Chapter 5
Natural Environment: Affected Environment and Project Impacts

5.0 Introduction

For the purposes of this Draft Environmental Impact Statement (Draft EIS), environmental resource areas have been divided into three categories: the Built Environment, the Natural Environment, and Operations (Chapters 4, 5, and 6, respectively). The purpose of this chapter is to discuss the natural environment resource areas assessed for the Millennium Bulk Terminals—Longview project (proposed export terminal).

Information contained in this Draft EIS was drawn from environmental technical reports found in Volume III of this Draft EIS and incorporated by reference. The technical reports include more detailed discussion on the determination of study areas, analysis methods, and potential impacts of the proposed export terminal.

5.0.1 Natural Environment Resource Areas

Chapter 5, *Natural Environment: Affected Environment and Project Impacts*, evaluates potential impacts on water resources, natural habitat, and biological communities near the On-Site Alternative and Off-Site Alternative locations. The resource areas in this analysis include geology and soils, surface water and floodplains, wetlands, groundwater, water quality, vegetation, fish, and wildlife (Table 5.0-1). Additional detailed information about these resources can also be found in the corresponding technical reports in Volume III of this Draft EIS.

Chapter 8, *Minimization and Mitigation*, presents measures to mitigate potential impacts of the proposed export terminal identified in this chapter.

Table 5.0-1. Natural Environment Resource Areas and Corresponding Draft EIS Sections

Chapter	Section Number	Environmental Resource Area
Chapter 5, Natural Environment: Affected Environment and Project Impacts	5.1	Geology and Soils
	5.2	Surface Water and Floodplains
	5.3	Wetlands
	5.4	Groundwater
	5.5	Water Quality
	5.6	Vegetation
	5.7	Fish
	5.8	Wildlife

5.0.2 Alternatives and Timeframe for Analysis

This chapter analyzes impacts that would likely occur as a result of construction and operation of the proposed export terminal. The analysis assumes construction beginning in 2018 and full operations[1] occurring by 2028. Throughout this chapter, the site of the proposed export terminal for both the On-Site Alternative and Off-Site Alternative is referred to as the *project area*.

This chapter also analyzes impacts that could occur under the No-Action Alternative. Chapter 3, *Alternatives*, of this Draft EIS provides a description of the On-Site Alternative, Off-Site Alternative, and No-Action Alternative.

5.0.3 Study Areas and Type of Impacts Analyzed

As discussed in Chapter 1, *Introduction*, the NEPA scope of analysis includes the activities requiring a Department of the Army permit from the Corps, plus those activities outside the permit area over which the Corps has sufficient control and responsibility. Therefore, the Corps' scope of analysis for this Draft EIS includes the project area, the area that would be dredged, any dredged material disposal sites, any off-site area that might be used for compensatory mitigation, and any other area in or adjacent to the Columbia River that would be affected by, and integral to, the proposed export terminal.

Within the overall NEPA scope of analysis, study areas have been defined for each resource. The size and location of each study area depends, in part, on physical and/or biological characteristics of the resource, logistics, nature and extent of potential impacts, and how the resource is regulated. Separate study areas are normally identified for direct impacts and indirect impacts. Table 5.0-2 explains the general differences between the direct and indirect impacts study areas.

Table 5.0-2. Types of Impacts and Impact Examples

Type of Impact	Description	Example of Impacts
Direct	An impact resulting from construction or operation of the proposed export terminal at the On-Site Alternative or Off-Site Alternative location. Direct impacts are caused by the action and occur at the same time and place (40 CFR 1508.8).	• **Construction:** Temporary impacts within the project area that are resolved or mitigated by the end of construction, or permanent changes to the project area due to construction of the proposed export terminal. • **Operation:** Impacts occurring in the project area resulting from rail unloading, coal storage, machinery operations, equipment, vessel loading, etc.

[1] Full operation means the coal export terminal would have a maximum throughput of up to 44 million metric tons of coal per year, as described in Chapter 3, *Alternatives*.

Type of Impact	Description	Example of Impacts
Indirect	An impact resulting from construction or operation of the proposed export terminal that occurs outside the project area or later in time. Indirect impacts are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8).	• **Construction:** Impacts that occur outside the project area, such as vehicle and rail traffic that support construction activities. • **Operation:** Impacts that occur outside the project area, such as rail, vehicle, and vessel traffic that support operational activities, or that occur within the project area later in time.

Table 5.0-3 provides a summary of the direct and indirect impacts study areas for natural environment resources. These study areas were developed based on the U.S. Army Corps of Engineers' Memorandum for Record (MFR) entitled *Scope of Analysis and Extent of Impact Evaluation for National Environmental Policy Act Environmental Impact Statement* (2014). The study areas contained in this Draft EIS typically conform with the MFR. In some cases, study areas were adjusted to reflect the characteristics and specific elements for each resource area.

Table 5.0-3. Direct Impacts Study Areas and Indirect Impacts Study Areas by Resource

Resource	Direct Impacts Study Area	Indirect Impacts Study Area
5.1, Geology and Soils	Project area for the On-Site Alternative and Off-Site Alternative.	Project area and the broader geologic environment that can influence the project area.
5.2, Surface Water and Floodplains	Surface Water: Columbia River and stormwater drainage ditches in and adjacent to the project areas for the On-Site Alternative and Off-Site Alternative. Floodplains: Project areas.	Surface Water: Stormwater system drainage ditches adjacent to the project areas and the Columbia River 1 mile downstream from the project areas. Floodplains: Project area and surrounding 500-year floodplain on the north side of the Columbia River in the vicinity of the project areas.
5.3, Wetlands	Project areas for the On-Site Alternative and Off-Site Alternative.	Project areas and the immediate vicinity, where wetlands might be affected by construction or operation of the proposed export terminal.
5.4, Groundwater	Project area for the On-Site Alternative and Off-Site Alternative.	City of Longview-Frontal Columbia River watershed (Hydrologic Unit Code [HUC]-12: 170800030602).
5.5, Water Quality	Project areas, the area extending 300 feet from the project areas into the Columbia River, potential in-river dredged material disposal sites, and an area extending 300 feet downstream of each disposal site.	Project areas, stormwater system drainage ditches adjacent to the project areas, the Columbia River from the project area downriver 1 mile downstream from the project areas, and potential dredged material disposal sites plus an area extending 300 feet downstream of each disposal site.

Resource	Direct Impacts Study Area	Indirect Impacts Study Area
5.6, Vegetation	Project areas for the On-Site Alternative and Off-Site Alternative.	Project areas, surrounding areas up to 1 mile from the project area, and the Columbia River from the project areas to the mouth of the river.
5.7, Fish	Columbia River 3.92 miles upstream and downstream of the project areas.	Direct impacts study area plus Columbia River from project area to the mouth of the river.
5.8, Wildlife	Terrestrial Species and Habitats: Project areas and 0.5 mile from project areas. Aquatic Species and Habitats (On-Site Alternative): Main channel of the Columbia River to 5.1 miles upstream and 2.1 miles downstream of the project areas. Aquatic Species and Habitats (Off-Site Alternative): Main channel of the Columbia River to 7.1 miles upstream and 6.8 miles downstream of the project areas.	Project areas, lands in the vicinity where project-related disturbance to wildlife and habitat could occur, and the Columbia River from the project areas to the mouth of the river.

5.1 Geology and Soils

Geology and soils are resources with defining characteristics (such as soil structure, composition, or geologic formations) that are unique or valuable or support unique habitats. Geology and soils can also influence the potential for geologic hazards, such as landslides, earthquakes, seismic effects (e.g., surface fault ruptures, strong ground shaking, liquefaction, lifting and lowering of the surface, and tsunamis), and volcanic activity. Understanding the types of soils and the underlying geologic conditions is important in determining whether a project would be exposed to increased risks related to these conditions.

This section describes the geology and soils in the study areas. It then describes potential impacts on geology and soils resulting from construction and operation of the proposed export terminal, as well as the geologic conditions in the study areas posing a risk to the project areas.

5.1.1 Regulatory Setting

Laws and regulations relevant to geology and soils are summarized in Table 5.1-1.

Table 5.1-1. Regulations, Statutes, and Guidelines for Geology and Soils

Regulation, Statute, Guideline	Description
Federal	
Clean Water Act Section 402 General Permit for Stormwater Discharges Associated with Construction Activities	Primarily deals with water quality but includes eroded soils potentially delivered offsite via runoff. Mandates certain types of construction activities (and operations) comply with the EPA NPDES program. The EPA has designated Washington State Department of Ecology the nonfederal authority for the NPDES program in Washington State. Includes development of a stormwater pollution prevention plan.
Local	
Cowlitz County Critical Areas Protection Ordinance (CCC 19.15)	Designates geologically hazardous areas (including seismic, volcanic, erosion, and landslide hazards) and defines performance standards and specific requirements for development within these areas.
Cowlitz County Grading (CCC 16.35)	Grading plan requirement and standards including the protection of water quality from adverse impacts of erosion and sedimentation.
Cowlitz County Building Code (CCC 16.05)	Cowlitz County has adopted the 2012 International Building and Residential Codes.
City of Longview Comprehensive Plan (Off-Site Alternative only)	Chapter 5, Natural Environment Element, including Goals, Objectives, and Policy for Geological Hazards
City of Longview Critical Areas Ordinance (LMC 17.10.140) (Off-Site Alternative only)	Classifies geologic hazard areas (seismic, landslides, erosion, mines, volcanic) and contains procedures to address them.

Notes:
EPA = U.S. Environmental Protection Agency; NPDES = National Pollutant Discharge Elimination System; CCC = Cowlitz County Code; LMC = Longview Municipal Code

5.1.2 Study Area

The direct impacts study area for geology and soils includes the project areas for the On-Site Alternative and Off-Site Alternative (Figure 5.1-1). The indirect impacts study area includes the broader geologic environment that can influence the project areas. These broader geologic influences include earthquakes (seismicity) and their associated impacts (e.g., ground shaking) as well as tsunamis (large earthquake-generated waves that can affect coastal zones and may extend some distance up large rivers) or off-site landslides that might reach the sites. These study areas are based on the Corps' *NEPA Scope of Analysis Memorandum for Record* (MFR) (2014) then adjusted to reflect groundwater characteristics in and near the project areas.

5.1.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts associated with the construction and operation of the proposed export terminal.

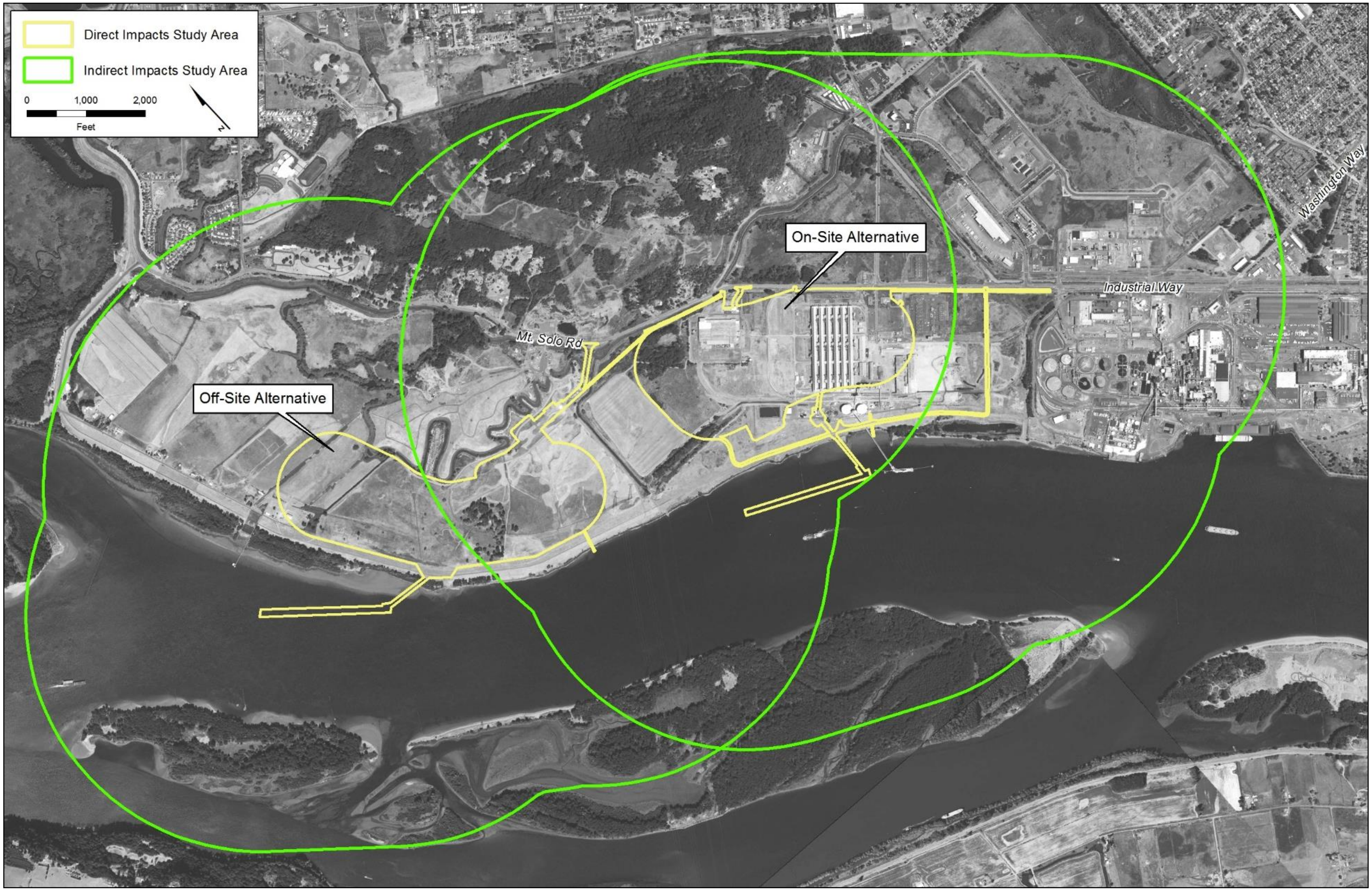
5.1.3.1 Information Sources

Information with respect to geology and soils was collected through review of information and reports provided by the Applicant as well as other sources of information and scientific literature, including Washington Department of Natural Resources Division of Geology and Earth Resources materials, U.S. Geological Survey (USGS) maps and reports, U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) soil information, and geological and soil literature. Additionally, a site visit by a professional geologist conducted on January 29, 2014, provided an overview of affected environment at the project area.

The following sources of information were used to identify the potential impacts of the On-Site Alternative, Off-Site Alternative, and No-Action Alternative on geology and soils in the study area.

- USGS National Seismic Hazard Maps and associated report (U.S. Geological Survey 2013).
- Cascadia Region Earthquake Workgroup (2013) report on the Cascadia Subduction Zone earthquakes.
- Washington Department of Natural Resources Division of Geology and Earth Resources geologic mapping and geologic hazards of the Longview area (various).
- NRCS soil mapping (2013).
- Geotechnical engineering reports and geotechnical engineering data reports prepared for the project area (GRI 2011, 2012).
- Professional workshop and refereed scientific journal materials on tsunamis in the Columbia River.
- Geology and soil report prepared for the project area by the Applicant (URS Corporation 2013).

Figure 5.1-1. Geology and Soils Study Areas



5.1.3.2 Impact Analysis

The analysis of potential impacts related to geology and soils considered the following.

- Regional and project area characteristics (bedrock, unconsolidated sediment, and soil characteristics) and how they could influence site or structure stability through soil erosion, landslides, and settling.
- Potential ground shaking and ground settling due to earthquakes and the stability of the underlying materials.
- The potential for impacts related to volcanic hazards and tsunamis.

5.1.4 Affected Environment

This section describes the affected environment in the study areas for the On-Site Alternative and Off-Site Alternative related to geology and soils affected by the construction and operation of each alternative. Broader geologic context is provided as a foundation for the project area-specific analysis presented in the following section.

5.1.4.1 On-Site Alternative

Geology in the Project Area and Vicinity

The project area is located on the north shore of the Columbia River, approximately 5 miles downstream of the confluence of the Cowlitz and Columbia Rivers (at approximately river mile 63 in the Columbia River). Levees were constructed along the river side of the project area (Figure 5.1-2) around 1920, and the area has been used as an industrial site since the 1940s (Anchor QEA 2011).

The project area is relatively level with some steep slopes descending into drainage ditches on the northern part of the project area and to the Columbia River on the south side. Soils consist mostly of alluvium (i.e., river deposits of gravel, sand, and silt) as well as human-made sources of fill. The project area is at an elevation approximately 16 feet above sea level.

The adjacent Columbia River navigation channel is approximately 43 feet deep at low tide (National Oceanic and Atmospheric Administration Chart 18524) and from 28 to 42 feet deep at low tide at the location of the proposed docks (Docks 2 and 3). No unique geologic physical features, such as unique geologic formations, rock outcroppings, cliffs, or soil formations, occur at the project area.

The study areas exhibit attributes typical of the lower Columbia River valley. The regional geology is dominated by events related to the eastward movement of the Juan de Fuca tectonic plate against the North American plate (Evarts et al. 2009; Parsons et al. 2005). As these plates shift, the Juan de Fuca plate descends below the North American plate and it liquefies at depth. The associated magma (lava) rises to the surface to form the volcanic Cascade mountain range.

Areas of exposed bedrock are present near the project area. These areas include Mount Solo to the immediate north of the On-Site Alternative and Off-Site Alternative project areas and Mount Coffin approximately 0.5 mile upstream of the project area (Washington Department of Natural Resources 2014). The outermost bedrock on Mount Solo is mapped as volcanic rocks (basalt). Within and adjacent to the indirect impacts study area, landslides are also mapped along the slopes of Mount Solo (Figure 5.1-3).

Figure 5.1-2. Levees in the Project Area and Vicinity

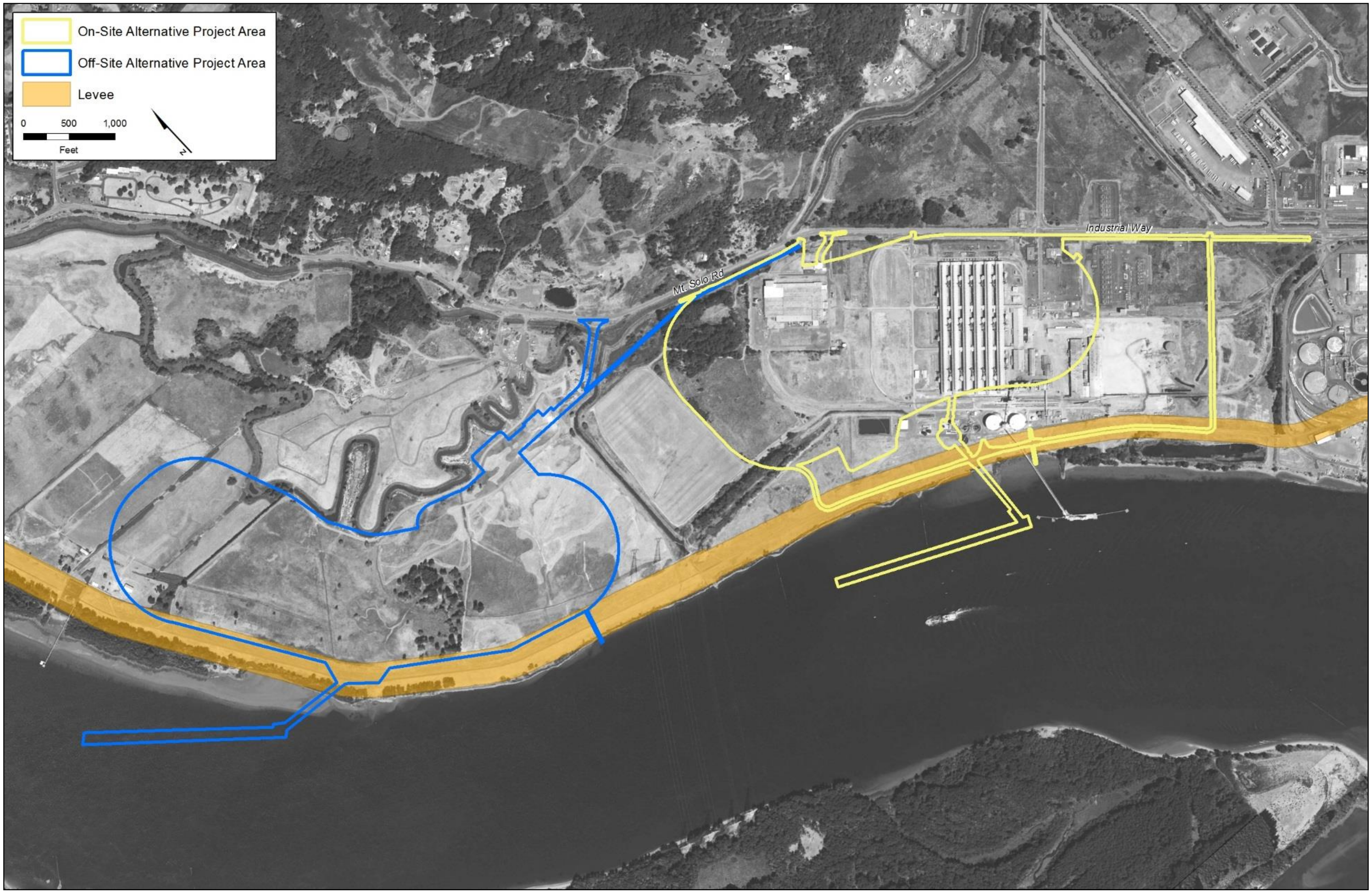
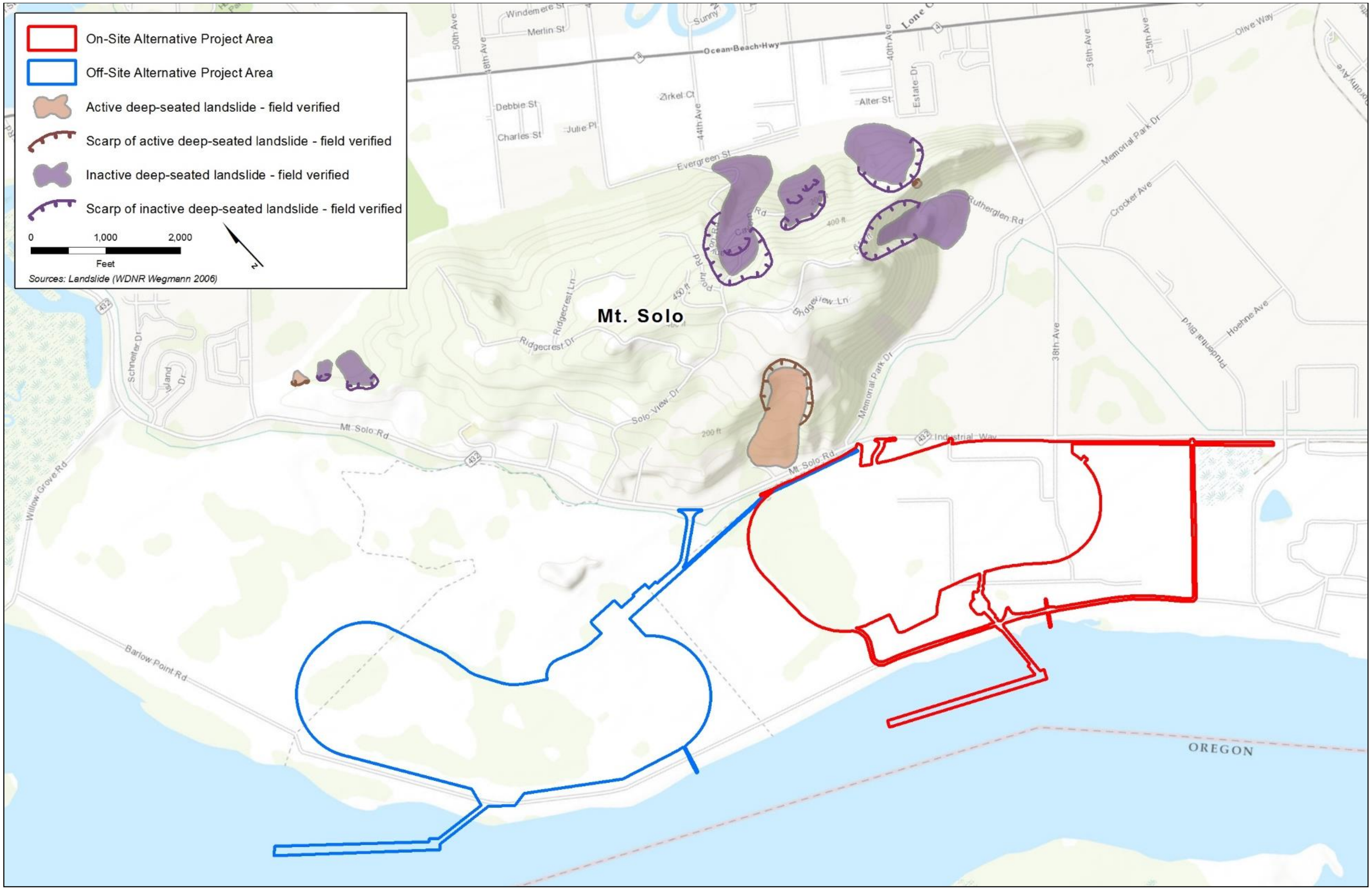


Figure 5.1-3. Landslides in the Project Area and Vicinity



Subsurface Conditions

The soil material beneath the project area is derived from the interaction of the river and the floodplain during high flow events, which deposit sediments consisting of sand, silt, and clay, as well as areas of peat (Anchor 2007; Anchor QEA 2011; GRI 2012; URS Corporation 2014a). Groundwater is found between 3 and 20 feet below the ground surface, so sediments have varying amounts of water content (Anchor QEA 2011, 2013; GRI 2012; URS Corporation 2014a). Geotechnical investigations indicate surface and near-surface sediments are soft or loose (URS Corporation 2014a). These conditions indicate the potential for some settlement under the weight of certain project features, such as stockpile pads, buildings, and rail loops. Field tests indicate the potential for large settlement of these underlying materials over a long period of time (URS Corporation 2014a).

Because saturated sandy soil conditions exist at the project area, liquefaction of soils could result from an earthquake. Geotechnical reports prepared for a previously proposed asphalt plant at the site identified the potential for post-earthquake liquefaction of soils to cause settlement of 7 to 16 inches (GeoEngineers 2007) and 12 to 16 inches (Shannon and Wilson 2008).

Landslides and Slope Stability

Landslides were not identified as a potential risk for the On-Site Alternative in local slope instability reports or on-site investigations (Figure 5.1-3) (Fiksdal 1989; Wegmann 2006; Anchor 2007; GRI 2011, 2012). The project area for the On-Site Alternative is flat; therefore, there is a low likelihood of landslides occurring. Much of the shoreline of the Columbia River has been armored with riprap along the length of the levee adjacent to the On-Site Alternative. The riprap protects the levee from erosion, while the levee itself disconnects the floodplain from the river.

Landslides have been identified on Mount Solo. Fiksdal (1989) identified two landslide areas on the eastern flanks of Mount Solo, as well as one on the north side and another on the south side (Figure 5.1-3). More detailed mapping by Wegmann (2006) identified multiple landslides around Mount Solo. Wegmann (2006) also determined whether the features were inactive or active. One of the active landslides is on the south side of Mount Solo, which could affect the project area. This landslide is formed by the exposed bedrock discussed in Section 5.1.4.1, *On-Site Alternative*. Landslides on Mount Solo could be caused by strong ground shaking from earthquakes or by substantial rainfall.

Seismicity

Pacific Northwest earthquakes are caused by one of four possible geologic events: movements between the tectonic plates on the coastal Cascadia Subduction Zone (CSZ), subduction of the Juan de Fuca plate sinking beneath the North American tectonic plate, shallow crustal movements in the North American tectonic plate, and movements related to volcanic activity.

No great earthquakes (magnitude 8.0 to 9.0[1] or higher) have occurred on the CSZ during the historical record but reconstructions from the geologic record show more than 10 great earthquakes have occurred in Oregon and Washington over the last 5,000 years (Cascadia Region Earthquake Workgroup 2013; URS Corporation 2014a). The interval in which these earthquakes reoccur is estimated at approximately 250 to 900 years with the last occurrence in 1700 (Atwater et al. 1994; Jacoby et al. 1997).

[1] The Richter scale is used to define the scale for earthquake magnitudes presented in this section.

Based on the historical record, plate movement due to the sinking of the Juan de Fuca plate under the North American plate is considered capable of causing earthquakes as large as magnitude 7.5 (URS Corporation 2014a). Earthquakes caused by this type of plate movement in Washington include the 1949 Olympia 7.1 magnitude, the 1965 Seattle 6.5 magnitude, and the 2001 Nisqually 6.8 magnitude. These earthquakes did not cause substantial damage in the Longview area (Noson et al. 1988; Washington Department of Natural Resources 2001; Washington State Seismic Safety Committee 2012; URS Corporation 2014a).

Shallow earthquakes in the earth's crust occur over large areas. Based on data gathered and historical records in the Pacific Northwest, these earthquakes can be greater than magnitude 6.0 and perhaps as high as magnitude 7.0 to 7.5 (URS Corporation 2014a). Shallow faults in southwestern Washington and northwestern Oregon have the potential to generate magnitude 6.0 and greater earthquakes (Wong et al. 2000; Lidke et al. 2003; Personius et al. 2003; URS Corporation 2014a).

Volcanic earthquakes occur beneath the Cascade volcanoes; Mount St. Helens is about 40 miles east of the project area. These earthquakes are associated with magma movement or volcanic faults within the Mount St. Helens seismic zone. The largest recorded earthquake beneath Cascade volcanoes was a magnitude 5.1 earthquake in 1981 (U.S. Geological Survey 2013).

Surface Fault Rupture

No shallow crustal faults are active or potentially active within the immediate vicinity of the project area (Lidke et al. 2003; Personius et al. 2003; Barnett et al. 2009; Czajkowski and Bowman 2014). The closest faults are the Portland Hills and Frontal Fault–Lacamas Lake Faults, about 40 miles to the southeast near Portland, Oregon (Wong et al. 2000; URS Corporation 2014a). The Mount St. Helens Seismic Zone is a fault line about 45 miles to the east and offshore faults are about 60 miles to the west.

Strong Ground Shaking

Large earthquakes between 1873 and 2014 potentially affecting the Longview area primarily took place in the Puget Sound area and Portland, Oregon. They range in magnitude from 5.0 to 7.1 (URS Corporation 2014a). Large earthquakes would cause severe ground shaking in the project area.

The USGS National Seismic Hazard Maps determine earthquake ground motions for different seismic thresholds used for seismic requirements in building codes. The maps display peak ground acceleration, the measure of the ground's acceleration from no motion at all to a peak motion during ground shaking. This acceleration causes shaking and stress on structures. A peak ground acceleration in the range of 0.34 to 0.65 gravity (g) is regarded as severe shaking and could cause moderate to heavy damage to buildings or structures, depending on the duration of the event, the types of underlying materials, and the structural integrity of the affected buildings or structures (Petersen et al. 2014). The USGS map shows a peak ground acceleration in the study area between 0.4 to 0.5 g, which has a 2% chance of being exceeded in 50 years (Petersen et al. 2014).

Ground shaking is also stronger in areas of soft soils or loose deposits such as sand and silt. The Site Class Map of Cowlitz County, Washington, shows the project area as site class E, which has the softest soil conditions and highest level of potential ground shaking (Palmer et al. 2004).

Cascadia Region Earthquake Workgroup (2013) notes underwater landslides, which could disrupt the Columbia River navigation channel and adjacent industrial and commercial berthing areas, also pose a ground shaking and liquefaction hazard to the area.

Secondary Seismic Hazards: Liquefaction and Subsidence

Liquefaction occurs when stress such as ground shaking causes saturated or partially saturated soil to lose its strength and act like a fluid. The project area has potential for liquefaction during ground shaking. The Liquefaction Susceptibility Map of Cowlitz County, Washington, shows the area as having high liquefaction potential (Palmer et al. 2004).

The geologic record provides evidence of liquefaction potential along the Columbia River. Previous investigations at the site for a proposed asphalt plant resulted in similar estimates for settlement from liquefaction ranging from 7 to 16 inches for a CSZ earthquake ranging from magnitudes 7.4 to 8.3, though this varies with location.

Volcanic Hazards

The main volcanic hazard at Longview is from airborne fragments, ash fall, and lahars (volcanic mudflows) reaching, and continuing down, the Columbia River. Active volcanoes within the Cascade Range lie to the east of Longview, with the closest active volcano being Mount St. Helens about 40 miles to the east. The project area does not lie within any of the three Cowlitz County-designated volcanic flowage hazard zones. USGS estimates the annual chance of ash fall greater than 4 inches at Longview to be between 0.01% and 0.02% or between 1 in 10,000 to 1 in 5,000 (Wolfe and Pierson 1995).

Lahars originating from the south flank of Mount Rainier in the upper Cowlitz River are unlikely to reach the lower Cowlitz River (Cakir and Walsh 2012). Lahars have been documented upstream along the Sandy River draining from Mount Hood in Oregon (Pierson et al. 2009) at approximately 55 miles upstream of Longview. Lahars from Mount Adams could reach the Columbia River via the White Salmon River; its confluence is more than 100 river miles upstream of Longview. The Longview area is also not within any of the three Cowlitz County-designated volcanic flowage hazard zones. Although the Cowlitz River adjacent to Longview is designated as a Cowlitz County-designated volcanic flowage hazard zone 3 (zone 3 areas typically require a an evacuation and emergency management plan).

Mine Hazard Areas

Mine hazard areas in Cowlitz County are mainly associated with historical coal mining and areas affected by mine workings such as adits, tunnels, drifts, or airshafts. There is no bedrock with coal along the Columbia River in the Longview area.

Tsunamis

Washington and Oregon tsunamis could result from CSZ earthquakes along their coastline or similar major earthquakes in areas such as southern Alaska, Japan, or Indonesia. Tsunami hazard and evacuation maps for Washington and Oregon only extend up the Columbia River to a point just east of Astoria, Oregon (river mile 15, approximately 50 miles downstream of the project area)(Walsh et al. 2000; Washington Department of Natural Resources 2010; Oregon Department of Geology and Mineral Industries 2012). Modeling calculations found an 18-foot-high tsunami at the Columbia River mouth would decrease to less than 8 inches at Longview (Yeh et al. 2012).

Sea-Level Rise

Sea-level rise in the Pacific Northwest is expected to be as little as 5 inches or less to more than 4 feet by the end of the century. The project area is approximately 60 miles inland from the mouth of the Columbia River, and sea-level rise at the project area is expected to be minimal. Further, the project area is behind Columbia River levees of approximately 36 feet above sea level, and since this is higher than the potential sea-level rise, there would not be any impacts on soils on the project area or an increased risk of erosion.

Soils in the Project Area and Vicinity

Cowlitz County soils have been mapped by NRCS (2013). These soil units and some of their characteristics are shown in Table 5.1-2. Excluding water, five soil units are mapped at the project area (Figure 5.1-4). All of these soil units reflect the alluvial (river deposit) origin of the soil material and are relatively fine-grained.

Table 5.1-2. Soils and Soil Properties in the On-Site Alternative Project Area

Map Unit Number[a]	Soil Map Unit Name	Drainage Class	K Factor[b]	Erosion Hazard	Corrosion of Concrete[c]	Corrosion of Uncoated Steel[d]	Linear Extensibility (Class)
5	Arents, 0 to 5% slopes	Moderately well drained	0.28	Slight	Moderate	Moderate	1.5% (Low)
17	Caples silty clay loam, 0 to 3% slopes	Somewhat poorly drained	0.43	Slight	Moderate	High	7.0% (High)
127	Maytown silt loam, 0 to 3% slopes	Moderately well drained	0.49	Slight	Moderate	High	3.6% (Moderate)
160	Pilchuck loamy fine sand, 0 to 8% slope	Not defined	0.20	Slight	Moderate	Low	1.5% (Low)
199	Snohomish silty clay loam, 0 to 1% slopes	Poorly drained	0.37	Slight	Moderate	High	4.5% (Moderate)
263	Water	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

[a] Soil Map Units are shown in Figure 5.1-4.

[b] Higher K factor values indicate greater potential for erosion: K factor values below 0.13 have low erosion potential; values 0.13 to 0.26 have medium erosion potential; values greater than 0.26 have high erosion potential.

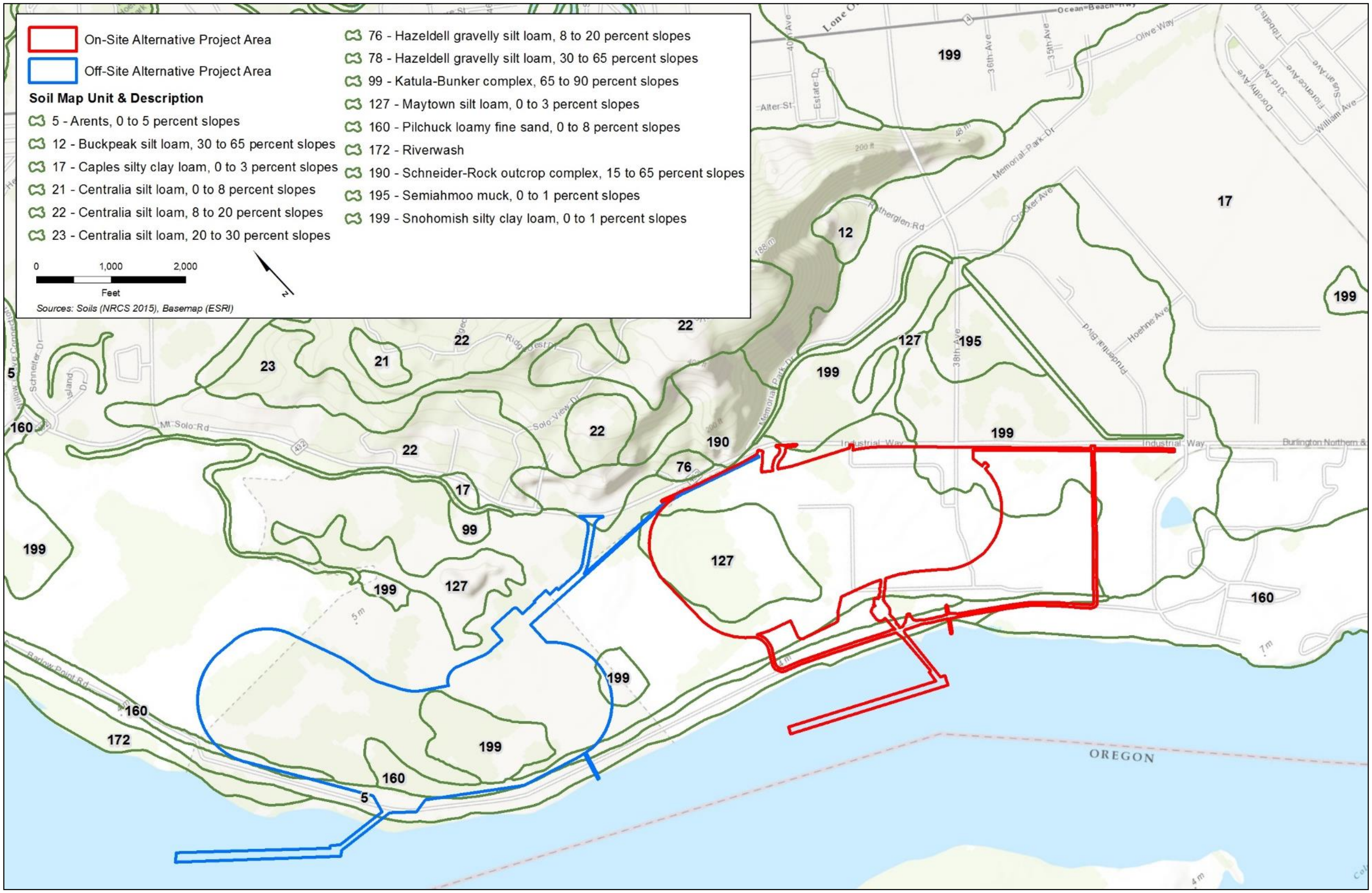
[c] The potential for concrete corrosion increases decreasing water and soil acidity and increases in sodium, magnesium sulfate, and sodium chloride.

[d] The potential for corrosion of uncoated steel increases with soil water saturation, greater water acidity and conductivity.

Source: Natural Resources Conservation Service 2013.

N/A = not applicable

Figure 5.1-4. Soil Types in the Project Area and Vicinity



The erosion hazard is considered slight for all of the soils in the study area. The Caples silty clay loam (Map Unit Number 17), the Maytown silt loam (Map Unit 127), and Snohomish silty clay loam (Map Unit Number 199) have a higher erosion hazard under bare soil conditions. These soils have a low susceptibility to wind erosion.

The site soils are all moderate regarding their potential for corrosion of concrete. Several engineering measures address concrete and steel corrosion, such as improving drainage and replacing native soil with fill (Washington State Department of Transportation 2014).

A soil's linear extensibility is the measure of its potential to expand during wetting and to contract during drying. The more a soil expands the more potential it has to affect overlying materials such as structure foundations. The soil expansion classes for the project area range from low (Arents, Pilchuck loamy fine sand), to moderate (Maytown silt loam, Snohomish silty clay loam), to high (Caples silty clay loam). The values in Table 5.1-2 are provided as a percent expansion and a descriptive classification (class).

The above discussion relates to the naturally occurring soils at the project area. However, the project area has been an industrial site since the 1940s and has had various amounts of surface disturbance and fill material (sand, silt, mixed silt and sand, large gravel, and crushed rock [Anchor QEA 2011; GRI 2011, 2012]) placement. Due to the industrial use, site-specific surface soil materials could vary from NRCS mapping. Data reports for the project area indicate varying areas of fill materials, particularly under existing structures.

5.1.4.2 Off-Site Alternative

The following sections describe the affected environment related to the geology and soils in the project area for the Off-Site Alternative and the surrounding area.

Local and Site Geology

The project area for the Off-Site Alternative is located about 0.3 mile west (downstream) of the project area for the On-Site Alternative. It is about 5 to 15 feet above sea level; it lies above river and floodplain deposits and the surface is level. The adjacent Columbia River navigation channel is approximately 32 to 46 feet deep at low tide and from about 10 to 42 feet deep at low tide at the location of the proposed docks (Dock A and Dock B) according to the National Oceanic and Atmospheric Administration Chart 18524. Levees were constructed along the riverside of the project area (Figure 5.1-2) in approximately 1920 (Anchor QEA 2011). No unique physical geologic features are present at the project area.

The local geology of the project area is the same as described for the project area for the On-Site Alternative (URS Corporation 2014b).

Although no detailed subsurface geotechnical information is available for the project area, the overall conditions are expected to be very similar to the project area for the On-Site Alternative, because of the similar landscape position, proximity, and similarity of deposits along this portion of the Columbia River (Peterson et al. 2013).

Subsurface Conditions

Although geotechnical data are not available for the project area, Peterson et al. (2013) presents directly connected cross-sections from the immediate area. The similarity in sediment deposits shows the geotechnical characteristics at the project area for the On-Site Alternative are generally the same for the Off-Site Alternative project area.

Landslides and Slope Stability

No landslides are identified for the project area in local slope instability reports (Figure 5.1-3) (Fiksdal 1989; Wegmann 2006). The project area is also flat and, therefore, has a low likelihood of landslides. Much of the shoreline has been armored with large riprap and angular rock along the length of the levee adjacent to the Off-Site Alternative location along the Columbia River, thereby disconnecting the river from its floodplain and protecting the levee system from erosion.

There are two active landslides on Mount Solo relevant to the project area (Figure 5.1-3). The larger (approximately 16-acre) active landslide on the south slope of Mount Solo is approximately 0.5 mile from the northeast corner of the project area. The smaller (approximately 0.56-acre) landslide at the western portion of the Mount Solo area is more than 0.5 mile north of the project area, is facing to the north, and has a low bedrock ridge to the south which isolates it from the project area (Figure 5.1-3) (Wegmann 2006).

Seismicity

The seismicity discussion provided for the On-Site Alternative applies to the Off-Site Alternative project area.

Volcanic Hazards

The discussion of volcanic hazards provided for the On-Site Alternative applies to the Off-Site Alternative project area.

Tsunamis

The discussion of tsunamis provided for the On-Site Alternative applies to the Off-Site Alternative project area.

Sea-Level Rise

The discussion of sea-level rise provided for the On-Site Alternative applies to the Off-Site project area.

Soils

The discussion of soils for the On-Site Alternative applies to the Off-Site Alternative project area except Soil Number 127, Maytown silt loam (Figure 5.1-4, Table 5.1-2), which is not at the Off-Site Alternative project area. Moreover, the naturally occurring soils mapped are representative of the affected environment at the project area.

5.1.5 Impacts

This section describes the potential direct and indirect impacts related to geology and soils resulting from construction and operation of the proposed export terminal.

5.1.5.1 On-Site Alternative

This section describes the potential impacts occurring in the study area[2] as a result of construction and operation of the proposed export terminal.

Construction activities could affect geology and soils directly through ground disturbance associated with construction of the export terminal for the shipment of coal and preloading of the coal stockpile areas. Operational activities could affect geology and soils indirectly through exposure of people and structures to potential effects from catastrophic events

Construction—Direct Impacts

Construction-related activities associated with the On-Site Alternative could result in direct impacts as described below. As explained in Chapter 3, *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).

Land, Physical Features, and Soil Erosion

Construction of the On-Site Alternative would not result in the enlargement of land area by placing fill in the Columbia River or by depositing sediments in the Columbia River. There are no unique physical features at the project area affected by the On-Site Alternative. Although steep slopes occur along drainage ditches and the Columbia River banks, there are no indications of instability and project activities are not expected to cause instability at these locations.

Construction at the On-Site Alternative location would involve ground-disturbing activities such as grading, railroad construction, excavating for foundations, and road construction affecting about 190 acres of land. Approximately 2.1 million cubic yards of material would be imported for compressing soils on site, as well as about 130,000 cubic yards of ballast rock for rail-related structures and infrastructure. Approximately 2.5 million cubic yards of material would be moved around the project area during the compression of on-site soils.

As discussed in Section 5.1.4.1, *On-Site Alternative*, and shown in Table 5.1-2, although the soils in the project vicinity have a moderate to high potential for erosion, the soils in the project area have a slight erosion hazard mainly due to the project area's flat, low gradient. Bare soil could be exposed for varying periods of time due to construction activities occurring over several years. This could lead to potential soil erosion due to rainfall or wind. Soil erosion would have the potential for off-site transport of eroded soil materials to waterways such as the Columbia River and adjacent ditches. However, construction best management practices (e.g., seeding temporarily disturbed areas, installing and monitoring silt fencing, and adhering to the stormwater pollution prevention plan). Imported preload and rail ballast materials would be obtained commercially from an appropriate source. Wind erosion potential would be limited

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[2] Acreages presented in the impacts analysis were calculated using geographic information system (GIS) technology, thus, specific acreage of impacts are an estimate of area based on the best available information.

due to seasonal precipitation and dust suppression during construction, but could occur during summer dry periods. Dust from coal stockpiles is addressed in Chapter 6, Section 6.6, *Air Quality*. When build-out is complete, the project area would be approximately 90% impervious surfaces, which would reduce soil erosion potential to near zero.

Dredging would occur at Docks 2 and 3. This activity is discussed in Sections 5.2, *Surface Water and Floodplains,* and 5.5, *Water Quality*.

Project Structures

As discussed in Section 5.1.4.1, *On-Site Alternative*, and shown in Table 5.1-2, the on-site soils have moderate potential to corrode concrete, low to high potential to corrode steel, and have an expansion-contraction (wet-dry) class of low to high. Impacts related to corrosion of project-related structures and infrastructure would be avoided through standard engineering and construction methods. Washington State Department of Transportation (2014) uses a variety of standard engineering measures to address concrete and steel corrosion such as improving drainage and replacing native soil with fill. Such standard engineering measures would be employed by the Applicant to ensure potential soil related corrosion would not occur.

The sediments beneath the project area are relatively fine-grained and water-saturated, and the water table is near the ground surface. These characteristics make the sediments vulnerable to compaction from the weight of overlying materials and structures. This vulnerability is mainly a concern for the coal stockpile areas on the project area due to the coal's weight. Thus, preloading and installing wick drains is required to expel the groundwater and consolidate soils beneath the stockpile areas prior to operations. Compaction would be less of a concern for other project components because they involve much less weight.

Compaction and settlement of underlying sediments in the coal stockpile areas are addressed in the project design through preloading. Preloading involves importing material to compact the underlying soil to improve its load-bearing capacity. Approximately 2.1 million cubic yards of material would be imported into the coal stockpile areas in stages over a period of up to 7 years. Preloading would provide soil compaction to avoid potential impacts associated with soil settlement during operations.

Construction—Indirect Impacts

Construction of the On-Site Alternative would not result in indirect impacts on geology and soils because construction impacts would be immediate and would be limited to the project area. Therefore, no construction impacts would occur later in time or farther removed in distance from the direct impacts on the project area.

Operations—Direct Impacts

The On-Site Alternative would result in the following direct impacts.

Operation of the terminal could expose people or structures to potential effects involving catastrophic events such as; rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure (liquefaction), landslides, and tsunamis. Thus, potential effects from these types of catastrophic events were evaluated.

Earthquake Faults

There are no earthquake faults in the study area reaching the ground surface. Therefore, no ground surface ruptures could directly damage structures or buildings in the study area.

Ground Shaking

The project area and surrounding area could be subject to strong ground shaking from earthquakes. The USGS National Seismic Hazard Maps estimate earthquake probability in the area with a peak ground acceleration of greater than 0.4 g at a 2% probability of occurrence (Petersen et al. 2014). This amount of shaking could directly damage proposed structures and buildings. As per the Cowlitz County Critical Areas Protection Ordinance (Cowlitz County Code [CCC] 19.15), construction of the terminal would be required to comply with International Building Code 16.05 and Cowlitz County Grading Ordinance 16.35, as applicable. Additionally, a geotechnical report would be prepared as part of the On-Site Alternative and would inform project design and construction techniques, which would likely reduce potential impacts associated with ground shaking.

Seismic-Related Ground Failure (Liquefaction)

The study area could be subject to liquefaction during strong ground shaking. Palmer et al. (2004) characterizes the area as having high liquefaction susceptibility. An investigation of the area was conducted for a previously proposed asphalt plant, which indicated settlement after liquefaction would vary with earthquake location and earthquake magnitude. The investigations concluded ground settling due to post-liquefaction settlement could damage the proposed structures and buildings. The On-Site Alternative would comply with the adopted International Building Code (per CCC 16.05 and 16.35 Grading Ordinance). Preloading the stockpile area would expel groundwater and consolidate soils in the immediate vicinity of the coal stockpile areas, which would reduce the susceptibility of the soils to liquefaction. This would also likely reduce the potential for damage to proposed structures in the immediate vicinity of the preloading area. Preparation of a geotechnical report would identify the specific soil conditions pre- and post-project construction, and would inform project design and construction techniques to further reduce potential impacts based on the potential susceptibility of liquefaction.

Landslides

There are no existing landslides in the study area. Strong ground shaking associated with earthquakes would have minimal potential to cause new landslides in the study area, because the area is level and there is only about 40 feet of elevation difference between the site surface and the adjacent Columbia River bottom.

The project area is near the active deep-seated landslide on the south side of Mount Solo, but it is approximately 250 feet from the edge of the estimated greatest extent of the landslide, more than the 50 feet required by the Cowlitz County Critical Areas Ordinance (CCC 19.15) for landslide hazards. However, as with all landslides, periods of prolonged and intense rainfall (including multiyear periods) or earthquake-caused ground shaking could trigger this landslide. However, because the project area is approximately 200 feet beyond the minimum distance required by the Cowlitz County Critical Areas Ordinance (CCC 19.15) and it is physically isolated from the landslide, the On-Site Alternative would not increase the risk of a landslide, nor would it be expected, if a landslide were to occur, it would affect the proposed export terminal.

Tsunamis

Large earthquakes in the Pacific Ocean or on the CSZ could cause a tsunami, which could affect the coastal zone of Washington and Oregon. Large tsunamis have been detected as far up the Columbia River as Portland, Oregon. Modeling calculations found an 18-foot-high tsunami at the Columbia River mouth decreased to less than 8 inches at Longview (Yeh et al. 2012). Tsunami levels at the project area would be similar and would not affect project-area structures or operations, including ships at the docks.

Operations—Indirect Impacts

Operation of the On-Site Alternative would not result in any indirect impacts on geology or soils because operations would not result in any changes to soils or geology occurring later in time or beyond the direct impacts study area.

5.1.5.1 Off-Site Alternative

The site plan and design (size of project area, project elements, and construction activities) for the Off-Site Alternative are very similar to the On-Site Alternative. Moreover, the local geology, landscape position, subsurface conditions, and soils are virtually identical between the two areas (Peterson et al. 2013). Therefore, the construction-related direct impacts of the Off-Site Alternative would be the same as, or similar to, those described for the On-Site Alternative.

Construction—Direct Impacts

Construction of the terminal would result in impacts similar to those described for the On-Site Alternative. The following discussion is focused on the differences in direct impacts potentially resulting from construction of the Off-Site Alternative.

Soil Erosion

Erosion hazards under the Off-Site Alternative would be the same as described for the On-Site Alternative. When build-out is complete, the Off-Site Alternative project area would be about 90% impervious surfaces, which would reduce soil erosion potential to near zero. Dredging would occur at Docks A and B, which is discussed in Sections 5.2, *Surface Water and Floodplains*, and 5.5, *Water Quality.*

Project Structures

The potential impacts on the project structures from soil materials would be the same as described for the On-Site Alternative.

Construction—Indirect Impacts

The Off-Site Alternative would not result in indirect impacts on geology and soils because construction impacts would be immediate and would not occur later in time or farther than the direct impacts study area.

Operations—Direct Impacts

Operation of the proposed export terminal at the Off-Site Alternative location would result in the following direct impact.

Catastrophic Events

Operation of the terminal could expose people or structures to potential effects involving catastrophic events such as rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure (liquefaction), landslides, and tsunamis. The impacts would be the same or similar to those described for the On-Site Alternative. The project area has no surface faults that would affect the site or its structures. The project area would experience the same ground-shaking-related ground failure (including the liquefaction potential), landslides, and tsunamis as the On-Site Alternative project area. Although no site-specific data were collected nor any analyses conducted for the Off-Site Alternative project area, the area's general characteristics are expected to be similar to the On-Site Alternative project area, because the local geology, landscape position, subsurface conditions, and soils are virtually identical between the two areas (Section 5.1.4.1, *On-Site Alternative*; Peterson et al. 2013).

The Off-Site Alternative would comply with the adopted International Building Code or International Residential Code (CCC 19.15).

Operations—Indirect Impacts

No indirect impacts have been identified for geology or soils related to operation of the terminal at the Off-Site Alternative location.

5.1.5.2 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the terminal would not occur. In addition, not constructing the terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area.

The potential impacts on geology and soils could occur under the No-Action Alternative similar to what is described for the On-Site Alternative, but the magnitude of the impact would depend on the nature and extent of the future expansion.

5.1.6 Required Permits

The following permits related to geology and soils would be required for the proposed export terminal.

5.1.6.1 On-Site Alternative

The On-Site Alternative would require the following permits for geology and soils.

- **Fill and Grade Permits/Building Permits—Cowlitz County**. Fill and grade permits and building permits would be required from Cowlitz County to ensure final design and construction follow the County and engineering requirements.

- **Critical Areas Permit—Cowlitz County**. The On-Site Alternative would require a Critical Areas Permit to address compliance with Cowlitz County's Critical Areas Ordinance related to the presence and protection of Critical Aquifer Recharge Areas located on site.
- **Construction Stormwater General Permit—Washington State Department of Ecology.** A Construction Stormwater General Permit would be required from the Washington State Department of Ecology to address erosion control and water quality during construction.
- **Industrial Stormwater General Permit—Washington State Department of Ecology.** An industrial Stormwater General Permit would be required from the Washington State Department of Ecology to address erosion control and water quality during operations. The permit and stormwater pollution prevention plan control adverse impacts through the application of best management practices. Best management practices are defined as schedules of activities, prohibitions of practices, maintenance procedures, and structural and managerial practices, when used singly or in combination, prevent or reduce the release of pollutants and other adverse impacts on waters of Washington State. The types of best management practices are source control, treatment, and flow control.

5.1.6.2 Off-Site Alternative

The Off-Site Alternative would require the following permits related to geology and soils.

- **Building Permit—City of Longview.** A building permit would be required from the City of Longview to ensure final design and construction follow the City of Longview engineering requirements.
- **Critical Areas Permit—Cowlitz County and City of Longview**. A Critical Areas Permit may be required to address compliance with the County and City's Critical Areas Ordinances should critical aquifer recharge areas be located on or adjacent to the Off-Site Alternative project area.
- **Construction Stormwater General Permit and Industrial Stormwater General Permit—** Washington State Department of Ecology. Permits would be required, for the same reasons described for the On-Site Alternative.

5.2 Surface Water and Floodplains

Surface water such as rivers, lakes, and coastal waterways provide natural beauty and sustain the health of human and natural communities. Floodplains are lowland areas adjacent to surface water features that are periodically inundated by water during flood events. Floodplains carry and store floodwaters, thus, protecting human life and property from flood damage. Floodplains often contain areas vital to a diverse and healthy ecosystem. Undisturbed, floodplains have high natural biological diversity and productivity, and support many waterfowl species and migrating birds.

The quality of surface water and floodplains refers to the physical, chemical, biological, and aesthetic characteristics of water, which are used to measure the ability of water to support aquatic life and human uses. Surface water and floodplain quality can be diminished by contaminants introduced by domestic, industrial, and agricultural practices.

This section describes the surface water and floodplains in the On-Site Alternative and Off-Site Alternative study areas. It then describes potential impacts on surface water and floodplains that could result from construction and operation of the proposed export terminal.

5.2.1 Regulatory Setting

Laws and regulations relevant to surface water and floodplains are summarized in Table 5.2-1.

Table 5.2-1. Regulations, Statutes, and Guidelines for Surface water and Floodplains

Regulation, Statute, Guideline	Description
Federal	
Rivers and Harbors Act of 1899	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 Act (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.
Clean Water Act (33 USC 1251 *et seq*.)	Establishes the basic structure for EPA to regulate discharges of pollutants into the waters of the United States and regulate quality standards for surface water.
Section 404 of the Clean Water Act	Regulates the placement of dredged or fill material into waters of the United States, including special aquatic sites such as sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes. EPA oversees the Section 404 program and the Corps administers the day-to-day Section 404 program, including individual and general permit decisions.
Section 401 of the Clean Water Act	Requires that a Water Quality Certification be obtained from Ecology for any activity that requires a federal permit or license to discharge any pollutant into a water of the United States. This certification attests that the state has reasonable assurance that the proposed activity will meet state water quality standards.

Regulation, Statute, Guideline	Description
Sections 301 and 402 of the Clean Water Act	Prohibits the discharge of any pollutant to a water of the United States without a permit. Section 402 (33 USC 1342) establishes the NPDES permitting program, under which such discharges are regulated.
National Flood Insurance Act of 1968	Established the NFIP, a federal floodplain management program designed to reduce future flood losses nationwide through the implementation of community-enforced building and zoning ordinances in return for the provision of affordable, federally backed flood insurance to property owners. The NFIP is a program in which counties and cities can voluntarily participate. FEMA is the agency responsible for enforcing the NFIP and the program is implemented at the city and county level.
EO 11990, Protection of Wetlands	Applies to all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. Federal agencies are responsible for enforcing this EO, as applicable.
EO 11988/13690, Floodplain Management	Requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative (42 FR 26951). To improve the nation's resilience to flooding and better prepare the nation for the impacts of climate change, EO 11988 was amended in 2015 (now EO 13690). Federal agencies are responsible for enforcing the EO, as applicable.
State	
Water Resources Act of 1971 (RCW 90.54)	Sets forth fundamental policies for the state to ensure that waters of the state are protected and fully utilized for the greatest benefit. Ecology is the agency responsible for enforcing the Water Resources Act.
Water Pollution Control (RCW 90.48)	Policy to maintain the purity of waters of the state consistent with public health and public enjoyment, as well as propagation and protection of wildlife and industrial development of the state, and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state.
Water Quality Standard for Surface water of the State of Washington (WAC 173-201A)	Establishes water quality standards for surface water of the state of Washington.
Shoreline Management Act	Regulates and manages the use, environmental protection, and public access of the state's shorelines. The SMA (RCW 90.58) was passed by the Washington State Legislature in 1971 and adopted in 1972. Ecology is the agency responsible for enforcing the SMA.

Regulation, Statute, Guideline	Description
Local	
Cowlitz County Stormwater Drainage Ordinance (CCC 16.22)	The Cowlitz County Stormwater Drainage Ordinance is a requirement of the NPDES Phase II Municipal Stormwater Permit issued to Cowlitz County by Ecology. The permit requires Cowlitz County to reduce stormwater runoff and pollution in unincorporated areas of Cowlitz County adjacent to the Cities of Longview and Kelso. The On-Site Alternative is not within the area affected by the NPDES Phase II Municipal Stormwater Permit.
Cowlitz County Phase II Municipal Stormwater Management Plan (CCC 19.15)	Requires Cowlitz County to develop a SWMP. The SWMP must incorporate best management practices to reduce the discharge of pollutants from the regulated area to the maximum extent practicable to protect water quality. Cowlitz County is responsible for enforcing the SWMP.
Cowlitz County Critical Areas Ordinance (CCC 19.20)	Requires Cowlitz County, in compliance with the GMA, to adopt development regulations based upon the best available science that assure the protection of critical areas such as wetlands, aquifer recharge areas, geologically hazardous areas, fish and wildlife habitat, and frequently flooded areas. Cowlitz County is responsible for enforcing this ordinance.
Cowlitz County Shoreline Master Program (CCC 19.15)	Requires Cowlitz County to provide for the enhancement of shorelines and protection against adverse effects to vegetation, wildlife, and waters of the state, and their aquatic life.
Cowlitz County Floodplain Ordinance (CCC 16.25)	Requires Cowlitz County to implement the Washington State Flood Control Zone permit program to regulate floodplain development. Cowlitz County adopted a revised floodplain ordinance and revised FIRM in December 2015.
City of Longview Stormwater Ordinance (Off-Site Alternative)	Establishes methods for controlling the introduction of runoff and pollutants into the municipal storm drain system to comply with requirements of the Western Washington Phase II Municipal Stormwater NPDES permit process. The City is responsible for enforcing this ordinance.
City of Longview Critical Areas Ordinance (Off-Site Alternative)	Requires compliance with the GMA to adopt development regulations based on the best available science that assure the conservation of critical areas such as wetlands, aquifer recharge areas, geologically hazardous areas, fish and wildlife habitat, and frequently flooded areas. The City is responsible for enforcing this ordinance.
City of Longview Shoreline Master Program (Off-Site Alternative)	The City's SMP consists of environmental designations for the shoreline segments and goals, policies, and regulations applicable to uses and modifications within the Shoreline Management Zone.

Notes:
USC = United States Code; EPA = U.S. Environmental Protection Agency; Ecology = Washington State Department of Ecology; NPDES = National Pollutant Discharge Elimination System; NFIP = National Flood Insurance Program; FEMA = Federal Emergency Management Agency; EO = Executive Order; FR = *Federal Register*; WAC = Washington Administrative Code; RCW = Revised Code of Washington; SMA = Shoreline Management Act; SMP = Shoreline Master Program; GMA = Washington State Growth Management Act; CCC = Cowlitz County Code; SWMP = Stormwater Management Plan; Corps = U.S. Army Corps of Engineers; FIRM = Flood Insurance Rate Map

5.2.2 Study Area

The study areas for the On-Site Alternative and Off-Site Alternative are described below. These study areas are based on *NEPA Scope of Analysis Memorandum for Record* (MFR) (2014) and adjusted to reflect specific surface water characteristics in and near the project areas.

