4.7 Fish

Fish and fish habitat are important resources of the Columbia River. They include fish listed as endangered or species of concern under state or federal regulations. Resident or anadromous[1] fish species support important tribal, commercial and recreational fisheries and are integral to a healthy freshwater and marine ecosystems.

This section describes fish in the study area. It then describes impacts on fish that could result from construction and operation of the Proposed Action and under the No-Action Alternative. This section also presents the measures identified to mitigate impacts resulting from the Proposed Action.

4.7.1 Regulatory Setting

Laws and regulations relevant to fish are summarized in Table 4.7-1.

Table 4.7-1. Regulations, Statutes, and Guidelines for Fish

Regulation, Statute, Guideline	Description
Federal	
Endangered Species Act (16 USC 1531 *et seq*.)	Requires that applicants seeking a federal action such as issuing a permit under a federal regulation (e.g., NEPA, Clean Water Act, Clean Air Act) undergo consultation with USFWS and/or NMFS. This will ensure the federal action is not likely to jeopardize the continued existence of any listed threatened or endangered animal species or result in the destruction or adverse modification of designated critical habitat. NMFS is responsible for managing, conserving, and protecting ESA-listed marine species. USFWS is responsible for terrestrial and freshwater species. Both NMFS and USFWS are responsible for designating critical habitat for ESA-listed species.
Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267)	Requires fishery management councils to include descriptions of essential fish habitat and potential threats to essential fish habitat in all federal fishery management plans. Also requires federal agencies to consult with NMFS on activities that may adversely affect essential fish habitat.
State	
Washington State Growth Management Act (36.70A RCW)	Defines a variety of critical areas, which are designated and regulated at the local level under city and county critical areas ordinances. These critical areas may include shorelines or portions of fish habitat.
Washington State Shoreline Management Act (90.58 RCW)	Requires cities and counties (through Shoreline Master Programs) to protect shoreline natural resources.

[1] *Anadromous* describes a life history of migration between fresh water and salt water. Reproduction and egg deposition occur in fresh water while rearing to the adult stage occurs in the ocean.

Regulation, Statute, Guideline	Description
Washington State Hydraulic Code (WAC 220-660)	WDFW issues a hydraulic project approval for certain construction projects or activities in or near state waters. The hydraulic code was specifically designed to protect fish life.
Clean Water Act Section 401 Water Quality Certification	Ecology issues Section 401 Water Quality Certification for in-water construction activities to ensure compliance with state water quality standards and other aquatic resources protection requirements under Ecology's authority as outlined in the federal Clean Water Act.
Local	
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Regulates activities within and adjacent to critical areas.
Cowlitz County Shoreline Master Program (CCC 19.20)	Regulates development within shoreline jurisdiction, including the shorelines of the Columbia River, a Shoreline of Statewide Significance.

Notes:
USC = United States Code; NEPA = National Environmental Policy Act; USFWS = U.S. Fish and Wildlife Service; NMFS = National Marine Fisheries Service; ESA = Endangered Species Act; RCW = Revised Code of Washington; WAC = Washington Administrative Code; WDFW = Washington Department of Fish and Wildlife; CCC = Cowlitz County Code; Ecology = Washington State Department of Ecology

4.7.2 Study Area

The study area for direct impacts on fish is the main channel of the Columbia River 3.92 miles upstream and downstream of the project area, measured from the two proposed docks (Figure 4.7-1). This study area accounts for the area where noise from construction or operation of the Proposed Action could affect fish.

The study area for indirect impacts on fish extends downstream from the project area to the mouth of the Columbia River (Figure 4.7-2). This extended study area accounts for areas with shallow-sloping beaches on which fish could be stranded by wakes from the 70 large vessels that would be operated monthly for the Proposed Action. An indirect study area was also established to evaluate the potential impacts that could occur as a result of a coal spill, which includes the rail routes for Proposed Action-related trains in Cowlitz County and Washington State to transport coal to the coal export terminal (refer to Chapter 5, Section 5.1, *Rail Transportation,* for rail routes in Cowlitz County and Washington State).

4.7.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts on fish associated with the construction and operation of the Proposed Action and No-Action Alternative.

Figure 4.7-1. Fish Direct Study Area

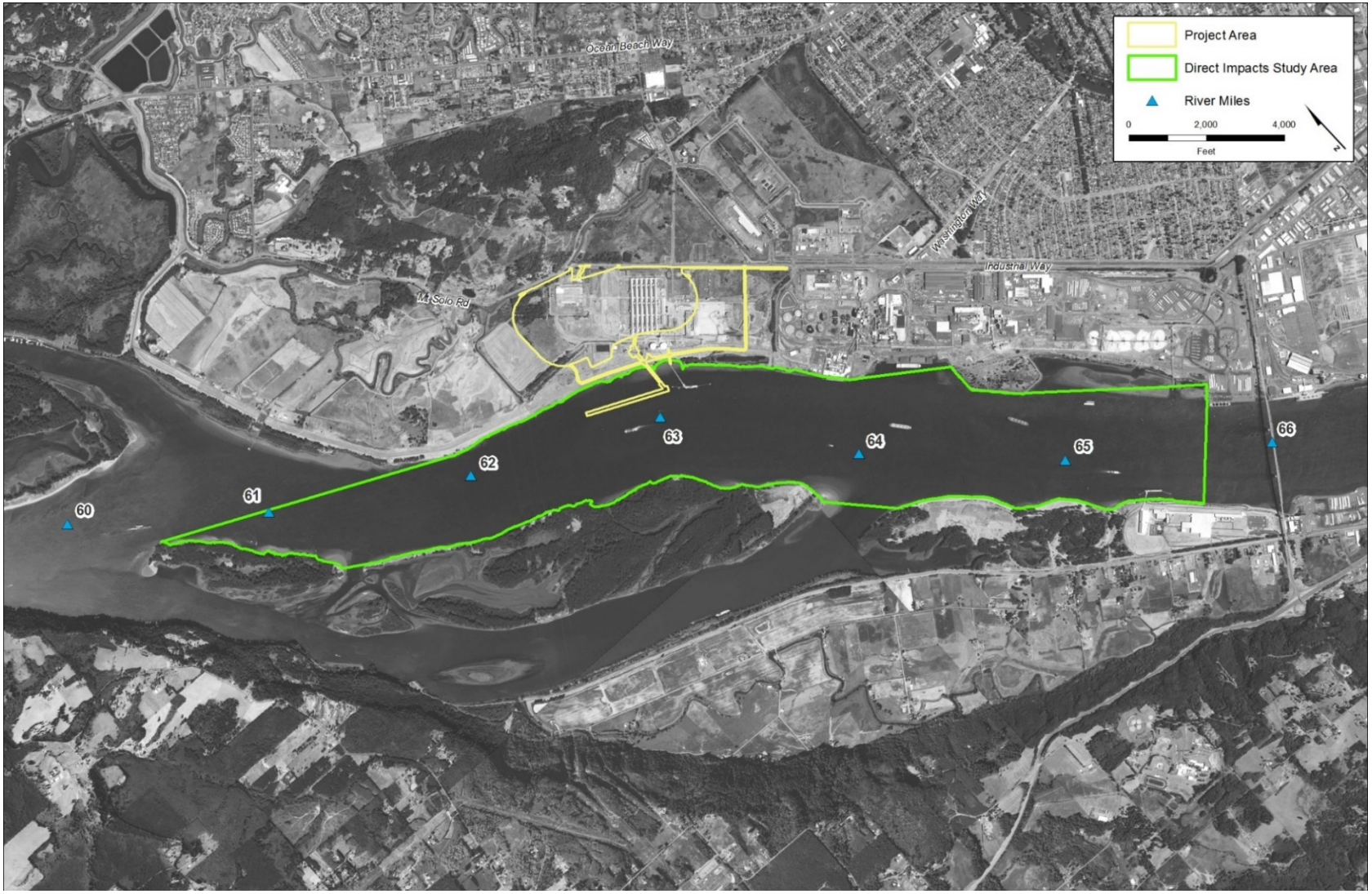
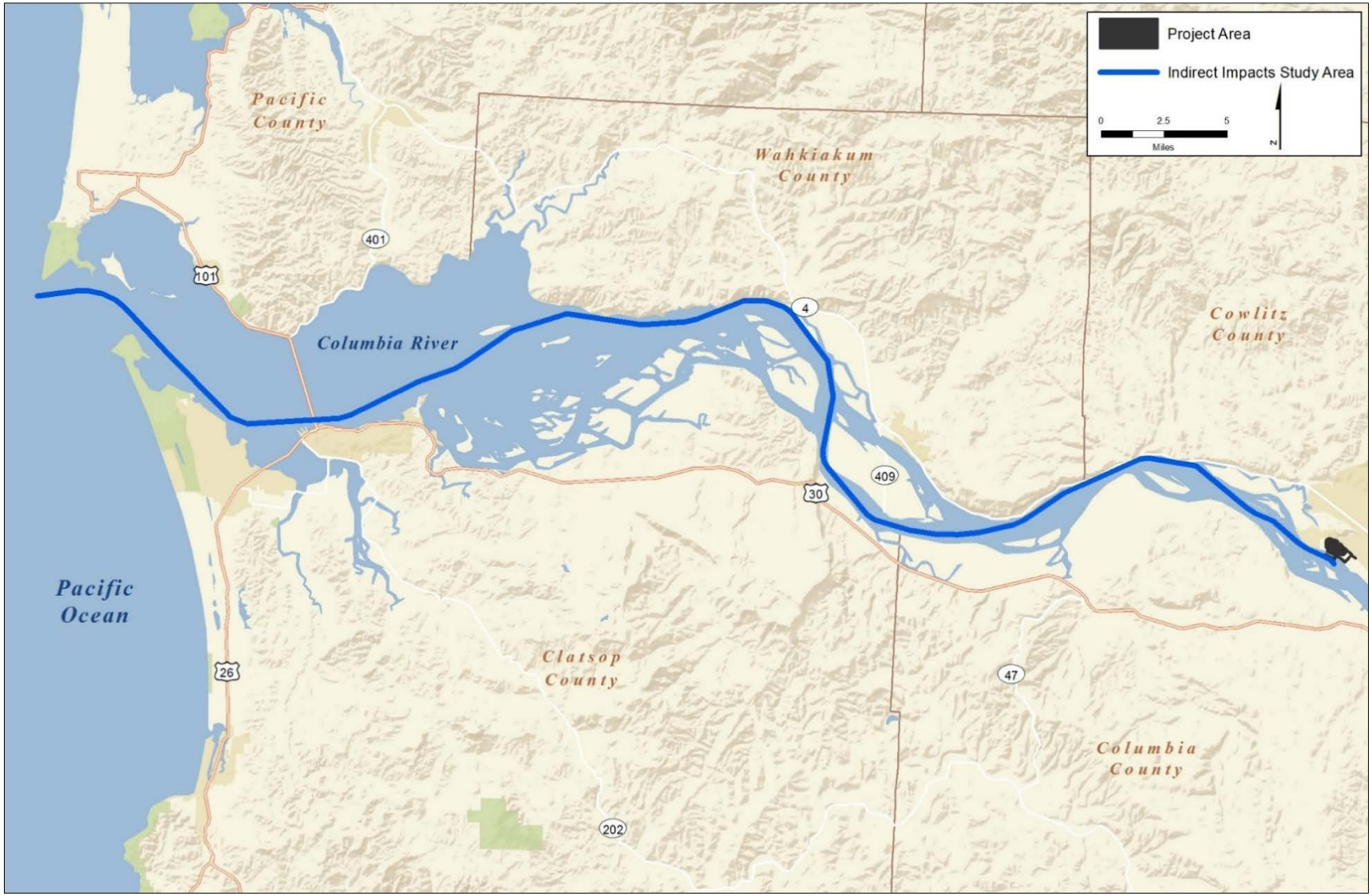


Figure 4.7-2. Fish Indirect Study Area



4.7.3.1 Information Sources

The following sources of information were used to define the existing conditions relevant to fish and identify the potential impacts of the Proposed Action and No-Action Alternative on fish in the study areas. These sources focus on fish, fish habitat, and aquatic resources in the study areas and, specifically, the aquatic and shoreline habitat adjacent to the project area.

