent studies (2011-2012) indicate water quality criteria for fecal coliform bacteria were exceeded (not met) at monitoring sites (Ecology 2013).

3.14.1.4.4 Other Water Quality Parameters

Running water temperature varies seasonally and, in smaller systems, on daily time scales. In addition to ambient air conditions, factors such as elevation, streamside vegetation, impoundments, and groundwater inputs can result in temperature variations. Water temperature strongly affects chemical and biological reactions, and most organisms have a very limited range in which they are able to sustain all aspects of their life cycle. Coldwater fish species, such as Coho and Steelhead rely on water temperatures between 41°F (5 degrees Celsius [°C]) and 55.4°F (13°C), with high water temperatures resulting in “severe impairment” to migration, alevin development, fry emergence, metabolism, behavior, and susceptibility to parasites, disease and mortality for salmonid species (PNWSHIWG 1998).

Ecology lists the seven-day average daily maximum water temperature aquatic life criteria as 63.5° F (17.5°C). Year-round water temperature is a concern in the Columbia River for the designated uses of salmon and steelhead migration. Water temperature data taken from the Columbia River at Ridgefield NWR, downstream of the Refuge, between August 2015 and January 2016 exceeded the daily maximum during late summer 2015 (CREST 2016) (Figure 3-12).

In general, increased temperature increases the rate of chemical reactions (for example dissolving more minerals). Conversely, warmer water holds less DO than colder water, which is critical to cold-blooded fish and macroinvertebrates. Reduced levels of DO can have deleterious impacts on fish growth and development of many life stages, which ultimately affect fitness and survival. Below 5.0 milligrams per liter (mg/L), most fish species are stressed, (e.g., embryo survival, avoidance) (Carter 2005) with fish kills occurring when concentrations are less than 3.0 mg/L for longer than 3.5 days (EPA 1986).

Gibbons Creek is subject to increased water temperatures due to important temperature problems in lower Campen Creek, a tributary to Gibbons Creek (Brandt et al. 2003). Over time, Campen Creek has undergone reduced shading and reduced summer flows that have contributed to elevated water temperatures (Ecology 2005). Also, ponds in the watershed may be contributing to elevated water temperatures; however, it has not been determined how much, if any, discharge contributes to the creek (Ecology 2005). Similarly, elevated summer water temperatures is the major water quality issue for Steigerwald Lake. This is largely due to its shallowness, with depths typically less than 5 ft. Another contributing factor is lack of seasonal water exchange with the Columbia River or other sources (e.g., Gibbons Creek).

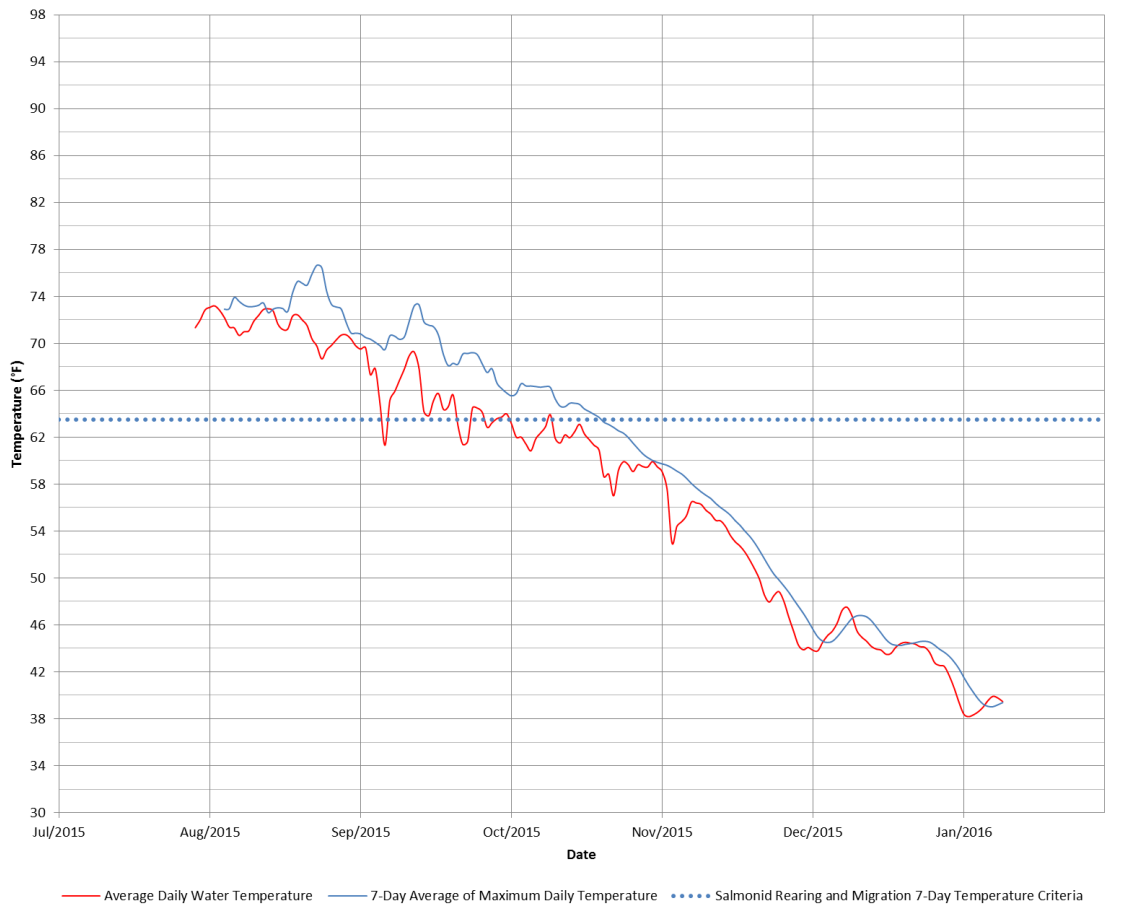


Figure 3-12: Average daily and seven-day average maximum water temperature (°F) in the Columbia River downstream of Steigerwald NWR (CREST 2016).

A waterbody's pH indicates the hydrogen ion concentration in the water and ranges from 0 to 14 (less than 7 being considered acidic). pH determines the solubility of chemicals and nutrients (e.g., phosphorus, ammonia, nitrogen) in the water. Lower pH values result in increased solubility of pollutants and nutrients. The solubility of these parameters determines their bioavailability for plants and animals. Although pH values in water naturally fluctuate with photosynthesis, values are also driven by local geology and human activities. In the spring, summer, and fall, pH levels are a concern to the designated uses of residential fish and aquatic life in the Columbia River.

Turbidity is a visual property of water due to suspended solids (clay, silt, sand, and very small organic materials) in the water column. Turbidity results in reduced water clarity. Turbidity is measured in Nephelometric Turbidity Units (NTU). In the Columbia River, turbidity levels commonly follow the hydrograph of the river, increasing during the spring freshets and winter flooding and decreasing during low summer flows. Increased turbidity reduces plant growth and interferes with the ability of fish to catch prey (Bisson and Bilby 1982; Henley et al. 2000). While turbidity levels can exceed 20 NTU during flood events, levels are typically less than 10 NTU in the Columbia River for most of the year (Corps 2011).

As previously mentioned, numerous pollutants are known to occur in the Columbia River in the vicinity of the project area. Specifically, elevated concentrations of DDE, dioxin, PCBs, and PAHs as well as temperature, DO, and pH levels are outside criteria ranges. Toxic substances impact designated beneficial uses, specifically dioxin, DDE, and PCBs impact drinking water, resident fish and aquatic life, and anadromous fish passage. PAHs impact resident fish and drinking water (ODEQ 2010). Elevated fecal coliform bacteria levels, as observed in Gibbons Creek, are detrimental to human health and degrade water quality as cells are broken down and DO is consumed.

3.14.2 Environmental Consequences – Proposed Action

3.14.2.1 Construction Impacts

Potential impacts to water resources resulting from construction activities could include:

- Short-term alterations to hydrology and the floodplain,
- Short-term impacts to turbidity, DO, and pH,
- Accidental spills from construction equipment, and
- Short-term impacts to some designated beneficial uses

Channel excavation and fill, levee setbacks and removal, and habitat expansion in existing wetlands could result in short-term impacts to hydrology and the surrounding floodplain. In particular, 2.2 miles of the WCRL would be fully removed and four floodplain channels would be excavated through the natural fluvial levee and into the interior of the Refuge. The removal of the Gibbons Creek diversion structure and aqueduct would accommodate Gibbons Creek flows into Steigerwald and Straub Lakes year-round. Channels 1 and 4 would require some channel grading to accommodate intended high flow connections.

Stormwater runoff from temporarily disturbed construction and staging areas could contribute sediment laden water to the river and increase turbidity. Most excavation would occur in the dry. In water work on the Columbia River side of the WCRL would be limited to excavation of the mouths of the floodplain channels. These areas would be isolated from the river to the degree possible by sediment curtains, and because of the extensive flow in the river, turbidity levels would be expected to return to background levels within 300 ft. downstream of the excavation areas due to dilution. In water work in the floodplain wetlands would create high rates of turbidity in the immediate work area, but since the work would occur when there was no flow through these wetlands, turbidity would be unlikely to move out of the construction area, and downstream turbidity impacts would not be likely to occur. Furthermore, there are no sensitive fish or wildlife resources found in the floodplain wetlands that would be affected by turbidity. As a result, these impacts would likely be low, and would be reduced further by implementation of mitigation measures identified below.

Construction activities that would result in short-term impacts to hydrology would also be expected to result in short-term impacts to water quality parameters, specifically turbidity, DO, and pH. Channel re-alignment inherently involves disturbing inundated or saturated sediments. Turbidity increases would be expected to be short-term and measures to control erosion and limit

the duration of in-water work would keep turbidity to moderate levels. Turbidity-related impacts would be low. Changes to DO and pH would be expected to occur as new areas were inundated and vegetation decomposed. Plant decomposition requires oxygen for microbes and, in turn, respiratory processes result in increased CO₂ in the water which lowers pH. These impacts to DO and pH would be expected to be short-term (within a season) and low and would not result in long-term impacts to water quality. Although decomposition of organic matter could result in the release of nutrients such as phosphorus and nitrogen, concentrations would be diluted by upstream waters and downstream impacts would be low.

During construction, petroleum products and hazardous materials such as fuels, oils, and lubricants would be present onsite, primarily in vehicles and construction equipment. Use of these materials as well as uncured concrete increases the risk of accidental discharge into riparian areas or directly into water bodies, resulting in impaired water quality as well as injury or mortality of aquatic species. Leakage of hydraulic fluids, fuels, and solvents could occur during construction in or near aquatic areas. These impacts would be reduced to low by implementation of a SPCC plan as well as use of standard construction BMPs designed to best contain hazardous materials and reduce the chances of spills or leaks.

Construction activities would be expected to result in short-term impacts to some designated beneficial uses, specifically aquatic life. Aquatic life such as invertebrates would likely be impacted in the short-term; however, no sensitive populations of invertebrate would be likely to be affected, and the impact would be low.

Restored or newly created riparian areas would provide shading of surface water and retention of groundwater, allowing it to be released from soils over a longer period of time. Both of these impacts would benefit water quality.

3.14.2.2 Operational Impacts

Impacts to water resources resulting from operations could include:

- Improved hydrologic connectivity,
- Improved floodplain wetland habitat,
- Improvement to designated beneficial uses, and
- Improved water quality

As previously described, the hydrologic connectivity between features would be increased across the project area to allow for natural water exchange with the Columbia River. Floodplain habitat would be increased by allowing for backwatering (inflow/outflow) of Columbia River water into the floodplain during the spring freshet and winter flow events. Additionally, by diverting flow from Gibbons Creek, there would be improved wetland habitat in Steigerwald and Straub Lakes during dry seasons. These restoration activities would be expected to result in improvement to designated beneficial uses, specifically rearing of aquatic life, wildlife habitat, and aesthetics, and would likely result in greater groundwater recharge and retention than occurs under current conditions. Since the groundwater table is likely already high in this area due to its proximity to the Columbia River, this impact would be low.

Despite evidence of groundwater contamination measured in the remnant Gibbons Creek channel, this site is outside the project area and would not be anticipated to be affected by construction actions. The Columbia River in the vicinity of the project area is included on Oregon and Washington's 303(d) list for a number of previously described pollutants that could be introduced to the project area through backwatering; however, dilution and flushing from Gibbons Creek would be expected to ameliorate impacts. Conversely, water leaving the project area would not be expected to further impact the previously described parameters for which there are 303(d) listings for the Columbia River, including pH, temperature, and TDG.

In comparison to flowing water in the Columbia River, there would be a potential for a slight increase in water temperature and decrease in DO in shallow wetlands during the summer. However, these changes would be expected to occur outside the timeframe for salmonid rearing. In fact, it is expected that there would be an overall improvement to water quality due to restored riparian areas, improved instream flows, floodplain reconnectedness, the removal of water control structures, and invasive species management. The impact to water quality would be low.

A hydrologic engineering center FDR model (HEC-FDA) was created by the design team for the Columbia River from RM 122.5 to RM 128.3 (ESA 2015). This model indicates that if the WCRL was breached as proposed, there would be no increase in the base flood elevation for the restoration area or the surrounding area (ESA 2015). Under the Proposed Action, up to 570 acres of the floodplain would be inundated during the normal spring freshet. These models also predict that up to 274 acres would be inundated under normal winter flows, and 67 acres under normal summer flows.

The proposed changes to the WCRL and the associated boundaries of the Special Flood Hazard Areas, including the 1-Percent Annual Chance Exceedance (commonly referred to as the 100-year) floodplain area, identified in the current effective FEMA Flood Insurance Rate Map (FIRM), necessitate compliance with the FEMA Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) process. The FEMA CLOMR and LOMR process requires that hydraulic evaluation of project impacts be performed and post-construction documentation be provided by the applicant. If FEMA approves the LOMR, then flood mapping for the site would be updated to reflect the revisions. The hydraulic analysis performed for the CLOMR submittal indicates that the project would have no effect on the FEMA flood elevations, but would result in an expansion of the floodplain area within the restoration area. The analysis indicates that the changes to the WCRL would continue to provide flood protection to levee protected areas.

Under a 500-year event, the entire floodplain between the east and west setback levees would be inundated, as well as part of the Refuge lands north of SR14. Gibbons Creek would be backwatered to just above SR14, but the proposed Gibbons Creek floodwall and berm would prevent flooding of areas west of Gibbons Creek. This increased flood protection west of Gibbons Creek would constitute a moderate impact. Evergreen Highway is already above the levee's design elevation of 45 ft. NAVD88 (approximately 7 ft. above the 500-year floodplain elevation) and would not be flooded. The setback levees have been designed with sufficient height and freeboard to contain river stages several feet in excess of the 500-year flood event, meaning floodwaters reaching the Steigerwald floodplain would not reach areas outside of the restoration area. Therefore, impacts from flooding up to the 500-year event (which is approximately 5 ft. above the peak stage of the 1996 flood) would be low.

Because stormwater runoff from Gibbons Creek and SR14 would flow into the restored floodplain and then into the Columbia River, the Proposed Action would affect stormwater management at the Port. Much less pumping would be needed compared to current conditions, lessening the flood risk on Port lands and reducing costs associated with pumping. This impact would be moderate. Additionally, Port and City infrastructure would be removed from the FEMA-mapped interior flood zone. This impact would be moderate, beneficial and long-term. No other stormwater management structures would be affected by the Proposed Action.

Upon completion of the proposed project, USFWS would benefit by no longer needing to dredge sediments from Gibbons Creek at the SR14 Bridge. This would be a moderate impact.

Inputs from Lawton Creek would no longer be diverted into the Refuge, and all flow would go directly into the Columbia River. This would not affect hydrology in the Refuge, as the current amount of diversion is minimal, particularly in comparison to the amount of water that would enter the refuge after the project was completed. Therefore this impact would be low.

3.14.3 Environmental Consequences – No Action

Under the no action alternative, no construction would occur, and current water quality management practices would remain in effect. Water would continue to collect in the floodplain wetlands and run off to Port properties, where it would be pumped to the Columbia River. This impact would be low. Moderate warming of surface waters likely occurs due to shallow areas and minimal inflow during dry periods, and would likely continue under this alternative. This impact would be low.

Impacts associated with the Gibbons Creek diversion structure would likely worsen over time if USFWS were to lose the ability to dredge at this location due to possible impacts to fish. In this scenario, sediment would continue to deposit in this location, increasing the incidence of overflow into the floodplain with resulting fish stranding, and increasing the potential for flooding at the SR14 Bridge. This impact would be moderate.

3.14.4 Cumulative Impacts

Previously described past, present, and reasonably foreseeable future actions have resulted in detrimental impacts to water resources along the Columbia River, including 303(d) listings for numerous pollutants. Considerable effort has been invested by the states of Washington and Oregon as well as numerous federal, state, tribal, non-profit, and volunteer organizations to improve water quality in the Columbia River. Results of these efforts indicate improvement in some pollutant concentrations (e.g., fecal coliform bacteria in Gibbons Creek has been reduced [Ecology 2013]).

When combined with the past, present, and reasonably foreseeable actions, the Proposed Action would result in long-term, low, beneficial cumulative impacts on water resources by restoring hydrologic connectivity between the Columbia River and the affected area. Expanded wetland area would improve water quality by ameliorating nutrients and other pollutants. Removal of the water control structure would impact water levels in Steigerwald Lake, and could cause the lake to dry up earlier in the year than it typically has. However, when designers set the invert elevation of channel 3, the goal was to maintain the lowest observed level in Steigerwald Lake,

and as a result, the lake level should not change drastically, and this impact would be low. In addition, future colonization of the area by beavers could eventually raise lake levels again. Nonetheless, following completion of the Proposed Action, lake levels would be lower during dry periods than they were previously, potentially reducing habitat for species adapted to longer inundation periods, such as native submergents, aquatic macro invertebrates, diving ducks (particularly early migrants), aquatic mammals such as muskrat and otter; and some species of amphibians. This impact would be low.

3.15 Wildlife

3.15.1 Affected Environment

3.15.1.1 General Wildlife

The project area, which is almost entirely within the Refuge, has been actively managed for wildlife since its establishment in 1987. This management has resulted in a productive and important site for native wildlife species in a region that has been highly altered by humans. The relatively high-quality habitat present is reflected in wildlife abundance, with more than 200 of the 300 bird species seen in Clark County being observed in this relatively small refuge (USFWS 2010). In addition, more than 20 species of mammals, 15 species of reptiles and amphibians, and a wide variety of insects, fish, and plants have all been identified on the refuge (USFWS 2010). Waterfowl have been of primary management focus on the Refuge, especially providing year-round support for breeders, migrant, and wintering species such as cackling goose (*Branta hutchinsii*), a species formally managed under a Pacific Flyway Management Plan (USFWS 2005). The Plan identifies the importance of habitat provided by the Refuge (Pacific Flyway Council 1999). Ongoing management actions at the Refuge include maintaining large expanses of short and/or disturbed grassland by annual mowing and haying from June to July and grazing from May to October (Chmielewski 2016, personal communication). USFWS also manages specifically for purple martin (*Progne subis*), a species identified as a “Conservation Target” of the Refuge (USFWS 2005). Management of this species entails ensuring access to large wetland complexes and appropriate nesting cavities that are typically human-made nesting structures.

Wildlife habitat in the action area is diverse and has generally been shaped by hydrology and disturbance, which work together to determine the distribution of vegetation (see Section 3.13 Vegetation and Wetlands, for a full discussion on the topic). Vegetation, in turn, largely determines wildlife site usage, particularly within this Refuge where human disturbance is low and follows predictable patterns. Seasonal changes drive wildlife habitat usage and result in some habitats hosting higher wildlife densities at certain times of the year. Wildlife are discussed in the context of the habitat they most frequently occupy. Habitats available in the action area are open water, emergent wetland, forested-shrub wetland, cottonwood riparian forest (gallery forest), and maintained grassland. Fish are discussed separately in Section 3.5, Fish.

3.15.1.1.1 Open water habitat

Open water habitat, which includes riverine and ponded sites that are either perennial or seasonal, is very important for a myriad of wildlife species in the Refuge. Waterfowl assemblage changes throughout the year with migratory species visiting the Refuge for wintering, as a stopover during migration, or for breeding. During non-breeding months, open water sites

provide important stopover or wintering habitat for various waterfowl including cackling goose, Canada goose (*Branta canadensis*), wood duck (*Aix sponsa*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), mallard (*Anas platyrhynchos*), cinnamon teal (*Anas cyanoptera*), and bufflehead (*Bucephala albeola*). Other wildlife found in ponded sites include western painted turtle (*Chrysemys picta*), American coot (*Fulica americana*), pied-billed grebe (*Podilymbus podiceps*), purple martin, common yellowthroat (*Geothlypis trichas*), various swallow species, and occasionally beaver (*Castor canadensis*) and the invasive nutria (*Myocastor coypus*). Both mammal species are actively managed on the Refuge. Many species frequent open water habitat for foraging but principally reside in neighboring habitats such as wetland and/or riparian zones. Examples include piscivorous species such as belted kingfisher (*Megaceryle alcyon*), bald eagle (*Haliaeetus leucocephalus*), and osprey (*Pandion haliaetus*), as well as the common garter snake (*Thamnophis sirtalis*) and most amphibians.

3.15.1.1.2 Emergent wetland

Emergent wetland, which may or may not fringe open water, provides a moderate quality habitat for wildlife but is somewhat degraded on the Refuge by an extensive infestation of reed canary grass. The same wildlife species associated with open water habitat are often also found in emergent wetlands. Amphibians and waterfowl use the dense herbaceous vegetation for egg laying, and numerous other species use this habitat for foraging and for cover. Typical species include great blue heron (*Ardea herodias*), dabbling ducks, and Pacific chorus frog (*Pseudacris regilla*).