5.2.2.1 On-Site Alternative

The study area for direct impacts, i.e., the extent of impact evaluation on surface water, is the portion of the Columbia River and stormwater drainage ditches in and adjacent to the project area. The study area for indirect impacts on surface water encompasses the Consolidated Diking Improvement District (CDID) #1 stormwater system drainage ditches adjacent to the project area and the Columbia River downstream 1 mile from the project area. Figure 5.2-1 shows the On-Site Alternative study areas for surface water.

The study area for direct impacts on floodplains is the project area. The study area for indirect impacts on floodplains is the surrounding 500-year floodplain on the north side of the Columbia River around the project area. The indirect study area extends 1 mile from the direct impacts study area unless there is no mapped floodplain, or if a levee or ditch is present that could affect flooding. Figure 5.2-2 shows the study areas for floodplains.

5.2.2.2 Off-Site Alternative

The study area for direct impacts on surface water is the portion of the Columbia River and stormwater drainage ditches within and adjacent to the project area for the Off-Site Alternative. The study area for indirect impacts on surface water encompasses the CDID #1 stormwater system drainage ditches adjacent to the project area for the Off-Site Alternative and the Columbia River downstream 1 mile from the project area. Figure 5.2-3 shows the Off-Site Alternative study areas for the surface water.

The study area for direct impacts on floodplains is the project area for the Off-Site Alternative. The study area for indirect impacts is the surrounding 500-year floodplain on the north side of the Columbia river around the project area. The indirect impacts study area extends 1 mile from the direct impacts study area unless there is no mapped floodplain, or if a levee or ditch is present that could affect flooding. Figure 5.2-4 shows the Off-Site Alternative study areas for floodplains.

5.2.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts on surface water and floodplains associated with construction and operation of the proposed export terminal.

Figure 5.2-1. Surface Water Study Area—On-Site Alternative

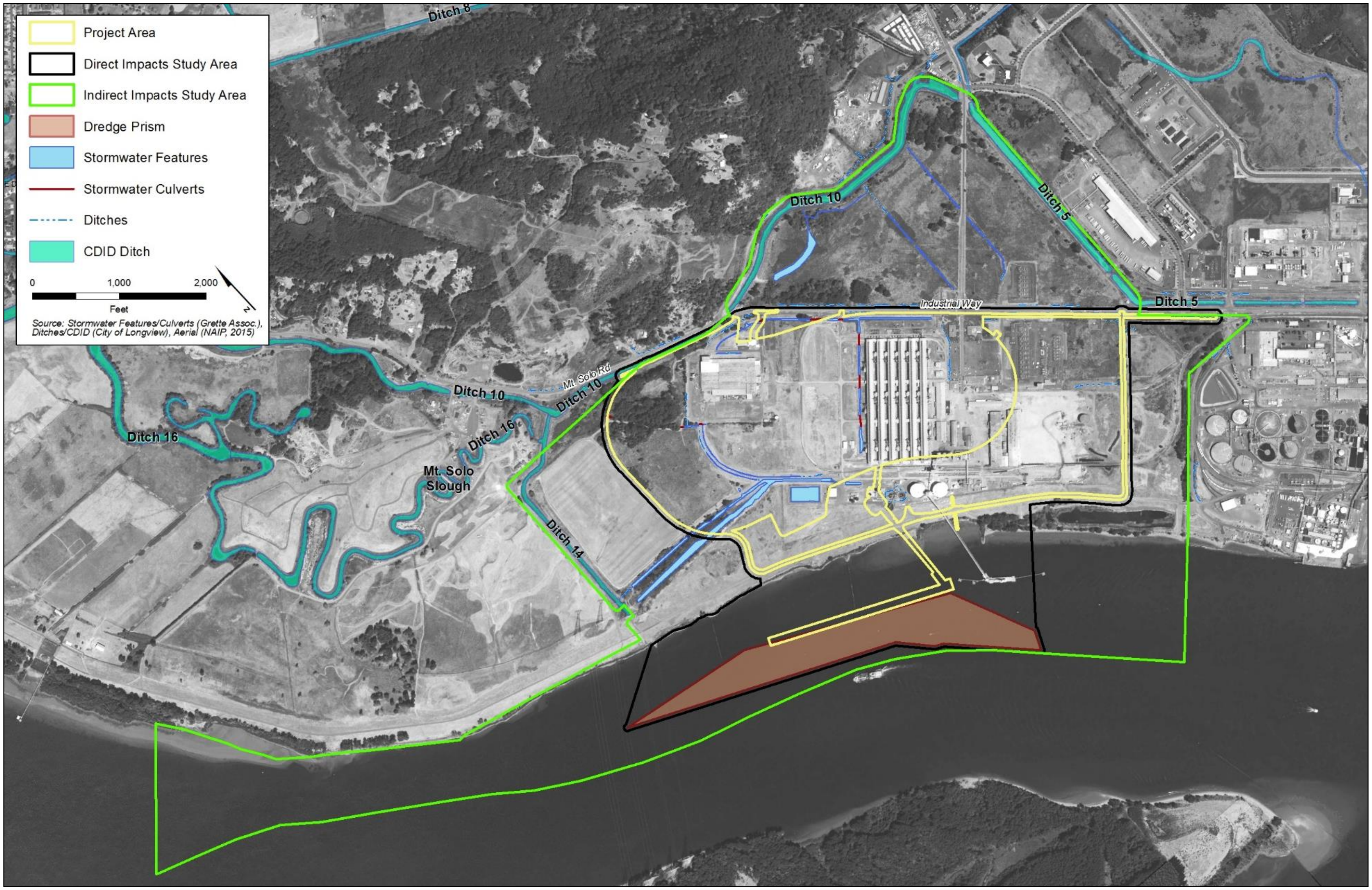


Figure 5.2-2. Floodplains Study Area—On-Site Alternative

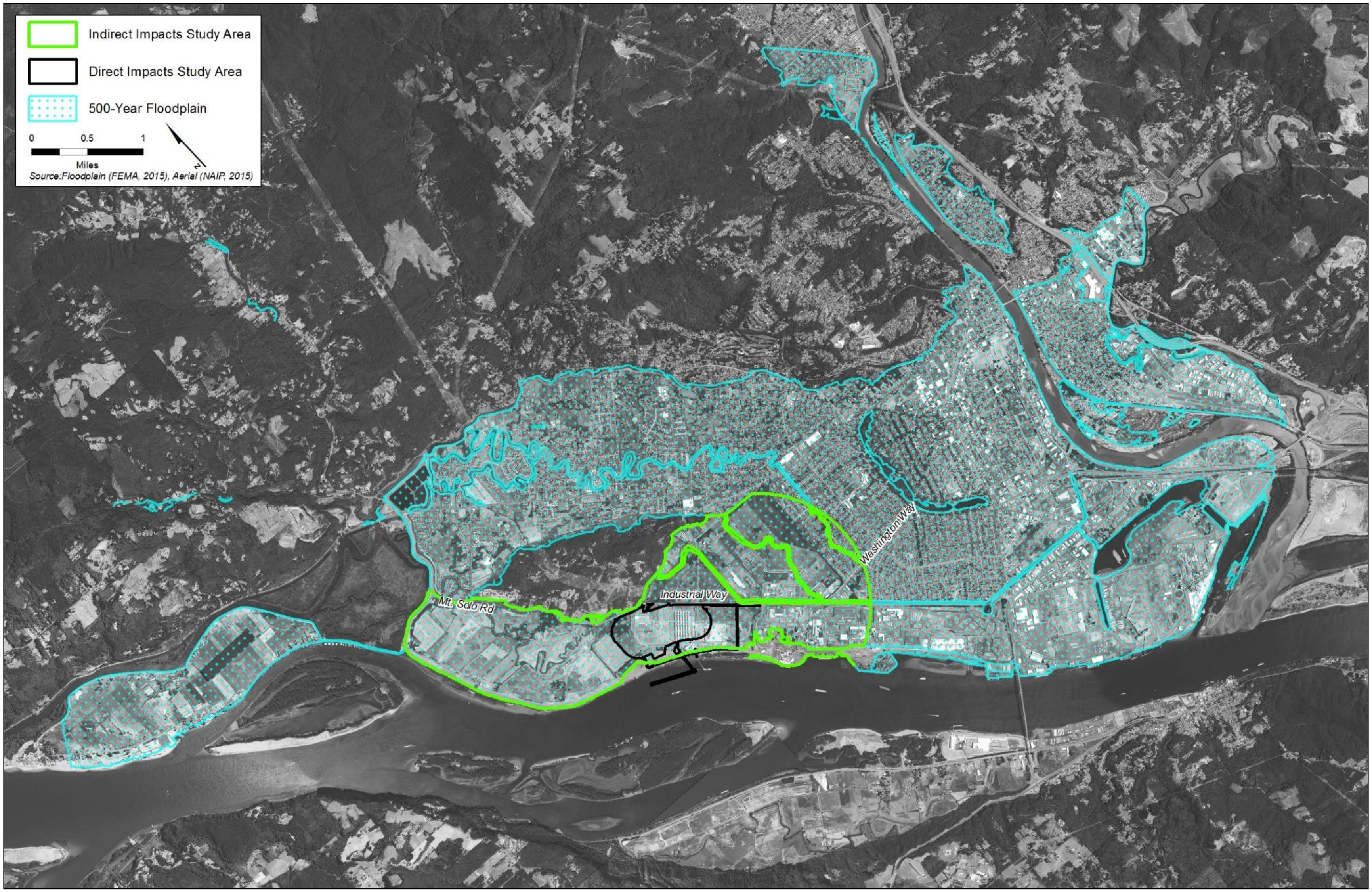


Figure 5.2-3. Surface Water Study Area—Off-Site Alternative

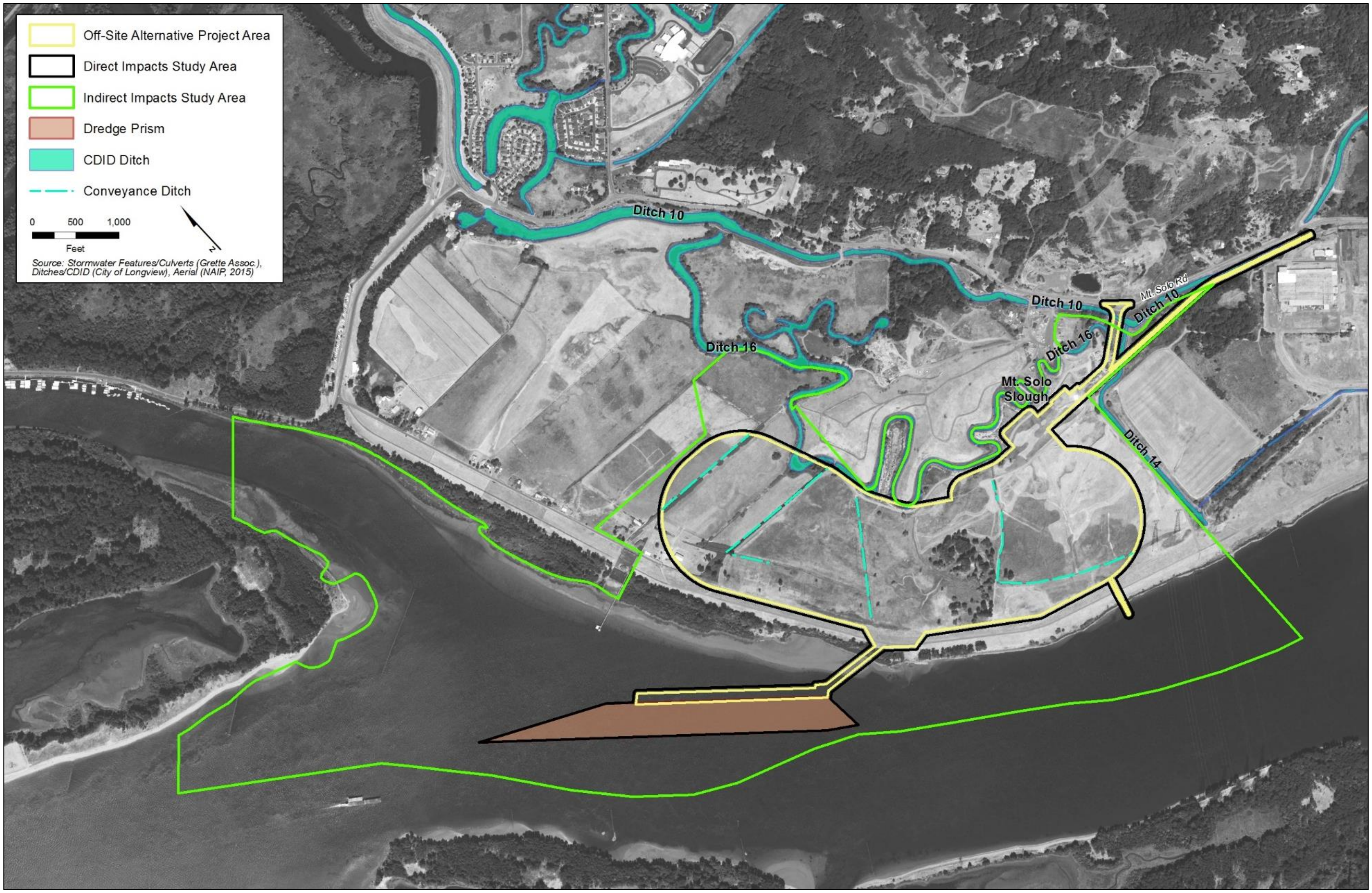
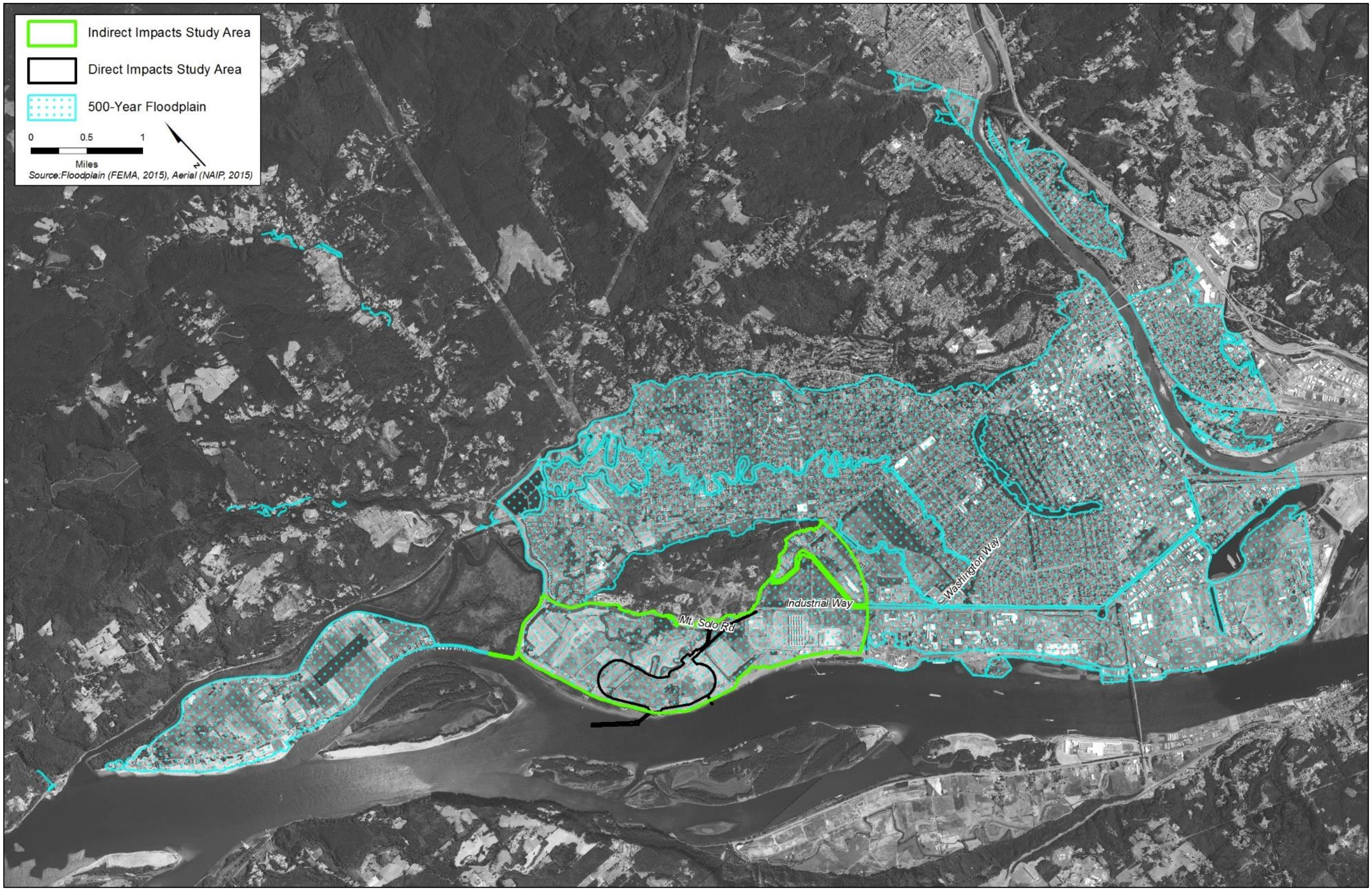


Figure 5.2-4. Floodplains Study Area—Off-Site Alternative



5.2.3.1 Information Sources

The following sources of information were used to define the affected environment relevant to surface water and floodplains and identify the potential impacts of the proposed export terminal on surface water and floodplains in the study areas.

- *Engineering Report for NPDES Application Millennium Bulk Terminals—Longview, LLC* (Anchor QEA 2011)
- *Engineering Report Update for NPDES Application Millennium Bulk Terminals—Longview, LLC* (Anchor QEA 2014)
- *Columbia River Basin: State of the River Report for Toxics* (U.S. Environmental Protection Agency 2009)
- *Diminishing Returns: Salmon Declines and Pesticides* (Ewing 1999)
- *Columbia River Estuary ESA Recovery Module for Salmon and Steelhead* (National Marine Fisheries Service 2011)
- Columbia River Estuary Operational Forecast System website
- *Designated Beneficial Uses Mainstem Columbia River 340-41-0101* (Oregon Department of Environmental Quality 2003)
- *303(d)/305(b) Integrated Water Quality Assessment Report* (Oregon Department of Environmental Quality 2012)
- USGS water-quality data, Columbia River Estuary, 2004–2005 (U.S. Geological Survey 2005)
- USGS water-quality data, Columbia River at The Dalles, Oregon, 2012 (USGS 14105700)
- *Stormwater Management Manual for Western Washington* (Washington State Department of Ecology 2012)
- Grays-Elochoman, Cowlitz River Basins Water Resource Management Programs (Washington State Department of Ecology 2014)
- Reports and analyses provided by the Applicant

5.2.3.2 Impact Analysis

Potential surface water and floodplains impacts have been evaluated regarding general parameters, such as changes to surface water drainage, surface water discharge, floodplain connectivity, and how the proposed export terminal could affect these parameters.

For the purpose of this analysis, construction impacts are based on peak construction period and operations impacts are based on maximum throughput capacity (up to 44 million metric tons per year). The assessment of impacts also considers regulatory controls, such as those required in the National Pollutant Discharge Elimination System (NPDES) Industrial Stormwater Permit and NPDES Construction Stormwater General Permit, which are required for the On-Site Alternative and Off-Site Alternative.

5.2.4 Affected Environment

This section describes the affected environment in the study areas related to surface water and floodplains that could be affected by construction and operation of the proposed export terminal.

5.2.4.1 On-Site Alternative

The project area is along the Columbia River near river mile 63 near Longview. The topography of the study areas is relatively flat; the vicinity of the project area is protected by a levee system operated and maintained by CDID #1, which also operates and maintains a series of ditches and pump stations in the vicinity of the project area. The Applicant operates and maintains independent stormwater and facility process water treatment and conveyance facilities for the project area.

Surface Water and Floodplain Features

Columbia River

The Columbia River basin comprises 260,000 square miles from its headwaters in British Columbia, Canada, to its mouth near Astoria, Oregon, bordering Washington and Oregon. The river's annual discharge rate fluctuates with precipitation and ranges from 63,600 cubic feet per second in a low water year to 864,000 cubic feet per second in a high water year (U.S. Geological Survey 2014). The Columbia River has been identified by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) as a flow exempt waterbody, which means it is exempt from flow control requirements associated with the detention/retention and discharge of stormwater. Water quality criteria must still be met for all stormwater discharges.

The lower Columbia River is tidally influenced by the Pacific Ocean from Astoria to Bonneville Dam, located upstream of Portland (Bonneville Power Administration 2001). Tidal fluctuations are diurnal, meaning there are two high tides and two low tides in each 24-hour tidal cycle. Tidal ranges vary along the lower Columbia River and are reported to have a mean range of 3.78 feet at Longview. The Columbia River experiences seasonal variation in flow from year to year depending on snow mass in the upper watershed.

All surface waters from the study area are ultimately discharged to the Columbia River, either as groundwater, surface water, or treated stormwater discharge. The project area is in the right-bank floodplain of the Columbia River (Figure 5.2-2) and is protected from Columbia River flooding by the CDID #1 levee (see *Columbia River Levee*, on the following page).

Water Resource Inventory Area 25

A watershed generally has a topographic boundary that defines an area draining to a single point of interest. The Washington State Department of Ecology (Ecology) and other state natural resources agencies have divided Washington State into 62 Water Resource Inventory Areas (WRIAs) to delineate and manage the state's major watersheds. The project area is located in WRIA 25, the Grays/Elochoman Basin.

Consolidated Diking Improvement District #1

The study areas are surrounded and protected by the levees, ditches, and pump stations of CDID #1. CDID #1 consists of 19 miles of levees, including the Columbia River levee; over 35 miles of sloughs, ditches, and drains for flood protection; a stormwater collection and routing system; and seven pump stations for removing and discharging stormwater to receiving waters outside of the levee system, such as the Columbia River. These pump stations are instrumental in removing stormwater and preventing local and area-wide flooding.

Columbia River Levee

The CDID#1 levee system can be divided into three major segments, but the study areas are primarily protected by the Columbia River levee segment. This levee protects the study areas from flooding along the Columbia River and from related backwater elevations in Coal Creek Slough. It extends from the main pump station and office complex around the western edge of Longview and unincorporated portions of Cowlitz County, up the Columbia River to its confluence with the Cowlitz River. The levee is a mixture of well-defined rural levees and overbuilt sections associated with urbanized levees through industrial areas.

Pump Stations

In addition to the CDID #1 levee, the study areas are surrounded and protected by smaller levees, ditches, and pump stations maintained by CDID #1 as described below (Figure 5.2-5).

The two pumps of primary interest in the project vicinity are the Reynolds Pump Station and the Industrial Way Pump Station.

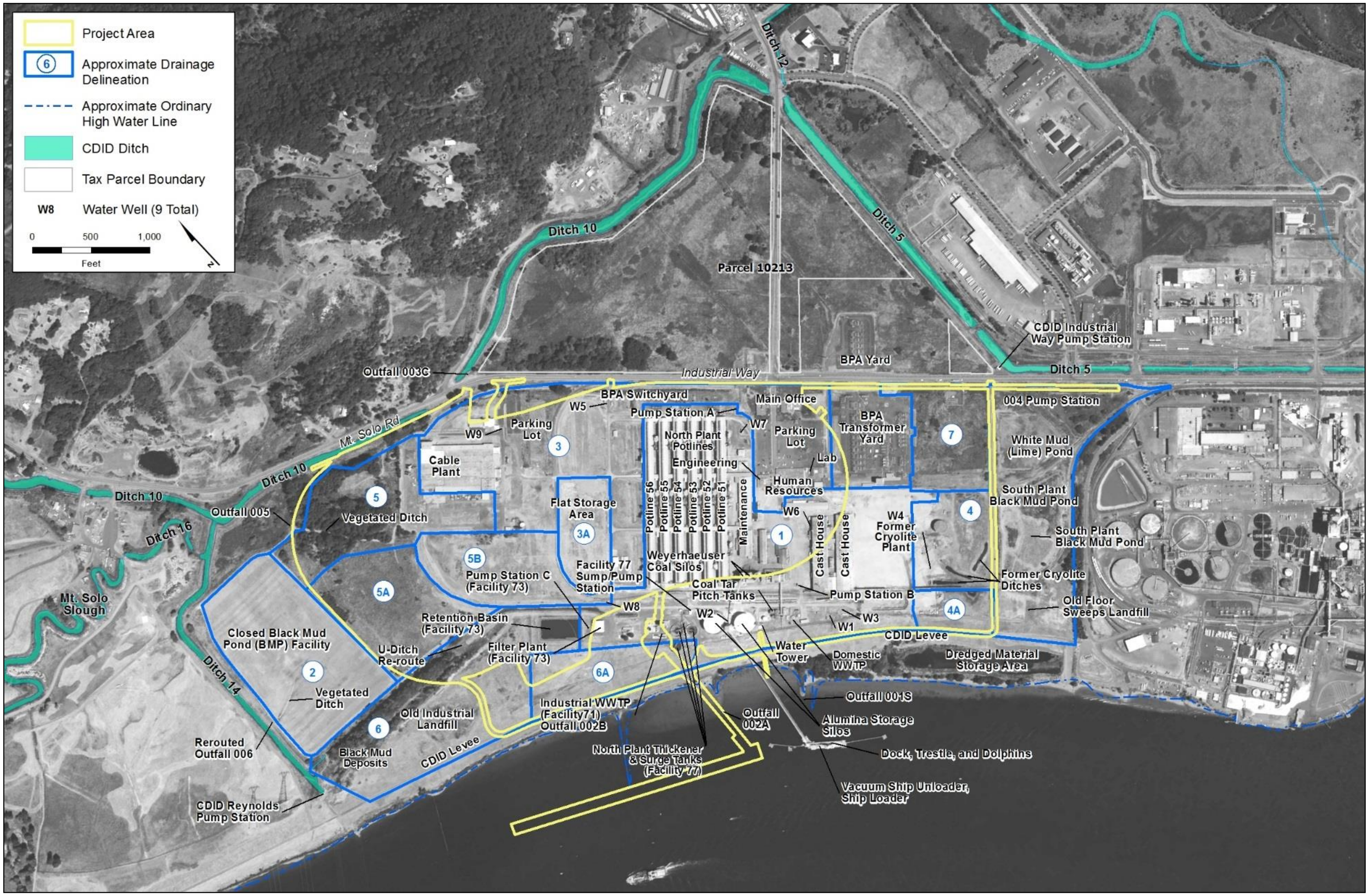
- **Reynolds Pump Station**. The Reynolds Pump Station is located at the terminus of Ditch 14, adjacent to the Columbia River. This pump station draws water from Ditch 10 and pumps directly to the Columbia River. Total pumping capacity is 80,000 gallons per minute.
- **Industrial Way Pump Station**. The Industrial Way Pump Station is located adjacent to Ditch 5 and Industrial Way. It has a pumping capacity of 90,000 gallons per minute and pumps water a distance of nearly 0.5 mile, where it discharges to the Columbia River through the levee at the east end of the project area.

Ditches

CDID #1 maintains approximately 35 miles of sloughs, ditches, and drains that collect and convey stormwater to the CDID #1 pump stations. The ditches have a dual function, acting as a conveyance system to transport stormwater to the pumping stations and as a storage reservoir for intense rainfalls exceeding the capacity of the pumps. The Columbia River is the ultimate destination of the drainage water. Below is a description of the CDID #1 ditches located on or adjacent to the project area (Figure 5.2-5).

- **Ditch 5.** Ditch 5 borders the eastern edge of Parcel 10213 and extends south from 38th Avenue to the Industrial Way Pump Station along Industrial Way, which pumps water to the Columbia River via an underground pipe. A second branch of Ditch 5 extends from the pump station southeast along the north side of Industrial Way to Washington Way. It connects with other drainage ditches (Ditches 1 and 3) and conveys flow to the pump station.

Figure 5.2-5. Existing Drainage Systems in the Project Area—On-Site Alternative



- **Ditch 10.** North of Industrial Way, Ditch 10 extends west from 38th Avenue, crosses under Industrial Way through a culvert, and turns northwest, eventually connecting to other segments of the drainage system including Ditch 14 and Ditch 16. Ditch 14 conveys flow south to the Reynolds Pump Station, which discharges to the Columbia River through an underground pipe. South of Industrial Way, Ditch 10 is north of the former cable plant and remnant forested area. Ditch 10 intersects with Ditch 14 just north of the closed Black Mud Pond (BMP) facility.
- **Ditch 14.** Ditch 14 is located along the western boundary of the project area and consists of a trapezoidal-shaped drainage ditch that receives flow from Ditch 10, Ditch 16, and other privately owned ditches located on site (e.g., Cable Plant Ditch) and off site. It conveys flow south toward the Reynolds Pump Station, which pumps water under the CDID #1 levee.

Stormwater and shallow groundwater drainage for the project area is controlled by a system of ditches, pump stations, treatment facilities, and outfalls. All of these facilities currently operate under a single NPDES permit. As shown in Figure 5.2-5, all project area drainage is either held on site until it evaporates, discharged to CDID #1 ditches and into the Columbia River, or treated and discharged through Outfall 002A (operated by the Applicant) to the Columbia River. Table 5.2-2 lists the drainage basins in the project area; and drainage basins are shown in Figure 5.2-5.

Table 5.2-2. Existing Drainage Basins in the Project Area—On-Site Alternative

Area	Description
1	Stormwater runoff gravity drains to Facility 77 and is pumped to Facility 73 for treatment prior to discharge through Outfall 002A.
2	Stormwater runoff gravity drains to a vegetated conveyance swale and is pumped into the U-Ditch, where it drains to the Facility 77 and is pumped to Facility 73 for treatment prior to discharge through Outfall 002A as designed. Larger runoff events may overflow the sump and discharge into CDID Ditch 14 through Rerouted Outfall 006.
3	Stormwater runoff ponds locally and/or gravity drains to a vegetated ditch and is discharged through Outfall 003C into CDID Ditch 10.
3A	Stormwater runoff ponds locally and infiltrates/evaporates and/or is pumped to the U-Ditch, where it drains to Facility 77 and is pumped to Facility 73 for treatment prior to discharge through Outfall 002A.
4	Stormwater runoff gravity drains to ditches and is pumped via Pump Station 004 to Facility 77, where it is pumped to Facility 73 for treatment prior to discharge through Outfall 002A.
4A	Stormwater runoff ponds locally and infiltrates/evaporates.
5	Stormwater runoff from improved areas pond locally and infiltrates/evaporates; runoff from the larger events may gravity drain to a vegetated ditch and discharge through Outfall 005 to CDID Ditch 14. Stormwater runoff from unimproved areas may gravity drain towards the vegetated ditch.
5A	Stormwater runoff ponds locally and infiltrates/evaporates.
5B	Stormwater runoff ponds locally and infiltrates/evaporates.
6	Stormwater runoff ponds locally and infiltrates/evaporates. Larger runoff events may sheet flow to the U-Ditch, which discharges to Facility 77, and is then pumped to Facility 73 for treatment prior to discharge through Outfall 002A.
6A	Stormwater runoff ponds locally and infiltrates/evaporates. Unimproved areas may gravity drain toward the vegetated ditch.
7	Stormwater runoff ponds locally and infiltrates/evaporates.

Drainage Components

The following is a brief description of the on-site drainage components of the project area.

- **Sheetflow and infiltration.** Subbasins 4A, 5, 5A, 5B, 6A, and 7 receive sheetflow from storm events. The water remains in the subbasins until it infiltrates or evaporates.
- **Columbia River discharge.** Subbasins 1, 2, 3A, 4, and 6 are conveyed via pumped systems or gravity to Facility 73 where they are treated and then discharged to the Columbia River via CDID #1 Outfall 002A.
- **CDID #1 discharge.** Subbasin 3 flows through a vegetated ditch that discharges to Ditch 10 through Outfall 003C. During larger storm events, a portion of the flows from Subbasin 2 and Subbasin 5 (both described above) can discharge to the CDID #1 ditch system. Subbasin 2 will overflow the rerouted 006 pump station and be discharged to Ditch 14 through Outfall 006. This is a designed overflow system and it is equipped with a high-flow alarm to alert staff when it is activated. Subbasin 5 flows can enter a vegetated ditch that discharges to Ditch 10 through Outfall 005. Ultimately, all CDID #1 ditch flows discharge to the Columbia River.
- **Drainage features on Parcel 10213.** These features include three vegetated ditches, two unvegetated ditches, and a shallow stormwater pond. Two of the vegetated ditches run north-south across the two larger portions of Parcel 10213 (Figure 5.2-5). They are narrow and linear and convey stormwater to a culvert approximately 16 inches in diameter located on the north end of these ditches, which then empties into CDID Ditch 10. The third vegetated ditch consists of three segments of linear vegetated ditches adjacent to Industrial Way. These three ditch segments are connected by two culverts that are beneath the site's access roads. This feature likely collects stormwater from Industrial Way and adjacent areas and conveys it to CDID Ditch 10.

  One unvegetated ditch runs parallel to Ditch 10 and consists of two sections of a narrow ditch that was likely constructed to intercept shallow groundwater that was affecting agricultural use of the site. This unvegetated ditch is several feet deep, nearly vertical along its sides, and is bisected by one of the vegetated ditches that runs parallel across the site; however, there is no surface hydrology connection between these two ditches. The other unvegetated ditch serves as the outlet channel for the stormwater pond. This ditch is located at the northeast end of the stormwater pond and conveys excess stormwater from the pond to CDID Ditch 10 through a 16-inch culvert. All six features are privately owned and are not managed by CDID #1.
- **Off-site privately owned ditch.** This ditch is located near the northwest corner of the former Reynolds Metals Company facility (Reynolds facility). It conveys flow into Ditch 14 at a point just north of the closed BMP facility.
- **Outfall 002A**. This is a 30-inch outfall to the Columbia River that discharges water received from Facility 73 (the site's stormwater treatment system). Typical flow rates through the outfall are currently less than 2,000 gallons per minute. The maximum flow rate is 14,000 gallons per minute.

Columbia River and Cowlitz River Floodplain

The project area is on the right bank, within the 500-year floodplain of the Columbia River approximately 5 miles downstream of the confluence of the Cowlitz River and the Columbia River. Longview and Kelso were developed on the floodplain of the Columbia and Cowlitz Rivers. The majority of the project area is located behind the CDID #1 levee that is operated and maintained by CDID #1. The average elevation of the project area is 13.9 feet North American Vertical Datum of 1988 (NAVD88) (16.4 feet Columbia River Datum [CRD]), and the levee averages 33.9 feet NAVD88 (36.4 feet CRD) (Anchor QEA 2014). The portion of the project area waterward of the CDID #1 levee is within the floodway of the Columbia River. Construction and operation of the proposed new docks and trestle would occur on the riverward side of the existing levee. Construction and operations landward of the levee system would be located beyond the 100-year floodplain, but within the 500-year floodplain (Federal Emergency Management Agency 2015a). The City of Longview and the adjacent industrial areas along the Columbia River in unincorporated Cowlitz County are all located within the 500-year floodplain (Figure 5.2-2). The 500-year floodplain are those areas that have a 0.2% chance of flooding annually.

CDID #1 operates the slough, ditch, and drain system several feet lower than the low-flow elevation of the Columbia River. The operation of these systems provides necessary stormwater storage capacity and allows the pump system to maximize the flood control potential of the levee's interior drainage. The combined capacity of the seven CDID #1 pump stations (a total of 19 pumps) is 700,000 gallons per minute. These pump stations are instrumental in removing stormwater and preventing local and area-wide flooding. The need for this pumping capacity is apparent when considering that 1 inch of rainfall on the 16,000-acre watershed is equivalent to 434 million gallons of water. Removal of 4.8 inches of rain deposited during a 1986 storm required 54 hours of continuous pumping.

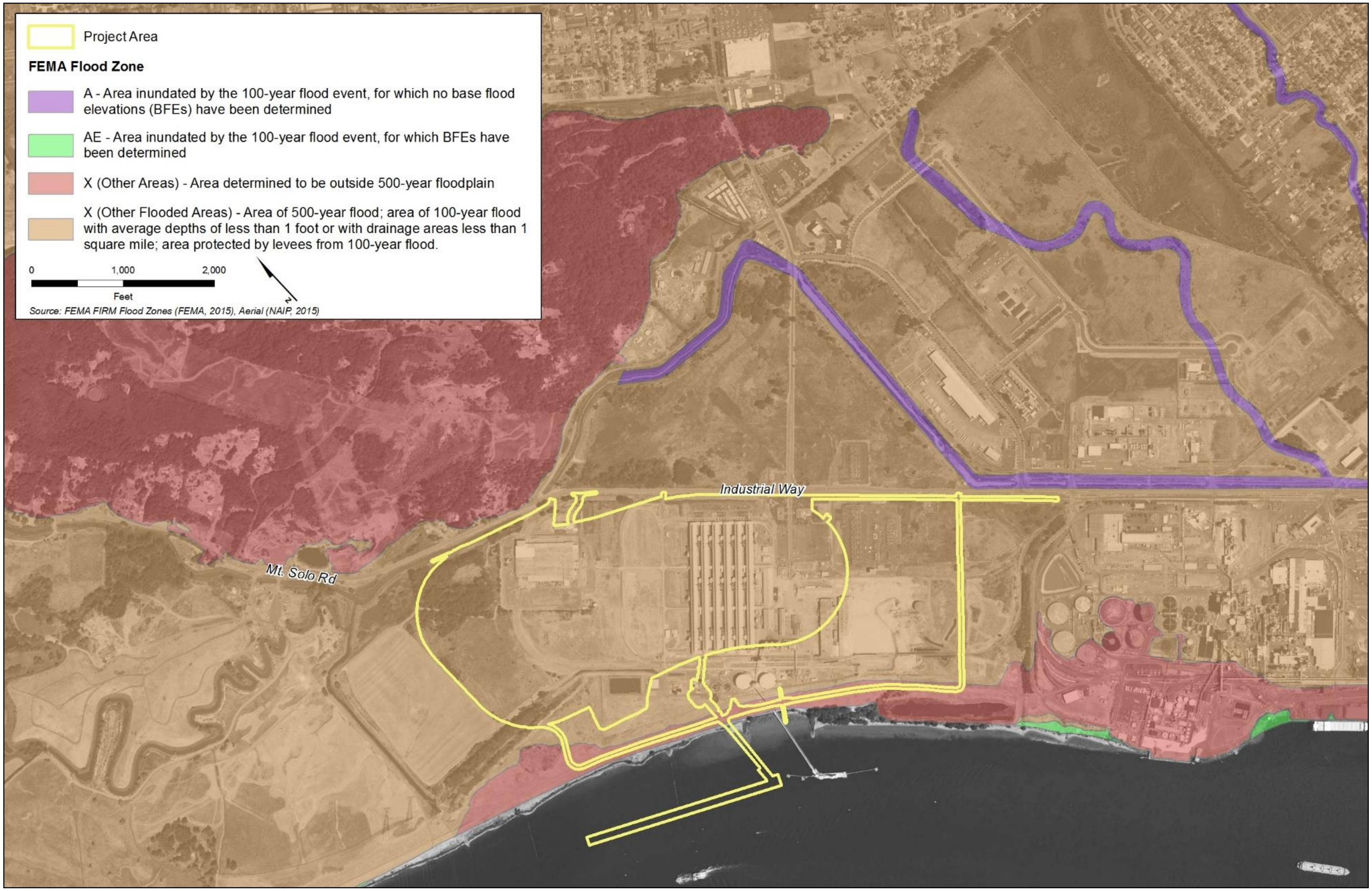
The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) maps the project area landward of the CDID #1 Columbia River levee as Zone X – Other Flooded Areas (Figure 5.2-6) (Federal Emergency Management Agency 2015b). Zone X – Other Flooded Areas is described by FEMA as follows.

> Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.

The FEMA FIRM designates the CDID #1 levee and areas waterward of the project area as Zone X – Other Areas (Figure 5.2-6) (Federal Emergency Management Agency 2015b). Zone X – Other Areas is defined by FEMA as an area determined to be outside the 500-year floodplain.

The portions of the project area located waterward of the levee (i.e., trestle and docks) are within the FEMA-mapped floodway. FEMA defines the floodway as the channel of a river and adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Under NFIP regulations, development in floodways must ensure there would be no increase in upstream flood elevations.

Figure 5.2-6. FEMA Flood Insurance Rate Map—On-Site Alternative



5.2.4.2 Off-Site Alternative

Similar to the On-Site Alternative, the Off-Site Alternative project area is also located on the right bank of the Columbia River and is protected by a robust levee system; however, the Off-Site Alternative project area is undeveloped, other than unpaved access roads, irrigation ditches, and agricultural activity. The project area for the Off-Site Alternative is approximately 6 miles downstream of the confluence of the Cowlitz River and the Columbia River, and is downstream of the On-Site Alternative project area. Surface water flow and floodplain interactions at the project area for the Off-Site Alternative are anticipated to be the same or similar to those of the On-Site Alternative project area, regarding drainage and infiltration, interaction with the Columbia River, and site-specific hydrology. No developed stormwater system is present in the Off-Site Alternative project area, other than irrigation ditches. No direct outfall to the Columbia River is associated with the Off-Site Alternative. All project area stormwater is either infiltrated or conveyed to CDID #1 ditches and then discharged to the Columbia River at existing CDID #1 pump stations. The Off-Site Alternative project area is disconnected from the Columbia River and does not provide floodplain functions such as water storage or fish and wildlife habitat.

Surface water features in or adjacent to the Off-Site Alternative project area include the Mount Solo Slough, Ditch 10, Ditch 14, and Ditch 16 (Figure 5.2-3). The project area is also crossed by a network of smaller excavated ditches that drain into Mount Solo Slough. Each of these is briefly described below.

- **Mount Solo Slough.** Mount Solo Slough is a privately owned drainage ditch located between the project area for the Off-Site Alternative and the closed Mount Solo landfill that forms the northern boundary of the project area. It is a highly meandering natural drainage that has been historically managed as a drainage ditch. It connects to Ditch 14 to the east and Ditch 16 to the north, both of which both connect to Ditch 10.
- **Ditch 10.** Ditch 10 runs along the south side of Mt. Solo Road north of the project area. Although it is located entirely offsite, Ditch 10 does connect with Ditch 14, which crosses the eastern portion of the project area, and to Ditch 16, which connects to the north end of Mount Solo Slough.
- **Ditch 14.** Ditch 14 crosses a short section of the eastern portion of the project area, just south of its confluence with Ditch 10.
- **Ditch 16.** Ditch 16 extends between the northern end of Mount Solo Slough and Ditch 10, which runs along Mt. Solo Road.

Similar to the On-Site Alternative, the FEMA FIRM delineates the project area in “medium shading” and maps the current levee that protects the project area; the project area landward of the levee is Zone X – Other Flooded Areas, with a reduced risk due to the levee (Figure 5.2-7). This area, which has a 0.2% chance of flooding annually, is in the 500-year floodplain. There is a linear band of Zone AE along the waterward side of the levee. Zone AE areas are inundated by the 100-year flood event for which base flood elevations have been determined. Flooding at the project area is minimal under current conditions. Like the On-Site Alternative, the portions of the project area (i.e., trestle and dock) located waterward of the levee are within the FEMA-mapped floodway.

Figure 5.2-7 FEMA Flood Insurance Rate Map—Off-Site Alternative

5.2.5 Impacts

This section describes the potential direct and indirect impacts related to surface water and floodplains that would result from construction and operation of the proposed export terminal.

5.2.5.1 On-Site Alternative

This section describes the potential impacts that could occur in the study areas as a result of construction and operation of the proposed export terminal at the On-Site Alternative location.

Construction—Direct Impacts

Construction-related activities at the project area that could affect surface water and floodplains include the following.

- Preparing the project area and preloading the coal stockpile areas.
- Regrading the project area to drain toward specific collection areas.
- Constructing the rail loop.
- Installing coal processing equipment (unloading facilities, transfer towers, conveyors).
- Constructing offices, maintenance buildings, and other structures.
- Constructing water-management and storage facilities.
- Constructing Docks 2 and 3 and removing existing pile dikes.

Construction-related activities associated with the On-Site Alternative could result in direct impacts as described below. Applicant identified minimization measures and best management practices were considered as part of the evaluation of potential impacts. Refer to Chapter 8 *Minimization and Mitigation*, for further information.

Drainage from Heavy Equipment and Staging Areas

The placement of heavy equipment and establishment of on-site staging areas could redirect sheetflow and potentially lead to localized flooding on or off site. The potential for localized flooding and increased erosion from redirected sheetflow increases with higher density of heavy equipment placement on site. Redirection of sheetflow has the potential to create rivulet and gully flow across bare soil, which could result in erosion and introduce sediment to the surrounding drainage channels and basins. Introduction of increased sediment loads to the drainage system could change the sediment deposition and transport characteristics of that system, resulting in potential changes in storage, increased channel gradient, and reduced pool depth. In compliance with the required Stormwater Pollution Prevention Plan that would be prepared and implemented during construction, a majority of the stormwater runoff would be collected and treated prior to discharge to the Columbia River. The potential for localized flooding and increased erosion from redirected sheet flow increases with higher density of heavy equipment placement on site. This could result in the need for additional channel maintenance. However, this is unlikely because the Applicant must comply with erosion and sediment control best management practices and the requirements of the NPDES Construction Stormwater General Permit, which would be obtained for the On-Site Alternative as described in

Section 5.5, *Water Quality*. Compliance with erosion and sediment control best management practices and NPDES Construction Stormwater General Permit requirements would minimize potential impacts during construction. All measures would also be monitored to ensure effectiveness. Weekly inspection and an inspection within 24 hours of a rain event would likely be required under the NPDES Construction Stormwater General Permit. Inspections must be performed by a Certified Erosion and Sediment Control Lead.

Floodwater Retention

Because the project area is protected by levees, it does not function as a floodplain during events up to the 500-year flood event. Vegetation that would be removed from the project area does not currently contribute to the Columbia River floodplain's ability to retain or absorb floodwaters below the 500-year flood event. Activities that occur landward of the levee would not modify conditions in the Columbia River. Construction and operation of the terminal would be unlikely to have any measurable impact on floodplain function at the 500-year flood event due to the extent of floodplain inundation and level of development within this area. Thus, the terminal would not decrease the ability of the Columbia River to retain floodwaters within the 500-year floodplain. A 500-year flood event would, however, have substantial impacts on the proposed terminal and would likely require substantial repair and replacement of facilities, equipment, and infrastructure.

Turbidity and Benthic Habitat

The Columbia River would be permanently altered and benthic (i.e., river bottom) habitat removed by the placement of piles. A total of 610 of the 630 36-inch-diameter steel piles required for the trestle and docks would be placed below the ordinary high water mark, permanently removing approximately 0.10 acre (4,312 square feet) of benthic habitat (Refer to Section 5.7, *Fish*, for further information regarding impacts on benthic habitat).

Creosote-treated piles would be removed from the deepest portions of two existing timber pile dikes located in the Columbia River. In total, approximately 225 linear feet of the dikes would be removed. Removal of creosote-treated piles would result in a temporary increase in turbidity and would temporarily affect benthic habitat. Refer to Sections 5.5, *Water Quality*, and 5.7, *Fish,* for further information regarding impacts on water quality and fish, respectively.

Water Use

Construction of the terminal at the On-Site Alternative location would use water from rainfall runoff and on-site groundwater wells for dust suppression, washdown water, and fire-protection systems. This use would be regulated under the NPDES Construction Stormwater General Permit. Rainfall would be collected and treated and either stored in a detention pond for reuse or discharged to the Columbia River through the existing Outfall 002A. The On-Site Alternative would not withdraw water from the Columbia River or other surface water in the study area to meet construction water needs and, therefore, would not affect surface water and floodplains.

Construction—Indirect Impacts

Construction of the proposed export terminal at the On-Site Alternative location would not result in indirect impacts on surface water or floodplains because construction would be limited to the project area.

Operations—Direct Impacts

Operation of the proposed export terminal at the On-Site Alternative location would result in the following direct impacts. Operation-related activities at the project area that could affect surface water and floodplains include the following.

- Operational water use and changes in water collection and discharge.
- Changes in discharges of water to the CDID#1 ditches.
- Risk of flooding within the project area.

Water Use

The terminal would use water from rainfall runoff and on-site groundwater wells for dust suppression, washdown water, and fire-protection systems. Rainfall would be collected and treated and either stored in a detention pond or discharged to the Columbia River through the existing Outfall 002A. Water would not be drawn from the Columbia River or other surface water in the study area for operations. Thus, no impacts on surface water and floodplains are anticipated during operations.

Water Collection and Discharge

Currently, stormwater runoff at the project area is managed by infiltration or evaporation and by a complex stormwater collection and treatment system in conformance with the Applicant's existing NPDES permit (WA-000008-6). The NPDES system includes 12 stormwater basins and five outfalls that the Applicant manages under its NPDES permit, which discharge to the Columbia River. The existing stormwater collection and treatment system configuration would not adequately serve the needs of the proposed export terminal and would need to be expanded. Information on stormwater is included in Section 5.5, *Water Quality*.

The project water management system would collect all stormwater and surface water (washdown water) from the stockpile areas, the rail loop, office areas, the dock and other paved/impervious surface areas at the project area and direct these waters to a series of vegetated ditches and ponds, then to a collection basin or sump. Similar to current conditions, collected water would be pumped to an existing on-site treatment facility consisting of settling pond(s) with a flocculent addition to promote settling as needed. Chemical treatments must be identified as part of the NPDES permit process. Treated water would be pumped to a surface storage pond for reuse to support operations, or, if storage is not necessary, the excess treated water would be discharged to the Columbia River via Outfall 002A in accordance with the NPDES permit limits.

Discharge to CDID #1 Ditches

Basins 2, 3, and 5 of the existing water management system at the project area currently discharge to CDID #1 drainage ditches. Once constructed, most of the project area would no longer drain to the CDID #1 ditches, with the exception of a portion of the access overpass and frontage improvements. All stormwater and excess dust suppression water within the project area would be collected, conveyed, treated, and either stored on site for reuse or discharged to the Columbia River. Therefore, no negative impacts on the CDID #1 ditches would occur, and less water would be discharged to the ditches. As discussed below, this could have a beneficial indirect impact on the CDID #1 ditches.

Flooding

A new pump station and 18-inch outfall line is proposed to convey stormwater from the project area to the existing Facility 77 sump, and then all waters from the project area would go through Facility 73 (Figure 5.2-5). Failure of the interior drainage pumps could result in flooding of Basin 3A (Figure 5.2-5). However, backup systems would be built into the system to avoid flooding associated with pump failure.

Operations—Indirect Impacts

Operation of the proposed export terminal would result in the following indirect impacts.

The project water management system would be unlikely to have any measurable impact on the Columbia River. Discharges to the river from the terminal are expected to decrease from 276 million to 138.5 million gallons per year. The Columbia River has a mean annual discharge of 55.85 trillion gallons per year.[1] The proposed changes to the volume and velocity of surface water discharged to the Columbia River associated with the On-Site Alternative would be negligible.

The CDID #1 ditches are much smaller than the Columbia River; therefore, changes to the volume of surface water discharged from the project area could potentially have a measurable effect on the capacity of the ditches. Operating the terminal would reduce flow to the ditches from 88 million to 26.3 million gallons per year. This could be beneficial to the ditches because there would be additional capacity for drainage. With a combined capacity of 700,000 gallons per minute, CDID #1 pump stations are instrumental in removing stormwater and preventing local and area-wide flooding. Any reduction in discharge to the CDID #1 ditch system could provide a flood control benefit during significant rain events.

The On-Site Alternative would be located behind the Columbia River Levee. The levee protects the City of Longview, as well as those adjacent areas of industrial waterfront in unincorporated Cowlitz County, from flooding associated with the Columbia and Cowlitz Rivers. The Columbia River Levee provides protection from the 100-year flood event, but not the 500-year flood event (Federal Emergency Management Agency 2015b).

The Columbia River is a heavily managed river system. Facilities such as flood control dams and reservoirs on the Columbia River and its tributaries provide flood control storage of 37 million acre-feet. The total active storage in the Columbia River basin is 55.8 million acre-feet (Harrison 2008). This active storage provides some protection against flood events but does not preclude a 500-year flood. Were a 500-year flood to occur, the terminal, as well as the City of Longview and adjacent industrial waterfront in unincorporated Cowlitz County would flood.

[1] U.S. Geological Station 14246900 Columbia River at Beaver Army Terminal, near Quincy, Oregon: Average Discharge for Period of Record, 23 years (water years 1969, 1992–2013).

A 500-year flood event would overtop the Columbia River levee and inundate the indirect impacts study area (Figure 5.2-2), and beyond. The terminal would not have a measurable impact on floodplain function (i.e., water storage) during a 500-year event, based on the extent of the 500-year floodplain and the level of development that currently exists within this area. However, a 500-year flood event would have a substantial impact on the terminal; it would likely cause considerable damage to the terminal and redeposit stockpiled coal across the floodplain and in the Columbia River. Any coal or other debris that remained on the floodplain once flood waters receded would likely be cleaned up and either retained for storage and shipment or disposed at an approved facility.

5.2.5.2 Off-Site Alternative

This section describes the potential impacts that could occur under the Off-Site Alternative.

Construction—Direct Impacts

Constructing the proposed export terminal at the Off-Site Alternative location would result in impacts similar to the On-Site Alternative, although the Off-Site Alternative would also require constructing a new access road and extending the rail spur line. The following direct impacts on surface water and floodplains could occur as a result of construction activities at the Off-Site Alternative location.

Drainage from Heavy Equipment and Staging Areas

Construction of the Off-Site Alternative would involve ground-disturbing activities (excavation, grading, filling, trenching, backfilling, and compaction) that would permanently alter the existing site drainage. In compliance with the required Stormwater Pollution Prevention Plan that would be prepared and implemented during construction, a majority of the stormwater runoff would be collected and treated prior to discharge to the Columbia River. Under existing conditions, stormwater that does not infiltrate or evaporate on site is assumed to flow into the CDID #1 ditches. However, it is unknown how much water is currently discharged to the CDID #1 ditches, thus the potential impact of altering drainage patterns on the Off-Site Alternative location are unknown.

Floodplain Floodwater Retention

Similar to the project area for the On-Site Alternative, the project area for the Off-Site Alternative is within the Columbia River 500-year floodplain, but protected from the 100-year flood event by a levee. Because the land is undeveloped, no demolition would be required; however, existing vegetation would need to be removed. This vegetation does not currently provide any sort of function that would contribute to the floodplain's ability to retain or absorb floodwater or reduce flow or velocity. Construction and operation of the terminal likely would not have a measurable impact on floodplain function during a 500-year flood event because of the extent of floodplain inundation and level of development within the 500-year floodplain. Thus, no measurable decrease in the ability of the Columbia River to retain floodwaters within the 500-year floodplain would be expected to result from constructing, or operating the Off-Site Alternative.

Turbidity and Benthic Habitat

The Columbia River would be permanently altered and benthic (i.e., river bottom) habitat removed by placement of piles. A total of 597 36-inch-diameter steel piles required for the trestle and dock would be placed below the ordinary high water mark, permanently destroying approximately 0.10 acre (4,221 square feet) of benthic habitat. Approximately 94% of this habitat (3,980 square feet) is located in deep water (at least -20 feet CRD) (Grette Associates 2014). Refer to Sections 5.5, *Water Quality*, and 5.7, *Fish,* for further information regarding impacts on water quality and fish, respectively.

Water Use

Construction of the terminal at the Off-Site Alternative location would use water from rainfall runoff and on-site groundwater wells for dust suppression, washdown water, and fire-protection systems. This would be regulated under the NPDES Construction Stormwater General Permit. Rainfall would be collected and treated and either stored in a detention pond for reuse or discharged to the Columbia River through a new outfall. The Off-Site Alternative would not withdraw water from the Columbia River or other surface water in the study area to meet construction water demands. Thus, no impacts on surface water and floodplains are anticipated related to water needs or use during construction.

Construction—Indirect Impacts

Construction of the proposed export terminal at the Off-Site Alternative location would not result in indirect impacts on surface water or floodplains because construction activities would be limited to the project area.

Operations—Direct Impacts

Operation of the proposed export terminal at the Off-Site Alternative location would result in the following direct impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Water Use

The volume of stormwater and water pumped for Off-Site Alternative operations and the volume of water stored for reuse would be similar to the On-Site Alternative. Thus, the potential impacts related to stormwater volume and velocity would be similar to those described for the On-Site Alternative. The Off-Site Alternative would also require an NPDES Industrial Stormwater permit, which would require that stormwater be collected and treated before being discharged to surface water.

Water Collection and Discharge

Under the Off-Site Alternative, stormwater currently infiltrates or evaporates with overflow conveyed and discharged to the CDID #1 ditch system. Under the Off-Site Alternative, stormwater would be collected, conveyed, and discharged to a project-treatment system and stored in a storage pond for reuse under a new NPDES permit. Because the acreage of the stockpiles, rail system, and other impervious areas would be similar to the On-Site Alternative, the amount of stormwater and water collected for reuse and/or discharged to the Columbia River would also be similar. Thus, it is expected that the Off-Site Alternative would result in an increase in discharge to the Columbia River and a decrease in discharge to the CDID #1 ditches.

Floodplains

The Off-Site Alternative project area is in an area of the floodplain that is protected from the base flood by a system of levees. The existing CDID #1 levee system is designed to protect the property from the 100-year and 500-year flood event. The Off-Site Alternative location would not require a City or County floodplain management permit since the entire location is in an area designated as between a 100-year and 500-year floodplain per the FEMA FIRM (panel 53015C0494G) dated December 16, 2015.

Operations—Indirect Impacts

Similar to indirect operations impacts of the On-Site Alternative, changes to the water management system for the Off-Site Alternative have the potential to affect receiving waters off site and downstream, such as the CDID #1 ditches. Changes in flow to the Columbia River would have a negligible impact because the anticipated change in flow would be imperceptible compared to the overall flow in the Columbia River.

Operation of the terminal at the Off-Site Alternative location could slightly increase CDID #1 ditch system drainage capacity by operating a water management system that would collect, convey, treat, and either store stormwater for on site reuse or discharge excess stormwater to the Columbia River.

Similar to the On-Site Alternative, the terminal would not be expected to have a measurable effect on floodplain storage during a 500-year event, based on the extent of the 500-year floodplain and level of development that currently exists within the floodplain.

5.2.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the terminal would not occur. In addition, not constructing the terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. The following discussion assesses the likely consequences of the No-Action Alternative related to surface water and floodplains.

The extent of impervious surface could increase but drainage patterns would be similar to current conditions. Any new or expanded industrial uses that could substantially alter drainage patterns would trigger a new NPDES Construction Stormwater General Permit, NPDES Industrial Stormwater Permit or modification to the permitting process. Thus, potential impacts related to surface water and floodplains under the No-Action Alternative would be similar to what is described for the On-Site Alternative, but the magnitude of impact would depend on the nature and extent of the expansion.

5.2.6 Required Permits

The following permits would be required in relation to surface water for the On-Site Alternative and Off-Site Alternative.

5.2.6.1 On-Site Alternative

The On-Site Alternative would require the following permits for surface water and floodplains.

- **Shoreline Substantial Development Permit and Conditional Use Permit—Cowlitz County Department of Building and Planning and Washington State Department of Ecology**. The On-Site Alternative would result in new development in the shoreline area regulated by the Washington State Shoreline Management Act and Cowlitz County Shoreline Master Program (Cowlitz County 2012). The On-Site Alternative would require a Shoreline Substantial Development Permit. This permit is administered by the Cowlitz County Department of Building and Planning. The On-Site Alternative would also require a Shoreline Conditional Use Permit. This permit is administered by the Cowlitz County Department of Building and Planning and Ecology.
- **Critical Areas Permit—Cowlitz County Department of Building and Planning**. The On-Site Alternative would result in development in designated critical areas because the project area contains a frequently flooded area, an erosion hazard area, and a critical aquifer recharge area. Therefore, it would require a Critical Areas Permit from the Cowlitz County Department of Building and Planning.
- **Floodplain Permit—Cowlitz County Building and Planning**. A floodplain permit would be required from Cowlitz County to address development in any areas designated as Frequently Flooded Areas.
- **NPDES Construction Stormwater General Permit—Washington State Department of Ecology**. A Construction Stormwater General Permit would be required from Ecology to address erosion control and water quality during construction.
- **NPDES Industrial Stormwater Permit—Washington State Department of Ecology**. An Industrial Stormwater Permit would be required from Ecology for discharge of industrial use water during operations.
- **Hydraulic Project Approval—Washington Department of Fish and Wildlife**. The On-Site Alternative would require a hydraulic project approval from WDFW because project elements would affect the Columbia River.
- **Clean Water Act Authorization, Section 404—U.S. Army Corps of Engineers**. Construction and operation of the On-Site Alternative would affect waters of the United States, including wetlands. Department of the Army authorization by standard individual permit would be required.
- **Rivers and Harbors Act—U.S. Army Corps of Engineers**. Construction and operation of the proposed export terminal 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 certain 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.

5.2.6.2 Off-Site Alternative

The Off-Site Alternative would require the same permits from the same entities for surface water and floodplains impacts as the On-Site Alternative, with the addition of the following.

- **Shoreline Substantial Development Permit—City of Longview**. The Off-Site Alternative would result in new development in the shoreline area regulated by the *Draft City of Longview Shoreline Master Program* (City of Longview 2015). Therefore, this alternative would require a Shoreline Substantial Development Permit from the City of Longview.
- **Critical Areas Permit—City of Longview and Cowlitz County.** The Off-Site Alternative would result in development in designated critical areas in the City of Longview and Cowlitz County. Therefore, this alternative would require Critical Areas Permits from the City of Longview Community Development Department and the Cowlitz County Department of Building and Planning.

5.3 Wetlands

For the purposes of this assessment, wetlands refer to areas that meet the federal definition of wetlands under the U.S. Army Corps of Engineers (Corps) *Wetlands Delineation Manual* (Environmental Laboratory 1987) as supplemented by the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Environmental Laboratory 2010). Wetlands, as defined by the Corps' wetland delineation manual (Environmental Laboratory 1987) are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands were identified in the field between 2011 and 2013 by Grette Associates (Grette Associates 2014a, 2014b, 2014c, 2014d, 2014e, 2014f, and 2014g).

This section describes wetlands in the On-Site Alternative and Off-Site Alternative study areas. It then describes impacts on wetlands that could result from construction and operation of the proposed export terminal.

Impacts on ditches and stormwater conveyance features or *other waters* are also presented as described in the Grette Associates documents referenced in Section 5.3.3.1, *Information Sources*. No determination of federal jurisdiction over these types of features is implied by their inclusion herein. The affected environment and impacts within the Columbia River are assessed in Section 5.2, *Surface Water and Floodplains*.

5.3.1 Regulatory Setting

Laws and regulations relevant to wetlands are summarized in Table 5.3-1. This section is largely focused on wetlands as a subset of waters of the United States, and thus, subject to Section 404 of the Clean Water Act as described in Table 5.3-1. Ditches, channels, and stormwater conveyance features that qualify as waters of the United States are generally subject to the same Clean Water Act requirements.

Table 5.3-1. Regulations, Statutes, and Guidelines for Wetlands

Regulation, Statute, Guideline	Description
Federal	
Clean Water Act (33 USC 1251 *et seq.*)	Section 401 (water quality certification) requires Water Quality Certification from the state for activities requiring a federal permit or license to discharge pollutants into a water of the United States. Certification attests the state has reasonable assurance the proposed activity will meet state water quality standards. Section 402 (33 USC 1342) establishes the NPDES program, under which certain discharges of pollutants into waters of the United States are regulated. Section 404 regulates the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands.

Regulation, Statute, Guideline	Description
State	
Washington State Shoreline Management Act (RCW 36.70A)	Requires cities and counties, in partnership with Ecology, (through their SMPs) to protect shoreline natural resources against adverse impacts.
Hydraulic Code Rules (RCW 77.55, WAC 220-660)	Issued by WDFW for projects with elements that may affect the bed, bank, or flow of a water of the state or productive capacity of fish habitat. Considers effects on riparian and shoreline/bank vegetation in issuance and conditions of the permit, including for the installation of piers, docks, pilings and bank armoring and crossings of streams and rivers (including culverts).
Local	
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Regulates activities within and adjacent to critical areas including vegetation occurring in wetlands and their buffers, fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded areas, and geological hazard areas.
Cowlitz County Shoreline Master Program (CCC 19.20)	Regulates development in the shoreline zone, including the shoreline of the Columbia River, a Shoreline of Statewide Significance.
City of Longview Shoreline Master Program (Off-Site Alternative only)	The City's SMP consists of environmental designations for the shoreline segments and goals, policies, and regulations applicable to uses and modifications within the Shoreline Management Zone.
City of Longview Critical Areas Ordinance (LMC 17.10.140) (Off-Site Alternative only)	Regulates activities within and adjacent to critical areas including vegetation occurring in wetlands and their buffers, fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded areas, and geological hazard areas.