- One site visit conducted by ICF International fish biologists on January 29, 2014.
- Reports prepared by Grette Associates for the Applicant as part of the permit application materials. (Grette Associates 2014a, 2014b, 2014c, 2014d, 2014e, 2014f).
- National Oceanic and Atmospheric Administration (NOAA) Fisheries West Coast Region species list and listing packages (2014a, 2014b
- U.S. Fish and Wildlife Service (USFWS) (2014) Information, Planning, and Conservation system online database.
- Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) geographic information system (GIS) data (2015a) and SalmonScape data (2015b).
- Washington Department of Natural Resources, Natural Heritage Program (2014).
- Washington State Department of Ecology (Ecology) 303(d)/305(b) Integrated Report Viewer (2014).
- Fish Passage and Timing Data Columbia River Data Access in Real Time, Columbia Basin Research, University of Washington (juvenile and adult fish passage) (Columbia River Research 2014).

A detailed list of references is provided in the *SEPA Fish Technical Report* (ICF International 2016a).

4.7.3.2 Impact Analysis

Potential fish and fish habitat that could be affected by construction and operation of the Proposed Action were determined as follows. For more information on these methods, see the *SEPA Fish Technical Report*.

Identifying Resources in the Study Area

The following species and habitat characteristics were identified and quantified, where possible.

- Documented species occurrences.
- Species likely to occur in the study area.
- Suitable habitat conditions.

Impacts on fish species are qualitatively described because fish are generally mobile and their presence and abundance in the study area cannot be quantitatively predicted at a specific location or time. Where appropriate, species sensitivity to construction or operation impacts is discussed.

Assessing Noise Impacts

Federal agencies have established interim criteria to protect fish from underwater noise generated by pile-driving (Fisheries Hydroacoustic Working Group 2008; Carlson et al. 2007). The criteria indicate that sound pressure levels ranging from 150 to 206 decibels (dB) peak could injure fish or change their behavior, depending on the size of the fish. Specific dB criteria for Endangered Species Act (ESA)-listed fish are provided in Table 4.7-2. NMFS assumes that a 12-hour recovery period with no exposure to sound is necessary to return to appropriate cumulative sound levels (Stadler and Woodbury 2009).

Table 4.7-2. Underwater Sound-Level Thresholds for Endangered Species Act-Listed Fish

Species	Effect Type	Threshold
All Listed Fish[a]	Injury, cumulative sound (fish ≥2 grams): onset of TTS (auditory response), with onset of auditory tissue damage and nonauditory tissue damage with increasing cumulative sound	187dBSELcum
	Injury, cumulative sound (fish <2 grams): similar to above, onset of nonauditory tissue damage occurs at lower sound levels with smaller fish	183dBSELcum
	Injury, single strike: onset of TTS and auditory tissue damage from single strike	206dBPEAK
	Behavioral Disruption	150dBRMS

Notes:

[a] Injury thresholds are based on interim criteria that were developed for salmonids based on data specific to hearing generalists with swim bladders (Carlson et al. 2007). NMFS also applied these thresholds to other listed fish with swim bladders (e.g., green sturgeon) and sometimes conservatively to fish without swim bladders (e.g., eulachon). Injury descriptions are based on information summarized in Carlson et al. (2007).

Source: Grette Associates 2014a.

TTS = temporary threshold shift; dB = decibel; SEL = sound exposure level; cum = cumulative; RMS = root mean square.

The criteria for sound pressure levels and underwater noise thresholds described above were applied to proposed pile-driving activities for the Proposed Action. Because the project area is similar to the Columbia River Crossing (the site of a proposed interstate crossing of the Columbia River, between Portland, Oregon and Vancouver, Washington), underwater noise characteristics from pile-driving at that site were used to calculate per-pile levels of underwater noise for the 36-inch diameter pile used for the Proposed Action (Grette Associates 2014b).

A complete description of noise impact models, calculations, and assessments is provided in the *SEPA Fish Technical Report*. Further, project-related vessels could generate underwater noise levels that could cause disturbance, as measured by the applicable noise thresholds for fish. Vessel noise levels were obtained from available literature, and are described in the *SEPA Fish Technical Report*.

4.7.4 Existing Conditions

This section describes the existing environmental conditions in the direct and indirect study areas related to fish that could be affected by the construction and operation of the Proposed Action and the No-Action Alternative. Key terms used in this section are defined in Table 4.7-3.

Table 4.7-3. Definitions of Key Terms

Term	Acronym	Definition
Active channel margin	ACM	The shoreline and nearshore edge habitat, extending from the OHW line to 0 feet (Columbia River Datum)
Columbia River Datum	CRD	The adopted fixed low water reference plane for the lower Columbia River.
Decibel	dB	A logarithmic unit used to express the ratio of two values of a physical quantity, often power or intensity.
Deepwater zone	DWZ	The area extending from the edge of the SWZ, approximately 450 feet from the shore at a depth of 31 feet, outward to a maximum depth of 56 feet deep approximately 1,200 feet from shore.
Distinct population segment	DPS	The smallest division of a taxonomic species permitted to be protected under the ESA.
Essential fish habitat	EFH	Per the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act, EFH includes those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.
Evolutionarily significant unit	ESU	A population of organisms that is considered distinct for purposes of conservation.
Peak	PEAK	The instantaneous maximum overpressure or underpressure observed during each pulse during pile-driving.
Primary constituent element	PCE	A physical or biological feature essential to the conservation of a species for which its designated or proposed critical habitat is based on, such as space for individual and population growth, and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and habitats that are protected from disturbance or are representative of the species' historic geographic and ecological distribution.
Priority habitat and species	PHS	Program fulfilled by WDFW to provide important fish, wildlife and habitat information to local governments, state and federal agencies, private landownders and consultants, and tribal biologists for land use planning purposes.
Root mean square	RMS	The square root sound of the energy divided by the impulse duration. Essentially, the average of the PEAK energy measured over time.
Shallow water zone	SWZ	The fully inundated near-shore zone extending from the edge of the ACM at 0 feet CRD out to -20 feet CRD.

Term	Acronym	Definition
Sound exposure level	SEL	A metric for acoustic events, often used as an indication of the energy dose.
Temporary threshold shift	TTS	Temporary hearing damage.

The lower Columbia River (Bonneville Dam to the mouth of the Columbia River), which encompasses the study areas, has been affected by extensive modifications for flood control, industrial development, and deep draft vessel traffic. The mainstem Columbia River is deeper than it was historically because of the deepening and periodic maintenance dredging of the navigation channel and the berths in and adjacent to the existing and proposed docks. The hydrologic regime and water temperature have been altered by the operation of dams throughout the Columbia River basin. River flows can reverse direction during periods when river flows are low and incoming tides are large. Although the flow may reverse in response to tidal fluctuation, saltwater does not intrude as far upstream as the study area and the water remains fresh through the tidal cycle. The study area can be considered a high energy environment, characterized by strong currents, active bedload transport, and variable patterns of sediment of deposition and erosion (Grette Associates 2014c).

Floodplain habitats have been disconnected from the riverine environment and in some cases eliminated. The shoreline and riparian environment has been substantially altered by extensive shoreline armoring and protection, construction of overwater structures, and development in adjacent upland and riparian zones. These modifications have eliminated and substantially altered habitat conditions and degraded habitat-forming processes, resulting in corresponding changes to the biological communities associated with these habitats.

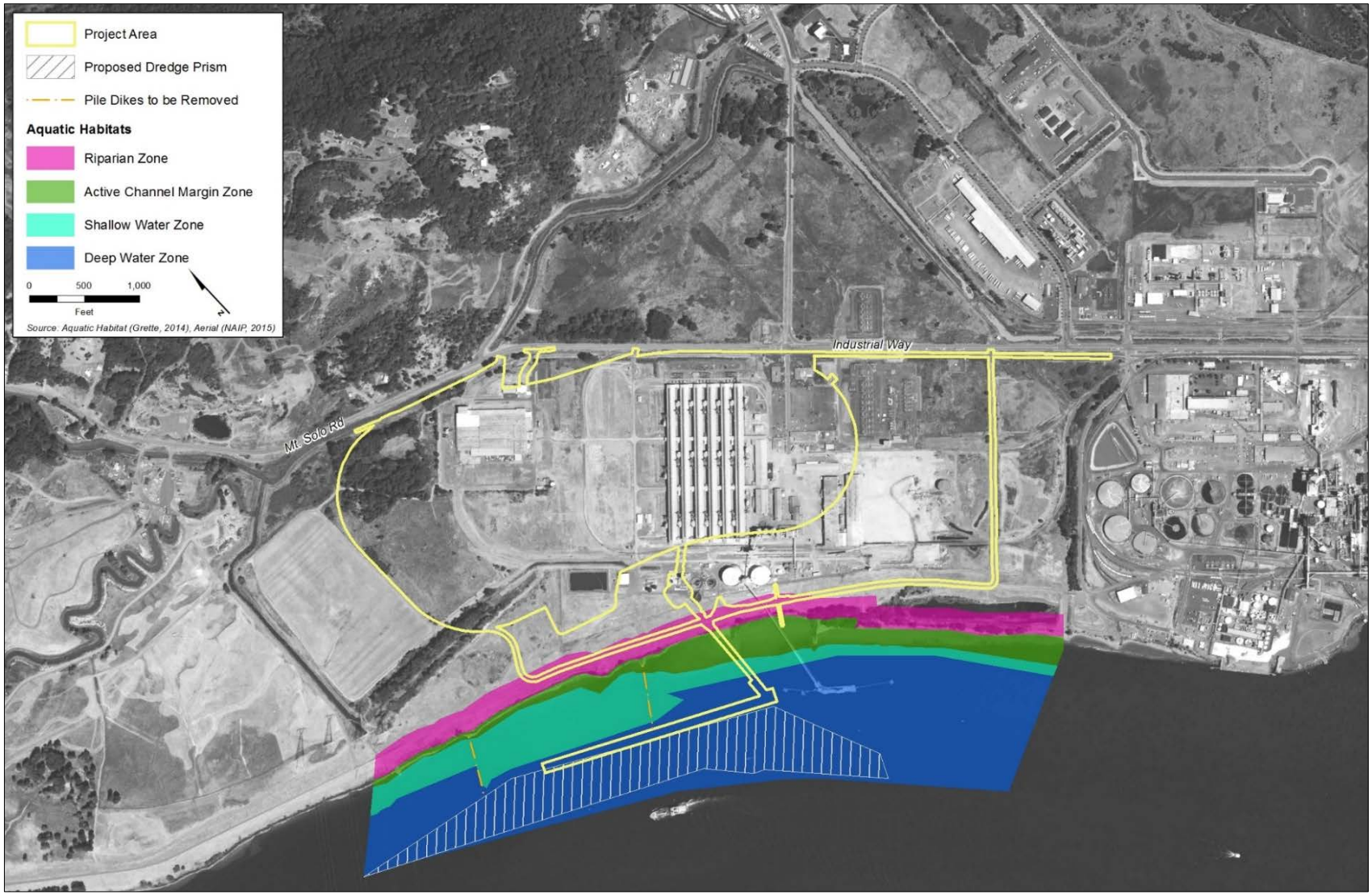
The Columbia River estuary is downstream of the project area. It has been considerably degraded from past use due to diking and filling and from water withdrawal for agricultural, municipal, and industrial purposes. The estuary is also influenced by a number of physical structures (e.g., jetties, pilings, pile dikes, bulkheads, revetments, and docks) that contribute to its overall degradation. Habitat-forming processes in the lower river and estuary have also been altered by loss of upstream sediment input (now constrained behind upriver dams), changes in flow patterns that move sediments and modify landforms, and channel deepening and dredging.

4.7.4.1 Aquatic Habitat Types

The aquatic habitat in the study area is discussed in terms consistent with habitat equivalency analysis,[2] which describes habitat quality in the context of habitat availability and suitability as a function of water depth and physical attributes. The aquatic portion of the study area adjacent to the project area is composed of three broad habitat types (Grette Associates 2014a): the active channel margin (ACM), the shallow water zone (SWZ), and the deepwater zone (DWZ). The riparian zone is also considered in terms of its interactions with aquatic habitats, as the riparian zone is the transition from aquatic to upland/terrestrial habitat. A plan view showing the extent of each habitat type is provided in Figure 4.7-3.

[2] Habitat equivalency analysis is a tool that can be used to estimate habitat gains and losses across a range of habitat types

Figure 4.7-3. Aquatic Habitat Types Potentially Affected by the Proposed Action



Riparian Zone

The riparian zone includes lands extending approximately 200 feet landward from ordinary high water mark (OHWM). Shoreline armoring and Consolidated Diking Improvement District (CDID) #1 levees have contributed to a low-complexity and artificially steepened upper shoreline with no floodplain connectivity downstream of the proposed new docks. Landward of the shoreline, most of the riparian area has been heavily modified such that there is little remaining habitat function (Grette Associates 2014a). Relative to shoreline areas with intact riparian habitat, the habitat equivalency analysis would rank shoreline habitat at a lower value, especially when compared to similar areas with intact riparian habitat (e.g., Lord Island, immediately across the river) (Grette Associates 2014a).