3.15.1.1.3 Emergent wetland

Forest-shrub wetland is comprised of a mix of woody shrubs and trees associated with an herbaceous understory of hydrophytic species. The woody structure provides important habitat for wildlife associated with shorter trees. Trees in this habitat are typically smaller than those found in riparian gallery forest but the thick woody shrub/tree layer it forms produces important foraging and nesting habitat and cover for birds and small mammals. Many bird species spend the majority of their time in the understory of this habitat, including bushtit (*Psaltriparus minimus*), dark-eyed junco (*Junco hyemalis*), lesser goldfinch (*Spinus psaltria*), black-capped chickadee (*Poecile atricapillus*), spotted towhee (*Pipilo maculatus*), song sparrow (*Melospiza melodia*), western scrub jay (*Aphelocoma californica*), and golden crowned kinglet (*Regulus calendula*).

3.15.1.1.4 Cottonwood riparian (gallery) forest

Cottonwood riparian (gallery) forest forms long, mostly contiguous patches of large mature trees (greater than 30 years-old) that create a mostly intact canopy. This habitat provides a corridor for wildlife to move along riparian system and into adjoining habitats. The mature cottonwoods that dominate this habitat vary in physical condition and compose a mix of standing mature trees, dead or dying individuals (i.e., snags), those with detached crowns and/or limbs, and large downed woody debris. Each provides important structural features for this relatively high-quality habitat. Standing mature trees provide habitat for large tree-nesting birds such as great blue heron, red-tailed hawk (*Buteo jamaicensis*), pileated woodpecker (*Hylatomus pileatus*), and forest hawks (*Accipiter* sp.).

A moderately sized, active great blue heron rookery (approximately 30 nests) is present in the southwestern corner of the study area. This rookery site was likely established because of its large trees, good access to foraging areas, and relatively low disturbance from humans or other predators (summarized in Vennesland and Butler 2011).

Dead or dying trees, including snags and those with detached crowns and/or limbs, are used by cavity-nesting birds such as woodpeckers (Picadae), swifts (Apodidae), swallows (Hirundinidae), wood duck (*Aix sponsa*), and great-horned owl (*Bubo virginianus*), as well as several bat species (Chiroptera), raccoons (*Procyon lotor*), and opossum (*Didelphis virginianus*). All seek cover in the structure it provides. Large downed woody debris provides a diversity of microhabitats used by small terrestrial wildlife throughout the year. Amphibians such as salamanders, garter snakes, small mammals, and bird species that frequent subcanopy areas can all be found in this habitat. These species, in turn, provide a prey-base for most predators in the study area. Coyote (*Canis latrans*), accipiters, raccoon, and Virginia opossum would all forage extensively in and around this habitat type.

3.15.1.1.5 Maintained grassland

Maintained grassland is a managed landscape that is mowed, hayed, and/or grazed as part of the land management of the Refuge for waterfowl intended to support cackling geese and other wintering species. Grassland nesting birds and open-land mammals are the most common species in this habitat type. Grassland birds include western meadowlark (*Sturnella neglecta*), savannah sparrow (*Passerculus sandwichensis*), and American goldfinch (*Spinus tristis*). A prominent mammal of this habitat is the Columbian black-tailed deer (*Odocoileus hemionus columbianus*). Fossorial mammals would also be typical, including; voles, gophers, moles, and mice. Predators of these species would also be common, such as northern harrier (*Circus cyaneus*), barn owl (*Tyto alba*), American kestrel (*Falco sparverius*), long-tailed weasel (*Mustela frenata*), red fox (*Vulpes vulpes*), and coyote. As with other habitats, use varies with season, and maintained grassland is key to sustaining migratory birds, primarily waterfowl, as they fly north to their breeding grounds, or south to their wintering grounds.

3.15.1.2 ESA/State-Listed Wildlife

Information on special status wildlife species was accessed from the USFWS ESA Program (USFWS 2016b), and the WDFW Priority Habitat and Species Program (WDFW 2008). The National Oceanic and Atmospheric Administration (NOAA) was also consulted but no ESA-listed marine mammals have the potential to occur in the study area (NMFS 2016). Lists of protected species identified by both programs were acquired during consultation and collectively indicated that four protected wildlife species may occur in the action area (Table 3-17). One species is listed under the ESA as endangered, while the other three are listed as threatened (USFWS 2016b). Three of these species are unlikely to occur in the action area, primarily due to their extirpation from the region but also because of only limited supporting habitat features present. The only listed species that is likely to occur in the action area is the streaked horned lark (*Eremophila alpestris strigata*), which is a federally threatened species with designated critical habitat. This species and its potential for occurrence is discussed in detail below.

The streaked horned lark was listed under the ESA as threatened in November 2013 (78 FR 61451), and critical habitat was designated in October 2013 (78 FR 61505). Suitable habitat for

the streaked horned lark exists within the study area but is generally limited, and there are no reported occurrences of this species on the Refuge. In the lower Columbia River region, this subspecies of the horned lark occurs sporadically throughout open farm fields, lowlands, sand islands, and shorelines of the Columbia River and the lower reaches of the main tributaries (Stinson 2005). This resident species inhabits large tracts of open, sparsely vegetated fields, and areas of exposed sand and dirt, next to large bodies of water (Stinson 2005). The large areas of maintained grassland may provide nesting habitat but vegetation in these areas is generally denser than is preferred by this species. Grasslands are mowed and hayed during the nesting season, further precluding this species' occupation. Many birders informally survey the Refuge, and although their observations are only anecdotal, this species has not been observed (Chmielewski 2016, personal communication).

Table 3-17: Federal ESA listed wildlife species possibly occurring in the project area

Common Name	Scientific Name	ESA Status/1	Critical Habitat ¹	State Status ²	Likelihood of Occurrence
Northern Spotted Owl	<i>Strix occidentalis caurina</i>	Threatened	Designated	Endangered	Not Likely
Streaked Horned Lark	<i>Eremophila alpestris strigata</i>	Threatened	Designated	Endangered	Not Likely
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Threatened	Proposed	Candidate	Not Likely
Gray Wolf	<i>Canis lupus</i>	Endangered	None	Endangered	Not Likely

¹USFWS 2016b, ²WDFW 2008, 2016

The project area falls outside of the units that were designated as critical habitat (USFWS 2013c). The primary constituent elements (PCEs) identified in the critical habitat listing include the following:

- Areas having a minimum of 16 percent bare ground that have sparse, low stature vegetation composed primarily of grasses and forbs less than 13 inches high found in:
 - a. Large (300-acre), flat (0 to 5 percent slope) areas within a landscape context that provides visual access to open areas such as open water or fields, or;
 - b. Areas smaller than described in (a), but that provide visual access to open areas such as open water or fields.

Both of these PCEs are present but limited in the action area.

There are no recorded occurrences of this species in the study area. However, because supporting habitat features (i.e., PCEs) are present in the action area, albeit limited, and extant populations are found within the region, the streaked horned lark can potentially occur in the action area. The likelihood of occurrence is considered low to moderate due to the presence of local populations, but those populations being small and unpredictable. Because the PCEs pertain to preferred breeding habitat, if streaked horned larks are present in the action area, the period of highest potential would be during the breeding season, occurring roughly from March through August

(Stinson 2005). Wintering habitat does occur in the action area as well (see Pearson and Altman 2005), indicating some potential for this species to be present during the remainder of the year.

Similarly to the streaked horned lark, suitable habitat for the yellow-billed cuckoo occurs on site, but this species is unlikely to occur at the Refuge other than on an occasional transient basis. Therefore, impacts to the yellow-billed cuckoo would be less than significant.

3.15.1.3 Marine Mammal Protection Act

Three species of marine mammals have been known to use the Columbia River in the vicinity of the action area: Steller sea lion (*Eumetopias jubatus*), California sea lion (*Zalophus californianus*), and harbor seal (*Phoca vitulin*) (NMFS 2006). The federal Marine Mammal Protection Act (MMPA) protects all marine mammals including these species. During the spring migration of smelt (Osmeridae), Pacific lamprey (*Entosphenus tridentatus*), salmon and steelhead (*Oncorhynchus* sp.), it is common for seals and sea lions to follow these prey species into the fresh water of the Columbia River up to Bonneville Dam (NMFS 2006), 18 miles upstream of the study area. Tens of seals and sea lions are known to feed in these upriver areas during the spring season (NMFS 2006), largely the result of Bonneville Dam constraining upstream fish movement. This pattern makes them susceptible to marine mammal predation. Some individual marine mammals stay and feed for only a few days, while others remain for much longer.

3.15.2 Environmental Consequences – Proposed Action

The following sections describe any anticipated direct or indirect impacts to wildlife, their habitat, or special status species due to the implementation of the Proposed Action.

3.15.2.1 Construction Impacts

3.15.2.1.1 General Wildlife

Temporary disturbance from construction activities, as well as slightly longer-term temporal impacts from revegetation, would be the major construction impacts to wildlife species from the Proposed Action. To allow most of the project construction to occur in dry conditions, the primary construction period in the first two construction seasons would be June 1 to October 31. However, some specific work components such as raising SR14 and constructing the parking area would start as early as April.

Construction activities would include widespread grading and use of other heavy equipment. Construction would occur over two primary seasons, with settlement surveys and minor fill activities (if necessary as a result of settlement) to be completed in a third limited season. Construction would result in a large area of temporary disturbance to native wildlife found in the Refuge. In addition, the Refuge's relatively high-quality habitat attracts high densities of a diversity of wildlife species to the Refuge – species that would be subjected to construction disturbances. Disturbance, however, would be mostly restricted to the displacement of individuals from the active work zone, and in most instances would only cause low, short-term impacts. Displaced wildlife could move to undisturbed sites within the Refuge or potentially out of the action area if suitable conditions were not available. Loss of fitness (i.e. from reduced foraging) to displaced wildlife could result from the construction disturbance. Construction

impacts would primarily affect various bird species that use the Refuge. It is anticipated that harm to most wildlife would be low and largely prevented by implementing mitigation measures described in Section 2.4.1. Primary construction would generally occur outside of peak waterfowl migrations (spring and fall) and the spring bird breeding season, thus causing low impacts to wildlife. To avoid impacting wintering waterfowl such as the cackling goose, construction activities would avoid their habitat to the degree possible while they are present during the winter season, which is generally October and November.

The great blue heron rookery described in Section 3.15.1 has an active breeding season for several months (rookery initiation begins mid-January, and the last fledglings would depart by mid-August [summarized in Vennesland and Butler 2011]). Construction activities adjacent to the rookery before July could cause moderate impacts to this highly sensitive species, likely leading to nest failures. Current construction plans show that the proposed west setback levee would take up 1.2 acres of the 10-acre rookery, which would be a permanent loss. The remaining 8.8 acres would not be suitable for nesting during the two primary construction seasons due to a high level of noise and disturbance from construction machinery and human presence, which would be a temporary but moderate loss, particularly if the great blue heron population permanently abandoned the rookery. If construction near the rookery during the breeding season was unavoidable, preventing the establishment of the rookery through hazing could be the best option to minimize impacts to this population. Construction in this area should start either prior to the arrival of individuals or after the chicks have fledged in late July and early August in order to minimize “harassment” under the Migratory Bird Treaty Act (MBTA). However, if this were not possible, hazing should occur starting in January to prevent nesting pairs from establishing broods. If this were to occur, it is unknown where the displaced individuals would recolonize. Although it is thought that the rookery originated on Reed Island, located in the Columbia River just south of the Refuge, its move to the current location was likely triggered by the old site becoming inhospitable to the rookery. The expansion of the local bald eagle population (bald eagles are antagonistic towards herons and often prey on chicks and adults) may have triggered the move to the mainland (Chmielewski 2016, personal communication), and may prevent the return of the rookery to the island. Because other nesting birds use the cottonwood riparian forest of the rookery, they would be similarly impacted by construction activities. Assuming measures are taken to avoid harassment of migratory birds during the nesting season, this impact would be moderate.

Reduced quality habitat for wildlife would occur after construction until maturation of restored vegetation, relative to existing conditions. However, because the affected portions of the Refuge would be expected to fully recover after several years and would be enhanced above existing conditions, the impacts would be considered temporary and low.

3.15.2.1.2 ESA/State-Listed Wildlife

The Proposed Action would be expected to have no impact on northern spotted owl, yellow-billed cuckoo, or gray wolf because they do not occur in the area, and there is little to no habitat present that would support viable populations. Critical habitat for these species is not found in the project area and would not be impacted by the Proposed Action.

Although the streaked horned lark is unlikely to be present in the project area, supporting habitat features are present in the project area, and they occur within the region. If streaked horned larks

are present in the action area, the period of highest potential for construction impacts would be during the breeding season, occurring roughly from March through August (WDFW 2008). It would be during this time that adults, nests, and chicks would be most susceptible to disturbance or harm from construction activities. Wintering habitat does occur in the project area as well (see Pearson and Altman 2005), indicating some potential for this species to be present during the remainder of the year. Wintering individuals would have reduced site fidelity and be more mobile, readily dispersing away from active construction. Construction is not anticipated to affect streaked horned larks, and would have no impact on critical habitat, which is not found in the Refuge.

3.15.2.1.3 Marine Mammal Protection Act

Although there is some potential for marine mammals to use the Columbia River channel adjacent to the Refuge, the likelihood of occurrence of these species in this area during construction is low. As part of the Proposed Action, part of the levee would be removed. However, because in-water work on the Columbia River side of the WCRL would be limited and in-water noise would be low, construction impacts on marine mammals would be limited to temporary disturbance and would be low.

3.15.2.2 Operational Impacts

3.15.2.2.1 General Wildlife

The Proposed Action would result in several beneficial changes for wildlife. The expansion of available open water would directly increase available habitat for wintering waterfowl, and the increase in emergent wetland would expand nesting capacity for ground nesting waterfowl during spring. Once the planted woody vegetation matures, which ranges between three to five years for shrub and wetland communities and 20 to 30 years for larger trees such as cottonwoods, the increase in forest-shrub wetland and cottonwood riparian forest would substantially increase the capacity for shrub- and/or tree-nesting birds such as passerines, woodpeckers, accipiters, herons, and owls. At that stage, the enhanced habitat would also likely provide diverse structure and would include important features such as standing snags at higher frequencies than current conditions. These impacts would be low.

Impacts to terrestrial avian and wildlife species that could occur during operations include mortality or displacement of species during flood events. Smaller species of wildlife or ground-burrowing animals might not be able to avoid rising waters or might be drowned if burrows were inundated. The Refuge supports a herd of approximately 12 black-tailed deer, which would be unlikely to be directly affected by inundation but which could be injured if they try to cross SR14 to escape rising waters. At least 200 acres of the project area is above the 100-year flood elevation and would be available as refugia for deer during high flows. Ground-nesting birds would be displaced and nests abandoned if they were located in the inundation area when flood events occur. The foraging and cover habitat within the inundated area would be lost to terrestrial species for the duration of the inundation period, but there would still be sufficient upland habitat to support them, so this impact would be low.

The increase in extent and diversity of water resources would also diversify associated aquatic wildlife species. It is anticipated that the Refuge would see increases in fish use, invertebrate

populations, and plant species, most of which would enhance conditions for native wildlife. Part of this increase in species diversity would be due to reestablishing direct connectivity to the Columbia River, which would allow species not currently present in the Refuge, such as western pond turtles, to more easily disperse into this area. The impact associated with this increase in the extent and diversity of aquatic habitat impact would be moderate. Unfortunately, the enhanced connectivity would likely facilitate the introduction of invasive species to the Refuge or the spread of existing species. Invasive species that would be likely to proliferate include nutria, purple loosestrife, shiny geranium, false indigo, and yellow flag iris. It is generally viewed that any increases in invasive species, both in diversity and population size, would degrade wildlife habitat in the Refuge and require additional management. This impact would be low due to implementation of an invasive species management plan as described in Section 2.4.1.

Additional long-term impacts would result from habitat enhancements that would alter productive, existing habitats. The removal of vegetation, including mature cottonwoods associated with the great blue heron rookery, would cause long-term negative impacts to wildlife that rely on those discrete habitat patches. The proposed location of the west setback levee, through the patch of cottonwood riparian forest that supports the heron rookery, could reduce the number of birds using the site or cause them to relocate the rookery. Nonetheless, a portion of the rookery would be permanently lost, and the functionality of the full rookery would be lost during construction, resulting in a moderate impact. Changes to wetlands in areas that are currently managed for wintering waterfowl could degrade the utility of those areas for species such as cackling geese, although it is assumed that conversion from managed grassland habitat would not reduce its extent below the goals set by the CCP. Goals include maintaining 168 acres of short perennial grasses for winter forage for geese, along with 71 acres of unmowed grassland habitat for nesting and foraging habitat. However, because the Proposed Action would result in extensive new riparian vegetation, restored wetlands, and a plant community comprised of more native species than under current conditions, this impact would be low.

3.15.2.2.2 ESA/State-Listed Wildlife

Long-term impacts to ESA/state-listed wildlife would only be to streaked horned larks in the event that they colonized the area. Enhancement of wetland areas resulting in additional unvegetated surface area would be likely to occur, and could substantially increase breeding habitat for this species.

3.15.2.2.3 Marine Mammal Protection Act

The occurrence of marine mammals in the lower Columbia River is primarily due to prey species such as migrating salmonids moving up the river system. Because the objective of the Proposed Action is to reconnect Gibbons Creek and the Steigerwald floodplain to the Columbia River, with the ultimate goal of enhancing salmonid habitat, salmonid populations could increase to some extent, as would their densities in the action area. If this occurs and salmonids begin to move into and out of the action area at higher frequencies, they could attract predators such as marine mammals to this area, resulting in enhanced conditions for marine mammals.

3.15.3 Environmental Consequences – No Action

Under the no action alternative, the project area would continue to provide a productive and important site for native wildlife species in the region. It would offer seasonally important habitat features for a diversity of native migratory birds, mammals, reptiles, and amphibians that are identified in the current species list for the Refuge (USFWS 2010). Assuming that current vegetation and other land management practices would continue, important habitat features for target species, including the cackling goose and purple martin, would be perpetuated over the foreseeable future, allowing USFWS to continue to meet goals described in the CCP (USFWS 2005). These management activities likely result in some negative impacts to non-target wildlife species that may be inadvertently affected during grazing or mowing. These species are likely not to be ESA- or state-protected species. The no action alternative would also perpetuate partial isolation of the Refuge from the greater Lower Columbia Region. This would continue to help keep down populations of invasive species, further aiding in maintaining habitat quality. It would also perpetuate isolating the Refuge from native aquatic species, including species such as the western pond turtles, which occur upstream (Chmielewski 2016, personal communication). The no action alternative would result in no construction impacts to various species of migrating and nesting birds, resident mammals, and other wildlife species. No changes are anticipated that would impact ESA- or state-listed wildlife species, including the streaked horned lark.

3.15.4 Cumulative Impacts

By increasing the quality of wetland habitat over 550 acres, the Proposed Action would contribute substantially to the cumulative amount of wetland habitat that has been and is being restored in the estuary. Such habitats are highly valuable to migratory waterfowl, and the cumulative impacts of these multiple restoration projects is moderate in terms of supporting populations of migratory birds.

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CHAPTER 4 ENVIRONMENTAL COMPLIANCE AND PERMITTING

This section describes statutes, regulations, and Executive Orders that are relevant to the Proposed Action and the resources that could be affected by the Proposed Action.

4.1 National Environmental Policy Act

NEPA requires federal agencies to assess the impacts that their actions may have on the environment. Major federal actions significantly affecting the quality of the human environment require the preparation of an EIS. This EA has been prepared to determine if the project would create any significant environmental impacts that would warrant preparing an EIS, or whether it is appropriate to prepare a FONSI.

4.2 Cultural Resources

Cultural resources are protected through the following:

- Antiquities Act of 1906 (16 USC 431–433)
- Historic Sites Act of 1935 (16 USC 461–467)
- NHPA (54 USC 300101 *et seq.*)
- Archaeological Data Preservation Act of 1974 (16 USC 469 a–c)
- Archaeological Resources Protection Act of 1979 (16 USC 470 aa–mm), as amended
- Native American Graves Protection and Repatriation Act (25 USC 3001 *et seq.*)
- Executive Order 13007 Indian Sacred Sites
- American Indian Religious Freedom Act of 1978 (42 USC 1996, 1996a)

Cultural resources include objects, structures, buildings, sites, or districts that provide irreplaceable evidence of natural or human history of national, state, or local significance. These may include National Landmarks, archeological sites, and properties listed or eligible for listing in the NRHP.

Section 106 of NHPA requires federal agencies to consider the impacts of their actions on historic properties. The NHPA provides a process (known as the Section 106 process) that enables agencies to assess impacts on historic properties along with participation from interested and affected parties such as tribes, and then avoid, minimize, or mitigate for these impacts. Historic properties may be pre-contact or historic sites, including objects and structures that are included in or eligible for inclusion in the NRHP. Historic properties also include artifacts or remains within historic sites and properties of traditional and cultural importance to tribes.

If a federal agency plans to undertake a type of activity that could affect historic properties, it must consult with the appropriate State Historic Preservation Officer and/or tribes to make an assessment of the property and to assess impacts on identified historic properties. The NHPA specifies that a traditional cultural property may be determined to be eligible for inclusion on the NRHP. In carrying out its responsibilities under Section 106, a federal agency is required to

consult with any Indian tribe that attaches religious or cultural significance to any such properties, along with other potential consulting parties. On Oct. 6, 2015, BPA sent letters to the Yakima, Nez Perce, Cowlitz, Umatilla, and Warm Springs tribes to initiate consultation. The letters described the Proposed Action, described the planning process, provided a map of the Area of Potential Effect (APE), and provided avenues for commenting and additional coordination. As described in Section 1.5, initial coordination with the Grand Ronde Tribe occurred during the scoping period. Additionally, BPA is coordinating with the Washington Department of Archaeology and Historic Preservation regarding the eligibility of the WCRL and mitigation measures needed to reduce the effect of modifying it.