Notes:
USC = United States Code; NPDES = National Pollutant Discharge Elimination System; RCW = Revised Code of Washington; WAC = Washington Administrative Code; WDFW = Washington Department of Fish and Wildlife; CCC = Cowlitz County Code; SMP = Shoreline Management Program; LMC = Longview Municipal Code

5.3.2 Study Area

The On-Site Alternative study area for direct impacts on wetlands is the project area (Figure 5.3-1). The study area for indirect impacts is the project area and the immediate vicinity, where wetlands might be affected by construction or operation of the proposed export terminal.

The Off-Site Alternative study area for direct impacts on wetlands is the project area (Figure 5.3-2). The study area for indirect impacts is the project area and the immediate vicinity, where wetlands might be affected by construction or operation of the proposed export terminal.

Figure 5.3-1. Wetlands in the Study Area—On-Site Alternative

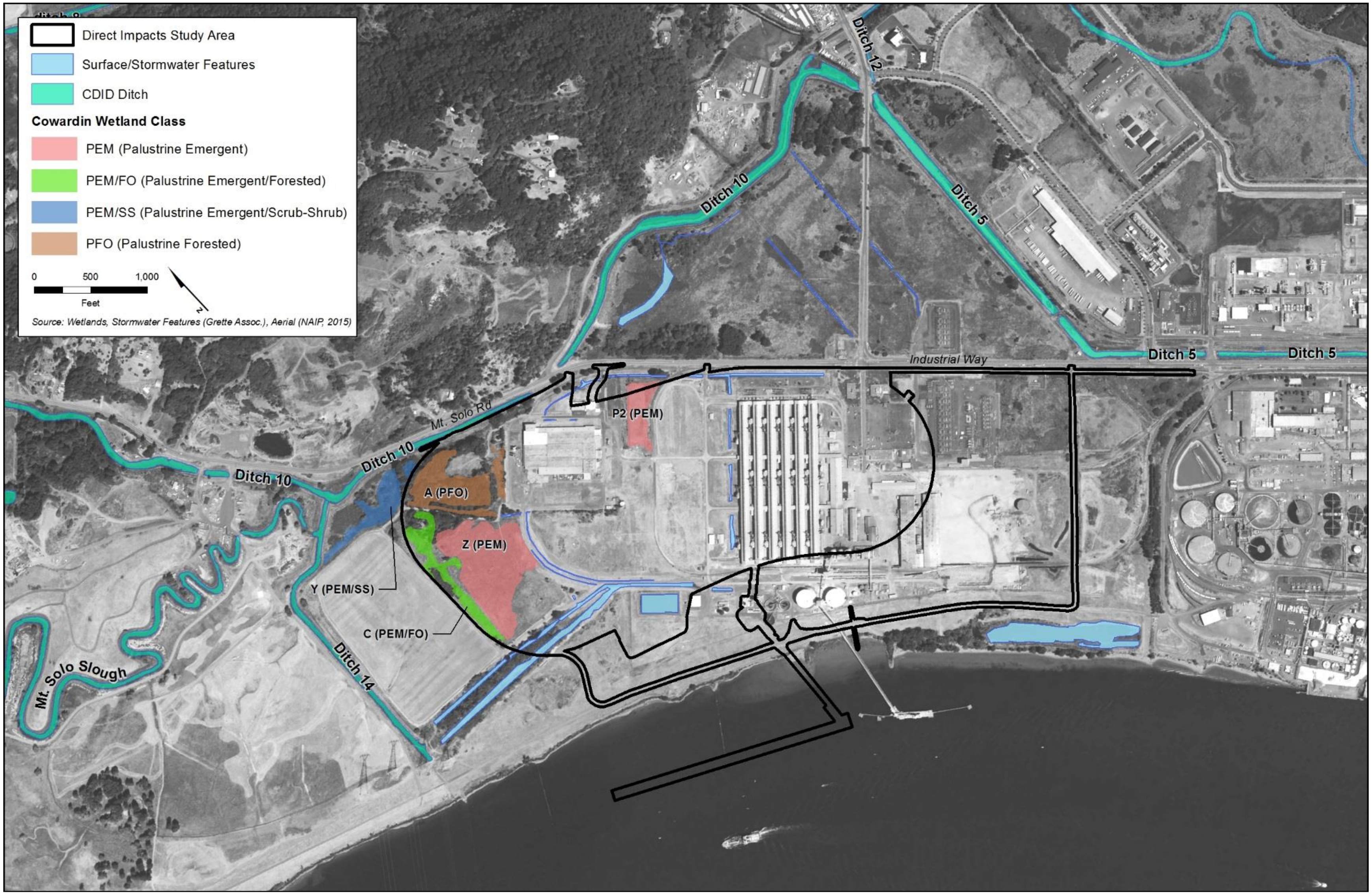


Figure 5.3-2. Wetlands in the Study Area—Off-Site Alternative

5.3.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts on wetlands associated with construction and operation of the proposed export terminal.

5.3.3.1 Information Sources

The following sources of information were used to identify the potential impacts of the On-Site Alternative, Off-Site Alternative, and No-Action Alternative on wetlands in the study area.

- Two reconnaissance level site visits conducted by ICF International wetland biologists on April 8 and December 11, 2014, to view the areas determined to be wetland by Grette Associates.
- Reports prepared by Grette Associates and provided by the Applicant as part of the permit application materials.
    - *Coal Export Terminal Wetland and Stormwater Ditch Delineation Report–Parcel 619530400 and associated appendices* (Grette Associates 2014a)
    - *Bulk Product Terminal, Wetland and Stormwater Ditch Reconnaissance Report–Parcel 10213* (Grette Associates 2014b)
    - *Bulk Product Terminal Wetland and Stormwater Ditch Delineation Report–Parcel 61953* (Grette Associates 2014c)
    - *Coal Export Terminal Wetland Impact Report–Parcel 619530400* (Grette Associates 2014d)
    - *Off-Site Alternative–Barlow Point Shoreline Habitat Inventory* (Grette Associates 2014e)
    - *Off-Site Alternative–Barlow Point Wetland Reconnaissance* Report (Grette Associates 2014f)
    - *Off-Site Alternative–Barlow Point Wetland Impact Report* (Grette Associates 2014dg)

The Grette Associates documents report the presence of field-delineated wetlands in the study area using the *Regional Supplement to the U.S. Army Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region Version 2.0* (U.S. Army Corps of Engineers 2010).

Wetlands were classified by vegetation type using the U.S. Fish and Wildlife *Classification of Wetlands and Deep Water Habitat* (Cowardin et al. 1979). The regulatory category of wetlands in Washington State is determined per the Washington State Department of Ecology (Ecology) *Washington State Wetland Rating System for Western* (or *Eastern*) *Washington* (Rating System), as applicable (Hruby 2006).

The category and functions of wetlands were evaluated using the Rating System. Functions evaluated included water quality functions (the ability to filter sediment and pollutants), habitat functions (a place for plants and animals to live and grow), and hydrologic functions (the interaction between ground or surface water and the landscape). Based on the Rating System, wetlands are rated as providing low, moderate, or high functions.

Information regarding the affected environment relative to ditches and stormwater conveyance features or other waters is presented in Section 5.2, *Surface Water and Floodplains*.

5.3.3.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the proposed export terminal on wetlands. For direct impacts, the analysis assumes best management practices were incorporated into the design, construction, and operations of the export terminal. More information about best management practices and mitigation measures, including compensatory mitigation for direct wetland impacts can be found in Chapter 8, *Minimization and Mitigation*, and Appendix H, *Export Terminal Design Features*.

All quantitative and qualitative impacts on wetlands are summarized as described in the Grette Associates documents referenced in Section 5.3.3.1, *Information Sources*. Direct construction impacts on wetlands were reported for wetlands in the project area. All wetlands within the project area were considered permanently affected, because they would be replaced with gravel pads, stockpiles, railroad tracks, buildings, pavement, and other project features. Direct wetland impacts would be mitigated at current federal, state and local mitigation ratios. Refer to Chapter 8, *Minimization and Mitigation* for more information.

5.3.4 Affected Environment

To identify areas that meet the definition of wetlands, per the Corps wetland delineation manual (Environmental Laboratory 1987), scientists look for specific field characteristics of soil, hydrology, and vegetation that indicate an area is a wetland. Typically, indicators of all three conditions (soil, hydrology, and vegetation) must be present for an area to be considered a wetland.

5.3.4.1 On-Site Alternative

There are 26.93 acres of wetlands in the study area. The distribution of wetlands in the study area is shown in Figure 5.3-1. Table 5.3-2 summarizes the wetlands by location, vegetation classification, hydrogeomorphic classification (i.e., where the wetland fits on the landscape position and associated hydrology), regulatory category, and acreage. Regulatory category refers to the system of ascribing a ranked regulatory protection category from one to four (I to IV) to wetlands based on their functions, as derived from the *Washington State Wetland Rating System for Western Washington* (Hruby 2006). Category I wetlands have the highest level of function, Category IV wetlands have the lowest level of function. All wetlands in the study area are considered depressional from a hydrogeomorphic classification perspective.

Under the Cowardin system, wetlands are classified by dominant vegetation. For example, wetlands can be classified as forested (woody plants over 20 feet tall), scrub-shrub (woody plants up to 20 feet tall), or emergent vegetation (nonwoody plants, such as grasses, sedges, rushes, and herbaceous flowering plants). Individual wetlands can consist of more than one vegetation type. Wetlands in the study areas are organized by Cowardin vegetation classification.

Table 5.3-2. Wetlands Identified in the Study Area—On-Site Alternative

Wetland	Location (Parcel)	Cowardin Classification[a]	HGM Classification[b]	Category[c]	Area (acres)[d]
A	619530400	PFO	Depressional	III	6.28
C	619530400	PEM/PFO	Depressional	III	3.38
Y	619530400	PEM/PSS	Depressional	III	3.40
Z	619530400	PEM	Depressional	III	11.22
P2	619530400	PEM	Depressional	IV	2.65
Total					**26.93**

Notes:

[a] Cowardin classification per Classification of Wetland and Deepwater Habitats of the United States (Cowardin et al. 1979). Values include PFO = palustrine forested; PSS = palustrine scrub-shrub; and PEM = palustrine emergent

[b] Hydrogeomorphic (HGM) classification per the Washington State Wetland Rating System for Western Washington (Hruby 2006).

[c] Wetland category determined by Grette Associates using the Washington State Wetland Rating System for Western Washington (Hruby 2006).

[d] Acreages as reported by Grette Associates 2014 a, b, c.

Forested Wetlands

Approximately 6.28 acres of forested wetland occur in the study area as Wetland A (Figure 5.3-1). This wetland is depressional and supported primarily by high groundwater and direct precipitation. Common plant species observed in the forested wetlands include a predominately native overstory of black cottonwood (*Populus balsamifera*), Pacific willow (*Salix lucida*), red alder (*Alnus rubra*), and Oregon ash (*Fraxinus latifolia*) trees, overlying a shrub layer dominated by salmonberry (*Rubus spectabilis*) and nonnative Himalayan blackberry (*Rubus armeniacus*). Reed canarygrass (*Phalaris arundinacea*), an invasive grass, is the common herbaceous plant.

Emergent/Forested Wetlands

Approximately 3.38 acres of emergent/forested wetland occur in the study area as Wetland C (Figure 5.3-1). This wetland is depressional and supported primarily by high groundwater and direct precipitation. The emergent portion of the wetland is dominated by reed canarygrass. Common plant species observed in the forested portion include a predominately native overstory of black cottonwood, Pacific willow, red alder, and Oregon ash trees, overlying a shrub layer dominated by salmonberry and nonnative Himalayan blackberry.

Emergent/Scrub-Shrub Wetlands

Approximately 3.40 acres of emergent/scrub-shrub wetland occur in the study area as Wetland Y. Wetland Y is located north of the closed Black Mud Pond (BMP) facility, and is the only wetland in the direct impacts study area that extends outside of the direct impacts study area (Figure 5.3-1). This wetland is depressional and supported primarily by high groundwater and direct precipitation. The scrub-shrub component is dominated by Himalayan blackberry, red osier dogwood (*Cornus sericea*), Douglas spirea (*Spiraea douglasii*), and narrowleaf cattail (*Typha angustifolia*). The emergent component is dominated by reed canarygrass and an unidentified bryophyte; some nonnative narrowleaf cattail is also present.

Emergent (Herbaceous) Wetlands

Approximately 13.87 acres of emergent wetland occur in the study area as Wetlands Z and P2 (Figure 5.3-1). These wetlands are depressional and supported primarily by high groundwater and direct precipitation. Wetland Z is dominated by reed canarygrass and soft rush (*Juncus effusus*) and contains several brush piles left over from past clearing activities. Wetland P2 is also dominated by reed canarygrass and soft rush.

Wetland Ratings and Functions

The wetlands in the study area were rated as Category III or Category IV based on their generally low to moderate level of function (Grette 2014a, 2014c).

Wetlands A, C, Z, Y and P2 generally provide low to moderate water quality, habitat, and hydrology functions (Grette 2014a). These wetlands filter out sediment from stormwater runoff and retain stormwater and overland flow during heavy rain events. Some of the wetlands also provide pollutant filtration and groundwater infiltration functions. Wildlife functions include habitat for large and small mammal foraging and cover; passerine, waterfowl, and raptor foraging and nesting; and amphibian foraging, breeding and refuge. Wetland Y provides the most potential to retain stormwater during heavy rain events due to its depth.

Ditches and Stormwater Conveyance Features or Other Waters

Ditches and stormwater conveyance features present in the study area include the Interceptor Ditch/U Ditch and several narrow stormwater ditches crossing through the study area (Figure 5.3-1). These features, as well as the Columbia River, are described for the On-Site Alternative in Section 5.2, *Surface Water and Floodplains*.

5.3.4.2 Off-Site Alternative

Approximately 64.76 acres of wetland were identified in the Off-Site Alternative study area. The distribution of wetlands in the study area is shown in Figure 5.3-2. All wetlands except Wetland B are located behind (landward of) the levee. Because access to the Off-Site Alternative location was not granted by the landowner, wetland areas were determined using aerial photographs, light detection and ranging (LiDAR)-based digital elevation data, the *Corps of Engineers Wetlands Delineation Manual*, and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (Grette 2014f). Wetland boundaries were estimated based on changes in vegetation, topography, visible hydrology, historical land use activities, and best professional judgement (Grette 2014f). Table 5.3-3 summarizes wetlands by location, Cowardin vegetation classification, hydrogeomorphic classification, regulatory category, and acreage.

Forested/Emergent Wetland

Approximately 17 acres of forested/emergent wetland occur in the study area (Table 5.3-3), as Wetland 2. Dominant vegetation includes black cottonwood, Oregon ash, and red alder underlain by a shrub layer composed of saplings of these species as well as various willows. The emergent layer consists of reed canarygrass.

Table 5.3-3. Wetlands Identified in the Study Area—Off-Site Alternative

Wetland	Location (Parcel)	Cowardin Classification[a]	HGM Classification[b]	Category[c]	Area (acres)
1	107150100	PEM	Depressional	III	3.00
2	107150100, 10716011	PFO/PEM	Depressional	III	17.00
3	106990100, 107170100	PSS	Depressional	III	9.00
4	107170100	PEM	Depressional	III	8.00
5	107170100, 107180100	PEM	Depressional	III	15.00
6	107840100	PEM	Depressional	III	6.00
B	107140100, 107190100	PFO/PSS	Riverine	III[d]	3.36
Y	106980100, 106970100	PEM/PSS	Depressional	III	3.4
Total					**64.76**

Notes:

[a] Cowardin classification per Classification of Wetland and Deepwater Habitats of the United States (Cowardin et al. 1979). Values include PFO = palustrine forested; PSS = palustrine scrub-shrub; PEM = palustrine emergent.

[b] Hydrogeomorphic (HGM) classification per Hruby 2006.

[c] Wetland Type determined by Grette per Hruby 2006.

[d] Wetland B was not rated by Grette. Ratings shown were determined by ICF based on wetland descriptions provided in Off-Site Alternative–Barlow Point Shoreline Habitat Inventory (Grette Associates 2014h).

Source: Grette Associates 2014e:20–30, 2014f:13–16

Scrub-Shrub Wetland

Approximately 9 acres of the project area are scrub-shrub wetlands (Table 5.3-3) that comprise Wetland 3. Dominant vegetation includes young black cottonwood, red alder, and Oregon ash, as well as red osier dogwood, Nootka rose (*Rosa nutkana*), willows, and Himalayan blackberry. Approximately 4.98 acres of this wetland was recently disturbed by vegetation clearing. Remnant vegetation includes black cottonwood, red alder, Pacific willow, Himalayan blackberry, and soft rush.

Emergent (Herbaceous) Wetlands

Approximately 32 acres of the project area are emergent wetlands (Table 5.3-3), consisting of Wetlands 1, 4, 5, and 6. These wetlands are dominated by reed canarygrass. Approximately 6.76 acres of Wetlands 4 and 5 appear to be mowed regularly.

Forested/Scrub-Shrub Wetland

Approximately 3.36 acres of the project area are forested/scrub wetlands (Table 5.3-3), that comprise Wetland B. Wetland B is a riparian wetland along the Columbia River on the riverward side of the levee. This wetland is dominated by black cottonwood, Oregon ash, red osier dogwood, Pacific willow, nootka rose, Columbia River willow, reed canarygrass, creeping buttercup (Ranunculus repens), and slough sedge.

Emergent/Scrub-Shrub Wetland

Approximately 3.4 acres of the project area are emergent/scrub-shrub wetlands (Table 5.3-3), that comprise Wetland Y. This wetland is dominated by reed canarygrass, Himalayan blackberry, red osier dogwood, rose spiraea, and narrowleaf cattail.

Wetland Ratings and Functions

All wetlands in this study are rated Category III based on their low to moderate level of function for hydrology, water quality, and habitat (Grette 2014f).

Wetlands 1, 2, 3, 4, 5, 6, and Y are depressional wetlands providing low hydrology functions and moderate water quality functions (except Wetland 6, which provides low water quality function). All of these wetlands provide low to moderate habitat functions. These depressional wetlands collect surface water runoff that provides some stormwater retention and sediment filtering. In addition, the wetlands provide some pollutant filtration and groundwater infiltration functions. However, during large rain events the relatively shallow depressions have limited potential to store stormwater. Habitat functions are moderate for Wetlands 2, 3, 5, and Y. They provide large and small mammal foraging and cover; passerine, waterfowl, and raptor foraging and nesting; and amphibian foraging, breeding, and nesting. WDFW PHS data indicate Columbia white-tailed deer occur in Wetland 2 (Grette 2014f). Wetlands 1, 4, and 6 provide low habitat functions due to surrounding agricultural and industrial land uses; wildlife functions in these wetlands areas are limited to temporary use by passerine birds and waterfowl for foraging, breeding, and refuge.

Wetland B is a riverine wetland that provides moderate to high water quality functions, moderate hydrology functions, and low habitat functions. The water quality function rating is based on the wetland’s forest and scrub-shrub plant cover and potential to filter pollutants. The moderate hydrology function of the wetland is based on forest and scrub-shrub cover capable of retaining flood waters, absence of downcutting adjacent to the wetland, and presence of potential surface flooding problems downstream of the wetland. Habitat functions are low due to low plant community structures, interspersion of habitat, plant richness, hydroperiods, and special habitat features. The surrounding habitat areas are also disturbed or disconnected from the wetland. However, the wetland did score a higher rating by providing habitat for special status species and being adjacent to some priority habitats.

Ditches and Stormwater Conveyance Features or Other Waters

Ditches and stormwater conveyance features in the study area include Ditches 10 and 14 and the Mount Solo Slough. These features, as well as the Columbia River, are described for the Off-Site Alternative in Section 5.2, *Surface Water and Floodplains*.

5.3.5 Impacts

The following impacts on wetlands could result from construction and operation of the proposed export terminal.

5.3.5.1 On-Site Alternative

The following sections describe the potential impacts on wetlands from construction and operation of the proposed export terminal at the On-Site Alternative location.

Construction—Direct Impacts

Construction would occur in the Columbia River and on developed and disturbed lands adjacent to the river. Impacts would include permanent fill and conversion to upland, and temporary alteration of vegetation and habitat conditions.

Wetland Acreage

Construction would result in the permanent loss of 24.10 acres of wetlands (Table 5.3-4). Construction activities would permanently fill Wetlands A, C, Z, and P2 and a portion of Wetland Y (Figure 5.3-3) (Grette Associates 2014d) to construct rail lines and coal-handling facilities. Construction of the terminal would not directly affect wetlands north of Industrial Way or the majority of wetlands at the east end of the study area.

Table 5.3-4. Wetland Impacts—On-Site Alternative

Wetland/Other Waters	Cowardin Classification	Category	Impact Type	Impact Area
A	PFO	III	Fill	6.28
C	PEM/PFO	III	Fill	3.38
Z	PEM	III	Fill	11.22
Y	PEM/PSS	III	Fill	0.57
P2	PEM	IV	Fill	2.65
Total				**24.10**

Notes:
PFO = palustrine forested; PEM = palustrine emergent; PSS = palustrine scrub-shrub

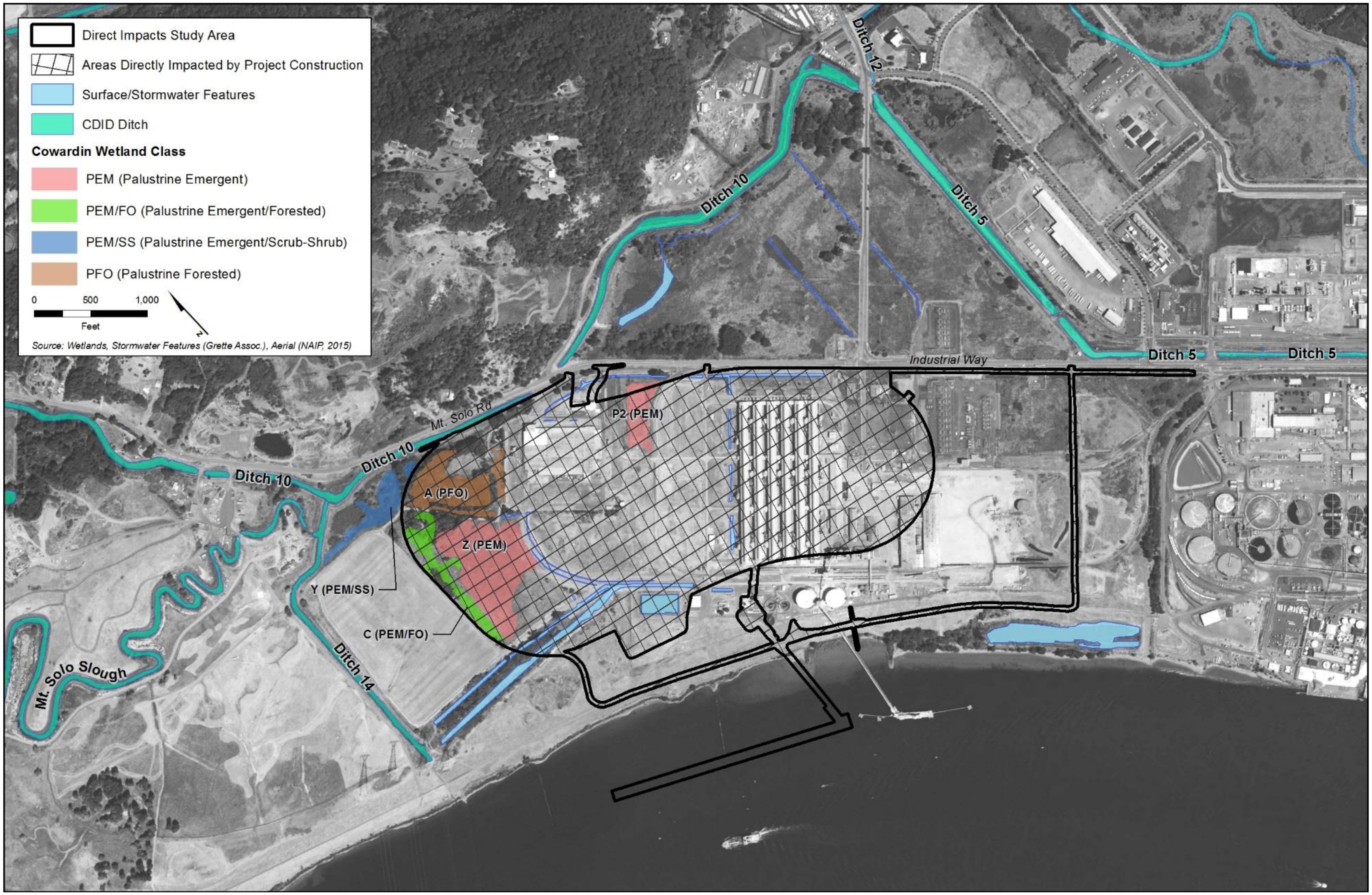
In addition, construction would permanently fill 5.17 acres of ditches conveying stormwater runoff (Grette Associates 2014d), including the eastern half of the Interceptor/U Ditch, portions of the ditch along the south edge of Industrial Way on the BPA parcel, and interior drainage ditches (Grette Associates 2014d). Refer to Section 5.2, *Surface Water and Floodplains*, for more information on ditches and other surface waters.

Wetland Functions

Placement of dredged or fill material to construct the terminal would result in the permanent total loss of wetland functions across 24.10 acres of wetlands (Table 5.3-4). The functions most affected would be water quality and wildlife habitat, as evidenced by the rating system scores for the affected wetlands (Grette Associates 2014d). Wetland scores for the Category III wetlands are highest for the water quality and wildlife habitat functions. Wetland scores for Wetland P2 (the only Category IV wetland) were low for all three functions.

All water quality and hydrology functions would be lost from Wetlands A, C, Z, and P2, with a portion of those functions lost in Wetland Y. Construction of the terminal would not displace water into surrounding areas, and stormwater runoff currently discharging into these wetlands would be redirected into an on-site stormwater treatment facility. Stormwater currently discharging into Wetland Y through outfall 005 would be rerouted to proposed stormwater facilities (see Section 5.2, *Surface Water and Floodplains*). However, since this is a minor source of hydrology compared with surface water and groundwater from ditches, hydrology in the unfilled portion of Wetland Y likely would not be affected (Grette Associates 2014d).

Figure 5.3-3. Wetlands Affected by the On-Site Alternative



While wetlands in the study area do provide some wildlife habitat, this function is limited due to prior heavy industrial land use at the On-Site Alternative location and adjacent areas (Grette Associates 2014d). Construction of the terminal would permanently destroy all habitat functions in filled wetlands. Construction would also destroy a forested portion of Wetland Y, which would reduce that wetland's habitat value from moderate to low. See Chapter 8 *Minimization and Mitigation*, for specific wetland mitigation that would offset wetland impacts.

Construction—Indirect Impacts

Construction of the proposed export terminal at the On-Site Alternative location would permanently fill 0.57 acre of Wetland Y, leaving 2.83 acres of Wetland Y unfilled and intact. The primary indirect impact would be the degradation or alteration of wetland functions in this wetland. While other indirect impacts, such as sedimentation from stormwater runoff and accidental fuel spills, could also occur, implementation of best management practices such as silt fencing would be required by various federal, state, and local permits to minimize impacts.

Wetlands north of Industrial Way, which are in the vicinity of the project area, are Category III and IV wetlands (Grette Associates 2014b). The Cowlitz County Code (CCC) Critical Areas Ordinance 19.15.120.C (4)(a) requires buffers around wetlands, and buffers for Category III and IV wetlands can range from 25 to 150 feet depending on the wetland function and land use intensity. However, the ordinance does not require wetland buffers to extend beyond existing natural or human-made barriers (e.g., a paved road). Industrial Way is a human-made barrier for off-site wetlands north of Industrial Way. Therefore, construction of the terminal at the On-Site Alternative location would not impact those wetland buffers (Grette Associates 2014d).

Wetland Functions

Construction could result in the alteration or degradation of wildlife and hydrologic functions in Wetland Y. These indirect impacts are expected to be minor given Wetland Y's low rating for each of these functions. Wildlife use would likely be slightly reduced due to a smaller habitat area. Additionally, Wetland Y would no longer have habitat connectivity with Wetland A (which would be filled), further reducing Wetland Y's functionality.

Wetland Y's hydrologic function is not expected to change much as a result of construction because it is located in a low area and hydrology is driven primarily by groundwater and precipitation. Indirect impacts on water quality functions are unlikely because it would be protected by a Stormwater Pollution Prevention Plan (SWPPP) and NPDES Construction Stormwater General Permit.

Operations—Direct Impacts

Operation of the proposed export terminal at the On-Site Alternative location would have no direct impacts on wetlands.

Operations—Indirect Impacts

Wetland Y vegetation would likely be affected by coal dust. The impact of coal dust on vegetation would depend on dust load, climatic conditions, and physical characteristics of the vegetation. Impacts could include blocked stomata, which would reduce respiration or increase transpiration; altered leaf surface reflectance and light absorption; and increased leaf temperature due to optical properties of the dust (Chaston and Doley 2006; Doley 2006:38; Farmer 1993). Such impacts can be complex, and neither the impact mechanism nor a threshold for any potential physical or biological impacts of coal dust deposition have been studied relative to the climate and native vegetation of the Pacific Northwest. The *NEPA Vegetation Technical Report* summarizes studies of the impacts of dust deposition on vegetation in other regions. Coal dust deposition is discussed further in Chapter 6, Sections 6.6, *Air Quality*, and 6.7, *Coal Dust.*

5.3.5.2 Off-Site Alternative

The following sections describe the potential impacts on wetlands from construction and operation of the terminal at the Off-Site Alternative location.

Construction—Direct Impacts

Wetland impacts associated with construction of the proposed export terminal at the Off-Site Alternative location would include permanent fill and conversion to upland, and temporary alteration of vegetation and habitat conditions as described below.

Acreage Loss

The Off-Site Alternative would permanently fill 51.28 acres of wetlands (Table 5.3-5)—all of Wetlands 1, 2, and 4 and portions of Wetlands 3, 5, 6, and Y (Figure 5.3-4)—to construct rail lines and associated terminal facilities. The Off-Site Alternative trestle would extend across 140 feet of Wetland B and involve permanently removing about 0.08 acre of trees.

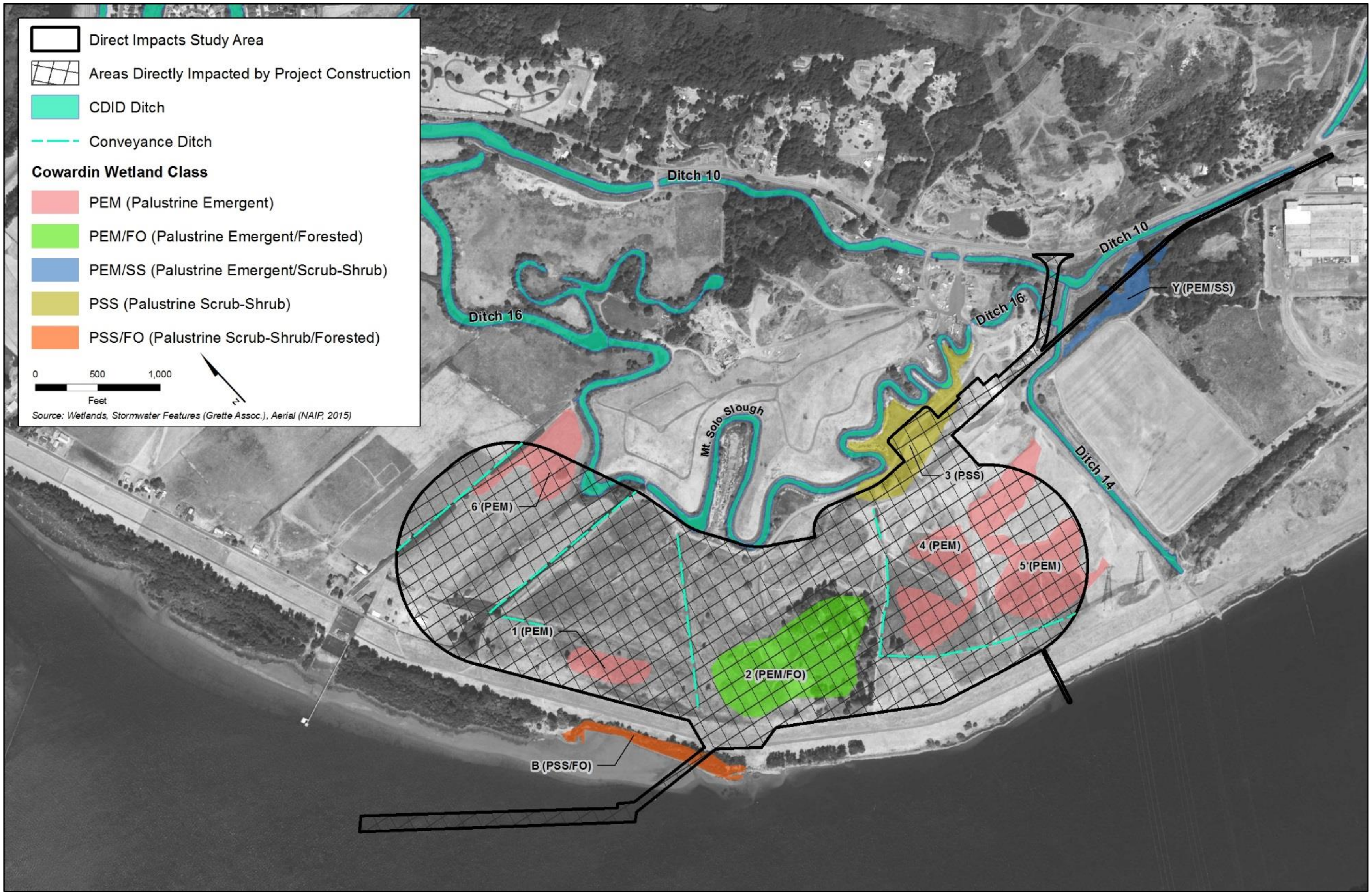
Table 5.3-5. Wetland Impacts—Off-Site Alternative

Wetland/Other Waters	Cowardin Classification	Category	Impact Type	Impact Area
1	PEM	III	Fill	3.0
2	PFO/PEM	III	Fill	17.0
3	PSS	III	Fill	3.0
4	PEM	III	Fill	8.0
5	PEM	III	Fill	15.0
6	PEM	III	Fill	4.0
B	PFO/PSS	III	Vegetation Clearing/ Trimming	0.08
Y	PEM/PSS	III	Fill	1.2
Total				**51.28**

Notes:
PFO = palustrine forested; PEM = palustrine emergent; PSS = palustrine scrub-shrub
Source: Grette 2014e: 20–30, 2014g: 10

The City of Longview's Critical Areas Ordinance (Longview Municipal Code [LMC] 17.10.110) requires 80-foot buffers around the Category III wetlands identified in the study area. Buffers adjacent to the filled portions of Wetlands 3, 5, 6, and Y would be removed.

Figure 5.3-4. Wetlands Affected by the Off-Site Alternative



In addition to impacts on wetlands, construction would permanently fill 5.0 acres of ditches conveying stormwater runoff (Grette Associates 2014g:10), including portions of CDID Ditches 10 and 14 and Mount Solo Slough. Refer to Section 5.2, *Surface Water and Floodplains,* for further information on ditches and other surface waters.

Wetland Functions

Construction would result in the permanent loss of wetland functions over 51.28 acres of wetlands (Table 5.3-5) and degrade the functions of the remaining portions of partially filled wetlands. The functions most affected would be water quality and wildlife habitat.

Construction would permanently destroy all water quality and hydrology functions in Wetlands 1, 2, and 4. Stormwater runoff currently discharging into these wetlands would be redirected into an on-site stormwater treatment facility. Wetlands 3, 5, 6, and Y would be partially filled but continue to provide reduced stormwater retention and storage, pollution filtration, and groundwater infiltration/recharge functions.

While wetlands that would be filled currently provide some wildlife habitat, this function would be limited because of industrial land use on adjacent areas (Grette Associates 2014g:1–19). Completely filling Wetlands 1, 2, and 4 would permanently remove all habitat functions these wetlands currently provide. Based on WDFW PHS data, Columbia white-tailed deer occur in Wetland 2. Wetlands 3, 5, 6, and Y would continue to provide limited habitat functions.

Wetland B would not be filled, but clearing and trimming 0.08 acre of wetland vegetation to facilitate construction of the trestle would likely degrade water quality and hydrology functions if vegetation is cleared down to ground level. This would reduce the wetland's capacity to slow flood flows and retain water and pollution, although the effect of this small area of impact would be minimal.

Clearing or trimming vegetation would also fragment habitat and reduce functionality. However, the wetland is already separated from other wetlands by the levee; it is located between the Columbia River and a mowed/maintained levee and road.

Construction—Indirect Impacts

As stated previously, the portions of Wetlands 3, 6, and Y extending beyond the boundaries of the project area would remain intact (6, 2, and 2.2 acres, respectively). While Wetland B would not be filled (it would be slightly cleared), there could be indirect impacts such as sedimentation during stormwater runoff and accidental fuel spills. The remaining portions of Wetlands 3, 5, 6, and Y would be exposed to similar potential indirect impacts. Implementing best management practices (e.g., silt fencing) required by federal, state, and local permits would minimize indirect impacts.

Wetland Functions

Wetland Y would be partially filled under the Off-Site Alternative (Table 5.3-5, Figure 5.3-4), and indirect impacts under the Off-Site Site Alternative would be similar to the On-Site Alternative. Wetlands 3 and 5 are similar to Wetland Y in functional ratings for water quality (moderate), hydrology (low), and habitat (moderate), and indirect construction impacts are expected to be similar for all three wetlands. Wetland 6 is in the same hydrogeomorphic class as Wetland Y but scores low on all three functions. Indirect impacts on Wetland 6 would be similar to Wetland Y but impacts would affect lower-rated water quality and habitat functions.

Operations—Direct Impacts

Operation of the proposed export terminal at the Off-Site Alternative location would have no direct impacts on wetlands.

Operations—Indirect Impacts

Indirect impacts on Wetlands 3, 5, 6, and Y related to contaminants from stormwater runoff and coal dust deposition would be similar to those described for the On-Site Alternative. Stormwater runoff would be collected for on-site treatment and would no longer discharge into wetlands. Water would be reused or discharged into the Columbia River in accordance with the NPDES Industrial Stormwater Permit. The impacts of coal dust on vegetation would depend on dust load, climatic conditions, and the physical characteristics of the vegetation, as reported in Section 5.6, *Vegetation*.

5.3.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. The following discussion assesses the likely consequences of the No-Action Alternative related to wetlands.

Under the No-Action Alternative, ongoing operations in the On-Site Alternative project area would continue. Additional storage and transfer activities might occur using existing buildings and structures. The Applicant would continue with current and future increased operations and the project area could be developed for other industrial uses including an expanded bulk product terminal or other industrial uses. New construction, demolition, or related activities to develop the project area into an expanded bulk terminal could occur on previously developed and undeveloped lands. Thus, potential impacts on wetlands could occur under the No-Action Alternative similar to those described for the On-Site Alternative, but the magnitude of the impacts would depend on the nature and extent of proposed future expansion.

5.3.5.4 Required Permits

Permits required for the proposed export terminal would likely include the following.

- **Clean Water Act Authorization, Section 404—U.S. Army Corps of Engineers.** Construction and operation of the terminal would affect waters of the United States, including wetlands. Department of the Army authorization from the Corps under Section 404 of the Clean Water Act would be required.
- **Clean Water Act Section 401 Water Quality Certification—Washington State Department of Ecology.** 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 the terminal.

- **Critical Areas Permit—Cowlitz County Department of Building and Planning.** Development in designated critical areas, including wetlands, requires a Critical Areas Permit from the Cowlitz County Department of Building and Planning.
- **Critical Areas Permit—City of Longview Community Development, Department Planning Division (Off-Site Alternative Only).** Development in designated critical areas, including wetlands, requires a Critical Areas Permit from the City of Longview Community Development, Department of Planning Division.

Other permits and approvals not specific to wetlands may be required, but associated with the On-Site Alternative's and Off-Site Alternative's location along the Columbia River, such as the State Shoreline Management Act, Cowlitz County Shoreline Master Program, and City of Longview Shoreline Master Program.

5.4 Groundwater

Groundwater, often stored in aquifers[1] formed of permeable rock or soil material, provides water for human and environmental well-being. Groundwater quality refers to the physical, chemical, biological, and aesthetic characteristics of water, which are used to measure the ability of water to support aquatic life and human uses. Groundwater quality can be degraded by contaminants introduced by domestic, industrial, and agricultural practices.

This section describes the groundwater resources in the study area and the impacts on groundwater likely to result from construction and operation of the proposed export terminal.

5.4.1 Regulatory Setting

Laws and regulations relevant to groundwater are summarized in Table 5.4-1.

Table 5.4-1. Regulations, Statutes, and Guidelines for Groundwater

Regulation, Statute, Guideline	Description
Federal	
Clean Water Act (33 USC 1251, *et seq*.)	Establishes the basic structure for regulating discharges of pollutants into waters of the United States and regulating quality standards for surface waters but not groundwater.
Safe Drinking Water Act	Requires the protection of groundwater and groundwater sources used for drinking water. Also, requires every state to develop a wellhead protection program.
National Pollutant Discharge Elimination System Permit	Authorized by the Clean Water Act, the permit program controls water pollution by regulating point sources discharging pollutants into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. Surface waters in the study area interacts with groundwater.
State	
Water Quality Standards for Groundwaters of the State of Washington (WAC-173-200)	Groundwater standards intended to preserve a level of quality for groundwater capable of meeting current state and federal safe drinking water standards.
Water Code (RCW 90.03)	Establishes rules for regulating and controlling water rights, and defines beneficial uses.
Regulation of Public Groundwaters (RCW 90.44)	Regulates and controls groundwater. Extends application of surface water statutes (90.02 RCW) to groundwater.
Drinking Water/Source Water Protection (RCW 43.20.050)	Requires the Washington State Department of Health assure safe and reliable public drinking water supplies in cooperation with local health departments and water purveyors.

[1] An aquifer consists of underground layers of rock saturated with water that can be brought to the surface through natural springs or by pumping.

Regulation, Statute, Guideline	Description
Model Toxics Control Act (RCW 70.105D)	Requires potentially liable persons to assume responsibility for cleaning up contaminated sites.
State Water Pollution Control Law (RCW 90.48)	Grants Ecology the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland water, salt waters, water courses, and other surface and groundwater in the state.
Water Resources Act of 1971 (RCW 90.54)	Sets forth fundamental policies for the state to insure waters of the state are protected and fully utilized for the greatest benefit.
Washington State Oil and Hazardous Substance Spill Prevention and Response (90.56 RCW)	Requires notification of releases of hazardous substances and establishes procedures for response and cleanup.
Model Toxic Control Act Cleanup Regulations (Chapter 173-340 WAC)	Establishes procedures for investigation and site cleanup actions. Requires potentially liable persons to assume responsibility for cleaning up contaminated sites.
Local	
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Designates critical areas and development regulations to assure the conservation of such areas in accordance with best available science.
Longview Water Supply Protection Ordinance (LMC 17.100)	Establishes a wellhead protection program to minimize the risk of groundwater contamination.
City of Longview Critical Areas Ordinance (Off-Site Alternative only) (LMC 17.10)	Identifies resource lands of long-term significance; designates and protects critical resource areas, including wetlands, geologically hazardous areas, critical aquifer recharge areas, fish and wildlife habitat, and frequently flooded areas.

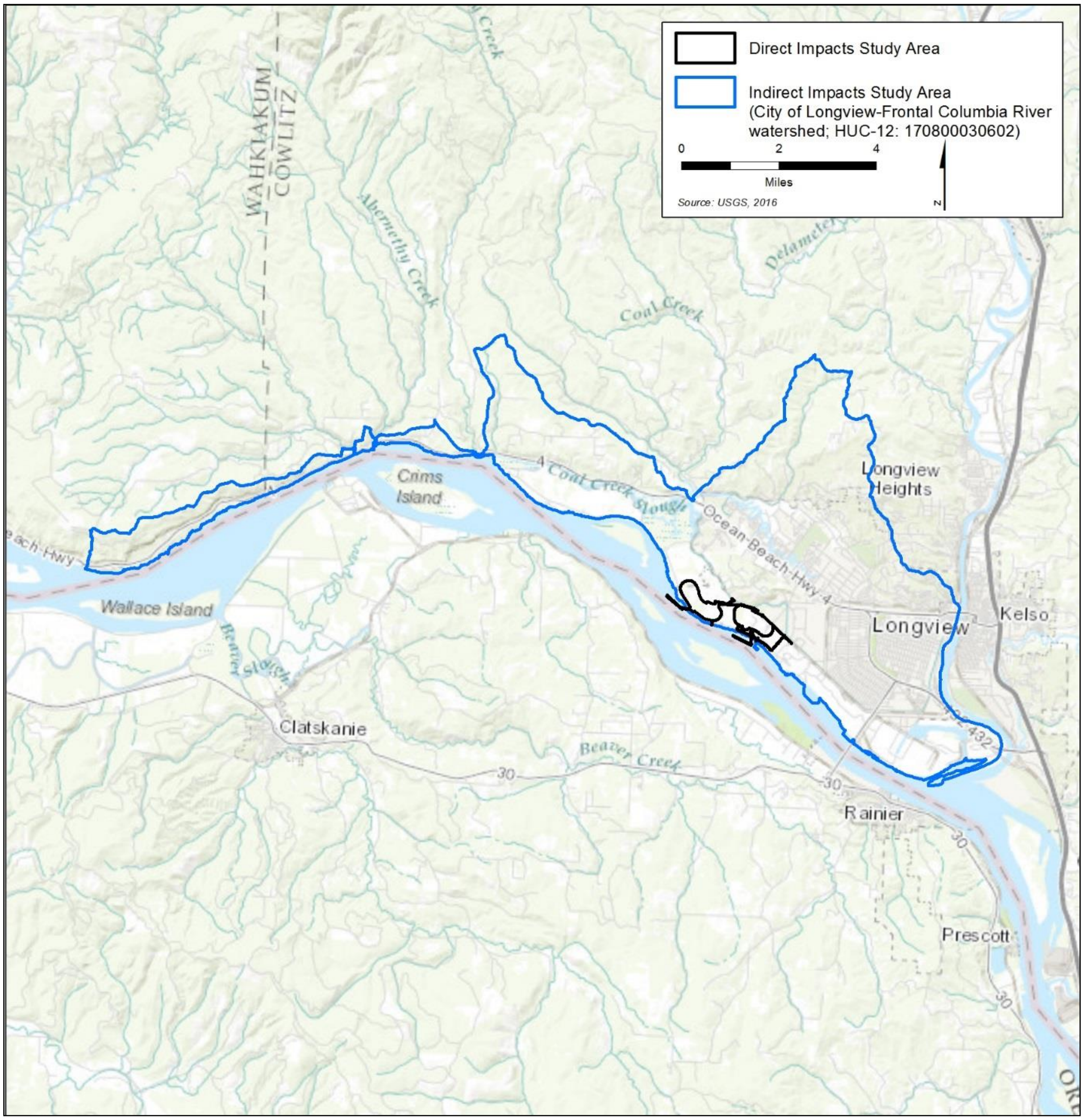
Notes:
USC = United States Code; WAC = Washington Administrative Code; RCW = Revised Code of Washington; Ecology = Washington State Department of Ecology, CCC = Cowlitz County Code; LMC = Longview Municipal Code

5.4.2 Study Area

The study areas for the On-Site Alternative and Off-Site Alternative are described below. These study areas are based on the Corps' Memorandum for Record (MFR), dated February 14, 2014, and then adjusted to reflect groundwater characteristics in and near the project areas.

The study area for direct impacts on groundwater for each alternative is the project area. The study area for indirect impacts for both alternatives is the City of Longview-Frontal Columbia River watershed (Hydrologic Unit Code [HUC]-12: 170800030602) (Figure 5.4-1).

Figure 5.4-1. Groundwater Study Areas for the On-Site Alternative and Off-Site Alternative



5.4.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts on groundwater associated with construction and operation of the proposed export terminal. For direct impacts, the analysis assumes best management practices were incorporated into the design, construction, and operations of the terminal. More information about best management practices can be found in Chapter 8, *Minimization and Mitigation*, and Appendix H, *Export Terminal Design Features*.

5.4.3.1 Information Sources

The following sources of information were used to identify and analyze potential impacts of the proposed export terminal on groundwater.

- *Remedial Investigation Report* (Anchor Environmental, LLC 2007)
- *Former Reynolds Metals Reduction Plant—Longview, Draft Remedial Investigation and Feasibility Study* (Anchor QEA 2014)
- *Millennium Coal Export Terminal Longview, Washington, Water Resources Report* (URS Corporation 2014a)
- *Millennium Coal Export Terminal Longview, Washington, Water Resource Report* (URS Corporation 2014b)
- *Millennium Coal Export Terminal Longview, Washington, Surface Water Memorandum* (URS Corporation 2014c)
- *Millennium Coal Export Terminal Longview, Washington Surface Water Memorandum, Second Supplement to Water Resource Report Water Collection and Drainage* (URS Corporation 2014d)
- *Millennium Coal Export Terminal Longview, Washington, Off-Site Alternative – Barlow Point, Appendix M, Water Resource Report* (URS Corporation 2014e)
- *Mint Farm Regional Water Treatment Plant, Preliminary Design Report, Part 2A, Hydrogeologic Characterization* (City of Longview 2010)

5.4.3.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the proposed export terminal on groundwater. Although the indirect impacts study area includes the City of Longview-Frontal Columbia River watershed, impacts on groundwater were determined to be limited to the project area and along the rail spurs that would provide access to the project area.

Potential groundwater impacts have been evaluated in terms of groundwater discharge and recharge, groundwater quality, and groundwater withdrawal. The assessment of impacts is based on the assumption the On-Site Alternative and Off-Site Alternative would include the following actions and authorizations.

On-Site Alternative

- National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit and Industrial Stormwater Permit for stormwater discharges.

- Remediation of any existing soil and groundwater contamination in the Applicant's leased area.
- Long-term monitoring as part of the remediation of the existing groundwater contamination to verify remedy effectiveness and natural attenuation of groundwater contamination.

Off-Site Alternative

- Individual NPDES Construction Stormwater General Permit and Industrial Stormwater Permit for stormwater discharges.

5.4.4 Affected Environment

This section describes the environment in the study areas related to groundwater potentially affected by construction and operation of the proposed export terminal.

5.4.4.1 On-Site Alternative

Groundwater Resources

The project area is situated within the Longview-Kelso basin, a topographic and structural depression formed by the Cascadia subduction zone (Anchor 2013 in URS Corporation 2014a). The Longview-Kelso basin is composed of unconsolidated alluvium (silt, fine-grained sand, and clay) underlain by alluvium (coarse-grained sand and gravel). Groundwater resources in the study areas include an upper alluvium aquifer (shallow aquifer) and a deeper-confined aquifer from which industries, small farms, and domestic well users withdraw groundwater. An aquifer is the underground soil or rock through which groundwater can easily move. The amount of groundwater able to flow through soil or rock depends on the size of the spaces in the soil or rock and how well the spaces are connected. Aquifers consisting of gravel, sand, sandstone, or fractured rock such as limestone are relatively permeable (or porous) materials.

In the vicinity of the On-Site Alternative project area, a confining, impervious unit consisting of clay and silt ranging in thickness from approximately 100 to 200 feet separates the two aquifer systems below the project area. The confining unit becomes appreciably thinner beyond the project area, to the north and east near residential areas. Shallow groundwater is hydraulically connected with the Columbia River. Preliminary hydrogeologic investigations conducted for the City of Longview indicate shallow, unconfined groundwater does not contribute significantly to the deeper aquifer as the lower aquifer is primarily recharged by deeper aquifers below the Columbia River (Anchor QEA 2014). The project area is not considered a significant source of groundwater recharge by infiltration because of the low recharge rates of the soils in the study area (URS Corporation 2014c).

Shallow Aquifer

Groundwater in the shallow aquifer is found at depths less than 5 feet below the ground surface (bgs) (Anchor QEA 2014). Groundwater flow in the shallow aquifer in the study area is complex due to the competing influences of the Consolidated Diking and Improvement District (CDID #1) system and, to a lesser extent, the tidally influenced Columbia River (Anchor 2014). Groundwater and stormwater discharged to the CDID #1 ditches are pumped from these ditches by the CDID #1 to maintain surface-water levels below those in the Columbia River. Water from CDID #1 is discharged to the Columbia River. A CDID #1 pump station is located near the southwest corner of the project-area boundary.

Deep Aquifer

The deep aquifer is located at an approximate depth of 200 feet bgs, with sand coarsening to gravel to a depth of 400 feet bgs (Anchor QEA 2014). The deep aquifer is a source of drinking water in the study area. Recharge to the deep aquifer in the project area is expected to be driven primarily by deeper aquifers below the Columbia River and insignificantly from shallow, unconfined aquifers (Anchor QEA 2014). Discharge from the deep aquifer is from seepage back to the Columbia River, direct discharge to the shallow aquifer, and pumpage from wells (URS Corporation 2014a).

Mint Farm Regional Water Treatment Plant

The Mint Farm Regional Water Treatment Plant is approximately 6,000 feet east of the eastern boundary of the project area. While the direct impacts study area does not extend to the Mint Farm Regional Water Treatment Plant, the indirect impacts study area includes the treatment plant, and both the direct and indirect impacts study areas include the treatment plant's wellhead protection area. The treatment plant consists of four 4,000 gallons per minute (gpm) groundwater wells and supplies the City of Longview and the Cowlitz County Public Utility District with municipal water. The plant draws from the same deep aquifer that underlies the project area, recharged by the Columbia River. Kennedy/Jenks Consultants (2010) completed a water quality and environmental risk assessment as part of the preliminary design report for the Mint Farm Regional Water Treatment Plant. The risk assessment included sampling and water quality analysis of the groundwater from the deeper aquifer of six wells. This study found no chemicals in the groundwater above human health screening levels. Kennedy/Jenks Consultants (2012) repeated the water quality analysis from the same wells in November 2012 and found manganese and iron at levels above the Washington State Department of Health secondary water quality standards and arsenic in one of the wells but at levels below thresholds established by the U.S. Environmental Protection Agency (EPA) for drinking water quality standards. Groundwater gradients and monitoring well locations at the Mint Farm Regional Water Treatment Plant are shown in Figures 5.4-2 and 5.4-3.

Surface Water Interaction with Groundwater

This section addresses how and where surface water interacts with groundwater in the study areas.

Columbia River

The Columbia River flows along the entire south/southwest boundary of the project area. Tidal influences on groundwater tend to propagate farthest in the coarse-grained deep aquifer and to a much lesser degree within the shallow aquifer (Anchor QEA 2014).

Consolidated Dike Improvement District #1 System

The CDID #1 system was developed to control local flooding and depress the groundwater elevation in lower elevation areas (e.g., the project area) near the Columbia River to facilitate development on low-lying properties (URS Corporation 2014a). Water levels in the CDID #1 ditches are maintained below the water surface elevation of the Columbia River, which influences groundwater flow direction in the shallow aquifer.

Figure 5.4-2. Shallow Aquifer Groundwater Gradients and Monitoring Well Locations

Figure 5.4-3. Deep Aquifer Groundwater Gradients and Monitoring Well Locations

At the project area, this results in a flow of shallow groundwater away from the Columbia River (to the north, east, and west) (Figure 5.4-4) and toward the CDID #1 ditches (Anchor QEA 2014) except for one localized area: groundwater flow south of the axis of the Columbia River levee is toward the Columbia River (Anchor Environmental 2007). Groundwater that discharges into the CDID #1 ditches and stormwater that is collected within the CDID #1 ditches are actively pumped by the CDID #1 system to the Columbia River through a network of pump stations and valves to maintain water levels below the level of the Columbia River. Some groundwater from the deep aquifer may be discharged into the CDID #1 ditches because an upward vertical gradient also exists in areas near the CDID #1 ditches, causing groundwater in the deep aquifer to move upward into the shallow aquifer (Anchor Environmental 2007).

Drainage Basins and Stormwater System

The on-site drainage system collects stormwater in 12 drainage basins and five outfalls (Section 5.2, *Surface Water and Floodplains*, Figure 5.2-5), which the Applicant manages under NPDES Industrial Stormwater Permit WA-000008-6. The outfalls discharge treated stormwater to CDID #1 ditches and the Columbia River. One of the five outfalls, Outfall 004, has been closed since 1991. The major collection and treatment systems, drainage basins, outfalls, and discharge locations currently managed under the NPDES program are described in more detail in Section 5.2, *Surface Water and Floodplains*.

Groundwater Quality

Local groundwater quality in the study area is good, with no identified pollutant concentrations above human health screening levels. Samples taken from the study area contain manganese, iron, and arsenic levels above the Washington State Department of Health secondary water quality standards, but at levels below thresholds established by the U.S. Environmental Protection Agency (EPA) for drinking water quality standards. These levels were found to be naturally occurring and are characteristic of the regional water supply aquifer (Anchor QEA 2014a).

Groundwater Contamination

Historical operations in the study area have included the operation of various facilities, e.g., an aluminum production facility, a cable plant, cryolite recovery, and industrial landfills (Figure 5.4-5).[2] Chapter 4, Section 4.6, *Hazardous Materials*, provides a history of contamination in the study areas. In the project area, groundwater samples show the presence of cyanide, fluoride, polycyclic aromatic hydrocarbons, heavy metals and petroleum hydrocarbons.

In January 2015, a remedial investigation/feasibility study (RI/FS) (Anchor QEA 2014) was prepared per the requirements of Washington State's Model Toxics Control Act (MTCA), which is administered by the Washington State Department of Ecology (Ecology). The RI/FS provides a detailed description of cleanup and remedial actions in the study area (Anchor QEA 2014). Figure 5.4-5 shows the locations of previous cleanup and removal activities and remedial investigation focus areas.

[2] Landfills include six areas referred to as Landfills and Fill Deposits associated with the operation of the Reynolds aluminum smelter and were used for depositing such things as industrial waste, residual carbon, construction debris, floor sweeps and spent lime. Cleanup of these features is ongoing as a separate project.

Figure 5.4-4. Groundwater Gradients and Flow Direction

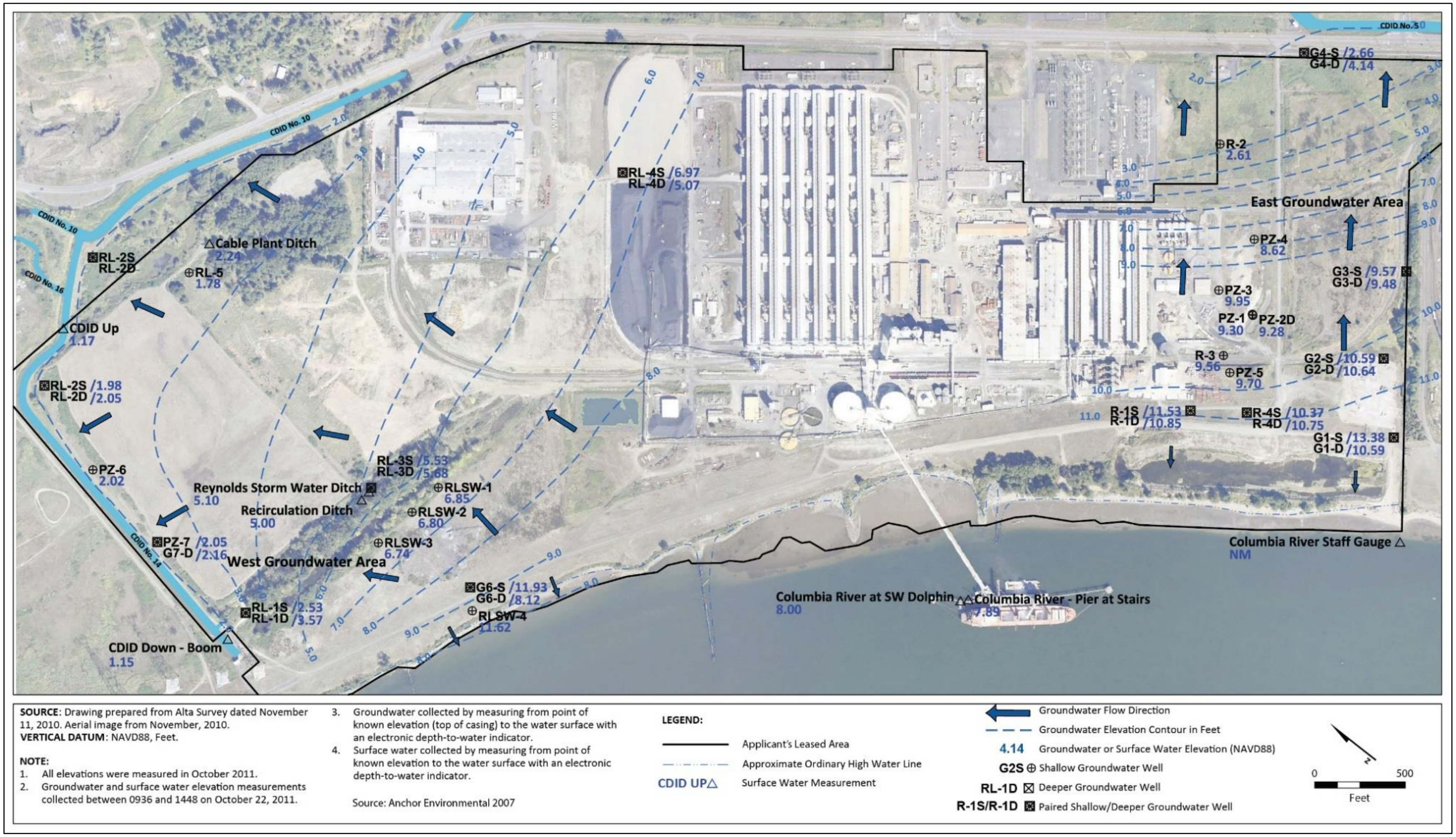
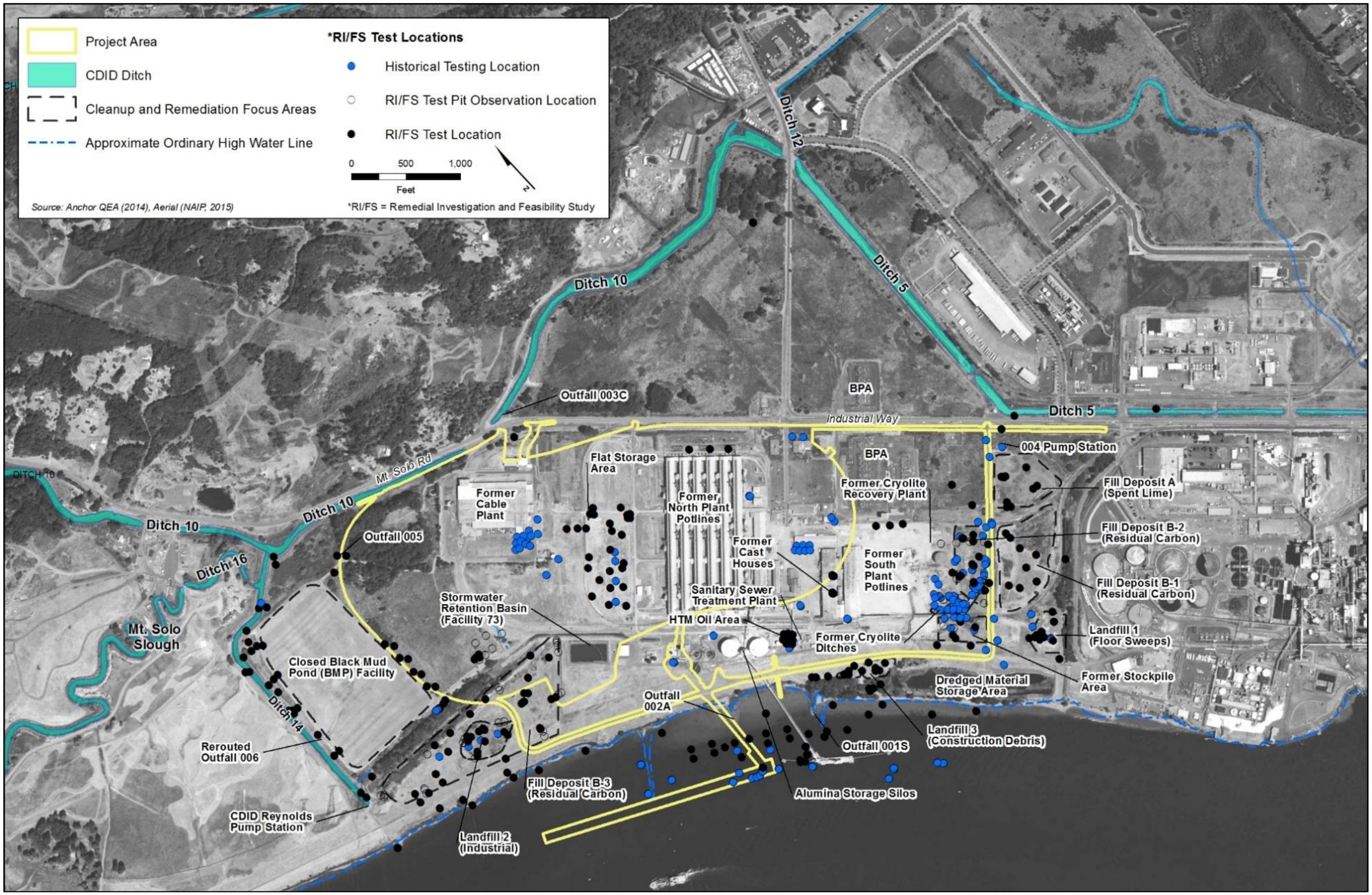


Figure 5.4-5. Remedial Investigation Environmental Testing (Geologic, Hydrogeologic, and Geochemical) Locations



Source Areas and Chemicals of Concern (Deep and Shallow Aquifers)

Cyanide

Groundwater cyanide concentrations in the study area are very low and have been decreasing over time. Free cyanide concentrations in all samples taken in the western portion of the study areas were below the groundwater screening level of 0.2 milligram per liter.