Active Channel Margin

The ACM is defined as the shoreline and nearshore edge habitat. The ACM near the proposed docks covers approximately 25 acres and extends from 25 to 350 feet offshore with a maximum depth of about 11 feet (Figure 4.7-2). Water levels in the ACM fluctuate continuously. Portions of the ACM are periodically dewatered by tidal influence and river flow conditions, with the extent and duration of exposure dependent on site-specific topography. Habitat functions in the ACM are strongly influenced by the condition of the shoreline and adjacent riparian zone. The shoreline in this area is highly modified by levees and riprap armoring with scattered large woody debris.

Shallow Water Zone

The SWZ includes the fully inundated near-shore zone extending waterward from the edge of the ACM. The SWZ covers approximately 34 acres near the proposed docks and extends from approximately 25 to 500 feet offshore with maximum depths ranging from 11 to 31 feet. Bottom structure is primarily (90%) flat or shallow sloping substrate, with some moderate slopes out to depths of about 25 feet, where the slope becomes markedly steeper. The substrate consists primarily of silty river sand with little organic matter (Grette Associates 2014a).

Deepwater Zone

The DWZ encompasses approximately 115 acres near the proposed docks, extending waterward from the edge of the SWZ. At approximately 450 feet from the shore, it is 31 feet deep; at 1,200 feet from shore, it reaches 56 feet deep. The DWZ is a dynamic environment, characterized by relatively high flows (high water velocity) and sediment transport. Sediments are composed of fine grain sands with little to no gravel or cobble for structure (Grette Associates 2014a).

4.7.4.2 Focus Fish Species

Fish species of special interest include federally and state-listed threatened and endangered fish and their designated critical habitat, as well as species of commercial, recreational, or cultural importance. Table 4.7-4 outlines the focus fish species, the listing status of each species (i.e., state and federal), habitat types these species typically occupy, and their seasonal occurrence in the study area. Other common native and introduced fish species also occur in the study area.

Salmon and Trout

Eight threatened or endangered salmon evolutionarily significant units (ESUs), five threatened steelhead distinct population segments (DPSs), one threatened bull trout DPS, and their designated critical habitats occur in the study area (Table 4.7-4) (Bottom et al. 2008; National Marine Fisheries Service 2011). In addition, essential fish habitat (EFH) has been designated for Chinook and coho salmon in the lower Columbia River. The Columbia River estuary is used primarily as migratory and rearing habitat by salmon, steelhead, and bull trout (salmonid), and no salmonid spawning takes place in the study area. Adult anadromous salmonids travel through the estuary and lower river relatively quickly during their migration to upstream spawning grounds, remaining primarily in offshore deepwater habitats. In contrast, juvenile salmonids use a wider variety of habitats and exhibit more variable downstream migration speed, taking advantage of shallow water and ACM for foraging and seeking cover.

General salmon reproductive strategies can be divided into two groups: stream-rearing and ocean-rearing. Stream-rearing fish tend to spend extended periods of time, usually more than a year, rearing in fresh water before emigrating to the ocean. Examples of stream-type fish are steelhead, coho and spring-run Chinook salmon. In contrast, ocean-type juvenile salmonids tend to return to the ocean in the same year they were spawned. Examples of ocean-type fish are chum salmon, and fall-run Chinook salmon. These strategies affect how each population uses the estuary and how it may be affected by the Proposed Action.

Designated critical habitat for federally protected salmonids within the study area consists of two primary elements: migration corridors and estuarine areas. Additionally, the Columbia River is also EFH, as defined by the Magnuson-Stevens Fishery and Management Conservation Act for Chinook salmon and coho salmon. EFH for Pacific salmon is defined as those waters and substrate necessary for salmon production needed to support a long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem.

A fully functioning ACM provides natural cover (large woody debris, undercut banks, overhanging vegetation), shoreline complexity, shade, submerged and overhanging large woody debris, logjams, and aquatic vegetation. All of these elements are identified in the primary constituent elements (PCEs) of critical habitat for ESA-listed salmon and steelhead, as well as bull trout (Grette Associates 2014a). PCEs are defined as those physical and biological features that a species needs to survive and reproduce. The ACM provides important habitat for juvenile salmon, with different species using different habitat types at different life stages. Table 4.7-4 identifies the seasons when salmon and steelhead species could be present in the ACM portion of the study area.

The SWZ is used primarily as a migratory corridor by adult salmon and steelhead and as foraging habitat by larger juveniles that are capable swimmers in open water. Juvenile Chinook salmon, and sockeye salmon and steelhead smolts are typically found in deeper open water in the SWZ, where they forage on phytoplankton, invertebrates, and small fish (Bottom et al. 2008; Carter et al. 2009). Juvenile Chinook salmon are most commonly present from March through July but juveniles of certain runs may be found in the SWZ during any month of the year. Juvenile coho salmon and steelhead are less likely to be found in the shallower areas but are abundant in deepwater offshore habitats during their outmigration period (Roegner and Sobocinski 2008), indicating that they likely occur in the deeper areas of the SWZ.

Table 4.7-4. Status of Focus Species and Seasonal Presences in the Study Area[a]

Species	Evolutionarily Significant Units/ Distinct Population Segments	Status Federal/ State	Life History Type	Critical Habitat Present in Study Area	Habitat Type	Expected Seasonal Presence[c]			
						Winter	Spring	Summer	Fall
Chinook Salmon[b] (*Onchorhyncus tshawytscha*)	Lower Columbia River	T/SC	O	Yes	ACM	X	X	X	
					SWZ		X	X	X
					DWZ	X	X	X	X
	Upper Willamette River	T/NL	O	Yes	ACM	X	X		
					SWZ		X		X
					DWZ	X	X		X
	Deschutes River Summer/Fall Run	NL/NL	O	NA	ACM		X	X	
					SWZ		X	X	X
					DWZ		X	X	X
	Middle Columbia River Spring Run	NL, PHS	S	NA	ACM				
					SWZ				
					DWZ		X		
	Upper Columbia River Summer/Fall Run	NL, PHS	0	NA	ACM		X	X	
					SWZ		X	X	X
					DWZ		X	X	X
	Upper Columbia Spring Run	E/SC	S	Yes	ACM				
					SWZ		X		
					DWZ		X		
	Snake River Fall Run	T/SC	O	Yes	ACM		X	X	
					SWZ		X	X	X
					DWZ		X	X	X
	Snake River Spring/Summer Run	T/SC	S	Yes	ACM				
					SWZ		X	X	
					DWZ		X	X	
Coho Salmon (*O. kisutch*)	Lower Columbia River	T/NL	S	Proposed	ACM	X	X	X	
					SWZ	X	X	X	X
					DWZ		X		X

Species	Evolutionarily Significant Units/ Distinct Population Segments	Status Federal/ State	Life History Type	Critical Habitat Present in Study Area	Habitat Type	Expected Seasonal Presence[c]			
						Winter	Spring	Summer	Fall
Chum Salmon (*O. keta*)	Columbia River	T/SC	O	Yes	ACM	X	X		
					SWZ	X	X		X
					DWZ				X
Sockeye Salmon (*O. nerka*)	Snake River	E/SC	S	Yes	ACM				
					SWZ		X	X	
					DWZ		X	X	
	Okanogan River	NL, PHS	S	NA	ACM				
					SWZ		X	X	
					DWZ		X	X	
	Lake Wenatchee	NL, PHS	S	NA	ACM				
					SWZ		X	X	
					DWZ		X	X	
Steelhead Trout (*O. mykiss*)	Snake River	T/SC	S	Yes	ACM				
					SWZ		X	X	X
					DWZ		X	X	X
	Upper Columbia River	T/SC	S	Yes	ACM				
					SWZ		X	X	X
					DWZ		X	X	X
	Middle Columbia River	T/SC	S	Yes	ACM				
					SWZ		X	X	X
					DWZ		X	X	X
	Lower Columbia River	T/SC	S	Yes	ACM				
					SWZ	X	X	X	X
					DWZ	X	X	X	X
	Upper Willamette River	T/NL	S	Yes	ACM				
					SWZ	X	X	X	X
					DWZ	X	X	X	X
Pink Salmon (*O. gorbuscha*)		NL/NL	0	NA	ACM				
					SWZ		X	X	
					DWZ		X	X	

Species	Evolutionarily Significant Units/ Distinct Population Segments	Status Federal/ State	Life History Type	Critical Habitat Present in Study Area	Habitat Type	Expected Seasonal Presence[c]			
						Winter	Spring	Summer	Fall
Bull Trout (*Salvelinus confluentus*)	Columbia River	T/SC	NA	Yes	ACM				
					SWZ	X	X	X	X
					DWZ	X	X	X	X
Cutthroat Trout (*Oncorhynchus clarki clarki*)	Columbia River	NL/NL	NA	NA	ACM				
					SWZ	X	X	X	X
					DWZ	X	X	X	X
Green Sturgeon (*Acipenser medirostris*)	Southern and Northern	T/NL (Southern) SOC/NL (Northern)	NA	Yes	ACM				
					SWZ			x	x
					DWZ			x	X
White Sturgeon (*A. transmontanus*)	Lower Columbia River	NL, PHS	NA	NA	ACM				
					SWZ	X	X	X	X
					DWZ	X	X	X	X
Eulachon (*Thaleichthys pacificus*)	Southern	T/SC	NA	Yes	ACM		X		
					SWZ	X	X	X	
					DWZ	X	X	X	
Pacific (*Entosphenus tridentatus*) and River Lamprey (*Lampetra ayresii*)	Multiple populations	NL, PHS	NA	NA	ACM				
					SWZ	X	X	X	X
					DWZ	X	X	X	X

Notes:

[a] Based on Fresh et al. (2005).

[b] Information for Chinook salmon is referenced from Roegner et al. (2012, 2013), Columbia River Research (2014), and Bottom et al. (2008). Lowercase "x" denotes that species/life stage use of this habitat type is limited relative to other habitat types.

[c] Seasons are based on Roegner et al. (2012, 2013): December–February = Winter; March–June = Spring; July–August = Summer; and September–November = Fall.

T = Federal Threatened; E = Federal Endangered; SOC = Species of Concern; SC = State Candidate; NL = not listed; PHS = priority habitats and species; NA = not applicable; ACM = active channel margin, SWZ = shallow water zone, DWZ = deepwater zone; O = ocean-type characterized by upstream migration as mature spawners, fry and fingerlings dominate age class in estuary, migrate to sea in same year as spawned, most affected by flow and habitat; S = stream-type characterized by upstream migration in unripened condition, extended rearing in stream, yearling or older age class dominate in estuary, affected by flow and predation.

The DWZ provides a migratory corridor for adult salmon and steelhead and foraging and migratory habitat for larger juvenile Chinook salmon, coho salmon, and sockeye salmon and steelhead smolts pursuing phytoplankton, invertebrates, and small fish (Bottom et al. 2008; Carter et al. 2009; Roegner and Sobocinski 2008). Generally, juvenile salmonids do not reside in specific habitats in the lower Columbia River for extended periods, remaining in a given area for just a day or two before moving downstream to new suitable habitats (Bottom et al. 2008; Johnson et al. 2003). Juvenile and adult salmon and steelhead are likely to be found in the DWZ during their respective migration and rearing periods (Table 4.7-4) as outmigrating salmonids (particularly stream type) tend to use deepwater (Carter et al. 2009).

Bull Trout (Char)

Columbia River bull trout are listed as threatened, and there is one extant population in the Lewis River subbasin, which drains to the lower Columbia River below Bonneville Dam. Bull trout migrate to the mainstem Columbia River to rear, overwinter, or migrate to and from spawning areas. Subadults may occur in the study area throughout the year in shallow rearing habitats of the ACM and SWZ while adults are more likely to occur in the deeper areas of the SWZ and the DWZ (U.S. Army Corps of Engineers 2004).

Eulachon

Eulachon are small anadromous fish in the smelt family (*Osmeridae*), sometimes known as Columbia River smelt (among other names), that spawn in coastal rivers and migrate to the ocean to rear to adulthood. The lower Columbia River up to Bonneville Dam and the lower reaches of those tributary streams that provide potential spawning habitats (i.e., Grays, Elochoman, Cowlitz, Kalama, Lewis and Sandy Rivers) have been designated as critical habitat (76 *Federal Register* [FR] 65324). Currently, the lower mainstem Columbia River and the Cowlitz River support the majority of eulachon production in the system (Gustafson et al. 2010). However, in years of relative abundance, spawning occurs broadly in the tidally influenced portions of the Columbia River and its tributaries (Grette Associates 2014c).