4.3 Wetlands, Floodplains, and Water Resources

Floodplains, streams, and wetlands are regulated under several federal and state statutes including the CWA (33 USC 1251 et seq.), Executive Orders 11988 (Floodplain Management) and 11900 (Protection of Wetlands), and Washington's Hydraulic Project Approval (HPA) process.

The CWA establishes the structure for (1) regulating discharges of pollutants into the waters of the U.S. and (2) regulating quality standards for surface waters. It is unlawful under the CWA to discharge any pollutant into navigable waters, unless a permit is obtained. The project sponsors would submit a Joint Aquatic Resources Permit Application to the Corps and WDFW prior to construction. The relevant sections of the CWA are described below.

4.3.1 Clean Water Act Section 401 (Water Quality Certification)

A federal permit to conduct an activity that causes discharge into navigable waters is issued only after the state certifies that existing water quality standards would not be violated if the permit were issued. Ecology would review the project's Section 402 and Section 404 permit applications for compliance with state water quality standards and grant certification if the permits comply with these standards. This project may be pre-certified for Section 401 compliance if it is permitted under a Section 404 Nationwide Permit (NWP) for restoration projects (see Section 4.3.3).

4.3.2 Clean Water Act Section 402 (NPDES)

This section authorizes the EPA and applicable state departments to permit the discharge of pollutants under the National Pollutant Discharge Elimination System (NPDES) for all land disturbances over one acre in size. The EPA, Region 10, has a general permit for discharges from construction activities. BPA would issue a Notice of Intent to attain coverage under this general permit, and would prepare a SWPPP describing methods to minimize construction discharges.

4.3.3 Clean Water Act Section 404

Authorization from the Corps is required in accordance with the provisions of Section 404 of the CWA when dredged or fill material is discharged into waters of the U.S., including wetlands. Federal regulations at 33 C.F.R. § 336.1 (a), provide that a Section 404 permit is not issued by the Corps to itself; however, the Corps shall apply all applicable substantive legal requirements, including public notice, opportunity for public hearing, and application of the Section 404 (b) (1)

guidelines. Project management would work with the Corps' regulatory process to comply with the CWA Section 404(b)(1) guidelines established by the EPA. The Corps NWP Program provides approval for a standard set of activities in wetlands and waters that have routine and known impacts.

Wetland restoration projects generally fall under a category of actions that has been pre-approved under the NWP program. To qualify for NWP authorization and to use the applicable states' pre-approved 401 water quality certification, the project must comply with the NWP general conditions, any regional or specific conditions and the applicable states' 401 water quality certification general or specific conditions. A "pre-certified" water quality permit means the 401 certification has been approved for all actions authorized by that particular NWP, provided all applicable national and regional NWP conditions and all applicable 401 certification conditions are adhered to. The permittee is not required to contact the certifying agency for further authorization or approval unless the 401 certification for a particular NWP requires it. Each NWP has an individual 404(b)(1) analysis associated with it that was made available for public comment during the FR notice announcing the renewed NWPs (77 FR 10184).

4.3.4 Hydraulic Project Approval

WDFW administers the HPA program under the state Hydraulic Code, which was specifically designed to protect fish. This legislation states that important opportunities exist to modify programs that provide for management and protection of the state's natural resources, including the state's forests, fish, and wildlife (Chapter 77.55 RCW). WDFW Habitat Biologists are available to help people and groups apply for an HPA and ensure their projects meet state conservation standards for finfish, shellfish and their aquatic environment.

4.3.5 Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899, as amended, regulates structures in or over any navigable water of the U.S., the excavating from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters. Section 408 of the act authorizes the Secretary of the Army, on the recommendation of the Chief of Engineers of the Corps, to grant permission for the alteration or occupation or use of a Corps' civil works project if the Secretary determines that the activity would not be injurious to the public interest and would not impair the usefulness of the project. The Rivers and Harbors Act is administered by the Corps and addresses structures or actions which may affect the course, location, condition, or capacity of navigable waterways.

In-water work would be required for implementation of the estuary restoration program. Under the implementing regulations for Section 10, the Corps issues permits for work in navigable waters of the U.S. BPA would obtain a Section 10 permit prior to implementing restoration actions in a "water of the U.S." as defined in the Rivers and Harbors Act and in a navigable water as defined by the Corps.

Under the Section 408 review process, the Corps would make a determination on the requested alteration to the in-place performance of the federally authorized Washougal FDR Project. BPA is following the Section 408 guidance (EC-1165-2-2-16) and submitting the required documentation necessary for the Corps to make a decision. Approval through Section 408 is

necessary to insure that alteration of the authorized federal project would not be injurious to the public interest and would not impair the usefulness of the flood control project.

4.4 Fish and Wildlife

Fish and wildlife are regulated under numerous state and federal laws. The most relevant regulations are described below.

4.4.1 Endangered Species Act

The ESA (16 USC § 1531 *et seq.*) established a national program for the conservation of threatened and endangered species of fish, wildlife, and plants, and the preservation of the ecosystems on which they depend. The ESA is administered by the USFWS for terrestrial species and some freshwater species, and by NMFS for anadromous fish and marine species. Requirements of the ESA ensure activities authorized, funded, and carried out by federal agencies are not likely to jeopardize the continued existence of any listed species or result in adverse impacts to designated critical habitat of a listed species. Section 7(a) of the ESA requires federal agencies to ensure that the actions they authorize, fund, and carry out do not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat. Section 7(c) of the ESA requires that federal agencies initiate consultation and prepare biological assessments addressing the potential impacts of their actions on listed or proposed endangered species and critical habitats.

Impacts to federally-listed anadromous fish, including Pacific lamprey, and critical habitat are covered by a programmatic BiOp issued by NMFS for BPA HIP projects (NMFS 2013a), and impacts to listed species terrestrial, marine, and non-anadromous fish species are covered by a BiOp issued by USFWS (USFWS 2013a). These BiOps are for habitat restoration projects on the Columbia River and Oregon coast that are funded by BPA under its HIP III, which is intended to mitigate for the impacts of the FCRPS on fish, wildlife, and their habitat.

The NMFS BiOp indicates that actions under this program are likely to have short-term adverse impacts to listed anadromous fish runs that may pass through the action area or access the restored habitat. These species are listed in Table 3-2 (Section 3.5.1). NMFS found that the program would not affect southern green sturgeon, eulachon, or Steller sea lion. The BiOp contains an incidental take statement that specifies the amount or extent of take that is allowed, the effect of the take, and the RPA measures and terms and conditions.

These BiOps identify a range of categories of actions that BPA may implement in its habitat restoration projects. For each category of action, subcategories specific to each project are identified, specific mitigation measures are described. The action categories and mitigation measures that pertain to the Proposed Action are listed in Table 4.1.

For each of the subcategories listed in Table 4.1, USFWS and NMFS have developed mitigation measures that must be applied to reduce potential impacts to listed species or their habitat during construction or operations. In addition to the mitigation measures that correspond to the specific action categories, the BiOps specify general aquatic mitigation measures applicable to all actions. These measures are applicable to project design and site preparation, work area isolation and fish salvage, conservation of aquatic species during construction and post-construction, and

conservation of terrestrial plants, wildlife, and aquatic invertebrates. Some of these measures have been incorporated as mitigation measures in this EA. All others are applicable and are described in their entirety in BPA's HIP III handbook (BPA 2016b) and in the programmatic BiOps. This project is being reviewed by the Restoration Review Team, which is comprised of BPA staff who help to ensure that such projects meet the BiOp requirements, promote interagency collaboration, advise in ways to maximize ecological benefits of BPA-funded restoration projects, facilitate site visits, and ensure that HIP III is used consistently across all projects.

Table 4-1: Action Categories and Subcategories Relevant to the Proposed Action

Action Category	Action Subcategories Relevant to the Proposed Action
Fish Passage Restoration	1a. Dams, water control, or legacy structures removal
	1c. Headcut and grade stabilization
	1f. Bridge and culvert removal or replacement
	1g. Bridge and culvert maintenance
River, Stream, Floodplain, and Wetland Restoration	2a. Improve secondary channel and wetland habitats
	2b. Setback or removal of existing berms, dikes, and levees
	2c. Protect streambanks using bioengineering methods
	2d. Install habitat-forming natural material instream structures
	2e. Riparian vegetation planting
	2f. Channel reconstruction
Invasive and Non-Native Plant Control	3a. Manage vegetation using physical controls
	3b. Manage vegetation using herbicides
Road and Trail Erosion Control, Maintenance, and Decommissioning	5b. Road decommissioning
Irrigation and Water Delivery/Management Actions	7g. Install new or upgrade/maintain existing fish screens
Special Actions (for terrestrial species)	9a. Install/develop wildlife structures
	9c. Implement erosion control practices
	9d. Plant vegetation
	9e. Tree removal for large wood projects

BPA has consulted with USFWS regarding potential impacts to Nelson's checkermallow, golden paintbrush, and bull trout, all of which are listed as threatened under the ESA. USFWS issued a BiOp that indicated that the Proposed Action could affect, but would not be likely to adversely affect, bull trout and golden paintbrush (USFWS 2016c). The BiOp also found that the Proposed Action could affect, and would be likely to adversely affect, Nelson's checkermallow. Adverse impacts to Nelson's checkermallow would occur during operations, when changes in hydrology could inundate the area in which it is found. It is assumed that all specimens of Nelson's

checkermallow found south of SR14 would be adversely affected by inundation. The BiOp specifies non-discretionary terms and conditions that the Refuge must comply with, as follows:

1. Continue to conduct annual monitoring in plots where Nelson's checkermallow occurs;
2. Continue to conduct annual vegetation management (invasive plant control and mowing); and,
3. Outplant additional checkermallow plants in suitable protected habitat and monitor the new populations to ensure the population does not decline because of the Proposed Action.

In addition to these terms and conditions, BPA would apply specific mitigation measures identified in the BiOp (USFWS 2016c).

4.4.2 Fish and Wildlife Conservation Act/Fish and Wildlife Coordination Act

The Fish and Wildlife Conservation Act (FWCA) encourages federal agencies to conserve and promote conservation of game and non-game species and their habitats. The FWCA requires federal agencies with projects affecting water resources to consult with USFWS and the state agency responsible for fish and wildlife resources, which in this case is WDFW. Analysis of impacts to fish and fish habitat in Section 3.5 of this document indicates that the adverse impacts would be low and temporary. BPA has consulted with USFWS regarding potential impacts to species that they regulate, and would implement the terms and conditions specified in Section 4.4.1, as well as relevant mitigation measures described in BPA's HIP III handbook (BPA 2016b).

4.4.3 Migratory Bird Treaty Act

The MBTA, as amended, implements various treaties and conventions between the U.S. and other countries, including Canada, Japan, Mexico, and Russia, for the protection of migratory birds (16 USC §§ 703-712). Under the MBTA, taking, killing, or possessing migratory birds, or their eggs or nests, is unlawful. The act classifies most species of birds as migratory, except for upland and nonnative birds.

The Department of Energy and USFWS have a memorandum of understanding to address migratory bird conservation in accordance with EO 13186 (Responsibilities to Federal Agencies to Protect Migratory Birds). This order directs each federal agency taking actions that may affect migratory birds to work with the USFWS to develop an agreement to conserve those birds. The memorandum of understanding addresses how both agencies can work cooperatively to address migratory bird conservation, and includes specific measures to consider implementing during project planning and implementation.

Specifically, this MOU describes the responsibilities of both parties as follows:

1. Protect, enhance, and manage habitats of migratory birds, to the extent practicable. This includes implementing management practices that avoid or minimize adverse impacts on migratory bird populations and their nesting, foraging, migration, staging or wintering habitats.

2. Promote monitoring, research, and information exchange related to migratory bird conservation and program actions that may affect migratory birds, and provide access to information on environmental contaminants and other avian stressors that are relevant to the conservation of migratory birds. This includes:
 - a. As practicable and compatible with other study needs and program mandates, collaborating on warranted studies: (1) on migratory bird species that may be affected by agency actions, infrastructure, or facilities; and (2) to identify habitat conditions essential to sustain migratory bird populations.
 - b. Sharing inventory, monitoring, and research results with other Federal and State agencies and Tribal Nations, as appropriate, and among DOE elements, as practicable, and with national repositories such as the Avian Knowledge Network.
 - c. Developing partnerships with other agencies and non-Federal entities to further bird conservation, as practicable.
3. Identify and pursue training opportunities for appropriate DOE and DOE contractor employees in appropriate methods and techniques to:
 - a. Inventory and monitor migratory birds;
 - b. Assess population status of migratory birds;
 - c. Assess temporal and spatial bird use within project areas;
 - d. Evaluate impacts of projects on migratory birds;
 - e. Develop management practices that avoid or minimize adverse impacts and promote beneficial proactive approaches to migratory bird conservation.
4. Participate annually, or as appropriate, in the interagency Council for the Conservation of Migratory Birds.
5. As identified in its charter, the duties of this Council include the following:
 - a. Sharing the latest resource information to assist in the conservation and management of migratory birds.
 - b. Developing an annual report of accomplishments and recommendations related to E.O. 13186.
 - c. Fostering partnerships to further the goals of E.O. 13186.
 - d. Selecting an annual recipient of a Presidential Migratory Bird Federal Stewardship Award for contributions to the protection of migratory birds.
6. Periodically evaluate the measures taken under this MOU, to protect, restore and enhance migratory birds, including avoiding or minimizing the take of migratory birds, to determine whether the most effective conservation measures are employed. These efforts will be coordinated through the FWS's Division of Migratory Birds.
7. Support efforts to promote the ecological, economic, and recreational values of migratory birds by supporting outreach and educational activities and materials, as appropriate.

4.4.4 Bald and Golden Eagle Protection Act

This act provides for the protection of bald and golden eagles by prohibiting the taking, possession and commerce of such birds, except under certain specified conditions. The act covers intentional acts of take or disturbance and acts in “wanton disregard” of the safety of bald or golden eagles. Take is defined as “to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.” “Disturbance” relates to activities that affect the viability of eagle populations (e.g., from nest or chick abandonment), which would result from otherwise normal, lawful business practices. The USFWS’s National Bald Eagle Management Guidelines (USFWS 2007) identify measures to avoid impacts to eagles during the nesting season. These measures differ depending on the type of activity (i.e. road construction, timber operations, off road use, etc.). Specific measures include developing buffers of vegetation or of distance where there is an active eagle nest between January 1 and August 15. No eagle nests have been identified in or near the construction area.

4.4.5 Marine Mammal Protection Act

The MMPA established a federal responsibility to conserve marine mammals within waters of the U.S. With certain specified exceptions, the MMPA establishes a moratorium on the taking and importation of marine mammals. All marine mammals are covered under the MMPA. Marine mammals that could be found in the Columbia River at the project area include harbor seals, Steller sea lion, and the California sea lion. Such occurrences are likely to be relatively rare, and these species would be likely to move elsewhere in the case of in-water construction.

4.4.6 Magnuson-Stevens Act

The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (now called the Magnuson-Stevens Act) was passed to prevent overfishing, rebuild fish populations, and conserve EFH. EFH is defined as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC § 1802(10)). Under the Magnuson-Stevens Act, NMFS promotes the protection of these habitats through review, assessment, and mitigation of activities that may adversely affect these habitats. The EFH mandate applies to all species managed under a Federal Fishery Management Plan (FMP). In Washington, Oregon, and California, there are four FMPs that cover groundfish, highly migratory species, coastal pelagic species, and Pacific salmon. Federal agencies must consider the impact of a proposed action on all four types of EFH. This project is located in the freshwater Columbia River and a tributary of the Columbia River, and is located below the Bonneville Dam. Therefore, both the Pacific salmon EFH and groundfish EFH are applicable in this area. The Pacific Salmon EFH designates EFH for Puget Sound pink salmon, Chinook salmon, and coho salmon. The full project area is within a 12-digit USGS hydrologic unit (170800010804) that is designated EFH for both Chinook and coho salmon. The Columbia River immediately adjacent to the project is designated EFH for groundfish (NMFS 2017).

4.5 Air Quality and Climate Change

4.5.1 Executive Orders 13653 and 13693

Executive Orders 13653 (Preparing the U.S. for the Impacts of Climate Change) and 13693 (Federal Leadership in Environment, Energy and Economic Performance) provide guidance to federal agencies on planning for climate change. These EOs require federal agencies to evaluate their climate change risks and vulnerabilities to manage the impacts of climate change on the agency's mission and operations in both the short and long-term as part of their formal planning processes, and to set sustainability goals for their operations.

Two recent CEQ guidance documents (Principles and Requirements for Federal Investments in Water Resources and Interagency Guidelines for Federal Investments in Water Resources) recommend that climate change adaptation processes be incorporated into NEPA processes to avoid instituting parallel planning (CEQ 2013a, 2013b). According to this guidance, climate change can be accounted by: 1) forecasting the key assumptions of future conditions; 2) characterizing the degree of uncertainty; 3) using multiple baselines; 4) accounting for changes resulting from a changing climate, including hydrologic and other conditions, increases in temporal and spatial variability of precipitation and water availability, and inundation in coastal areas; 5) using historical records and best available models to forecast projected future condition; and 6) giving particular consideration of climate change to long-lived projects (CEQ 2013b). The draft guidance encourages using the best available science to forecast the impacts of climate change “to enable evaluation of each alternative’s impacts on ecosystem resilience, the sustainability of critical ecosystem services, and the vulnerability of human and natural systems to climate change” (CEQ 2013b).

The Proposed Action has been designed with flexibility to respond to changing hydrologic conditions that may occur under various climate change scenarios. It would also offer benefits by attenuating higher flood flows that are predicted, and offering refugia to juvenile fish during high flows.

4.5.2 Clean Air Act

The CAA, as amended, requires the EPA and delegated states to carry out a wide range of regulatory programs intended to assure attainment of the NAAQS. The NAAQS are health standards set for criteria pollutants: CO; lead; NO₂; 8-hour ozone; PM₁₀ and PM 2.5 micrometers or less in diameter (PM_{2.5}); and SO₂. The EPA sets these standards and Ecology and ODEQ maintain a list of areas/counties that have exceeded these health standards and are considered “non-attainment” areas. The project area is in an attainment area and the construction emissions would be well below threshold levels. Furthermore, there would be no stationary sources of emissions during operations, therefore there would be no new sources of GHGs associated with the project. Therefore, air quality impacts and contributions to climate change would be low.

4.6 Other Relevant Regulations

4.6.1 Farmland Protection Policy Act

The Farmland Protection Policy Act directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands. The purpose of this act is to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to non-agricultural uses. The Proposed Action could affect up to 115 acres of Prime Farmland by lowering its elevation and exposing it to seasonal inundation. This action, however, would not be likely to result in the loss of such farmland, as it would still be accessible to farming practices such as grazing and mowing during most times of the year when such uses would be desired.

4.6.2 Environmental Justice, Executive Order 12898

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority and Low-income Populations) was released to federal agencies in February 1994. This order states that federal agencies shall identify and address, as appropriate, disproportionately high and adverse human health or environmental impacts of its programs, policies, and activities on minority and low income populations. Although part of the Proposed Action would occur in an environmental justice community, the environmental impacts of the components of the project that would occur there would be relatively minor. Impacts would include temporarily increased noise and traffic during construction, and long-term impacts to visual resources due to the presence of the floodwall. The floodwall would be constructed to provide continued flood protection to residents of this area, and it could not be placed elsewhere. Impacts related to environmental justice would be moderate.

4.6.3 Federal Noxious Weed Act

This federal act, as amended in 2009, directs federal agencies to manage undesirable plant species on federal lands when management programs for those species are in place on state or private land in the same area. Undesirable plant species are defined as those that are classified as undesirable, noxious, harmful, exotic, injurious, or poisonous, pursuant to state or federal law. A noxious weed list (7 CFR 360.200) is developed by the Secretary of Agriculture, which lists noxious weeds (as defined by the Plant Protection Act) that are subject to restrictions on interstate movement (7 USC § 7712).

Mitigation measures that are incorporated into the planning and design of this project directly address the import, spread, or establishment of invasive species, and are sufficient to control the spread or introduction of these species. During operations, ongoing invasive weed control would target populations of the most noxious species.

4.6.4 Executive Order 13112 Invasive Species

EO 13112 calls upon federal agencies to take steps to prevent the introduction and spread of invasive species and to support efforts to eradicate and control established populations of invasive species. USFWS will update the Refuge's invasive species management plan in response to the increased potential for the spread of invasive species due to disturbance of soils

during construction and because of the heightened potential for introduction of water-borne propagules due to direct inflow of waters from the Columbia River.

4.6.5 Comprehensive Environmental Response Compensation Liability Act, as Amended

The Comprehensive Environmental Response Compensation Liability Act (42 USC 9601 *et seq.*), as amended, provides funding for hazardous materials training in emergency planning, preparedness, mitigation implementation, response, and recovery. Eligible individuals include public officials, emergency service responders, medical personnel, and other tribal response and planning personnel. No sites listed under this act are located within the project area.

4.6.6 Shoreline Substantial Development Permit

Substantial Development Permits (SDPs) are required by the State of Washington for all developments (unless exempt) that meet the legal definition of substantial development, which includes any development of which the total cost or fair market value exceeds five thousand dollars, or any development which materially interferes with the normal public use of the water or shorelines of the state. SDPs are reviewed and processed by local governments and subsequently sent to Ecology for filing. Under WAC 173-27-150, substantial development permits cannot be approved unless they are consistent with policies and procedures of the Shoreline Management Act, Ecology rules, and the local master program. In addition, state rules under WAC 173-27-140 prohibit issuance of permits for any new or expanded building or structure of more than 35 ft. above average grade level on shorelines of the state that would obstruct the view of a substantial number of residences on areas adjoining such shorelines, except where a master program does not prohibit the same and then only when overriding considerations of the public interest would be served.

4.7 Permitting and Environmental Clearances

A summary of the compliance status of several of the key permits and environmental processes is given in Table 4-2.