Groundwater cyanide concentrations in samples collected in the eastern portion of the study areas have also been decreasing over time. One groundwater sample, located near the Former Stockpile Area in the southeast corner of the study areas in Figure 5.4-5, exceeded the groundwater Maximum Contaminant Level in 2006, but concentrations decreased significantly by the 2011 and 2012 sampling events. Free cyanide[3] concentrations in most of the eastern portion of the study areas were below the groundwater screening level.

Fluoride

Fluoride concentrations in most of the Applicant's leased area are below groundwater screening levels. The exceptions are the shallow groundwater located in or immediately adjacent to Landfills 1 and 2 and fill deposits A, B-1, B-2 and B-3. Surface-water monitoring suggests the fluoride present in the shallow groundwater is not affecting water quality in the adjacent CDID Ditches 10, 5, or 14 (Anchor QEA 2014).

Carcinogenic Polycyclic Aromatic Hydrocarbons

Carcinogenic polycyclic aromatic hydrocarbon (CPAH) concentrations from the western portion of the Applicant's leased area do not exceed groundwater screening levels. In the eastern portion of the Applicant's leased area, and outside the project area boundaries, CPAH concentrations were below groundwater screening levels in all locations except for wells located immediately within or adjacent to fill deposits. Three localized areas (purple dots in Figure 5.4-6) include wells located immediately adjacent to Landfill 1 and Fill Deposit B-2. CPAH concentrations in wells located farther downgradient were lower than the groundwater screening level and the surface water screening level.

Polychlorinated Biphenyls

No polychlorinated biphenyls (PCBs) were detected in any of the groundwater samples analyzed.

Heavy Metals

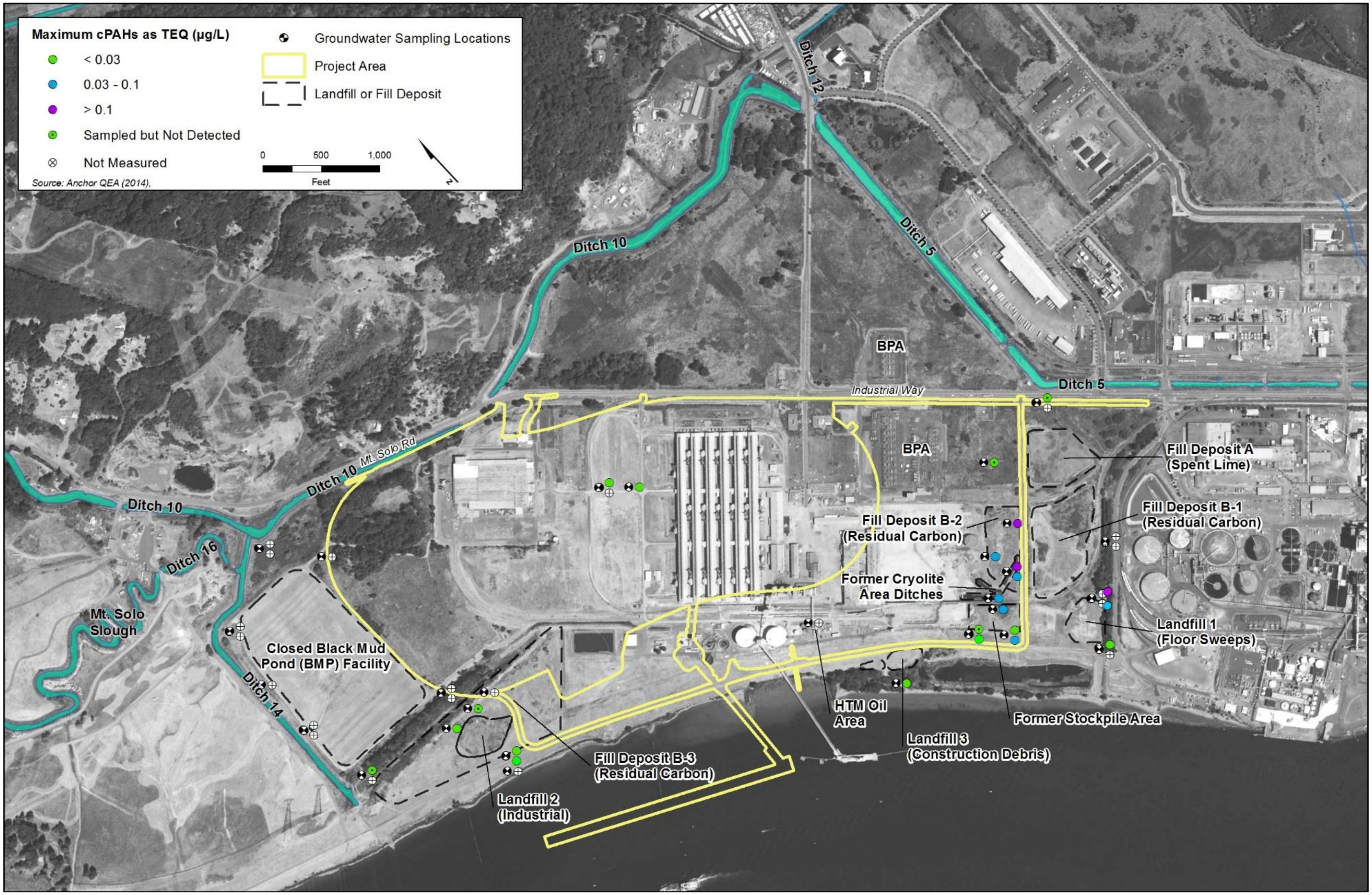
Test findings indicate groundwater heavy metals concentrations are below applicable screening levels.

Volatile Organic Compounds

No volatile organic compounds were detected in any of the groundwater samples analyzed.

[3] Free cyanide refers to the sum of hydrogen cyanide (HCN) and cyanide ion (CN-) in a sample. Free cyanide is bioavailable and toxic to organisms in aquatic environments.

Figure 5.4-6. 2007–2012 Groundwater Testing Results (Total CPAHs as Toxic Equivalents)



Total Petroleum Hydrocarbons

The RI/FS testing program included analysis for total petroleum hydrocarbons (TPHs) in the HTM Oil Area (Figure 5.4-6). All samples collected were below groundwater screening levels.

Distribution of Chemicals of Concern

Fluoride and cyanide levels found in the shallow groundwater within or immediately adjacent to Landfills 1, 2, and 3 have limited mobility and are not affecting downgradient groundwater (Anchor QEA 2014). Groundwater contaminated with fluoride and cyanide could occur during leaching when soils or solid media come into contact with the groundwater. However, the upward hydraulic gradients in the shallow aquifer cause dispersion of fluoride and cyanide and prevent migration into the north-south groundwater flows. This subsequently protects groundwater, surface water, and the Columbia River and limits fluoride and cyanide from traveling to the CDID #1 ditches. Fluoride and cyanide concentrations have been decreasing over time, since the closure of the former Reynolds Metals Company facility (Reynolds facility). It is unlikely fluoride and cyanide in the study area affect the surrounding groundwater (Anchor QEA 2014).

Final Cleanup Actions

A draft MTCA Cleanup Action Plan for the study area, released in January 2016, describes proposed cleanup actions to protect human health and the environment, meet state cleanup standards, and comply with other applicable state and federal laws. Cleanup standards would be consistent with the current and anticipated future land use. Ecology's comment period on the *Draft MTCA Cleanup Action Plan* ended March 18, 2016, and issuance of a final plan is pending. Cleanup is estimated to be completed between 2019 and 2020.

Applicant's Water Rights

The Applicant currently holds several water rights to extract groundwater from the deep aquifer (Kennedy/Jenks 2012), which have been held since at least 1967. The total instantaneous withdrawal volume allowance under these water rights is 23,150 gpm and the total annual withdrawal allowance is 31,367 acre-feet per year (AFY). It is estimated the Applicant has an existing demand of 1.53 million gallons per day (Chaney pers. comm.), which is well within the Applicant's water rights[4] limits for groundwater pumping. However, if the Applicant does not fully beneficially use each water right within a 5-year period, the Applicant must relinquish the unused portion (Revised Code of Washington [RCW] 90.14.160).

5.4.4.2 Off-Site Alternative

The project area for the Off-Site Alternative is also on the northeast shore of the Columbia River. The project area is undeveloped and vegetated, with grassy areas extending to the shoreline of the Columbia River. A portion of the eastern side of the project area is an agricultural use, while another portion of the area appears to have been used by recreational off-road vehicles.

[4] The Applicant is responsible for maintaining water rights. The Draft EIS did not verify water rights are current.

Surrounding land uses include the residential neighborhoods of Barlow Point, Memorial Park, and West Longview to the north and east of the project area, and the closed Mount Solo Landfill immediately north-northeast of the project area. The nearest residential community is the West Longview neighborhood located 1 mile north of the project area. The next nearest residential communities, located 1 to 2 miles east of the project area toward the Longview city center include the Olympic West, Highlands, and Columbia Valley Gardens neighborhoods.

Groundwater conditions are assumed to be similar to those described for the On-Site Alternative because the CDID #1 system borders both project areas. Thus, the shallow aquifer groundwater flow gradient beneath the Off-Site Alternative is assumed to be similar to the On-Site Alternative. There may be a slight groundwater gradient from the closed Mount Solo Landfill toward the Off-Site Alternative project area within the shallow aquifer, based on local topography. Therefore, the CDID #1 system may have a reduced impact on the shallow aquifer in terms of groundwater gradient in this isolated area.

The Mount Solo Slough is a privately owned drainage ditch forming the northern boundary of the project area and near the closed Mount Solo Landfill. It is a highly meandering drainage that has been historically managed as a drainage ditch. It connects to CDID Ditch 14 to the east and CDID Ditch 16 to the north, both of which connect to CDID Ditch 10.

Groundwater quality information for the Off-Site Alternative project area was not available at the time of preparation of this document. Although there are no known sources of environmental contamination in the Off-Site Alternative project area, farming of agricultural lands and operations and maintenance of the former motocross/off-road vehicle trails may have included the use of pesticides, herbicides, fuels, and other related contaminants, which have the potential to affect soil, surface water, and groundwater. It is unknown if any residual chemicals remain in the Off-Site Alternative project area.

No groundwater wells have been recorded for the Off-Site Alternative project area.

5.4.5 Impacts

This section describes the potential direct and indirect impacts related to groundwater that would result from construction and operation of the proposed export terminal.[5]

5.4.5.1 On-Site Alternative

This section describes the impacts potentially occurring in the study areas as a result of construction and operation of the proposed export terminal at the On-Site Alternative location.

Construction site preparation activities would involve preloading and installing vertical wick drains to aid with consolidation of low consistency silt and low-density sand (i.e., unconsolidated materials). Wick drains would direct groundwater from the shallow aquifer upward toward the surface during preloading, where it would discharge. Water discharged from the wick drains would be captured, tested for contaminants, and treated prior to discharge to any surface waters.

[5] 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.

Process water supply for construction and operation of the On-Site Alternative would come from two sources: the on-site water management system during the wet season and onsite groundwater wells during the dry season. Process water uses on the project area would include dust control, equipment washdown, and cleanup. Water for dust suppression would be applied on the main stockpiles, within unloading and conveying systems, and at the docks.

The following construction activities could affect groundwater.

- Disturbance of surface soils during construction
- Release of hazardous and non-hazardous materials during construction
- Disturbance of previously contaminated sites
- Use of groundwater for dust control

The following operational activities could affect groundwater.

- Alteration of surface runoff patterns
- Use of groundwater for dust control, equipment washdown, and cleanup

Construction—Direct Impacts

Construction-related activities associated with the On-Site Alternative could result in direct impacts as described below. As explained in Chapter 3, *Alternatives,* construction-related activities include demolishing existing structures and preparing the site, constructing the rail loop and dock, and constructing supporting infrastructure (e.g., conveyors and transfer towers).

Groundwater Recharge

Construction would involve preloading and installing vertical wick drains to direct groundwater from the shallow aquifer upward toward the surface during preloading, where it would discharge. Ground-disturbing activities (excavations, grading, filling, trenching, backfilling, and compaction) could temporarily disrupt the existing drainage and groundwater recharge patterns in the study area. The study area is not considered a major source of groundwater recharge of the deep aquifer. During construction, drainage and groundwater recharge patterns are expected to be similar to those of the existing conditions, with wick drain effluent and runoff directed to collection and treatment facilities and minimal infiltration to groundwater of the deep aquifer. Therefore, construction of the On-Site Alternative would not be expected to have a measurable impact on groundwater recharge patterns of the deep aquifer.

The shallow water aquifer in the project area is only minimally recharged by stormwater through surface infiltration due to the low recharge rates of soils in the study area (URS Corporation 2014c). During construction, impervious surfaces would be sloped to convey stormwater to collection sumps on the project area. The collected stormwater would then be conveyed to water-collection facilities and discharged through a monitored internal outfall to existing facilities within the project area for treatment prior to discharge to the Columbia River (Outfall 002A). Therefore, construction of the terminal at the On-Site Alternative location would be expected to slightly reduce groundwater recharge in the shallow aquifer.

For more information on the NPDES Construction Stormwater General Permit for the On-Site Alternative, see Section 5.5, *Water Quality*.

Groundwater Quality

Any construction-related contaminant accidentally released on the ground could infiltrate groundwater and temporarily degrade groundwater quality if the contaminant were to reach groundwater. This would be a concern primarily for the shallow aquifer and not the deep aquifer because there is a confining, impervious soil unit consisting of clay and silt that separates the two aquifer systems, and the deep aquifer is primarily recharged by deeper aquifers below the Columbia River (Anchor QEA 2014) rather than surface infiltration. Poured concrete, cement, mortars, and other Portland cement- or lime-containing construction material could alter the pH of stormwater, which could infiltrate into the ground and affect the shallow aquifer water quality. Petro-chemicals could also be released through leaks and accidental spills, which could infiltrate into the ground and potentially reach groundwater. However, the likelihood of a large contaminant spill would be low with implementation of the best management practices required as part of the NPDES Construction Stormwater General Permit. In addition, cleanup efforts would begin immediately after an accidental contaminant release, so it would be unlikely for a large amount of contaminant would reach groundwater and impair water quality. Therefore, construction is not expected to result in groundwater degradation as a result of an accidental contaminant release and no long-term effects are anticipated.

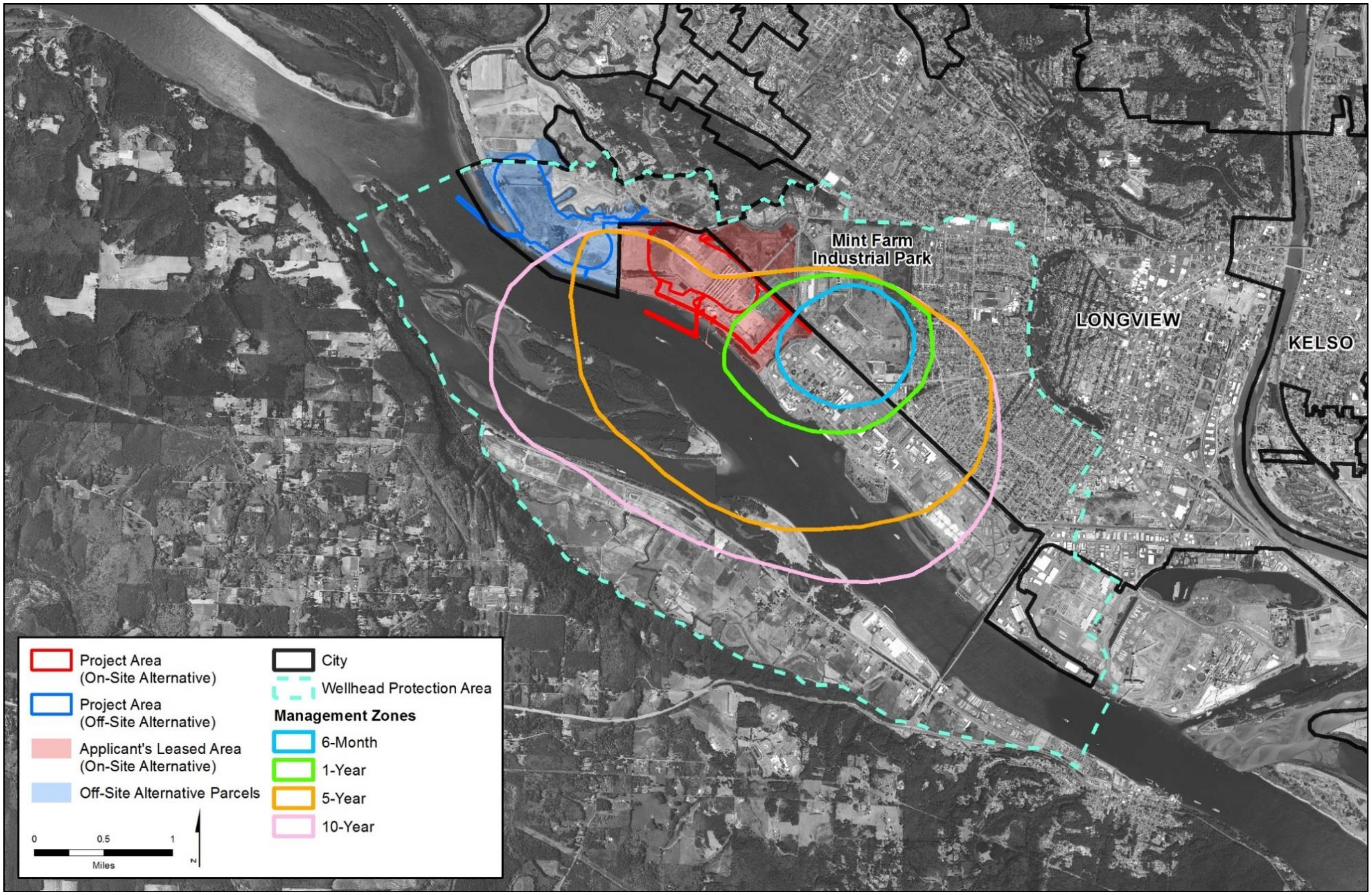
Site preparation activities would involve preloading and installation of vertical wick drains to aid in the consolidation of low consistency silt and low-density sand (i.e., unconsolidated materials). Wick drains would direct groundwater from the shallow aquifer upward toward the surface during preloading, where it would discharge. These activities could take place adjacent to areas where known groundwater contamination exists, and the contaminated groundwater could penetrate these areas. However, the permeability of the soil materials affected by preloading would be relatively low, and thus, would not be particularly susceptible to the infiltration of contaminated groundwater. Water discharged from the wick drains would be captured, tested for contaminants, and treated prior to discharge to any surface waters. Therefore, construction is not expected to result in groundwater degradation as a result of preloading and vertical wick drains and no long-term effects are anticipated.

Construction could encounter previously contaminated areas currently being addressed by the MTCA Cleanup Action Plan, which could degrade groundwater quality. However, with the exception of two small areas—the eastern corner of the Flat Storage Area and the northeastern portion of Fill Deposit B-3 (Figure 5.4-5)—cleanup actions are not recommended in the draft Cleanup Action Plan for the project area. For the Flat Storage Area and Fill Deposit B-3, construction and remediation activities would be coordinated to reduce conflicts and minimize any environmental impact. Fluoride and cyanide levels found in shallow groundwater have limited mobility and do not affect downgradient groundwater or surface water quality. Therefore, construction at the On-Site Alternative location is not expected to result in groundwater degradation as a result of disturbing previously contaminated areas.

Construction would be unlikely to affect the wellfield at the Mint Farm Industrial Park, which is located in the indirect impacts study area, and is upgradient and approximately 1.14 miles (6,000 feet) away. However, the direct impacts study area is located within Zone 2 of the Mint Farm Industrial Park's wellhead protection and sanitary control areas (Figure 5.4-7).[6]

[6] In Washington State, wellhead protection areas are based on horizontal time-of-travel rates for groundwater. Zone 2 areas are based on a 5-year time-of-travel for groundwater.

Figure 5.4-7. City of Longview Wellhead Protection Area



The wellfield draws water from the deep aquifer, which is protected by a confining, impervious soil unit consisting of clay and silt that separates the two aquifer systems, and the deep aquifer is primarily recharged by deeper aquifers below the Columbia River. So it would be unlikely that contaminants from a spill would ever reach the groundwater withdrawn by the wellfield.

Groundwater Supply

Construction would require groundwater for dust suppression. The maximum amount of water to be used for dust suppression is estimated to be 40,000 gallons per day (44.8 AFY). Combined with demand from existing activities in the project area of 1,994 AFY, the total demand for groundwater during construction would be approximately 2,039 AFY. As described above, the Applicant holds water rights for instantaneous extraction from on-site wells of 23,150 gpm or 31,367 AFY. Water demand for construction-related activities and existing operations, together, would represent only 6.5% of the Applicant's current groundwater extraction rights and would be an increase of approximately 2% over current groundwater extraction. Therefore, construction of the On-Site Alternative would have a negligible impact on groundwater supply.

It is possible excavation activities could intercept groundwater in low-lying areas, which could result in temporary fluctuations in shallow groundwater in the immediate area. Dewatering effluent would be pumped to temporary containment tanks for settling, where it will be tested for pollutants before being discharged to receiving waters. If pollutants are encountered during testing, dewatering would be suspended and Ecology would be notified. Contaminated water would be treated before being discharged to receiving waters.

Construction—Indirect Impacts

Construction at the of the propsed export terminal at the On-Site Alternative location would not result in indirect impacts on groundwater because construction would be limited to the project area and would not occur later in time or be farther removed in terms of distance than the direct impacts.

Operations—Direct Impacts

Operation of the proposed export terminal at the On-Site Alternative location would result in the following direct impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Groundwater Recharge

Operation of the terminal could permanently reduce infiltration due to soil compaction and new impermeable surfaces (e.g., roads and buildings). The project area would occupy some of the existing drainage basins in the project area (Figure 5.5-3), effectively eliminating a portion of the runoff presently handled under the Applicant's existing NPDES Industrial Stormwater Permit. (The Applicant would be required to obtain a separate NPDES Industrial Stormwater Permit for a separate system of stormwater collection and discharge.) However, the project area is not an important source of groundwater recharge due to relatively impermeable soils (URS Corporation 2014c). In addition, runoff is currently collected in a ditch system and operating the proposed terminal would not substantively change these conditions; the primary source of shallow groundwater recharge in the project area would continue to be the Columbia River. Overall, operation of the terminal at the On-Site Alternative location would not substantially change shallow groundwater recharge volumes or patterns in the project area.

Operations would not be expected to measurably affect groundwater recharge for the deeper aquifer because the deep aquifer is primarily recharged by deeper aquifers below the Columbia River (Anchor QEA 2014).

Groundwater Quality

Contaminants and coal dust generated during operations could degrade groundwater quality if contaminated runoff were to infiltrate into the ground and reach groundwater. However, as described under *Groundwater Recharge* above, the project area is not considered a significant source of groundwater recharge through infiltration because of the low recharge rates of the soil characteristics in the study area (URS Corporation 2014c), limiting contaminant movement into the ground. In addition, runoff from the study area, and any contaminants in that runoff, would be directed to on-site drainage systems, treated, and either reused on site or discharged in accordance with the NPDES Industrial Stormwater Permit for the proposed terminal. Water reused on site would be brought up to Washington State Class A Reclaimed Water standards (URS Corporation 2014c). Excess water not reused on site would be further treated and tested prior to being routed to permitted outfalls and discharged to the Columbia River. Discharge of water to the Columbia River during operation of the terminal would mostly occur during the rainy season when excess surface water would be more likely to be generated on site.

The potential for coal dust to affect groundwater would be relatively low due to the low permeability of soils in the study area, the propensity for soil to filter out coal dust suspended in water, and treatment of on-site stormwater runoff. Thus, it would be unlikely coal dust would come in contact with groundwater.

The potential for toxic constituents of coal to reach groundwater would also be relatively low. Toxic constituents of coal include CPAHs and trace metals, which are present in coal in variable amounts and combinations dependent on the type of coal. The coal type, along with mineral impurities in the coal and environmental conditions, determine whether these compounds can be leached from the coal (see Section 5.5 *Water Quality*, for coal constituents of Powder River Basin and Uinta Basin coal). The potential risk for exposure to toxic chemicals contained in coal would be relatively low as these chemicals tend to be bound in the matrix structure and not quickly or easily leached. See Section 5.5, *Water Qualit*y, and Chapter 6, Section 6.7, *Coal Dust*, for more information.

Operation of the terminal would not encounter or disturb previously contaminated areas being addressed by the MTCA Cleanup Action Plan. Remediation activities would be carried out in accordance with relevant regulations and coordinated to avoid exposure to the environment.

Overall, operation of the proposed terminal would not degrade groundwater quality due to the low recharge rates of soils in the area. Surface runoff treatment would minimize any infiltration of contaminant-laden runoff into the ground.

Groundwater Supply

Process water, i.e., water to be used during operations for dust control and equipment washdown, would be supplied from two sources: the on-site water management system during the wet season and on-site groundwater wells during the dry season.

The on-site water management system would provide process water in the following ways.

- Stormwater and surface water (washdown water) would be collected from the stockpile areas, rail loop, office areas, docks, and other paved surfaces in the project area and directed to a series of vegetated ditches and ponds, then to a collection basin or sump.
- The collected water would be pumped to an onsite treatment facility consisting of retention pond(s) with flocculent added to promote settling as required.
- The water would then be pumped to a surface storage pond. The surface storage pond would have an approximate capacity of 3.6 million gallons (MG), including a reserve of 0.36 MG for fire suppression.

Approximately 1,200 gpm during the wet season and 2,000 gpm during the dry season (approximately 2,034 AFY) would normally be required for dust suppression. On-site groundwater wells would provide approximately 635 gpm (1,025 AFY) to maintain minimum water levels in the storage pond to meet process water demands during the dry season. The Applicant holds water rights for instantaneous extraction of 23,150 gpm up to a total volume of 31,367 AFY. Combined with the groundwater demand from existing activities in the study area (approximately 1,994 AFY), operation of the terminal at the On-Site Alternative location would require approximately 3,019 AFY, an increase of approximately 51% over existing groundwater demands, which is less than 10% of the pumping limit. Therefore, operation of the terminal would have a negligible impact on groundwater supply.

Operations—Indirect Impacts

Operation of the proposed export terminal at the On-Site Alternative location would result in the following indirect impacts on groundwater related to operations in the direct impacts study area and increased rail traffic on the BNSF Spur and Reynolds Lead within the direct and indirect study areas. Operations-related activities are described in Chapter 3, *Alternatives*.

Groundwater Quality

The On-Site Alternative likely would not affect groundwater at the Mint Farm Industrial Park because the wellfield draws water from the deep aquifer, and as previously mentioned, there is a confining, impervious layer of clay and silt separating the two aquifers. So it would be unlikely contaminants from a spill during operations would ever reach the wellfield. The majority of the study area is located within Zone 2 of the Mint Farm Industrial Park's wellhead protection and sanitary control areas (Figure 5.4-7). Although it would be highly unlikely a contaminant would ever reach the deep aquifer, should a contaminant release occur during operations, cleanup would occur rapidly. In addition, surface water generated on the study area would be collected and reused on site or treated before discharge to the Columbia River, further minimizing the potential for contaminants to infiltration into the ground.

Spills of fuel or other potentially hazardous materials could occur along the rail spur if rail cars were to collide and/or derail within the study areas. The indirect impacts study area begins at the west side of the Cowlitz River where the rail line crosses into the City of Longview-Frontal Columbia River watershed. Materials released onto the ground as a result of a fuel spill could degrade groundwater quality. As discussed in Chapter 4, Section 4.6, *Hazardous Materials*, if a release of hazardous materials occurred, the rail operator would implement emergency response and cleanup actions as required by Occupational Safety and Health Administration rules (29 Code of Federal Regulations [CFR] 1910.120), the Washington State Oil and Hazardous Substance Spill Prevention and Response regulations (90.56 RCW), and/or the Model Toxic Control Act Cleanup Regulations (Chapter 173-340 Washington Administrative Code [WAC]). In addition, Federal Railroad Administration accident reporting requirements (49 CFR 225) include measures to prevent a spill of fuel or other potentially hazardous material from affecting groundwater quality through quick response, containment and cleanup. Overall, a release of potentially hazardous materials would not be expected to affect groundwater.

5.4.5.2 Off-Site Alternative

This section describes the impacts potentially occurring in the study areas as a result of construction and operation of the proposed export terminal at the Off-Site Alternative location. Construction and operational activities would be the same or similar to those described for the On-Site Alternative.

Construction—Direct Impacts

The Off-Site Alternative would result in the following direct impacts.

Groundwater Recharge

Construction would involve ground-disturbing activities that would permanently alter the existing drainage and groundwater recharge patterns in the study area. The project area is currently undeveloped. Therefore, groundwater recharge, assumed to occur at the site, would largely be eliminated by a terminal dominated by impervious surfaces.

During construction, a majority of stormwater runoff would be collected and treated prior to discharge to the Columbia River, which is the major source of groundwater recharge in the area. Although construction of the terminal would essentially eliminate groundwater recharge at the Off-Site Alternative location, treated runoff would be discharged to the Columbia River, where it would be available for groundwater recharge.

Groundwater Quality

Due to the absence of site-specific groundwater-related information, the quality of groundwater associated with the Off-Site Alternative project area is unknown. Farming and operations and maintenance of the former motocross/off-road vehicle trails may have included the use of pesticides, herbicides, fuels, and other related contaminants, which have the potential to affect groundwater. It is unknown whether any residual chemicals remain in the soil. It is expected impacts on groundwater quality would be minimal due to the required implementation of a construction stormwater pollution prevention plan and best management practices to protect surface waters from discharge of polluted stormwater. The majority of the stormwater would be collected and treated prior to discharge to any surface water, reducing the potential for pollutants to enter the Columbia River and affect groundwater quality.

Construction could release contaminants into the ground through leaks and spills during construction. Construction activities would be required to comply with a construction stormwater pollution prevention plan and implement best management practices to prevent any discharge of polluted stormwater.

Preparation of the project area for construction would involve installation of vertical wick drains, which could create a temporary groundwater gradient, or increase an existing gradient, toward the project area. Due to the proximity of the project area to the closed Mount Solo Landfill, groundwater quality could be affected. If contaminant concentrations in groundwater are found to be above MTCA screening levels established by Ecology, groundwater expelled through wick drains would need to be evaluated and treated prior to disposal or discharge.

Construction is not expected to affect the wellfield at the Mint Farm Industrial Park. While construction-related spills of hazardous materials could occur, the potential risks of groundwater contamination resulting from such accidents generally would be low due to the likely small size of the spills and the localized and short-term nature of an accidental release. Impacts would be the same as, or similar to, those described for the On-Site Alternative.

Groundwater Supply

Construction would require less than 40,000 gallons per day of groundwater for dust control and other construction-related uses. To meet this demand, groundwater would need to be obtained from a new well or from an off-site source during construction. A new groundwater supply well(s) at the Off-Site Alternative property would require hydrogeology studies and a grant of water rights prior to construction to ensure that groundwater supplies would not be adversely affected.

Construction—Indirect Impacts

No indirect impacts have been identified for groundwater related to construction of the Off-Site Alternative.

Operations—Direct Impacts

Operation of the Off-Site Alternative would result in the following direct impacts.

Groundwater Recharge

Full build-out of the proposed terminal would substantially increase impervious surfaces compared to existing conditions. Stormwater otherwise recharging groundwater through infiltration would be collected and conveyed to a treatment system for reuse or discharged to the Columbia River. Operation of the terminal would permanently modify surface water drainage and groundwater recharge patterns at the project area to some extent. However, treated runoff discharged to the Columbia River would be available for groundwater recharge because of the hydrologic connection between the river and the shallow groundwater in the project area.

Groundwater Quality

Operation of the terminal could release contaminants onto the ground, which could infiltrate to groundwater and degrade groundwater quality. Potential impacts would be similar to those described above for the On-Site Alternative. Overall, operation of the terminal would not degrade groundwater quality due to collection and on-site treatment of runoff.

Groundwater Supply

Operation of the terminal would require process water, which would be drawn, in part, from a new groundwater well. About 334 million gallons per year (MGY) (1,025 AFY) of groundwater would be needed to augment the surface supply. While a new well would tap groundwater supplies, pumping would not be expected to measurably affect groundwater levels given the proximity of the Off-Site Alternative location to the Columbia River and expected recharge rates in the area. In addition, any new wells proposed for the Off-Site Alternative would require an evaluation of the groundwater hydrology at the site, and application and approval for new water rights to ensure there would be no adverse impacts on groundwater supply.

Operations—Indirect Impacts

Potential impacts on groundwater quality during operations of the proposed export terminal and from accidental train collisions or derailments would be the same as those described for the On-Site Alternative. A release of potentially hazardous materials would not be expected to affect groundwater.

5.4.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. The following discussion assesses the likely consequences of the No-Action Alternative related to groundwater.

Continued use of groundwater would occur under the approved water rights for the existing on-site groundwater wells. The existing NPDES Industrial Stormwater Permit would remain in place, maintaining the water quality of existing stormwater discharges to the Columbia River, which would maintain water quality of groundwater. Any new or expanded industrial uses would trigger a new or modified NPDES permit. Thus, potential impacts on groundwater could occur under the No-Action Alternative similar to those described for the On-Site Alternative, but the magnitude of the impact would depend on the nature and extent of the future expansion.

5.4.6 Required Permits

The following permits would be required related to groundwater.

- **Cowlitz County Critical Areas Permit—Cowlitz County**. The Cowlitz County Critical Areas permit would be needed to address compliance with the County's Critical Areas Ordinance related to the presence and protection of Critical Aquifer Recharge Areas located on-site.
- **Clean Water Act Section 401 Water Quality Certification—Washington State Department of Ecology.** This certification would be required to ensure impacts on groundwater quality from construction and operation of the proposed export terminal woud not violate state water quality standards.
- **National Pollution Discharge Elimination System Construction Stormwater General Permit—Washington State Department of Ecology.** The NPDES Construction Stormwater General Permit would be required for stormwater discharges during construction of the On-Site Alternative.

- **National Pollution Discharge Elimination System Industrial Stormwater Permit—Washington State Department of Ecology**. The NPDES Industrial Stormwater Permit would be required for stormwater discharges related to operation of the On-Site Alternative.
- **Water Rights—Washington State Department of Ecology.** The Applicant would ensure existing water rights are current prior to using those rights. If the Applicant's water rights are current, the Applicant must maintain those water rights. If the Applicant's water rights are partially relinquished, the Applicant must apply for and obtain the necessary water rights.
- **Critical Areas Permit—City of Longview (Off-Site Alternative only)**. Critical Areas permit from the City of Longview would be required to address compliance with the City's Critical Areas Ordinance should Critical Aquifer Recharge Areas be located on or adjacent to the Off-Site Alternative.

5.5 Water Quality

Surface water is used for a wide range of purposes, including wildlife habitat, industrial process water, drinking water, irrigation, flood control, and recreational activities. The quality of these resources refers to the physical, chemical, biological, and aesthetic characteristics of the water body. Water quality can be degraded by contaminants introduced through domestic, industrial, and agricultural practices. Water quality impacts can occur with changes in turbidity, suspended sediment, and temperature, and the introduction of a wide variety of physical and chemical pollutants.

This section describes water quality in the On-Site Alternative and Off-Site Alternative study areas. It then describes potential impacts on water quality resulting from construction and operation of the proposed export terminal.

5.5.1 Regulatory Setting

Laws and regulations relevant to water quality are summarized in Table 5.5-1.

Table 5.5-1. Regulations, Statutes, and Guidelines for Water Quality

Regulation, Statute, Guideline	Description
Federal	
Clean Water Act (33 USC 1251 *et seq*.)	Authorizes EPA to establish the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.
Safe Drinking Water Act (42 USC 300f *et seq*.)	Requires the protection of groundwater and groundwater sources used for drinking water. Also, requires every state to develop a wellhead protection program. EPA is the responsible agency.
National Pollutant Discharge Elimination System Permit (40 CFR 122)	Controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. Authorized by the Clean Water Act. EPA is the responsible agency but typically delegates authority to state resource agencies.
National Pollutant Discharge Elimination System Vessels Program	Regulates incidental discharges from the normal operation of vessels. These incidental discharges include, but are not limited to, ballast water, bilge water, graywater (e.g., water from sinks, showers), and antifoulant paints (and their leachate). Such discharges, if not adequately controlled, may result in negative environmental impacts via the addition of traditional pollutants or, in some cases, by contributing to the spread of aquatic invasive species. Authorized by the Clean Water Act. EPA is the responsible agency.
Washington State	
Clean Water Act Section 401 Water Quality Certification	Section 401 (water quality certification) requires water quality certification from the state for activities requiring a federal permit or license to discharge pollutants into a water of the United States. Certification attests the state has reasonable assurance the proposed activity will meet state water quality standards.

Regulation, Statute, Guideline	Description
Drinking Water/Source Water Protection (RCW 43.20.050)	Ensures safe and reliable public drinking water supplies in cooperation with local health departments and water purveyors. Ecology is the responsible agency.
Model Toxics Control Act (RCW 70.105D)	Requires potentially liable persons to assume responsibility for cleaning up contaminated sites. Ecology is the responsible agency.
State Water Pollution Control Law (RCW 90.48)	Provides Ecology with the jurisdiction to control and prevent the pollution of streams, lakes, rivers, ponds, inland water, salt waters, watercourses, and other surface and groundwater in the state.
Water Resources Act of 1971 (RCW 90.54)	Sets forth fundamental policies for the state to ensure that waters of the state are protected and fully used for the greatest benefit. Ecology is the responsible agency.
Water Quality Standard for Surface Waters of the State of Washington (WAC 173-201A)	Establishes water quality standards for surface waters of the state of Washington. Ecology is the responsible agency.
Ballast Water Management (RCW 77-120)	Governs discharge of ballast water into waters of the state. Includes reporting and testing requirements. WDFW is the responsible agency.
Washington Administrative Code (WAC 173-340-300)	Requires reporting of hazardous substance releases if they may constitute a threat to human health or the environment.
Washington Administrative Code (WAC 173-204)	Establishes administrative procedural requirements and criteria to identify, screen, evaluate and prioritize, and clean up contaminated surface sediment sites.
Washington State Oil and Hazardous Substance Spill Prevention and Response (90.56 RCW)	Requires notification of releases of hazardous substances and establishes procedures for response and cleanup
Oregon State	
Treatment Requirements and Performance Standards for Surface Water, Groundwater Under Direct Influence of Surface Water, and Groundwater (OAR 333-061-0032)	Establishes water quality standards for groundwater to meet current state and federal safe drinking water standards. Oregon DEQ is the responsible agency.
Oregon Drinking Water Quality Act (ORS 448.119 to 448.285; 454.235; and 454.255) (applicable to Columbia River)	Ensures safe and reliable public drinking water supplies in cooperation with local health departments and water purveyors. Oregon DEQ is the responsible agency.
Water Quality Standards: Beneficial Uses, Policies, And Criteria for Oregon Oregon State Legislature: Turbidity Rule (OAR 340-041-0036)	Establishes the following turbidity standard: No more than a 10% cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity-causing activity. However, limited-duration activities to address an emergency, essential dredging, construction, or other legitimate activities that cause the standard to be exceeded may be authorized, provided all practicable turbidity control techniques have been applied. Oregon DEQ is the responsible agency.

Regulation, Statute, Guideline	Description
Local	
Cowlitz County Stormwater Ordinance (CCC 16.22)	Establishes minimum standards to guide and advise all who make use of, contribute to, or alter the surface waters and stormwater drainage systems in the County.
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Requires the County to designate critical areas such as wetlands; aquifer recharge areas; geologically hazardous areas; fish and wildlife habitat; and frequently flooded areas; and adopt development regulations to assure the protection of such areas.
Cowlitz County Phase II Municipal Stormwater Management Plan	Requires Cowlitz County to develop a SWMP and update it at least annually. The SWMP incorporates best management practices to reduce the discharge of pollutants from the regulated area to the maximum extent practicable in order to protect water quality.
City of Longview Stormwater Ordinance (LMC 17.80)	Establishes methods for controlling the introduction of runoff and pollutants into the municipal storm drain system (MS4) in order to comply with requirements of the Western Washington Phase II Municipal Stormwater NPDES Construction Stormwater General Permit process.

Notes:
USC = United States Code; CFR = Code of Federal Regulations; EPA = U.S. Environmental Protection Agency; RCW = Revised Code of Washington; Ecology = Washington State Department of Ecology; WAC = Washington Administrative Code; WDFW = Washington Department of Fish and Wildlife; OAR = Oregon Administrative Rules; Oregon DEQ = Oregon Department of Environmental Quality; ORS = Oregon Revised Statutes; CCC = Cowlitz County Code; SWMP = stormwater management plan; LMC = Longview Municipal Code

5.5.2 Study Area

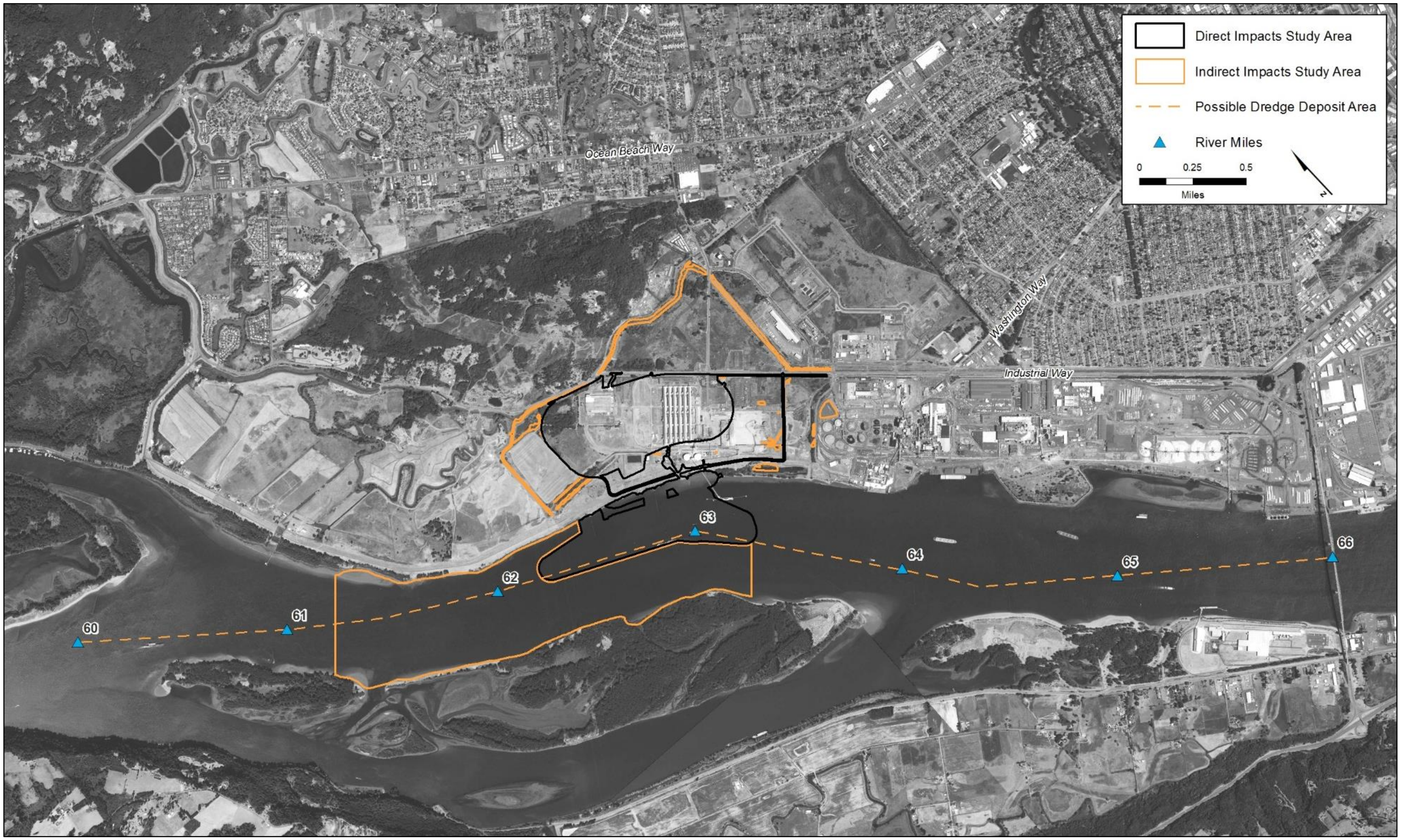
The study areas for the On-Site Alternative and Off-Site Alternative are described below. These study areas are based on the Corps' Memorandum for Record (MFR) dated February 14, 2014, and then adjusted to reflect water quality in and near the project areas.

5.5.2.1 On-Site Alternative

The study area for direct impacts on water quality is the project area and an area extending 300 feet from the project area into the Columbia River. This portion of the study area accommodates the analysis of in-water construction and dredging impacts on water quality associated with suspended sediment and elevated turbidity. The study area also incorporates potential in-river dredged material disposal sites and an area extending 300 feet downstream of each disposal site (Figure 5.5-1).

The study area for indirect impacts on water quality incorporates the project area, the Consolidated Diking Improvement District (CDID) #1 drainage ditches adjacent to the project area, the Columbia River up to 1 mile downstream of the project area, and potential in-river dredged material disposal sites plus an area extending 300 feet downstream of each disposal site.

Figure 5.5-1. Water Quality Study Area—On-Site Alternative



5.5.2.2 Off-Site Alternative

The Off-Site Alternative study area for direct impacts on water quality is the project area and the mixing zone in the Columbia River within 300 feet of the project area, as well as the dredge disposal sites, as described for the On-Site Alternative (Figure 5.5-2).

For indirect impacts, the study area includes the project area, CDID #1 drainage ditches adjacent to the project area, the Columbia River up to 1 mile downstream of the project area, and potential in-river dredged material disposal sites plus and area extending 300 feet downstream of each disposal site. This study area includes Mount Solo Slough due to its proximity to the Off-Site Alternative project area.

5.5.3 Methods

This section describes the sources of information and methods used to evaluate the potential impacts on water quality associated with the construction and operation of the proposed export terminal.

5.5.3.1 Information Sources

The following sources of information were used to identify and analyze potential impacts of the proposed export terminal on water quality.

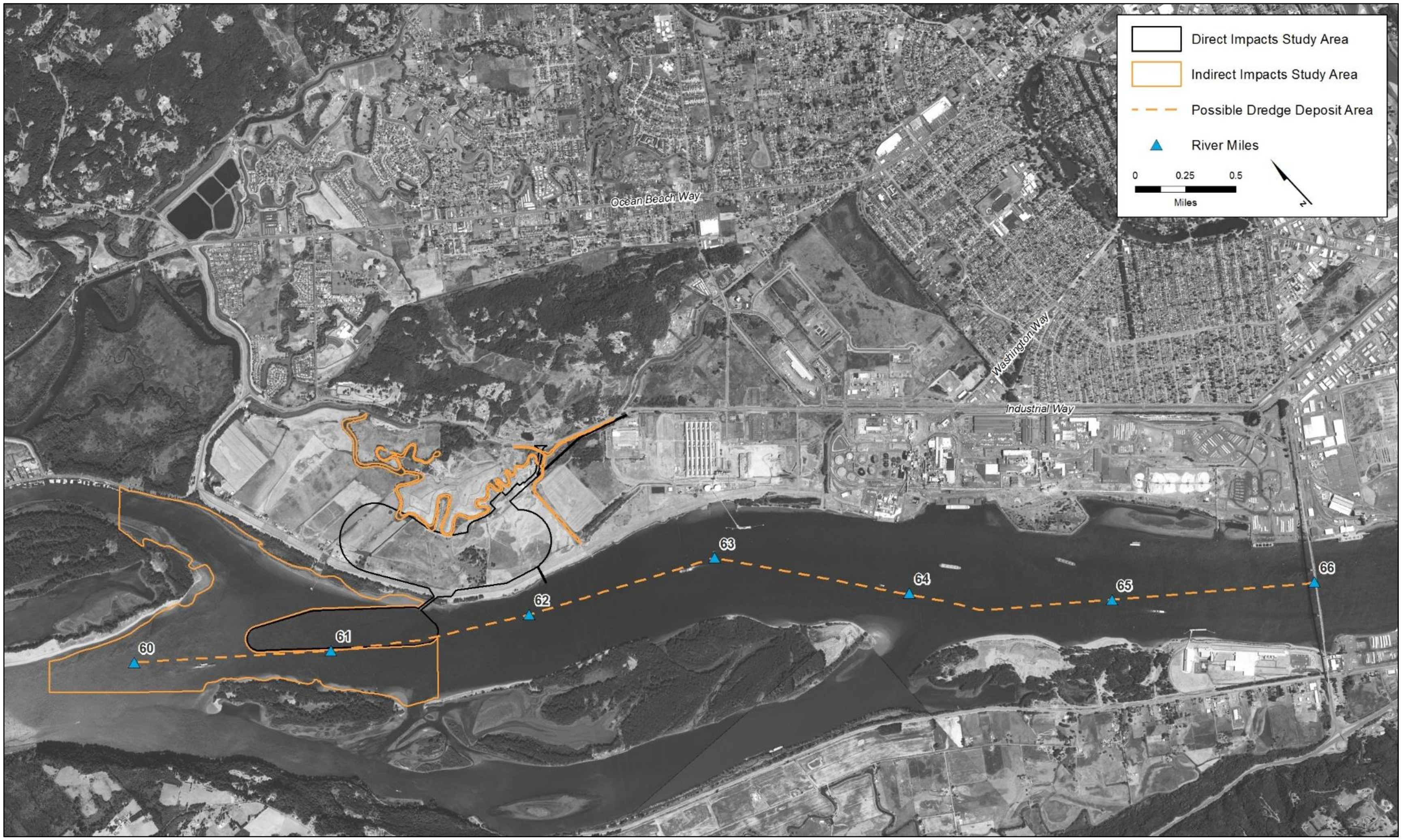
- Reports on baseline water conditions at the project area and Columbia River (Anchor QEA 2011; Oregon Department of Environmental Quality 2012; Washington State Department of Ecology 2014; Grette 2014a, 2014b, 2014c; URS Corporation 2014)
- Reports on the salmon populations in the Columbia River (Ewing 1999; National Marine Fisheries Service 2011)
- Report on toxics in the Columbia River (U.S. Environmental Protection Agency 2009)
- Reports on beneficial and recreational uses of the Columbia River (Oregon Department of Environmental Quality 2003; Oregon State Marine Board 2012)

5.5.3.2 Impact Analysis

The following methods were used to evaluate the potential impacts of the proposed export terminal on water quality.

The analysis of direct construction impacts was based on a peak construction period, while operations impacts were based on the terminal's nominal maximum throughput capacity (up to 44 million metric tons of coal per year). Potential water quality impacts were evaluated with respect to existing water quality conditions and project-related water usage and discharge. The assessment of impacts also assumes the terminal would comply with all applicable laws and regulations regarding water quality. For direct impacts, the analysis assumes best management practices were incorporated into the design, construction, and operations of the terminal. More information about best management practices can be found in Chapter 8, *Minimization and Mitigation*, and Appendix H, *Export Terminal Design Features*.

Figure 5.5-2. Water Quality Study Area—Off-Site Alternative



5.5.4 Affected Environment

This section describes the affected environment in the study areas related to water quality that could be affected by construction and operation of the proposed export terminal.

5.5.4.1 On-Site Alternative

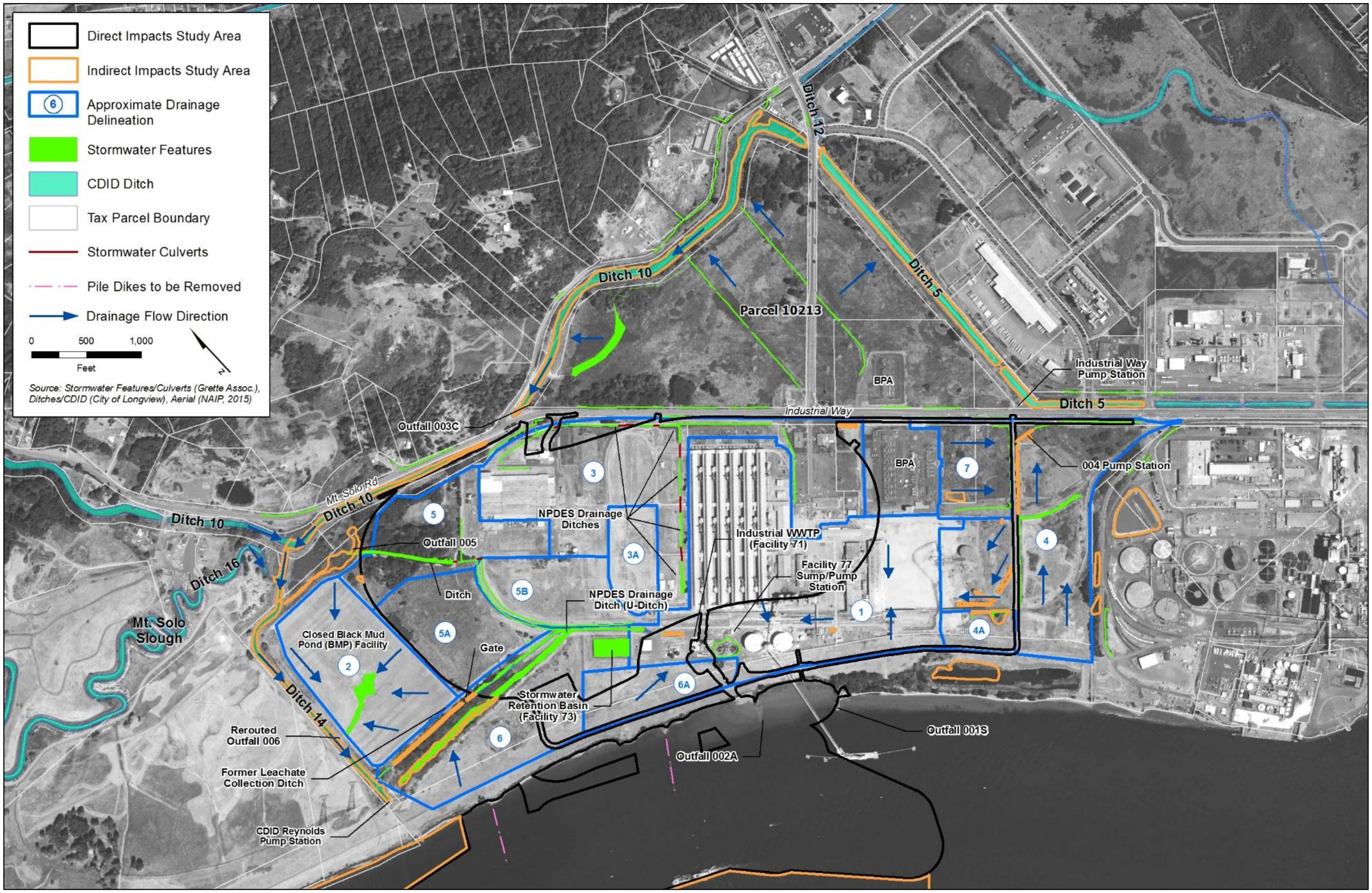
Project Area Characteristics

Drainage

Stormwater and shallow groundwater drainage for the project area are controlled by a system of ditches, pump stations, treatment facilities, and outfalls, shown in Figure 5.5-3. All of these facilities operate under a single NPDES permit. Project area drainage is either held on site until it evaporates, discharged to surrounding CDID #1 ditches (Ditches 10 and 14), or treated and discharged through Outfall 002A to the Columbia River. The following is a brief description of drainage components in the Applicant's leased area.

- **Sheet flow and infiltration.** Subbasins 4A, 5, 5A, 5B, 6A, and 7 receive sheet flow from storm events where it subsequently infiltrates or evaporates.
- **Columbia River discharge.** Subbasins 1, 2, 3A, 4, and 6 are conveyed via pumped systems or gravity to Facility 73, where they are treated and then discharged to the Columbia River via Outfall 002A.
- **CDID #1 discharge.** Subbasin 3 flows through a vegetated ditch that discharges to Ditch 10 through Outfall 003C. During larger storm events, a portion of the flows from Subbasin 2 and Subbasin 5 can discharge to the CDID #1 ditch system. Subbasin 2 overflows the rerouted 006 pump station and is discharged to Ditch14 through Outfall 006. This is a designed overflow system and it is equipped with a high flow alarm to alert staff when it is activated. Subbasin 5 flows can enter a vegetated ditch that discharges to Ditch 10 through Outfall 005. Ultimately, all CDID #1 ditch flows discharge to the Columbia River.
- **Drainage features on Parcel 10213**. These features include three vegetated ditches, two unvegetated ditches, and a shallow stormwater pond. Two of the vegetated ditches run north-south across the two larger portions of Parcel 10213. They are narrow and linear and convey stormwater to a culvert approximately 16 inches in diameter located at the north end of these ditches which then empties into Ditch 10. The third vegetated ditch consists of three segments of linear vegetated ditches adjacent to Industrial Way. These three ditches are connected by two culverts beneath the site's access roads. This feature likely collects stormwater from Industrial Way and adjacent areas and conveys it to Ditch 10.
- One unvegetated ditch runs parallel to Ditch 10 and consists of two sections of a narrow ditch likely constructed to intercept shallow groundwater that was affecting agricultural use of the site. This unvegetated ditch is several feet deep, near vertical along its sides, and is bisected by one of the vegetated ditches that runs parallel across the site; however, there is no surface hydrology connection between these two ditches. The other unvegetated ditch serves as the outlet channel for the stormwater pond. This ditch is located at the northeast end of the stormwater pond and conveys excess stormwater from the pond to Ditch 10 through a 16-inch culvert. All six features are privately owned and are not managed by CDID #1.

Figure 5.5-3. Drainage Features of the On-Site Alternative



Consolidated Diking Improvement District # 1

The project area is served by the CDID #1 system of levees and ditches, which protect the project area from flooding. Water from Ditches 5, 10 and 14 in the study area was tested in 2006, 2011, and 2012 to determine levels of cyanide and fluoride (contaminants associated with the site cleanup). Total suspended solids were also tested. The results showed that water quality standards were met and that there were no exceedances or violations of established Washington State water quality standards (Anchor QEA 2011). The entire CDID #1 ditch system discharges to the Columbia River.

Columbia River

The Columbia River flows along the southwest project area boundary. Near the project area, the river is fresh water but tidally influenced. The project area is located at river mile 63. The river's discharge rate fluctuates with precipitation, snowmelt, and reservoir releases. Flows in the river range from a low of about 63,600 cubic feet per second (cfs) to a maximum flow of about 864,000 cfs depending on conditions in the watershed (U.S. Geological Survey 2014). The Columbia River's annual cycle is driven by snowmelt and general climate of the Pacific Northwest, which produces high flows during the spring snowmelt period and low flows during the late summer and early fall. The river's flow, however, is highly managed through the operations of the many hydroelectric and irrigation dams throughout the basin. The average annual discharge ranges from about 120,000 cfs during a low water year to about 260,000 cfs during a high water year (Washington State Department of Ecology 2016a).

Water Quality Characteristics and Criteria

Designated Beneficial Uses

Designated beneficial uses for a water body, as established in the Clean Water Act, are used to design protective water quality criteria, to assess the general health of surface waters, and to establish thresholds for future permit limits. Table 5.5-2 provides a list of the beneficial uses for the Columbia River as defined by the Washington State Department of Ecology (Ecology) and the Oregon Department of Environmental Quality (Oregon DEQ). A designated beneficial use provides a waterbody's assessed function or utility, and if a waterbody fails to meet the established water quality standards (see *Water Quality Impairments* below), the waterbody's designated use can be adversely affected.

Water Quality Impairments

The Columbia River faces water quality issues that endanger the health of important habitats found throughout the basin. Portions of the Columbia River are considered impaired for a number of water quality factors according to the EPA-approved 303(d) lists for Washington and Oregon. Table 5.5-3 shows the 303(d) listed impairments for water quality factors in the study area. The State of Washington recently finalized the state's 2012 water quality assessment and 303(d) list of impaired waters. According to this 303(d) list, in the study area the Washington State portion of the Columbia River is impaired (i.e., Category 5) for water temperature and bacteria (Washington State Department of Ecology 2016a). In addition, Ditch 5 in the study area is impaired by bacteria. Oregon has listed the Columbia River in the study area as impaired for arsenic, DDE 4,4, and PCB. Arsenic, fecal coliform (indicator bacteria), and dioxin were detected during monitoring of existing outfalls that would drain the project area (Anchor QEA 2014).

Table 5.5-2. Beneficial Uses for the Columbia River

Washington State Department of Ecology[a]	Oregon Department of Environmental Quality[b]
Domestic water supply	Public domestic water supply; private domestic water supply
Industrial water supply	Industrial water supply
Agricultural water supply	Irrigation
Stock water supply	Livestock watering
Spawning/rearing uses for aquatic life	Fish and aquatic life
Harvesting	Fishing; wildlife and hunting
Boating	Boating
Primary contact for recreation uses	Water contact recreation
Commerce/navigation	Commercial navigation and transportation
Aesthetics	Aesthetic quality

Notes:
[a] Washington State Department of Ecology (2012) approved uses for the Columbia River from its mouth to river mile 309.3.
[b] Oregon Department of Environmental Quality (2003) approved uses for the Columbia River from its mouth to river mile 86 (2003).