Recent studies have documented egg and larval stage eulachon between the Port of Longview above Barlow Point and the channel below the Cowlitz River mouth including four sample sites offshore of the project area (Mallette 2014). Peak larval abundance occurred in mid-March during two of the three survey years and in late April/early May in the third (Mallette 2014). Eggs could be present From December through April; however, peak of spawning season is usually in February or March. Larval eulachon, particularly from spawning aggregations in the Cowlitz River, likely pass through the study area as they are transported downstream.

Adult eulachon could arrive in the study area as early as November, although most adults would migrate through the study area during peak spawning between February and March. Eggs from early spawners could be transported with currents from the tributaries downstream to portions of the study area where suitable incubation conditions exist (i.e., sand waves) shortly thereafter. Emergent larvae could be present in the study area as early as December. However, based on the timing of peak spawning, and because incubation occurs for 1 to 2 months (Grette Associates 2014b), peak larval transport has been shown to occur between mid-March and early May (Mallette 2014).

Dredging in the Columbia River is identified as an activity of concern for eulachon conservation because this activity takes place in proximity to known and potential eulachon habitats. Dredging activities during the migratory and spawning period could entrain and kill adult fish, eggs, and larvae; bury and smother incubating eggs; or cause stress and disturbance that could contribute to decreased spawning success (National Marine Fisheries Service 2010).

Sturgeon

Both green and white sturgeon may be present in the deepwater habitats of the study area as adults and subadults. Two green sturgeon DPSs occur in in the lower Columbia River. While this species does not spawn in the Columbia River or its tributaries, subadult and adult green sturgeon from all major spawning populations use the lower Columbia River and other coastal estuaries in Oregon and Washington for holding habitat in the summer and early fall (Adams et al. 2002; Lindley et al. 2011; Moser and Lindley 2007). Sturgeon are most commonly found in association with the bottom, where they feed on a mixture of aquatic insects and benthic (i.e., bottom dwelling) invertebrates (Adams et al. 2002; Independent Scientific Review Panel 2013). The water depth preferences of white sturgeon indicate this species is most likely to be found in the DWZ, but individuals may also be present in the SWZ and, infrequently, in the ACM. The DWZ near the proposed docks does not provide suitable substrates for white sturgeon spawning or larval rearing, so these life stages are unlikely to occur for extended periods in this area. In contrast, juvenile white sturgeon are found throughout the lower Columbia River and use a wide variety of habitats, including both main-channel and off-channel areas. They are most commonly found at depths greater than 33 feet (Independent Scientific Review Panel 2013).

The white sturgeon population in the Columbia River downstream from Bonneville Dam has been among the most productive sturgeon populations in North America. White sturgeon downstream from Bonneville Dam continue to range freely throughout the lower river mainstem, estuary, and marine habitats to take advantage of dynamic seasonal patterns of food availability. Individual growth, condition, and maturation values from the Lower Columbia River remain among the highest observed for white sturgeon range-wide. Habitat use of subadults and adults varies with habitat availability. Given the abundance and mobility of white sturgeon in the Lower Columbia River, there likely would be some present during construction and operation of the Proposed Action.

Lamprey

Lamprey are primitive anadromous fish that spend their adult lives in the ocean but return to freshwater habitats for spawning and larval rearing. Two species, Pacific and river lamprey, spawn in tributaries to the Columbia River and migrate through the study area as adults and juveniles. Adults migrate through the lower Columbia River from March through October on their return to spawning tributaries (Columbia River Research 2014). Adult lamprey ascend rivers by swimming upstream briefly, sucking to rocks, resting, and then proceeding. Larval lamprey (ammocoetes) hatch after 2 to 3 weeks and are dispersed downstream by currents to slack-water areas with soft substrates, where they settle in sediments. The larval lamprey burrow into soft substrate where they may reside for 3 to 8 years as filter feeders. Late in the larval lamprey's life stage, unknown factors trigger metamorphosis, when larval lamprey become juvenile lamprey. During late winter or early spring, juvenile lamprey migrate to the ocean where they mature. The study area lacks suitable spawning substrates for either species. Juvenile and adult lamprey may be present in the SWZ and DWZ during their respective migration periods (Table 4.7-4).

Nonfocus Fish

The nonfocus fish (Table 4.7-5) are important food fish (harvested commercially and recreationally), game fish (harvested recreationally), or on Washington's PHS list. Two of the species, mountain whitefish (*Prosopium williamsoni*) and leopard dace (*Rhinichthys falcutus*), are on Washington's PHS list as state candidate species. Both species are widely distributed in the Columbia and Frasier River basins. The remainder of the species in this group are important as commercial or recreational species. Most are abundant and widely distributed in the system, including several introduced species. Some are known predators of juvenile salmonid, such as largemouth bass, northern pikeminnow, smallmouth bass, striped bass, and walleye.

Table 4.7-5. Nonfocus Fish Species that Could Occur in the Study Area

Species	Reason for Interest	Native or Introduced
Channel catfish (*Ictalurus punctatus*)	WDFW game fish	I
Common carp (*Cyprinus carpio*)	WDFW food fish	I
Largemouth bass (*Micropterus salmoides*)	WDFW game fish	I
Leopard dace (*Rhinichthys falcutus*)	WDFW PHS	N
Mountain sucker (*Catostomus platyrhuchus*)	WDFW PHS, WDFW game fish	N
Mountain whitefish (*Prosopium williamsoni*)	WDFW game fish	N
Northern pikeminnow (*Ptychocheilus oregonensis*)	WDFW game fish	N
Peamouth (*Mylocheilus caurinus*)	WDFW game fish	N
Perch (family Percidae)	WDFW game fish	I
Shad (subfamily Alosinae)	WDFW food fish	I
Smallmouth bass (*Micropterus dolomieu*)	WDFW game fish	I
Suckers (family Catostomidae)	WDFW game fish	N
Sunfish (family Centrarchidae)	WDFW game fish	I
Striped bass (*Morone saxatilis*)	WDFW game fish	I
Walleye (*Sander vitreus*)	WDFW game fish	I

Notes:
Source: Grette Associates 2014a.
WDFW = Washington Department of Fish and Wildlife; PHS = Priority Habitats and Species; I = introduced; N = native

Commercial, Tribal and Recreational Fishing

Commercial, tribal and recreational fisheries in the lower Columbia River are managed by the States of Washington and Oregon, and tribes, subject to the terms of the 2008–2017 *United States v. Oregon* Management Agreement. The agreement establishes tribal harvest allocations and upholds the right of tribes to fish for salmon in their usual and accustomed fishing grounds. Commercial and recreational fishing primarily target hatchery-produced salmon and steelhead, as well as sturgeon and other game fish. Tribal fish resources are discussed in Chapter 3, Section 3.6, *Tribal Resources*.

Commercial fisheries in these waters are managed under the Columbia River Compact, a congressionally mandated process that adopts seasons and rules for Columbia River commercial fisheries (National Marine Fisheries Service 2015). The Columbia River Compact consists of the Washington and Oregon Departments of Fish and Wildlife Directors or their delegates, acting on

behalf of the Oregon and Washington Fish and Wildlife Commission. The Columbia River Compact is charged by congressional and statutory authority to adopt seasons and rules for Columbia River commercial fishers. When addressing commercial seasons for salmon, steelhead, and sturgeon, the Columbia River Compact must consider the effect of the commercial fishery on escapement, treaty rights, and sport fisheries, as well as the impact on species listed under the federal ESA. Although the Columbia River Compact has no authority to adopt sport fishing seasons or rules, its inherent responsibility is to address the allocation of limited resources among users. This responsibility has become increasingly demanding in recent years. The Columbia River Compact can be expected to be more conservative than in the past when considering fisheries that will affect listed salmon and steelhead (National Marine Fisheries Service 2015).

In Washington, recreational fishing seasons and rules are updated annually and presented in the Washington Sport Fishing Rules pamphlet. Sport fishing seasons are generally established for July 1 through June 30 of the following year. The pamphlet covers all fresh waters and marine waters in Washington, including the lower Columbia River, and establishes the seasons and rules for recreational fishing for finfish and shellfish or seaweed.

Water Quality Conditions

Sediment conditions in the study area are generally uniform with slight variations between aquatic habitat types. ACM sediments are primarily sand mixed with silt, SWZ sediments are primarily sand, and DWZ sediments are primarily silt mixed with sand (Grette Associates 2014c). The Lower Columbia River is listed as a Washington State 303(d) impaired water and is classified by Ecology as a Category 5 polluted water for dissolved oxygen, Dieldrin (organochlorine insecticide), PCB (polychlorinated biphenyl), and 2,3,7,8 TCDD (tetrachlorodibenzo-p-dioxin), and 4,4,4 DDE (dichlorodiphenyldichloroethylene) (Grette Associates 2014c). The nearest measured water quality impairment (for dioxin and bacteria) occurs approximately 2.5 miles upstream of the project area (Washington State Department of Ecology 2014). Over the years, downstream salinity patterns have changed, but intrusion and salinity within the study area are generally similar to historic patterns. Turbidity in the study area consistently ranges from 29 to 67 nephelometric turbidity units (NTUs) at all depths (U.S. Army Corps of Engineers Dredged Material Management Office 2010 in Grette Associates 2014c). Water temperature within the study area ranges from low 40s to low 70s (°F), and while this is slightly warmer than historic values (Bottom et al. 2008), the area is not listed as a Washington State 303(d) impaired water for temperature. Salmonids typically move from habitat areas as temperatures approach 66°F, and the study area habitat within the ACM and upper SWZ likely reaches this threshold and may become unsuitable for juveniles salmonids in the summer months. Refer to the *SEPA Water Quality Technical Report* (ICF International 2016b) for further information regarding water quality conditions near the project area.

Fish Stranding

A growing body of evidence indicates that juvenile salmon and other fish are at risk of stranding on wide, gently sloping beaches because of wakes generated by deep draft vessel passage (Bauersfeld 1977; Hinton and Emmett 1994; Pearson et al. 2006; ENTRIX 2008). Depending on the slope and breadth of a beach, wakes from passing vessels can travel a considerable distance, carrying fish and depositing them on the beach where they are susceptible to stress, suffocation, and predation.

Pearson et al. (2006) published the most detailed study of Columbia River fish stranding completed to date. They evaluated stranding at three sites in the Lower Columbia River: Sauvie Island, Barlow

Point (adjacent to the project area), and County Line Park. The sites were chosen because prior work had established them as sites with a high risk of stranding (Bauersfield 1977). Pearson et al. (2006) observed 126 vessel passages, 46 of which caused stranding. They also measured numerous site variables such as fish density (measured via beach seining), site topography, river stage, current velocity, tidal stage, tidal height, and a variety of vessel variables including direction of movement, velocity, ship type, ship size, and draft. Although the study provides an understanding of the factors that contribute to stranding, it does not create a predictive model because it was limited to analysis of known or suspected high-risk sites. From the study, certain sites appear to be more susceptible to stranding than others. For example, the highest occurrence of stranding occurred at Barlow Point, where 53% of the observed passages resulted in stranding. Stranding occurred less frequently at Sauvie Island (37% of the observed passages resulted in stranding) and County Line Park (15% of observed passages resulted in stranding) (Person et al. 2006). The Proposed Action would add 840 vessel transits to the Columbia River at full build-out, which would introduce additional permanent risk of fish stranding in the Columbia River. However, Barlow Point is directly downstream from the Proposed Action and vessels would be slowing as they approach the docks and accelerating as they leave the docks, which could reduce the size of vessel wakes generated by vessels associated with the Proposed Action at Barlow Point. Other sites downstream of Barlow Point would be susceptible to increased risk of fish stranding because of the vessels associated with the Proposed Action.

4.7.5 Impacts

This section describes the potential direct and indirect impacts related to fish and fish habitat that would result from the construction and operation of the Proposed Action and the No-Action Alternative.[3]

4.7.5.1 Proposed Action

This section describes the potential impacts that could occur in the study areas as a result of construction and operation of the Proposed Action. The Applicant has identified the following design features and best management practices to be implemented as part of the Proposed Action, and were considered when evaluating potential impacts of the Proposed Action.