Table 4-2: Permits and Environmental Clearances

RELEVANT LAW / REGULATION	AGENCY	COMPLIANCE STATUS
NEPA 42 USC 4321 <i>et seq.</i>	Council on Environmental Quality	Draft EA to be circulated for public review in winter of 2017-2018.
CWA 33 USC 1251 <i>et seq.</i> ; Section 404	Corps	Section 404 permit application will be submitted during later stages of design.
CWA Section 401	Ecology	LCEP will apply for Section 401 Water Quality Certification unless project is preauthorized.

RELEVANT LAW / REGULATION	AGENCY	COMPLIANCE STATUS
FWCA 16 USC 661 et seq.	USFWS	Coordination with USFWS as part of Section 7 consultation is complete. A Coordination Act Report will be requested by the Corps during the permitting phase to coordinate measures to reduce impacts to non-listed species.
ESA 16 USC 1531 et seq.	USFWS and NMFS	Coordination with USFWS for impacts to terrestrial species and bull trout complete in May 2016. Ongoing coordination with NMFS for compliance with HIP III BiOp. Project is under review by RRT.
CAA USC 7401	EPA	Project would be in compliance with the CAA.
Columbia Gorge Scenic Area Compliance	USFS	LCEP is coordinating with USFS and will submit an application for a permit to construct the components of the project that would occur within the scenic area later in the design process.
Rivers and Harbors Acts 33 USC 403	Corps	Review for Section 10 will occur concurrently with Section 404 application. Coordination under Section 408 is ongoing.
Coastal Zone Management Act/Shoreline SDP	Ecology	Coordination for approval to occur during permitting phase.
NHPA 54 USC 300101	Washington State Department of Archaeology and Historic Preservation	Project is being coordinated with Washington State Department of Archaeology and Historic Preservation, and surveys for cultural resources are ongoing.
Executive Order 11988, Floodplain Management	FEMA	In compliance.
HPA	WDFW	Coordination for approval to occur during permitting phase.
MBTA 16 USC §§ 703-712	USFWS	LCEP and BPA to coordinate measures to avoid impacts to MBTA species and mitigate for impacts.

CHAPTER 5 TRIBES, AGENCIES, AND PERSONS RECEIVING THE EA

Those consulted or receiving notice of document availability include local, state, and federal agencies, public officials, and tribes in the project vicinity. Specific individuals were contacted to gather information and data about the project area and applicable requirements.

5.1 Federal

National Marine Fisheries Service (NMFS)

Senator Patty Murray

Senator Maria Cantwell

Representative Jaime Herrera Beutler

U.S. Environmental Protection Agency (EPA)

U.S. Army Corps of Engineers (Corps)

U.S. Fish and Wildlife Service (USFWS), Washington Fish and Wildlife Office, Lacey

5.2 State Agencies

U.S. Forest Service (USFS), Portland, Oregon

Washington Department of Ecology (Ecology)

Washington Department of Fish and Wildlife (WDFW)

Washington Department of Transportation (WSDOT)

Washington State Governor's Office

State of Washington House and Senate, Districts 14 and 18

Washington State Department of Archaeology and Historic Preservation

Southwest Clean Air Agency (SWCAA)

5.3 Tribes

Confederated Tribes of the Grand Ronde Community of Oregon

Chinook

Clatsop-Nehalem

Siletz

Warm Springs

Cowlitz

Confederated Tribes of the Umatilla Indian Reservation Nez Perce

Shoalwater

5.4 Local Governments

Clark County, Washington

City of Washougal

City of Camas

Skamania County Public Utility District

Port of Camas-Washougal (Port)

5.5 Other

Burlington Northern Santa Fe (BNSF) Railroad

Lower Columbia Fish Recovery Board (LCFRB)

CHAPTER 6 LIST OF PREPARERS AND REVIEWERS

Name	Education	Years of Experience	Project Role
Tetra Tech			
David Munro, PWS	MA, Natural Resources Management	22	Project Manager, Wetlands
Tricia Gross	BS, Marine Biology	17	Fisheries
Jeff Barna, CWB	MS, Ecology and Evolutionary Biology	16	Wildlife
Sara Townsend	MS, Wildlife Ecology and Conservation	20	Deputy Project Manager, Vegetation, Wetlands, Soils and Geology
Toni Pennington, Ph.D.	Ph.D., Aquatic Biology	13	Water Quality / Hydrology
Patti Sexton, PE, CFM	MS, Water Resource Engineering	20	Section 408 Editor/Writer
Chuck Kirchner	MA, Urban Affairs	38	Land Use/ Recreation
Emmy Andrews	MS, Environmental Management	11	Air Quality, Noise, Public Health and Safety, Transportation
Erin King, RPA	MA, Cultural Anthropology	15	Cultural Resources
James Carney	BA, Environmental Economics	7	Socioeconomics
Robert Evans	MS, Landscape Architecture	9	Aesthetics / Visual Resources
Greg Woloveke	BS, Ecological Engineering	4	GIS
Merri Martz, PWS	MMA, Marine Affairs, Wetland Ecology	24	QA/QC for Biological Resources
Peter Stroud, CEG	BA, Geology	31	QA/QC for Physical Resources
Historical Research Associates			
Natalie Perrin	MS, Historic Preservation	8	Cultural Resources

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CHAPTER 8 APPENDICES

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Appendix A: Scoping Summary Report

Steigerwald Floodplain Restoration Project
Scoping Summary Report

Formal public scoping for the Steigerwald Floodplain Restoration Project EA was initiated on December 28, 2015 and closed on January 27, 2016. BPA initiated the scoping period for the EA by mailing public letters and maps to interested parties and creating a project webpage at: https://www.bpa.gov/efw/Analysis/NEPADocuments/Pages/Steigerwald_Floodplain_Restoration.aspx. A public meeting was conducted for the project in Washougal, WA on January 14, 2016, with attendance from a total of 32 members of the public. Attending the public meeting were representatives from BPA, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Lower Columbia Estuary Partnership, and the Friends of the Columbia Gorge Land Trust. BPA also met with natural resources and tribal staff members of the Confederated Tribes of the Grand Ronde in Grand Ronde, OR on January 26, 2016. During the scoping period, BPA received 21 comments, either at the scoping meeting, electronically, or by mail. Comments are posted in their entirety at the project webpage linked above.

During the scoping period, BPA received written comments from the following individuals/organizations:

<u>Name</u>	<u>Organization</u>
Gridley	Gibbons Forever
Pinkernell	Individual
Starr	Individual
Devlin	Individual
Danielson	Gibbons Creek Mobile Estates LLC
Sixberry	Individual
Pace	Individual
Clapp	Individual
Kelly	Individual
Burhenn	Individual
Campbell	Individual
Rhodig	Individual
Helmeste	Individual
Hickey	Individual
Breckel	Lower Columbia Fish Recovery Board
Williams	Washington State Department of Transportation
Wall/Evers	Cities of Camas and Washougal
Hutchison	Individual
Tetz	Clark Public Utilities
Karnosh	Confederated Tribes of the Grand Ronde Community of Oregon
James	Individual

Issues raised during the scoping process can generally be divided into the following issue categories:

Fish

BPA received several comments on the anticipated effects of the project on fish species using Gibbons Creek and the Steigerwald lake system. Certain comments requested information on types of fish currently using the area, while others requested information on types of fish anticipated to use the area for refugia or spawning after project completion. Representative comments on fish included the following:

- What species is the project intended to protect and enhance?
- What species have historically used the area for refugia? What species spawn in Gibbons Creek?
- Will there be monitoring associated with the project to determine how the project impacts fish, particularly after project completion?
- What efforts will be taken if the project improves habitat for fish other than salmonids such as pike-minnows, chub, suckers, carp, bass, etc?
- It is important to more fully evaluate potential benefits and impacts in the context of broader goals, strategies and actions outlined in the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan.
- It is not clear how the proposed timing, extent and duration of anticipated connection to the Columbia River would relate to the various life history stages of salmonid species expected to use the site.
- The EA should provide detailed information on the anticipated duration, frequency and extent of fish access, in relation to the key life history stages of each population expected to use the site.
- Following construction and deconstruction work, routine monitoring of project objectives will be necessary. In addition to channel maintenance, probable need for other activities such as periodic checks for fish stranding and resultant salvage operations, should be recognized and provided for in the EA.
- Prior to construction activity, installation of water temperature logs in Steigerwald Lake and seining there to gather baseline fish population information is recommended.
- Consider releasing PIT tagged groups of coho and/or steelhead smolts into Gibbons Creek, then at the creek's mouth record their success in passing through the refuge.

Wildlife

Many commenters requested that BPA consider the impacts of the proposal on wildlife either currently within the project area or anticipated to return to the project area post-completion. Certain comments requested that surveys be conducted to determine population trends of various wildlife species both before and after the project. Comments on wildlife included:

- How will the project affect wildlife?
- Is there a plan for wildlife surveys for species before and after the project to determine impacts and trends?
- What impacts, either positive or negative, will the project have on turtles in and around the Refuge?
- Does the project area support cormorants? If so, will they be affected?
- Please ensure that beavers are able to be a part of the ecosystem within the refuge.

Cultural/Tribal Resources

BPA had the opportunity to meet with and received comments from the Confederated Tribes of the Grand Ronde. Interests of the tribe included ensuring that notification and consultation be completed for any cultural resources found in the area, and raising the possibility that the project may create new opportunities for partnerships. Comments regarding cultural and tribal resources included:

- Will the project allow opportunities for planting new populations of plants important to tribes, such as wapato?
- Will the project allow opportunities for partnerships with tribes to allow access for gathering culturally significant plants?
- Will the project allow opportunities for tribal interpretation?
- How will BPA ensure that cultural resources within the project area are protected?

Vegetation

Certain comments requested impacts of the project on existing vegetation and potential new vegetation within the Refuge, including:

- What impacts will the project have on invasive plants within the Refuge?
- What impacts will the project have on trees bordering Gibbons creek west of the Refuge?

Flood Risk/Flood Potential/Erosion

Many neighboring residents and landowners in the City of Washougal requested information on whether the project would lead to increased flood risk and/or erosion associated with the project. Such comments included:

- Will there be any increased flood risk associated with lowering the levee?
- The existing levee along the river eroded and had to be fortified during the 1996 Columbia River flood. How would the setback levees be built to high standards to ensure that this does not occur again?
- What impacts will the project have on flood risk during winter months and heavy rains?
- Will the project lead to increased erosion to private land along the Columbia River? If erosion is anticipated, what measures can be incorporated to minimize this loss?

Water Resources

Some comments requested that the EA consider the impact of the project, both positive and negative, on water quality both in Gibbons Creek and in the Refuge. Additionally, comments raised issues regarding the project and the relationship to municipal water supplies. These comments included:

- What impacts will increased development upstream on Gibbons Creek have on sediment transport, and water quality?
- Will the project enhance wetlands?

Project Design

Many comments requested specific inclusions in the project design, both in terms of recreation and access and in terms of the floodplain and stream channel reconstruction. One comment requested consideration of a new alternative that would maintain the existence of the Gibbons Creek elevated channel and the fish ladder. Such comments included:

- Instead of proceeding with the project as proposed, and in order to reduce costs and increase salmonid survival in the area, could the diversion structure be removed and the elevated channel be widened to accommodate high Gibbons Creek flows?
- Please maintain the width of the trail on top of the levee to ensure that there is sufficient room for vehicles and pedestrians to pass.
- Suggest that the levee be left at its current height in certain locations to facilitate better views of the river and surrounding landscape.
- Why is replacement of the Highway 14 bridge an aspect of the proposal? How is this an obligation of the FCRPS?
- Is there any plan to add gravel or structure to Gibbons Creek?
- The project proposes construction of a flood wall on private property north of Highway 14. The private property landowner is against any modification to his property and to Gibbons Creek.
- The project as proposed will require an adequate channel through the alluvial fan in order to allow fish passage. Otherwise, fish blockage, delays, and mortality are expected.
- Will the proposal consider alternative locations for the setback levees, particularly around the property owned by the cities of Camas/Washougal?
- Who will own and manage the restoration project systems?

Proposed Camas/Washougal Water Well Field

The cities of Camas and Washougal have purchased property that is proposed to be bisected by the western setback levee for the project. This property is the site of the future Steigerwald Well Field, which is a groundwater supply project intended to provide future water supply needs. Comments received from the two cities and from the Lower Columbia Fish Recovery Board raised issues regarding project design included:

- How will the project impact and/or affect the feasibility of developing a regional water supply well field at property in the project area owned by the Cities of Camas and Washougal?
- For the project to be completed, there need to be assurances that the restoration will not be a basis for any challenge to the development and operation of the well field.
- The EA should thoroughly evaluate the impacts of the project on the development of the Steigerwald Lake regional municipal water supply.
- The elevation of the well field property should be raised to 38 feet for access roads and well buildings and 35 feet for the wellhead sanitary control zone to eliminate any issues with access or maintenance of future water wells during a large flood event.
- The proposed setback levee as described in the 30% design will divide the well field property. Access provisions to the east half of property will be required, designed to accommodate construction and maintenance equipment vehicle loadings, limited clearance and turning movements.
- Proposed site utilities at the Camas and Washougal well field include raw water transmission, water treatment plant backwash discharge, power / communication conduits and pipeline air release / siphon breaker installations at the levee crest. Increased construction costs and future permitting requirements resulting from levee routing through the property would dictate that the installation of these pipeline crossings occur with the proposed levee construction.

- Levee construction will result in a loss of developable property. Levee easement, setback and use restrictions must be identified and compatible with well field development including potential overlap of wellhead sanitary control zones.
- New and modified levees are proposed to include pedestrian trails. What security measures will the project include to protect the well development project?
- How will BPA ensure that all commitments to the cities of Camas and Washougal are followed? Will BPA ensure that all uses associated with the proposed well development project be permitted and guaranteed into the future?

Other Comments

Members of the public also raised issues not falling into any of the categories described above. Comments on these other issues included the following:

- What impacts will increased development upstream on Gibbons Creek have on air quality?
- What costs will this project have on the local population?
- Will there be any noise associated with project construction?
- Will the project have impacts on traffic on Highway 14?
- What is the commitment to maintain Gibbons Creek north of Highway 14?
- The City of Washougal has proposed a bus barn north of Highway 14 adjacent to the project area. What effects will this proposal have on the project and the area?
- What is the estimated cost savings to the Port?
- Will the project have any land use or regulatory consequences to neighboring or affected properties?
- The project is within the Columbia River Gorge National Scenic Area. How will this be considered?
- How can public access to the present recreation trails be maintained?
- What is the relationship of the project to the Northwest Power and Conservation Council and Independent Scientific Review Panel?
- Will BPA be looking at other restoration projects to learn lessons about similar types of projects?
- Will the project have any impacts on operations or access to overhead or buried power lines at or surrounding the Refuge?

Appendix B: BPA's HIP III Mitigation Measures

Steigerwald
BPA project #2003-011-00
Contract #70379

3/30/16

HIP III CONSERVATION MEASURES

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General Aquatic Conservation Measures Applicable to all Actions

The activities covered under the HIPIII are intended to protect and restore fish and wildlife habitat with long-term benefits to ESA-listed species. However, project construction may have short-term adverse effects on ESA-listed species and associated critical habitat. To minimize these short-term adverse effects and make them predictable for the purposes of programmatic analysis, the BPA will include in all projects implemented under this HIP III proposed action the following general conservation measures (developed in coordination with USFWS and NMFS) applicable to.

Variance Requests

Because of the wide range of proposed activities and the natural variability within and between stream systems, some projects may require minor variations from criteria specified herein. The Services will consider granting variances, especially when there is a clear conservation benefit or there are no additional adverse effects (especially incidental take) beyond that covered by the opinion. Minor variances can be authorized by the Services at the NMFS Branch Chief or FWS Field Office Supervisor level. Variances can be sought on minor alterations to the proposed action (conservation measures) and reasonable and prudent measures.

Minor variance requests may be submitted and approved by email correspondence and will include:

- 1) Name and brief description of project, location of project and 6th field HUC number.
- 2) Define the requested variance and the relevant criterion by page number.
- 3) Current environmental conditions (current flow and weather conditions).
- 4) Biological justification as to why a variance is necessary and a brief rationale why the variance will either provide a conservation benefit or, at a minimum, not cause additional adverse effects beyond the scope of the Opinion
- 5) Include as attachments any necessary approvals by state agencies.

Documentation (to be posted onsite)

- 1) Name(s), phone number(s), and address(es) of the person(s) responsible for oversight.
- 2) A description of hazardous materials that will be used, including inventory, storage, and handling procedures.
- 3) Procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities.
- 4) A standing order to cease work in the event of high flows (above those addressed in the design and implementation plans) or exceedance of take or water quality limitations.

Project Design and Site Preparation

- 1) **Climate change.** Best available science regarding the future effects within the project area of climate change, such as changes in stream flows and water temperatures, will be considered during project design.
- 2) **State and Federal Permits.** All applicable regulatory permits and official project authorizations will be obtained before project implementation. These permits and authorizations include, but are not limited to, National Environmental Policy Act, National Historic Preservation Act, and the appropriate state agency removal and fill permit, USACE Clean Water Act (CWA) 404 permits, and CWA section 401 water quality certifications.
- 3) **Timing of in-water work.** Appropriate state (Oregon Department of Fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), Idaho Department of Fish

and Game (IDFG), and Montana Fish Wildlife and Parks (MFWP)) guidelines for timing of in-water work windows (IWW) will be followed.

- a) Bull trout - While utilizing the appropriate State designated in-water work period will lessen the risk to bull trout, this alone may not be sufficient to adequately protect local bull trout populations. This is especially true if work is occurring in spawning and rearing areas because eggs, alevin, and fry are in the substrate or closely associated habitats nearly year round. Some areas may not have designated in-water work windows for bull trout or if they do, they may conflict with work windows for salmon and steelhead. If this is the case, or if proposed work is to occur within bull trout spawning and rearing habitats, project proponents will contact the appropriate USFWS Field Office (see Appendix B in this BO) to insure that all reasonable implementation measures are considered and an appropriate in-water work window is being used to minimize project effects.
 - b) Lamprey – the project sponsor and/or their contractors will avoid working in stream or river channels that contain Pacific Lamprey from March 1 to July 1 in low to mid elevation reaches (<5,000 feet). In high elevation reaches (>5,000 feet), the project sponsor will avoid working in stream or river channels from March 1 to August 1. If either timeframe is incompatible with other objectives, the area will be surveyed for nests and lamprey presence, and avoided if possible. If lampreys are known to exist, the project sponsor will utilize dewatering and salvage procedures outlined in US Fish and Wildlife Service (2010)¹.
 - c) Exceptions to ODFW, WDFW, MFWP, or IDFG in-water work windows will be requested from NMFS and the FWS. An IWW variance request (pre-coordinated with staff biologists) will be e-mailed from an appropriate representative of the action agency to the NMFS Habitat Branch Chief and the FWS Field Office Supervisor for the project area. Work will not proceed outside of the IWW until the exception is approved by e-mails from NMFS and/or the FWS.
- 4) **Contaminants.** The project sponsor will complete a site assessment with the following elements to identify the type, quantity, and extent of any potential contamination for any action that involves excavation of more than 20 cubic yards of material:
- a) A review of available records, such as former site use, building plans, and records of any prior contamination events;
 - b) A site visit to inspect the areas used for various industrial processes and the condition of the property;
 - c) Interviews with knowledgeable people, such as site owners, operators, and occupants, neighbors, or local government officials; and
 - d) A summary, stored with the project file that includes an assessment of the likelihood that contaminants are present at the site, based on items 5(a) through 5(c).
- 5) **Site layout and flagging.** Prior to construction, the action area will be clearly flagged to identify the following:

¹ U.S. Fish and Wildlife Service. 2010. Best management practices to minimize adverse effects to Pacific lamprey. Available online at: <http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf>

- a) Sensitive resource areas, such as areas below ordinary high water, spawning areas, springs, and wetlands;
 - b) Equipment entry and exit points;
 - c) Road and stream crossing alignments;
 - d) Staging, storage, and stockpile areas; and
 - e) No-spray areas and buffers.
- 6) **Temporary access roads and paths.**
- a) Existing access roads and paths will be preferentially used whenever reasonable, and the number and length of temporary access roads and paths through riparian areas and floodplains will be minimized to lessen soil disturbance and compaction, and impacts to vegetation.
 - b) Temporary access roads and paths will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. If slopes are steeper than 30%, then the road will be designed by a civil engineer with experience in steep road design.
 - c) The removal of riparian vegetation during construction of temporary access roads will be minimized. When temporary vegetation removal is required, vegetation will be cut at ground level (not grubbed).
 - d) At project completion, all temporary access roads and paths will be obliterated, and the soil will be stabilized and revegetated. Road and path obliteration refers to the most comprehensive degree of decommissioning and involves decompacting the surface and ditch, pulling the fill material onto the running surface, and reshaping to match the original contour.
 - e) Temporary roads and paths in wet areas or areas prone to flooding will be obliterated by the end of the in-water work window.
- 7) **Temporary stream crossings.**
- a) Existing stream crossings will be preferentially used whenever reasonable, and the number of temporary stream crossings will be minimized.
 - b) Vehicle fords will only be allowed in intermittent streams with no anadromous fish spawning.
 - a) Temporary bridges and culverts will be installed to allow for equipment and vehicle crossing over perennial streams during construction.
 - b) Equipment and vehicles will cross the stream in the wet only where:
 - i. The streambed is bedrock; or
 - ii. Mats or off-site logs are placed in the stream and used as a crossing.
 - c) Vehicles and machinery will cross streams at right angles to the main channel wherever possible.
 - d) The location of the temporary crossing will avoid areas that may increase the risk of channel re-routing or avulsion.
 - e) Potential spawning habitat (i.e., pool tailouts) and pools will be avoided to the maximum extent possible.
 - f) No stream crossings will occur at active spawning sites, when holding adult listed fish are present, or when eggs or alevins are in the gravel. The appropriate state fish and wildlife agency will be contacted for specific timing information.
 - g) After project completion, temporary stream crossings will be obliterated and the stream channel and banks restored.