Table 5.5-3. 303(d) Listed Impairments for Surface Waters in the Study Area

Parameter	Washington		Oregon[c]
	Columbia River	Ditch 5	Columbia River
Arsenic	-	-	5
Bacteria	5[a]	-	-
DDE 4,4	-	-	5
Dioxin (2,3,7,8-TCDD)	-	-	4A[b]
Dioxin	4A[b]	-	-
Dissolved Oxygen	-	5	-
PCB	-	-	5
Temperature	5		
Total dissolved gas	-	-	4A[b]

Notes:
[a] Category 5 waters are impaired 303(d) waters, which means water quality standards have been violated for one or more pollutants and a TMDL or other water quality improvement is required.
[b] Category 4A listing indicates a TMDL has been developed and is actively being implemented.
[c] Oregon 2012 303(d) list is pending approval from EPA. The 2010 effective list for this segment of the Columbia River is the same as the 2014 list that is pending approval by EPA.
Sources: Washington State Department of Ecology 2016b; Oregon Department of Water Quality 2012
DDE = Dichlorodiphenyldichloroethylene; TCDD = Tetrachlorodibenzo-p-dioxin; PCB = polychlorinated biphenyl

Sediment sampling from within, adjacent to, and upstream of the project area (to approximately river mile 68) has demonstrated that in deepwater areas of the Columbia River, sediments are typically composed of silty sands with a low proportion of fines (i.e., silt, mud, or fine sediment) and very low total organic carbon. Further, sediments sampled from deepwater areas in the vicinity of the project area have consistently met suitability requirements for flow lane disposal or beneficial use in the Columbia River (Grette 2014b: Appendix B). Sediment testing performed by the Applicant in the project area has revealed no exceedance of sediment-management standards at any nearshore or offshore location, except for in a localized area immediately adjacent to the existing Outfall 002A. Testing criteria were exceeded at one location downstream of the outfall, but did not exceed criteria for human health protection (Anchor QEA 2014 in Grette 2014b: Appendix B). The distribution of contamination was limited in area and depth to an isolated layer 6 inches thick, and the contamination source was identified as an historical discharge and not the result of an ongoing release (Grette 2014b: Appendix B).

The water quality impairments in the study area result from a variety of practices throughout the Columbia River basin that degrade water quality, primarily human activities. Elevated water temperatures, increased nutrient loading, reduced dissolved oxygen, and increases in toxic contaminants in the watershed pose risks to fish and wildlife, as well as to humans. Sources of these contaminants include agricultural practices, urban and industrial practices, and riparian practices (National Marine Fisheries Service 2011). Additional information on the general baseline conditions for the broader Columbia River basin as well as the lower Columbia River and Estuary can be found in the *NEPA Water Quality Technical Report* (ICF International 2016).

5.5.4.2 Off-Site Alternative

Project Area Characteristics

Drainage

Stormwater and shallow groundwater drainage for the Off-Site Alternative project area is managed by infiltration and evaporation with overflow directed to the CDID #1 ditches via a network of small excavated conveyance ditches and Mount Solo Slough (Figure 5.5-4) (see Section 5.4, *Groundwater,* for further information on groundwater). The conveyance ditches flow toward Mount Solo Slough, which discharges to Ditch 14, where water is eventually pumped to the Columbia River by the CDID #1 system. The stormwater is not managed under an NPDES permit. Surface water features on or adjacent to the project area include the Columbia River, Mount Solo Slough, and Ditches 10, 14, and 16.

Mount Solo Slough

Mount Solo Slough forms the northern boundary of the project area and is near the closed Mount Solo Landfill. It is a highly meandering drainage that connects to Ditch 14 to the east and Ditch 16 to the north, both of which connect to Ditch 10.

Consolidated Diking Improvement District #1

The project area is in CDID #1, same as described for the On-Site Alternative. The study area includes CDID Ditch 14, Ditch 10, and Ditch 16. Ditch 14 crosses a short section of the eastern portion of the project area (for the rail access extension), just south of its confluence with Ditch 10. Ditch 16 extends between the northern end of Mount Solo Slough and Ditch 10, which runs along Mt. Solo Road.

Columbia River

The Columbia River characteristics are the same as described for the On-Site Alternative.

Figure 5.5-4. Drainage Features for the Off-Site Alternative

Water Quality Characteristics and Criteria

All water quality impairments for the Columbia River in the study area are the same as described for the On-Site Alternative study area. There are no additional surface waters in the Off-Site Alternative study area listed on Washington's list of 303(d) impaired waters.

5.5.5 Impacts

This section describes the potential direct and indirect impacts related to water quality resulting from construction and operation of the proposed export terminal.

5.5.5.1 On-Site Alternative

This section describes the potential impacts on water quality as a result of construction and operation of the terminal at the On-Site Alternative location.

Construction activities potentially affecting water quality include the following.

- Ground disturbance associated with construction
- Delivering, handling, and storing construction materials and waste
- Using heavy construction equipment
- In- and above-water work and dredging activities and disposal
- Demolishing existing structures
- Preloading ground for coal stockpiles

Operational activities potentially affecting water quality include the following.

- Coal spills from rail and vessel loading and unloading
- Transport of airborne fugitive coal dust from stockpiles or rail cars
- Operating and maintaining heavy equipment and machinery
- Maintenance dredging and disposal
- Operation of 16 trains a day
- Operation of 70 ships a month

Construction—Direct Impacts

Construction projects in Washington State involving clearing, grading, and excavating activities that disturb 1 or more acres and discharge stormwater to surface waters of the state are required to obtain an NPDES Construction Stormwater General Permit from Ecology. Prior to the issuance of permits, sites with known contaminated soils or groundwater are required to provide a list of contaminants with concentrations, depths found and boring locations shown on a map with an overlay of where excavation or construction may occur. Additional alternative best management practices may be necessary based on the contaminants and how contaminated construction stormwater would be treated. The permit requires preparing a Temporary Erosion and Sediment Control Plan (TESC), a Construction Stormwater Pollution Prevention Plan (SWPPP) and best management practices to avoid and minimize the risk of erosion. Guidance for the design and implementation of these best management practices would be sourced from the Ecology *2012 Stormwater Management Manual for Western Washington* (Washington State Department of Ecology 2014) including but not limited to those developed by the Applicant. These measures were considered when evaluating the potential direct impacts associated with construction.

Surface Water

Construction would include ground-disturbing activities that expose soils and generate soil stockpiles. Rain could erode soil and carry it to adjacent waterways (e.g., Columbia River and CDID #1 ditches) and temporarily increase turbidity. However, the potential for erosion during most ground-disturbing activities is considered low because the project area is relatively level and appropriate erosion and sediment control measures would be required by regulatory agencies. Runoff from the project area would be required to meet the terms and conditions of all permits issued for the On-Site Alternative; thus, water quality conditions would be expected to be maintained and construction would not cause a measurable impact on water quality or affect designated beneficial uses.

Contaminants Associated with Equipment and Material Use

Handling construction materials and operating construction equipment have the potential to introduce pollutants such as fuel, oil, hydraulic fluid, grease, paints, solvents, and cleaning agents and could degrade water quality if improperly handled. Construction waste such as metal, welding waste, and uncured concrete can also degrade water quality and be harmful to aquatic organisms (Washington State Department of Ecology 2014).

Development and implementation of a site-specific construction SWPPP, including best management practices for material handling and construction waste management, would reduce the potential for water quality impacts from these sources. Typical SWPPP best management practices that would help prevent releases to surface waters include the following.

- All fuel and chemicals would be stored and handled properly to ensure no opportunity for entry into the water.
- No land-based construction equipment would enter any shoreline body of water except as authorized.
- Equipment would have properly functioning engine closures (i.e., hydraulic, fuel, lubricant reservoirs) according to federal standards; the contractor would inspect fuel hoses, oil or fuel transfer valves, and fittings on a regular basis for drips or leaks to prevent spills into the surface water.
- The contractor would have a spill containment kit on site, including oil-absorbent materials, to be used in the event of a spill or if any oil product is observed in the water.

If a spill were to occur during construction, the amount is likely to be relatively small (typically less than 50 gallons), and response time would be relatively quick. A fuel truck would visit the site as needed. The frequency would vary based on usage and could range from once or twice per day to once or twice per week. The trucks would have a capacity of 3,000 to 4,000 gallons. A spill could have potential impacts on water quality if the spill were to reach surface waters, which could affect aquatic species and habitats (see Sections 5.7, *Fish,* and 5.8, *Wildlife,* for additional information on this potential impact).

Construction activities would involve preloading and installing of vertical wick drains to aid in the consolidation of low consistency silt and low-density sand (i.e., unconsolidated materials). Wick drains would direct groundwater from the shallow aquifer upward toward the surface during preloading, where it would discharge. Water discharged from the wick drains would be captured, tested for contaminants, and treated prior to discharge to any surface waters. Refer to Section 5.4 *Groundwater*, for further information regarding water discharged from wick drains.

Pollutants and Turbidity

Construction of the proposed terminal would require dredging an estimated 500,000 cubic yards of sediment from the river to provide berthing at Docks 2 and 3. The work necessary to construct the approach trestle and Docks 2 and 3 would require in-water work that could resuspend pollutants and sediment and increase turbidity. Dredging would permanently deepen a 48-acre area to a target depth of -43 feet Columbia River Datum (CRD) with a 2-foot overdredge allowance. The deepening would require dredging depths of up to 16 feet (vertically) of sediment. The dredging permit would require testing of the sediment and suitability determination for flow lane disposal.

Dredging and in-water work would result in temporary increases in suspended sediments and turbidity. As described previously in Section 5.5.4, *Affected Environment*, 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 2014c). Thus, sediment in the dredge prism for Docks 2 and 3 would likely be deemed suitable for flow lane disposal or beneficial use in the Columbia River. However, prior to obtaining a permit for 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 2014c). If flow lane disposal is approved, the disposal area for dredged materials would require approximately 80 to 110 acres. The actual acreage and specific location of the disposal site would be determined by the permitting agencies.

Standard best management practices for working in aquatic areas would be followed to maintain acceptable construction water-quality conditions, including but not limited to maintaining appropriate standards for construction-related turbidity (including during active dredging and flow lane disposal), minimizing the risks of unintended discharges of materials such as fuel or hydraulic fluid, and managing construction debris. In addition, typical construction best management practices for working over, in, and near water would be applied.

Construction of the approach trestle and Docks 2 and 3 would require both in-water and over-water work. In-water work windows would be scheduled to avoid and minimize impacts on various natural resources, most notably federally protected fish species (Section 5.7, *Fish*). In-water construction would primarily involve dredging, pile-driving, and removal of pile dikes and would use barge-based equipment and purpose-built vessels, although some work would likely be supported from land. A total of 610 of the 630 36-inch-diameter steel piles required for the trestle and docks would be placed below the ordinary high water mark, permanently removing an area equivalent to 0.10 acre (4,312 square feet) of river bottom. The construction would also remove 225 feet of the deepest portion of timber pile dikes (Grette Associates 2014a).

Some sediments disturbed during dredging activities would be expected to move down current and monitoring requirements would be identified in the dredge permit. The period of increased turbidity at the project area is anticipated to be relatively brief, as the bed material is primarily silty sands with low proportions of fines and organic material, thus reducing the potential to increase turbidity as compared to silty mud or sediments with high concentrations of organic material.

Release of creosote could occur from the removal of existing creosote-treated timber piles associated with two pile dikes. Creosote is composed of more than 300 chemicals, including polyaromatic hydrocarbons (PAHs), which have been shown to be fatal to marine life (Washington State Department of Natural Resources 2008). Creosote contamination could be exacerbated by removing piles buried in a zone generally depleted of oxygen and water, which leaves the creosote highly volatile when re-exposed to water. Droplets of previously unexposed creosote would be released from the piling into the surrounding sediments.

The removal of creosote-treated piling would result in temporary suspension of sediments and a potential long-term increase in the exposure of creosote in the project area. To minimize this impact, the contractor will follow the following standard best management practices for removal of creosote-treated wooden piles.

- **Pile removal.** If possible, the contractor will use vibratory extraction, the preferred method of pile removal. A creosote release to the environment could occur if equipment (bucket, steel cable, vibratory hammer) pinches the creosoted piling below the water line. Therefore, the contractor would keep the pile extraction equipment out of the water to the extent practicable to remove the piling. Cutting would be necessary if the pile were to break off at or near the riverbed, which means it could not be removed without excavation. Pile cutoff would be an acceptable alternative if vibratory extraction or pulling were not feasible. The piling would be cut 2 feet below the riverbed, and the subsequent hole would be capped/filled with clean sand.
- **Disposal of creosote treated piling, sediment, and construction residue.** The contractor would place the pulled pile in a containment basin to capture any adhering sediment immediately after the pile is removed. Containment basins typically have continuous sidewalls and controls as necessary (e.g., straw bails, oil absorbent boom, plastic sheeting) to contain all removed materials and prevent reentry into the water. The type and location (e.g., barge, land) of the containment basin would be determined when the contractor's work plan is developed. Cut-up piling, sediments, construction residue, and plastic sheeting from the containment basin would be packed into a container and disposed of at a facility in compliance with federal and state regulations.

Above-water work would include installing the pile-supported elements of the dock structures and coal-handling infrastructure and equipment. Some concrete components (such as the dock decking, crane rail supports, and pile caps) would need to be cast in place. Appropriate techniques and best management practices, such as the use of a bib, would minimize the potential for wet or uncured concrete to come in contact with the Columbia River.

Materials handling infrastructure and equipment, such as shiploaders and conveyors, would be delivered by barge and offloaded by crane directly to the docks and trestle. Barges would not offload materials or equipment to any area below the ordinary high water mark of the Columbia River. As much as practicable, infrastructure would be prefabricated so above-water work would consist largely of installation and assembly.

Impacts on water quality from in- and over-water work would be addressed in the Water Quality Monitoring and Protection Plan to be prepared by the Applicant. Impacts on water quality from dredging would be minimized with the preparation and implementation of a dredging plan in compliance with the dredged material management program (DMMP) as required by state agencies (Ecology and Washington State Department of Natural Resources) and federal agencies (the Corps and EPA). Adhering to a plan developed in compliance with DMMP would minimize water-quality impacts, ensuring potential impacts are temporary and localized in nature. No long-term changes in the baseline conditions in the study area would be expected to occur.

Hazardous or Toxic Materials

Demolition of the existing structures (cable plant building, potline buildings, and small ancillary structures) in the project area has the potential to affect water quality by disturbing soil or building parts and debris containing hazardous or toxic materials such as asbestos, lead, and concrete dust, which could cause harm to aquatic environments and organisms. This impact would be minimized by the collection and removal of all concrete and other structural debris and the collection and treatment of all stormwater from the site prior to discharge to surface waters. The implementation of best management practices in compliance with the NPDES Construction Stormwater General Permit would be obtained for the On-Site Alternative, which would reduce the potential for demolition-related pollutants to enter and contaminate surface waters. Overall, the demolition activities associated with the On-Site Alternative would not cause a measurable impact on water quality or biological indicators, or affect designated beneficial uses.

Construction—Indirect Impacts

Construction of the terminal at the On-Site Alternative location would not result in indirect impacts on water quality because construction impacts would be limited to the project area and would not occur later in time or be farther removed in terms of distance than the direct impacts.

Operations—Direct Impacts

Operation of the proposed export terminal at the On-Site Alternative location would result in the following direct impacts.

Contaminants

Stormwater would be managed in accordance with the requirements of a new NPDES Industrial Stormwater Permit obtained for water-management facilities of the proposed export terminal. Contaminants such as oil and grease, coal dust, and other chemicals could accumulate on the ground and surfaces and become constituents of site stormwater. All stormwater runoff would be collected for treatment before reuse or discharge to the Columbia River. Coal particulates would be removed from stormwater by allowing the coal dust to settle out in stormwater ponds. The coal dust would be removed from the stormwater ponds and placed back in the coal stockpile area during regular maintenance of the stormwater ponds. Other solids accumulated in the treatment systems not acceptable for reuse would be periodically collected and disposed of at an appropriate off-site disposal site.

As mentioned in Section 5.5.4, *Affected Environment*, arsenic, fecal coliform (indicator bacteria), and dioxin were detected during monitoring of existing outfalls that would drain the project area (Anchor QEA 2014). These pollutants may continue to be introduced as a result of the On-

Site Alternative, although maximum reported outfall concentrations for these pollutants fall below established water-quality standards. Continued discharges at existing levels would not cause a measureable increase in chemical indicators in the Columbia River and would not cause a measurable impact on water quality or biological indicators or affect designated beneficial uses. Any changes in concentrations of these pollutants that may occur during operations would be addressed under the NPDES Industrial Stormwater Permit to ensure water quality standards continue to be met post discharge to the Columbia River.

Operations—Indirect Impacts

Operation of the proposed export terminal at the On-Site Alternative location would result in the following indirect impacts.

Contaminants from Coal Spills and Coal Dust

Coal and coal dust could enter the Columbia River directly or via the surrounding drainage channels from accidental spills during loading or through airborne transport of coal dust during operations. The extent of average annual coal dust deposition was modeled and mapped (Chapter 6, Section 6.7, *Coal Dust*, Figure 6.7-3). Coal dust is anticipated to deposit a maximum of 1.45 grams per square meter per year (g/m^2/year) adjacent to the proposed export terminal, including Docks 2 and 3 in the Columbia River. This amount of deposition is well below the nuisance level, which is defined as the level of dust deposition that affects the aesthetics, look, or cleanliness of surfaces. Additional information on these deposition levels is provided in Chapter 6, Section 6.7, *Coal Dust*, and the spatial extent of the maximum annual coal dust deposition near the project area is shown in Figure 6.7-3.

At sufficient quantities, coal and coal dust in marine and estuarine environments have similar adverse effects as elevated levels of suspended sediments on water quality (Ahrens and Morrisey 2005). During periods of lower flow, a smaller amount of coal dust could have a greater impact on water quality. Impacts include increased turbidity, which can interfere with photosynthesis and increase water temperatures (Ahrens and Morrisey 2005). Coal and coal dust in the water column can also affect marine organisms through abrasion of tissue and smothering and clogging of respiratory and feeding organs (Ahrens and Morrisey 2005). However, at a maximum deposition rate of 1.45 g/m^2/year adjacent to the project area, and at the minimum flow[1] recorded over the 23-year period of record for 1 day, coal dust deposition directly into the river assumed to be an area of approximately 3 million square meters (1.16 square miles) in the study area would result in a change in suspended sediment concentration of less than 1 part per 10 billion (0.000075 milligrams per liter [mg/L]). This change would not be measureable and is not anticipated to increase turbidity or water temperature, or affect marine organisms.

Coal and coal dust captured in stormwater (e.g., from precipitation that falls on the stockpile areas, water used for dust suppression) would be collected within the stockpile pads (low permeable surfaces allowing minimal infiltration), conveyed within an enclosed stormwater system, and treated at Facility 73 in settling ponds before being discharged from the site. Some settled coal dust from the project area could discharge to the Columbia River through the CDID

[1] The minimum recorded flow at the Columbia at Beavery Army Terminal, Quincy, Oregon, is 65,600 cubic feet per second (1969 to 2014).

#1 system. If coal dust from the project area accumulated without being disturbed throughout the dry season (assumed to be 120 days), the anticipated change in suspended sediment concentration in the Columbia River within the study area for the minimum recorded flow over 1 day would be 0.0192 mg/L). This change would not be measureable and likely would not increase turbidity or water temperature, or affect marine organisms. The proposed export terminal would employ dust suppression systems throughout the terminal, including the tandem rotary dumpers, all conveyors, stockpile pads, surge bins, transfer towers, and trestle. Approximately 4,900 linear feet of the 16,100 linear feet of conveyor belts would be enclosed, as would the shiploaders, to limit the release of coal dust. The dust suppression system would employ sprayers, sprinklers and foggers to capture coal dust. Dust suppression water would be collected and conveyed through the stormwater collection, conveyance and treatment system. Once treated, the water would either be reused or, if not needed, discharged to the Columbia River. All water discharged to the Columbia River would be required to meet specific water quality standards that would be outlined in the NPDES permit, prior to discharge.

Coal contains trace amounts of toxic elements, but coal it is a naturally occurring substance that has not been identified to be toxic or hazardous. Coal has a heterogeneous chemical composition; therefore, specific impacts related to the toxic contaminants of coal are highly dependent on coal composition and source (Ahrens and Morrisey 2005). The majority of coal transloaded at the proposed terminal is expected to be mined in the Powder River Basin, with lesser amounts of coal being sourced from the Uinta Basin in Utah and Colorado. Trace elements of environmental concern (TEEC) in Powder River and Uinta Basin coal include antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, selenium, and uranium. Table 5.5-4 presents the average concentrations of each TEEC sampled in parts per million. However, at a maximum coal dust deposition rate of 1.45 g/m^2/year adjacent to the project area and at the minimum flow recorded over the 23-year period of record for 1 day, TEEC deposition directly into the Columbia River assumed to be an area of approximately 3 million square meters (1.16 square miles) in the study area would result in unmeasurable changes in concentration for each of the elements of concern on the order of 0.0000000000001 to 0.000000000000001 g/L, or 0.0000001 to 0.000000001 ppb. If coal dust from the project area accumulated without being disturbed throughout the dry season (assumed to be 120 days long), the anticipated change in TEEC concentration for the minimum recorded flow over one day would be on the order of 0.0000000001 to 0.000000000001 g/L, or 0.0001 to 0.000001 ppb. Again, this change would not be measureable and is not anticipated to affect human health or affect marine organism functions (respiration, feeding).

Table 5.5-4. Average Concentration of Trace Elements in Wyodak and Big George Coalbeds, Powder River Basin, Wyoming and Miscellaneous Uinta Basin Coalbeds in Colorado Plateau

Trace Element of Environmental Concern	Average Concentration in Sampled Coal (ppm)	
	Powder River Basin[a,b]	Uinta Basin[b]
Antimony	0.10	0.7
Arsenic	1.43	2.2
Beryllium	0.18	1.5
Cadmium	0.06	0.1
Chromium	2.63	6.1
Cobalt	1.93	2.0
Lead	1.26	13.9
Manganese	10.05	28.2
Nickel	1.58	4.5
Selenium	0.57	1.4
Uranium	0.46	1.8

Notes:
[a] U.S. Geological Survey 2007.
[b] Pierce and Dennen 2009.

Toxic constituents of coal include PAHs and trace metals, which are present in coal in variable amounts and combinations dependent on the type of coal. The coal type, along with mineral impurities in the coal and environmental conditions determine whether these compounds can be leached from the coal. Some PAHs are known to be toxic to aquatic animals and humans. Metals and PAHs could also potentially leach from coal to the pore water of sediments. One review of coal dust's chemical composition (U.S. Geological Survey 2007) suggests 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 are not easily leached. Furthermore, the type of coal anticipated to be exported from the proposed export terminal is alkaline, low in sulfur and trace metals and the conditions to produce concentrations in pore waters are not present in a dynamic riverine environment. This would further support the view of Ahrens and Morrisey (2005) that the bioavailability of such toxins would likely be low.

In summary, coal dust from operations of the terminal is not expected to have a demonstrable effect on water quality. Additionally, the potential risk for exposure to toxic chemicals contained in coal (e.g., PAHs and trace metals) would be relatively low as these chemicals tend to be bound in the matrix structure and not quickly or easily leached.

Coal spilling into the Columbia River could occur during vessel loading operations. Cleanup efforts would be implemented quickly and it would be expected the majority of the spilled coal would be recovered. Toxic chemicals in coal tend to be bound to the matrix structure of the coal and not quickly or easily leached and would not, therefore, be expected to result in a substantial increase in chemical indicators in the Columbia River. They would also not be expected to cause a measurable impact on water quality or biological indicators, or affect designated beneficial uses.

Contaminants from Maintenance and Operations

Potential contaminants, including diesel fuel, oils, grease, and other fluids would be required for the operation and maintenance of heavy equipment and machinery used to transport, store, move, and load coal at the proposed terminal. Normal operations and maintenance activities would not result in a direct discharge of pollutants or process water into surface water. Most operation-related impacts would result from inadvertent spills of potentially hazardous materials, such as petroleum products or industrial solvents, either directly into surface waters or in locations where they could be transported and discharged to surface water or groundwater. While a release would likely be relatively small (less than 50 gallons), locomotives have a fuel capacity of 5,000 gallons and could also release fuel during operations. Also, fuel trucks would visit the site as often as once or twice per day. Fuel trucks typically have a 3,000- to 4,000-gallon capacity. A spill that occurred in the project area would be contained, conveyed and treated within the proposed stormwater system and not be discharged to surface waters outside the project area. The Applicant would be required to manage contaminated stormwater in accordance with the requirements of the NPDES Industrial Stormwater Permit.

Maintenance dredging for Docks 2 and 3 would be expected to occur every few years. Maintenance dredging impacts on water quality would be similar to those discussed for dredging during construction, but to a lesser magnitude because maintenance dredging volumes would be considerably smaller than the initial dredging action during construction. A dredging plan, as discussed previously for construction dredging, would be prepared for each future maintenance dredging project.

Small scale maintenance dredging could be needed more frequently, especially in the early years following the initial dredging work when higher-than-normal accretion is more likely (WorleyParsons 2012). Similar to construction-related dredging, changes in study area conditions likely would not persist as a result of maintenance dredging.

Contaminants from Shipping Vessels or Rail Transport

Coal would be transported to the proposed export terminal via rail, then loaded onto vessels and transported to its final destination in Asia. Water quality could be indirectly affected as a result of transportation of coal within the study area. Details regarding vessel operations are available in Chapter 6, Section 6.4, *Vessel Transportation*. Details regarding a release of hazardous materials during rail operations and collision or derailment are discussed in Chapter 4, Section 4.6, *Hazardous Materials*.

- **Propeller wash.** Propeller wash increases the potential for scour and erosion of the sides and bottom of the navigation channel, as well as a temporary, localized increase in turbidity. While pilot vessels maneuvering near Docks 2 and 3 could cause erosion, cargo vessels would be more likely to create turbulence that could erode bottom sediments because the large propellers on these ships are closer to the river bottom as they travel the Columbia River. The propeller wash from tugboats would be nearer the surface and have less potential to result in scour or erosion of bottom sediments. The likelihood of temporary, localized increases in turbidity resulting from propeller wash is considered low based on the amount of dredging anticipated to be required to accommodate vessels at Docks 2 and 3. The dredge prism would tie into the navigation channel, thus reducing the potential for propeller wash during vessel movements at Docks 2 and 3. Vessels calling at Docks 2 and 3 would have sufficient depth to minimize propeller wash. Any increase in turbidity would be temporary and localized and not expected to be measurable beyond the study area.

- **Ballast water.** Ballast water could contain materials that degrade surface waters. Common contaminants include invasive marine plants and animals, bacteria, and pathogens that could harm or displace native aquatic species. However, the likelihood of such occurrences is considered low since state and federal regulations control the discharge and water quality of ballast water. Oversight of federal ballast water regulations is provided by the U.S. Coast Guard and EPA, while Washington State regulations are administered by the Washington Department of Fish and Wildlife. Discharge of ballast water into waters of the state is not allowed unless there has been an open sea exchange (replacing coastal water with open-ocean water to reduce the density of coastal organisms) or the vessel has treated its ballast water to meet state and federal standards set by the U.S. Coast Guard (33 USC 1251–1387).
- **Spills from vessel.** Coal and fuel spills could occur if the cargo tanks on a vessel are ruptured during such events as a grounding or collision; however, the potential for a vessel rupture incident is low. Chapter 6, Section 6.4, *Vessel Transportation*, evaluates the risk of vessel-related incidents. Chapter 4, Section 4.6, *Hazardous Materials*, also discusses actions to be taken for emergency response and cleanup. A spill from a vessel could have substantial potential impacts on water quality based on the location, quantity spilled, and response actions taken.
- **Day-to-day rail operations.** Day-to-day rail operations could release contaminants to stormwater, including coal dust, metals, hydraulic and brake fluid, oil, and grease from track lubrication. As discussed in Chapter 4, Section 4.6, *Hazardous Materials*, if a release of hazardous materials were to occur, the rail operator would implement emergency response and cleanup actions per Federal Railroad Administration requirements and state law, including Washington State regulations under Revised Code of Washington (RCW) 90.56.
- **Spill from collision or derailment of train.** Fuel or hazardous material spills could occur if trains or rail cars collide or derail. As discussed in Chapter 4, Section 4.6, *Hazardous Materials*, if a release of hazardous materials were to occur, the rail operator would implement emergency response and cleanup actions as required by the Federal Railroad Administration and state law, including Washington State regulations under RCW 90.56. Spills of coal from a rail car could affect water quality based on the location, quantity spilled, and response actions taken.

5.5.5.2 Off-Site Alternative

Potential impacts on water quality from construction and operation of the proposed export terminal at the Off-Site Alternative location are described below.

Construction—Direct Impacts

Construction-related activities associated with the Off-Site Alternative could result in direct impacts as described below. Construction of the Off-Site Alternative would be similar to the On-Site Alternative, and impacts would be expected to also be similar. Substantive differences are identified below.

Surface Water Turbidity

The Off-Site Alternative would disturb a smaller area of soil than the On-Site Alternative. The smaller area would result in lower volumes of sediment potentially being mobilized and discharged to surface waters. Like the On-Site Alternative, this potential impact would be temporary and last only for the duration of construction.

Contaminants Associated with Equipment and Material Use

Impacts on water quality associated with equipment and material use would be similar to the On-Site Alternative. Runoff from the project area during construction would be required to meet the terms and conditions of all permits issued for the Off-Site Alternative; thus, water quality conditions would be expected to be maintained and temporary release of contaminants associated with equipment and material use during construction is not be expected to cause a measurable effect on water quality or affect designated beneficial uses.

Pollutants or Turbidity

The Off-Site Alternative would involve dredging an estimated 50,000 cubic yards of material from the Columbia River compared to the 500,000 cubic yards for the On-Site Alternative. This smaller volume of dredged material would likely require less dredging time, resulting in a shorter period of temporary impact on water quality compared to the On-Site Alternative.

Hazardous or Toxic Materials

Current land use at the Off-Site Alternative location is substantially different than the On-Site Alternative and, therefore, potential for pollution related to demolition would not be the same. The Off-Site Alternative project area is primarily vegetated and does not have an existing facility that would need to be demolished like the On-Site Alternative. Further, no existing hazardous or toxic materials are known to occur at the Off-Site Alternative project area. Therefore, this potential impact is not anticipated to occur to the extent it could under the On-Site Alternative.

Construction—Indirect Impacts

The Off-Site Alternative would not result in indirect impacts on water quality because no impacts would occur later in time or farther removed in distance from the contamination site.

Operations—Direct Impacts

Direct impacts on water quality associated with introducing contaminants from coal spills and coal dust, maintenance and operations, and stormwater runoff would be similar to the impacts described for the On-Site Alternative. Contaminants in stormwater runoff could reach surface water and degrade water quality. However, stormwater would be managed in accordance with the requirements of a new NPDES Industrial Stormwater Permit obtained for water-management facilities of the proposed export terminal to ensure water quality standards are met prior to discharge to any surface water.

Operations—Indirect Impacts

Indirect operations impacts on water quality associated with introduction of contaminants from coal spills and coal dust, maintenance and operations, and shipping vessels or rail transport would be similar to the impacts described for the On-Site Alternative.

Contaminants from Coal Spills and Coal Dust

Coal dust is anticipated to deposit a maximum of 1.83 g/m^2/year in the direct and indirect impacts study areas, including the Columbia River within these study areas. This amount of deposition is still well below the nuisance level, as described in Chapter 6, Section 6.7, *Coal Dust*. Coal dust from operations of the terminal is not expected to have a measureable impact on water quality. Additionally, the potential risk for exposure to toxic chemicals contained in coal (e.g., PAHs and trace metals) would be relatively low as these chemicals tend to be bound in the matrix structure and not quickly or easily leached.

Contaminants from Maintenance and Operations

A contaminant spill during maintenance and operations could reach a surface water. However, inadvertent spills in the project area would be contained and conveyed and treated within the proposed stormwater system; they would not be discharged to surface waters outside the project area. Maintenance dredging impacts on water quality would be similar to those discussed for the On-Site Alternative.

Contaminants from Shipping Vessels or Rail Transport

Potential contaminant spills, propwash impacts, and ballast impacts related to shipping vessels and rail transport would be temporary and minimized through the appropriate state and federal regulations specific to each of these potential impacts.

5.5.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. The following discussion assesses the likely consequences of the No-Action Alternative related to water quality.

If existing industrial activities are expanded and additional land developed, impacts on water quality could be similar to those described for the On-Site Alternative regarding potential oil and grease spills from equipment or other raw materials shipped from the terminal but the magnitude would be less compared to the On-Site Alternative. The existing NPDES permit would remain in place, maintaining the water quality of existing stormwater discharges. Maintenance dredging at Dock 1 would likely continue, with dredging occurring every 2 to 3 years. Any new or expanded industrial uses would likely trigger a new or modified NPDES permit. Buildings could be demolished and replaced for new industrial uses. Any new impervious surface area would generate stormwater, but all stormwater would be collected and treated to meet state and federal water quality requirements prior to discharge to the Columbia River. Thus, potential impacts related to water quality under the

No-Action Alternative would be similar to what is described for the On-Site Alternative, but the extent of the impact would depend on the proposed export terminal.

5.5.6 Required Permits

The following required permits are expected to reduce impacts on water quality.

- **NPDES Construction Stormwater General Permit—Washington State Department of Ecology**. Construction would result in more than 1 acre of ground disturbance and would require a construction stormwater general permit.
- **NPDES Industrial Stormwater Permit—Washington State Department of Ecology**. The On-Site Alternative and Off-Site Alternative would result in industrial activities such as the operation of a transportation facility or bulk station and terminal and would require an industrial stormwater permit.
- **Clean Water Act Section 404—U.S. Army Corps of Engineers**. Construction of the proposed terminal requires Department of the Army authorization from the Corps under Section 404 of the Clean Water Act.
- **Clean Water Act Section 401—Washington State Department of Ecology**. An Individual Water Quality Certification from Ecology under Section 401 of the Clean Water Act and an NPDES permit under Section 402 of the Clean Water Act would also be required for construction of the On-Site Alternative and Off-Site Alternative. Additional details regarding the permitting process related to the Clean Water Act can be found in the *NEPA Water Quality Technical Report*.
- **Rivers and Harbors Act—U.S. Army Corps of Engineers**. Construction of the proposed terminal would require Department of the Army authorization from the Corps under Section 10 of the Rivers and Harbors Act. 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 in, over, or under navigable waters, and any work affecting the course, location, condition, or capacity of those waters.
- **Hydraulic Project Approval—Washington Department of Fish and Wildlife**. The On-Site Alternative and Off-Site Alternative would require a Hydraulic Project Approval from WDFW. 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 project-related dredging activities and other project-related in-water work.

5.6 Vegetation

Vegetation is the foundation of most aquatic and terrestrial ecosystems. Among other functions, plants release oxygen and sequester carbon, provide wildlife habitat and food, affect soil development, and can increase slope stability. Plants are involved in the regulation of biogeochemical cycles such as the movement and filtration of water, carbon, and nitrogen. Plants can also have cultural, spiritual, and psychological benefits for humans.

This section describes vegetation in the study areas and the impacts on vegetation potentially resulting from construction and operation of the proposed export terminal.

5.6.1 Regulatory Setting

Laws and regulations relevant to vegetation are summarized in Table 5.6-1.

Table 5.6-1. Regulations, Statutes, and Guidelines for Vegetation

Regulation, Statute, Guideline	Description
Federal	
Clean Water Act (33 USC 1251, *et seq.*)	Authorizes EPA to establish the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Regulates many activities in streams, wetlands, and other aquatic resources, including integral vegetated components.
Endangered Species Act (16 USC 1531-1544)	The federal Endangered Species Act of 1973, as amended, provides for the conservation of species listed as threatened or endangered and the habitat upon which they depend. Section 7 of the federal Endangered Species Act requires federal agencies to consult with the USFWS and/or NMFS to ensure a federal action is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of designated critical habitat.
State	
Washington State Growth Management Act (RCW 36.70A)	Defines a variety of critical areas, which are designated and regulated at the local level under city and county critical areas ordinances.
Washington State Shoreline Management Act (RCW 90.58)	Requires cities and counties (through their Shoreline Master Programs) to protect shoreline natural resources against adverse impacts.
Washington Natural Resource Damage Assessment (RCW 90.56.370)	Holds parties responsible for spilling oil into state waters liable for damages resulting from injuries to public resources.

Regulation, Statute, Guideline	Description
Washington State Noxious Weed Control Act (RCW 17.10, WAC 16-750)	Establishes noxious weed control boards, which designate certain plant species as Class A, B, or C noxious weeds. Authorizes the management, control, and/or elimination of noxious weed populations in the state.
Washington State Hydraulic Code (WAC 220-110)	WDFW issues a hydraulic project approval for certain construction projects or activities in or near state waters. Considers effects on riparian and shoreline or bank vegetation in issuance and conditions of the permit.
Local	
Cowlitz County Critical Areas Protection Ordinance (CCC 19.15)	Requires the County to designate critical areas, including vegetation in wetlands and their buffers.
City of Longview Critical Areas Ordinance (LMC 17.10.140) (Off-Site Alternative only)	Regulates activities within and adjacent to critical areas including vegetation occurring in wetlands and their buffers, fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded areas, and geological hazard areas.

Notes:
USC = United States Code; EPA = U.S. Environmental Protection Agency; USFWS = U.S. Fish and Wildlife Service; NMFS = National Marine Fisheries Service; RCW = Revised Code of Washington; WAC = Washington Administrative Code; WDFW = Washington Department of Fish and Wildlife; CCC = Cowlitz County Code; LMC = Longview Municipal Code

5.6.2 Study Area

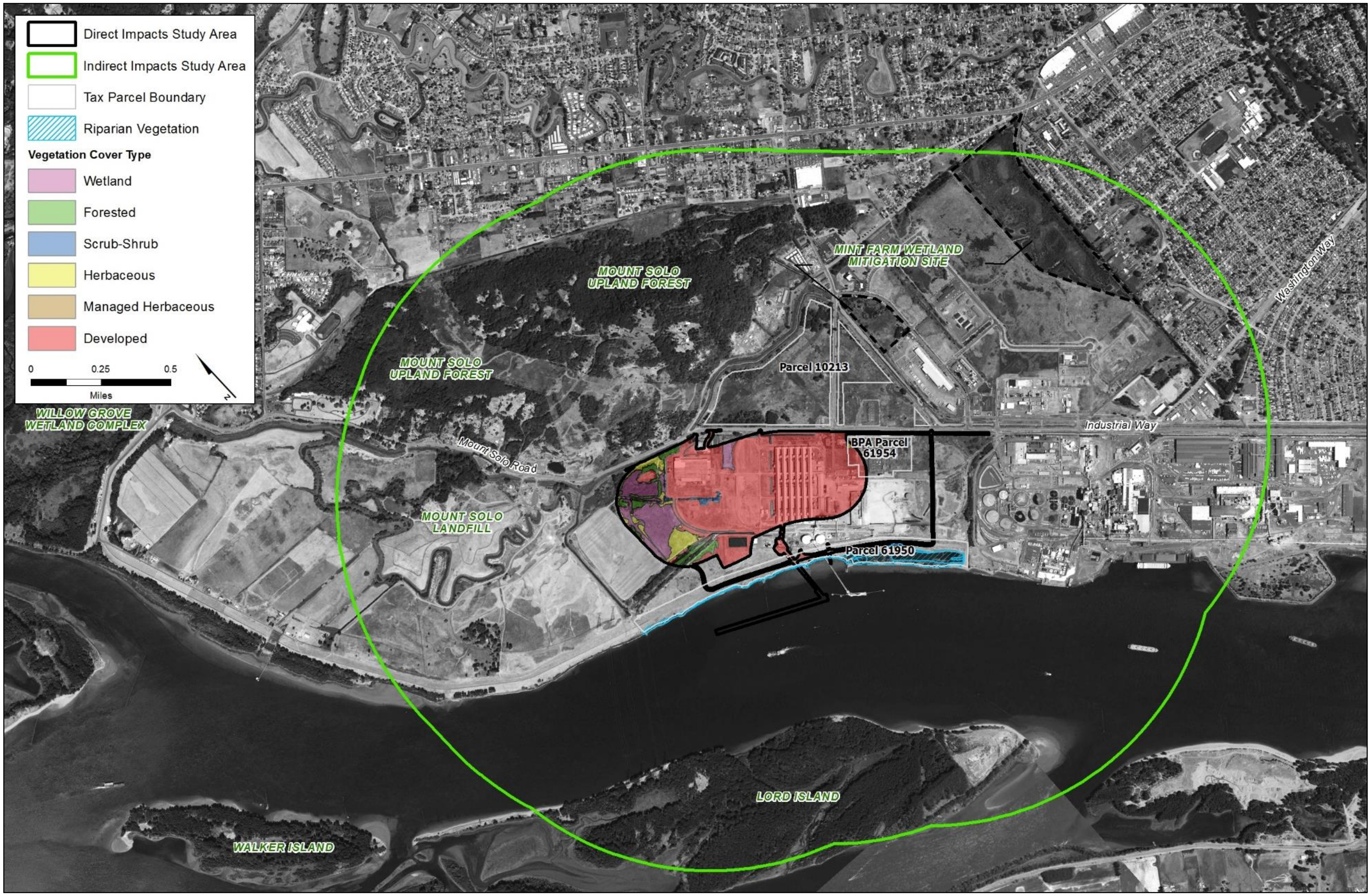
The study areas for the proposed export terminal at the On-Site Alternative and Off-Site Alternative locations are described below. These study areas are based on the Corps' *NEPA Scope of Analysis Memorandum for Record* (MFR) (2014) and adjusted to reflect vegetation characteristics in and near the project areas.

5.6.2.1 On-Site Alternative

The study area for direct impacts on vegetation is defined as the 212-acre project area.[1] The study area for indirect impacts on vegetation is defined as the project area, surrounding areas up to 1 mile from the project area, and the lower Columbia River from the project area to the mouth of the river. The broader 1-mile study area considers the extent to which potential coal dust deposition (Chapter 6, Section 6.7, *Coal Dust*) could affect vegetation during operations (Figure 5.6-1). The lower Columbia River study area was established to evaluate the potential impacts on shoreline vegetation resulting from project-related vessels transiting the Columbia River; this same study area is shown in Section 5.7, *Fish*, Figure 5.7-2. Wetland vegetation is further discussed in Section 5.3, *Wetlands*.

[1] The On-Site Alternative project area for vegetation is approximately 212 acres, which includes the 190-acre project area identified for the proposed export terminal, plus additional elements (e.g., access roads, docks, and rail line).

Figure 5.6-1. Vegetation Study Area—On-Site Alternative



5.6.2.2 Off-Site Alternative

The study area for direct impacts on vegetation is defined as the 225-acre project area. The study area for indirect impacts is defined as the project area, surrounding areas up to 1 mile from the project area, and the lower Columbia River from the project area to the mouth of the river (Figure 5.6-2). The broader 1-mile study area considers the extent to which potential coal dust deposition (Chapter 6, Section 6.7, *Coal Dust*) could affect vegetation during operations. The lower Columbia River study area was also established to evaluate the potential impacts on shoreline vegetation as resulting from project-related vessels transiting the Columbia River; this same study area is shown in Section 5.7, *Fish*, Figure 5.7-2. Wetland vegetation is further discussed in Section 5.3, *Wetlands*.

5.6.3 Methods

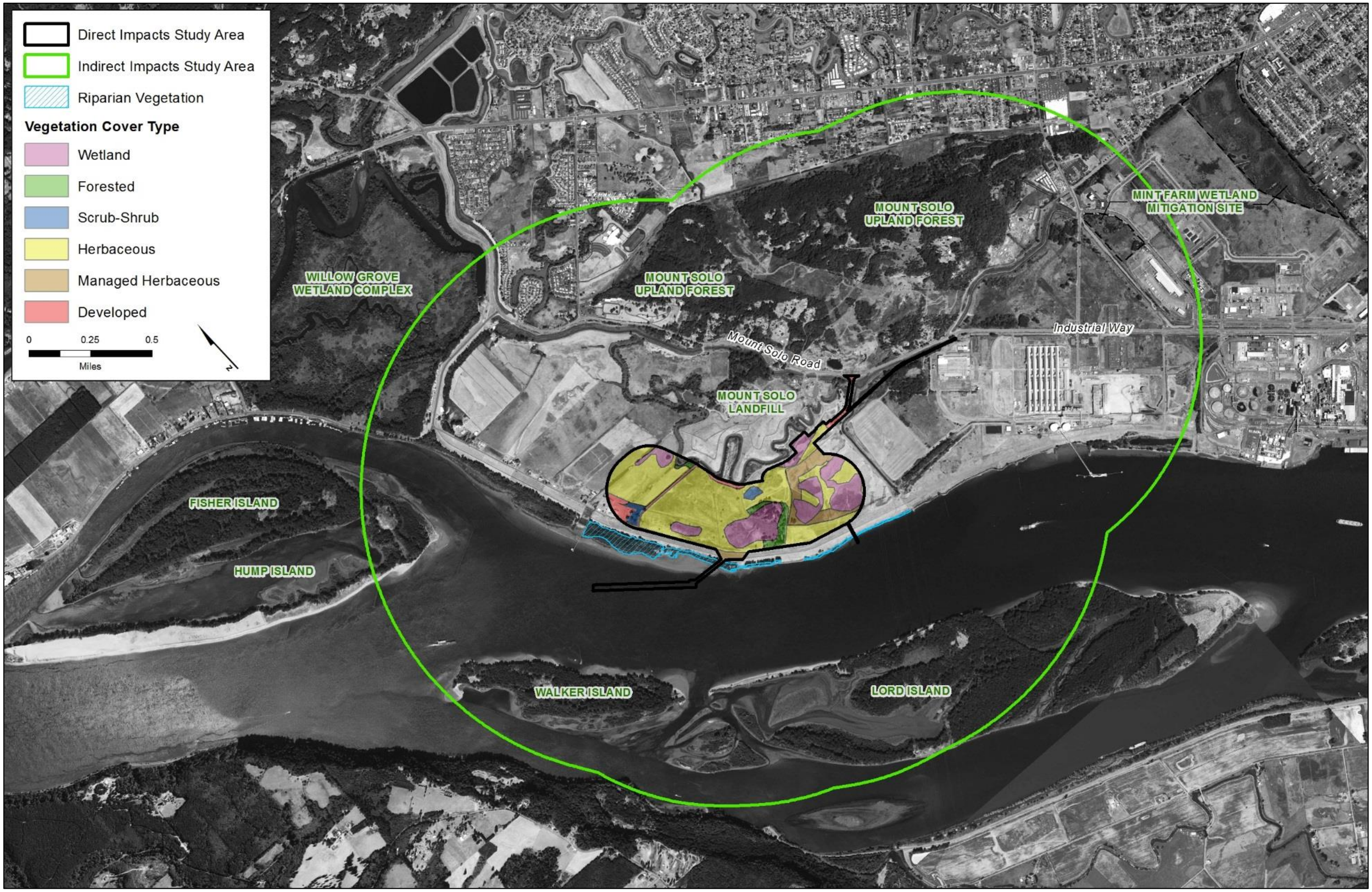
This section describes the sources of information and methods used to evaluate the potential impacts on vegetation associated with construction and operation of the proposed export terminal.

5.6.3.1 Information Sources

The following sources of information were used to identify the potential impacts of the proposed export terminal on vegetation in the study areas.

- Two site visits conducted by ICF International biologists on April 8, 2014, and December 11, 2014.
- Historical aerial photos from between 1994 and 2014 accessed through Google Earth Professional, a 2010 aerial photo provided by ESRI, and a 2012 aerial photo from the North Agriculture Imagery Program.
- Reports prepared by Grette Associates for the Applicant as part of the permit application materials (Grette 2014a through 2014i).
- U.S. Fish and Wildlife Service (USFWS) (2015) Information for Planning and Conservation (IPaC) online database.
- 2011 National Land Cover Database (Homer et al. 2015) to describe land cover classes in the indirect impacts study area.
- Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species (PHS) spatial data provided by WDFW on May 5, 2014, for the study area (Washington Department of Fish and Wildlife 2014).
- The Washington Department of Natural Resources (WDNR) Natural Heritage Program Information System (Washington Department of Natural Resources 2015) list of known occurrences of rare plants in Cowlitz County, Washington, and details regarding their occurrence, habitat, and range.

Figure 5.6-2. Vegetation Study Area—Off-Site Alternative



5.6.3.2 Impact Analysis

The following methods were used to identify the potential impacts of the On-Site Alternative, Off-Site Alternative, and No-Action Alternative on vegetation in the study areas. The *NEPA Vegetation Technical Report* (ICF International 2016) provides a full description of the analysis methods.

- Five land cover types (developed lands, uplands, wetlands, riparian lands, and open water) were mapped to describe vegetation for the direct impacts study area based on site visits, aerial photographs, federal databases, and information provided by the Applicant. Vegetation cover within these land cover types was then characterized (e.g., forested, scrub-shrub, herbaceous, and managed herbaceous). Land cover type mapping was adjusted based on field observations.
- Land cover types in the indirect impacts study area are described based on the 2011 National Land Cover Database GIS data (Homer et al 2015); land cover classifications described in this data consist of open water, developed, forest, shrub, herbaceous, barren land, agriculture (planted/cultivated and hay/pasture), and wetlands.
- Direct impacts on vegetation from construction of the proposed project would result when portions of the study area are cleared to construct the proposed export terminal and associated infrastructure. These impacts were quantified by overlaying the study areas on the land cover map. The approximate acreage of each affected cover type was calculated and expressed as a percentage of all cover types in the study area.
- Indirect impacts on vegetation from construction could occur outside of the On-Site Alternative's and Off-Site Alternative's direct impacts study areas. These impacts are qualitatively described by identifying the impact mechanism (i.e., how the impact would occur), describing the potential impacts, and assessing the likelihood of impacts after implementation of mitigation measures.
- Direct and indirect impacts from operations are qualitatively described, including the impact mechanism, potential impacts, duration (i.e., temporary or permanent), and likelihood of occurrence.

For the purposes of this analysis, construction impacts are based on peak construction period and operations impacts are based on maximum throughput capacity (up to 44 million metric tons per year).

5.6.4 Affected Environment

This section describes the environment in the study areas related to vegetation potentially affected by construction and operation of the proposed export terminal.

5.6.4.1 On-Site Alternative

Direct Impacts Study Area

The following land cover types are found in the direct impacts study area for the On-Site Alternative.

Developed Lands

Developed lands account for 151.14 acres (71%) of the direct impacts study area. Developed lands are those areas where the majority of the vegetation has been removed and replaced with pavement, buildings, or other types of infrastructure. Developed lands also include disturbed areas of land comprised of widely scattered patches of invasive shrubs such as Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*); these areas are typically found on higher mounds and around derelict structures and equipment. Developed lands include all of the areas previously developed by the former Reynolds Metals Company facility (Reynolds facility) and the Bonneville Power Administration (BPA) and Cowlitz County Public Utility District substations. Named features and facilities described below are shown in Section 5.2, *Surface Water*, Figure 5.2-5. Wetlands discussed below are shown in Section 5.3, *Wetlands*, Figures 5.3-1 through 5.3-4.

Uplands

Uplands are undeveloped vegetated areas that do not exhibit wetland characteristics. Uplands account for 26.26 acres (12%) of the direct impacts study area and consist of the following vegetation types.

- **Forested upland.** Forested uplands are areas where trees more than 16 feet in height provide more than 20% canopy cover (Multi-Resolution Land Characteristic Consortium 2011). Approximately 8.90 acres (4%) of the direct impacts study area were identified as forested upland. On the former Reynolds facility, forested upland occurs around Wetlands A, C, and Y between the closed Black Mud Pond (BMP) facility and the former Cable Plant and along the U-Ditch and Interceptor Ditch. Dominant trees in the uplands adjacent to Wetlands A, C, and Y include black cottonwood (*Populus trichocarpa*), some Pacific willow (*Salix lucida*), and Oregon ash (*Fraxinus latifolia*). Common shrubs include Himalayan blackberry, red elderberry (*Sambucus racemose*), and sweetbriar rose (*Rosa rubiginosa*), with black cottonwood and Oregon ash sapling also present. Dominant trees in the forested corridor along the U-Ditch and Interceptor Ditch include black cottonwood, red alder (*Alnus rubra*), and some Oregon ash along the ditch banks. Himalayan blackberry is the most common plant in the shrub layer, but has been recently cleared from some areas on the western end of the U-Ditch. Red osier-dogwood (*Cornus sericea*) is also common. Several types and sizes of fallen trees are present in this forested corridor, as are various snags. Reed canarygrass is common in the herbaceous layer in all of these forested upland areas.

  Forested upland in the direct impacts study area also includes a small area (0.05 acre) of forest in the riparian zone along the Columbia River between the ordinary high water mark (OHWM) and the top of the Consolidated Diking Improvement District (CDID) #1 levee.

- **Scrub-shrub upland.** Scrub-shrub uplands are areas with more than 20% canopy cover of shrubs or small trees less than 16 feet high (Multi-Resolution Land Characteristic Consortium 2011). Approximately 2.11 acres (1%) of the direct impacts study area were identified as scrub-shrub upland. Scrub-shrub uplands on the former Reynolds facility occur around the former Cable Plant and north of the closed BMP facility around Wetland Y. Common species in these areas include young black cottonwood, willows, and Himalayan blackberry. Reed canarygrass is also common in the herbaceous layer.

- **Unmanaged herbaceous upland.** Unmanaged herbaceous uplands are areas dominated by native and nonnative grasses and forbs and not maintained or managed (e.g., mowed) on a regular basis. Approximately 10.88 acres (5%) of the direct impacts study area were identified as unmanaged herbaceous uplands. These areas occur on the former Reynolds facility and BPA Parcel 61954. Unmanaged herbaceous uplands on the direct impacts study area occur along the CDID #1 Ditch 10 to the northwest of the former Cable Plant; in the former borrow area to the east of the closed BMP facility; and in the southeastern portion of the direct impacts study area along the Reynolds Lead spur. These areas are primarily dominated by reed canarygrass. Unmanaged herbaceous uplands on BPA parcel 61954 are located in a transmission line easement to the northwest of the Longview Substation. This area is dominated by species similar to those listed above for the direct impacts study area, as well as Himalayan blackberry.

- **Managed herbaceous upland.** Managed herbaceous uplands are areas regularly managed by mowing, grazing, or other activities. Approximately 4.37 acres (2%) of this cover type occur at the former Reynolds facility, CDID #1 levee, lawns around the administrative and maintenance buildings, and caps of the closed BMP facility. All of these areas are dominated by grasses and forbs mown regularly. Species present include reed canarygrass (*Phalaris arundinacea*), haired bentgrass (*Agrotis scabra*), colonial bentgrass (*Agrostis capillaris*), broadleaf plantain (*Plantago major*), orchard grass (*Dactylis* spp.), short-awn foxtail (*Alopecurus aequalis*), western bittercress (*Cardamine oligosperma*), blue wildrye (*Elymus glaucus*), common horsetail (*Equisetum arvense*), Queen Anne's lace (*Daucus carota*), scouring rush (*Equisetum hyemale affinis*), bedstraw (*Calium aparine*), velvetgrass (*Holcus lanatus*), perennial ryegrass (*Lolium perenne*), Kentucky bluegrass (*Poa pratensis*), and American vetch (*Vicia americana*).

Wetlands

Wetlands are areas that exhibit the wetland vegetation, soil, and hydrology characteristics defined in the federal wetland delineation manual. Wetlands account for 24.10 acres (11%) of the direct impacts study area. The most prevalent wetland type is herbaceous wetlands, followed by forested wetlands and scrub-shrub wetlands. Section 5.3, *Wetlands*, discusses wetlands and wetland vegetation in detail.

Open Water

Open water accounts for 10.78 acres (5%) of the direct impacts study area and consist of the Columbia River and various ditches and ponds. This land cover is described in more detail Section 5.2, *Surface Water and Floodplains*. These areas support vegetation along their outer perimeters, typically including native plants as well as noxious weeds. Curly pondweed (*Potamogeton crispus*)was observed at approximately -1 foot Columbia River Datum downstream of Dock 1 during a period of high visibility. The gently sloping portion of the shallow water habitat area between the east and west pile dikes near the project area may support a narrow band of sparse aquatic vegetation in the uppermost elevations.

Indirect Impacts Study Area

Table 5.6-2 summarizes the areas and percent cover of land cover classes in the indirect impacts study area for the Off-Site Alternative within 1 mile of the project area. Approximately 70% of the indirect impacts study area is occupied by developed lands, open water (primarily the Columbia River), and agricultural lands; the remaining 30% consists of forest, shrub, herbaceous, wetlands, and barren lands.

Table 5.6-2. Land Cover in the Indirect Impacts Study Area – On-Site Alternative

Land Cover Classification	Area in Indirect Impacts Study Area (acres)	Percent Cover in Indirect Impacts Study Area
Developed	1631	37
Forest	347	8
Shrub	106	2
Herbaceous	62	2
Agriculture	573	13
Wetlands	719	16
Open Water	880	20
Barren land	83	2
TOTAL	4401	100

Source: National Land Cover Data Base 2011 (Homer et al 2015)

Land cover surrounding the project area is similar to the project area, consisting primarily of developed areas, managed/unmanaged herbaceous areas, wetlands, and open water (the Columbia River). Riparian lands are found predominantly along the Columbia River between the OHWM and the top of the CDID #1 levee, and include vegetation adjacent to the active channel margin in riparian zones identified in the previous upland and shoreline habitat inventories (Grette Associates 2014e, 2014g, 2014h). These riparian lands consist of three vegetation types: forest, scrub-shrub, and herbaceous.

- **Riparian forest.** Riparian forest extends in a band of varying width along most of the shoreline, with the widest areas found on the southern portion of the shoreline near the previous Dredged Material Storage Area. Dominant vegetation in this cover type includes black cottonwood and various willow trees, underlain by a mixture of native shrubs such, as red osier dogwood, and invasive shrubs, such as Himalayan blackberry and Scotch broom. Scattered accumulations of large woody material are present in these areas.
- **Riparian scrub-shrub.** Riparian scrub-shrub contains similar species to riparian forest. Two scrub-shrub riparian areas are found on Parcel 61950 between the Columbia River and the levee. These areas are dominated by black cottonwood saplings, various willow, and nonnative vegetation including Himalayan blackberry and Scotch broom. Native and nonnative herbaceous species are also present.
- **Riparian herbaceous.** Riparian herbaceous areas are generally dominated by grasses and weeds including reed canarygrass, velvet grass, common horsetail, and English plantain (*Plantago lanceolate*). These sparse patches of emergent vegetation occur under the existing Dock 1 conveyor and trestle, and on sandy flats between OHWM and the approximate elevation of mean high water.

The following areas in the indirect impacts study area contain higher quality vegetation communities and generally represent contiguous forest and other intact vegetation communities (Figure 5.6-1).

- **Mount Solo upland forest**. Mount Solo is a forested ridge north of the project area. It supports a large area (approximately 505 acres) of native forest intermixed with rural residential areas and some light industrial uses. This area is the largest inland forested area in the indirect impacts study area. Vegetation includes Douglas fir (*Pseudotsuga menziesii*), big leaf maple (*Acer* *macrophyllum*), red alder (*Alnus rubra*), and western hemlock (*Tsuga heterophylla*). It supports a diversity of native plant communities and provides habitat for a variety of wildlife species.

- **Mint Farm wetland mitigation sites**. Two compensatory wetland mitigation sites for the Mint Farm Industrial Park are located east of the project area. The Phase I mitigation site is 4.28 acres and is a complex of forested, scrub-shrub and emergent wetlands; the Phase II mitigation site is 67 acres and is a mixture of forested, scrub-shrub and emergent wetlands intermixed with forested uplands.
- **Lord Island**. Lord Island is located in the Columbia River near the project area. The 234-acre island was previously used for dredge material disposal. It is densely forested and bisected by various high-flow channels supporting tidal marshes and shallow habitat areas. Vegetation on the island is largely native.

Special-Status Plant Species

As shown in Table 5.6-3, there are 15 plant species with some type of federal or state status in Cowlitz County (Washington Department of Natural Resources 2015). None of these species has been recorded in the direct or indirect impacts study areas. The nearest record of occurrence of a special-status plant species is a documented siting of the obligate wetland species Columbia water-meal approximately 1.5 miles northwest of the project area and study areas (Washington Department of Natural Resources 2015).

The special-status plant species, and the preferred elevation, habitat and geographic range for each are provided in Table 5.6-4. As indicated in Table 5.6-4, of the 15 special-status plant species known to occur in Cowlitz County, six were identified as potentially occurring in the direct impacts study area, based on the presence of potentially suitable habitat. These species are Nelson's checker-mallow (*Sidalcea nelsoniana*), western wahoo (*Euonymus occidentalis*), western false dragonhead (*Physostegia parviflora*), loose-flowered bluegrass (*Poa laxiflora*), soft-leaved willow (*Salix sessilifolia*), and Columbia water-meal (*Wolffia columiana*).

Table 5.6-3. Known Occurrences of Threatened, Endangered, Sensitive, and Rare Plants in Cowlitz County

Scientific Name	Common Name	Federal Status[a]	State Status[b]	Historical Record[c]
Agoseris elata	Tall agoseris	--	S	C
Buxbaumia viridis	Buxbaumia moss	--	R1	C
Cimicifuga elata	Tall bugbane	SC	S	H
Corydalis aquae-gelidae	Clackamas corydalis	SC	S	C
Erythronium revolutum	Pink fawn-lily	--	S	C
Euonymus occidentalis var. *occidentalis*	Western wahoo	--	S	C
Isoetes nuttallii	Nuttall's quillwort	--	S	C
Physostegia parviflora	Western false dragonhead	--	R1	H
Poa laxiflora	Loose-flowered bluegrass	--	S	C
Poa nervosa	Wheeler's bluegrass	--	S	C
Salix sessilifolia	Soft-leaved willow	--	S	C
Sidalcea nelsoniana	Nelson's checker-mallow	LT	E	C
Tetraphis geniculata	Tetraphis moss	--	R1	C
Utricularia gibba	Humped bladderwort	--	R1	C
Wolffia columbiana	Columbia water-meal	--	R1	C

Notes:

[a] Federal Status under the Endangered Species Act:LT = Listed Threatened (likely to become endangered)SC = Species of Concern. An unofficial status, the species appears to be in jeopardy, but insufficient information to support listing.

[b] State Status of plant species is determined by the Washington Natural Heritage Program. Factors considered include abundance, occurrence patterns, vulnerability, threats, existing protection, and taxonomic distinctness. Values include:
E = Endangered. In danger of becoming extinct or extirpated from Washington.S = Sensitive. Vulnerable or declining and could become Endangered or Threatened in the state.
R1 = Review group 1. Of potential concern but needs more fieldwork to assign another rank.

[c] Historical Record refers to when the occurrence was documented:
C = Most recent sightings after 1977.
H = Most recent sighting before 1977.

Source: Washington Department of Natural Resources 2014.

Table 5.6-4. Elevation, Habitat, and Geographic Range of Listed Threatened, Endangered, Sensitive, and Rare Plants in Cowlitz County

Common Name	Scientific Name	Elevation Range	Habitat	Geographic Range	Occurrence Relative to Project Area
Tall agoseris	*Agoseris elata*	500 to 7,800 feet	Found in meadows, prairies, open woods, and exposed rocky ridges. Occurs in areas with little to no canopy cover and assumed to be shade intolerant.	Throughout California, Oregon, and Washington.	Documented in northeastern Cowlitz County. Not likely to occur on the project area due to elevation.
Buxbaumia moss	*Buxbaumia viridis*	Low to subalpine elevations	Found in coniferous forests on well-rotted logs and peaty soil and humus.	Western North America including the western portion of Washington.	Documented in east-central Cowlitz County. Not likely to occur on the project area due to lack of suitable coniferous habitat.
Tall bugbane	*Cimicifuga elata*	100 to 2,800 feet, with majority below 700 feet	Occurs in or along margins of mixed mature or old growth forests, including mesic coniferous or mixed coniferous-deciduous stands. Frequently found on north or east-facing slopes.	Southwestern British Columbia to southern Oregon, west of Cascade range.	Documented in western Cowlitz County in areas along the Columbia River. Not likely to occur on the project area due to lack of appropriate forest habitat.
Clackamas corydalis	*Corydalis aquae-gelidae*	1,250 to 4,200 feet	Occurs in or near cold flowing water, including seeps and small streams; often occurring in stream channels. Moist shady woods in western hemlock (*Tsuga heterophylla*) and silver fir (*Abies amabilis)* zones. Prefers intermediate levels of overstory canopy closure.	Regionally endemic of Washington; Clackamas and Multnomah Counties in Oregon.	Documented in eastern Cowlitz County. Not likely to occur on the project area due to elevation and lack of suitable habitat.