- The Applicant would design the trestle to be long and narrow, and at a height above OHW to minimize shading in the shallow water zone. From shore, the trestle would measure 24 feet in width for 700 feet, and 51 feet in width for the final 150 feet. The top of the deck would be +22 feet Columbia River Datum and the bottom of the deck +19.5 feet Columbia River Datum. Therefore, the bottom of the deck would be more than 8 feet above OHW. This design would minimize overall impacts in shallow water, including impacts on habitat connectivity along the shoreline.
- The Applicant would locate Docks 2 and 3 entirely in deepwater habitat to distance the structure and terminal activities from shallow water areas.
- The Applicant would locate the berthing area at depths of at least -20 feet Columbia River Datum to avoid habitat conversion from shallow to deepwater during dredging.

[3] Acreages presented in the impacts analysis were calculated using Geographic Information System (GIS), thus, specific acreage of impacts are an estimate of area based on the best available information.

- The Applicant would locate the berthing area in deepwater closer to the navigation channel to minimize the scope of future maintenance dredging.
- The Applicant would direct project lighting downward or at structures, and would incorporate shielding to avoid spillage of light into aquatic areas.
- The Applicant would include a pinpoint light source at the end of the shiploading boom, aimed straight down into the ship hold area to avoid a broader beam that could cause light spillage.
- The Applicant would remove the piles slowly to minimize sediment disturbance and turbidity in the water column.
- Prior to pile extraction, the Applicant would break the friction between the pile and substrate to minimize sediment disturbance.
- The Applicant would prepare a mitigation plan in coordination with the Corps, Ecology, and Cowlitz County to address the impacts on wetlands and aquatic habitats. Mitigation actions may be implemented at one or several locations to ensure that a wide range of ecological functions is provided to offset identified, unavoidable impacts of the Proposed Action. The mitigation actions may include applicant-sponsored mitigation actions or use of credits from existing or proposed mitigation banks.
- The Applicant would conduct impact pile-driving using a confined bubble curtain or similar sound attenuation system capable of achieving approximately 9 dB of sound attenuation.
- During pile removal and pile-driving, the Applicant would place a containment boom around the perimeter of the work area to capture wood debris and other materials released into the waters as a result of construction activities. The Applicant would collect all accumulated debris and dispose of it upland at an approved disposal site. The Applicant would deploy absorbent pads should any sheen be observed.
- The Applicant would provide a containment basin on the work surface on the barge deck or pier for piles and any sediment removed during pulling. The Applicant would dispose of any sediment collected in the containment basin at an appropriate upland facility, as with all components of the basin (e.g., straw bales, geotextile fabric) and all pile removed.
- Upon removal from substrate, the Applicant would move the pile expeditiously from the water into the containment basin. The Applicant would not shake, hose, strip, or scrape the pile, nor leave it hanging to drip or any other action intended to clean or remove adhering material from the pile.
- The Applicant would limit the impact of turbidity to a defined mixing zone and will otherwise comply with WAC 173-201A.
- The Applicant would not stockpile dredged material on the river bottom surface.
- The Applicant would contain all dredged material in a barge prior to flow lane disposal; dredged material would not be stockpiled on the riverbed.
- During hydraulic dredging, the Applicant would not operate hydraulic pumps unless the dredge intake is within 3 feet of the bottom.
- The Applicant would remove any floating oil, sheen, or debris within the work area as necessary to prevent loss of materials from the site. The Applicant would be responsible for retrieval of any floating oil, sheen, or debris from the work area and any damages resulting from the loss.

- The Applicant would dispose materials to the flow lane using a bottom-dump barge or hopper dredge. These systems release material below the surface, minimizing surface turbidity.
- The Applicant would have a spill containment kit, including oil-absorbent materials, on site to be used in the event of a spill or if any oil product is observed in the water.
- The Applicant would not allow barges to ground out during construction.
- The Applicant would be required to retrieve any floating debris generated during construction using a skiff and a net. The Applicant would dispose of debris at an appropriate upland facility. If necessary, the Applicant would install a floating boom to collect any floated debris generated during in-water operations.
- The Applicant would not allow land-based construction equipment to enter any shoreline body of water except as authorized.
- The Applicant would store, handle, and use all fuel and chemicals in a fashion to ensure that they do not enter the water.

Construction activities that could affect fish or fish habitat include the following.

- Permanent removal or temporary alteration of fish habitat and prey resources from dredging and pile installation.
- Noise impacts on fish associated with pile-driving.
- Shading of aquatic habitat during construction from construction vessels and construction of docks.
- Spills and leaks during construction from equipment or storage of potentially hazardous materials.

Operation activities that could impact fish or fish habitat include the following.

- Shading of aquatic habitat from Docks 2 and 3 and vessels.
- Spills and leaks of potentially hazardous materials associated with operations (i.e., fuel, hydraulic fluids, lubricants or other chemicals).
- Vessel generated noise.
- Vessel generated wakes resulting in fish stranding.
- Impacts on fish and benthic habitat during maintenance dredging.
- Coal dust deposition in aquatic environments.

Construction—Direct Impacts

Construction-related activities associated with the Proposed Action could result in direct impacts as described below. As explained in Chapter 2, *Project Objectives, Proposed Action*, *and Alternatives,* construction-related activities include demolishing existing structures and preparing the site, constructing the rail loop and dock, and constructing supporting infrastructure (i.e., conveyors and transfer towers).

Temporarily Alter and Permanently Remove Aquatic Habitat

Construction of the proposed docks would temporarily alter or permanently remove aquatic habitat in the Columbia River adjacent to the project area. A total of 610, 36-inch-diameter steel piles would be placed in-water, permanently removing 0.10 acre (4,312 square feet) of benthic habitat. The majority of this habitat is located in the DWZ, and pile placement would result in the loss of benthic habitat and primary and secondary production from affected benthic habitat. Benthic, epibenthic (i.e., living at the water-substrate interface), or infaunal (i.e., beneath the surface of the river floor) organisms within the footprint of individual piles at the time of pile-driving would likely perish.

Existing creosote-treated piles would be removed from portions of two existing timber pile dikes. Removal of approximately 225 lineal feet of pile dike would result in long-term benefits by removing a source of creosote, a mixture of polycyclic aromatic hydrocarbons (PAHs) and other chemicals that are toxic to aquatic organisms (Brooks 1995). However, removal could temporarily increase suspended sediments, resulting in short-term contamination of water and long-term contamination of sediments from creosote piling that have been in place for many years, which may be mobilized during extraction and result in temporary water contamination.

Dredging would permanently alter a 48-acre area of benthic habitat in the DWZ by removing approximately 500,000 cubic yards of benthic sediment to achieve a depth of -43 feet Columbia River Datum, with a 2-foot overdredge allowance. Water depth would be increased by up to 16 feet in the dredge prism (i.e., extent of the area to be dredged). The majority of benthic, epibenthic, and infaunal organisms within the proposed dredge prism would be removed during dredging. Recolonization by benthic, epibenthic and infaunal organisms would be rapid, and disturbed habitats would return to reference conditions following recolonization by benthic organisms (McCabe et al. 1996). Typically 30 to 45 days is the amount of time required for benthic organisms to recolonize disturbed environments.

Sediment sampling from within, adjacent to, and upstream of the project area has demonstrated that in deepwater areas of the Columbia River, sediments are typically composed of silty sands with a low proportion of fines (e.g., silt or mud) and very low total organic carbon. Further, sediments sampled from deepwater areas in the project vicinity have consistently met suitability requirements for flow lane disposal or beneficial use in the Columbia River (Grette Associates 2014c). Thus, it is anticipated that sediment within the dredge prism for Docks 2 and 3 would be deemed suitable for flow lane disposal or beneficial use in the Columbia River. However, prior to obtaining permits for the Proposed Action, including dredging, the Applicant would conduct site-specific sediment sampling to characterize the proposed dredge prism and ensure compliance with the dredged materials management plan (Grette Associates 2014c). The disposal area for dredged materials is anticipated to be approximately 80 to 110 acres. The actual acreage and specific location of the disposal site would be determined by the permitting agencies and would be based on sediment characteristics (i.e., consistency and density of sediments). Recent authorizations for flow lane disposal of dredged materials in the Columbia River in the vicinity of the project area were generally in or adjacent to the Columbia River navigation channel between approximately river miles 60 and 66 (Grette Associates 2014b). Riparian vegetation at the project area is sparse and degraded. Project construction would not result in measurable impacts on riparian vegetation or habitat conditions.

Cause Physical or Behavioral Reponses from Elevated Turbidity during Pile Driving and Dredge Disposal

Removal of piles and the dredging and disposal of dredge materials would temporarily increase turbidity. The Proposed Action would permanently affect approximately 48 acres of benthic habitat due to dredging activities (i.e., removal of benthic habitat and benthic organisms) and 610 piles for construction of the docks. Suspended sediment concentrations near dredging activity do not typically cause gill damage to salmonids (Servizi and Martens 1992; Stober et al. 1981).

Behavioral effects related to increased turbidity are another consideration. Some of the documented behavioral effects of turbidity on fish include avoidance, disorientation, decreased reaction time, increased or decreased predation and increased or decreased feeding activity. However, many fish species (especially estuarine species) have been documented to prefer higher levels of turbidity for cover from predators and for feeding strategies. For example, increased foraging rates for juvenile Chinook salmon were attributable to increase in cover provided by increased turbidity, while juvenile steelhead and coho salmon had reduced feeding activity and prey capture rates at relatively low turbidity levels. Juvenile Chinook salmon were also found to have reduced predator-avoidance recovery time after exposure to turbid water. (ECORP Consulting 2009). Thus, while there may be some beneficial behavioral effects from increased turbidity, it is expected that for many of the focus fish species and native non-focus fish species behavior effects from increased turbidity would generally be negative. Although it is difficult to determine exactly how much of a temporary increase in turbidity would result from the construction activities, increases in suspended sediments are expected to be relatively short term, occurring during in-water construction activities and maintenance dredging. Thus, in-water construction and maintenance activities would not result in chronic sediment delivery to adjacent waters, because sediments would be disturbed only during in-water work and, thus, temporary.

The temporary increase in turbidity from the Proposed Action is expected to be short term and would not result in chronic sediment delivery to adjacent waters. Construction-related dredging is proposed to occur from August 1 through December 31, when many fish species would be present in the study area.

Cause Physical or Behavioral Responses to Underwater Noise during Pile Driving

Installation of 610 structural steel piles to support Docks 2 and 3 would generate underwater noise during pile-driving (Grette Associates 2014b). Most piles would be installed to a depth approximately 140 to 165 feet below the mudline to provide the necessary resistance to support Docks 2 and 3, the shiploaders, and conveyors (Grette Associates 2014a). The duration of vibratory and impact pile-driving required to install each pile would depend on the depth at which higher-density materials (e.g., volcanic ash or dense sand and gravels) are encountered; shallower resistance would require less vibratory and more impact driving, while deeper resistance would require more vibratory and less impact driving.

Pile driving would occur over two construction seasons, with multiple rigs operating simultaneously between September 1 and December 31. The sequence of pile-driving and the number of pile-driving rigs operating at the same time would be determined during permitting. Each pile would be installed using a vibratory driver until it meets resistance, at which point an

impact pile driver would be used to proof the pile to the necessary weight-bearing capacity. Impact pile-driving would be expected to last 20 to 120 minutes per pile.

Noise attenuation and fish movement models predicted that underwater noise thresholds would be exceeded, resulting in injury or behavior impacts, at distances ranging from 45 feet (single sound strike) to 3.92 miles (cumulative sound). The specific distances and effects on ESA-listed fish are provided in Table 4.7-6. Because the number of pile strikes per day would be variable, it was assumed that a minimum of 5,000 strikes/day would occur. Increasing pile strikes beyond 5,000 would not affect the distance at which thresholds would be exceeded for all federally protected fish. Predicted noise reduction using confined or unconfined bubble curtains or similar attenuation devices would be at least 9 dB, based on observations at the Columbia River Crossing (David Evans Associates 2011) and at Puget Island (Washington State Department of Transportation 2010).

Table 4.7-6. Underwater Noise Thresholds and Distances to Threshold Levels

Species	Effect Type	Threshold	Distance to Effect Threshold[a]
All Federally Protected Fish	Injury, cumulative sound (≥2 grams)	187 dB_{SEL}	1,775 feet[b]
	Injury, cumulative sound (<2 grams)	183 dB_{SEL}	1,775 feet[b,c]
	Injury, single strike	206 dB_{PEAK}	45 feet[d]
	Behavior	150 dB_{RMS}	3.92 miles

Notes:

[a] Impact Pile Driver Operation, 36-inch steel pile with 9 dB attenuation from use of confined bubble curtain.