- 2) **Staging, storage, and stockpile areas.**
 - a) Staging areas (used for construction equipment storage, vehicle storage, fueling, servicing, and hazardous material storage) will be 150 feet or more from any natural water body or wetland, or on an adjacent, established road area in a location and manner that will preclude erosion into or contamination of the stream or floodplain.
 - b) Natural materials used for implementation of aquatic restoration, such as large wood, gravel, and boulders, may be staged within the 100-year floodplain.
 - c) Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during site restoration at a specifically identified and flagged area.
 - d) Any material not used in restoration, and not native to the floodplain, will be removed to a location outside of the 100-year floodplain for disposal.
- 3) **Equipment.** Mechanized equipment and vehicles will be selected, operated, and maintained in a manner that minimizes adverse effects on the environment (e.g., minimally-sized, low pressure tires; minimal hard-turn paths for tracked vehicles; temporary mats or plates within wet areas or on sensitive soils). All vehicles and other mechanized equipment will be:
 - a) Stored, fueled, and maintained in a vehicle staging area placed 150 feet or more from any natural water body or wetland or on an adjacent, established road area;
 - b) Refueled in a vehicle staging area placed 150 feet or more from a natural waterbody or wetland, or in an isolated hard zone, such as a paved parking lot or adjacent, established road (this measure applies only to gas-powered equipment with tanks larger than 5 gallons);
 - c) Biodegradable lubricants and fluids should be used, if possible, on equipment operating in and adjacent to the stream channel and live water.
 - d) Inspected daily for fluid leaks before leaving the vehicle staging area for operation within 150 feet of any natural water body or wetland; and
 - e) Thoroughly cleaned before operation below ordinary high water, and as often as necessary during operation, to remain grease free.
- 4) **Erosion control.** Erosion control measures will be prepared and carried out, commensurate in scope with the action, that may include the following:
 - a) Temporary erosion controls.
 - i. Temporary erosion controls will be in place before any significant alteration of the action site and appropriately installed downslope of project activity within the riparian buffer area until site rehabilitation is complete.
 - ii. If there is a potential for eroded sediment to enter the stream, sediment barriers will be installed and maintained for the duration of project implementation.
 - iii. Temporary erosion control measures may include fiber wattles, silt fences, jute matting, wood fiber mulch and soil binder, or geotextiles and geosynthetic fabric.
 - iv. Soil stabilization utilizing wood fiber mulch and tackifier (hydro-applied) may be used to reduce erosion of bare soil if the materials are noxious weed free and nontoxic to aquatic and terrestrial animals, soil microorganisms, and vegetation.
 - v. Sediment will be removed from erosion controls once it has reached 1/3 of the exposed height of the control.
 - vi. Once the site is stabilized after construction, temporary erosion control measures will be removed.
 - b) Emergency erosion controls. The following materials for emergency erosion control will be available at the work site:

- i. A supply of sediment control materials; and
 - ii. An oil-absorbing floating boom whenever surface water is present.
- 5) **Dust abatement.** The project sponsor will determine the appropriate dust control measures (if necessary) by considering soil type, equipment usage, prevailing wind direction, and the effects caused by other erosion and sediment control measures. In addition, the following criteria will be followed:
- a) Work will be sequenced and scheduled to reduce exposed bare soil subject to wind erosion.
 - b) Dust-abatement additives and stabilization chemicals (typically magnesium chloride, calcium chloride salts, or ligninsulfonate) will not be applied within 25 feet of water or a stream channel and will be applied so as to minimize the likelihood that they will enter streams. Applications of ligninsulfonate will be limited to a maximum rate of 0.5 gallons per square yard of road surface, assuming a 50:50 (ligninsulfonate to water) solution.
 - c) Application of dust abatement chemicals will be avoided during or just before wet weather, and at stream crossings or other areas that could result in unfiltered delivery of the dust abatement materials to a waterbody (typically these would be areas within 25 feet of a waterbody or stream channel; distances may be greater where vegetation is sparse or slopes are steep).
 - d) Spill containment equipment will be available during application of dust abatement chemicals.
 - e) Petroleum-based products will not be used for dust abatement. Water drafting/pumping (for dust suppression or other needs) will be done in accordance with the following criteria:
 - i) Non-stream sources will be used prior to the use of stream sources whenever feasible;
 - ii) when non-stream sources are unavailable, streams with the greatest flow will be used whenever feasible;
 - iii) water withdrawal will not reduce stream flow by more than 1/10th (stream flow may be estimated visually). For pumps with adjustable pump rates, pumping rates will be adjusted to avoid drafting more than 1/10th of the current stream flow;
 - iv) streams with less than 5 cfs are used for drafting, no more than 18,000 gallons will be removed in one day;
 - v) if streams with less than 5 cfs are used for drafting, no more than one pump will operate at one time at any one drafting site;
 - vi) no water will be drafted from sites where adult salmonids are visibly present, to prevent interference with spawning activities;
 - vii) no dams or channel alterations will be made for pumping in streams occupied by listed fish species.
- 6) **Spill prevention, control, and counter measures.** The use of mechanized machinery increases the risk for accidental spills of fuel, lubricants, hydraulic fluid, or other contaminants into the riparian zone or directly into the water. Additionally, uncured concrete and form materials adjacent to the active stream channel may result in accidental discharge into the water. These contaminants can degrade habitat, and injure or kill aquatic food organisms and ESA-listed species. The project sponsor will adhere to the following measures:
- a) A description of hazardous materials that will be used, including inventory, storage, and handling procedures will be available on-site.

- b) Written procedures for notifying environmental response agencies will be posted at the work site.
 - c) Spill containment kits (including instructions for cleanup and disposal) adequate for the types and quantity of hazardous materials used at the site will be available at the work site.
 - d) Workers will be trained in spill containment procedures and will be informed of the location of spill containment kits.
 - e) Any waste liquids generated at the staging areas will be temporarily stored under an impervious cover, such as a tarpaulin, until they can be properly transported to and disposed of at a facility that is approved for receipt of hazardous materials.
 - f) Vegetable based hydraulic fluids (biodegradable oil) will be used in any vehicle that will be operated near the water.
- 7) **Invasive species control.** The following measures will be followed to avoid introduction of invasive plants and noxious weeds into project areas:
- a) Prior to entering the site, all vehicles and equipment will be power washed, allowed to fully dry, and inspected to make sure no plants, soil, or other organic material adheres to the surface.
 - b) Watercraft, waders, boots, and any other gear to be used in or near water will be inspected for aquatic invasive species.
 - c) Wading boots with felt soles are not to be used due to their propensity for aiding in the transfer of invasive species.

Work Area Isolation & Fish Salvage.

Any work area within the wetted channel will be isolated from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is less than 300-feet upstream from known spawning habitats. When work area isolation is required, design plans will include all isolation elements, fish release areas, and, when a pump is used to dewater the isolation area and fish are present, a fish screen that meets NMFS's fish screen criteria (NMFS 2011², or most current). Work area isolation and fish capture activities will occur during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress and death of species present.

For salvage operations in known bull trout spawning and rearing habitat, electrofishing shall only occur from May 1 to July 31. No electrofishing will occur in any bull trout occupied habitat after August 15. Bull trout are very temperature sensitive and generally should not be electroshocked or otherwise handled when temperatures exceed 15 degrees celsius. Salvage activities should take place during periods of the coolest air and water temperatures possible, normally early in the morning versus late in the day, and during conditions appropriate to minimize stress to fish species present.

Salvage operations will follow the ordering, methodologies, and conservation measures specified below in Steps 1 through 6. Steps 1 and 2 will be implemented for all projects where work area isolation is necessary according to conditions above. Electrofishing (Step 3) can be implemented to ensure all fish have been removed following Steps 1 and 2, or when other means of fish capture may not be feasible or effective. Dewatering and rewatering (Steps 4 and 5) will be

² National Marine Fisheries Service. 2011. Anadromous salmonid passage facility design. Northwest Region. Available online at: <http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf>

implemented unless wetted in-stream work is deemed to be minimally harmful to fish, and is beneficial to other aquatic species. Dewatering will not be conducted in areas known to be occupied by lamprey, unless lampreys are salvaged using guidance set forth in US Fish and Wildlife Service (2010)³.

1) **Isolate.**

- a) Block nets will be installed at upstream and downstream locations and maintained in a secured position to exclude fish from entering the project area.
- b) Block nets will be secured to the stream channel bed and banks until fish capture and transport activities are complete. Block nets may be left in place for the duration of the project to exclude fish.
- c) If block nets remain in place more than one day, the nets will be monitored at least daily to ensure they are secured to the banks and free of organic accumulation. If the project is within bull trout spawning and rearing habitat, the block nets must be checked every four hours for fish impingement on the net. Less frequent intervals must be approved through a variance request.
- d) Nets will be monitored hourly anytime there is instream disturbance.

2) **Salvage.** – As described below, fish trapped within the isolated work area will be captured to minimize the risk of injury, then released at a safe site:

- a) Remove as many fish as possible prior to dewatering.
- b) During dewatering, any remaining fish will be collected by hand or dip nets.
- c) Seines with a mesh size to ensure capture of the residing ESA-listed fish will be used.
- d) Minnow traps will be left in place overnight and used in conjunction with seining.
- e) If buckets are used to transport fish:
 - i. The time fish are in a transport bucket will be limited, and will be released as quickly as possible;
 - ii. The number of fish within a bucket will be limited based on size, and fish will be of relatively comparable size to minimize predation;
 - iii. Aerators for buckets will be used or the bucket water will be frequently changed with cold clear water at 15 minute or more frequent intervals.
 - iv. Buckets will be kept in shaded areas or will be covered by a canopy in exposed areas.
 - v. Dead fish will not be stored in transport buckets, but will be left on the stream bank to avoid mortality counting errors.
- f) As rapidly as possible (especially for temperature-sensitive bull trout), fish will be released in an area that provides adequate cover and flow refuge. Upstream release is generally preferred, but fish released downstream will be sufficiently outside of the influence of construction.
- g) Salvage will be supervised by a qualified fisheries biologist experienced with work area isolation and competent to ensure the safe handling of all fish.

3) **Electrofishing.** Electrofishing will be used only after other salvage methods have been employed or when other means of fish capture are determined to not be feasible or effective. If electrofishing will be used to capture fish for salvage, the salvage operation will be led by an experienced fisheries biologist and the following guidelines will be followed:

³ U.S. Fish and Wildlife Service. 2010. Best management practices to minimize adverse effects to Pacific lamprey. Available online at: <http://www.fws.gov/pacific/Fisheries/sphabcon/lamprey/pdf/Best%20Management%20Practices%20for%20Pacific%20Lamprey%20April%202010%20Version.pdf>

- a) The NMFS's electrofishing guidelines (NMFS 2000).
 - b) Only direct current (DC) or pulsed direct current (PDC) will be used and conductivity must be tested.
 - i. If conductivity is less than 100 μ s, voltage ranges from 900 to 1100 will be used.
 - ii. For conductivity ranges between 100 to 300 μ s, voltage ranges will be 500 to 800.
 - iii. For conductivity greater than 300 μ s, voltage will be less than 400.
 - c) Electrofishing will begin with a minimum pulse width and recommended voltage and then gradually increase to the point where fish are immobilized.
 - d) The anode will not intentionally contact fish.
 - e) Electrofishing shall not be conducted when the water conditions are turbid and visibility is poor. This condition may be experienced when the sampler cannot see the stream bottom in one foot of water.
 - f) If mortality or obvious injury (defined as dark bands on the body, spinal deformations, de-scaling of 25% or more of body, and torpidity or inability to maintain upright attitude after sufficient recovery time) occurs during electrofishing, operations will be immediately discontinued, machine settings, water temperature and conductivity checked, and procedures adjusted or electrofishing postponed to reduce mortality.
- 4) **Dewater.** Dewatering, when necessary, will be conducted over a sufficient period of time to allow species to naturally migrate out of the work area and will be limited to the shortest linear extent practicable.
- a) Diversion around the construction site may be accomplished with a coffer dam and a bypass culvert or pipe, or a lined, non-erodible diversion ditch. Where gravity feed is not possible, a pump may be used, but must be operated in such a way as to avoid repetitive dewatering and rewatering of the site. Impoundment behind the cofferdam must occur slowly through the transition, while constant flow is delivered to the downstream reaches.
 - b) All pumps will have fish screens to avoid juvenile fish impingement or entrainment, and will be operated in accordance with NMFS's current fish screen criteria (NMFS 2011⁴, or most recent version). If the pumping rate exceeds 3 cubic feet second (cfs), a NMFS Hydro fish passage review will be necessary.
 - c) Dissipation of flow energy at the bypass outflow will be provided to prevent damage to riparian vegetation or stream channel.
 - d) Safe reentry of fish into the stream channel will be provided, preferably into pool habitat with cover, if the diversion allows for downstream fish passage.
 - e) Seepage water will be pumped to a temporary storage and treatment site or into upland areas to allow water to percolate through soil or to filter through vegetation prior to reentering the stream channel.
- 5) **Re-watering.** Upon project completion, the construction site will be slowly re-watered to prevent loss of surface flow downstream and to prevent a sudden increase in stream turbidity. During re-watering, the site will be monitored to prevent stranding of aquatic organisms below the construction site.
- 6) **Salvage Notice.** Monitoring and recording of fish presence, handling, and mortality must occur during the duration of the isolation, salvage, electrofishing, dewatering, and rewatering operations. Once operations are completed, a salvage report will document procedures used, any fish injuries or deaths (including numbers of fish affected), and causes of any deaths.

⁴ National Marine Fisheries Service. 2011. Anadromous salmonid passage facility design. Northwest Region. Available online at: <http://www.nwr.noaa.gov/Salmon-Hydropower/FERC/upload/Fish-Passage-Design.pdf>

Construction and Post-Construction Conservation Measures for Aquatic Species

- 1) **Fish passage.** Fish passage will be provided for any adult or juvenile fish likely to be present in the action area during construction, unless passage did not exist before construction or the stream is naturally impassable at the time of construction. If the provision of temporary fish passage during construction will increase negative effects on aquatic species of interest or their habitat, a variance can be requested from the NMFS Branch Chief and the FWS Field Office Supervisor (Appendix B of this BO). Pertinent information, such as the species affected, length of stream reach affected, proposed time for the passage barrier, and alternatives considered, will be included in the variance request.
- 2) **Construction and discharge water.**
 - a) Surface water may be diverted to meet construction needs, but only if developed sources are unavailable or inadequate.
 - b) Diversions will not exceed 10% of the available flow.
 - c) All construction discharge water will be collected and treated using the best available technology applicable to site conditions.
 - d) Treatments to remove debris, nutrients, sediment, petroleum hydrocarbons, metals and other pollutants likely to be present will be provided.
- 3) **Minimize time and extent of disturbance.** Earthwork (including drilling, excavation, dredging, filling and compacting) in which mechanized equipment is in stream channels, riparian areas, and wetlands will be completed as quickly as possible. Mechanized equipment will be used in streams only when project specialists believe that such actions are the only reasonable alternative for implementation, or would result in less sediment in the stream channel or damage (short- or long-term) to the overall aquatic and riparian ecosystem relative to other alternatives. To the extent feasible, mechanized equipment will work from the top of the bank, unless work from another location would result in less habitat disturbance.
- 4) **Cessation of work.** Project operations will cease under the following conditions:
 - a) High flow conditions that may result in inundation of the project area, except for efforts to avoid or minimize resource damage;
 - b) When allowable water quality impacts, as defined by the state CWA section 401 water quality certification, have been exceeded; or
 - c) When “incidental take” limitations have been reached or exceeded.
- 5) **Site restoration.** When construction is complete:
 - a) All streambanks, soils, and vegetation will be cleaned up and restored as necessary using stockpiled large wood, topsoil, and native channel material.
 - b) All project related waste will be removed.
 - c) All temporary access roads, crossings, and staging areas will be obliterated. When necessary for revegetation and infiltration of water, compacted areas of soil will be loosened.
 - d) All disturbed areas will be rehabilitated in a manner that results in similar or improved conditions relative to pre-project conditions. This will be achieved through redistribution of stockpiled materials, seeding, and/or planting with local native seed mixes or plants.
- 6) **Revegetation.** Long-term soil stabilization of disturbed sites will be accomplished with reestablishment of native vegetation using the following criteria:
 - a) Planting and seeding will occur prior to or at the beginning of the first growing season after construction.

- b) An appropriate mix of species that will achieve establishment, shade, and erosion control objectives, preferably forb, grass, shrub, or tree species native to the project area or region and appropriate to the site will be used.
 - c) Vegetation, such as willow, sedge and rush mats, will be salvaged from disturbed or abandoned floodplains, stream channels, or wetlands.
 - d) Invasive species will not be used.
 - e) Short-term stabilization measures may include the use of non-native sterile seed mix (when native seeds are not available), weed-free certified straw, jute matting, and other similar techniques.
 - f) Surface fertilizer will not be applied within 50 feet of any stream channel, waterbody, or wetland.
 - g) Fencing will be installed as necessary to prevent access to revegetated sites by livestock or unauthorized persons.
 - h) Re-establishment of vegetation in disturbed areas will achieve at least 70% of pre-project conditions within 3 years.
 - i) Invasive plants will be removed or controlled until native plant species are well-established (typically 3 years post-construction).
- 7) **Site access.** The project sponsor will retain the right of reasonable access to the site in order to monitor the success of the project over its life.
- 8) **Implementation monitoring.** Project sponsor staff or their designated representative will provide implementation monitoring to ensure compliance with the applicable biological opinion, including:
- a) General conservation measures are adequately followed; and
 - b) Effects to listed species are not greater than predicted and incidental take limitations are not exceeded
- 9) **CWA section 401 water quality certification.** The project sponsor or designated representative will complete and record water quality observations to ensure that in-water work is not degrading water quality. During construction, CWA section 401 water quality certification provisions provided by the Oregon Department of Environmental Quality, Washington Department of Ecology, or Idaho Department of Environmental Quality will be followed.

Turbidity Monitoring Protocol

The Project Sponsor shall complete and record the following water quality observations to ensure that any increase in suspended sediment is not exceeding the limit for HIPIII compliance. Records shall be reported in the HIPIII Project Notification Completion (PNC) Form.

If the geomorphology of the project area (silty or claylike materials) or the nature of the action (large amounts of bare earth exposed below the waterline) shall preclude the successful compliance with these triggers, please inform the EC lead who will notify the services.

- 1) Take a background turbidity sample using an appropriately and frequently calibrated turbidimeter in accord with manufacturer's instructions, or a visual turbidity observation, every 2 hours while work is being implemented, or more often if turbidity disturbances vary greatly, to ensure that the in-water work area is not contributing visible sediment to the water column. The background samples or observations should be taken at a relatively undisturbed area approximately 100 feet upstream from the project area. Record the observation, location, and time before monitoring at the downstream point.

- 2) Take a second sample or observation, immediately after each upstream sample or observation, approximately 50 feet downstream from the project area in streams that are 30 feet wide or less; 100 feet downstream from the project area for streams between 30 and 100 feet wide; 200 feet downstream from the project area for streams greater than 100 feet wide; and 300 feet from the discharge point or nonpoint source for areas subject to tidal or coastal scour. Record the downstream observation, location, and time.
- 3) Compare the upstream and downstream observations/samples. If observed or measured turbidity downstream is more than upstream observation or measurement (> 10%), the activity must be modified to reduce turbidity. If visual estimates are used, an obvious difference between upstream and downstream observations shall bear the assumption of a (> 10%) difference. Continue to monitor every 2 hours as long as instream activity continues.
- 4) If exceedances occur twice in a row (after 4 hours), the activity must stop until the turbidity level returns to background, and the EC lead must be notified within 48 hours. The EC lead shall document the reasons for the exceedance, corrective measures taken, notify the local NMFS branch chief and/or USFWS field supervisor and seek recommendations.
- 5) If at any time, monitoring, inspections, or observations/samples show that the turbidity controls are ineffective, immediately mobilize work crews to repair, replace, or reinforce controls as necessary.

Stormwater Management Guidance

The project proponent must provide stormwater management for any project that will: increase the contributing impervious area within the project area; construct new pavement that increases capacity or widens the road prism; construct pavement down to subgrade; rehabilitate or restore a bridge to repair structural or functional deficiencies that are too complicated to be corrected through normal maintenance, except for seismic retrofits that make a bridge more resistant to earthquake damage (e.g., external post-tensioning, supplementary dampening) but do not affect the bridge deck or drainage; replace a stream crossing; change stormwater conveyance

Stormwater management is not required for the following pavement actions: minor repairs, patching, chip seal, grind/inlay, overlay or resurfacing (i.e., non-structural pavement preservation, a single lift or inlay).

Stormwater management consists of:

- 1) Water quality (pollution reduction) treatment for post-construction stormwater runoff from all contributing impervious area.
- 2) Water quantity treatment
 - a) Water quantity (flow) management for runoff from all contributing impervious area that will discharge into an intermittent or perennial water body in a watershed that is smaller than 100 mi², unless the outfall discharges directly into a lake, reservoir, or estuary.

OR

- b) Water quantity (flow) management for runoff from all contributing impervious area that will discharge more than 0.5 cfs during the 2-year, 24-hour storm into an intermittent or perennial water body in a watershed smaller than 100 mi², unless the outfall discharges directly into a lake, reservoir, or estuary.

Stormwater management plans must:

- 1) Explain how highway runoff from all contributing impervious area that is within or contiguous with the project area will be managed using site sketches, drawings, specifications, calculations, or other information commensurate with the scope of the action.
- 2) Identify the pollutants of concern.
- 3) Identify all contributing and non-contributing impervious areas that are within and contiguous with the project area.
- 4) Describe the BMPs that will be used to treat the identified pollutants of concern, and the proposed maintenance activities and schedule for the treatment facilities.
- 5) Provide a justification for the capacity of the facilities provided based on the expected runoff volume, including, e.g., the design storm, BMP geometry, analyses of residence time, as appropriate.
- 6) Include the name, email address, telephone number of a person responsible for designing the stormwater management facilities so that NMFS may contact that person if additional information is necessary.