Common Name	Scientific Name	Elevation Range	Habitat	Geographic Range	Occurrence Relative to Project Area
Pink fawn-lily	*Erythronium revolutum*	100 to 600 feet	Occurs in high-precipitation areas within 100 km of the coast, in moist soil in open or moderately shaded forests that provide full light at ground level. Habitats in Washington include swampy western red cedar (*Thuja plicata*)-lodgepole pine (*Pinus contorta*) forests, Sitka spruce (*Picea sitchensis*) woods on consolidated sand dunes, Sitka spruce-western hemlock forests, and shaded river bottoms.	Pacific coast region from southern British Columbia to northwestern California.	Documented in northwestern Cowlitz County. Not likely to occur on the project area due to lack of suitable coniferous forest habitat.
Western wahoo	*Euonymus occidentalis* var. *occidentalis*	20 to 600 feet	Occurs in moist woods and forested areas on west side of Cascades. Often found in shaded draws, riparian areas, and ravines. Sometimes found in grassy areas with scattered trees. In Washington, it typically occurs on fine sandy loam, silty loam, and silty clay loams.	British Columbia, western Washington and Oregon, south to central California	Documented in west-central Cowlitz County, potentially near the project area. Appropriate habitat may occur on and near the project area.
Nuttall's quillwort	*Isoetes nuttallii*	200 to 345 feet	Terrestrial species found in seasonally wet ground, seepages, temporary streams, and mud near vernal pools.	Southeast Vancouver Island, British Columbia to southern California	Documented in west-central Cowlitz County, potentially near the project area. Not likely to occur on the project area due to elevation.
Western false dragonhead	*Physostegia parviflora*	None provided.	Occurs along shores of streams and lakes, marshes, and other low, wet places in the valleys and foothills.[a]	East of the Cascade summits, British Columbia south through Washington to the Columbia Gorge, then west to Portland, Oregon; east to Idaho and North Dakota.[a]	Most recent documentation in Cowlitz County is prior to 1977. Appropriate habitat may occur on and near the project area.

Common Name	Scientific Name	Elevation Range	Habitat	Geographic Range	Occurrence Relative to Project Area
Loose-flowered bluegrass	*Poa laxiflora*	50 to 3,700 feet	Found on moss-covered rocks and logs, along streams and rivers, and on edges of wet meadows in moist shady woods.	Coastal Alaska, British Columbia, western Washington, and western Oregon	Documented in northwestern Cowlitz County. Appropriate habitat may occur on and near the project area.
Wheeler's bluegrass	*Poa nervosa*	10 to 800 feet	Found in low-elevation wet habitats west of the Cascade crest in forest openings with minimal canopy cover, mossy rock outcrops, cliff crevices, and occasionally talus. Sites are often sparsely vegetated with little soil development.	Endemic from Vancouver Island, British Columbia, to northwest Oregon	Documented in west-central Cowlitz County, potentially near project area. Unlikely to occur on the project area due to lack of preferred habitat elements.
Soft-leaved willow	*Salix sessilifolia*	None provided	Found in wet lowland habitats, including silty or sandy riverbanks, riparian forests, dredge spoils, sandy beaches, and at the upper edge of an intertidal zone.	Southern British Columbia to northern California	Documented in northern Cowlitz County. Appropriate habitat may occur on or near the project area.
Nelson's checker-mallow	*Sidalcea nelsoniana*	None provided	Found in low-elevation meadows, prairie or grassland, along fencerows, streams, and roadsides, drainage swales, and edges of plowed fields adjacent to wooded areas.	Regionally endemic of Benton County, Oregon, north to Lewis County, Washington, and from central Linn County, Oregon to just west of the crest of the Coast Range.	Documented in northwestern Cowlitz County. Appropriate habitat may occur on and near the project area.
Tetraphis moss	*Tetraphis geniculata*	Sea level to subalpine elevations.	Occurs on the cut or broken ends or lower half of large decay class rotten logs or stumps, and occasionally on peaty banks in moist coniferous forests.	From Alaska and British Columbia through western Washington and select sites in Oregon.	Not documented in Cowlitz County. Not likely to occur on project area due to lack of suitable coniferous habitat with logs and stumps.

Common Name	Scientific Name	Elevation Range	Habitat	Geographic Range	Occurrence Relative to Project Area
Humped bladderwort	*Utricularia gibba*	160 to 490 feet	Occurs in lakes, lake edges, and muddy disturbed sites in the lowland zone.	Southern British Columbia south to California.	Documented in northern Cowlitz County. Not likely to occur on project area due to elevation.
Columbia water-meal	*Wolffia columbiana*	10 to 250 feet	Found in freshwater lakes, ponds, and slow streams.	From California to British Columbia, east to Quebec, and south to Florida, excluding the interior southwestern states.	Occurs within 1.5 miles of the project area; could occur in ponded habitats on or near the project area.

Notes:

[a] Herbarium, Burke Museum of Natural History and Culture 2014.

Source: Unless noted otherwise, this information came from the Washington Department of Natural Resources, Washington Natural Heritage Program plant species fact sheets; available at: http://www1.dnr.wa.gov/nhp/refdesk/lists/plantsxco/cowlitz.html

Noxious Weeds

The project area supports plant species regulated as noxious weeds. Fourteen noxious weed species have been documented in the project area (Table 5.6-5) (Cowlitz County Noxious Weed Control Board 2015; Washington State Noxious Weed Control Board 2015). No species designated for Cowlitz County as Class A noxious weeds has been observed in the project area (Table 5.6-6 provides definitions for the noxious weed classifications). Six of the species identified in the project area (indigobush [*morpha fruticose*], scotch broom, policeman's helmet [*Impatiens glandulifera*], Eurasian water milfoil [*Myriophyllum spicatum*], parrotfeather [*Myriophyllum aquaticum*], and water primrose [*Ludwigia peploides glabrescens*]) are considered Class B weeds, and identified as priorities for control, either by Washington State or Cowlitz County. The remaining eight species in the study area are listed Class C noxious weeds, a classification assigned to weeds not typically considered a priority for weed control because they are already widespread throughout the state. These species are Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), English ivy (*Hedera helix*), yellow-flag iris (*Iris pseudacorus*), reed canarygrass, Himalayan blackberry, common tansy (*Tanacetum vulgare*), and nonnative cattail.

Table 5.6-5. Noxious Weeds Identified in the Project Area—On-Site Alternative

Noxious Weed Species			Classification		
Common Name	**Scientific Name**	**Location Observed[a,b,c]**	**State[d]**	**Cowlitz County[e]**	**State/County Priority Weed for Control[e]**
Indigobush	*Amorpha fruticosa*	Riparian[b]	B	B	Yes/No
Scotch broom	*Cytisus scoparius*	W/U[a, b]	B	B	No/Yes
Policeman's helmet	*Impatiens glandulifera*	W/U[a]	B	B	Yes/Yes
Eurasian water milfoil	*Myriophyllum spicatum*	W/OW[a]	B	B	Yes/No
Parrotfeather	*Myriophyllum aquaticum*	W/OW[a]	B	B	No/No
Water primrose	*Ludwigia hexapetala*	D[c]	B	B	No/No
Canada thistle	*Cirsium arvense*	W/U[a, b]	C	C	No/Yes
Bull thistle	*Cirsium vulgare*	W/U[a, b]	C	C	No/No
English ivy	*Hedera helix*	W/U[a, b]	C	C	No/No
Yellowflag iris	*Iris pseudacorus*	W/D[b]	C	C	No/No
Reed canarygrass	*Phalaris arundinacea*	W/U[a, b]	C	Not listed	No/No
Himalayan blackberry	*Rubus armeniacus*	U[a, b]	C	C	No/No
Common tansy	*Tanacetum vulgare*	U[a]	C	C	No/Yes
Nonnative cattail	*Typha* spp.	W[a, b]	C	C	No/No

Notes:

[a] *Appendix F: Noxious Weeds and Sensitive Plants* in Grette Associates 2014a. Location values: W = wetland; U = upland; D = Ditches; OW = open water

[b] Observations made by ICF International during site investigations in April and December 2014.

[c] Observations by Washington State Noxious Weed Control Board (1999).

[d] State classification based on Washington State Noxious Weed Control Board 2015 Noxious Weed List.

[e] County classification and priority for weed control (state and county level) based on Proposed 2015 Cowlitz County Noxious Weed List (Cowlitz County Noxious Weed Control Board 2015).

Table 5.6-6. Washington State Noxious Weed Classification

Class	Definition
A	Nonnative species whose distribution in Washington is still limited. Preventing new infestations and eradicating existing infestations are the highest priority. Eradication of Class A plants is required by law.
B	Nonnative species presently limited to portions of the State. Species are designated for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal.
C	Noxious weeds typically widespread in Washington or are of special interest to the state's agricultural industry. The Class C status allows counties to require control if locally desired. Other counties may choose to provide education or technical consultation.

Notes:
Source: Washington State Noxious Weed Control Board 2015.

5.6.4.2 Off-Site Alternative

Direct Impacts Study Area

The following land cover types are found in the Off-Site Alternative direct impacts study area.

Developed Lands

The Off-Site Alternative site is mostly undeveloped, with developed lands accounting for 9.62 acres of the direct impacts study area (4%). Developed land with disturbed vegetation occurs in association with an existing residence and a few outbuildings in the northwest corner of the direct impacts study area; fill stockpile areas, gravel lots, and equipment storage areas around the site entrance; and several areas within the meanders of Mount Solo Slough where recent land clearing and woody debris placement has occurred. These sparsely vegetated areas are dominated by nonnative species including Himalayan blackberry, Scotch broom, reed canarygrass, other common grasses, and weedy forbs. This area also includes several brush piles placed along Mount Solo Slough. Section 5.3, *Wetlands*, Figure 5.3-5, shows the wetlands discussed later in this section.

Uplands

Uplands account for 155.46 acres (69%) of the direct impacts study area and include the following vegetation types.

- **Forested upland**. Approximately 6.74 acres (3%) of the direct impacts study area were identified as forested upland. This cover type occurs in the south-central portion of the area, contiguous with a forested wetland area (Figure 5.6-2). Dominant species include black cottonwood and red alder, with some willow species.
- **Scrub-shrub upland**. Approximately 4.42 acres (2%) of the direct impacts study area were identified as scrub-shrub upland, similar in proportion to scrub-shrub upland occurring in the On-Site Alternative direct impacts study area. These areas occur near the center of the project area and near the existing agricultural complex in the northwestern portion (Figure 5.6-2). Dominant vegetation includes young cottonwood, red alder, and willows. Scrub-shrub upland in the direct impacts study area also includes a small area (0.01 acre) of scrub-shrub riparian land along the Columbia River shoreline.

- **Unmanaged herbaceous upland**. Approximately 126.57 acres (56%) of the direct impacts study area were identified as unmanaged herbaceous upland (Figure 5.6-2). Dominant vegetation is primarily reed canarygrass mixed with other common grasses and weedy forbs, including bentgrass, Canada thistle, soft rush (*Juncus effuses*), orchard grass, velvetgrass, hairy cat's ear (*Hypochaeris radicata*), perennial ryegrass, English plantain, broad-leaf plantain, fowl bluegrass (*Poa palustris*), Kentucky bluegrass, curly dock (*Rumex crispus*), red clover (*Trifolium pretense*), and American vetch.
- **Managed herbaceous upland**. Approximately 17.73 acres (8%) of the direct impacts study area were identified as managed herbaceous upland (Figure 5.6-2). This area includes the mown area in the southern portion of the project area and for the CDID #1 levee. Reed canarygrass is the dominant species present with the remaining vegetation similar to that found in the unmanaged herbaceous upland cover type.

Wetlands

Wetlands account for 51.28 acres (23%) of the direct impacts study area (Figure 5.6-2). The most prevalent wetland type present is herbaceous wetlands followed by forested wetlands, and scrub-shrub wetland. The extent, configuration, and vegetation classification of wetlands was based on the reconnaissance-level surveys using aerial photographs, existing resource maps, and LIDAR data. Wetlands are described in more detail in Section 5.3, *Wetlands*.

Open Water

Approximately 8.61 acres (4%) of the direct impacts study area were identified as open water. These areas include the sections of Mount Solo Slough and portions of CDID Ditches 14 and 16 (Figure 5.6-2). Aquatic vegetation was not specifically quantified in the direct impacts study area. However, a narrow band of aquatic vegetation likely exists along the Columbia River shoreline. This land cover is described in more detail in Section 5.2, *Surface Water and Floodplains*.

Indirect Impacts Study Area

Table 5.6-7 summarizes the areas and percent cover of the different land cover classes in the indirect impacts study area within 1 mile of the project area. Approximately 60% of the indirect impacts study area is occupied by developed lands, open water (primarily the Columbia River) and agricultural lands; and 24% is occupied by wetlands. The remaining 16% consists of forest, shrub, herbaceous, and barren lands.

Table 5.6-7. Land Cover in the Indirect Impacts Study Area—Off-Site Alternative

Land Cover Classification	Area in Indirect Impacts Study Area (acres)	Percent Cover in Indirect Impacts Study Area
Developed	978	21
Forest	389	8
Shrub	110	2
Herbaceous	72	2
Agriculture	645	14
Wetlands	1145	24
Open Water	1164	25
Barren land	183	4
TOTAL	**4686**	**100**

Source: National Land Cover Data Base 2011 (Homer et al 2015)

Land cover in the indirect impacts study area surrounding the project area is similar to what is described for the direct impacts study area, mostly consisting of managed and unmanaged herbaceous areas, wetlands, and open water of the Columbia River. Riparian lands are found predominantly along the Columbia River shoreline and include vegetation growing adjacent to the active channel margin in the riparian zone. These riparian lands consist of two vegetation types—forest and scrub-shrub—with the forested riparian cover type the most prevalent.

- **Riparian forest**. Riparian forest vegetation is dominated by black cottonwood, Oregon ash, red osier dogwood, Columbia River willow (*Salix fluviatilis*), Sitka willow (*Salix sitchensis*), and Pacific willow. Other species present include big leaf maple, Nootka rose (*Rosa nutkana*), Himalayan blackberry, trailing blackberry (*Rubus ursinus*), Scouler's willow (*Salix scouleriana*), and various native and nonnative grasses and forbs.
- **Riparian scrub-shrub**. Riparian scrub-shrub vegetation consists of relatively sparse shrubs including noxious weeds (primarily indigobush and Himalayan blackberry), as well as native shrubs such as Pacific crabapple (*Malus fusca*)and big leaf maple. Occasional black cottonwood trees are also present. Scattered patches of spikerush (*Eleocharis palustris*) occur in the herbaceous layer along with other native and nonnative grasses and forbs. Standing snags also occur in this area.

Higher-quality vegetation communities in the indirect impacts study area include the plant communities described for the On-Site Alternative (i.e., Mount Solo upland forest, Mint Farm Wetland Mitigation Sites, and Lord Island), as well as three additional areas in the Off-Site Alternative indirect impacts study area.

- **Walker Island.** Walker Island is a 190-acre island in the Columbia River downstream from Lord Island and connected to the island by a narrow sand spit. Like Lord Island, it was previously used for dredged material disposal but is now heavily forested. It includes tidal marshes on its southern shoreline that provide high-quality habitat for a variety of waterfowl and other wildlife species (Oregon Wetlands Joint Venture 1994:20).
- **Willow Grove Wetland Complex.** The Willow Grove Wetland Complex consists of 388 acres of Category I tidal fringe wetlands indirectly connected to the Columbia River by Coal Creek Slough (Ecological Land Services 2014:6). Vegetation includes a mix of native and nonnative emergent plants, with native shrubs and trees dominant along tidal channels and shoreline areas. It is a

relatively intact and functional intertidal wetland area that provides habitat for a variety of species including bald eagle, peregrine falcon, and a variety of waterfowl, as well as ESA-listed salmonids. The Willow Grove Wetland Complex is owned by Columbia Land Trust (312 acres) and Port of Longview (76 acres) and is used for wetland preservation and mitigation purposes (Ecological Land Services 2014:6).

- **Hump-Fisher Islands.** Hump-Fisher Islands are a 400-acre island complex located in the Columbia River downstream from the project area and from Lord and Walker Islands. Similar to Lord and Walker Islands, Hump-Fisher Islands support native forested vegetation, as well as tidal marshes and provide important wildlife habitat.

Special-Status Plant Species

The same six special-status plant species identified as potentially occurring in the On-Site Alternative direct impacts study area also could occur in the direct impacts study area for the Off-Site Alternative (special-status plant species are listed in Table 5.6-3). The history of land manipulation, agricultural use, and ongoing maintenance of the Off-Site Alternative direct impacts study area decreases the likelihood of these rare plant species actually being present in the area.

The nearest record of a special-status plant occurrence is the obligate wetland species Columbia water-meal (*Wolffia columbiana*) approximately 0.5 mile northwest of the Off-Site Alternative direct impacts study area (Washington State Department of Natural Resources 2015). Based on documented habitat and known proximity to the direct impacts study area, it could occur within the Mount Solo Slough and CDID #1 ditches along the northern edge of the direct impacts study area.

Noxious Weeds

Seven noxious weed species have been documented in the Off-Site Alternative direct impacts study area, including indigobush, Scotch broom, Eurasian water milfoil, Canada thistle, reed canarygrass, Himalayan blackberry, and nonnative cattail. Three of these species (indigobush, scotch broom, and Eurasian water milfoil) are Class B species and considered priorities for control, either by Washington State or Cowlitz County (Cowlitz County Noxious Weed Control Board 2015).

Additional detail regarding the occurrence of these noxious weed species in the specific habitats present on the Off-Site Alternative project area is presented in the *NEPA Vegetation Technical Report*.

5.6.5 Impacts

This section describes the direct and indirect impacts on vegetation potentially resulting from construction and operation of the proposed export terminal.

5.6.5.1 On-Site Alternative

Direct impacts could result from activities that directly disturb or damage vegetation including such actions as removing vegetation during clearing and grading activities and the physical and chemical management of vegetation and noxious weeds as part of routine maintenance of the proposed export terminal. Indirect impacts include the future spread of noxious weeds into areas adjacent to the construction site and the associated changes in plant communities that could result.

Potential impacts on vegetation were also considered in terms of duration. Permanent impacts would modify vegetation cover types to such a degree that they would not return to their preconstruction state for the life of the project. Temporary vegetation impacts would result in the disturbance of vegetation cover types but implementation of best management practices, project design components, regulatory requirements, or an on-site vegetation management plan would facilitate reestablishment of vegetation cover types similar to preproject conditions after construction is completed.

Construction—Direct Impacts

Construction-related activities associated with the On-Site Alternative could result in direct impacts as described below. As explained in Chapter 3, *Alternatives,* construction-related activities include demolishing existing structures and preparing the site, constructing the rail loop and docks, and constructing supporting infrastructure (e.g., conveyors and transfer towers).

Removed Vegetation

Clearing and grading would permanently alter or remove approximately 212 acres of land cover types from the direct impacts study area (Table 5.6-8). Most of the clearing would affect disturbed vegetation and weedy areas that generally do not support native plant species or provide suitable wildlife habitat (Figure 5.6-3).

Table 5.6-8. Permanent Direct Impacts by Land Cover and Vegetation Cover Type—On-Site Alternative

Land Cover Category	Vegetation Cover Type	Direct Impacts (Acres)[b]	Percentage of Cover Type[c,d]
Developed land			
	Developed land total	**151.14**	**71**
Upland	*Forested*	*8.90*	*4*
	Scrub-shrub	*2.11*	*1*
	Herbaceous	*10.88*	*5*
	Managed herbaceous	*4.37*	*2*
	Upland total	**26.26**	**12**
Wetlands	**Wetlands total[a]**	**24.10**	**12**
Open water	**Open water total**	**10.78**	**5**
Total		**212.28**	**100**

Notes:

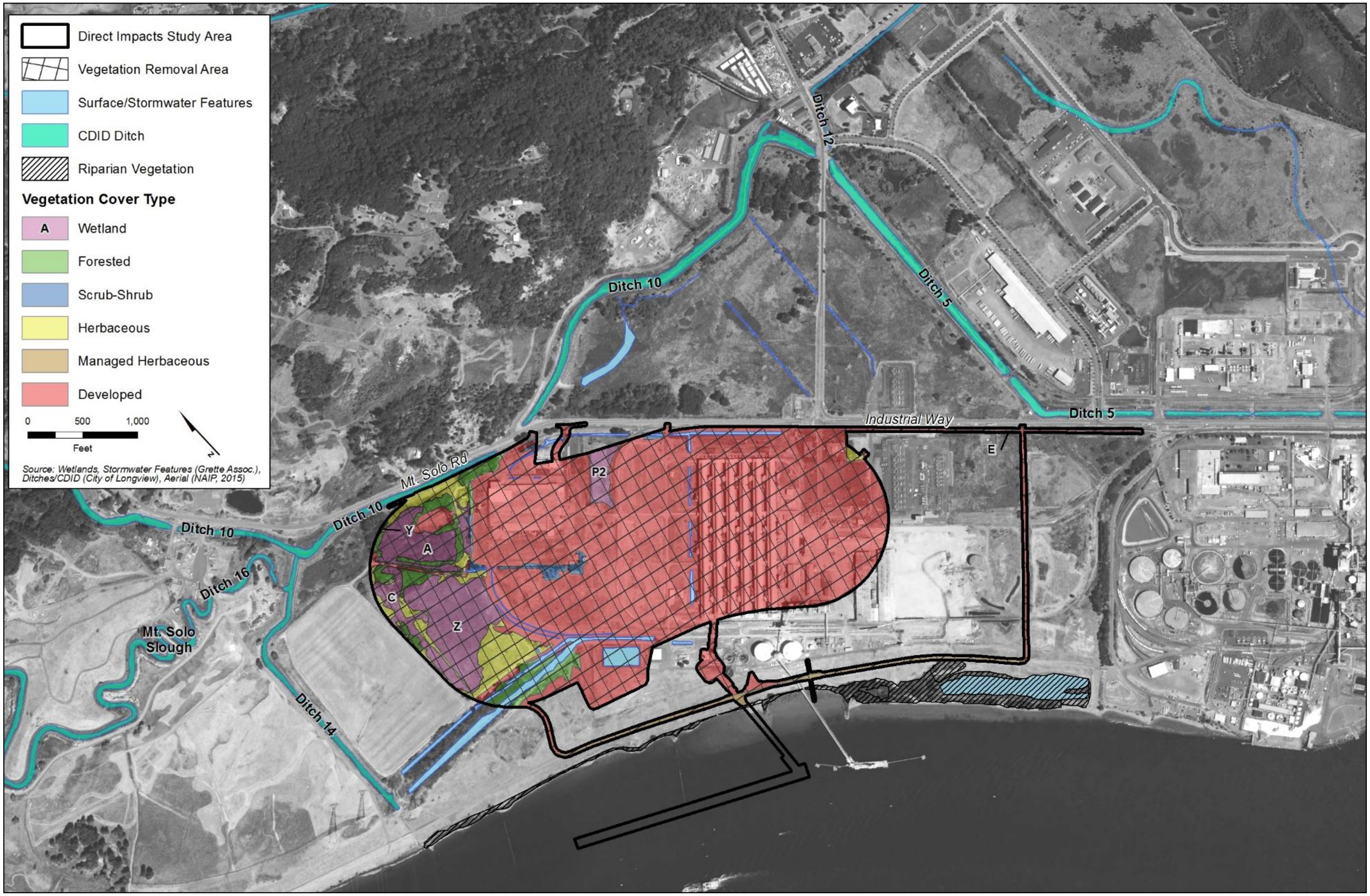
[a] For a detailed discussion of wetland impacts refer to Section 5.3, *Wetlands*.

[b] These are direct impacts on vegetation in the 212-acre project area, which includes the 190-acre project area for the proposed export terminal plus additional elements (e.g., access roads, docks, and rail line).

[c] This column represents the percent of cover type in the direct impacts study area affected by construction.

[d] Total does not equal sum of values due to rounding.

Figure 5.6-3. Impacts on Existing Land Cover Classes and Vegetation Cover Types—On-Site Alternative



The majority of the total impact (71%) would occur in areas occupied by developed lands, typically consisting of scattered grasses and weeds in and around the developed portions of the project area or areas of existing infrastructure. Approximately 26.26 acres of upland vegetation would be removed, or 12% of the direct impact study area. Herbaceous upland vegetation surrounding Wetlands A, C, and Z make up the majority of this acreage. These herbaceous upland areas are generally dominated by reed canarygrass. Approximately 8.90 acres of upland forest would be removed, with most impacts occurring around Wetland A and the areas surrounding the interception ditch and stormwater conveyance. These areas are dominated by native trees, primarily black cottonwood, red alder, Oregon ash, and Pacific willow trees, with an understory of mixed native and invasive shrubs dominated by red elderberry, sweetbriar rose, and Himalayan blackberry. The impacts would occur as a result of construction of the rail loop, stockpile pads, and a series of stacking and reclaim conveyors.

Approximately 0.05 acre of upland forest impact consists of riparian forest. This impact would occur as a result of construction of the trestle conveyor connecting the surge bin to Docks 2 and 3, and would include the removal and trimming of black cottonwood and willow trees, and understory shrubs such as red-osier dogwood and Himalayan blackberry.

Construction would result in the permanent loss of 24.10 acres of wetlands from placement of permanent fill in all of Wetlands A, C, Z, and P2, and a portion of Wetland Y. For a detailed discussion of wetland impacts refer to Section 5.3, *Wetlands*.

Although no special-status plant species have been recorded in the project area, potentially suitable habitat is present. Should any special-status plant species occur in the project area, they would likely be destroyed as a result of project construction. To minimize any losses, a special-status plant survey would be conducted as a mitigation measure. These surveys would occur during the appropriate time of year, prior to any project related construction activities beginning. If special-status plants are identified by the survey, the impact would be mitigated through Cowlitz County's Critical Areas Ordinance mitigation requirements for special-status plants (19.15.170).

Adjacent Vegetation

Construction and staging activities along the edges of the project area could crush and bury adjacent vegetation and compact soil in the direct impacts study area through vehicle use, material storage and stockpiling, and ground disturbance. Ground disturbance related to these activities could also increase the opportunity for stormwater runoff to carry sediments, spilled vehicle fluids, or other construction materials into areas outside of the project area, potentially affecting the health and vigor of adjacent vegetation. Depending on the extent, duration, and content of this runoff, vegetation could be affected through interference with photosynthesis, respiration, growth, and/or reproduction.

Dust from construction activities could also affect vegetation by collecting on leaves and other plant surfaces, potentially inhibiting photosynthesis and other plant functions.

The 35-foot-high preload material piles could provide an area for invasive plant species, including noxious weeds, to colonize. Such conditions would provide a seed source that could be readily dispersed into adjacent areas by wind and runoff, increasing the potential for invasive species and noxious weeds to spread and displace native vegetation.

Special-status plants adjacent to the project area could be temporarily affected by construction. The extent of any such impact cannot be quantified until a special-status plant survey is conducted.

Construction—Indirect Impacts

Construction of the proposed export terminal would not result in indirect impacts on vegetation because the impacts of construction would be limited to the project area, and would not occur later in time or be further removed in terms of distance than the direct impacts.

Operations—Direct Impacts

Direct impacts on vegetation from operation of the proposed export terminal at the On-Site Alternative location would likely be limited to the continued existence or possible colonization by noxious weeds around the periphery of the project area, impacts from vessel loading and transport along railroad tracks, and maintenance of vegetation under the conveyor and along the railroad tracks and rail loop.

Noxious Weeds

The disturbed nature of the project area during operations would favor colonization by noxious weeds, which are generally adapted to highly disturbed areas such as the periphery and other portions of the project area. Areas along rail tracks, along stacking conveyors, and between tracks of the rail loop would be most likely to support noxious weed species in scattered patches. Reed canarygrass, Himalayan blackberry, Canadian and/or bull thistle, and Scotch broom, which are already present on the project area, would likely persist during operations.

Disturbed Vegetation during Rail and Vessel Loading

Operation of the terminal could disturb vegetation along the railroad tracks entering the project area, along the shoreline of the Columbia River, and in the shallow waters of the Columbia River near the project area. Such impacts could occur as the result of spills of coal or other materials associated with operation of the rail cars, the conveyor and stockpiling systems, the mobile maintenance equipment, and the shiploaders.

Direct impacts on aquatic vegetation along the shoreline of the Columbia River cannot be quantified until an aquatic vegetation survey is conducted. The Applicant would conduct an aquatic vegetation survey (see Chapter 8, *Minimization and Mitigation*) to reduce potential impacts on aquatic vegetation prior to initiating in-water work. Impacts on water quality associated with the routine movement of coal near water bodies could also affect vegetation along or in receiving waters. However, stormwater runoff would be collected and treated prior to discharge to the Columbia River.

Altered Vegetation

Trees and tall shrubs around the trestle and conveyor to Docks 2 and 3 would likely be regularly trimmed or removed, slightly reducing organic material delivered to the river, shading for the upper beach and shoreline, and native foraging, resting, and perching opportunities for birds. The 45- to 50-foot-wide area affected would be very small relative to the approximately 5,000 linear feet of vegetated shoreline in the project area.

Routine vegetation maintenance along the perimeter road, rail tracks, and rail loop would involve trimming trees and tall shrubs within approximately 25 feet of either side of the perimeter road. This maintenance would artificially stunt individual trees and shrubs in these areas but would not measurably reduce the functions of native plant communities because it would be confined to the outermost edges of such communities. Any vegetation colonizing the disturbed interior of the project area along the rail loop would likely also be removed, controlled, or trimmed to eliminate any interference with the movement of the rail cars, equipment, or personnel.

Any special-status plants occurring along the periphery of the project area, along the rail tracks and rail loop, or under the conveyor would be affected by operations as described above. The spatial extent of any such impact cannot be quantified until a special status plant survey is conducted.

Coal Dust

The movement of coal into and around the project area, creation of large stockpiles of coal, and use of 29,100 linear feet of open conveyors to move coal onto vessels could generate coal particles and fugitive coal dust. Windborne coal dust can deposit on vegetation, soils, and sediments. The potential extent and deposition rate of coal dust particles less than 75 microns diameter was modeled as part of the air quality analysis. Based on this modeling, the highest rate of coal dust deposition would be expected in the area adjacent to the project area, but smaller particles could also deposit in a zone extending around and downwind of the project area. Deposition rates could range from 1.45 grams per square meter per year (g/m^2/year) closest to the project area, gradually declining to less than 0.01 g/m^2/year approximately 2.41 miles from the project area.

The potential zone of deposition includes the coniferous forest vegetation on the hills adjacent to the northern extent of the project area, as well as the riparian vegetation along the shoreline of the river. Deposition rates of less than 0.1 g/m^2/year are projected to occur over the forested communities on Lord Island within the Columbia River just east of the project area, with declining concentrations across the island and to the south and west toward Walker Island.

The impacts of dust on vegetation, including special status plants, would vary depending on dust load, climatic conditions, and the physical characteristics of the vegetation. Impacts could be physical, such as blocked stomata that alters gas diffusion into and out of the leaves, causing reduced respiration or increased transpiration; altered leaf surface reflectance and light absorption potential; and increased leaf temperature due to optical properties of the dust (Chaston and Doley 2006; Doley 2006:38; Farmer 1993). The *NEPA Vegetation Technical Report* summarizes studies of the impacts of dust deposition on vegetation in other regions. Coal dust deposition is also discussed in Chapter 6, Sections 6.6, *Air Quality*, and 6.7, *Coal Dust.*

Although coal transport could release contaminants such as arsenic and polycyclic hydrocarbons into the soil, concentrations would vary greatly and impacts on vegetation communities in the study area are not known. Given the number and variety of environmental, climatic and plant factors affecting the deposition of coal dust (Doley 2006), information regarding foliage density, leaf dimensions and characteristics, as well as particle size distribution, dust color, and climatic conditions would likely be needed to determine the level of dust deposition that could affect vegetation or plant functions.

To reduce the potential impacts of coal dust on vegetation, the Applicant would use enclosed conveyors and transfer points (except for stockyard and shiploader conveyors). Transfer chutes would be enclosed in transfer towers with soft flow transfer chutes and inlet and outlet curtains and side skirts. The conveyor system would include a washdown water collection and containment system as discussed in Section 5.5, *Water Quality*. During shiploading, the shiploader boom would be enclosed and coal would be discharged below deck, in the vessel's cargo hold.

Coal Spills

Direct impacts resulting from a coal spill during coal handling at the terminal would likely be minor because the amount of coal that could be spilled would be expected to be relatively small. Also, impacts would be negligible because of the absence of vegetation in the project area and the contained nature and features of the terminal (e.g., fully enclosed belt conveyors, transfer towers, and shiploaders).

Coal spilled into terrestrial environments could impact vegetation. Herbaceous vegetation would be more susceptible to damage and smothering from a coal spill compared to more rigid, woody vegetation like shrubs and trees, which may be better able to withstand the weight and force of a coal spill, depending on the magnitude of the spill. The physical impact of coal spilled on vegetation would range from minor plant damage to complete loss of vegetation. Coal dust associated with a coal spill could also cover vegetation, resulting in reduced light penetration and photosynthesis, which could lead to reduced vegetation density and plant diversity. Cleanup of coal spilled during operations could further impact vegetation by either removing or further damaging vegetation as a result of ground disturbance related to cleanup activities. Any coal remaining on the ground after a cleanup effort could leach chemicals from exposure to rain, which could damage or kill vegetation. However, if this were to occur, the impact area would generally be highly localized and limited to the extent of the spill, and unlikely to disrupt the overall plant community in the project area.

Operations—Indirect Impacts

Operation of the proposed export terminal at the On-Site Alternative Location would result in the following indirect impacts.

Coal Dust

The movement of coal by rail along the BNSF spur and Reynolds Lead could generate coal particles and fugitive coal dust, which could be deposited on vegetation, soil, and sediments in the study area. Coal transported by vessel would be in enclosed cargo holds and is not likely to result in deposition of coal on vegetation along the vessel route in the Columbia River. Coal dust deposition from rail cars is discussed in Chapter 6, Sections 6.6, *Air Quality*, and 6.7, *Coal Dust.* Potential impacts from coal dust deposition on vegetation is described the *Operations—Direct Impacts* section.

Eroded Vegetation due to Vessel Wakes

Increased vessel traffic from the terminal and associated wakes could contribute to erosion of vegetation along the shoreline of the Columbia River. Operation of the terminal at maximum throughput would result in 1,680 vessel transits (i.e., one-way trips either to or from the termina) per year (Chapter 6, Section 6.4, *Vessel Transportation*). The location and extent of these impacts would depend on vessel design, hull shape, vessel weight and speed, angle of travel relative to the shoreline, proximity to the shoreline, currents and waves, tidal stage, and water depth (Jonason 1993:29–30; MARCOM 2003). The potential for shoreline erosion could also be influenced by the slope and physical character of the shoreline (i.e., soil erodibility), as well as the amount and type of vegetation occurring along the shoreline.

Shoreline erosion is a natural process that removes sediment from the shoreline. It is caused by a number of factors including storms, wave action, and wind. Erosion of shoreline sediment can remove the substrate in which vegetation grows, eventually leading to loss of plants. Although erosion is not intrinsically harmful, it can be increased by vessel wakes, which can intensify the impacts and/or rate of the erosion process. In riverine environments the wave periods of vessels are longer compared to waves generated by wind. Riverbank vegetation is naturally adapted to the shorter period of wind waves, but not to the longer periods of vessel wakes. Long-period waves are an erosion mechanism to which the riverbank vegetation may be susceptible (Macfarlane and Cox 2004 in Gourlay 2011). While shoreline erosion along the Columbia River currently occurs due to existing vessel traffic, operation of the terminal would increase vessel traffic and probably increase or intensify the extent and/or rate of shoreline erosion and subsequent loss of shoreline vegetation.

The potential for vessel wake impacts on vegetation along the project area shoreline would be limited due to the slope of the shoreline and the general lack of aquatic vegetation near the docks. Additionally, vessels maneuvering near the docks would be moving very slowly and likely would not generate a wake sufficient to cause shoreline erosion. However, there is potential for erosion along the thin strip of shoreline vegetation along the northern end of Lord Island from large wakes or wakes oriented perpendicular to the main navigation channel and docks, such as those occurring when tugs push vessels into position at docks. There is higher potential for vessel wake impacts on vegetation along the shoreline of the lower Columbia River. Measures that could be implemented to reduce shoreline erosion and impacts on vegetation could include actions outside the control of the Applicant and permitting agencies. These actions include, but are not limited to, soft beach armoring, planting of native vegetation, and bank armoring. Vessel operations in the lower Columbia River are federally regulated, including size, speed, and navigation. Additionally, large vessels must be operated in the lower Columbia River by pilots licensed by the United States Coast Guard to perform this function. The navigation channel and its ongoing maintenance are also managed and regulated at the federal level.

5.6.5.2 Off-Site Alternative

Constructing the proposed export terminal at the Off-Site Alternative location would involve a project design very similar to the On-Site Alternative, although the Off-Site Alternative would involve constructing a new access road and extending the Reynolds Lead. Therefore, the types of impacts and impact mechanisms would be similar for the two alternatives, although the extent of potential impacts would differ somewhat due to differences in vegetation communities.

Construction—Direct Impacts

Construction of the proposed export terminal at the Off-Site Alternative location would result in the following direct impacts.

Removed Vegetation

Vegetation would be removed from the Off-Site Alternative project area as depicted in Figure 5.6-4. Clearing and grading would result in the permanent removal of approximately 225 acres of various land cover types from the project area, as shown in Table 5.6-9.

The majority of vegetation loss (56%) under the Off-Site Alternative would occur in herbaceous uplands, i.e., large areas of unmaintained grasses supporting a mixture of native and invasive plant species providing some wildlife habitat. Under the On-Site Alternative, the majority of vegetation loss (71%) would be to developed lands characterized by disturbed vegetation.

Construction would permanently fill 51.28 acres of wetlands, including all of Wetlands 1, 2, 4, and 5, and portions of Wetlands 3, 6, and Y. The proposed trestle would pass above approximately 140 feet of Wetland B. While there is no anticipated placement of fill or trestle structure in this wetland, construction would remove about 0.08 acre of trees in Wetland B. For a detailed discussion of wetland impacts refer to Section 5.3, *Wetlands*.

The Off-Site Alternative would remove approximately six times more upland vegetation than the On-Site Alternative (155.46 acres compared to 26.26 acres) because the project area for the Off-Site Alternative is currently undeveloped and largely vegetated. Most of the upland vegetation to be removed would consist of managed (17.73 acres) and unmanaged (126.57 acres) herbaceous vegetation. The remaining upland vegetation to be removed would consist of smaller areas of forest (6.74 acres) and scrub-shrub (4.42 acres) vegetation. These areas are dominated by a similar mixture of plant species as the upland forest and upland scrub-shrub vegetation for the On-Site Alternative.

Approximately 0.01 acre of riparian scrub-shrub vegetation would be removed to install a new stormwater outfall, including a sparse cover of noxious weed species (i.e., indigobush and Himalayan blackberry) and native species such as Pacific crabapple and big-leaf maple. The affected area would be similar and proportionate to the riparian vegetation impact under the On-Site Alternative, although forested riparian vegetation would be affected under the On-Site Alternative.

Disturbed Adjacent Vegetation

Construction activities could temporarily affect vegetation adjacent to the Off-Site Alternative project area by the same mechanisms described for the On-Site Alternative. Impacts could include temporary disturbance to riparian vegetation along the shoreline of the Columbia River, which is closer to the outer extent of the rail loop configuration under the Off-Site Alternative than for the On-Site Alternative.

Figure 5.6-4. Impacts on Existing Land Cover Classes and Vegetation Cover Types—Off-Site Alternative

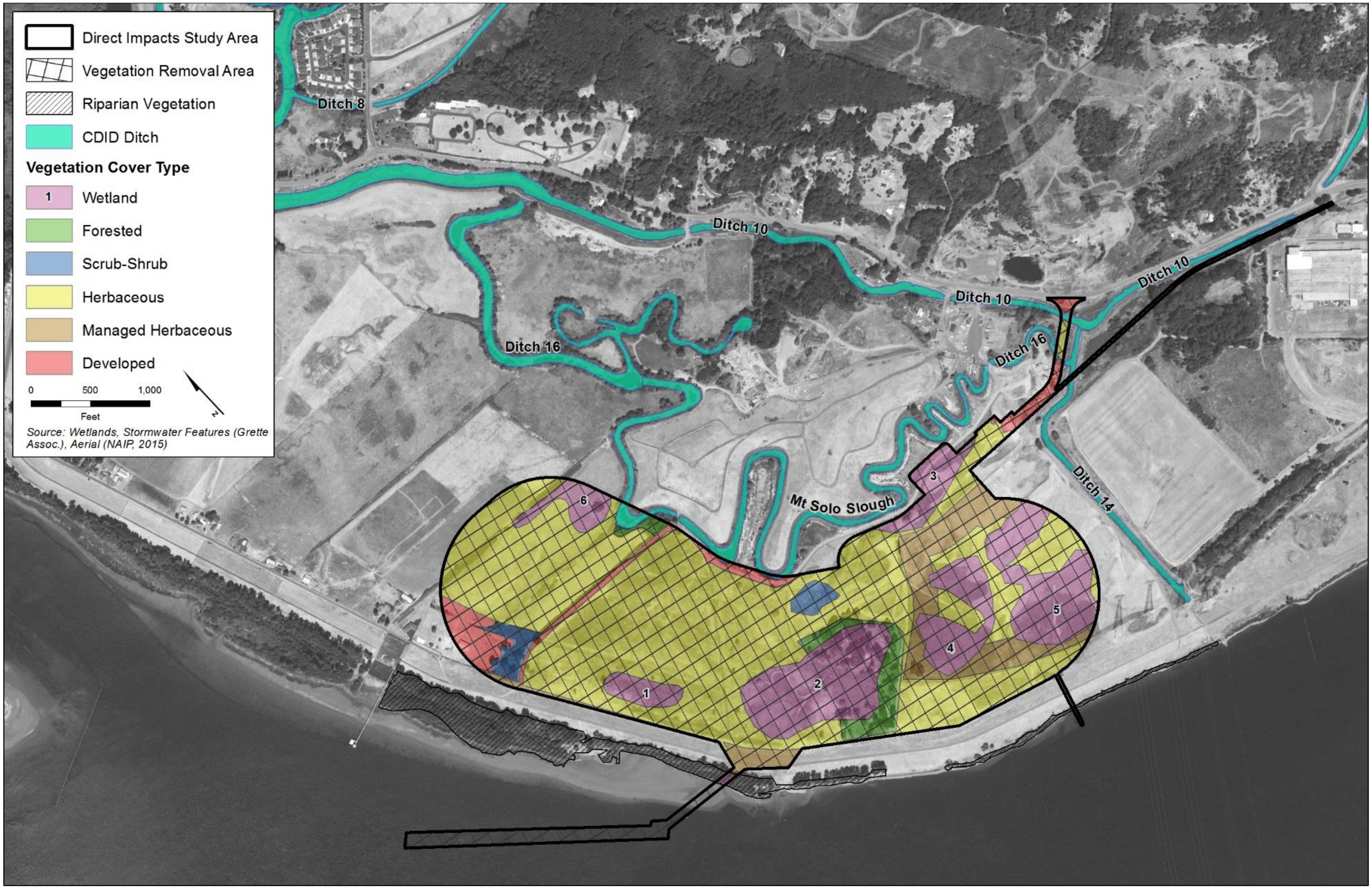


Table 5.6-9. Permanent Direct Impacts by Land Cover and Vegetation Cover Type in the Project Area—Off-Site Alternative

Land Cover Category	Vegetation Cover Type	Direct Impacts (Acres)[b]	Percentage of Cover Type[c]
Developed Land	**Developed Land Total**	**9.62**	**4**
Upland	Forested	6.74	3
	Scrub-Shrub	4.42	2
	Herbaceous	126.57	56
	Managed Herbaceous	17.73	8
	Upland Total	**155.46**	**69**
Wetlands	**Wetlands Total**[a]	**51.28**	**23**
Open Water	**Open Water Total**	**8.61**	**4**
Total		**224.97**	**100**

Notes:
[a] For a detailed discussion of wetland impacts refer to Section 5.3, *Wetlands*.
[b] These are direct impacts on vegetation in the 225-acre direct impacts study area, which includes the 220-acre terminal plus additional elements (e.g., access roads, docks, and rail line).
[c] This column represents the percent of cover type in the direct impacts study area affected by construction.

Construction—Indirect Impacts

Construction of the proposed export terminal at the Off-Site Alternative location would not result in indirect impacts on vegetation because construction would be limited to the project area, and would not occur later in time or be further removed in terms of distance than the direct impacts.

Operations—Direct Impacts

Operation of the proposed export terminal at the Off-Site Alternative location would result in the following direct impacts, similar to the On-Site Alternative.

Promote Colonization by Noxious Weeds

The potential for the Off-Site Alternative to result in colonization by noxious weeds would be the same as described for the On-Site Alternative and would occur through the same mechanisms. The magnitude of the impacts would be greater under the Off-Site Alternative because of the extent of the existing vegetation, relatively lower occurrence of noxious weeds, and larger extent of ground disturbance occurring at the Off-Site Alternative project area. Colonization by noxious weeds could increase the prevalence of such weedy species in closer proximity to intact native vegetation (e.g., Willow Grove Wetland Complex) than under the On-Site Alternative.

Disturb Vegetation during Rail and Vessel Loading

The Off-Site Alternative could affect riparian forested and scrub-shrub vegetation along the shoreline of the Columbia River, as well as scattered areas of aquatic vegetation possibly present in the shallow waters of the Columbia River in the vicinity of the Off-Site Alternative project area. The mechanisms and likelihood of these impacts would be the same as described for the On-Site Alternative.

Alter Vegetation during Maintenance Activities

The potential for the Off-Site Alternative to affect vegetation during maintenance vegetation under the proposed docks would be the same as described for the On-Site Alternative. The approximate extent, mechanisms, and likelihood of these impacts would also be the same. The Off-Site Alternative would affect a more well-developed riparian forest community, but one more dominated by the noxious weed indigobush than the more sparsely vegetated riparian area under the On-Site Alternative.

The Off-Site Alternative would affect vegetation along the railroad tracks entering the project area and along the rail loop used to stage coal trains at the terminal. Trees and tall shrubs within approximately 25 feet of either side of the perimeter road surrounding the tracks would likely be trimmed to ensure branches and leaves do not interfere with the movement of the rail cars. Areas along the railroad tracks entering the site and along the perimeter road surrounding the tracks have fewer trees and shrubs compared to the On-Site Alternative.

Deposit Coal Dust on Vegetation

Moving coal into and around the project area, managing large stockpiles of coal in the project area, and operating 17,900 linear feet of open conveyors within the project area would generate coal dust, which could become wind-borne and deposit on vegetation.

The highest rate of coal dust deposition would be expected adjacent to the project area, but smaller particles would also be expected to deposit in a zone extending downwind of the terminal. Deposition rates could range from 1.83 g/m^2/year closest to the terminal, gradually declining to less than 0.01 g/m^2/year at approximately 2.98 miles from the terminal.

The potential impact of coal dust on vegetation would be similar to that expected from the On-Site Alternative but would extend further downriver. The zone of deposition would include coniferous forest vegetation on the hills adjacent to the north end of the Off-Site Alternative project area, as well as riparian vegetation along the shoreline of the river. Coal dust would be expected to temporarily settle on some areas of higher quality native vegetation in the study area at a rate of approximately less than 0.1 g/m^2/year, including the native wetland vegetation communities of the Willow Grove Wetland Complex, as well as native forest communities on Walker Island, Fisher Island, and Hump Island within the Columbia River. However, given the number and variety of environmental and plant-specific factors affecting the deposition of dust (Doley 2006:36), information regarding foliage density, leaf dimensions and characteristics, and particle size distribution and dust color would likely be needed to determine the level of dust deposition that might affect sensitive plant species or functions.

Spill Coal during Operations

The potential impact of coal spills on vegetation during operations would be same as described for the On-Site Alternative, but would occur in the vegetation context described for the Off-Site Alternative.

Operations—Indirect Impacts

Operation of the proposed export terminal at the Off-Site Alternative location would result in the following indirect impacts.

Coal Dust

The potential impact of deposition of coal dust on vegetation in the study area during operations would be same as described for the On-Site Alternative.

Erode Vegetation due to Vessel Wakes

The Off-Site Alternative could result in indirect impacts on vegetation along the shoreline of the Columbia River related to increased vessel traffic and associated vessel wakes and bank erosion.

Increased vessel traffic in the Columbia River has the potential to increase the impact of vessel wakes, which could increase shoreline erosion and affect vegetation in low-lying areas along the river through the same mechanisms and to the same extent as under the On-Site Alternative. However, the actual extent, location, and magnitude of shoreline erosion would be influenced by a complex interaction of multiple factors, including vessel design, hull shape, vessel weight and speed, angle of travel relative to the shoreline, proximity to the shoreline, currents and waves, and water depth (Jonason 1993:29–30; MARCOM 2003). The potential for shoreline erosion is also influenced by the physical character of the shoreline and amount and type of vegetation.

There is a potential for shoreline vegetation along the northeastern end of Walker Island to be eroded by large wakes or wakes oriented perpendicular to the main navigation channel and docks, such as those occurring when tugs push vessels into position at docks.

5.6.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. Potential impacts on vegetation could occur under the No-Action Alternative similar to what is described for the On-Site Alternative, but the magnitude of the impact would depend on the nature and extent of future expansion.

5.6.6 Required Permits

No permits related to vegetation would be required for the proposed export terminal.

5.7 Fish

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

This section describes fish in the study area and the impacts on fish that could result from construction and operation of the proposed export terminal.

5.7.1 Regulatory Setting

Laws and regulations relevant to fish are summarized in Table 5.7-1.

Table 5.7-1. Regulations, Statutes, and Guidelines for Fish

Regulation, Statute, Guideline	Description
Federal	
Endangered Species Act (16 USC 1531 *et seq.*)	The federal Endangered Species Act of 1973, as amended, provides for the conservation of species that are listed as threatened and endangered and the habitat upon which they depend. Section 7 of the federal Endangered Species Act requires that federal agencies initiate 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.
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 SMPs) to protect shoreline natural resources.
Washington State Hydraulic Code (WAC 220-660)	Protects fish life. WDFW issues a hydraulic project approval for certain construction projects or activities in or near state waters.

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
Clean Water Act Section 401 Water Quality Certification	Ensures 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, including those that support fish and fish habitat.
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.
City of Longview Shoreline Master Program (Off Site-Alternative only)	The City's SMP consists of environmental designations for the shoreline segments and goals, policies, and regulations applicable to uses and modifications within the Shoreline Management Zone.
City of Longview Critical Areas Ordinance (LMC 17.10.140) (Off-Site Alternative only)	Regulates activities within and adjacent to critical areas, including those that support fish and fish habitat.

Notes:
USC = United States Code; Corps = U.S. Army Corps of Engineers; 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; SMP = Shoreline Master Program; WDFW = Washington Department of Fish and Wildlife; CCC = Cowlitz County Code; Ecology = Washington State Department of Ecology; LMC = Longview Municipal Code

5.7.2 Study Area

The study areas for the On-Site Alternative and Off-Site Alternative are described below. These study areas are based on the Corps' *NEPA Scope of Analysis Memorandum for Record* (MFR) (2014) and adjusted to reflect groundwater characteristics in and near the project areas.

5.7.2.1 On-Site Alternative

The study area for direct impacts on fish includes the Columbia River 3.92 miles upriver and downriver of the project area, measured from the two proposed docks (Figure 5.7-1), to account for elevated underwater noise levels associated with project-related pile-driving activities. This study area accounts for the area where noise from construction or operation of the On-Site Alternative could affect fish.

The study area for indirect impacts on fish includes the direct impacts study area plus the area of the Columbia River extending downriver from the project area to the landward line of the territorial sea (i.e., a line between the western-most end of the north and south jetties), from here on referred to as the mouth of the Columbia River (Figure 5.7-2). This study area includes shallow-sloping beaches along the river on which fish could be stranded by the wakes of passing vessels.

Figure 5.7-1. On-Site Alternative Direct Impacts Study Area

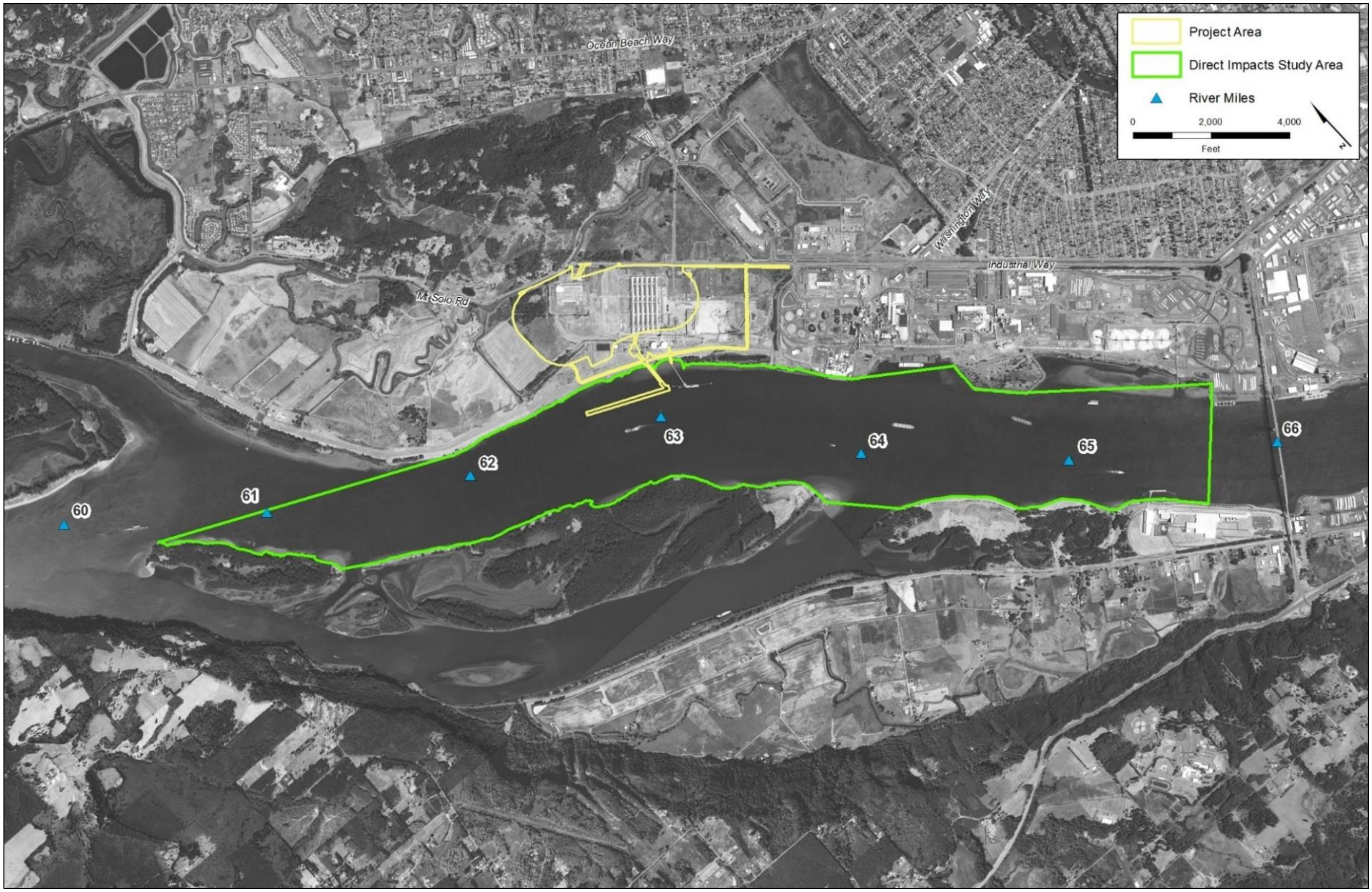
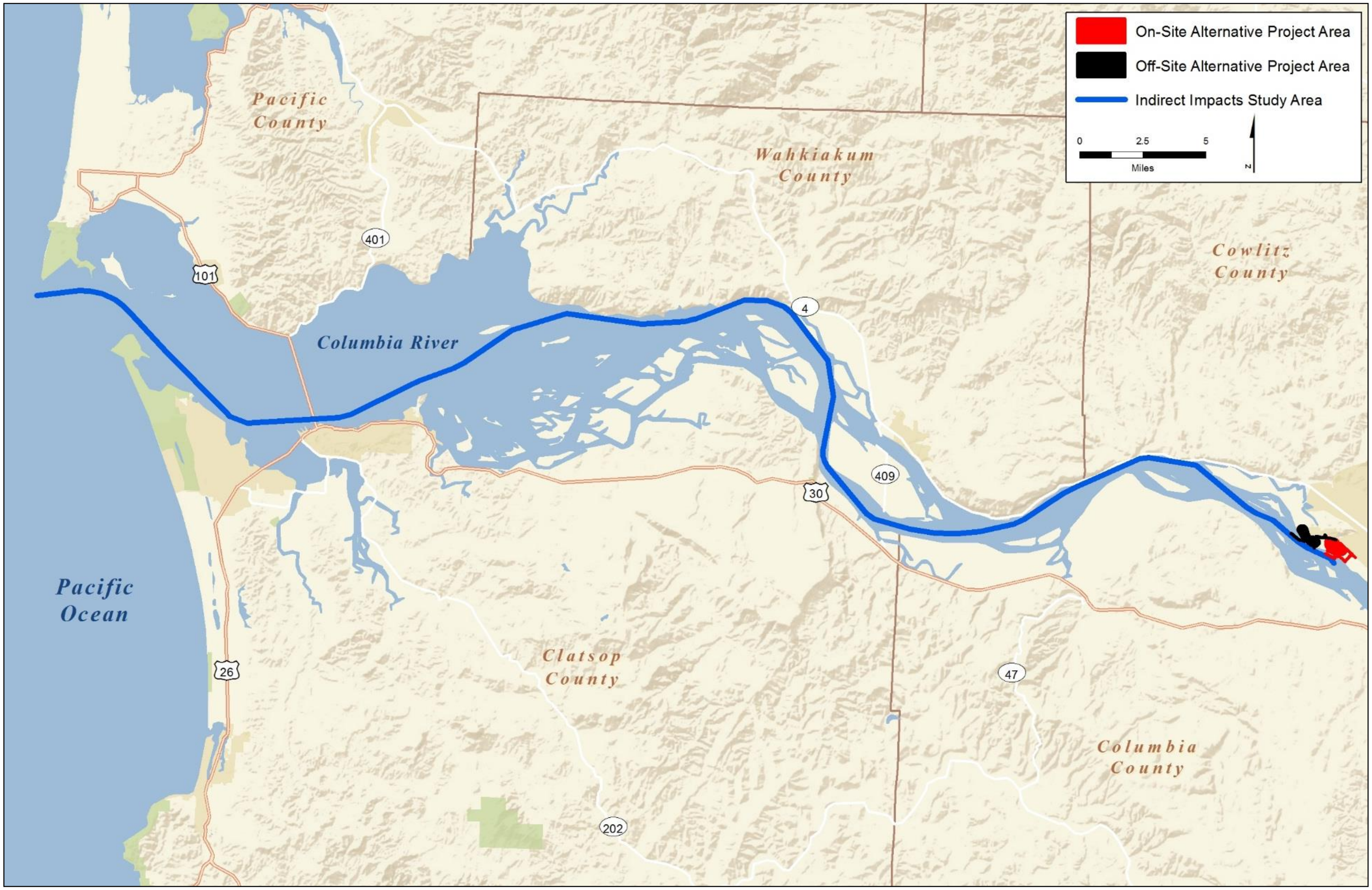


Figure 5.7-2. Fish Indirect Impacts Study Area



5.7.2.2 Off-Site Alternative

The direct impacts study area for the Off-Site Alternative is similar to the On-Site Alternative direct impacts study area. The direct impacts study area extends a distance of approximately 3.92 miles upriver and downriver in the Columbia River (measured, respectively, from the upriver and downriver extents of the proposed docks at the Off-Site Alternative) (Figure 5.7-3).

Similar to the On-Site Alternative, the study area for indirect impacts on fish has been expanded to include the Columbia River downriver from the Off-Site Alternative to the Columbia River mouth to accommodate an analysis of the potential impacts of fish stranding on shallow sloping beaches (Figure 5.7-2).

5.7.3 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 export terminal.

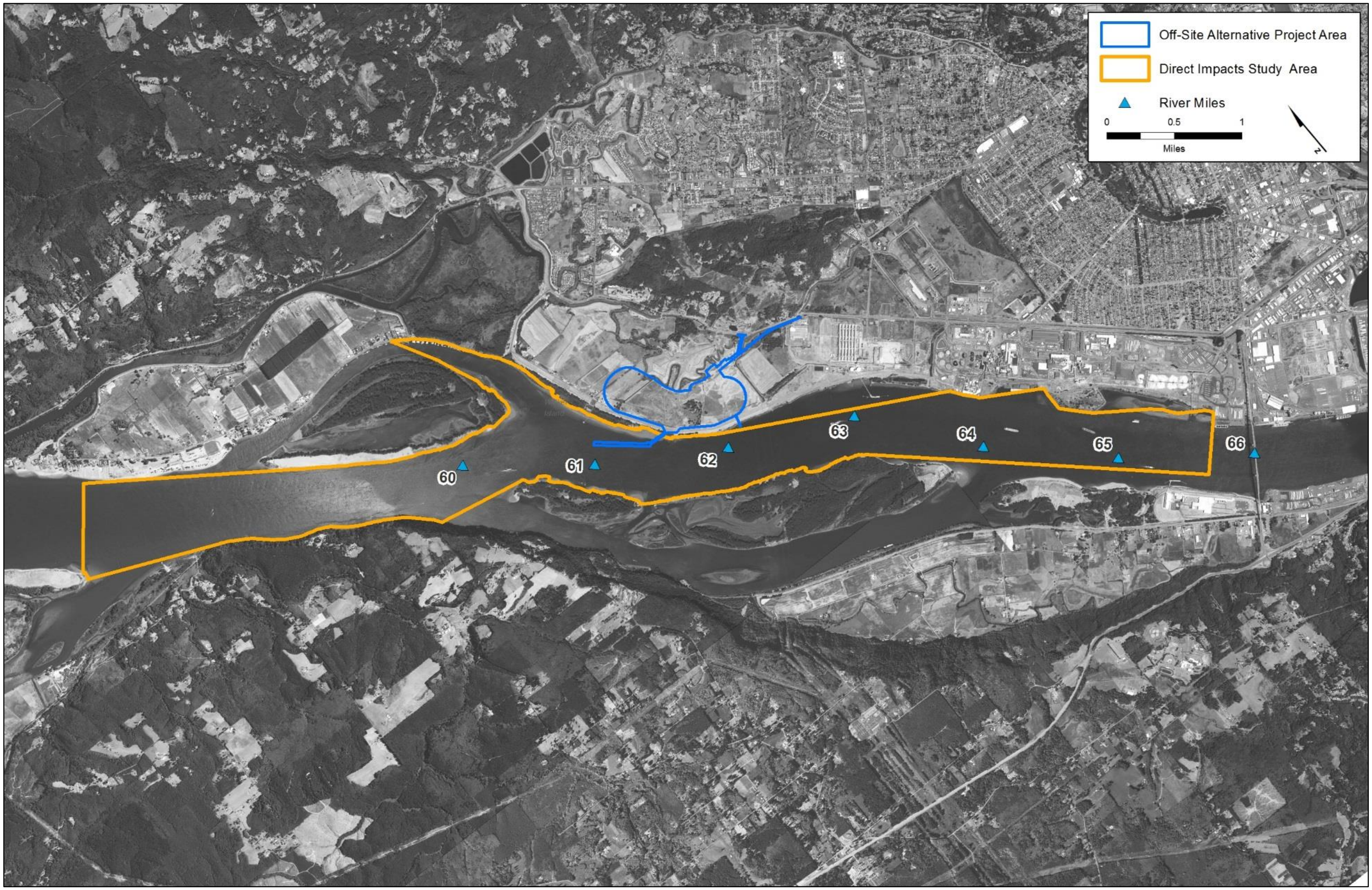
5.7.3.1 Information Sources

The following sources of information were used to identify the potential impacts of the On-Site Alternative, Off-Site Alternative, 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). The Priority Habitat and Species Program is fulfilled by WDFW to provide important fish, wildlife, and habitat information to local governments, state and federal agencies, private landowners, consultants, and tribal biologists for land use planning purposes.
- 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 *NEPA Fish Technical Report* (ICF International 2016a).