[b] This represents the point at which the model for distance to threshold for cumulative sound no longer increases with increased pile strikes. For 187 dB $_{SELcum}$ (fish ≥ 2 grams), this is at 5,003 strikes; for 187dB_{SELcum} (fish >2 grams), this is at 1,992 strikes. The concept of effective quiet makes the 1,775-foot distance applicable to both thresholds and therefore is applicable to fish both greater than and less than 2 grams.

[c] Given the On-Site Alternative location and adherence to the proposed in-water work window, most salmonids in the area during construction are assumed to be > 2 grams (187 dB_{SELcum} threshold), except possibly for very early subyearling chum salmon in December

[d] Because the distance to cumulative sound thresholds are greater than the distance to the single-strike sound threshold, this analysis follows the NMFS dual criteria guidance and moves forward solely considering the larger values.

dB_{SEL} = decibels sound exposure level; dB_{PEAK} = decibels at peak sound level; dB_{RMS} = decibels root mean square

Underwater sound generated by impact pile-driving could affect fish in several ways, ranging from alteration of behavior to physical injury or mortality. The impact would depend on the intensity and characteristics of the sound, the distance and location of the fish in the water column relative to the sound source, the size and mass of the fish, and the fish's anatomical characteristics (Hastings and Popper 2005).

Based on calculations of where underwater noise thresholds would be exceeded by pile-driving noise (Section 4.7.3.2, *Impact Analysis, Assessing Noise Impacts*), the area where cumulative sound levels could reach or exceed the injury threshold (potential injury area) would extend from the proposed trestle and dock to a maximum distance of 1.1 miles along the shoreline (1,775 feet upstream and downstream plus the 2,300-foot length of Docks 2 and 3). The total potential injury area would encompass 0.44 square mile. Although the thresholds were developed for salmonids, they would apply to other fish species. The potential for injury or behavioral effects depends on the duration of the fish in the potential injury area.

Five threatened salmon species could occur in the study area during the in-water work window of September 1 through December 31 (Table 4.7-7). All life history stages of the Snake River spring/summer-run Chinook salmon, upper Columbia River spring-run Chinook salmon, Snake River sockeye salmon, and upper Willamette River steelhead populations units would likely be absent from the study area and not affected by pile-driving. Bull trout are expected to occur infrequently and in very low numbers relative to all other salmonids. The likelihood of bull trout presence at any given time is very low, and the potential for pile-driving activities to affect bull trout is, therefore, considered negligible. According to the USFWS (2002), bull trout in the Lower Columbia River Recovery Unit could have migrated seasonally from tributaries downstream into the Columbia River to overwinter and feed. However, the extent to which bull trout in the Lower Columbia River Recovery Unit currently use the mainstem Columbia River is unknown.

Table 4.7-7. Salmonids in the Study Area during the Proposed Work Window (September 1–December 31) by Life Stage

Species	Federal Status	Shallow-water Subyearling	Deepwater Subyearling	Deepwater Yearling	Adult
Chinook Salmon					
Snake River fall-run ESU	T[a]	X[b]	X		Sept–Oct
Lower Columbia River ESU	T	X	X	X	Sept–Oct
Upper Willamette River ESU	T	X	X	X	
Coho Salmon					
Lower Columbia River ESU	T	X			Sept–Dec
Chum Salmon					
Columbia River ESU	T	X			Sept–Dec
Steelhead Trout					
Snake River DPS	T				Sept–Oct
Upper Columbia River DPS	T				Sept–Oct
Middle Columbia River DPS	T				Sept–Oct
Lower Columbia River DPS	T				Sept–Dec
Green Sturgeon	**T**				**Sept–Dec**
Eulachon	**T**	**December**			**Nov–Dec**

Notes:
[a] T denotes federally threatened (no Endangered in this table).
[b] X denotes expected presence; see Grette Associates (2014c).
ESU = Evolutionary Significant Unit; DPS = Distinct Population Segment

Green sturgeon, eulachon, and other salmonid populations could be present in the study area during the proposed in-water work window. For these species, pile-driving could affect fish migrating in the SWZ and the migrants and residents in the DWZ. Approximately 0.09 of the 0.44-square-mile potential injury area would be in the SWZ. The risk of injury could be lower for some populations, depending on their abundance or absence during in-water work, but juvenile

salmon present as shallow water subyearlings could be at risk of injury. Larger subyearling or yearling individual salmonids could occur in all of the 0.44-square-mile potential injury area.

Adult salmon could migrate upstream through the study area during the proposed in-water work window, but none of the salmon populations spawn in the potential injury area. Chinook salmon, chum salmon, and steelhead migrate approximately 19 to 25 miles per day (Keefer et al. 2004; English et al. 2006; Buklis and Barton 1984). Coho salmon migrate approximately 9 to 20 miles per day (Sandercock 1991). These migration rates suggest that adult salmon would move through the study area relatively quickly, travelling through the potential injury area in approximately 20 to 90 minutes, depending on the species and actual rate of travel. These migration patterns could limit the potential for and duration of exposure; however, adult salmon migrating through the study area could be injured by pile-driving noise. Injuries to adult salmon could include temporary and long-term hearing damage, referred to as Temporary Threshold Shifts (TTS) and Permanent Threshold Shifts (PTS), respectively (Grette Associates 2014b). Exposure to very loud noise, or loud noise for extended periods of time may result in permanent reductions in sensitivity or PTS. Generally, TTS would occur at lower levels than those resulting in auditory tissue damage, which result in PTS. The effect of hearing loss in fish may relate to the fish's reduced fitness, which may increase the vulnerability to predators or result in a reduced ability to locate prey, inability to communicate, or inability to sense their physical environment (Hastings and Popper 2005). Popper et al. (2005) found fish experiencing TTS were able to recover from varying levels of TTS, including substantial TTS, in less than 18 hours post exposure. Meyers and Corwin (2008) reported evidence that fish can replace or repair sensory hair cells that have been damaged in both the inner ear and lateral line, indicating that fish may be able to recover from PTS over a period of days to weeks. Measures to reduce the risk of TTS and PTS to salmonids includes noise attenuation measures to be implemented during in-water pile-driving activities (i.e., use of confined bubble curtain or similar noise attenuation and implementing a soft-start when initiating pile-driving). See Section 4.7.7, *Potential Mitigation Measures*, for further information.

Sound pressure levels could exceed the threshold for behavioral impacts up to 3.92 miles from pile-driving activities per the *SEPA Fish Technical Report*. A line-of-sight rule, meaning that noise may propagate into any area that is within sight of the noise source, is used to determine the extent of noise propagation in river systems. Fish in the potential injury area could exhibit behavioral responses, which could include reduced predator avoidance and foraging efficiency. Based on studies by Carlson et al. (2007) the potential injury area would extend approximately 10 meters (33 feet) from the pile-driving activity. Because the potential injury area would be limited to such a small area, it is extremely unlikely that adult fish would experience injury.

Increase Temporary Shading that Affects Aquatic Habitat

Overwater structures, barges, and vessels required for construction would increase shading to the aquatic environment beneath and adjacent to the structure, which could result in changes to primary productivity, fish behavior, predation and migration. The use of these structures and vessels would primarily be during the in-water construction period for installation of support piling for Docks 2 and 3. Pile-driving activities would be expected to be much more disruptive to

fish than the shading created by construction-related barges and vessels, and would likely affect migration and foraging opportunities in the study area to a greater extent.

Cause Spills and Leaks that Temporarily Contaminate Water Quality

Construction activities could result in temporary water quality impacts from the release of hazardous materials such as fuels, lubricants, hydraulic fluids, or other construction- related hazardous materials. Spills could affect aquatic habitat or fish near the discharge point, resulting in potential toxic acute or subacute impacts that could affect the respiration, growth, or reproduction of the affected fish. It is assumed that a spill would be relatively small (e.g., less than 50 gallons) because limited quantities of potentially hazardous materials would be stored and used during construction at the project area. However, a spill could cause potential impacts on fish based on the location, weather conditions, quantity and material spilled. The potential risks, impacts, and mitigation measures related to water quality are addressed in Section 4.5, *Water Quality*. Appropriate training and implementation of prevention and control measures would guard against these risks, greatly reducing the potential for these types of impacts.

Construction—Indirect Impacts

Construction of the Proposed Action would not result in indirect impacts on fish because construction impacts are immediate and no construction impacts would occur later in time or farther removed in distance than the direct impacts.

Operations—Direct Impacts

Operation of the Proposed Action would result in the following direct impacts. Operations-related activities are described in Chapter 2, *Project Objectives, Proposed Action, and Alternatives*.

Increase Shading that Affects Fish and Fish Habitat

Overwater structures (Docks 2 and 3 and large vessels) would increase shading to the aquatic environment, which could result in changes to primary productivity as well as fish behavior, predation and migration. Permanent shading could reduce primary productivity by phytoplankton and macrophytes (Carrasquero 2001). Less primary productivity contributes to less energy for epibenthic communities and ultimately the fish that prey on epibenthic organisms. Shadows may also directly affect fish migration, prey capture, and predation. Juvenile salmon tend to migrate along the edges of shadows rather than passing through them (Simenstad et al. 1999). Low levels of underwater light are also favorable for predatory fish such as bass and northern pikeminnow to see and capture their prey, including juvenile salmonids. Reduction of primary productivity in DWZ habitat would not likely translate to reductions of epibenthic communities, which are more prevalent in SWZ habitat.

Light attenuation could affect fish migration, prey capture and predation. While salmon fry are known to use darkness and turbidity for refuge, they generally migrate along the edges of shadows rather than penetrate them. Foraging opportunities for juvenile fish are generally associated with SWZ habitat, which are expected to provide greater availability of benthic organisms as compared to DWZ habitat. Juvenile salmon primarily migrate in SWZ habitat, although larger juveniles do migrate in DWZ habitat. Juveniles migrating in DWZ habitat are likely migrating relatively quickly and not rearing for extended periods in any particular area. The trestle is the only structure that would generate shade in SWZ habitat. The potential

shading created by the trestle would be relatively limited because the trestle is elevated over the OHW by approximately 8 feet. The height of the trestle would allow light to penetrate beneath the structure and would, therefore, not be expected to have measurable shading effects on primary productivity or fish behavior, migration, or predation in SWZ habitat.

The trestle would shade 0.3 acre of SWZ habitat, while Docks 2 and 3 and a portion of the trestle would shade 4.83 acres of DWZ habitat. Vessels loading at Docks 2 and 3 during operations would further increase the shading of DWZ habitat. If two Panamax vessels were being loaded simultaneously, they would shade an additional 4.7 acres of DWZ habitat, or 9.83 total shaded acres. The study area (Figure 4.7-1) encompasses approximately 1,300 acres, primarily DWZ habitat. Shading created by Docks 2 and 3 as well as vessels being loaded at the docks would shade approximately 0.8%. Because, juvenile salmonids tend to migrate in SWZ habitat, shading of DWZ habitat would likely affect juvenile salmonids to a lesser extent than adults or larger juveniles that tend to migrate in DWZ habitat. Shading of DWZ habitat would have low impacts on primary productivity, as primary productivity tends to be higher in SWZ habitat. Based on the location of Docks 2 and 3 over DWZ habitat, and the relatively small area shaded in relation to the overall study area, the overall shading impact would be low.

The trestle is the only structure that would cross the SWZs where juvenile salmon may be present. The design, orientation (north-south), narrow width (24 feet), and height above the water surface (8 feet) would allow some natural light to pass under the structure during all seasons and limit the potential impacts of shading on fish and fish habitat. The dock and moored vessels would be located over DWZ habitats, where shaded habitat could provide suitable conditions for larger predatory fishes and piscivorous (i.e., fish-eating) birds. Piles and moored vessels may also create flow conditions favorable for predatory fishes. The extent or magnitude to which an increase in overwater surface area could alter the predator–prey relationship in the study area is unknown, but it is assumed that the relationship would change and an increase in predation would be likely.