All stormwater quality treatment practices and facilities must be designed to accept 50% of the cumulative rainfall from the 2-year, 24-hour storm for that site, except as follows: climate zone 4 – 67%; climate zone 5 – 75%; and climate zone 9 – 67%. A continuous rainfall/runoff model may be used instead of the above runoff depths to calculate water quality treatment depth.

Use low impact development practices to infiltrate or evaporate runoff to the maximum extent feasible. For runoff that cannot be infiltrated or evaporated and therefore will discharge into surface or subsurface waters, apply one or more of the following specific primary treatment practices, supplemented with appropriate soil amendments:

- 1) Bioretention cell
- 2) Bioslope, also known as an “ecology embankment”
- 3) Bioswale
- 4) Constructed wetlands
- 5) Infiltration pond
- 6) Media filter devices with demonstrated effectiveness
- 7) Porous pavement, with no soil amendments and appropriate maintenance

All stormwater flow control treatment practices and facilities must be designed to maintain the frequency and duration of flows generated by storms within the following end-points:

- 1) Lower discharge endpoint, by USGS flood frequency zone:
 - a. Western Region = 42% of 2-year event
- 2) Eastern Region
 - a. Southeast, Northeast, North Central = 48% of 2-year event
 - b. Eastern Cascade = 56% of 2-year event
- 3) Upper discharge endpoint

- a. Entrenchment ratio <2.2 = 10-year event, 24-hour storm
- b. Entrenchment ratio >2.2 = bank overtopping event

When conveyance is necessary to discharge treated stormwater directly into surface water or a wetland, the following requirements apply:

- 1) Maintain natural drainage patterns.
- 2) To the maximum extent feasible, ensure that water quality treatment for highway runoff from all contributing impervious area is completed before commingling with offsite runoff for conveyance.

General Conservation Measures for Terrestrial Plants, Wildlife and Aquatic Invertebrates

This section describes general conservation measures (CMs) and practices included in the proposed action to minimize or avoid the exposure of certain endangered, threatened, and proposed species managed by USFWS to any effects of the underlying restoration activities. These standards include practices that would minimize or avoid any such effects on designated critical habitat for those species. Restoration projects are unlikely to occur within the range of some of the listed species included herein, but due to the programmatic approach to this consultation, and the fact that specific project locations are unknown at this time, we are providing the benefit of the doubt to the species and have included project design measures for all species that occur within the proposed action area.

An FWS biologist will review the Project Notification/Completion form for each project to confirm the project design meets the conditions for *no effect* or *not likely to adversely affect* to listed species or critical habitat. Projects that cannot meet these conditions will need to be modified or will require a separate section 7 consultation.

Identifying Species Locations. When proposed project locations have been identified, the action agency or project proponent will obtain the current species list for the county in which the proposed project is located. The species lists can be accessed at the following websites:

- **Washington, Western:** <http://www.fws.gov/wafwo/speciesmap.html>

If species are located within the county where the proposed project is located, refer to the habitat descriptions for each species below for each species or critical habitat to determine whether that listed species may occur in the vicinity of the proposed project. Maps for some species have also been provided at the end of this Appendix to assist in identifying suitable habitat that may be occupied by listed species. For additional assistance, contact the appropriate state FWS office for more information:

- **Washington Fish and Wildlife Office,** (360) 753-9440

Site-specific information of listed species occurrences in Washington State may be obtained from the Washington Department of Fish and Wildlife Priority Habitat and Species Program <http://www.wdfw.wa.gov/hab/phspage.htm> and from the Washington Department of Natural Resources Natural Heritage Program at <http://wdfw.wa.gov/mapping/phs/>.

- 1) If it is determined that listed species, critical habitat, or unsurveyed suitable habitat for listed species are located within the vicinity (generally within 1 mile) of the proposed project, the action agency will implement the following project design standards for each species. Additional species-specific conservation measures may apply (Your EC lead shall provide you with those).
- 2) **Project Access.** Existing roads or travel paths will be used to access project sites whenever possible; vehicular access ways to project sites will be planned ahead of time and will provide for minimizing impacts on riparian corridors and areas where listed species or their critical habitats may occur.
- 3) **Vehicle use and human activities.** Including walking in areas occupied by listed species, will be minimized to reduce damage or mortality to listed species.
- 4) **Flight patterns.** Helicopter flight patterns will be established in advance and located to avoid seasonally important wildlife habitat
- 5) **Herbicide Use.** On sites where ESA-listed **terrestrial wildlife** may occur, herbicide applications will be avoided or minimized to the extent practicable while still achieving project goals. Staff will avoid any potential for direct spraying of wildlife or immediate habitat in use by wildlife for breeding, feeding, or sheltering. Herbicide use in or within 1 mile of habitat where listed terrestrial wildlife occur will be limited to the chemicals and application rates as shown in **Table 1**. Additional species-specific herbicide limitations are also defined below in each species CMs section.

TABLE 1: Maximum Herbicide Application Rates in or Within 1 Mile of Habitat Where ESA-listed Terrestrial Species Occur⁵

	2,4-D	Aminopyralid	Chlorosulfuron	Clethodim	Clopyralid	Dicamba	Glyphosate 1	Glyphosate 2	Imazapic	Imazapyr	Metsulfuron	Picloram	Sethoxydim	Sulfometuron	Triclopyr (TEA)
Listed Species	Maximum Rate of Herbicide Application (lb/ac)														
Mammals	NA	0.22	0.083	NA	0.375	NA	2.0	2.0	0.189	1.0	0.125	NA	0.3	NA	NA
Birds*	NA	0.11	0.083	NA	0.375	NA	2.0	2.0	0.189	1.0	0.125	NA	0.3	NA	NA
Invertebrates*	NA	NA	NA	NA	0.375	NA	2.0	2.0	NA	1.0	NA	NA	0.3	NA	NA
NA = Not Authorized for use															
* See required buffers and methods restrictions within each species-specific PDS															

⁵ This list of chemicals is based on the analyses in the Syracuse Environmental Research Associates (SERA) risk assessments maintained by the U.S. Forest Service and available at <http://www.fs.fed.us/foresthealth/pesticide/risk.shtml>. The herbicides and application rates listed in this table include only those that were found in the SERA assessments to be below both the acute and chronic NOAELs for terrestrial wildlife.

Fish Passage Restoration (Profile Discontinuities)

Ia: Dams, Water Control Structures, or Legacy Structures Removal

Description. BPA proposes to fund and review fish passage projects, and restore more natural channel and flow conditions by removing small dams, channel-spanning weirs, earthen embankments, subsurface drainage features, spillway systems, tide gates, outfalls, pipes, instream flow redirection structures (e.g., drop structure, gabion, groin), or similar devices used to control, discharge, or maintain water levels.

Small dams include instream structures that are 10 feet in height or less for streams with an active channel width of less than 50-feet and a slope less than 4%, or up to 16.4 feet in height and a slope greater than 4%.

If the structure being removed contains material (i.e. large wood, boulders, etc) that is typically found within the stream or floodplain at that site, the material can be reused to implement habitat improvements. Any such project must follow the design criteria outlined in the **Install Habitat-Forming Natural Material Instream Structures (Large Wood, Boulders, and Spawning Gravel)** activity category.

Conservation Measures:

- 1) Restore all structure banklines and fill in holes with native materials to restore contours of stream bank and floodplain. Compact the fill material adequately to prevent washing out of the soil during over bank flooding. Do not mine material from the stream channel to fill in “key” holes. When removal of buried (keyed) structures may result in significant disruption to riparian vegetation and/or the floodplain, consider leaving the buried structure sections within the streambank.
- 2) If the legacy structures (log, rock, or gabion weirs) were placed to provide grade control, evaluate the site for potential headcutting and incision due to structure removal by using the appropriate guidance.⁶ If headcutting and channel incision are likely to occur due to structure removal, additional measures must be taken to reduce these impacts (see grade control options described under **Headcut and Grade Stabilization** activity category).
- 3) If the structure is being removed because it has caused an over-widening of the channel, consider implementing other HIP III restoration categories to decrease the width to depth ratio of the stream at that location to a level commensurate with representative upstream and downstream sections (within the same channel type).
- 4) Tide gates can only be removed not modified or replaced. Modification or replacement of tidegates will require a separate individual consultation with the Services.

Fish Passage Restoration (Transportation)

⁶ Castro, J. 2003. Geomorphologic Impacts of Culvert Replacement and Removal: Avoiding Channel Incision. Oregon Fish and Wildlife Office, Portland, OR. Available at: <http://library.fws.gov/pubs1/culvert-guidelines03.pdf>

If: Bridge and Culvert Removal or Replacement

Description. For unimpaired fish passage it is desirable to have a crossing that is a larger than the channel bankfull width, allows for a functional floodplain, allows for a natural variation in bed elevation, and provides bed and bank roughness similar to the upstream and downstream channel. In general, bridges will be implemented over culverts because they typically do not constrict a stream channel to as great a degree as culverts and usually allow for vertical movement of the streambed (see #3 below). Bottomless culverts may provide a good alternative for fish passage where foundation conditions allow their construction and width criteria can be met.

Conservation measures:

- 1) Stream crossings shall be designed to the design benchmarks set in (NMFS 2011 or more recent version)⁷ and restore floodplain function.
- 2) A crossing shall: (a) maintain the general scour prism, as a clear, unobstructed opening (i.e., free of any fill, embankment, scour countermeasure, or structural material); (b) be a single span structure that maintains a clear, unobstructed opening above the general scour elevation that is at least as wide as 1.5 times the active channel width; (c) be a multiple span structure that maintains a clear, unobstructed opening above the general scour elevation, except for piers or interior bents, that is at least as wide as 2.2 times the active channel width.⁸ This criteria will restore any physical or biological processes associated with a fully functional floodplain that was degraded by the previous crossing.
- 3) Bridge scour and stream stability countermeasures may be applied below the general scour elevation, however, except as described above in (2), no scour countermeasure may be applied above the general scour elevation.
- 4) Remove all other artificial constrictions within the functional floodplain of the project area as follows: (a) remove existing roadway fill, embankment fill, approach fill, or other fills; (b) install relief conduits through existing fill; (c) remove vacant bridge supports below total scour depth, unless the vacant support is part of the rehabilitated or replacement stream crossing; and (d) reshape exposed floodplains and streambanks to match upstream and downstream conditions.
- 5) If the crossing will occur within 300 feet of active spawning area, only full span bridges or streambed simulation will be used.

⁷ NMFS (National Marine Fisheries Service). 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon. Available at: <http://www.nwr.noaa.gov/Publications/Reference-Documents/Passage-Refs.cfm>

⁸ For guidance on how to complete bridge scour and stream stability analysis, see Lagasse *et al.* 2001a (HEC-20), Lagasse *et al.* 2001b (HEC-23), Richardson and Davis 2001 (HEC-18), ODOT 2005, and AASHTO 2007.

Active channel width means the stream width measured perpendicular to stream flow between the ordinary high water lines, or at the channel bankfull elevation if the ordinary high water lines are indeterminate. This width includes the cumulative active channel width of all individual side- and off-channel components of channels with braided and meandering forms, and measure outside the area influence of any existing stream crossing, e.g., five to seven channel widths upstream and downstream.

- 6) Projects in stream channels with gradients above six percent will utilize a bridge or if a bridge is determined to not be feasible, the crossing will be designed using the stream simulation option.
- 7) Culverts shall not be longer than: 150 feet for stream simulation, 75 feet for no-slope and 500 feet for any other option. Maximum culvert width shall be 20 feet, for widths greater than 20 feet a bridge will be used.
- 8) Designs must demonstrate that the vertical and lateral stability of the stream channel are taken into consideration when designing a crossing.
- 9) Designs must demonstrate that culverts and bridges shall mimic the natural stream processes and allow for fish passage, sediment transport, and flood and debris conveyance.
- 10) Designs must demonstrate that the crossings: (a) avoid causing local scour of streambanks and reasonably likely spawning areas; (b) allow the fluvial transport of large wood, up to a site potential tree height in size, through the project area without becoming stranded on the bridge structure; (c) allow for likely channel migration patterns within the functional floodplain for the design life of the bridge; and otherwise align with well-defined, stable channels; and (d) allow for the passage of all aquatic organisms.
- 11) The proponent shall include suitable grade controls to prevent culvert failure caused by changes in stream elevation. Grade control structures to prevent headcutting above or below the culvert or bridge may be built using rock or wood as outlined in the **Headcut and Grade Stabilization** criteria under the **Profile Discontinuity** activity subcategory.

River, Stream, and Floodplain Restoration

2a: Improve Secondary Channel and Wetland Habitats

Description. BPA proposes to review and fund projects that reconnect historical stream channels within floodplains, restore or modify hydrologic and other essential habitat features of historical river floodplain swales, abandoned side channels, spring-flow channels, wetlands, historical floodplain channels and create new self-sustaining side channel habitats which are maintained through natural processes.

Actions include the improvement and creation of secondary channels, off channel habitats and wetlands to increase the available area and access to rearing habitat; increase hydrologic capacity, provide resting areas for fish and wildlife species at various levels of inundation; reduce flow velocities; and provide protective cover for fish and other aquatic species.

Reconnection of historical off- and side channels habitats that have been blocked includes the removal of plugs, which impede water movement through off- and side-channels. Excavating pools and ponds in the historic floodplain/channel migration zone to create connected wetlands; Reconnecting existing side channels with a focus on restoring fish access and habitat forming processes (hydrology, riparian vegetation); Wetland habits will be created to reestablish a hydrologic regime that has been disrupted by human activities, including functions such as water depth, seasonal fluctuations, flooding periodicity, and connectivity.

All activities intended for improving secondary channel habitats will provide the greatest degree of natural stream and floodplain function achievable and shall be implemented to address basin

specified limiting factors. The long-term development of a restored side channel will depend on natural processes like floods and mainstem migration.

If more than 20% of the amount of water from the main channel shall be diverted into the secondary channel then the action shall be considered Channel Reconstruction (pg. 46).

Conservation measures:

- 1) Off- and side-channel improvements can include minor excavation ($\leq 10\%$) of naturally accumulated sediment within historical channels. Evidence of historical channel location, such as land use surveys, historical photographs, topographic maps, remote sensing information, or personal observation. There is no limit as to the amount of excavation of anthropogenic fill within historic side channels as long as such channels can be clearly identified through field and/or aerial photographs.
- 2) Designs must demonstrate sufficient hydrology and that the project will be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain.
- 3) Proposed new side channel construction must be within the functional floodplain (5-year recurrence interval), current channel meander migration zone, and require limited excavation for construction. Reconnection of historical fragmented habitats are preferred.
- 4) Side channel habitat will be constructed to prevent fish stranding by providing a continual positive **overall** grade to the intersecting river or stream, or by providing a year-round water connection.
- 5) Excavated material removed from off- or side-channels shall be hauled to an upland site or spread across the adjacent floodplain in a manner that does not restrict floodplain capacity. Hydric soils may be salvaged to provide appropriate substrate and/or seed source for hydrophytic plant community development. Hydric soils will only be obtained from wetland salvage sites.
- 6) Excavation depth will never exceed the maximum thalweg depth in the main channel.
- 7) Restoration of existing side channels including one-time dredging and an up to two times project adjustment including adjusting the elevation of the created side channel habitat.
- 8) All side channel and pool habitat work will occur in isolation from waters occupied by ESA-listed salmonid species until project completion, at which time a final opening may be made by excavation to waters occupied by ESA-listed salmonid or water will be allowed to return into the area.
- 9) Adequate precautions will be taken to prevent the creation of fish passage issues or stranding of juvenile or adult fish by demonstrating sufficient hydrologic conditions.
- 10) **Rewatering stream channels.** For stream channels which have been isolated and dewatered during project construction:
 - a) Reconstructed stream channels will be “pre-washed” into a reach equipped with sediment capture devices, prior to reintroduction of flow to the stream.
 - b) Stream channels will be re-watered slowly to minimize a sudden increase in turbidity (see Staged Rewatering Plan).

2b: Set-back or Removal of Existing Berms, Dikes, and Levees

Description: The BPA proposes to review and fund projects that reconnect estuary, stream and river channels with floodplains, increase habitat diversity and complexity, moderate flow

disturbances, and provide refuge for fish during high flows by either removing existing berms, dikes or levees or increasing the distance that they are set back from active streams or wetlands. This action includes the removal of fill, such as dredge spoils from past channelization projects, road, trail, and railroad beds, dikes, berms, and levees to restore natural estuary and fresh-water floodplain functions. Such functions include overland flow during high flows, dissipation of flood energy, increased water storage to augment low flows, sediment and debris deposition, growth of riparian vegetation, nutrient cycling, and development of side channels and alcoves.

Techniques that are covered by this programmatic need to have the sole purpose of restoring floodplain and estuary functions or to enhance fish habitat. Covered actions in freshwater, estuarine, and marine areas include: 1) full and partial removal of levees, dikes, berms, and jetties; 2) breaching of levees, dikes, and berms; 3) lowering of levees, dikes, and berms; and, 4) setback of levees, dikes, and berms.

Conservation Measures:

- 1) To the greatest degree possible, nonnative fill material, originating from outside the floodplain of the action area will be removed from the floodplain to an upland site.
- 2) Where it is not possible to remove or set-back all portions of dikes and berms, or in areas where existing berms, dikes, and levees support abundant riparian vegetation, openings will be created with breaches.
- 3) Breaches shall be equal to or greater than the active channel width (as defined above) to reduce the potential for channel avulsion during flood events.
- 4) In addition to other breaches, the berm, dike, or levee shall always be breached at the downstream end of the project and/or at the lowest elevation of the floodplain to ensure the flows will naturally recede back into the main channel thus minimizing fish entrapment.
- 5) When necessary, loosen compacted soils once overburden material is removed.
- 6) Overburden or fill comprised of native materials, which originated from the project area, may be used within the floodplain to create set-back dikes and fill anthropogenic holes provided that does not impede floodplain function.
- 7) When full removal is not possible and a setback is required, the new structure locations should be prioritized to the outside of the meander belt width or to the outside or the channel meander zone margins.

2c: Protect Streambanks Using Bioengineering Methods

Description. The BPA proposes to review and fund projects that restore eroding streambanks by bank shaping and installation of coir logs or other soil reinforcements – bioengineering techniques as necessary to support development of riparian vegetation and/or planting or installing large wood, trees, shrubs, and herbaceous cover as necessary to restore ecological function in riparian and floodplain habitats.

Streambank erosion often occurs within meandering alluvial rivers on the outside of meander bends. The rate of erosion and meander migration is often accelerated due to degradation of the stream side riparian vegetation and land use practices that have removed riparian woody species. Historically, as the river migrates into the adjacent riparian areas, LW would be recruited from the banks resulting in reduced near bank velocities and increased boundary roughness. Where a

functional riparian area is lacking, the lateral bank erosion may occur at an unnaturally accelerated rate. The goal of streambank restoration is to reestablish long term riparian processes through re-vegetation and riparian buffer strips. Structural bank protection may be used to provide short term stability to banklines allowing for vegetation establishment.

The primary proposed structural streambank stabilization action is the use of large wood and vegetation to increase bank strength and resistance to erosion in an ecological approach to engineering streambank stabilization.

The following bioengineering techniques⁹ are proposed for use either individually or in combination: (a) Woody plantings and variations (e.g., live stakes, brush layering, facines, brush mattresses); (b) herbaceous cover, for use on small streams or adjacent wetlands; (c) deformable soil reinforcement, consisting of soil layers or lifts strengthened with biodegradable coir fabric and plantings that are penetrable by plant roots; (d) coir logs (long bundles of coconut fiber), straw bales and straw logs used individually or in stacks to trap sediment and provide a growth medium for riparian plants; (e) bank reshaping and slope grading, when used to reduce a bank slope angle without changing the location of its toe, to increase roughness and cross section, and to provide more favorable planting surfaces; (f) tree and LW rows, live siltation fences, brush traverses, brush rows and live brush sills in floodplains, used to reduce the likelihood of avulsion in areas where natural floodplain roughness is poorly developed or has been removed and (g) floodplain flow spreaders, consisting of one or more rows of trees and accumulated debris used to spread flow across the floodplain; and (h) use of LW as a primary structural component.

Conservation Measures:

- 1) Without changing the location of the bank toe, damaged streambanks will be restored to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose, or the use of benches in consolidated, cohesive soils. The purpose of bank shaping is to provide a more stable platform for the establishment of riparian vegetation, while also reducing the depth to the water table, thus promoting better plant survival.
- 2) Streambank restoration projects shall include the placement of a riparian buffer strip consisting of a diverse assemblage of species native to the action area or region, including trees, shrubs, and herbaceous species. Do not use invasive species.
- 3) Large wood will be used as an integral component of all streambank protection treatments unless restoration can be achieved with soil bioengineering techniques alone.
- 4) LW will be placed to maximize near bank hydraulic complexity and interstitial habitats through use of various LW sizes and configurations of the placements.
- 5) Structural placement of LW should focus on providing bankline roughness for energy dissipation vs. flow re-direction that may affect the stability of the opposite bankline.
- 6) Large wood will be intact, hard, and undecayed to partly decaying with untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or fragmented wood found

⁹ For detailed descriptions of each technique refer to the WDFW Integrated Streambank Protection Guidelines: <http://wdfw.wa.gov/publications/00046/>, the USACE's EMRRP Technical Notes, Stream Restoration: <http://el.ercd.usace.army.mil/publications.cfm?Topic=technote&Code=emrrp>, or the NRCS National Engineering Handbook Part 654, Stream Restoration: <http://policy.nrcs.usda.gov/viewerFS.aspx?id=3491>

lying on the ground may be used for additional roughness and to add complexity to LW placements but will not constitute the primary structural components.