Figure 5.7-3. Off-Site Alternative Direct Impacts Study Area



5.7.3.2 Impact Analysis

The following methods were used to identify the potential impacts of the proposed export terminal on fish in the study areas. For more information on these methods, see the *NEPA Fish Technical Report*. For direct impacts, the analysis assumes best management practices were incorporated into the design, construction, and operations of the terminal. More information about best management practices can be found in Chapter 8, *Minimization and Mitigation*, and Appendix H, *Export Terminal Design Features*.

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 of 150 decibels (dB) $_{RMS}$ could result in behavioral changes, while sound pressure levels of 206 dB_{PEAK} could result in injury to fish. Specific dB criteria for Endangered Species Act (ESA)-listed fish are provided in Table 5.7-2. The National Marine Fisheries Service (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).

The criteria for sound pressure levels and underwater noise thresholds described above were applied to proposed pile-driving activities for the On-Site Alternative and Off-Site Alternative. 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 On-Site Alternative and the Off-Site Alternative (Grette Associates 2014b, 2014c, respectively).

A complete description of noise impact models, calculations, and assessments is provided in the *NEPA 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 *NEPA Fish Technical Report*.

Table 5.7-2. Underwater Sound-Level Thresholds for Endangered Species Act-Listed Fish

Species	Impact 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	$187dB_{SELcum}$
	Injury, cumulative sound (fish <2 grams): similar to above, onset of nonauditory tissue damage occurs at lower sound levels with smaller fish	$183dB_{SELcum}$
	Injury, single strike: onset of TTS and auditory tissue damage from single strike	$206dB_{PEAK}$
	Behavioral Disruption	$150dB_{RMS}$

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; a temporary shift in auditory threshold, such as temporary hearing loss

dB = decibel; a logarithmic unit used to express the ratio of two values of a physical quantity, often power or intensity

SELcum = sound exposure level; metric of acoustic events, often used as an indication of the energy dose.

PEAK = The instantaneous maximum overpressure or underpressure observed during each pulse during pile-driving.

RMS = root mean square; the square root of the sound energy divided by the impulse duration. Essentially, the average of the PEAK energy measured over time.

5.7.4 Affected Environment

This section describes the environment in the study areas related to fish potentially affected by the proposed export terminal.

5.7.4.1 On-Site Alternative

This section describes the affected environment specific to On-Site Alternative study areas related to fish.

The study areas have been affected by extensive modifications for flood control, industrial development, and deep draft vessel traffic. The lower Columbia River is deeper than it was historically because of construction and periodic maintenance dredging of the federal navigation channel and berthing areas along the river. The hydrologic regime and water temperature have been altered by the operation of dams throughout the Columbia River basin. River flows can reverse direction when river flows are low and incoming tides large. Saltwater does not intrude as far upriver as the study area and the water remains fresh through the tidal cycle. The study area is 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. Extensive shoreline armoring and protection, overwater structures, and development in adjacent upland and riparian zones have substantially degraded habitat conditions and altered habitat-forming processes, resulting in corresponding changes to the biological communities associated with these habitats.

The Columbia River estuary extends upstream from the mouth of the Columbia River to the Bonneville Dam (Simenstad et al. 2011). 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, piles, pile dikes, bulkheads, revetments, and docks) that contribute to its overall degradation. Habitat-forming processes in the estuary have also been altered by loss of upriver sediment input (now constrained behind upriver dams), changes in flow patterns that move sediments and modify landforms, and channel deepening and dredging.

5.7.4.2 Aquatic Habitat Types

The aquatic habitat in the study area is discussed in terms consistent with habitat equivalency analysis (HEA) model,[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). Although not technically an aquatic habitat, the riparian zone is discussed because of its interaction with aquatic habitats, as the riparian zone is the transition zone between aquatic and upland/terrestrial habitats. Habitat type locations associated with the On-Site Alternative are provided in Figure 5.7-4.

Riparian Zone

The riparian zone includes lands extending approximately 200 feet landward from the ordinary high water mark (OHWM). Shoreline armoring and Consolidated Diking Improvement District (CDID) #1 levees have contributed to a low habitat complexity, artificially steepened the upper shoreline, and largely cut off floodplain connectivity. Landward of the shoreline, most of the riparian area has been so heavily modified there is little remaining habitat function (Grette Associates 2014a). Relative to shoreline areas with intact riparian habitat (e.g., Lord Island, immediately across the river), shoreline habitat at the On-Site Alternative location is low value (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, based on OHWM of +11.1 feet Columbia River Datum (CRD)[3] (Figure 5.7-2). 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 that includes scattered large woody debris.

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

[3] Columbia River Datum (CRD) is a vertical datum that is the adopted fixed low water reference plane for the lower Columbia River. It is the plane of reference from which river stage is measured on the Columbia River from the lower Columbia River up to Bonneville Dam, and on the Willamette River up to Willamette Falls.

Figure 5.7-4. Aquatic Habitat Types Potentially Affected by the On-Site Alternative

Shallow Water Zone

The SWZ includes the fully inundated near-shore zone extending waterward from the ACM. The SWZ covers approximately 34 acres adjacent to the proposed docks and extends from approximately 25 to 500 feet offshore with maximum depths ranging from 11 to 31 feet, based on OHWM of +11.1 feet CRD. The bottom is primarily 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 in the project area, adjacent to the proposed docks, extending waterward from the edge of the SWZ, beyond 31 feet deep, based on OHWM of +11.1 feet CRD. At approximately 450 feet from the shore, this zone is about 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).

5.7.4.3 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 5.7-3 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. Detailed information about specific fish species can be found in the *NEPA Fish Technical Report*.

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 5.7-3) (Bottom et al. 2008; National Marine Fisheries Service 2011). An ESU is defined as a population of organisms considered distinct for purposes of conservation. A DPS is defined as the smallest division of a taxonomic species permitted to be protected under the ESA. In addition, essential fish habitat (EFH) has been designated for Chinook and coho salmon in the lower Columbia River. EFH includes those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity, per the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act. 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 areas. Adult anadromous salmonids travel through the estuary and lower river relatively quickly during their migration to upriver spawning grounds, remaining primarily in offshore deepwater habitats. In contrast, juvenile salmonids use a wider variety of habitats and exhibit more variable downriver migration speed, taking advantage of shallow water and ACM for foraging and seeking cover.

Table 5.7-3. Status of Focus Species and Seasonal Presences in the Study Area[a]

Species, ESU/DPS	Federal Status[a]	Life Stage	Sept			Oct			Nov			Dec		
			A[b]	S[b]	D[b]	A	S	D	A	S	D	A	S	D
Chinook Salmon														
Snake River fall-run ESU	T	Adults			X[c]			…						
		Subyr		…[d]	…		…	…		…	…			
Lower Columbia River ESU	T	Adults			X			X						
		Yrlng												…
		Subyr		…	…		…	…		…	…	…		
Upper Willamette River ESU	T	Yrlng												…
		Subyr		…	…		…	…		…	…	…		
Coho Salmon														
Lower Columbia River ESU	T	Adults			X			X			X			X
		Subyr		…			…			…		…	…	
Chum Salmon														
Columbia River ESU	T	Adults						X			X			
		Subyr										…	…	
Steelhead Trout														
Snake River DPS	T	Adults			X			…						
Upper Columbia River DPS	T	Adults			X			…						
Middle Columbia River DPS	T	Adults			X			…[e]						
Lower Columbia River DPS	T	Adults			X			X			X			X
Bull Trout														
Columbia River DPS	T	Adults		…	…		…	…		…	…		…	…
Cutthroat Trout														
Columbia River DPS	NL	Adults/Juveniles		X	X		X	X		X	X		X	X
Green Sturgeon														
Southern DPS	T	Adults/Subadults		X	X		X	X						
Northern DPS	SOC	Adults		X	X		X	X						
		Subadults		X	X		X	X						

Species, ESU/DPS	Federal Status[a]	Life Stage	Sept A[b]	Sept S[b]	Sept D[b]	Oct A	Oct S	Oct D	Nov A	Nov S	Nov D	Dec A	Dec S	Dec D
White Sturgeon														
Lower Columbia River		Adults		X	X		X	X		X	X		X	X
		Subadults		X	X		X	X		X	X		X	X
Eulachon														
Southern DPS	T	Adults								…	…		X	X
		Eggs/Larvae								…	…		X	X
Pacific & River Lamprey														
Multiple populations	NL	Adults		X	X		X	X						
		Ammoceotes		X	X		X	X		X	X		X	X

Notes:

[a] T denotes federally threatened (no Endangered in this table), "NL denotes Not Listed, SOC denotes Species of Concern.

[b] A, S, and D represent the HEA habitat categories of ACM, SWZ, and DWZ; see Grette (2014c) Section 3.2.3.1 for additional information.

[c] X denotes expected or potential presence; see Grette Associates (2014c), Section 3.3 for additional information.

[d] "…" denotes expected presence but low relative abundance; see Grette Associates (2014c), Section 3.3 for additional information.

[e] The Middle Columbia River DPS includes a very small proportion of winter-run fish (Klickitat River, Fifteen-Mile Creek); because passage data at Bonneville Dam indicate that the vast majority of steelhead have passed the dam by early October, it is assumed that this includes winter steelhead spawning above it.

ESU = Evolutionary Significant Unit; DPS = Distinct Population Segment; Subyr = subyearling; Yrlng = yearling.

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 On-Site Alternative.

Designated critical habitat for federally protected salmonids in 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 and coho salmon. EFH for Pacific salmon is defined as those waters and substrate necessary for salmon production needed to support a 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 5.7-3 identifies the seasons when salmon and steelhead species could be present in the ACM portion of the study areas.

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 they likely occur in the deeper areas of the SWZ.

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 downriver 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 5.7-3) 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).

WDFW and ODFW conducted plankton tows to sample for eulachon eggs and larvae between the Port of Longview above Barlow Point and the channel below the Cowlitz River mouth including four sample sites offshore in the vicinity 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). As part of a related one-time sampling effort, eulachon eggs/larvae were documented in plankton tows at six sample sites (inshore and offshore) near the project area between river miles 62.8 and 64.0 in February 2012 (Mallette 2014: Report B). 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 downriver. Further, it is likely that at least limited spawning occurs in the mainstem Columbia River, as documented on the Oregon side of the Columbia River by Mallette (2014). Mallette (2014) found the greatest numbers of eulachon larvae were found in samples collected well downstream of the Lewis, Kalama, and Cowlitz rivers and upstream of the Elochoman (rivers with known eulachon spawning). While the relatively distant proximity of sampling events to known spawning areas does not discount the possibility that larvae in samples may be the product of spawning in these tributaries, Mallette (2014) concluded that these findings highlight the potential for at least limited spawning in the mainstem Columbia River.

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 downriver 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).

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 (i.e., areas where fish hold and feed) 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).

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 upriver briefly, sucking to rocks, resting, and then proceeding. Larval lamprey (ammocoetes) hatch after 2 to 3 weeks and are dispersed downriver 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. Larval, juvenile and adult lamprey may be present in the SWZ and DWZ during their respective migration periods (Table 5.7-3).

Nonfocus Fish

The nonfocus fish (Table 5.7-4) 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 salmonids, such as largemouth bass, northern pikeminnow, smallmouth bass, striped bass, and walleye.

Table 5.7-4. 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 4, Section 4.5, *Tribal Treaty Rights and Trust Responsibilities*.

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 impact 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 upriver of the project area (Washington State Department of Ecology 2014). Turbidity in the study area is variable based on a number of factors. For example, over 5 days of water quality monitoring for dredging, background levels (upstream of active dredging) ranged from the mid-20s to the mid-60s 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 *NEPA 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 (Bauersfeld 1977). Pearson et al. (2006) observed 126 vessel passages, 46 of which caused stranding. 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 export terminal would add 840 vessel calls, or round-trips to and from the terminal, or 1,680 one-way transits to Columbia River vessel traffic at full capacity, which would introduce additional permanent risk of fish stranding in the Columbia River. Many factors affect the risk of fish stranding in the lower Columbia River, including but not limited to vessel size, draught and speed, and beach slope and permeability.

5.7.4.4 Off-Site Alternative

The affected environment for the Off-Site Alternative is similar to the On-Site Alternative based on the proximity of the two project areas. This section highlights the differences that exist at the Off-Site Alternative project area.

Aquatic Habitat Types

The aquatic portion of the Off-Site Alternative is a functioning, although somewhat modified, habitat complex (riparian, ACM, SWZ, and DWZ) (Figure 5.7-5) with a varying water-level regime that fluctuates on daily (tidal) and seasonal (discharge) scales. Modifications (e.g., diking, shoreline armoring) and simplifications (e.g., lack of vegetation) limit habitat development, but functional habitat is present in the ACM and SWZ portions of the study area (Grette 2014c).

Riparian

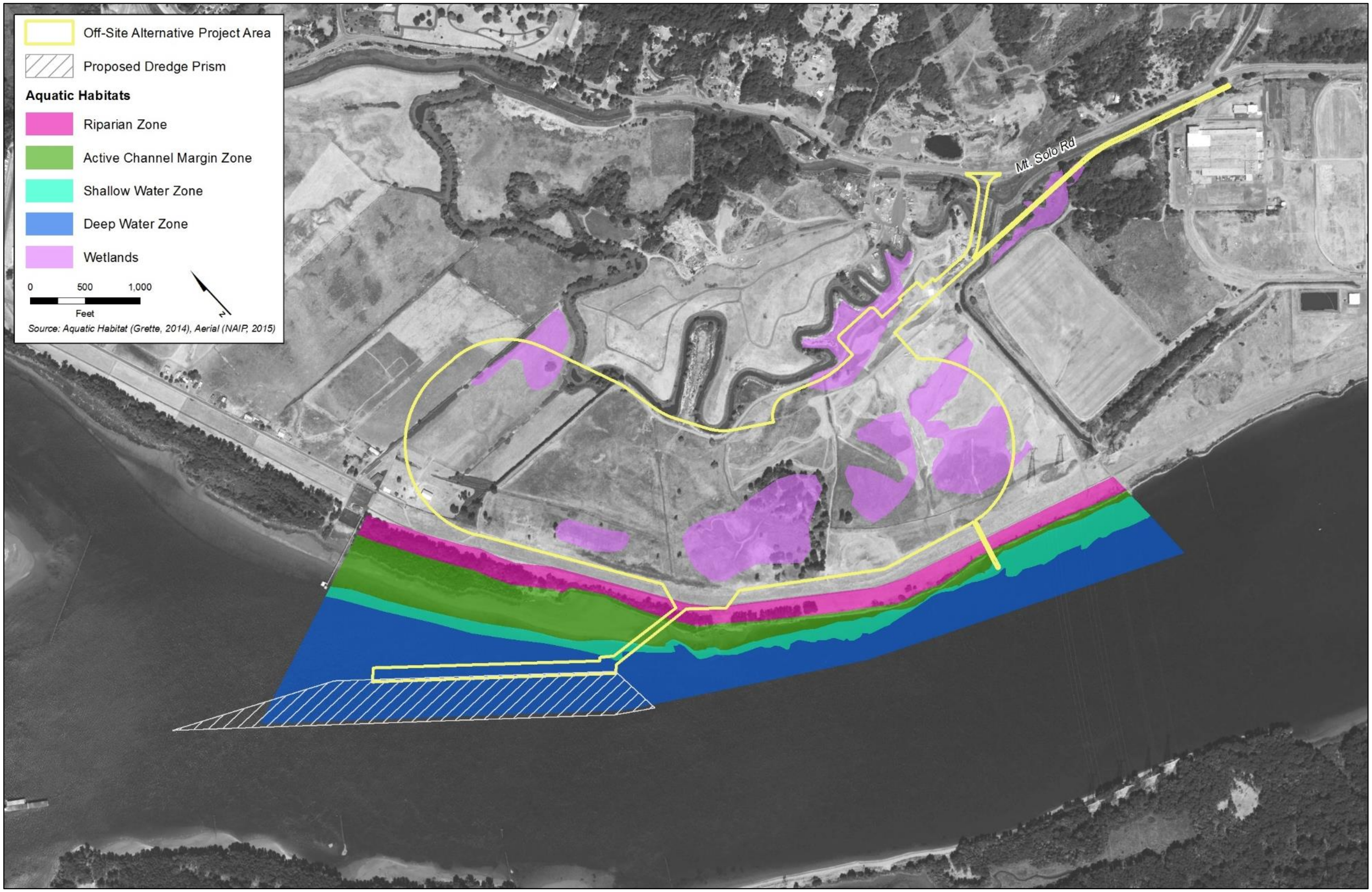
Shoreline armoring and the CDID #1 dike have contributed to what is considered low-complexity aquatic habitat conditions with an artificially steepened upper shoreline area and no floodplain connectivity in the upriver two-thirds of the Off-Site Alternative project area. Landward of the shoreline, ongoing dike maintenance prevents establishment of riparian vegetation (Grette 2014c).

However, the Off-Site Alternative project area includes relatively intact riparian habitat below the toe of the dike. Approximately the middle one-third of the Off-Site Alternative project area contains a band of riparian/wetland habitat, varying from approximately 20 to 140 feet wide, and the downriver one-third contains wide (approximately 250 feet), dense riparian/wetland habitat. Thus, much of the Off-Site Alternative contributes moderate to high levels of biological material (e.g., leaf litter, woody material, insects) to the aquatic environment, as well as shade and other physical functions (Grette 2014c).

Active Channel Margin

The middle and lower portions of the ACM consist largely of unvegetated silty sands that provide shallow water habitat (e.g., 2 to 6 feet deep) during high and low water-level seasons. Specifically, the flats in the ACM provide shallow water foraging and refuge opportunities for juvenile salmon during the early part of the outmigration period, which tends to correspond to high water levels in the Columbia River and its tributaries. This shallow, flat habitat occurs almost exclusively in the downriver portion of the study area, and primarily in the ACM. During low water periods when the ACM is dewatered or very shallow, similar flat habitat in the upper SWZ providing similar function is scarce because the SWZ is more steeply sloped (Grette 2014c).

Figure 5.7-5. Aquatic Habitat Types Potentially Affected by the Off-Site Alternative



Shallow Water Zone

Shallow-water areas provide inherently higher biological function than DWZ habitat. In areas with poor quality riparian habitat (e.g., the upriver one-third of the Off-Site Alternative project area), the overall habitat function of the ACM—and to a lesser extent the SWZ—at the project area is expected to be relatively less than similar areas with intact riparian habitat (Grette 2014c).

Deep Water Zone

Because light penetration is reduced with increased water depth, the quality of benthic habitat in DWZ areas ranks at least ten times lower than that of ACM or SWZ habitats. Though no studies have been conducted at the Off-Site Alternative project area, the quality of DWZ habitat is likely reduced due to the highly dynamic nature of currents acting upon it (Grette Associates 2014a). Areas with dynamic bedload typically express reduced biological productivity due to limited sediment stability and insufficient buildup of detritus and fine material (McCabe et al. 1997). In addition, the potential for benthic invertebrates to successfully colonize areas exposed to strong currents is reduced by the risk of burial associated with accretion and the risk of scouring due to erosion. Therefore, in the context of the HEA model, the quality of habitat in the DWZ portions of the Off-Site Alternative project area would rank low compared to the SWZ areas and those portions of the DWZ not exposed to strong downriver flow.

Columbia River

The existing conditions of the Columbia River within the Off-Site Alternative project area are the same as or similar to those of the On-Site Alternative.

5.7.5 Impacts

This section describes the potential direct and indirect impacts on fish and fish habitat that would result from construction and operation of the proposed export terminal.

5.7.5.1 On-Site Alternative

This section describes the potential impacts that could occur in the study areas as a result of construction and operation of the proposed export terminal at the On-Site Alternative location.

Construction—Direct Impacts

Construction-related activities associated with the On-Site Alternative could result in direct impacts as described below. As explained in Chapter 3, *Alternatives,* construction-related activities include demolishing existing structures and preparing the site, constructing the rail loop and dock, and constructing supporting infrastructure (e.g., conveyors and transfer towers).

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 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 organisms within the proposed dredge prism would be removed during dredging. Recolonization by organisms would be relatively rapid, and disturbed habitats would return to reference conditions following recolonization by benthic organisms (McCabe et al. 1996). Typically 30 to 45 days are required for benthic organisms to recolonize disturbed environments.

The Applicant has proposed to do the in-water work between August 1 and February 28. The Applicant has proposed to do impact pile-driving between September 1 and December 31; dredging, including flow lane disposal of dredged material, would be performed between August 1 and December 31; and impact pile-driving between September 1 and December 31. While the specific times dredging activities would be allowed by the permitting agencies has not been determined and would not be defined until permits would be issued for the terminal, the Applicant-proposed timing for performing the dredging activities would avoid and minimize impacts on spawning adult, egg, and larval eulachon. Adult eulachon typically enter the Columbia River and tributaries (i.e., Cowlitz, Kalama, Lewis, Sandy, Elochoman), in December and January. Peak spawning migration occurs in February and March. Peak larval abundance occurred in mid-March during two of three survey years and in late April/early May in the third (Mallette 2014). Eggs could be present from mid-November through April; however, dredging activities that occur between August 1 and November 30 would minimize potential impacts on adult eulachon that may spawn within 300 feet of the dredge prism. Limiting dredging activities to August 1 through November 30 would further reduce the potential to affect eulachon spawning or migrating adults.

Dredging and dock construction associated with the terminal could affect habitat that may be suitable for eulachon spawning. Spawning substrates include sand, course gravel, and detrital substrates. Sand substrate occurs within the dredge prism, and is assumed to provide suitable habitat for eulachon spawning. Project-related dredging would affect approximately 48 acres for the On-Site Alternative. Trestle and dock construction would install 610 piles below OHWM, affecting an additional 0.10 acre (4,312 square feet). The dock, with two Panamax-size vessels being loaded simultaneously, would shade approximately 9.83 acres (refer to Operational Direct Impacts, below). The direct impacts study area for the On-Site Alternative is approximately 1,549 acres (Figure 5.7-1). Thus, project-related dredging would modify approximately 3% of the direct impacts study area, while dock construction would permanently affect approximately

0.6% of the direct impacts study area. The extent of this area that may be used by eulachon for spawning is unknown.

During eulachon spawning eggs are deposited through broadcast spawning and attach to the substrate. After approximately 1 month of incubating the eggs hatch into larvae that drift passively downstream to saltwater. It is likely that much of the dredge prism area is used for egg incubation and larval transport/rearing, either from spawning within the dredge prism area or egg drift from areas upstream within the Columbia River, or the Cowlitz River, located approximately 5 miles upstream of the project area.

Eulachon are assumed to occur in the Columbia River adjacent to the project area from December through May. Any project-related work that would occur between December and May could directly affect eulachon. Mitigation would reduce the potential impact by confirming the presence/absence of eulachon, and, if present, coordinating with the fish and wildlife agencies (i.e., NMFS and WDFW) on the appropriate course of action to avoid and minimize potential impacts on eulachon. Sediment sampling from within, adjacent to, and upriver 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 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 issuing a Department of the Army permit, the Corps would require the Applicant to conduct site-specific sediment sampling and prepare an agency-approved 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.

Elevated Turbidity

Removal of piles and the dredging and disposal of riverbed substrate would temporarily increase turbidity. 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. 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 behavioral 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 occasional temporary in-water work.

Construction-related dredging is proposed to occur from August 1 through December 31, when many fish species would be present in the study area.

Underwater Noise

Installation of 610 structural steel piles below the OHWM to support the trestle and Docks 2 and 3 would generate underwater noise during pile-driving (Grette Associates 2014b). Most piles would be driven to a depth of 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 pile-driving, while deeper resistance would require more vibratory and less pile-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 impacts on ESA-listed fish are provided in Table 5.7-5. 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).

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).

Table 5.7-5. Underwater Noise Thresholds and Distances to Threshold Levels

Species	Impact Type	Threshold	Distance to Impact 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-driving 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

Based on calculations of where underwater noise thresholds would be exceeded by pile-driving noise (Section 5.7.3.2, *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 upriver and downriver 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 amount of time that fish are present in the study area.

Five threatened salmon species could occur in the study area during the in-water work window of September 1 through December 31 (Table 5.7-6). 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 downriver 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 5.7-6. Salmonids and Other Fish 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]	Sep–Nov[b]	Sep–Nov[b]		Sept–Oct
Lower Columbia River ESU	T	Sep–Nov[b]	Sep–Dec[b]	Sep–Dec[b]	Sept–Oct
Upper Willamette River ESU	T	Sep–Nov[b]	Sep–Dec[b]	Sep–Dec[b]	
Coho Salmon					
Lower Columbia River ESU	T	Sep–Dec[b]	Sep–Dec[b]		Sept–Dec
Chum Salmon					
Columbia River ESU	T				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	Dec	Dec	Dec	Nov–Dec

Notes:
[a] T denotes federally threatened (no Endangered in this table).
[b] Denotes expected presence during the proposed in-water work window; see Grette Associates (2014c).
ESU = Evolutionary Significant Unit; DPS = Distinct Population Segment

Green sturgeon, eulachon, and salmonids 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 (20%) 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 upriver 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 on 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 impact 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 Chapter 8, *Minimization and Mitigation*, for further information.

Sound pressure levels could exceed the threshold for behavioral impacts up to 3.92 miles from pile-driving activities per the *NEPA 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. The injury area for a single-strike would extent approximately 45-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.

Temporary Shading

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 likely be 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.

Spills and Leaks

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. A spill would likely 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 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 5.5, *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 export terminal would not result in indirect impacts on fish because no construction impacts would occur later in time or outside of the direct impacts study area.

Operations—Direct Impacts

Operation of the proposed export terminal at the On-Site Alternative location would result in the following direct impacts. Operations-related activities are described in Chapter 3, *Alternatives*.

Shading

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 results in less energy for epibenthic communities and ultimately the fish that prey on epibenthic organisms. Shadows may also 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 salmon. 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 OHWM 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 impacts 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 5.7-1) 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 salmon 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.

Spills and Leaks

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 On-Site Alternative. The potential risks, impacts, and mitigation measures related to water quality are addressed in Section 5.5, *Water Quality*. Refer to Chapter 4, Sections 4.6, *Hazardous Materials, and* 4.7, *Energy,* as well as Chapter 6, Section 6.4, *Vessel Transportation*, for more information related to fuel and refueling activities associated with the On-Site Alternative. Similarly, appropriate training and implementation of prevention and control measures would guard against these risks, greatly reducing the potential for these types of impacts.

Coal Spills

Direct impacts on the natural environment from a coal spill during operations of the terminal could occur. Direct impacts resulting from a spill during coal handling at the 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 by 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.

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 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 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 export terminal at the On-Site Alternative location would result in the following indirect impacts.

Fish Stranding from Vessel Wakes

At full build-out, 70 cargo vessels per month (840 per year) would be loaded at the terminal. 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 On-Site Alternative 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 near the project area. For example, Lord Island is just across the navigation channel from the project area, and Barlow Point is about 1.2 miles downriver. Vessels maneuvering near the project area would be either slowing to stage nearby if the docks are full or slowing to prepare for docking. Once vessels are loaded, they would maneuver back to the navigation channel and then proceed downriver toward the Pacific Ocean. It is assumed such maneuvering would result in little risk of stranding near the proposed docks, as very little wake would be generated by vessels moving at slow speeds. Sites farther downriver, such as near Puget Island, would be more likely to have a higher risk of fish stranding from vessel wakes because vessels are transiting those areas at higher speeds.

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 due to unconsolidated substrate material). 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 terminal throughput, the proposed terminal would represent approximately 27% of the projected vessel traffic volume in the lower Columbia River. The additional traffic associated with the terminal would increase the risk of fish stranding.

Vessel operations in the lower Columbia River are federally regulated, including the size, speed, and navigation within the river. Additionally, large vessels sailing the lower Columbia River are required to be operated by pilots licensed by the U.S. Coast Guard. The navigation channel is managed and regulated at the federal level, including maintenance dredging and dredged material disposal.

Physical or Behavioral Responses to Vessel Noise

Vessels transit the Columbia River carrying oil, freight, and materials to and from ports along the river. Mean source sound levels of bulk carrier vessels were calculated in Puget Sound at between 187.9 and 198.2 dB sound pressure level 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.

Maintenance Dredging and Aquatic Habitat

Maintenance dredging would likely occur every few years, 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 On-Site Alternative. Maintenance dredging would follow the same methods and have the same impacts as those described for construction-related dredging.

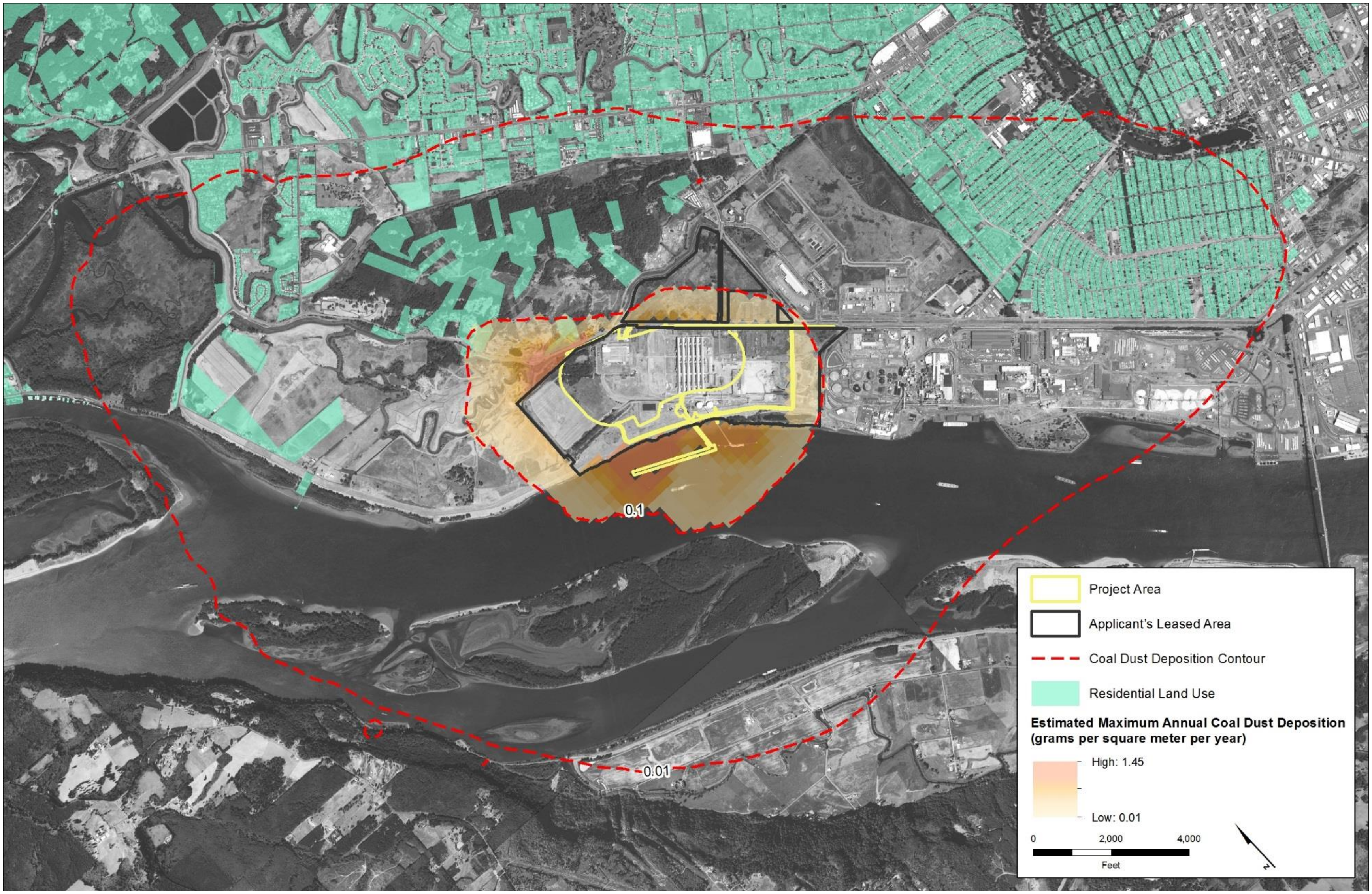
Coal Dust

Coal dust would be generated during operation of the terminal through the movement of coal into and around the project area, as well as during transfer onto vessels (Chapter 6, Sections 6.6, *Air Quality,* and 6.7, *Coal Dust*). Coal dust could also become airborne from stockpiles located within the project area. Modeled fugitive coal dust concentrations (Figure 5.7-6) indicate that deposition would range from 1.45 grams per square meter per year (g/m^2/year) adjacent to the terminal to 0.01 gram per square meter 2.41 miles from the terminal (Chapter 6, Section 6.7, *Coal Dust*). One review of the chemical composition of coal dust (U.S. Geological Survey 2007) suggests the risk of exposure to toxic materials (e.g., PAHs and trace metals) from coal are low because the concentrations in coal are low and the chemicals bound to coal and not easily leached. Particles would also be transported downriver by the flow of the river and distributed over a broad area, diluting any potential impacts.

Commercial and Recreational Fishing

Project-related increases in vessel traffic in the lower Columbia River and associated underwater noise could affect fishing in the study area. Increases in vessel traffic could cause behavioral responses including quicker migration or avoidance of the navigation channel. An average of 70 large commercial vessels would be loaded at the terminal each month. If adult fish targeted in commercial and recreational fishing were to alter behavior in response to increased underwater noise, they may avoid or migrate quickly through the navigation channel. It is also likely that commercial and recreational fishing vessels would not be fishing within the navigation channel when large vessels are present. Therefore, the On-Site Alternative likely would not significantly reduce commercial or recreational fishing catches or limit access for fishing activities. See Chapter 6, Section 6.4, *Vessel Transportation,* for potential impacts on commercial and recreational fishing vessels associated with project-related vessels.

Figure 5.7-6. 3-Year Annual Average Coal Dust Deposition for the Proposed Action



5.7.5.2 Off-Site Alternative

This section describes the potential impacts that could occur in the study area as a result of construction and operation of the terminal at the Off-Site Alternative location. Impacts would be similar to those described in Section 5.7.2.1, *On-Site Alternative,* with minor differences.

Construction—Direct Impacts

Construction of the proposed export terminal at the Off-Site Alternative location would result in the following direct impacts.

Aquatic Habitat

Habitat in the Columbia River would be permanently removed by the placement of piles. A total of 597 36-inch-diameter steel piles would be placed in the Columbia River, permanently removing 0.10 acre (4,220 square feet) of benthic habitat. Benthic organisms within the footprint of individual piles at the time of pile-driving would likely perish.

Dredging would permanently alter a 15-acre area of deep water habitat by removing approximately 50,000 cubic yards of benthic sediment to achieve the necessary depth, with a 2-foot overdredge allowance (Grette 2014e). As with the On-Site Alternative, dredged materials would likely be disposed of within the flow lane, in or adjacent to the Columbia River navigation channel between river miles 60 and 66, allowing these sediments to support the downriver sediment transport system (Grette 2014d, 2014e, 2014f). The overall impacts of dredging activities on fish would be the same as or similar to those described previously for the On-Site Alternative.

Overall impacts from pile installation are expected to be similar to those described for the On-Site Alternative. The Off-Site Alternative would require fewer piles (597 compared to 610) below the OHWM and the area of benthic habitat permanently lost would be less (4,220 square feet compared to 4,312). The Off-Site Alternative would involve dredging a smaller area (15 acres compared to 48 acres) and a smaller volume of material (50,000 cubic yards compared to 500,000 cubic yards). Under the Off-Site alternative no creosote piles would be removed because no timber pile dikes exist in the project area; therefore, no potential adverse impacts or benefits related to creosote piles would occur.

Physical or Behavioral Response from Elevated Turbidity

Potential impacts on fish resulting from elevated turbidity from pile-driving and dredged material disposal would be the same as or similar to those described for the On-Site Alternative. However, the Off-Site Alternative would require driving 597 piles below the OHWM, 13 fewer than the On-Site Alternative. The difference in terms of turbidity from driving 13 fewer piles would be negligible.

Physical or Behavioral Response to Underwater Noise

Potential impacts on fish resulting from underwater construction noise would be very similar to those described for the On-Site Alternative because of the small difference (597 compared to 610) in the number of piles driven.

Temporary Shading

Potential impacts on fish resulting from shading would be very similar to those described for the On-Site Alternative. The surface area of the docks and trestle for the Off-Site Alternative would be 0.01 acre less than the On-Site Alternative (4.82 compared to 4.83), and the overall area shaded would decrease slightly. The shading created by the vessels would be the same (4.7 acres for two Panamax vessels) for both alternatives.

Spills and Leaks

Potential impacts on fish resulting from construction-related spills and leaks would be the same as or similar to those described for the On-Site Alternative.

Construction—Indirect Impacts

Construction of the proposed export terminal at the Off-Site Alternative would not result in indirect impacts on fish because no construction impacts would occur later in time or outside of the direct impacts study area.

Operations—Direct Impacts

Direct operational impacts of the Off-Site Alternative would result in impacts very similar to those described for the On-Site Alternative.

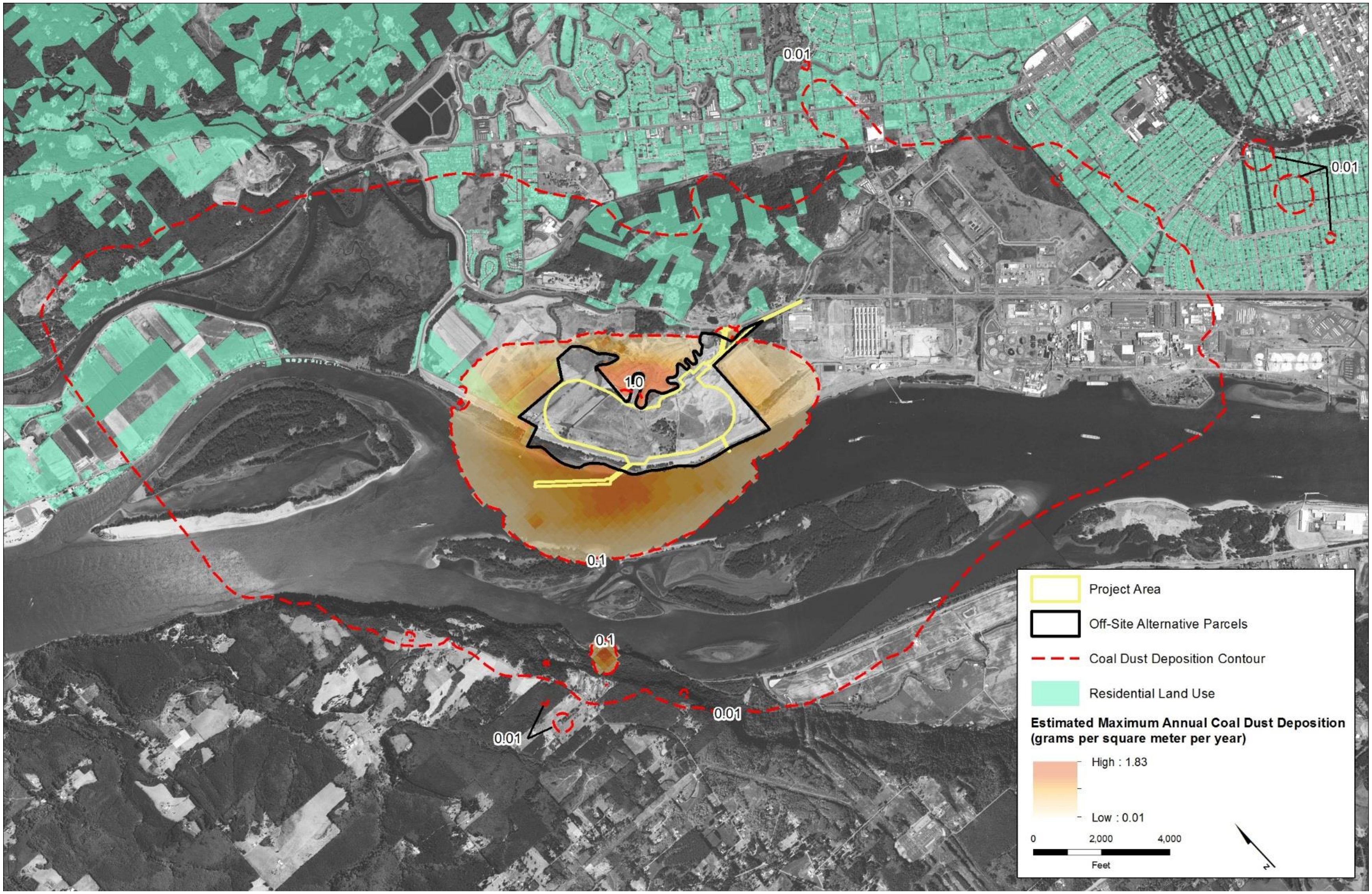
Operations—Indirect Impacts

Indirect operational impacts of the Off-Site Alternative would result in impacts very similar to those described for the On-Site Alternative. However, modeled fugitive coal dust concentrations for the Off-Site Alternative (Figure 5.7-7) indicate that deposition rates would range from 1.83 grams per square meter per year ($g/m^2/year$) adjacent to the proposed export terminal to 0.01 $g/m^2/year$ approximately 2.98 miles from the terminal (Chapter 6, Section 6.7, *Coal Dust*), compared to the On-Site Alternative, which ranges from 1.45 $g/m^2/year$ adjacent to the terminal to 0.01 $g/m^2/year$ 2.41 miles from the terminal.

5.7.5.3 No-Action Alternative

Under the No-Action Alternative, the Corps would not issue a Department of the Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the terminal would not occur. In addition, not constructing the terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. Potential impacts on fish could occur under the No-Action Alternative similar to what is described for the On-Site Alternative, but the magnitude of the impact would depend on the nature and extent of the future expansion.

Figure 5.7-7. 3-Year Annual Average Coal Dust Deposition for the Off-Site Alternative



5.7.6 Required Permits

The following required permits are expected to reduce impacts on 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 (Cowlitz County 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**. Either Alternative would require local permits related to impacts on regulated critical areas. CCC 19.15 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.** Both Alternatives 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 On-Site Alternative.
- **Clean Water Act Authorization—U.S. Army Corps of Engineers.** Construction and operation of the terminal would involve discharges of dredged and fill material waters of the United States, including wetlands. Department of the Army authorization from the U.S. Army Corps of Engineers would be required under Section 404 of the Clean Water Act.

  An Individual Water Quality Certification from Ecology under Section 401 of the Clean Water Act and a National Pollutant Discharge Elimination System (NPDES) permit under Section 402 of the Clean Water Act would also be required. Additional details regarding the permitting process related to the Clean Water Act can be found in the *NEPA Water Quality Technical Report.*
- **Rivers and Harbors Act—U.S. Army Corps of Engineers.** Construction and operation of the terminal would take place in 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 Rivers and Harbors Act (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.** Both alternatives 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 Docks 2 and 3 and piles, as well as for project-related dredging activities and other project-related in-water work.
- **Local Critical Areas and Construction Permits—City of Longview (Off-Site Alternative only).** The Off-Site Alternative would require permits from the City of Longview. Chapter 17.10 of the City of Longview Municipal Code (LMC) regulates activities within and adjacent to critical areas and in so doing regulates vegetation occurring in wetlands and their buffers, fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded

areas, and geological hazard areas. The City of Longview would require Critical Areas and Floodplain permits, as well as a building permit for clearing, grading, and construction.

- **Shoreline Substantial Development—City of Longview (Off-Site Alternative only)**. The City of Longview administers the Shoreline Management Act through its Shoreline Management Master Program. The Off-Site Alternative project area would have elements and impacts within jurisdiction of the act and would, thus, require a Shoreline Substantial Development permit from the City of Longview.

5.8 Wildlife

A rich diversity of wildlife historically inhabited or used the waters of, and terrestrial habitat adjacent to, the Columbia River. Although development along the river has altered the natural environment, many wildlife species occur or depend on habitats found in the study area. Wildlife includes terrestrial and marine mammals, birds, reptiles, amphibians, and invertebrates, including species that are currently protected or proposed for protection under the federal Endangered Species Act (ESA) or other federal and state regulations. Fish species are discussed in Section 5.7, *Fish*.

This section describes wildlife in the study area. It then describes impacts on wildlife potentially resulting from construction and operation of the proposed terminal.

5.8.1 Regulatory Setting

Laws and regulations relevant to wildlife are summarized in Table 5.8-1.

Table 5.8-1. Regulations, Statutes, and Guidelines for Wildlife

Regulation, Statute, Guideline	Description
Federal	
Endangered Species Act of 1973, as amended (16 USC 1531 *et seq*.)	The federal ESA provides for the conservation of threatened and endangered species and the habitat upon which they depend. ESA Section 7 requires federal agencies to initiate consultation with the USFWS and/or NMFS to ensure federal actions would not jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of designated critical habitat.
Migratory Bird Treaty Act of 1918, as amended (16 USC 703–713)	Makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations. Under the regulatory authority of USFWS.
Bald and Golden Eagle Protection Act of 1940, as amended (16 USC 668–668c)	Prohibits the taking of bald eagles, including their parts, nests, or eggs without a permit issued by USFWS, and provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle... [or any golden eagle], alive or dead, or any part, nest, or egg thereof."

Regulation, Statute, Guideline	Description
Marine Mammal Protection Act of 1972, as amended (50 CFR 216)	Protects marine mammals from "take" without appropriate authorization, which may only be granted under certain circumstances. NMFS and USFWS enforce the act. Animals under the jurisdiction of NMFS may be present in the study area. An incidental harassment authorization or letter of authorization (specific authorization to be determined) may be required pursuant to the act.
State	
Washington State Environmental Policy Act (197-11 WAC, RCW 43.21C)	Requires state and local agencies in Washington to identify potential environmental impacts that could result from governmental decisions.
Washington State Growth Management Act (RCW 36.70A)	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 portions of wildlife habitat.
Washington State Shoreline Management Act (RCW 90.58)	Requires cities and counties (through their Shoreline Master Programs) to protect shoreline natural resources.
Washington State Hydraulic Code (RCW 77.55)	WDFW administers the hydraulic project approval program under the state hydraulic code in or near state waters.
WAC 220-660-160 –Marinas and Terminals in Freshwater Areas	Applies to constructing, maintaining, and repairing marinas and terminals in freshwater areas and addresses fish life concerns.
Local	
Cowlitz County SEPA Regulations (CCC 19.11)	Provide for the implementation of SEPA in Cowlitz County.
Cowlitz County Critical Areas Ordinance (CCC 19.15)	Requires the County to designate critical areas such as wildlife habitat conservation areas.
Cowlitz County Shoreline Master Program (CCC 19.20)	Regulates development in the shoreline zone, including the shoreline of the Columbia River, a Shoreline of Statewide Significance.
City of Longview Shoreline Master Program (LMC 17.60) (Off-Site Alternative only)	The City's SMP consists of environmental designations for the shoreline segments and goals, policies, and regulations applicable to uses and modifications within the Shoreline Management Zone.
City of Longview Critical Areas Ordinance (LMC 17.10.140) (Off-Site Alternative only)	Regulates activities within and adjacent to critical areas and in so doing regulates fish and wildlife habitat conservation areas.

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; CFR = Code of Federal Regulations; RCW = Revised Code of Washington; WAC = Washington Administrative Code; CCC = Cowlitz County Code; SEPA = State Environmental Policy Act; LMC = Longview Municipal Code

5.8.2 Study Area

The study areas for the On-Site Alternative and Off-Site Alternative are described below. These study areas are based on the Corps' NEPA scope of analysis MFR, dated February 14, 2014, adjusted as appropriate to reflect habitat characteristics in and near the proposed terminal site.

5.8.2.1 On-Site Alternative

Three study areas have been identified for the wildlife analysis for the Off-Site Alternative.

Terrestrial Species and Habitats Study Area for Direct Impacts

The study area for terrestrial species consists of the project area plus the area extending up to 0.5 mile beyond the project area (Figure 5.8-1). This distance accommodates noise and visual disturbance thresholds set by the U.S. Fish and Wildlife Service (USFWS) for some sensitive species (U.S. Fish and Wildlife Service 2006).

Aquatic Species and Habitats Study Area for Direct Impacts

The study area for direct impacts on aquatic wildlife species and habitats includes the main channel of the Columbia River and extends approximately 5.1 miles upriver and 2.1 miles downriver from the upriver and downriver ends of the proposed Docks 2 and 3 (Docks 2 and 3), respectively (Figure 5.8-1). The aquatic study area is based on the distances where underwater noise generated by construction or operation of the proposed terminal is estimated to reach harassment levels (Section 5.8.3.2, *Impact Analysis*). These distances represent the in-water "line of site" distances from the ends of the dock with respect to underwater noise.

Terrestrial and Aquatic Species and Habitats Study Area for Indirect Impacts

The study area for indirect impacts includes the project area and lands in the vicinity where project-related disturbance to wildlife and habitat could occur. The indirect study area extends to the mouth of the Columbia River (Figure 5.8-2) to address potential impacts of increased vessel traffic on aquatic species and habitat in the lower Columbia River.

5.8.2.2 Off-Site Alternative

Three study areas have been identified for the wildlife analysis for the Off-Site Alternative.

Terrestrial Species and Habitats Study Area for Direct Impacts

The terrestrial study area for direct impacts associated with the Off-Site Alternative extends the same distances as identified for the on-site alternative (Figure 5.8-3).

Aquatic Species and Habitats Study Area for Direct Impacts

The study for the Off-Site Alternative extends a distance of approximately 7.1 miles upriver and 6.8 miles downriver in the Columbia River (measured respectively, from the upriver and downriver ends of the proposed docks at the project area) (Figure 5.8-3). The aquatic study area is based on the same criteria of harassment levels mentioned above in the On-Site Alternative.

Figure 5.8-1. Direct Impacts Study Area Boundaries for the On-Site Alternative

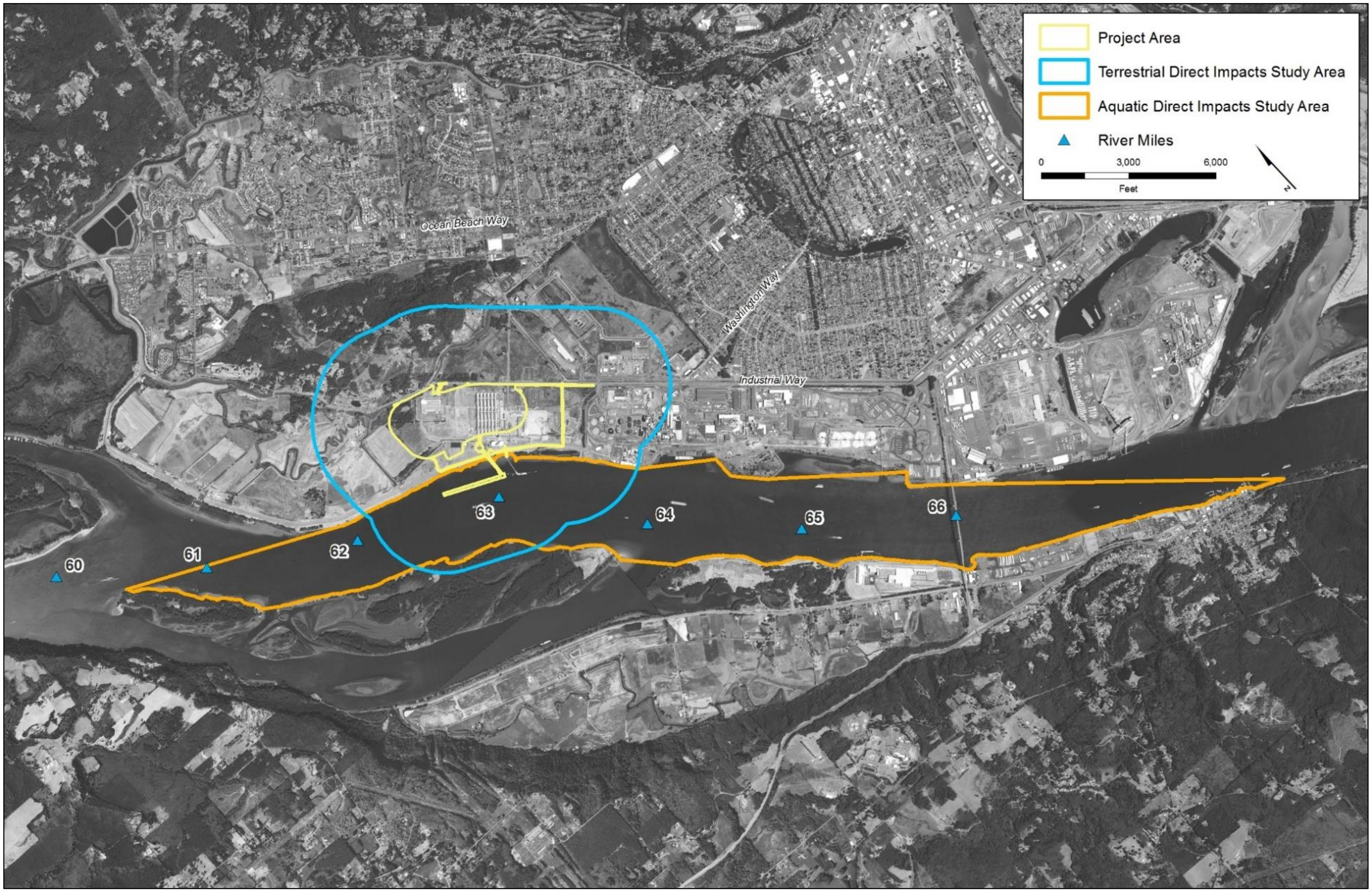


Figure 5.8-2. Indirect Impacts Study Area Boundaries for the On-Site and Off-Site Alternatives

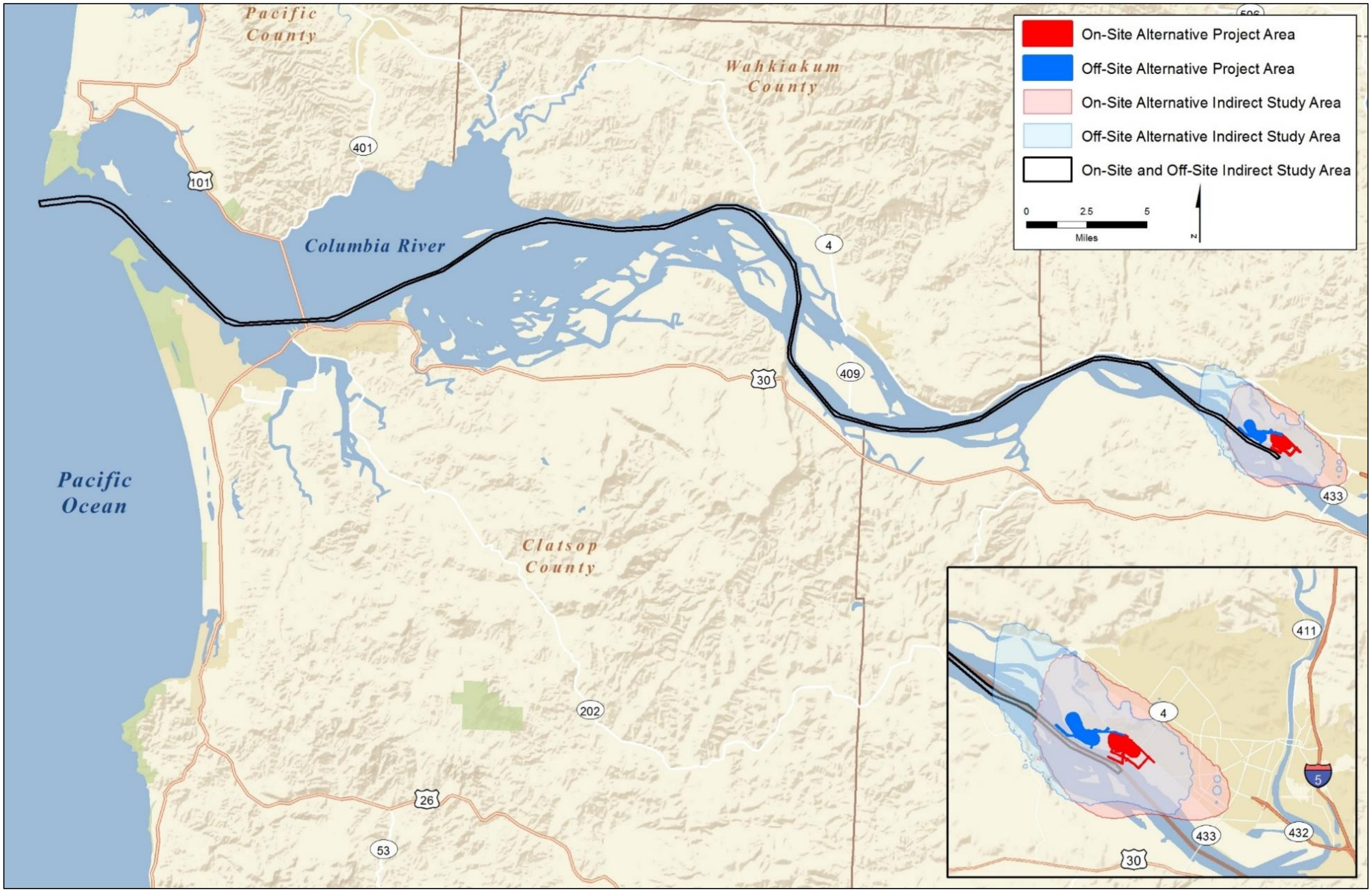
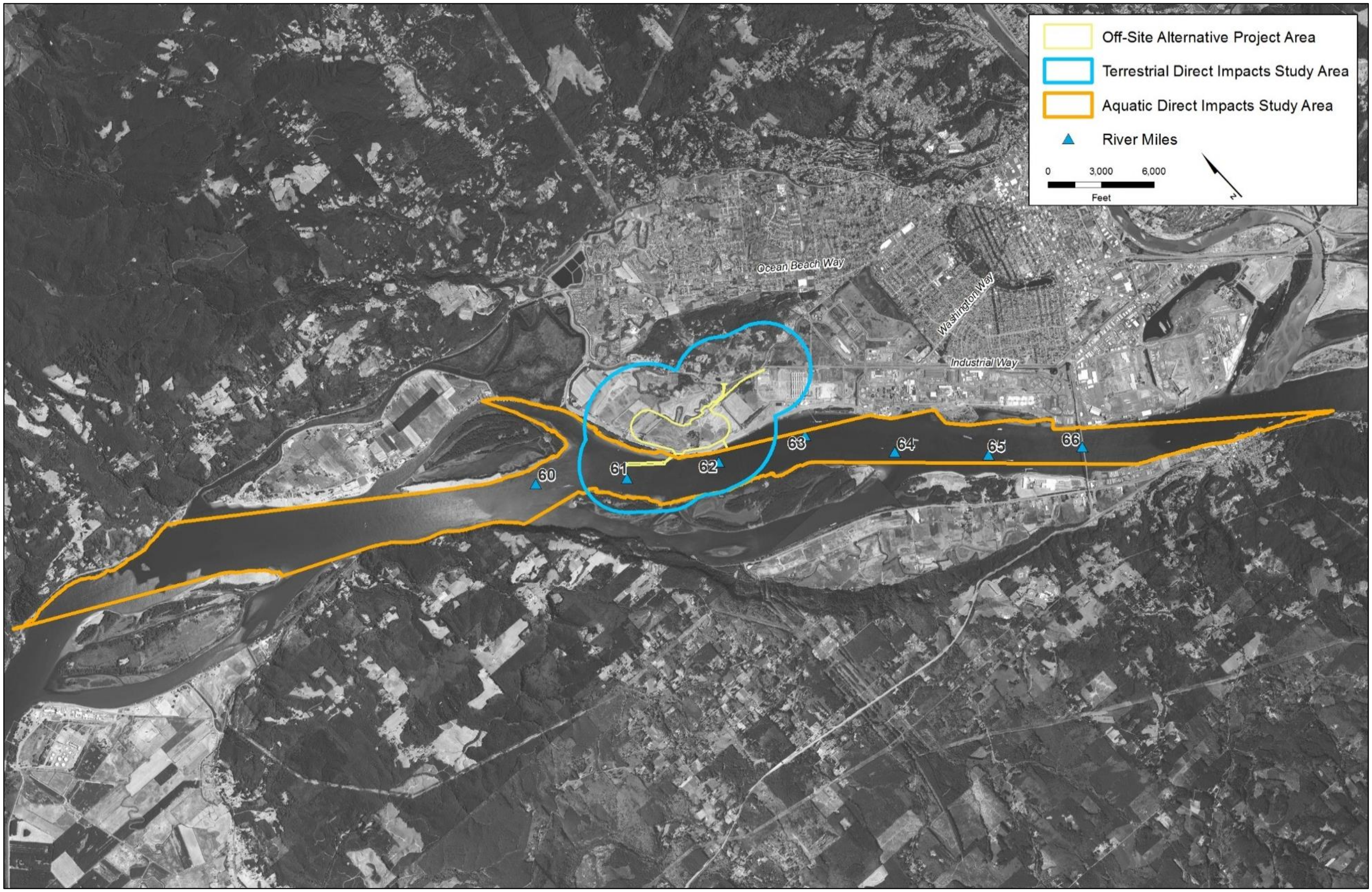


Figure 5.8-3. Study Area Boundaries for the Off-Site Alternative



Terrestrial and Aquatic Species and Habitats Study Area for Indirect Impacts

The study area for indirect impacts associated with the Off-Site Alternative (Figure 5.8-2) is the same as identified above for the On-Site Alternative.

5.8.3 Methods

This section describes the sources of information and methods used to evaluate potential wildlife impacts associated with construction and operation of the proposed export terminal.

5.8.3.1 Information Sources

The following sources of information were used to identify potential impacts . The *NEPA Wildlife Technical Report* (ICF International 2016) provides a detailed list of information sources.

- Site visits conducted by ICF International biologists on April 8, 2014, and December 12, 2014.
- A site visit to the Mount Solo Landfill was conducted by ICF International (ICF) professional biologists on December 12, 2014, to view the project area for the Off-Site Alternative[1] with binoculars from an elevated position. The site was also viewed with binoculars from the project area for the On-Site Alternative and from publicly accessible roads.
- Reports prepared by Grette Associates for the Applicant as part of the permit application materials (Grette Associates 2014a through 2014p).
- National Marine Fisheries Service (NMFS) (2015) west coast region species list.
- USFWS (2015) Information, Planning, and Conservation system online database.

5.8.3.2 Impact Analysis

The following methods were used to identify the potential impacts of the On-Site Alternative, Off-Site Alternative, and No-Action Alternative on wildlife in the study areas. For more information on these methods, see the *NEPA Wildlife Technical Report*. For direct impacts, the analysis assumes best management practices were incorporated into the design, construction, and operation of the export terminal. More information about best management practices can be found in Chapter 8, *Mitigation*, and Appendix H, *Export Terminal Design Features*.