Cause Spills or Leaks that Contaminate Water Quality

Operations activities on land as well as in- and over-water could result in temporary water quality impacts from a release of hazardous materials such as fuels, lubricants, hydraulic fluids, or other chemicals. Spills could affect aquatic habitat or fish that occur near the discharge point, resulting in potential toxic acute or subacute impacts that could affect the respiration, growth, or reproduction of the affected fish. Overall, it is assumed that a spill would be relatively small (e.g., less than 50 gallons) because limited quantities of potentially hazardous materials would be stored and used during operations at the project area. Refueling of vehicles during operations would occur off site at approved refueling stations, or fuel would be delivered to the site by a refueling truck (capacity of 3,000 to 4,000 gallons). Refueling trucks are required to carry appropriate spill response equipment, thereby reducing the potential risk and impact associated with a fuel spill. Vessel bunkering (i.e., a vessel receiving fuel while at the dock) would not occur at the project area. Thus, there would be no increased risk of spills associated with vessel transferred associated with the Proposed Action. The potential risks, impacts, and mitigation measures related to water quality are addressed in Section 4.5, *Water Quality*. Refer to Section 4.9, *Energy and Natural Resources,* as well as Chapter 3, Section 3.6, *Hazardous Materials,* and Chapter 5, Section 5.4, *Vessel Transportation*, for more information related to fuel and refueling activities associated with the Proposed Action. Similarly, appropriate training and

implementation of prevention and control measures would guard against these risks, greatly reducing the potential for these types of impacts.

Cause Physical or Behavioral Responses to Vessel Noise

Vessels transit the Columbia River carrying oil, freight, and materials to and from ports along the river. Source sound levels of bulk carrier vessels were measured in Puget Sound at between 187.9 and 198.2 dB sound pressure level at 1 meter when vessels were travelling between 9.0 and 11.1 knots (Hemmera Envirochem et al. 2014). These source sound levels exceed identified thresholds for potential behavioral disturbance for fish and may cause avoidance or other behavioral responses (Fisheries Hydroacoustic Working Group 2008). Fish near transiting vessels could experience behavioral responses to the vessel noise but would not likely be injured.

Generate and Disperse Coal Dust in the Aquatic Environment

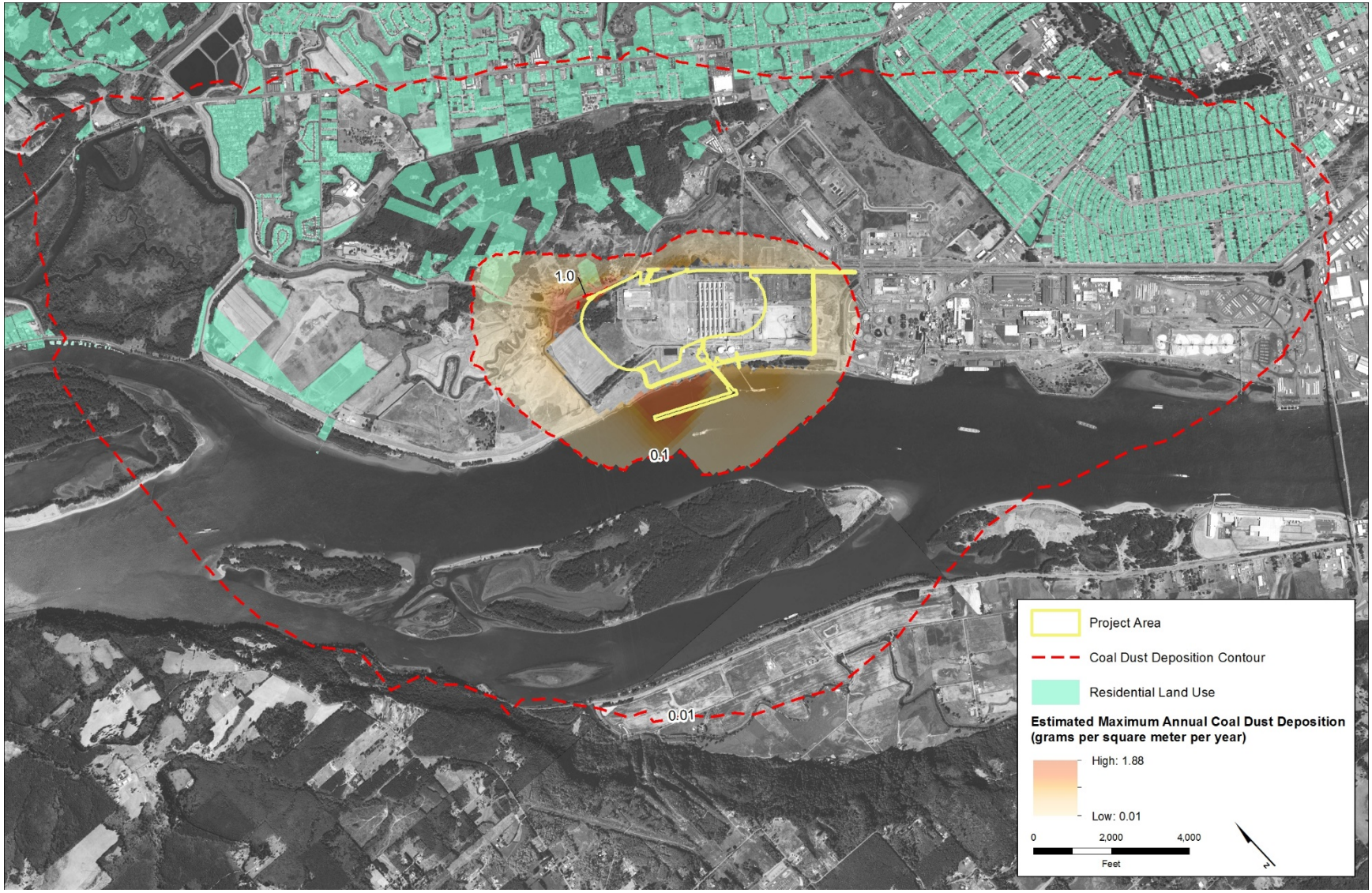
Fugitive coal dust particles would be generated by the Proposed Action through the movement of coal into and around the project area, as well as during transfer onto vessels (Chapter 5, Sections 5.6, *Air Quality,* and 5.7, *Coal Dust*). Coal dust could also become airborne from stockpiles located within the project area. Modeled fugitive coal dust concentrations (Figure 4.7-4) indicate that deposition would range from 1.88 grams per square meter per year ($g/m^2/year$) adjacent to the coal export terminal to 0.0003 gram per square meter 2.5 miles from the proposed terminal (Chapter 5, Section 5.7, *Coal Dust*). One review of the chemical composition of coal dust (U.S. Geological Survey 2007) suggests that the risk of exposure to concentrations of toxic materials (e.g., PAHs and trace metals) from coal are low because the concentrations are low and the chemicals bound to coal and not easily leached. Particles would also be transported downstream by the flow of the river and distributed over a broad area, thus diluting any potential impacts.

Spill Coal during Operations of the Proposed Action

Direct impacts on the natural environment from a coal spill during operations of the Proposed Action could occur. Direct impacts resulting from a spill during coal handling at the coal export terminal would likely be minor because the amount of coal that could be spilled would be relatively small. Also, impacts would be minor because of the absence of aquatic environments in the project area and the contained nature and features of the terminal (e.g., enclosed belt conveyors, transfer towers, and shiploaders). Potential physical and chemical effects of a coal release on the aquatic environments that occur adjacent to the terminal are described below.

Aquatic environments could potentially be affected from a coal spill both physically and chemically. A coal spill could have physical effects on aquatic environments, including abrasion, smothering, diminished photosynthesis, alteration of sediment texture and stability, reduced availability of light, temporary loss of habitat, and diminished respiration and feeding for aquatic organisms. The magnitude of these potential impacts would depend on the amount and size of coal particles suspended in the water, duration of coal exposure, and existing water clarity (Ahrens and Morrisey 2005). Therefore, the circumstances of a coal spill, the existing conditions of a particular aquatic environment (e.g., pond, stream, wetland), and the physical effects on aquatic organisms and habitat from a coal spill would vary.

Figure 4.7-4. 3-Year Annual Average Coal Dust Deposition for the Proposed Action



Similarly, cleanup of coal released into the aquatic environment could result in temporary impacts on habitat, such as smothering, altering sediment composition, temporary loss of habitat, and diminished respiration and feeding for aquatic organisms. The recovery time required for aquatic resources would depend on the amount of coal spill and the extent and duration of cleanup efforts, as well as the environment in which the incident occurred. It is unlikely that coal handling in the upland portions of the coal export terminal would result in a spill of coal that would affect the Columbia River. This is unlikely because the rail loop and stockpile areas would be contained, and other areas adjacent to the coal export terminal are separated from the Columbia River by an existing levee, which would prevent coal from being conveyed from upland areas adjacent to the rail loop to the Columbia River. Coal could be spilled during shiploading operations as a result of human error or equipment malfunction. However, such a spill would likely result in a limited release of coal into the environment due to safeguards to prevent such operational errors, such as start-up alarms, dock containment measures (i.e., containment "gutters" placed beneath the docks to capture water and other materials that may fall onto and through the dock surface) to contain spillage /rainfall/runoff, and enclosed shiploaders.

The chemical effects on aquatic organisms and habitats would depend on the circumstances of a coal spill and the existing conditions of a particular aquatic environment (e.g., stream, lake, wetland). Some research suggests that physical effects are likely to be more harmful than the chemical effects (Ahrens and Morrisey 2005).

A recent coal train derailment and coal spill in Burnaby, British Columbia, in 2014, and subsequent cleanup and monitoring efforts provide some insight into the potential impacts of coal spilled in the aquatic environment. Findings from spill response and cleanup found there were potentially minor impacts in the coal spill study area, and that these impacts were restricted to a localized area (Borealis Environmental Consulting 2015).

Operations—Indirect Impacts

Operation of the Proposed Action would result in the following indirect impacts. Operations-related activities are described in Chapter 2, *Project Objectives, Proposed Action, and Alternatives*.

Cause Fish Stranding from Vessel Wakes

At full build-out, 70 cargo vessels per month (840 per year) would be used for the Proposed Action. The vessels would consist of the newer Panamax and Handymax vessels. Panamax vessels measure approximately 738 feet long by 105 feet wide with a draft of 43 feet. Handymax vessels measure approximately 490 to 655 feet long by 105 feet wide with a draft of 36 feet.

Subyearling Chinook salmon appear to be more susceptible to stranding, accounting for approximately 80% of the fish stranded by vessel wakes along the lower Columbia River (Hinton and Emmett 1994; Dawley et al. 1984; Pearson et al. 2006) despite being less common (i.e., 49%) in beach seine samples along the same shorelines (Pearson et al. 2006).

Studies indicate that juvenile salmon and other fish are at risk of stranding on wide, gently sloping (i.e., less than 5% slope) beaches as a consequence of wakes generated by deep-draft vessel passage (Bauersfeld 1977; Hinton and Emmett 1994; Pearson et al. 2006; ENTRIX 2008). Depending on various factors—such as the slope and breadth of a beach, river stage, tidal stage,

depth of water vessel is transiting in, and vessel size—direction of travel and speed, wakes from passing vessels can travel a considerable distance. When these wakes meet the shoreline, they can carry fish and deposit them, essentially stranding them on the beach where they are susceptible to stress, suffocation, and predation before than can return to the water.

The Proposed Action would result in an increase in vessel traffic, which characteristically produces wakes that would contribute to stranding, and many of the sites in the study area where fish stranding could occur are located near the project area. For example, Lord Island is just across the channel from the project area, and Barlow Point is about 1.2 miles downstream. Vessels maneuvering near the project area would be either slowing to stage off shore if the docks are full or slowing to prepare for docking. Once vessels are loaded, they would be maneuvering back to the navigation channel and would then proceed to transit downstream toward the Pacific Ocean. It is assumed that such maneuvering would result in little risk of stranding near the proposed docks, as very little wake would be expected from vessels moving at slow speeds in this area. Sites farther downstream near Puget Island would be more likely to have a risk of fish stranding from vessel wakes as the vessels are transiting. Thus, it is likely that fish stranding associated with wakes from project–related vessels would occur because of the Proposed Action.

Fish stranding in the Lower Columbia River appears to be associated with various factors, but is generally believed to be an issue when wakes produced by deep-draft vessels (i.e., those with a draft of 26 feet or more) transiting the river during low tides encounter shorelines with shallow sloping beaches (i.e., less than a 5% slope). The issue is particularly prevalent on beaches that are highly permeable (i.e., high rates of infiltration). However, beaches are not necessarily conducive to stranding at all times. For example, stranding may occur less frequently or not at all during high tide or during periods when the river is at a certain stage, when the beaches are more inundated and less exposed. The potential for fish stranding on any given beach is also likely affected by fish migration changes through the area. In 2028, with full coal terminal export throughput, the Proposed Action would represent approximately 27% of the projected vessel traffic volume in the lower Columbia River. The additional traffic associated with the Proposed Action would result in an increased risk of fish stranding.