- 7) Wood that is already within the stream or suspended over the stream may be repositioned to allow for greater interaction with the stream.
- 8) LW anchoring will not utilize cable or chain. Manila, sisal or other biodegradable ropes may be used for lashing connections. If hydraulic conditions warrant use of structural connections then rebar pinning or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity in high energetic systems such as (high gradient systems with lateral confinement and limited floodplain). Need for structural anchorage shall be demonstrated in the design documentation.
- 9) Rock will not be used for streambank restoration, except as ballast to stabilize large wood unless it is necessary to prevent scouring or downcutting of an existing flow control structure (e.g., a culvert or bridge support, headwall, utility lines, or building). In this case rock may be used as the primary structural component for construction of vegetated riprap with large woody debris. Scour holes may be filled with rock to prevent damage to structure foundations but will not extend above the adjacent bed of the river. This does not include scour protection for bridge approach fills.
- 10) The rock may not impair natural stream flows into or out of secondary channels or riparian wetlands.
- 11) Any action that requires additional excavation or structural changes to a road, culvert, bridge foundation or that may affect fish passage is covered under the **Fish Passage Restoration** activity category.
- 12) Fencing will be installed as necessary to prevent access and grazing damage to revegetated sites and project buffer strips.
- 13) Riparian buffer strips associated with streambank protection shall extend from the project bankline towards the floodplain a minimum distance of 35 feet.

2d: Install Habitat-Forming Natural Material Instream Structures (LW, Boulders, and Spawn Gravel)

Description. The BPA proposes to review and fund projects that include placement of natural habitat forming structures to provide instream spawning, rearing and resting habitat for salmonids and other aquatic species. Projects will provide high flow refugia; increase interstitial spaces for benthic organisms; increase instream structural complexity and diversity including rearing habitat and pool formation; promote natural vegetation composition and diversity; reduce embeddedness in spawning gravels and promote spawning gravel deposition; reduce siltation in pools; reduce the width/depth ratio of the stream; mimic natural input of LW (e.g., whole conifer and hardwood trees, logs, root wads); decrease flow velocities; and deflect flows into adjoining floodplain areas to increase channel and floodplain function. In areas where natural gravel supplies are low (immediately below reservoirs, for instance), gravel placement can be used to improve spawning habitat.

Anthropogenic activities that have altered riparian habitats, such as splash damming and the removal of large wood and logjams, have reduced instream habitat complexity in many rivers and have eliminated or reduced features like pools, hiding cover, and bed complexity. Salmonids need habitat complexity for rearing, feeding, and migrating. To offset these impacts large wood, boulders and spawning gravel will be placed in stream channels either individually or in combination.

Large wood will be placed to increase coarse sediment storage, increase habitat diversity and complexity, retain gravel for spawning habitat, improve flow heterogeneity, provide long-term nutrient storage and substrate for aquatic macroinvertebrates, moderate flow disturbances, increase retention of leaf litter, and provide refugia for fish during high flows. Engineered log jams create a hydraulic shadow, a low-velocity zone downstream that allows sediment to settle out. Scour holes develop adjacent to the log jam which can provide valuable fish and wildlife habitat by redirecting flow and providing stability to a streambank or downstream gravelbar. Boulder placements increase habitat diversity and complexity, improve flow heterogeneity, provide substrate for aquatic vertebrates, moderate flow disturbances, and provide refuge for fish during high flows. The placement of individual large boulders and boulder clusters to increase structural diversity is important to provide holding and rearing habitat for ESA-listed salmonids where similar natural rock has been removed. This treatment will be used in streams that have been identified as lacking structural diversity and that are naturally and/or historically have had boulders.

The quality and quantity of available spawning gravel has been impacted by many anthropogenic features and activities. For example, dams and culverts can block the downstream movement of gravel and result in gravel starved reaches. Channelization, hard streambank stabilization, and diking restrict a stream from meandering and recruiting gravel. Elimination of riparian buffers and grazing up to the stream's edge introduces fines that often cause embedded or silted-in spawning gravel. Spawning gravel will be placed to improve spawning substrate by compensating for an identified loss of a natural gravel supply and may be placed in conjunction with other projects, such as simulated log jams and boulders.

All activities intended for installing habitat-forming instream structures will provide the greatest degree of natural stream and floodplain function achievable through application of an integrated, ecological approach and linkage to basin defined limiting factors. Instream structures capable of enhancing habitat forming processes and migratory corridors will be installed only within previously degraded stream reaches, where past disturbances have removed habitat elements such as LW, boulders, or spawning gravel.

Conservation Measures (Large Wood):

- 1) LW placements for other purposes than habitat restoration or enhancement are excluded from this consultation.
- 2) LW will be placed in channels that have an intact, well-vegetated riparian buffer area that is not mature enough to provide large wood, or in conjunction with riparian rehabilitation or management.
- 3) LW may partially or completely span the channel in first order streams if the active channel top width is less than 20 feet.
- 4) When available and if the project is located within the appropriate morphology and sized stream, trees with rootwads attached should be a minimum length of 1.5 times the bankfull channel width, while logs without rootwads should be a minimum of 2.0 times the bankfull width.
- 5) Stabilizing or key pieces of large wood that will be relied on to provide streambank stability or redirect flows must be intact, hard, and undecayed to partly decaying, and should have untrimmed root wads to provide functional refugia habitat for fish. Use of decayed or

fragmented wood found lying on the ground or partially sunken in the ground is not acceptable for key pieces but may be incorporated to add habitat complexity.

- 6) The partial burial of LW and boulders may constitute the dominant means of placement and key boulders (footings) or LW can be buried into the stream bank or channel.
- 7) If LW anchoring is required, a variety of methods may be used. These include buttressing the wood between riparian trees, the use of manila, sisal or other biodegradable ropes for lashing connections or if hydraulic conditions warrant use of structural connections then rebar pinning or bolting may be used. The utilization of structural connections should be used minimally and only to ensure structural longevity in high energetic systems such as (high gradient systems with lateral confinement and limited floodplain). Need for structural anchorage shall be demonstrated in the design documentation.
- 8) Rock may be used for ballast but is limited to that needed to anchor the LW.

Conservation Measures (Boulder Placement):

- 1) Boulder placements for other purposes than habitat restoration or enhancement are excluded from this consultation.
- 2) The cross-sectional area of boulder placements may not exceed 25% of the cross-sectional area of the low flow channel, or be installed to shift the stream flow to a single flow pattern in the middle or to the side of the stream.
- 3) Boulders will be machine-placed (no end dumping allowed) and will rely on the size of boulder for stability.
- 4) Boulders will be installed low in relation to channel dimensions so that they are completely overtopped during channel-forming flow events (approximately a 1.5-year flow event).
- 5) Permanent anchoring, including rebar or cabling, may not be used.

Conservation Measures (Spawning Gravel):

- 1) Spawning gravel to be placed in streams must be obtained from an upland source outside of the channel and riparian area and properly sized gradation for that stream, clean, and non-angular. When possible use gravel of the same lithology as found in the watershed. After spawning gravel placement, allow the stream to naturally sort and distribute the material.
- 2) A maximum of 100 cubic yards of spawning sized gravel can be imported or relocated and placed upstream of each structure when in combination with other restoration activities that address the underlying systematic problem. For example a combined project consisting of: planting streambank vegetation, placing instream LW and supplementing spawning gravel.
- 3) Imported gravel must be free of invasive species and non-native seeds.

2e: Riparian Vegetation Planting

Description. The BPA proposes to fund vegetation planting to recover watershed processes and functions associated with native plant communities and that will help restore natural plant species composition and structure. Under this activity category, project proponents would plant trees, shrubs, herbaceous plants, and aquatic macrophytes to help stabilize soils. Large trees such as cottonwoods and conifers will be planted in areas where they historically occurred but are currently either scarce or absent. Native plant species and seeds will be obtained from local sources to ensure plants are adapted to local climate and soil chemistry.

Vegetation management strategies will be utilized that are consistent with local native succession and disturbance regimes and specify seed/plant source, seed/plant mixes, and soil preparation. Planting will address the abiotic factors contributing to the sites' succession, *i.e.*, weather and disturbance patterns, nutrient cycling, and hydrologic condition. Only certified noxious weed-free seed (99.9%), hay, straw, mulch, or other vegetation material for site stability and revegetation projects will be utilized.

Conservation Measures:

- 1) An experienced silviculturist, botanist, ecologist, or associated technician shall be involved in designing vegetation treatments.
- 2) Species to be planted must be of the same species that naturally occurs in the project area.
- 3) Tree and shrub species as well as sedge and rush mats to be used as transplant material shall come from outside the bankfull width, typically in abandoned flood plains, and where such plants are abundant.
- 4) Sedge and rush mats should be sized as to prevent their movement during high flow events.
- 5) Concentrate plantings above the bankfull elevation.
- 6) Species distribution shall mimic natural distribution in the riparian and floodplain areas.

2f: Channel Reconstruction

Description. The BPA proposes to review and fund channel reconstruction projects to improve aquatic and riparian habitat diversity and complexity, reconnect stream channels to floodplains, reduce bed and bank erosion, increase hyporheic exchange, provide long-term nutrient storage, provide substrate for macroinvertebrates, moderate flow disturbance, increase retention of organic material, and provide refuge for fish and other aquatic species by reconstructing stream channels and floodplains that are compatible within the appropriate watershed context and geomorphic setting.

The reconstructed stream system shall be composed of a naturally sustainable and dynamic planform, cross-section, and longitudinal profile that incorporates unimpeded passage and temporary storage of water, sediment, organic material, and species. Stream channel adjustment over time is to be expected in naturally dynamic systems and is a necessary component to restore a wide array of stream functions. It is expected that for most projects that there will be a primary channel with secondary channels that are activated at various flow levels to increase floodplain connectivity and to improve aquatic habitat through a range of flows. This proposed action is not intended to artificially stabilize streams into a single location or into a single channel for the purposes of protecting infrastructure or property.

Channel reconstruction consists of re-meandering or movement of the primary active channel, and may include structural elements such as streambed simulation materials, streambank restoration, and hydraulic roughness elements. For bed stabilization and hydraulic control structures, constructed riffles shall be preferentially used in pool-riffle stream types, while roughened channels and boulder weirs shall be preferentially used in step-pool and cascade stream types. Material selection (large wood, rock, gravel) shall also mimic natural stream system materials.

Due to the complexity of channel reconstruction projects, there shall be separate procedural guidelines, data and information requirements, that will be refined, amended, and updated through an iterative collaborative process with BPA, NMFS, and USFWS.

The channel reconstruction activity is considered *high risk* and will require RRT and NMFS Hydro review.

High Risk projects in the Channel Reconstruction activity shall address the **General Project and Data Summary Requirements (Appendix C)**, the following **Conservation Measures**, and include a **Monitoring and Adaptive Management Plan**.

Conservation Measures:

Because of the complexity of channel reconstruction projects, there shall be an interdisciplinary design team minimally consisting of a biologist, engineer, and hydrologist.

Data requirements for RRT & NMFS review and analysis include:

- 1) Designs must demonstrate a clear linkage to limiting factors identified within the appropriate sub-basin plan, recovery plan or recommendations by a technical oversight and steering committee within a localized region.
- 2) Detailed construction drawings
- 3) Designs must demonstrate that channel reconstruction will identify, correct to the extent possible, and then account for in the project development process, the conditions that lead to the degraded condition.
- 4) Designs must demonstrate that the proposed action will mimic natural conditions for gradient, width, sinuosity and other hydraulic parameters.
- 5) Designs must demonstrate that structural elements shall fit within the geomorphic context of the stream system.
- 6) Designs must demonstrate sufficient hydrology and that the project will be self-sustaining over time. Self-sustaining means the restored or created habitat would not require major or periodic maintenance, but function naturally within the processes of the floodplain.
- 7) Designs must demonstrate that the proposed action will not result in the creation of fish passage issues or post construction stranding of juvenile or adult fish.

Invasive Plant Control

3a: Manage Vegetation Using Physical Control

Description. BPA proposes to use two mechanisms for vegetation management by physical control: (a) Manual control includes hand pulling and grubbing with hand tools; bagging plant residue for burning or other proper disposal; mulching with organic materials; shading or covering unwanted vegetation; controlling brush and pruning using hand and power tools such as chain saws and machetes; using grazing goats. When possible, manual control (e.g., hand pulling, grubbing, cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality. (b) Mechanical control includes techniques such as mowing, tilling, disking, or plowing. Mechanical control may be carried out over large areas or be confined to smaller areas (known as scalping). Ground-disturbing mechanical activity will be restricted in established buffer zones adjacent to streams, lakes, ponds, wetlands and other identified sensitive

habitats based on percent slope. For slopes less than 20%, a buffer width of 35 feet will be used. For slopes over 20%, no ground-disturbing mechanical equipment will be used.

Conservation Measures:

- 1) For mechanical control that will disturb the soil, an untreated area will be maintained within the immediate riparian buffer area to prevent any potential adverse effects to stream channel or water quality conditions. The width of the untreated riparian buffer area will vary depending on site-specific conditions and type of treatment.
- 2) Ground-disturbing mechanical activity will be restricted in established buffer zones adjacent to streams, lakes, ponds, wetlands and other identified sensitive habitats based on percent slope. For slopes less than 20%, a buffer width of 35 feet will be used. For slopes over 20%, no ground-disturbing mechanical equipment will be used.
- 3) When possible, manual control (*e.g.*, hand pulling, grubbing, cutting) will be used in sensitive areas to avoid adverse effects to listed species or water quality.
- 4) All noxious weed material will be disposed of in a manner that will prevent its spread. Noxious weeds that have developed seeds will be bagged and burned.

3b: Manage Vegetation Using Herbicides

Description. The BPA proposes to fund management of vegetation using chemical herbicides to recover watershed processes and functions associated with native plant communities.

Herbicides will be applied in liquid or granular form using wand or boom sprayers mounted on or towed by trucks, backpack equipment containing a pressurized container with an agitation device, injection, hand wicking cut surfaces, and ground application of granular formulas. Herbicides will be mixed with water as a carrier (no petroleum-based carriers will be used) and may also contain a variety of additives (see adjuvant paragraph below) to promote saturation and adherence, to stabilize, or to enhance chemical reactions. Aerial treatment is not proposed to be covered under this consultation, nor is treatment of aquatic weeds except for knotweed (*Polygonum cuspidatum*).

Conservation Measures:

- 1) **Maximum herbicide treatment area.** The area treated with herbicides above bankfull elevation, within riparian areas, will not exceed 10 acres above bankfull elevation and 2 acres below bankfull elevation, per 1.6-mile reach of a stream, per year.
- 2) **Herbicide applicator qualifications.** Herbicides will be applied only by an appropriately licensed applicator using an herbicide specifically targeted for a particular plant species that will cause the least impact to non-target species. The applicator will be responsible for preparing and carrying out the herbicide transportation and safety plan, as follows.
- 3) **Herbicide transportation and safety plan.** The applicator will prepare and carry out an herbicide safety/spill response plan to reduce the likelihood of spills or misapplication, to take remedial actions in the event of spills, and to fully report the event. At a minimum, the plan will:
 - a) Address spill prevention and containment.
 - b) Estimate and limit the daily quantity of herbicides to be transported to treatment sites.

- c) Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling.
 - d) Require a spill cleanup kit be readily available for herbicide transportation, storage and application.
 - e) Outline reporting procedures, including reporting spills to the appropriate regulatory agency.
 - f) Ensure applicators are trained in safe handling and transportation procedures and spill cleanup.
 - g) Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition.
 - h) Address transportation routes so that hazardous conditions are avoided to the extent possible.
 - i) Specify mixing and loading locations away from waterbodies so that accidental spills do not contaminate surface waters
 - j) Require that spray tanks be mixed or washed further than 150 feet of surface water.
 - k) Ensure safe disposal of herbicide containers.
 - l) Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft.
 - m) All individuals involved, including any contracted applicators, will be instructed on the plan.
- 4) **Herbicides.** BPA proposes the use of the following herbicides in the typical application rates (see Tables 1 and 2) for invasive plant control. These products were previously evaluated in risk assessments by the US Forest Service (<http://www.fs.fed.us/foresthealth/pesticide/risk>).

Table 1. Herbicides Proposed for Use by BPA.

Common Name	Trade Name	Typical Application Rates (ai/ac)	Maximum Label Application Rate (ai/ac)	General Geographic Application Areas
2,4-D (amine)	Many	0.5 - 1.5 lbs.	4.0 lbs	Upland & Riparian
Aminopyralid	Milestone [®]	0.11 - 0.22 lbs	0.375 lb	Upland & Riparian
Chlorsulfuron	Telar [®]	0.25 - 1.33 oz	3.0 oz	Upland
Clethodim	Select [®]	0.125 – 0.5 lbs	0.50 lb	Upland
Clopyralid	Transline [®]	0.1 - 0.375 lbs	0.5 lb	Upland & Riparian
Dicamba	Banvel [®] only	0.25 - 7.0 lbs	8.0 lbs	Upland & Riparian
Glyphosate 1	Many	0.5 - 2.0 lbs	3.75 lbs	Upland & Riparian
Glyphosate 2	Many	0.5 - 2.0 lbs	3.75 lbs	Upland
Imazapic	Plateau [®]	0.063 – 0.189 lbs	0.189 lb	Upland & Riparian
Imazapyr	Arsenal [®] Habitat [®]	0.5 – 1.5 lbs.	1.5 lbs	Upland & Riparian

Metsulfuron methyl	Escort®	0.33 - 2.0 oz	4.0 oz	Upland
Picloram	Tordon®	0.125 - 0.50 lb	1 lb	Upland
Sethoxydim	Poast®	0.1875 – 0.375 lb	0.375 lb	Upland
Sulfometuron methyl	Oust®	0.023 - 0.38 oz	2.25 oz	Upland
Triclopyr (TEA)	Garlon 3A®	1.0 - 2.5 lbs	9.0 lbs	Upland & Riparian

- 5) **2,4-D.** As a result of the National Consultation¹⁰, this herbicide shall comply with all relevant reasonable and prudent alternatives from the 2011 Biological Opinion (NMFS 2011a):
 - a) Do not apply when wind speeds are below 2 mph or exceed 10 mph, except when winds in excess of 10 mph will carry drift away from salmonid-bearing waters.
 - b) Do not apply when a precipitation event, likely to produce direct runoff to salmonid bearing waters from the treated area, is forecasted by NOAA/NWS (National Weather Service) or other similar forecasting service within 48 h following application.
- 6) Control of invasive plants within the riparian habitat shall be by individual plant treatments for woody species, and spot treatment of less than 1/10 acre for herbaceous species per project per year.
- 7) **Adjuvants.** The following adjuvants are proposed for use (Table 2). Polyethoxylated tallow amine (POEA) surfactant and herbicides that contain POEA (e.g., Roundup) have been removed from the proposed action.
- 8) **Herbicide carriers.** Herbicide carriers (solvents) are limited to water or specifically labeled vegetable oil.
- 9) **Herbicide mixing.** Herbicides will be mixed more than 150 feet from any natural waterbody to minimize the risk of an accidental discharge and no more than three different herbicides may be mixed for any one application.
- 10) **Herbicide application rates.** Herbicides will be applied at the lowest effective label rates, including the typical and maximum rates given (Table 1). For broadcast spraying, application of herbicide or surfactant will not exceed the typical label rates.

Table 2. Adjuvants Proposed for Use by BPA.

Adjuvant Type	Trade Name	Labeled Mixing Rates per Gallon of Application Mix	General Geographic Application Areas
Colorants	Dynamark™ U.V. (red)	0.1 fl oz	Riparian
	Aquamark™ Blue	0.1 fl oz	Riparian

¹⁰ On June 30, 2011, NMFS issued a final biological opinion addressing the effects of this herbicide on ESA-listed Pacific salmonids. The opinion has concluded that EPA’s proposed registration of certain uses of 2,4-D, including aquatic uses of 2,4-D BEE are likely to jeopardize the continued existence of the 28 endangered and threatened Pacific salmonids. <http://www.nmfs.noaa.gov/pr/consultation/pesticides.htm>

	Dynamark™ U.V. (blu)	0.5 fl oz	Upland
	Hi-Light® (blu)	0.5 fl oz	Upland
Surfactants	Activator 90®	0.16 – 0.64 fl oz	Upland
	Agri-Dex®	0.16 – 0.48 fl oz	Riparian
	Entry II®	0.16 – 0.64 fl oz	Upland
	Hasten®	0.16 – 0.48 fl oz	Riparian
	LI 700®	0.16 – 0.48 fl oz	Riparian
	R-11®	0.16 – 1.28 fl oz	Riparian
	Super Spread MSO®	0.16 – 0.32 fl oz	Riparian
	Syl-Tac®	0.16 – 0.48 fl oz	Upland
Drift Retardants	41-A®	0.03 – 0.06 fl oz	Riparian
	Valid®	0.16 fl oz	Upland

- 11) **Herbicide application methods.** Liquid or granular forms of herbicides to be applied by a licensed applicator as follows:
 - a) Broadcast spraying – hand held nozzles attached to back pack tanks or vehicles, or by using vehicle mounted booms;
 - b) Spot spraying – hand held nozzles attached to back pack tanks or vehicles, hand-pumped spray, or squirt bottles to spray herbicide directly onto small patches or individual plants using;
 - c) Hand/selective – wicking and wiping, basal bark, fill (“hack and squirt”), stem injection, cut-stump;
 - d) Triclopyr – will not be applied by broadcast spraying.
- 12) **Emergent Knotweed Application.** No aquatic application of chemicals is covered by this consultation except for treating emergent knotweed. Only aquatic labeled glyphosate formulations will be used. The only application methods for emergent knotweed are stem injection (formulation up to 100% for emergent stems greater than 0.75 inches in diameter), wicking or wiping (diluted to 50% formulation), and hand-held spray bottle application of glyphosate (up to the percentage allowed by label instructions when applied to foliage using low pressure hand-held spot spray applicators).
- 13) **Water Transportation.** Most knotweed patches are expected to have overland access. However, some sites may be reached only by water travel, either by wading or inflatable raft (or kayak). The following measures will be used to reduce the risk of a spill during water transport:
 - a) No more than 2.5 gallons of glyphosate will be transported per person or raft, and typically it will be one gallon or less.
 - b) Glyphosate will be carried in 1 gallon or smaller plastic containers. The containers will be wrapped in plastic bags and then sealed in a dry-bag. If transported by raft, the dry-bag will be secured to the watercraft.
- 14) **Minimization of herbicide drift and leaching.** Herbicide drift and leaching will be minimized as follows:
 - a) Do not spray when wind speeds exceed 10 miles per hour, or are less than 2 miles per hour;

- b) Be aware of wind directions and potential for herbicides to affect aquatic habitat area downwind;
- c) Keep boom or spray as low as possible to reduce wind effects;
- d) Increase spray droplet size whenever possible by decreasing spray pressure, using high flow rate nozzles, using water diluents instead of oil, and adding thickening agents;
- e) Do not apply herbicides during temperature inversions, or when ground temperatures exceed 80 degrees Fahrenheit;
- f) Do not spray when rain, fog, or other precipitation is falling or is imminent. Wind and other weather data will be monitored and reported for all broadcast applications. Tables 5 and 6 identify BPA’s proposed minimum weather and wind speed restrictions (to be used in the absence of more stringent label instructions and restrictions). During application, applicators will monitor weather conditions hourly at sites where spray methods are being used.