Identifying Resources in the Terrestrial and Aquatic Study Areas

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

- Documented species occurrences
- Species likely to occur in the terrestrial and aquatic study areas
- Suitable habitat conditions

Wildlife species are mobile and their presence and abundance in the terrestrial and aquatic study areas cannot always be reliably predicted. Wildlife species identified in the Washington Department of Fish and Wildlife (WDFW) Priority Habitat Species (PHS) database were used to document occurrence. Geospatial PHS data containing mapped locations of priority species occurrences and

[1] Permission was not granted to visit the project area for the Off-Site Alternative directly.

priority habitats were obtained from WDFW (Washington Department of Fish and Wildlife 2014) and overlaid with the study area to determine presence of documented priority species and habitat occurrences.

- A list of special-status wildlife species was compiled for the study area, consisting of those species federally listed as threatened, endangered, proposed, or candidate species; wildlife species listed in the WDFW PHS database; and marine mammals.
- A list of federally listed wildlife species for Cowlitz County was generated from the USFWS Information for Planning and Conservation (iPAC) online planning tool (U.S. Fish and Wildlife Service 2015).
- A list of state priority species that occur in Cowlitz County was obtained from the WDFW PHS program website (Washington Department of Fish and Wildlife 2013).
- A list of federally protected marine mammals that could occur in the study area was compiled from the NMFS (2015) West Coast Region website.

Assessing Noise Impacts

An animal's response to sound depends on various factors, including noise level and frequency, distance and event duration, equipment type and conditions, frequency of noisy events over time, slope, topography, weather conditions, previous exposure to similar noises, hearing sensitivity, reproductive status, time of day, behavior during the noise event, and an animal's location relative to the noise source (Delaney and Grubb 2003 in Washington State Department of Transportation 2015). However, USFWS has established some noise and visual distance thresholds for some sensitive species that occur in Washington, including the bald eagle (*Haliaeetus leucocephalus*), marbled murrelet (*Brachyramphus marmoratus*), Northern spotted owl (*Strix occidentalis caurina*), and Columbia white-tailed deer (*Odocoileus virginianus leucurus*) (U.S. Fish and Wildlife Service 2006) (Table 5.8-2). The bald eagle has the lowest threshold for disturbance and, therefore, the greatest protective distance (0.5) mile. This distance is a conservative proxy for assessing potential impacts on other terrestrial wildlife species as well. The 0.5-mile distance used to delineate the terrestrial study area for direct effects was based on this disturbance threshold.

Table 5.8-2. Harassment Distances for Federally Listed Species in Washington State

Species	Scientific Name	Activity and Harassment Distance
Bald eagle	*Haliaeetus leucocephalus*	Noise: 0.25 mile[a] Visual: 0.5 mile[b]
Marbled murrelet	*Brachyramphus marmoratus*	Pile-driving: 180 feet[c] Visual: 300 feet
Northern spotted owl	*Strix occidentalis caurina*	Pile-driving: 180 feet
Columbia white tailed deer	*Odocoileus virginianus leucurus*	Noise: 0.25 mile

Notes:

[a] Noise level disturbance varies on bald eagles. It has been found that visual disturbance is more likely to provoke escape behavior than noise disturbance (U.S. Department of Transportation 2004).

[b] Visual disturbance can be caused by close visual proximity of human activities at sensitive locations (i.e., nest trees), and could result in significant disruption of normal behavior patterns.

[c] Injury would occur at 202 decibels at this distance (Washington State Department of Transportation 2015.

Source: U.S. Fish and Wildlife Service 2006.

NMFS has established standard underwater marine mammal noise thresholds under the Marine Mammals Protection Act. NMFS has established Levels A and B harassment thresholds for pinnipeds (i.e., seals and sea lions) from impact and vibratory pile-driving (Grette Associates 2014a) (Table 5.8-3).

Table 5.8-3. NMFS Underwater Sound Level Effect Thresholds for Marine Mammals

Effect Type	Effect Threshold (dB_{RMS})
Impulse Sound (Impact Driver Operation)	
Level A harassment	190
Level B harassment	160
Continuous Sound (Vibratory Driver Operation)	
Level B harassment	120

Notes:
Source: Grette Associates 2014a.
dB_{RMS} = decibel root mean square

Pinniped harassment can occur between approximately 178 feet and the extent of the aquatic study area for direct impacts, from the noise source without attenuation, depending on the method of pile-driving. Use of a bubble curtain during impact pile-driving decreases the distance pinniped harassment can occur to between 45 feet and 4,459 feet. Harassment can include hearing-related injuries and behavior changes. These criteria were used to establish pinniped impact thresholds in the aquatic wildlife study area.

For diving birds, USFWS has established impact thresholds for the federally listed marbled murrelet (Table 5.8-2), which can provide some guidance on underwater noise thresholds for other diving birds in the aquatic study area. The USFWS recognizes a behavioral guideline of 150 decibels root mean square (dB_{RMS}), an injurious auditory threshold of 202 sound exposure level (dB_{SEL}) (i.e., permanent threshold shift in hearing due to permanent loss of cochlear hair cells), and a non-auditory injury threshold of 208 dB_{SEL}; underwater noise below 150 dB_{SEL} does not cause injury (Washington State Department of Transportation 2015). These criteria were used to establish impact thresholds for diving birds in the aquatic study area.

5.8.4 Affected Environment

This section describes the environment in the study areas related to wildlife potentially affected by construction and operation of the proposed export terminal.

5.8.4.1 On-Site Alternative

Study Area

This section describes the existing environmental conditions in the terrestrial and aquatic study areas related to wildlife that could be affected by construction and operation of the proposed terminal.

Extensive modifications of the lower Columbia River (flood control, industrial development, deep-draft vessel traffic) have altered the habitat conditions in the study area available to wildlife species. Floodplain habitats have been disconnected from the riverine environment, and in some cases eliminated. The shoreline and riparian environment has been substantially altered (e.g., armoring and shoreline protection, overwater structures, and development), affecting habitat in adjacent upland and riparian zones. Industrial and transportation development inland have further altered habitat conditions, changing the biological communities associated with these habitats.

Terrestrial Habitat

The On-Site Alternative is located on a disturbed industrial site developed with roads and industrial buildings. Many of the surrounding areas are also highly disturbed. In general, suitable wildlife habitat on the project area is degraded because of past industrial uses on the property. The patches of suitable habitat that are present support foraging and cover for small to large mammals; foraging and nesting for birds , including waterfowl, raptors, and passerine birds; and foraging, breeding, and nesting for amphibians (Grette Associates 2014c, 2014d, 2014e, and 2014h). Of the undeveloped areas on the project area, many are small and fragmented, and separated from similar habitat patches. These areas are limited in their habitat value due to their relatively small size and fragmented condition. The largest contiguous areas of habitat are located on the west side of the project area and include an herbaceous and forested area (associated with wetland). The highest quality habitat on the project area is a small forested area surrounding parallel drainage ditches located in the southwest portion of the site. Upriver of the project area, the heavily developed shoreline lacks suitable habitat and wildlife species are not present. Downriver of the project area are upland, wetland, and riparian habitats as well as disturbed areas. Habitat conditions for wildlife in these areas are similar to those of the project area: disconnected patches of suitable habitat.

Adjacent to the project area is a triangular area bounded by Industrial Way to the south and Consolidated Diking Improvement District (CDID) #1 ditches to the east and west. This area primarily contains herbaceous wetland habitat dominated by reed canarygrass. Other habitats, including forested and scrub-shrub wetlands and uplands (forested, scrub-shrub, and herbaceous), are small and isolated from other similar habitat types. A small portion of the site is disturbed. The habitat likely supports foraging and cover for small to large mammals; foraging and nesting for waterfowl, raptors, and passerine birds; and foraging, breeding, and refuge for amphibians and reptiles. Land to the east is largely disturbed by the Mint Farm Industrial Park, which supports a few small areas of herbaceous or scrub-shrub habitat. South of the project area, the terrestrial study area consists of a levee with managed herbaceous vegetation and riparian area bordering the Columbia River. The riparian area is primarily forested and scrub-shrub habitat and likely provides foraging and cover for small and large mammals; foraging and nesting for passerine, waterfowl and raptor bird species; and foraging, breeding, and refuge for amphibians (Grette Associates 2014d).

A small portion of Lord Island is located in the terrestrial study area. The island was previously used for dredged material disposal and consists of forested habitat in the study area. With the exception of several transmission towers, the island is undeveloped. More detail on Lord Island wildlife species and habitat is provided in the *NEPA Wildlife Technical Report*. Additional information on vegetation cover classes in the study area is found in Section 5.6, *Vegetation*.

Aquatic Habitat

The aquatic study area includes wetlands (refer to Section 5.3, *Wetlands*, for more information), the Columbia River, and smaller areas of open water within the study area, including various ditches and a pond that provide aquatic habitat. Ditches in the aquatic study area include those maintained by CDID #1 and privately owned stormwater ditches. The Columbia River supports marine mammals, fish, birds, and a variety of invertebrates (which serve as forage to support wildlife higher on the food chain). Fish are discussed in Section 5.7, *Fish*. Ponds and ditches in the aquatic study area could support common species of invertebrates and amphibians as well as small mammals and birds.

Habitat types in the Columbia River include a deepwater zone, shallow water zone, and the active channel margin (Figure 5.8-4) (Grette Associates 2014i); all of these habitats are below the river's ordinary high water mark (OHWM). The active channel margin includes the shoreline and nearshore edge habitat extending toward the water from the OHWM out to a depth of 11.1 feet, Columbia River datum (CRD).[2] In general, the shoreline adjacent to the aquatic study area is highly modified by extensive levees and riprap armoring with scattered large woody debris.

The conditions in the shallow water zone are relatively narrow and more steeply sloped making it unlikely to support aquatic vegetation (Grette Associates 2014j). The benthic (i.e., river bottom) habitats of the Columbia River are subjected to strong currents and reduced light penetration with depth and, therefore, support little to no aquatic vegetation.

Wildlife Species

Wildlife likely to be found in the terrestrial study area include common species of birds, rodents, amphibians, reptiles, and invertebrates. Larger and more mobile species of mammals could also be present.

Wildlife likely to be found in both the terrestrial and aquatic study areas include common species of birds (waterfowl, raptors, shorebirds, marine birds, and passerine birds), rodents, frogs, salamanders, snakes, lizards, and invertebrates. Larger and highly mobile species of mammals that are habituated to disturbed environments may also be present in the study area, including coyote (*Canis latrans*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and deer (*Odocoileus* sp.).

During the December site visit, two Columbian black-tailed deer (*Odocoileus hemionus columbianus*) were observed in the forested wetland area (Wetland A) at the northwest portion of project area, and two nutrias (*Myocastor coypus*) were observed on the sloped bank of the CDID Ditch 10, on the north side of Industrial Way. Other signs of mammal presence were observed, including several unidentified small mammal scats, a coyote scat along the dike road, a beaver (*Castor canadensis*)-chewed tree in the riparian habitat along the Columbia River, and an unidentified species of sea lion heard barking from the Columbia River.

Several common bird species were recorded in the terrestrial study area during the site visits, including red-winged blackbird (*Agelaius phoeniceus*), sparrows (*sp*.), robins (*Turdus migratoius*) and other songbirds, American coot (*Fulica Americana*), bufflehead (*Bucephala albeola*), mallards (*Anas platyrhnchos*) and other unidentified ducks, Canada geese (*Branta Canadensis*), cormorants (*sp*.), scaup (*sp*.), gulls (*sp*.), and great blue heron (*Ardea herodias*). A turkey vulture (*Cathartes aura*), red-tailed hawk, kestrel (*Falco sparverius*), and bald eagle (*Haliaeetus leucocephalus*) were observed flying overhead. A small flock of Canada geese were also observed grazing on wetland grasses at the project area, and several unoccupied raptor nests were observed in the forested habitat adjacent to the stormwater ditches on the southwest side of the project area and on an electrical tower near the west side of the dike road.

[2] Columbia River Datum (CRD) is a vertical datum that is the adopted fixed low water reference plane for the lower Columbia River. It is the plane of reference from which river stage is measured on the Columbia River from the lower Columbia River up to Bonneville Dam, and on the Willamette River up to Willamette Falls.

Figure 5.8-4. Aquatic Habitats for the On-Site Alternative

Grette Associates biologists conducted surveys for the federally threatened and state endangered streaked horned lark in the project area during the 2013 and 2014 breeding seasons. No streaked horned larks were detected; however, 33 other bird species were recorded. A list of these species is included in the *NEPA Wildlife Technical Report*. A few of these bird species are special-status species, which are addressed in Section 5.8.4.1, *On-Site Alternative, Special-Status Wildlife Species*.

Wildlife likely to be found only in aquatic habitats include three species of pinnipeds, which may be present in the aquatic study area within the Columbia River: harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), and Steller sea lion (*Eumetopias jubatus*) (Jeffries et al. 2000). Because these marine mammals are all protected under the Marine Mammal Protection Act, they are described in more detail in Section 5.8.4.1, *On-Site Alternative, Special-Status Wildlife Species*. Various bird species, including waterfowl, raptors, and shorebirds are supported by the Columbia River's aquatic habitats in the aquatic study area, as well as numerous fish species. Freshwater insects and other invertebrate species (e.g., mollusks, crayfish) inhabit the upper layers of the benthos and provide forage for many species of fish and birds. Fish and their habitats are discussed in Section 5.7, *Fish.*

Special-Status Wildlife Species

Special-status wildlife species are those listed as threatened, endangered, proposed for listing, or listed as candidate species under the ESA or are listed as a priority species by WDFW. Table 5.8-4 lists the special-status wildlife species likely to occur in the terrestrial and aquatic study areas. Further descriptions of each species are provided in the *NEPA Wildlife Technical Report*. Some of the PHS listings are not for individuals of a species (PHS Criteria 1) but for vulnerable aggregations (PHS Criteria 2) of individuals, such as western Washington nonbreeding concentrations.

Columbian White-tailed Deer (*Odocoilieus virginianus leucurus*)

The Columbia River population of the Columbian white-tailed deer is a federally and state-listed endangered species. The Columbia River population is one of only two extant populations in the United States: the lower Columbia River population and the Douglas County population. The lower Columbia River population occurs in Wahkiakum and Cowlitz Counties, Washington, and Clatsop and Columbia Counties, Oregon. The Douglas County population, which occurs in Umpqua River Basin, Douglas County, Oregon, was delisted in 2003. The Columbia River population inhabits the lower Columbia River floodplain and islands within the river channel. The current range of the Columbian white-tailed deer overlaps with the study area, including Barlow Point and Fisher, Walker, and Lord Islands (Washington Department of Fish and Wildlife 2013).

WDFW has identified specific locations along the Columbia River for recovery (Washington Department of Fish and Wildlife 2013). The nearest recovery location to the study area is downriver of Longview, which includes Fisher, Hump, Lord, and Walker Islands (Washington Department of Fish and Wildlife 2013). The presence of white-tailed deer in the study area has been documented.

Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*)

Black-tailed deer use upland slopes and closed-canopy coniferous forests as they require a mix of forest and openings for cover and forage (Washington Department of Fish and Wildlife 2014). Columbian black-tailed deer have been observed in the project area.

Table 5.8-4. Special-Status Wildlife Species that Could Occur in the Terrestrial Study Area—On-Site Alternative

Wildlife Species	Potential for Occurrence[a]	Potential Habitat	State Priority Species Criteria[b]	Federal Status[c]	State Status[d]
Mammals					
Columbian black-tailed deer (*Odocoileus hemionus columbianus*)	Yes	Species documented on project area. Limited habitat on project area. May use forested portions of terrestrial study area.	3	N/A	N/A
Columbian white-tailed deer (*Odocoilieus virginianus leucurus*)	Yes	Species documented on project area.[e] Limited forage and cover on project area. Suitable habitat available on Lord Island.	1	E	E
Harbor seal (*Phoca vitulina*)	Yes	Present in Columbia River	2	N/A	N/A
California sea lion (*Zalophus californianus*)	Yes	Present in Columbia River	2	N/A	N/A
Stellar Sea lion (*Eumetopias jubatus*)	Yes	Present in Columbia River	1, 2	SC	T
Birds					
Streaked horned lark (*Eremophila alpestris strigata*)	Possibly	Not documented during surveys on project area. Potential suitable habitat on Lord Island.	1	T	E
Bald eagle (*Haliaeetus leucocephalus*)	Yes	Forested wetlands could provide roosting habitat. Suitable habitat on Lord Island.	1	SC	S
Peregrine falcon (*Falco peregrinus*)	Possibly	Potential foraging habitat	1	SC	S
Barrows goldeneye (*Bucephala islandica*)	Possibly (nonbreeding concentrations unlikely)	Open water	2, 3	N/A	N/A
Common goldeneye (*Bucephala clangula*)	Possibly (nonbreeding concentrations unlikely[f])	Open water	2, 3	N/A	N/A

Wildlife Species	Potential for Occurrence[a]	Potential Habitat	State Priority Species Criteria[b]	Federal Status[c]	State Status[d]
Bufflehead (*Bucephala albeola*)	Yes (nonbreeding concentrations unlikely[f])	Open water	2, 3	N/A	N/A
Waterfowl concentrations	Yes	Suitable habitat documented in terrestrial and aquatic study areas	2, 3	N/A	N/A
Vaux's swift (*Chaetura vauxi*)	Possibly	No large snags for nesting or roosting identified on project area but possible in terrestrial study area.	1	N/A	C
Pileated woodpecker (*Dryocopus pileatus*)	Possibly	Possible in forested habitat.	1	N/A	C
Purple martin (*Progne subis*)	Yes	Species documented in terrestrial study area, possible foraging.	1	N/A	C

Notes:

[a] The likelihood of each species or vulnerable aggregations occurring in the terrestrial and aquatic study areas is listed as follows (Washington Department of Fish and Wildlife 2013).

- *Yes* (known to occur)
- *Possibly* (likely to occur due to presence of suitable habitat, but not documented)
- *Unlikely* (individuals may occur in the terrestrial or aquatic study areas but vulnerable aggregations are not documented in the PHS database)

[b] State PHS Species Criteria: 1 – State-listed or candidate species; 2 – Vulnerable aggregation; 3 – commercial, recreational, or tribal importance

[c] Federal Status under the U.S. Endangered Species Act: E = Endangered; T = Threatened; SC = Species of Concern

[d] State Status: E = Endangered; T = Threatened; C = Candidate; S = Sensitive

[e] Source: Grette Associates 2014j

[f] Western Washington Nonbreeding Concentrations

[g] Source: Willapa Hills Audubon Society 2014

Streaked Horned Lark (*Eremophila alpestris strigata*)

The streaked horned lark is a federally threatened and state endangered species. Streaked horned larks prefer wide open spaces characterized by flat, treeless landscapes of 300 acres or more, sparse grass/forb vegetation, and few or no shrubs. In the lower Columbia River, they were historically known to nest on sandy beaches and spits. Now, they can be found nesting on dredge spoil depositions. At the project area and within the study area, there are a few small areas containing potentially suitable habitat (low vegetative cover and no woody vegetation) located adjacent to the Columbia River near the former Reynolds Metal Company landfill and along the edges of roadbeds. No streaked horned larks were observed during the surveys in the project area during the 2013 and 2014 breeding seasons (Grette Associates 2014j, 2014k).

Critical habitat has been designated for the streaked horn lark, but none of these designated areas occur in the terrestrial study area. The closest designated critical habitat is on Crims Island, approximately 5 miles downriver of the project area.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles nest and forage for fish along the lower Columbia River. There are no documented bald eagle nests in the study area and no suitable nesting habitat in the project area. The nearest documented nest sites are located approximately 2 miles downriver and 4 miles upriver of the study area (Washington Department of Fish and Wildlife 2014). The study area provides foraging habitat for this species. Lord Island also provides suitable habitat for bald eagles (Pacific Coast Joint Venture 1994). Bald eagles were observed soaring over the study area during the April 8, 2014 site visit. Bald eagles were also observed in the study area during the July 12, 2013 streaked horned lark surveys (Grette Associates 2014j).

Peregrine Falcon (*Falco peregrinus*)

Peregrine falcons nest on cliff ledges but also use tall manmade structures such as bridges, overpasses, buildings, and power plants (Oregon Department of Transportation undated). The nearest documented nest location is approximately 3 miles south of the study area (Washington Department of Fish and Wildlife 2014). Peregrine falcons nesting within a few miles of the study area could potentially use the study area for foraging.

Waterfowl

Nonbreeding concentrations of Barrow's goldeneye (*Bucephala islandica*), common goldeneye (*B. clangula*), and bufflehead (*B. albeola*) are considered priority species (vulnerable aggregation) by WDFW. A few individual bufflehead were observed resting on open water (both in wetlands and on the Columbia River) in the study area during the April 8, 2013 site visit. However, within the study area there are no vulnerable concentrations of waterfowl documented in the WDFW PHS database (Washington Department of Fish and Wildlife 2014). The nearest documented vulnerable concentration is located approximately 0.25 mile northwest of the study area, east of Willow Grove Island. Lord Island and adjoining Walker Island support waterfowl and suitable habitat is located just outside of the study area in the tidal marsh area between the islands south of the sand spit (Pacific Coast Joint Venture 1994).

Purple Martin (*Progne subis*)

The purple martin is a state-listed species of concern. Purple martins were observed in the project area during the streaked horned lark surveys in July 2013 (Grette Associates 2014j). Several nest sites are documented in the Coal Creek Slough, approximately 3 to 4 miles downriver of the study area (Washington Department of Fish and Wildlife 2014).

Vaux's Swift (*Chaetura vauxi*)

The Vaux's swift is a state candidate species. They are summer (June to mid-August) residents in Washington, migrating north to Washington during the spring (April to late May) and south during the fall (mid-August to late September). There is no suitable nesting or roosting habitat in the project area; however, there are other forested areas in the study area that may contain suitable habitat. Vaux's swifts may fly through the study area during migrations or while foraging. They are commonly observed at the Mint Farm (Willapa Hills Audubon Society 2014) east of the study area.

Pileated Woodpecker (*Dryocopus pileatus*)

Pileated woodpeckers inhabit mature deciduous or mixed deciduous-coniferous forests. There is no suitable nesting habitat in the project area. Limited foraging habitat may be available in the forested areas on site. Forested portions of the study area may contain suitable habitat for nesting and foraging.

Pinnipeds

Three species of pinniped are found in the lower Columbia River in the study area: California sea lions (*Zalophus californianus*), Steller sea lions (*Eumetopias jubatus*), and harbor seals (*Phoca vitulina*). Sea lions use the lower Columbia River for foraging on fish and resting at haulout sites. Breeding areas (both mating rookeries and pupping sites) for California sea lions are located in California and Mexico. Steller sea lions are primarily present during the nonbreeding season.

Surveys conducted in the 1990s identified four haulout sites used by sea lions between the mouth of the Columbia River and its confluence with the Cowlitz River (Jeffries et al. 2000), which is approximately 4.5 miles upriver of the project area. There are no documented sea lion haulout sites in the study area, but individuals likely swim through the study area as they migrate up and down the Columbia River. Harbor seals are the most numerous of the pinnipeds found in Washington waters. Like sea lions, they forage and rest along the lower Columbia River, with dozens of haulout sites identified between the mouth of the river and the study area. There are no documented seal haulout sites in the study area, but individuals swim through the study area as they migrate up and down the Columbia River.

5.8.4.2 Off-Site Alternative

Study Area

The Off-Site Alternative is located on previously disturbed lands adjacent to upriver industrial developments. Prior to 2000, the project area was used primarily for agriculture and grazing and a small portion of the area continues to be used for agricultural activities. This area is currently undeveloped and vegetation on the property is mostly overgrown, consisting of dense shrub vegetation and grassy areas that extend to the shoreline. The majority of the area consists of herbaceous habitat.

The direct impacts study area includes lands within 0.5 miles from the project area as is illustrated in Figure 5.8-3. Approximately one-half of the Off-Site Alternative study area overlaps the study area for the On-Site Alternative. In addition to the previously described habitats is the Mount Solo landfill, located adjacent to the project area. The landfill habitat is classified as disturbed but likely to provide some wildlife habitat, including foraging and cover for small to large mammals, and foraging for bird species.

Terrestrial Habitat

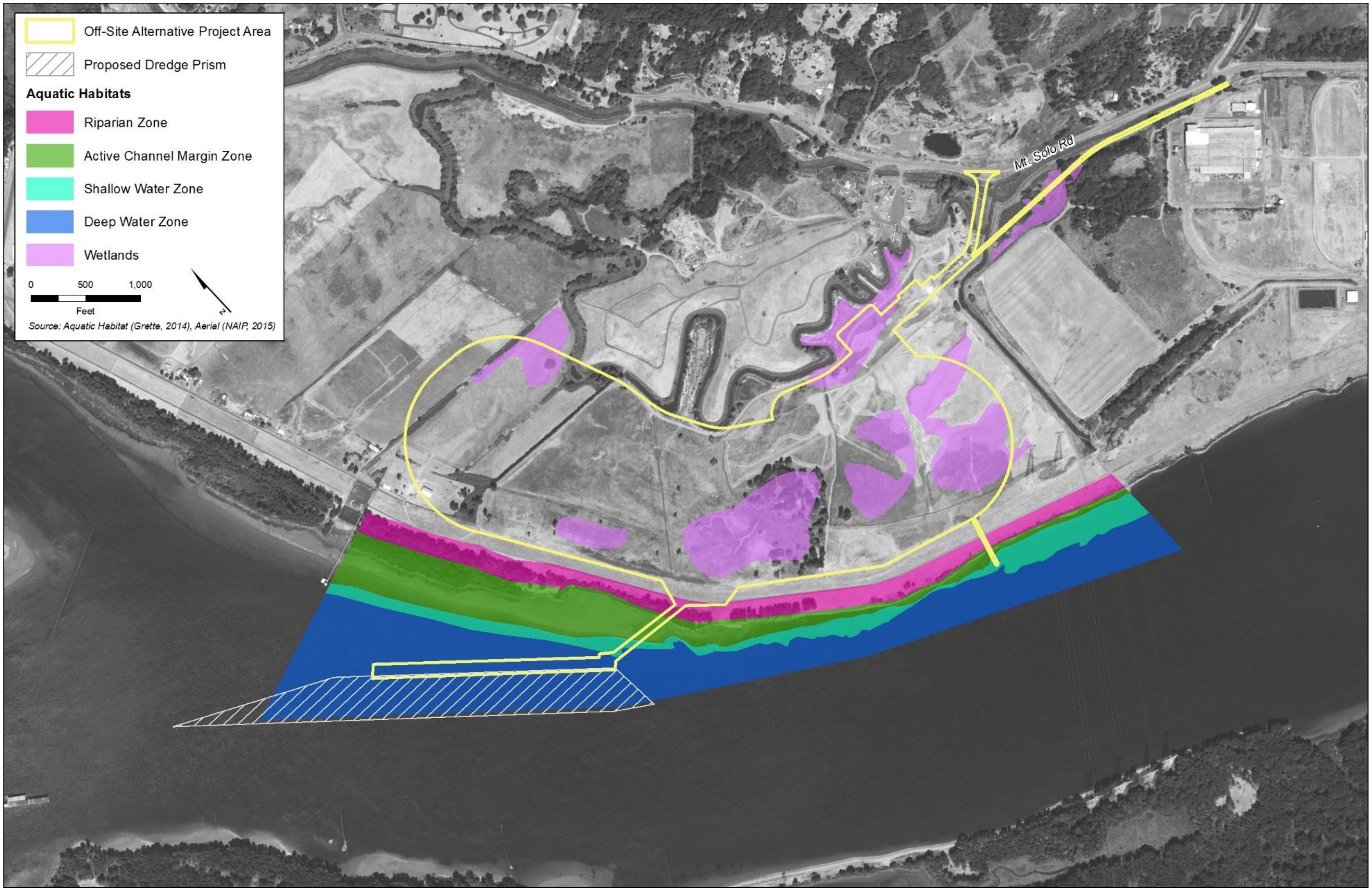
Terrestrial habitat types found in the study area are characterized as developed (disturbed), upland (forested, scrub-shrub, herbaceous, and managed herbaceous), wetland (forested, scrub-shrub, herbaceous, managed herbaceous, and disturbed), and riparian (forested and scrub-shrub) and detailed in the Section 5.6, *Vegetation*. Habitat types present in the study area are generally similar to those in the On-Site Alternative study area. Habitat at the northern end of the project area is mostly herbaceous uplands with smaller herbaceous seasonal wetlands. This habitat has been documented in the PHS database as supporting regular concentrations of wintering waterfowl (Washington Department of Fish and Wildlife 2014). Other wildlife that may be supported by herbaceous habitat in the area include foraging and cover habitat for small to large mammals and foraging habitat for raptors. Close to the Columbia River is a small disturbed area with houses and other small buildings associated with the residences and agricultural fields. A levee with managed herbaceous vegetation spans the study area upland from the Columbia River riparian area. The riparian area in the downriver portion of the study area is dominated by densely forested trees and shrubs that likely provide high-quality habitat for wildlife. Upriver, the riparian area transitions to scrub-shrub habitat and is more sparsely vegetated. Support for wildlife in the riparian area includes foraging and cover for small and large mammals, foraging and nesting for a variety of birds, and foraging, breeding and nesting for amphibians. Downriver habitats are similar to those at the downriver end of the project area, consisting of herbaceous agricultural fields which support regular concentrations of wintering waterfowl (Washington Department of Fish and Wildlife 2014), foraging and cover for small to large mammals, and foraging for raptors. Upriver habitats are similar to what is described in Section 5.8.4.1, *On-Site Alternative, Terrestrial Habitat*.

Walker Island is offshore from the project area in the Columbia River (Figure 5.8-3). The island contains high-quality habitat for wildlife. Walker Island is predominantly forested and connects to Lord Island, upriver, by a narrow sand bar. Between the two islands lies a tidal marsh and shallows. This area provides foraging and resting habitat for waterfowl and supports wintering ducks and geese (Pacific Coast Joint Venture 1994). Suitable habitat is present in this area to support wildlife species including mammals, various birds, amphibians, and reptiles.

Aquatic Habitat

Aquatic habitats include wetlands (refer to Section 5.3, *Wetlands*, for more information), the Columbia River, and smaller open-water areas, such as ponds and drainage ditches, throughout the study area. Habitat types in the Columbia River are similar to those described in Section 5.8.4.1, *On-Site Alternative, Aquatic Habitat*, and are also shown in Figure 5.8-5. The majority of wetland habitats in the project area are in the southern portion of the project area, and include both forested and herbaceous wetland areas. Wetlands in the project area likely support foraging and cover for small to large mammals, foraging and nesting for a variety of birds, and foraging, breeding, and nesting for amphibians (Grette Associates 2014i, and 2014l).

Figure 5.8-5. Aquatic Habitats for the Off-Site Alternative



Wildlife

The study area for the Off-Site Alternative is adjacent to and overlaps with the On-Site Alternative study area. Due to this proximity and similar habitat types and characteristics, wildlife species that may occur in the study area for the Off-Site Alternative are expected to be similar to those described for the On-Site Alternative.

During the December 12, 2014 site visit to the adjacent Mount Solo landfill, bird species observed at the project area included red-tailed hawk, great blue heron, and mallard. Additionally, an unoccupied raptor's nest was observed. Columbian white-tailed deer have been documented in the project area (Washington Department of Fish and Wildlife 2014) but were not observed during the site visit.

Special-Status Wildlife Species

Descriptions of special-status wildlife species that could occur in the study area are the same as those described for the On-Site Alternative. Table 5.8-5 lists special-status wildlife species likely to occur in the study area. The potential for occurrence in the study area follows the same definitions as for the On-Site Alternative.

Table 5.8-5. Special-Status Animal Species that Could Occur in the Study Area—Off-Site Alternative

Common Name	Potential for Occurrence in Study Area[a]	Potential Habitat in the Study Area	State Priority Species Criteria[b]	Federal Status[c]	State Status[d]
Mammals					
Columbian black-tailed deer (*Odocoileus hemionus columbianus*)	Yes	Documented in study area	3	N/A	N/A
Columbian white-tailed deer (*Odocoilieus virginianus leucurus*)	Yes	Documented on project area (PHS)	1	E	E
Harbor seal (*Phoca vitulina*)	Yes	Present in Columbia River	2	N/A	N/A
California sea lion (*Zalophus californianus*)	Yes	Present in Columbia River	2	N/A	N/A
Stellar Sea lion (*Eumetopias jubatus*)	Yes	Present in Columbia River	1, 2	SC	T

Common Name	Potential for Occurrence in Study Area[a]	Potential Habitat in the Study Area	State Priority Species Criteria[b]	Federal Status[c]	State Status[d]
Birds					
Streaked horned lark (*Eremophila alpestris strigata*)	Possibly	Not documented in study area. Few areas of potential suitable habitat on site.	1	T	E
Bald eagle (*Haliaeetus leucocephalus*)	Yes	Forested wetlands could provide roosting habitat	1	SC	S
Peregrine falcon (*Falco peregrinus*)	Possibly	Potential foraging habitat	1	SC	S
Barrows Goldeneye (*Bucephala islandica*)	Possibly[e] (Nonbreeding Concentrations Unlikely[e])	Open water	2, 3	N/A	N/A
Common Goldeneye (*Bucephala clangula*)	Possibly (Nonbreeding Concentrations Unlikely[e])	Open water	2, 3	N/A	N/A
Bufflehead (*Bucephala albeola*)	Possibly (Nonbreeding Concentrations Unlikely[e])	Open water	2, 3	N/A	N/A
Waterfowl concentrations[e]	Yes	Suitable habitat documented at project area	2, 3	N/A	N/A
Vaux's swift (*Chaetura vauxi*)	Possibly	Deciduous forest with snags documented on project area	1	N/A	C
Pileated woodpecker (*Dryocopus pileatus*)	Possibly	Possible in forested areas	1	N/A	C
Purple martin (*Progne subis*)	Possibly	Species presence documented in vicinity of study area, possible foraging	1	N/A	C

Notes:

[a] Potential for individuals to occur based on multiple sources, including PHS data, scientific literature, and agency documents; potential for vulnerable aggregations based on PHS data only.

[b] State PHS Species Criteria: 1 = State-listed or candidate species; 2 = Vulnerable aggregation; 3 = commercial, recreational, or tribal importance

[c] Federal Status under the U.S. Endangered Species Act: E = Endangered; T = Threatened; SC = Species of Concern

[d] State Status: E = Endangered; T = Threatened; C = Candidate; S = Sensitive

[e] Western Washington Nonbreeding Concentrations

5.8.5 Impacts

This section describes the direct and indirect impacts to wildlife potentially resulting from construction and operation of the proposed export terminal.[3]

5.8.5.1 On-Site Alternative

This section describes the potential impacts on wildlife as a result of construction and operation of the proposed export terminal at the On-Site Alternative location.

Construction activities that could affect wildlife include the following:

- Permanent removal of habitat and wildlife displacement and mortality in terrestrial and aquatic habitats associated with clearing and construction of the proposed terminal.
- Noise and visual impacts on wildlife associated with operation of construction equipment, general construction-related noise, and pile-driving.
- Spills and leaks associated with the use of construction equipment and materials.

Operation activities that could affect wildlife include the following.

- Noise impacts on wildlife associated with operations such as train movement, managing the coal stockpile, transfer of coal to vessels, and general industrial operations.
- Spills and leaks from trains, vehicles, or equipment.
- Vessel strikes of marine mammals.
- Underwater vessel noise impacts on pinnipeds and diving birds.
- Removal of benthic habitat during maintenance dredging affecting wildlife and habitat.
- Coal dust deposition impacting terrestrial, wetland, and aquatic habitats and wildlife.

Construction—Direct Impacts

Construction activities associated with the On-Site Alternative could result in direct impacts as described below. As explained in Chapter 3, *Alternatives*, construction-related activities include demolishing existing structures and preparing the site, constructing the rail loop and docks, and constructing supporting infrastructure (e.g., conveyors and transfer towers).

Alter or Permanently Remove Terrestrial Habitat

Construction of the On-Site Alternative would result in the permanent removal of wildlife habitat within the limits of the project area.

A total of 201.5 acres of terrestrial habitat would be permanently removed during construction (Table 5.8-6). The majority of these impacts (151.14 acres) would occur in previously developed lands in which industrial buildings, pavement, and infrastructure currently exist with scattered areas of vegetation surrounding the developed areas, or sparsely vegetated areas that previously served as material storage or disposal sites associated with past industrial uses of the

[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.

property. In general, these developed lands provide degraded wildlife habitat conditions that do not provide suitable habitat for many species of wildlife, but may support bats, birds, rodents and insects.

Table 5.8-6. Permanent Terrestrial Habitat Loss by Type in the Study Area

Habitat Type	Direct Impact Area (acres)
Developed	151.14
Upland	26.26[a]
Wetland	24.10
Total	**201.5**

[a] Includes 0.05 acre of upland riparian forest.

Construction of the On-Site Alternative would result in the permanent loss of 26.26 acres of upland and 24.10 acres of wetland habitats containing forested, herbaceous, managed herbaceous, and scrub-shrub vegetation, and a small area (0.05 acre) of forested riparian habitat (Table 5.8-6). Animals inhabiting these areas could be displaced to other habitats outside of the project area and mortality of some less mobile individual species could occur.

Wildlife Displacement or Mortality

Wildlife present in the study area during construction could be displaced, injured or killed by construction vehicles or equipment, placement of construction materials on the ground, or ground disturbance such as land clearing and preloading activities. Approximately 151 acres (71%) of the project area are currently developed and many species of wildlife would likely not be present in these areas due to the lack of suitable habitat. Most wildlife species are mobile, and construction activities on approximately 50 acres of suitable wildlife habitat would result in the displacement and possibly the mortality of wildlife in the project area, particularly less mobile species such as burrowing mammals, reptiles, amphibians, and insects. Overall, the project would result in the loss of approximately 50 acres of suitable wildlife habitat and approximately 151 acres of developed lands that do not provide suitable habitat conditions for many species of wildlife. Wildlife that occur in these habitats would be displaced, injured, or killed as a result of construction of the proposed terminal.

Physical or Behavioral Responses to Construction

Construction of the terminal under the On-Site Alternative could affect both terrestrial and aquatic wildlife because of increased human presence, elevated noise levels, and/or ground-disturbing activities. While wildlife in and around the terrestrial and aquatic study areas is likely habituated to human activity and noise associated with existing industrial activities, noise levels at the project area would increase above ambient levels during construction, especially during impact pile-driving for dock and trestle construction.

Wildlife species exhibit different hearing ranges and not all wildlife responds the same way to sound. Wildlife response to sound depends on numerous factors, including noise level, frequency, distance and event duration, equipment type and conditions, frequency of noise events over time, slope, topography, weather conditions, previous exposure to similar noises, hearing sensitivity, reproductive status, time of day, behavior during the noise event, and the animal's location relative to the noise source (Delaney and Grubb 2003 in Washington State

Department of Transportation 2015). Therefore, an animal's reaction to elevated noise levels could range from mild disturbance with little or no reaction to escape behavior, which would displace individuals by forcing them to abandon the area of elevated noise levels, potentially resulting in significant impairment or disruption of normal behavioral patterns. Such displacement and disruption of behavior could reduce productivity and survival of individuals as the individual would likely expend more energy relocating to new suitable habitat, and would be less familiar with new habitat areas and at an increased risk of predation, potentially limiting survival of individual adults or offspring (e.g., abandoning young). These impacts would be exacerbated where there is no adjacent or nearby suitable habitat that is easily accessible. In addition, visible construction equipment, materials, and an increase in infrastructure could cause displacement because some species would avoid areas within the line-of-sight of construction equipment.

Dredging could affect birds, including streaked horned larks. No studies specifically identify noise sensitivities of the streaked horned lark but the marbled murrelet is very sensitive to underwater noise such as pile-driving and to noise that lasts longer than 10 to 15 minutes (Mountain Loop Conservancy 2010). Shorebird sensitivities are more similar to those of sea lions because they spend most of their time above water and generally stay in the shallow water while hunting (Science Applications International Corporation 2011). Dredging activities have been shown to generate in-air noise levels of 72 decibels in commercial or industrial areas (Epsilon Associates, Inc. 2006). Noise levels in this range could disturb birds, but would not likely result in injury.

Construction would be temporary, occurring over the estimated 6-year construction period. A lower density of development northwest of the terrestrial study area could connect to potentially suitable wildlife habitat where wildlife could relocate during and after construction. Because wildlife in the study area is likely habituated to noise associated with industrial activities and are generally mobile, construction noise could affect individuals of a species, but would not likely affect the local population.

Alter or Permanently Remove Aquatic Habitat

Construction would result in the alteration or permanent loss of approximately 83 acres of aquatic habitat. Dredging to provide vessel access to Docks 2 and 3 would alter approximately 48 acres of benthic habitat and construction would result in the permanent loss of approximately 11 acres of aquatic habitat (ditches and ponds) throughout the project area. Additionally, the project would result in the permanent loss of approximately 24 acres of wetland habitat (refer to Section 5.3, *Wetlands*, for further information).

These open areas of freshwater and wetlands support amphibians, small mammals, and birds. The project would permanently remove approximately 11 acres of aquatic habitat and 24 acres of wetlands, which would reduce suitable habitat available to these species.

The placement of 610 piles would permanently remove approximately 0.10 acre (4,312 square feet) of river bottom habitat (7.07 square feet per pile). Construction of docks and trestle would also create 5.13 acres of new overwater surface area that would limit light penetration into the aquatic environment. Benthic organisms within the pile footprint at the time of pile-driving would likely perish.

Approximately 225 feet of two existing pile dikes would be removed using vibratory extraction or direct-pull methods (Grette Associates 2014n). Pile dikes were installed throughout the lower Columbia River between 1889 and 1969. The specific year the pile dikes to be partially removed as part of the proposed project were installed is unknown, but their degraded condition indicates that they've been in the river for considerable time. Removing creosote-treated piles from the Columbia River would improve water quality over the long term; however, removing the piles could cause temporary, short-term increases in suspended sediments, short-term water contamination, and long-term sediment contamination from creosote released during extraction or long-term exposure to the water column. Those portions of the creosote-treated piles that have been exposed to water and air have little creosote remaining. Those portions of the treated piles below the mud line likely have more creosote remaining, which would become exposed during extraction. Backfilling the holes left after extracting the piles with clean-sand would avoid and minimize exposure to the water column of the creosote that may be present in the surrounding soils.

Creosote and associated chemicals, particularly those that are water soluble and that persist in the water column are known to bioconcentrate in many aquatic invertebrates (Eisler 1987; Brooks 1997). Creosote contains a mixture 200 to 250 compounds, with primary components composed of polycyclic aromatic hydrocarbons (PAHs) (National Marine Fisheries Service 2009). PAHs are known to be toxic to aquatic organisms including invertebrates and fish and can cause sublethal and lethal effects (Eisler 1987; Brooks 1997). Most of the components of creosote are heavier than water and sink in the water column. PAHs from creosote accumulate in sediments and are likely to persist at the site of pile removal or wherever they settle after suspension until they degrade (National Marine Fisheries Service 2009). However, PAHs from sediment are less bioavailable to aquatic species and, thus, these organisms are not likely to bioaccumulate PAHs from sediments (Brooks 1997). Over the long term, the source of creosote would be removed or capped by the sediment falling into the hole left by the extracted pile. Water quality would improve, the concentration of creosote in the sediment would be expected to decrease, and the potential pathway of exposure for wildlife through contamination of prey would be reduced.

Dredging would permanently alter a 48-acre area of deepwater habitat by removing approximately 500,000 cubic yards of benthic sediment. Within the proposed dredged area, the amount of deepening would depend on existing depths, varying from no removal up to 16 feet of removal. Most benthic organisms are stationary or slow moving and would likely perish during dredging. Benthic organisms typically recolonize disturbed areas within 30 to 45 days.

Physical or Behavioral Responses to Dredging and Underwater Construction Noise—Pinnipeds

Dredging activities could affect pinnipeds through collisions with vessels and dredging-related turbidity. Collisions with vessels and dredging equipment are possible but unlikely given the slow speeds of dredging vessels. Information on turbidity is limited; however, existing research indicates that dredging-related turbidity is unlikely to cause substantial impacts on pinnipeds since they often inhabit naturally turbid or dark environments and are likely to use senses in addition to their vision (Todd et al. 2014). Noise generated by dredging could cause masking and behavioral changes but is unlikely to cause auditory damage to pinnipeds (Todd et al. 2014). Increases in turbidity and underwater noise associated with dredging would be short-term and localized. Dredging would not likely cause long-term negative impacts on pinnipeds.

Installation of steel piles to support Docks 2 and 3 would generate underwater noise during pile-driving (Grette Associates 2014b) that could exceed the harassment thresholds described in Section 5.8.3.2, *Impact Analysis, Assessing Noise Impacts*. Pile installation would likely occur over two in-water work window construction periods due to the large number of piles involved.

Impact Pile-Driving

Level A harassment could occur up to a radius distance of 178 feet from active impact pile-driving without any sound attenuation in place. With implementation of a bubble curtain to attenuate noise levels during impact pile-driving, there would be a reduction of at least 9 decibels at the source, which would decrease the Level A harassment area to a 45-foot radius around each pile as it is driven. Because the Columbia River is approximately 3,000 feet wide at the point where pile-driving would occur, there would be a wide area of the river that pinnipeds could utilize and avoid exposure to the small area where underwater noise reaching Level A harassment would be generated. Based on the seasonal use patterns for California sea lion, Steller sea lion, and harbor seals in the study area, presence of individual pinnipeds during impact pile-driving would be unlikely.

It is estimated that Level B harassment could occur up to a radius distance of 3.36 miles from active impact pile-driving without any sound attenuation in place. With implementation of a bubble curtain to attenuate sounds, it is estimated that there would be a reduction of at least 9 decibels at the source, which would decrease the Level B harassment area to a 0.84-mile radius (4,459 feet) around each pile as it is driven. In the event these pinnipeds pass through the study area during impact pile-driving, they would be exposed to sound in excess of the Level B harassment threshold.

Vibratory Pile-Driving

Vibratory pile-driving may occur during much or all of each working day during the proposed in-water work window. Vibratory pile-driving would be used to drive the pile to the greatest extent possible. Final driving and/or proofing would require an impact pile-driver. Given the likely use of multiple pile-driving rigs and variable subsurface conditions, vibratory pile-driving might not occur throughout the working day. California sea lions, Steller sea lions, and harbor seals are considered unlikely to be present during much of the vibratory pile-driving period, based on their seasonal occurrence and the in-water pile-driving construction timing. This would minimize the likelihood that individual pinnipeds would experience sound in excess of the 120 dB_{RMS} Level B harassment threshold for continuous pile-driving sound. Individuals that occur within approximately 5.1 miles (26,928 feet) of vibratory pile-driving would experience elevated sound levels. If an individual were to initially avoid the area of elevated sound it would be expected to eventually move through the study area, either once acclimated to the sound or once pile-driving has ceased.

Physical or Behavioral Responses to Underwater Construction Noise—Diving Birds

Installation of piles could result in underwater noise impacts on diving birds. Given USFWS thresholds for marbled murrelet (Section 5.8.3.2, *Impact Analysis, Assessing Noise Impacts*), the small area where these noise levels would be reached, and the presence of construction equipment, vessels, and humans during pile-driving, it is likely a diving bird would avoid the area and not be exposed to injurious noise levels.

The reaction of a diving bird exposed to underwater noise levels above 150 dB_{RMS} (but below 202 dB_{SEL}) could range from mild disturbance to escape behavior, which would displace individuals. Displacement and disruption of behavior could interrupt feeding and diving, and reduce productivity and survival of individuals as the individual would likely expend more energy relocating to a new area. However, impact pile-driving noise impacts would be temporary, occurring over two in-water work windows. It is not anticipated underwater impact pile-driving noise would affect the overall fitness of diving bird populations.

Temporary Spills and Leaks

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 and terrestrial wildlife, particularly in terms of respiration, growth, and reproduction. The risk of a spill or release of hazardous materials is low because of the requirements associated with the handling, transfer, use, and storage of most construction-related hazardous materials. The potential risks and impacts related to impacts on water quality are addressed in Section 5.5, *Water Quality*. The potential for these types of impacts would be minimized by implementing construction best management practices, avoidance and minimization measures, in-water work windows, and compliance with regulatory and permit requirements.

Construction—Indirect Impacts

Construction under the On-Site Alternative would not result in indirect impacts on wildlife or wildlife habitat because construction would be limited to the project area.

Operations—Direct Impacts

Operation of the proposed terminal at the On-Site Alternative location would result in the following direct impacts.

Spills or Leaks

Routine operations at the project area could result in spills or leaks of hazardous materials from vehicles, trains, or equipment. Contaminants could degrade aquatic habitat in the Columbia River and drainage ditches in the project area. Training, oil discharge prevention briefings, and regulatory compliance would reduce the likelihood of accidental spills impacts. Additional measures are outlined Section 5.5, *Water Quality*, and Chapter 4, Section 4.6, *Hazardous Materials*.

Physical or Behavioral Reponses to Noise

Operations could result in increased noise, which could affect wildlife by causing disturbance or avoidance behavior. Wildlife present in the area is likely habituated to the elevated noise levels associated with industrial, commercial, and residential uses. Wildlife is generally mobile and avoids disturbing noise levels and human activities beyond those to which it is habituated. Noise generated by terminal operations would be similar to noise generated by existing activities along the industrial waterfront and should have no measurable impact on wildlife in the terrestrial study area.

Spill Coal during Operations

Direct impacts resulting from a spill during coal handling at the proposed terminal would likely be minor because the amount of coal that could be spilled would be relatively small. Also, there would be no impacts to wildlife or wildlife habitat in the project area due to the absence of terrestrial and aquatic environments in the project area and the contained nature and features of the proposed terminal (e.g., fully enclosed belt conveyors, transfer towers, and shiploaders). Potential physical and chemical effects of a coal release on the aquatic and terrestrial environments that occur adjacent to the proposed terminal are described below.

Coal spilled into the Columbia River would have physical effects on aquatic wildlife and habitats, 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. Cleanup of coal released into the aquatic environment could also 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 spilled 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 export terminal would result in a spill of coal that would affect the Columbia River because the rail loop and stockpile areas would be contained, and other areas adjacent to the export terminal are separated from the Columbia River by an existing levee. 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 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 terminal would result in the following indirect impacts.

Injury or Mortality from a Vessel Strike—Pinnipeds

Operation of the terminal would increase vessel traffic in the Columbia River (Chapter 6, Section 6.4, *Vessel Transportation*) by 1,680 vessel transits per year. Increased vessel traffic would increase the risk of vessel collisions with pinnipeds in the lower Columbia River. Most research and literature on marine mammal vessel strikes is associated with vessel-whale collisions at sea. Compared to pinnipeds, whales are typically much larger, slower-moving, and, therefore, are assumed to be more vulnerable to vessel strikes. Vessel strikes on marine mammals are usually described as massive blunt-force trauma (Geraci and Lounsbury 1993 in Horning and Mellish 2009), but are considered extremely rare for pinnipeds (Andersen et al. 2007 in Horning and Mellish 2009).

The potential for a pinniped strike with a vessel depends on many factors, including time of year, vessel type, vessel size, pinniped species, vessel location, vessel speed, and location of animal relative to vessel. The behavior of a pinniped in the path of an approaching vessel in the study area is uncertain, but it is likely that an individual would have the ability to swim away from an approaching vessel. In addition, pinnipeds in the Columbia River are likely habituated to existing Columbia River vessel traffic, and vessel speed would be less than 14 knots. Therefore, the potential risk for a vessel collision with a pinniped would be low.

Physical or Behavioral Responses to Vessel Noise and Maintenance Dredging—Pinnipeds

Operation of the proposed terminal would increase vessel traffic and underwater noise in the lower Columbia River (Chapter 6, Section 6.4, *Vessel Transportation*). Studies in the Salish Sea have shown that the greater the ship size, the greater the underwater noise due to propeller cavitation,[4] with the exception of tug vessels, which have greater underwater noise levels while performing such activities as berthing or accelerating a ship (Hemmera Envirochem et al. 2014). Vessel noise levels are likely to be similar in the Columbia River.

The peak hearing sensitivity frequencies of the Steller sea lion, California sea lion, and harbor seal are generally outside the noise frequencies generated by vessels (generally between 10 and 1,000 hertz (Wright 2008) and these species are habituated to existing Columbia River vessel noise levels. In response to vessel noise, marine mammals may modify or cease producing sounds they use to communicate, forage, or gain awareness of their environment (Wright 2008). Vessel noise may influence marine mammal behavior, but would not be great enough to cause physiological damage.

Impacts from noise generated during dredging would be similar to those described under construction-related direct impacts.

[4] As propellers move through water, low-pressure areas are formed as the water accelerates around and moves past the propellers. The faster the propeller moves, the lower the pressure around it can become. As it reaches vapor pressure, the water vaporizes and forms small bubbles. This is cavitation. When the bubbles collapse, they typically cause very strong local shock waves in the water, which may be audible and even damage propellers.

Remove or Alter Habitat during Maintenance Dredging

Maintenance dredging is anticipated to occur every few years, but could occur as frequently as every year. Other neighboring berths typically maintenance dredge on an annual basis. Maintenance dredging impacts on pinnipeds and benthic organisms would be similar to those described for initial construction, but maintenance dredging would likely remove a smaller amount of material over a shorter period of time. Maintenance dredging would still result in mortality of invertebrate organisms and temporary disruption of benthic productivity, but benthic organisms typically recolonize an area 30 to 45 days following disturbance. In general, baseline benthic productivity is expected to be low in this deepwater habitat (McCabe et al. 1997), given the depth of water and amount of ambient light penetration to the river bottom.

Generate and Disperse Coal Dust

Coal particles would be generated during operation of the terminal as coal is unloaded from trains, stockpiled, and loaded into vessels.

The potential extent and deposition rate of coal dust particles less than 75 microns in diameter was modeled as part of the air quality analysis. Based on this modeling, the highest rate of coal dust deposition would be expected in the immediate area surrounding the export terminal, but smaller particles would also be expected to deposit in a zone extending around and downwind of the terminal. Deposition rates could range from 1.45 grams per square meter per year (g/m^2/year) adjacent to the project area, gradually declining to 0.01 g/m^2/year approximately 2.41 miles from the project area. Based on the modeling results, the zone of deposition would extend primarily northwest of the project area and over the Columbia River. Deposition rates of less than 0.1 g/m^2/year are projected to occur over the forested habitats of Lord Island within the study area, with declining concentrations across the island and to the south and west toward Walker Island. Thresholds for possible effects of coal dust on wildlife have not been established. However, as described in Chapter 6, Section 6.7, *Coal Dust*, the benchmark used for the analysis of potential negative impacts on people was 2.0 g/m^2/month. Coal dust deposition in the indirect study area would be below this benchmark. See Section 6.7, *Coal Dust*, for more information.

Although concerns regarding coal dust are commonly expressed relative to air quality and human health concerns, scientific literature examining the potential impacts of coal dust on wildlife, in particular, on terrestrial wildlife is scarse. More research has been conducted on potential effects of coal dust on aquatic organisms. Potential physical effects of coal dust have been well documented but the potential toxic effects of coal dust on aquatic organisms is not well known.

Coal particles could affect aquatic wildlife in a manner comparable to any form of suspended particulate, such as tissue abrasion, smothering, obstruction or damage to feeding or respiratory organs, and effects resulting from reduced light. Another potential manner in which coal could affect aquatic wildlife is through coal leachates. Unburnt coal can be a source of acidity, salinity, trace metals, hydrocarbons, chemical oxygen demand, and potentially macronutrients if they leach from the coal matrix into aquatic habitats. Toxic constituents of coal include PAHs and trace metals, which are present in coal in variable amounts and combinations dependent on the type of coal. Some PAHs are known to be toxic to aquatic animals and humans. Metals and PAHs could also potentially leach from coal to the pore water of sediments and be ingested by benthic-feeding organisms, providing a mechanism for subsequent ingestion by other organisms throughout the food chain. However, the low aqueous extractability and bioavailability of the contaminants likely minimizes potential toxic effects.

5.8.5.2 Off-Site Alternative

This section describes the potential impacts on wildlife that could occur as a result of the construction and operation of the proposed export terminal at the Off-Site Alternative location. Construction and operation impacts at the Off-Site Alternative location are the same as those at the On-Site Alternative, with the exception of the following notable differences.

Construction—Direct Impacts

Alter or Permanently Remove Terrestrial Habitat

Construction of the terminal would destroy all wildlife habitat within the limits of construction. A total of 216.36 acres of terrestrial habitat would be permanently removed during construction by grading and clearing (Table 5.8-7). Although the majority of the habitats at the project area are vegetated, these habitats have been altered and degraded by past agriculture and recreational activities.

Table 5.8-7. Permanent Direct Impacts by Terrestrial Habitat Type in the Project Area—Off-Site Alternative

Habitat Type	Direct Impact Area (acres)
Developed	9.62
Upland	155.46[a]
Wetland	51.28
Total	**216.36**

[a] Includes 0.01 acre of upland riparian scrub-shrub

Alter or Permanently Remove Aquatic Habitat

A total of 597 36-inch-diameter steel piles would be installed in the river to construct the trestle and docks, removing an area equivalent to 0.10 acre of benthic habitat. Approximately 94% of this habitat (3,980 square feet) is located in deep water (Grette Associates 2014o). Bottom-dwelling organisms within the pile footprint at the time of pile-driving would likely perish.

Dredging would permanently alter a 15-acre area of deep water habitat by removing approximately 50,000 cubic yards of benthic sediment (Grette Associates 2014o). As with the On-Site Alternative, the Applicant has proposed disposing of dredged materials within the flow lane, adjacent to or within the navigation channel, to support the downriver sediment transport system (Grette Associates 2014i, 2014m, 2014o). The flow lane disposal area may be located between river miles 61 and 64, similar to other nearby projects. These river miles are illustrated on Figures 5.8-1 and 5.8-3.

Potential impacts on wildlife and wildlife habitat from dredging activities would be similar to those described for the On-Site Alternative, although the magnitude would be much less for the Off-Site Alternative. The On-Site Alternative would involve approximately 48 acres and 500,000 cubic yards of material while the Off-Site Alternative would involve approximately 15 acres and 50,000 cubic yards of material (approximately 10% of the volume of the On-Site Alternative).

The majority of bottom-dwelling organisms are stationary or slow-moving and occur relatively close to the substrate surface, and they would likely perish during dredging. Because benthic organisms generally occur near the interface between the water and substrate, the area of impact best represents the magnitude of the potential impact to benthic organisms, which for the Off-Site Alternative would be approximately 30% of the potential magnitude of impact associated with the On-Site Alternative. These organisms serve as prey for larger species. The proposed dredge area is deep water, where productivity is low relative to shallower areas. Dredging activities are not typically associated with long-term reductions in the availability of prey, and impacts on productivity are expected to be temporary. Dredging activities could potentially affect pinnipeds as described for the On-Site Alternative.

Beyond the Columbia River, construction would result in the loss of approximately 8.61 acres of other aquatic habitats (primarily ditches) that meander through the Off-Site Alternative project area. These open waters support amphibians and are used by small mammals and birds, which are highly mobile species that can leave the area during construction. Some mortality of amphibians and other less mobile species would likely occur.

Operations—Indirect Impacts

Generate and Disperse Coal Dust

Deposition rates could range from 1.83 grams per square meter per year (g/m^2/year) adjacent to the project area, gradually declining to 0.01 g/m^2/year approximately 2.98 miles from the project area. Based on the models, the zone of deposition would extend primarily northwest of the project area and over the Columbia River. Deposition rates of less than 0.1 g/m^2/year are projected to occur over the forested habitats of Lord Island within the study area, with declining concentrations across the island and to the south and west toward Walker Island.

5.8.5.3 No-Action Alternative

Under the No-Action Alternative the Corps would not issue a Department of Army permit authorizing construction and operation of the proposed export terminal. As a result, impacts resulting from constructing and operating the export terminal would not occur. In addition, not constructing the export terminal would likely lead to expansion of the adjacent bulk product business onto the export terminal project area. The following discussion assesses the likely consequences of the No-Action Alternative regarding wildlife.

Under the No-Action Alternative, ongoing operations in the On-Site Alternative project area would continue. Additional storage and transfer activities might occur using existing buildings and structures. The Applicant would continue with current and future increased operations and the project area could be developed for other industrial uses including an expanded bulk product terminal or other industrial uses. New construction, demolition, or related activities to develop the project area into an expanded bulk terminal could occur on previously developed and undeveloped lands. This could affect areas that provide suitable terrestrial and aquatic wildlife habitat. Cleanup activities, relative to past industrial uses, would continue to occur. These could affect developed areas and associated disturbed habitats. Vessel traffic would continue and any aquatic wildlife disturbance or injury associated with vessel movements would continue. Thus, potential impacts on wildlife could occur under the No-Action Alternative similar to what is described for the On-Site Alernative, but the extent of the impact would depend on the proposed action.

5.8.6 Required Permits

The following required permits are expected to reduce impacts on wildlife.

5.8.6.1 On-Site Alternative

The On-Site Alternative would require the following permits for wildlife.

- **Endangered Species Act Consultation—U.S. Fish and Wildlife Service and National Marine Fisheries Service.** Constructing and operating the proposed terminal at the On-Site Alternative location would affect species listed (or eligible for listing) under the ESA or designated critical habitat. In accordance with Section 7(a)(2) of the ESA, as amended, any action that requires federal authorization or funding, or is carried out by a federal agency, must undergo consultation with the USFWS and/or NMFS to ensure the 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.
- **Clean Water Act Authorization, Section 404—U.S. Army Corps of Engineers.** Construction and operation of the terminal would result in discharges of dredged and fill material into waters of the United States, including wetlands. Department of the Army authorization from the U.S. Army Corps of Engineers would be required.
- **Rivers and Harbors Act, Section 10—U.S. Army Corps of Engineers**. Construction and operation of the proposed export terminal 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 certain 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.
- **Marine Mammal Protection Act—National Marine Fisheries Service.** Construction of the proposed terminal would involve pile-driving, which could result in harassment, or "take," of marine mammals protected under the Marine Mammal Protection Act (MMPA) of 1972, as amended. Under the MMPA, the NMFS would have to issue authorization for incidental "take" of marine mammals. Take is defined under the MMPA as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal."
- **Local Critical Areas and Construction Permits—Cowlitz County.** The On-Site Alternative would require local permits for clearing and grading of the project area and for impacts on regulated critical areas. Cowlitz County would issue a fill and grade permit, and would review the On-Site Alternative for consistency with the County's critical areas ordinance.
- **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 (Cowlitz County Code (CCC 19.20) and would thus require a Shoreline Substantial Development and Conditional Use Permit from Cowlitz County and Ecology.
- **Hydraulic Project Approval—Washington Department of Fish and Wildlife.** The On-Site Alternative would require a hydraulic project approval from WDFW because it will change the natural flow or bed of the Columbia River.

- **Clean Water Act, Section 401 Water Quality Certification—Washington State Department of Ecology.** Because the export terminal authorization under Section 404 of the Clean Water Act, the regulated discharges would require a Clean Water Act, Section 401 water quality certification. This certification is administered by Ecology. The dredged materials management plan requires site-specific sediment sampling to characterize sediments and determination of suitability of dredged material for disposal.

5.8.6.2 Off-Site Alternative

The Off -Site Alternative would require the same permits related to wildlife as described for the On-Site Alternative.

- Endangered Species Act Consultation
- Clean Water Act Authorization, Section 404
- Rivers and Harbors Act, Section 10
- Marine Mammal Protection Act
- Hydraulic Project Approval
- Clean Water Act, Section 401 Water Quality Certification
- **Local Critical Areas and Construction Permits—City of Longview.** In addition to the Cowlitz County permits, the Off-Site Alternative would require permits from the City of Longview. Chapter 17.10 of the City of Longview Municipal Code regulates activities within and adjacent to critical areas such as wetlands and their buffers, fish and wildlife habitat conservation areas (including streams and their buffers), frequently flooded areas, and geological hazard areas. The City of Longview would require Critical Areas and Floodplain permits, as well as a Building Permit for clearing, grading, and construction.
- **Shoreline Substantial Development—City of Longview**. A Shoreline Substantial Development permit from the City of Longview would also be required. The City of Longview administers the Shoreline Management Act through its Shoreline Management Master Program. The project area would have elements and impacts within jurisdiction of the act and would thus require a Shoreline Substantial Development permit from the City of Longview. The Off-Site Alternative would not require a Shoreline Substantial Development Permit or Conditional Use Permit from Cowlitz County.