It is also worth noting that vessel operations in the Lower Columbia River are federally regulated, including the size, speed, and navigation within the Lower Columbia River. Additionally, large vessels are required to be operated by pilots within the Lower Columbia River, whom are licensed by the Coast Guard to perform this function. The navigation channel and its ongoing maintenance are also managed and regulated at the federal level, including dredging and dredged material disposal.

Periodically Remove or Alter Aquatic Habitat during Maintenance Dredging

Maintenance dredging would be scheduled to occur on a multiyear basis, but could occur annually or following extreme flow conditions, as needed, to maintain required depths at Docks 2 and 3 and to allow for navigation between the docks and the navigation channel (WorleyParsons 2012). Maintenance dredging would require separate permitting beyond those permits issued for construction of the Proposed Action. Maintenance dredging would follow the same methods and have the same impacts as those described for construction-related dredging.

Generate and Disperse Coal Dust in the Aquatic Environment

Indirect impacts associated with fugitive coal dust particles would be the same as those described previously for operational direct impacts.

Spill Coal during Rail Transport

The magnitude of the potential indirect impact from a coal spill on the aquatic environments would be similar to those described previously and would depend on the location of the spill, the volume of the spill, and success of efforts to contain and clean up the spill, none of which can be predicted.

The potential impact of a coal spill from a Proposed Action-related train is directly related to the probability of a Proposed Action-related train incident occurring. Section 5.2, *Rail Safety*, estimates the number of Proposed Action-related train incidents that could potentially occur during coal transport within Cowlitz County and Washington State. In Cowlitz County, the predicted number of loaded coal train incidents is approximately one every 2 years. The predicted number of loaded coal train incidents within Washington State is approximately five per year.

Not every incident of a loaded coal train would result in a rail car derailment or a coal spill. A train incident could involve one or multiple rail cars, and could include derailment in certain circumstances. The size and speed of the train and the terrain where an incident were to occur would influence if the incident resulted in a coal spill. A broad range of spill sizes from a partial rail car to multiple rail cars could potentially occur from a Proposed Action-related train accident.

Additionally, containment and cleanup efforts for coal spills from a rail incident factor into the potential impact on the environment. It is expected that coal spills in the terrestrial and built environments would be easier to contain and clean up than spills occurring in an aquatic environment. Spills occurring on land may have a quicker response time and cleanup in some locations due to their visibility and access for cleanup equipment, as compared to spills into aquatic environments.

Potential physical and chemical effects of a coal release into aquatic environments would be the same or similar to those described above under direct impacts.

Research suggests that the bioavailability of contaminants in coal is limited, and that at levels of coal contamination at which estimates of bioavailable concentrations of contaminants might give cause for concern, the acute physical effects are likely to be more harmful than the chemical effects (Ahrens and Morrisey 2005). However, the variable chemical properties of coal could conceivably result in contaminant mobility and enhanced bioavailability in the aquatic environment. Coal can be a source of acidity, salinity, trace metals, PAHs, and chemical oxygen demand (a measure of organic pollutants found in water). Interactions between coal and water could alter pH and salinity, release trace metals and PAHs, and increase chemical oxygen demand. However, if and how much these alterations occur in the aquatic environment and whether the alterations are significant enough to be potentially toxic to aquatic organisms depends on many factors, including the type of coal, the relative amount of time the coal is exposed to water, dilution, and buffering.

In summary, fugitive coal dust from project operations is not expected to increase suspended solids in the Columbia River to the point that there would be a demonstrable effect on fish distribution, abundance, or survival, or acute physical effects. Additionally, the potential risk for exposure to toxic chemicals contained in coal (e.g., PAHs and trace metals) would be relatively low because these chemicals tend to be bound in the matrix structure and not quickly/easily leached. Any coal particles would be transported downstream by the flow of the river and either carried out to sea or distributed over a broad area, further reducing the potential for adverse impacts on fish from suspended solids.

Affect Commercial and Recreational Fishing

Project-related increases in vessel traffic in the lower Columbia River and associated underwater noise could affect the fishing in study area. Increases in vessel traffic could cause behavioral responses including quicker migration or avoidance of the navigation channel. The 70 large commercial vessels anticipated per month under the Proposed Action, would be limited to the navigation channel. Adult fish targeted in commercial and recreational fishing would likely migrate outside of the navigation channel to avoid the increased underwater noise levels. It is also likely that commercial and recreational fishing vessels would not be fishing within the navigation channel when large vessels are present. The Proposed Action would, therefore, be unlikely to significantly reduce commercial or recreational fishing catches or limit access for fishing activities. See Chapter 5, Section 5.4, *Vessel Transportation,* for potential impacts on commercial and recreational fishing vessels associated with Proposed Action-related vessels.

4.7.5.2 No-Action Alternative

Under the No Action Alternative, the Applicant would not construct the Proposed Action. Current operations would continue and the existing bulk product terminal site would be expanded. Any expansion activities would not require a permit from the U.S. Army Corps of Engineers (Corps) or a shoreline permit from Cowlitz County. Therefore, no construction impacts on aquatic habitats or species would be expected to occur as a result of an expansion of the existing bulk production terminal under the No-Action Alternative.

4.7.6 Required Permits

The Proposed Action would require the following permits related to fish and fish habitat.

- **Shoreline Substantial Development and Conditional Use Permits—Cowlitz County**. Cowlitz County administers the Shoreline Management Act through its Shoreline Management Master Program. The project area would have elements and impacts within jurisdiction of the act (Washington Administrative Code (CCC 19.20) and would thus require a Shoreline Substantial Development and Conditional Use permit from Cowlitz County and Ecology.
- **Critical Areas Permits—Cowlitz County**. The Proposed Action would require local permits related to impacts on regulated critical areas. Chapter 19.15 of the Cowlitz County Code regulates activities within and adjacent to critical areas and in so doing regulates fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded areas, and other sensitive areas.
- **Construction and Development Permits—Cowlitz County**

The Proposed Action would require fill and grade permits (CCC 16.35) and construction permits (CCC 16.05) for clearing and grading and other ground disturbing activities, as well as construction of structures and facilities associated with the Proposed Action.

- **Clean Water Act Authorization—U.S. Army Corps of Engineers.** Construction and implementation of the Proposed Action would affect waters of the United States, including wetlands. Because impacts would exceed 0.5 acre, Individual Authorization from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act and appropriate compensatory mitigation for the acres and functions of the affected wetlands would be required.

  An Individual Water Quality Certification from Ecology under Section 401 of the Clean Water Act and a National Pollution Discharge Elimination System permit under Section 402 of the Clean Water Act would also be required for construction of the Proposed Action. Additional details regarding the permitting process related to the Clean Water Act can be found in the *SEPA Water Quality Technical Report.*

- **Rivers and Harbors Act—U.S. Army Corps of Engineers.** Construction and implementation of the Proposed Action would affect navigable waters of the United States (i.e., the Columbia River). The Rivers and Harbors Act authorizes the Corps to protect commerce in navigable streams and waterways of the United States by regulating various activities in such waters. Section 10 of the RHA (33 USC 403) specifically regulates construction, excavation, or deposition of materials into, over, or under navigable waters, or any work that would affect the course, location, condition, or capacity of those waters.

- **Hydraulic Project Approval—Washington Department of Fish and Wildlife.** The Proposed Action would require a Hydraulic Project Approval from WDFW because project elements would affect and cross the shoreline of the Columbia River. The approval would consider impacts on riparian and shoreline/bank vegetation in issuance and conditions of the permit, including for the installation of the proposed docks and piles, as well as for interior culverts or other crossings of drainage features.

4.7.7 Potential Mitigation Measures

This section describes the mitigation measures that would reduce impacts related to fish from construction and operation of the Proposed Action. These mitigation measures would be implemented in addition to project design measures, best management practices, and compliance with environmental permits, plans, and authorizations that are assumed as part of the Proposed Action and described below.

Additionally, the Corps is conducting a review of the Proposed Action under NEPA, as the lead federal agency, and will be consulting under Section 7 of the federal ESA with both the USFWS and the NMFS. Additional measures may be identified under one or both of these processes that could further reduce potential impacts on fish and fish habitat.

4.7.7.1 Applicant Mitigation

The Applicant would implement the following measures to mitigate impacts on fish.

MM FISH-1. Implement Best Available Noise Attenuation Method for Pile-Driving.

To minimize underwater noise impacts on fish during pile-driving, the Applicant will employ the best available noise attenuation methods during pile-driving. These methods may include, but are not limited to, confined bubble curtain, temporary noise attenuation pile, double-walled noise attenuation pile, or other similar technology. The Applicant is currently proposing use of a confined bubble curtain, but other methods may be found to be better at attenuating noise impacts during the Endangered Species Act Section 7 consultation or by the time construction begins. Should other methods in the future prove to attenuate underwater noise better than a confined bubble curtain, those methods will be employed.

MM FISH-2. Implement a "Soft-Start" Method during Pile-Driving.

To minimize underwater noise impacts on fish during pile-driving, the Applicant will commence impact pile-driving using a "soft-start," or other similar method. The "soft-start" method is a method of slowly building energy of the pile driver over the course of several pile strikes until full energy is reached. This "soft-start" method cues fish and wildlife to pile-driving commencing and allows them to move away from the pile-driving activity.

MM FISH-3. Monitor Pile-Driving and Dredging Activities for Distress to Fish and Wildlife.

To minimize the potential harm to marine mammals, diving birds, or fish, a professional biologist will observe the waters near pile-driving and dredging activities for signs of distress from fish and wildlife during these activities. If any fish or wildlife species were to show signs of distress during pile-driving, the biologist will issue a stop work order until the species are recovered, moved, or relocated from the area. The Applicant will immediately report any distressed fish or wildlife observed to the appropriate agencies (i.e., Washington Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and National Marine Fisheries Service) and determine the appropriate course of action.

MM FISH-4. Conduct Eulachon Surveys.

The Applicant will conduct underwater surveys for eulachon spawning and larval activity within those areas where in-water work will occur (i.e., Docks 2 and 3 and the dredge prism). Surveys will be conducted prior to any in-water work occurring (i.e., construction of the Docks 2 and 3, as well as construction and operations related maintenance dredging). Survey design and results will be provided to Washington Department of Fish and Wildlife and the National Marine Fisheries Service. Should eulachon spawning and larval activity be observed, the Applicant will coordinate with the fish and wildlife agencies on the appropriate measures to avoid and minimize impacts to spawning and larval eulachon.

MM-WQ-2. Develop and Implement a Coal Spill Containment and Cleanup Plan

To limit the exposure of spilled coal to the terrestrial, aquatic, and built environments during coal handling, the Applicant will develop a containment and cleanup plan. The plan will be reviewed by Cowlitz County and Ecology and implemented prior to beginning operations.

MM CDUST-1. Monitor and Reduce Coal Dust Emissions in the Project Area.

To address coal dust emissions, the Applicant will monitor coal dust during operation of the Proposed Action at locations approved by the Southwest Clean Air Agency. If coal dust levels

exceed an established level, the Applicant will take further actions to reduce coal dust emissions. Potential locations to monitor coal dust include the coal piles, on the dock, where the rail line enters the facility when coal operations begin, and at a location near the closest residences to the project area, if agreed to by the property owner(s). The Applicant will conduct monthly reviews of the emissions data and maintain a record of data for at least 5 years after full operations. If emissions data show exceedances of air quality standards, the Applicant will report this information to Southwest Clean Air Agency, Cowlitz County and Ecology. The Applicant will gather 1 year of fenceline data on particulate matter (PM) 2.5 and PM10 prior to beginning operations and maintain the data as reference. This data will be reported to the Southwest Clean Air Agency, Cowlitz County, and Ecology.

MM CDUST-3. Reduce Coal Dust Emissions from Rail Cars.

To address coal dust emissions, the Applicant will not receive coal trains unless surfactant has been applied at the BNSF Railway Company (BNSF) surfactant facility in Pasco, Washington for BNSF trains traveling through Pasco. While other measures to control emissions are allowed by BNSF, those measures were not analyzed in this Draft EIS and would require additional environmental review. For trains that will not have surfactant applied at the BNSF surfactant facility in Pasco, before beginning operations, the Applicant will work with rail companies to implement advanced technology for applicants of surfactants along the rail routes for Proposed Action-related trains.

4.7.8 Unavoidable and Significant Adverse Environmental Impacts

Compliance with laws and implementation of the voluntary measures and mitigation measures described above would reduce impacts on fish. There would be no unavoidable and significant adverse impacts.