Table 3. Herbicide Buffer Widths (from High Water Mark)

Herbicide	Broadcast Application ¹¹		Backpack Sprayer/Bottle ¹² Spot Spray Foliar/Basal		Hand Application ¹³ Wicking/Wiping/Injection
	Min buffer from high water mark (ft)	Max/ Min wind speed (mph)	Min buffer from high water mark (ft)	Max/ Min wind speed (mph)	Min buffer from high water mark (wind speed not a factor)
2,4-D (amine)	100	10/2	50	5/2	15 feet for aquatic labeled formulations.
Aminopyralid	100	10/2	15	5/2	Up to high water mark.
Chlorsulfuron	100	10/2	15	5/2	Up to high water mark.
Clethodim	NA	NA	50	5/2	Do not use within 50 feet of any surface water.
Clopyralid	100	10/2	15	5/2	Up to high water mark.
Dicamba (Banvel only)	100	10/2	15	5/2	Up to high water mark.
Glyphosate 1	100	10/2	15	5/2	Up to water’s edge for aquatic labeled formulations.
Glyphosate 2	100	10/2	100	5/2	100 feet
Imazapic	100	10/2	15	5/2	Up to water’s edge for aquatic labeled formulations.
Imazapyr	100	10/2	15	5/2	Up to water’s edge for aquatic labeled formulations; otherwise, up to the high water mark.

¹¹ Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.

¹² Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.

¹³ Hand applications to a specific portion of the target plant using wicking, wiping or injection techniques. This technique implies that herbicides do not touch the soil during the application process.

Metsulfuron	100	10/2	15	5/2	Up to high water mark.
Picloram	100	8/2	100	5/2	Do not use within 100 feet of any surface water.
Sethoxydim	100	10/2	50	5/2	Do not use within 50 feet of any surface water.
Sulfometuron	100	10/2	15	5/2	Up to high water mark.
Triclopyr (TEA)	100	10/2	50	5/2	Up to high water mark for cut-stump application of aquatic labeled formulations; 15 feet for other applications.
Herbicide Mixtures	100	Most conservative of listed herbicides	15	Most conservative of listed herbicides	Most conservative of listed herbicides.

Table 4. Adjuvant Buffer Widths to Minimize Impacts on Non-Target Resources.

Adjuvant	Broadcast Application ¹⁴	Backpack Sprayer/Bottle ¹⁵ Spot Spray Foliar/Basal	Hand Application ¹⁶ Wicking/Wiping/Injection
	Minimum buffer (ft)	Minimum buffer (ft)	Minimum buffer (ft) (wind speed not a factor)
Dynamark (red)	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Dynamark (yel)	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Dynamark (blu)	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.
Hi-Light (blu)	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.
Activator 90®	100	15	Up to water's edge for aquatic labeled formulations.
Agri-Dex	100	15	Up to water's edge for aquatic labeled formulations.
Entry II	100	<100 Do not use	<100 Do not use.
Hasten	100	15	Up to water's edge for aquatic labeled formulations.

¹⁴ Ground-based only broadcast application methods via truck/ATV with motorized low-pressure, high-volume sprayers using spray guns, broadcast nozzles, or booms.

¹⁵ Spot and localized foliar and basal/stump applications using a hand-pump backpack sprayer or field-mixed or pre-mixed hand-operated spray bottle.

¹⁶ Hand applications to a specific portion of the target plant using wicking, wiping or injection techniques. This technique implies that herbicides do not touch the soil during the application process.

LI 700	100	15	Up to water's edge for aquatic labeled formulations.
R-11	100	>50 <50 Do not use	>50 Herbicide dependent from Table 2-3. <50 Do not use.
Super Spread MSO	100	15	Up to water's edge for aquatic labeled formulations.
Syl-Tac	100	<50	<50 Do not use.
41-A	100	15	Up to water's edge when using herbicides labeled for aquatic uses.
Valid	100	50	<50 Do not use.

Road and Trail Erosion Control, Maintenance, and Decommissioning

5b: Road Decommissioning

Description. BPA proposes to decommission and obliterate roads that are no longer needed, e.g., logging roads. Water bars will be installed, road surfaces will be insloped or outsloped, asphalt and gravel will be removed from road surfaces, culverts and bridges will be altered or removed, streambanks will be recontoured at stream crossings, cross drains will be installed, fill or sidecast materials will be removed, road prism will be reshaped, and sediment catch basins will be created.

- 1) All surfaces will be revegetated to reduce surface erosion of bare soils.
- 2) Recontour the affected area to mimic natural floodplain contours and gradient to the extent possible.
- 3) Surface drainage patterns will be recreated, and dissipaters, chutes or rock will be placed at remaining culvert outlets.
- 4) Conduct activities during dry-field conditions (generally May 15 – October 15) when the soil is more resistant to compaction and soil moisture is low.
- 5) Slide and waste material will be disposed in stable, non-floodplain sites unless materials are to restore natural or near-natural contours, and approved by a geotechnical engineer or other qualified personnel.

Irrigation and Water Delivery/Management Actions

7g: Install New or Upgrade/Maintain Existing Fish Screens

Description. Irrigation diversion intake and return points will be designed or replaced to prevent fish and other aquatic organisms of all life stages from swimming or being entrained into the irrigation system. Fish screens for surface water that is diverted by gravity or by pumping at a rate that exceeds 3 cfs will be submitted to NMFS for review and approval. All other diversions will have a fish screen that utilizes an automated cleaning device with a minimum effective surface area of 2.5 square feet per cfs, and a nominal maximum approach velocity of 0.4 feet per second (fps), or no automated cleaning device, a minimum effective surface area of 1 square foot per cfs, and a nominal maximum approach rate of 0.2 fps; and a round or square screen mesh that is no larger than 2.38 mm (0.094”) in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069”) in the narrow dimension. Each fish screen will be installed, operated, and

maintained according to NMFS' fish screen criteria (NMFS 2011). Periodic maintenance, which may include temporary removal, of fish screens will be conducted to ensure their proper functioning, e.g., cleaning debris buildup, and replacement of parts.

State resource agencies may submit one PNC form for all anticipated fish screen installation, repairs, and maintenance for each field season. The PNC shall contain proposed locations (GIS map) and specific activities. PNCs shall contain actual locations, specific activities undertaken, and a statement of compliance with NMFS fish screen criteria (NMFS 2011).

Fisheries, Hydrologic, and Geomorphologic Surveys

Description. BPA proposes to fund the collection of information in uplands, floodplains, and streambeds regarding existing on-ground conditions relative to habitat type, condition, and impairment; species presence, abundance, and habitat use; and conservation, protection, and rehabilitation opportunities or effects. Electro-shocking and fish handling for research purposes is not included, as this work must have an ESA Section 10 research permit.

Work may entail use of trucks, survey equipment, and crews using hand tools, and includes the following activities:

- 1) Measuring/assessing and recording physical measurements by visual estimates or with survey instruments.
- 2) Installing rebar or other markers along transects or at reference points.
- 3) Installing piezometers and staff gauges to assess hydrologic conditions and installing recording devices for stream flow and temperature.
- 4) Conducting snorkel surveys to determine species of fish in streams and observing interactions of fish with their habitats
- 5) Excavating cultural resource test pits.
- 6) Installing PIT detector arrays.

Special Actions (for Terrestrial Species)

9d: Tree Removal for LW Projects

Description. Live conifers and other trees can be felled or pulled/pushed over in a Northwest Forest Plan (USDA and USDI 1994b) Riparian Reserve or PACFISH/INFISH (USDA-Forest Service 1995; USDA and USDI 1994a) riparian habitat conservation areas (RHCA), and upland areas (e.g., late successional reserves or adaptive management areas for northern spotted owl and marbled murrelet critical habitat) for in-channel LW placement only when conifers and trees are fully stocked. Tree felling shall not create excessive stream bank erosion or increase the likelihood of channel avulsion during high flows. Trees may be removed by cable, ground-based equipment, or helicopter. Danger trees and trees killed through fire, insects, disease, blow-down and other means can be felled and used for in-channel placement regardless of live-tree stocking levels. Trees may be felled or pushed/pulled directly into a stream or floodplain. Trees may be stock piled for future instream restoration projects. The project manager for an aquatic restoration action will coordinate with an action-agency wildlife biologist in tree-removal planning efforts.

The purpose of these criteria is to ensure that there would be no removal or adverse modification of suitable habitat for marbled murrelet or spotted owl.

- 1) The following Conservation Measures apply to tree removal within the range of marbled murrelets and the spotted owl in Douglas-fir dominated stands less than 80 years old that are not functioning as foraging habitat within a spotted owl home range and do not contain murrelet nesting structure. It does not apply to tree selection in older stands or hardwood-dominated stands unless stated otherwise.
 - a) A wildlife biologist must be fully involved in all tree-removal planning efforts, and be involved in making decisions on whether individual trees are suitable for nesting or have other important listed bird habitat value.
 - b) Outside of one site potential tree height of streams, trees can be removed to a level not less than a Relative Density (RD) of approximately 35 (stand scale), which is considered as fully occupying a site. This equates to approximately 60 trees per acre in the overstory and a tree spacing averaging 26 feet. Additionally 40% canopy cover would be maintained when in spotted owl or marbled murrelet CH, when within 300 feet of occupied or unsurveyed murrelet nesting structure, and when dispersal habitat is limited in the area.
 - c) Tree species removed should be relatively common in the stand (i.e., not “minor” tree species).
 - d) Snags and trees with broad, deep crowns (“wolf” trees), damaged tops or other abnormalities that may provide a valuable wildlife habitat component can not be removed.
 - e) No gaps (openings) greater than 0.5 acre will be created in spotted owl CH. No gaps greater than ¼ acre will be created in murrelet CH. No gaps shall be created in Riparian Reserves that contain ESA-listed fish habitat.
- 2) The following conservation measures applies to tree removal within the range of marbled murrelet and the spotted owl in Douglas-fir dominated stands greater than 80 years old or that are functioning as foraging habitat within a spotted owl home range, and/or do contain marbled murrelet nesting structure.
 - a) Individual trees or small groups of trees should come from the periphery of permanent openings (roads etc.) or from the periphery of non-permanent openings (e.g., plantations, along recent clear-cuts etc.). Groups of trees greater than 4 trees shall 1) not be removed from within marbled murrelet suitable stands or stands buffering (300 ft.) MM suitable stands, 2) not be buffering (300 ft.) individual trees with marbled murrelet nesting structure. A minimum distance of one potential tree height feet should be maintained between individual or group removals.
 - b) Trees up to 36” dbh may be felled in any stands with agreement from an FWS wildlife biologist that the trees are not providing marbled murrelet nesting structures or providing cover for nest sites. No known spotted owl nest trees or alternate nest trees are to be removed. Potential spotted owl nest trees may only be removed in limited instances when it is confirmed with the FWS wildlife biologist that nest trees will not be limited in the stand post removal.
 - c) In order to minimize the creation of canopy gaps or edges, groups of adjacent trees selected should not create openings greater than ¼ acre within 0.5 miles of marbled murrelet occupied habitat or when within murrelet CH. Within spotted owl critical habitat, stands greater than 80 years old or within stands providing foraging habitat to spotted owl home ranges, gaps will be restricted to 0.5 acre openings or less. Gaps shall not be created in Riparian Reserves where ESA-listed fish occur.

Species Specific Conservation Measures for Birds

Within the Columbia River Basin, BPA funded activities may occur in areas that are near or occupied by the following avian ESA-listed species; (a) Streaked horned lark (*Eremophila alpestris strigata*), (b) Marbled murrelet (*Brachyramphus marmoratus*) and critical habitat, (c) Northern spotted owl (*Strix occidentalis caurina*) and critical habitat and (d) Western snowy plover (*Charadrius alexandrinus nivosus*) and their critical habitat (Pacific coast DPS).

Streaked horned lark (Eremophila alpestris strigata)

Description. Streaked horned lark and its critical habitat were proposed to be listed as threatened on October 11, 2012. The current range of the streaked horned lark can be divided into three regions: (1) Puget lowlands in Washington, (2) Washington coast and lower Columbia River islands (including dredge spoil deposition sites near the Columbia River in Portland, Oregon), and (3) Willamette Valley in Oregon.

Streaked horned larks prefer wide open spaces with no trees and few or no shrubs. They nest on the ground in sparsely vegetated sites dominated by grasses and forbs. Data indicate that sites used by larks are generally found in open (i.e., flat, treeless) landscapes of 120 hectares (ha)(300 acres) or more. Some patches with the appropriate characteristics (i.e., bare ground, low stature vegetation) may be smaller in size if the adjacent fields provide the required open landscape context. This situation is common in agricultural habitats and on sites next to water. For example, many of the sites used by larks on the islands in the Columbia River are small, but are adjacent to open water, which provides the landscape context needed.

Conservation Measures:

- 1) Restoration projects proposed at locations with suitable habitat will be surveyed for streaked horned larks (using a survey protocol approved by the USFWS) prior to project design. If streaked horned larks are identified, contact the appropriate USFWS field office to confirm the project is *not likely to adversely affect* streaked horned lark.
- 2) Restoration activities generating noise above ambient levels within 200 feet (1.0 mile for blasting and pile driving) of likely occupied nesting habitat will not occur from March 15 to August 15.
- 3) If an area is identified as likely to be occupied by larks, riparian plantings will not occur within 300 feet to maintain the open habitat suitable required by streaked horned larks unless individual project approval has been received from the appropriate FWS field office.

Species Specific Conservation Measures for Plants

Within the Columbia River Basin, BPA funded activities may occur in areas that are near or occupied by the following ESA-listed plant species; Bradshaw's lomatium (*Lomatium bradshawii*), Cook's lomatium (*Lomatium cookie*) and their critical habitat, Gentner's fritillary (*Fritillaria gentneri*), Golden paintbrush (*Castilleja levisecta*), Howell's spectacular thelypody (*Thelypodium howellii spectabilis*), Kincaid's lupine (*Lupinus sulphureus ssp. Kincaidii*) and their critical habitat, Large-flowered wooly meadowfoam (*Limnanthes floccosa*) and their critical habitat, Malheur wire-lettuce (*Stephanomeria malheurensis*) and their critical habitat, McFarlane's four o'clock (*Mirabilis macfarlanei*), Nelson's checkermallow (*Sidalcea nelsoniana*), Rough popcorn flower (*Plagiobothrys hirtus*), Showy stickseed (*Hackelia hispida*),

Slickspot peppergrass (*Lepidium papilliferum*) and their proposed critical habitat, Spalding's catchfly (*Silene spaldingii*), Umtanum Desert buckwheat (*Eriogonum codium*) and their critical habitat, Ute ladies' tresses (*Spiranthes diluvialis*), Water howellia (*Howellia aquatilis*), Wenatchee Mountain checkermallow (*Sidalcea oregana var. calva*) and their critical habitat, Western lily (*Lilium occidentale*), Willamette daisy (*Erigeron decumbens*) and their critical habitat, and White Bluffs bladderpod (*Physaria douglasii*) and their critical habitat.

Surveys.

If an ESA- listed plant is located within the county where a project is proposed (based on a review of the most recent USFWS county species list), contact the appropriate USFWS field office to determine whether there are known ESA-listed plants or suitable unsurveyed habitat for ESA-listed plants in the project area. If a known site of an ESA-listed plant is within 0.4 km (0.25 mi) of the project action area, or suitable or potential habitat may be affected by project activities, then a BPA contract botanist will conduct a site visit/vegetation survey to determine whether ESA-listed plants are within the project area. This visit and survey will be conducted at the appropriate time of year to identify the species and determine whether individual listed plants or potential habitat are present and may be adversely affected by project activities (**Table 5**). If listed plants are present and likely to be adversely affected by the project, then an individual consultation with the USFWS under Section 7 of the ESA must be initiated.

Table 5 – Optimal Survey Times for Flowering Periods of Listed Plants in Oregon and Washington

Species	Optimal Survey Time Period*
Bradshaw’s Lomatium (<i>Lomatium bradshawii</i>)	April to mid-May
Cook’s Lomatium (<i>Lomatium cookii</i>)	Mid-March through May (varies with spring moisture)
Gentner’s Fritillary (<i>Fritillaria gentneri</i>)	April to June
Golden Paintbrush (<i>Castilleja levisecta</i>)	April to September
Howell’s Spectacular Thelypody (<i>Thelypodium howellii</i> ssp. <i>spectabilis</i>)	June through July
Kincaid’s Lupine (<i>Lupinus sulphureus</i> ssp. <i>kincaidii</i>)	May through July
Large-flowered Woolly Meadowfoam (<i>Limnanthes floccose</i>)	Mid-March to May (varies with spring moisture)
Malheur Wire-Lettuce (<i>Stephanomeria malheurensis</i>)	July through August
MacFarlane’s four o’clock (<i>Mirabilis macfarlanei</i>)	May through June
Nelson’s Checkermallow (<i>Sidalcea nelsoniana</i>)	Late May to Mid-July
Rough Popcornflower (<i>Plagiobothrys hirtus</i>)	Mid-June to early July

Showy Stickseed (<i>Hackelia venusta</i>)	May to July
Slickspot peppergrass (<i>Lepidium papilliferum</i>)	Mid-May to Mid-July
Spalding’s Catchfly (<i>Silene spaldingii</i>)	June to September
Umtanum Desert Buckwheat (<i>Eriogonum codium</i>)	June through July
Ute Ladies’-Tresses (<i>Spiranthes diluvialis</i>)	July to late August
Water Howellia (<i>Howellia aquatilis</i>)	May through August
Wenatchee Mountains Checker-Mallow (<i>Sidalcea oregano</i> var. <i>calva</i>)	June to Mid-August
Western Lily (<i>Lilium occidentale</i>)	May to July
Willamette Daisy (<i>Erigeron decumbens</i> var. <i>decumbens</i>)	Mid-June to early July
White Bluffs Bladderpod (<i>Physaria douglasii</i> ssp. <i>tuplashensis</i>)	Mid-May to Mid-June

Conservation Measures:

For all of the above mentioned ESA-listed plant species that may occur in project areas within the scope of this proposed action, the following criteria will be applied:

- 1) Prior to restoration activities at areas with listed plants, all project staff will be familiarized with identification of any ESA-listed plants in the area and will be aware of ESA-listed plant locations within the project area.
- 2) Access points and tracks within occupied or suitable habitats for ESA-listed plant species must be limited and clearly marked to avoid soil compaction and damage to ESA-listed plant species from vehicles and/or foot traffic.
- 3) Revegetation activities in habitats where ESA-listed plants may occur or within their critical habitat must be approved by the USFWS field office prior to implementation.
- 4) Dust-abatement additives and stabilization chemicals will not be applied within 10 m (33 ft) of listed plants or critical habitat for listed plants.
- 5) Restoration activities will avoid actions that cause soil compaction, erosion, or deposition, or change the hydrology or drainage of a site with listed plants or critical habitat for listed plants.
- 6) Vehicle and equipment staging areas will be located at least 15 m (50 ft) from listed plants or critical habitat for listed plants.

Steigerwald Floodplain Restoration Project

BPA Project # 2003-011-00

Contract # 70379

11/16/2015

Sponsor Signature

As a condition of funding, I acknowledge my responsibility to ensure that the project as described will meet all of the applicable general and specific conservation measures, in addition to all the applicable terms and conditions of the HIP III Biological Opinion, unless NMFS and/or USFWS has approved a variance request.

Project Sponsor's Signature

Date

Appendix C: Air Quality Model Results

	B	C	D	E	F	H	I	J	K	L	O
2	Road Construction Emissions Model, Version 7.1.5.1										
3											
4	Emission Estimates for -> Steigerwald Lake										
5	Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
6	Grubbing/Land Clearing	-	-	-	5.0	-	5.0	1.0	-	1.0	-
7	Grading/Excavation	8.4	40.5	80.4	8.6	3.6	5.0	4.3	3.2	1.0	10,562.5
8	Drainage/Utilities/Sub-Grade	4.2	21.5	32.6	6.7	1.7	5.0	2.6	1.5	1.0	4,043.8
9	Paving	-	-	-	-	-	-	-	-	-	-
10	Maximum (pounds/day)	8.4	40.5	80.4	8.6	3.6	5.0	4.3	3.2	1.0	10,562.5
11	Total (tons/construction project)	0.6	2.9	5.5	0.6	0.3	0.4	0.3	0.2	0.1	714.4
12	Notes:	Project Start Year ->	2017								
13		Project Length (months) ->	8								
14		Total Project Area (acres) ->	42								
15		Maximum Area Disturbed/Day (acres) ->	1								
16		Total Soil Imported/Exported (yd ³ /day)->	800								
17	PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.										
18	Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in columns K and L.										

BONNEVILLE POWER ADMINISTRATION
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