

5.4 Vessel Transportation

The Columbia River navigation channel provides passage for deep-draft vessels, such as those related to the Proposed Action, to various ports along its shoreline. Vessel transportation in this area also includes recreational boating, passenger and ferry operations, and commercial and tribal fishing.

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

5.4.1 Regulatory Setting

Conventions, regulations, statutes, and guidelines relevant to vessel transportation are summarized in Table 5.4-1. Project vessels carry fuel oil for the purposes of engine propulsion. Therefore, this section also describes laws and regulations related to oil spill preparedness and response.

Table 5.4-1. Conventions, Regulations, Statutes, and Guidelines for Vessel Transportation

Convention, Regulation, Statute, Guideline	Description
International	
International Convention for the Safety of Life at Seas	Required safety standards for international ships for construction, navigation, life-saving, communications, and fire equipment. Also referred to as SOLAS.
International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)	International convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.
International Ship and Port Facility Security Code	Security-related requirements for governments, port authorities, and shipping companies.
International Maritime Solid Bulk Cargoes Code	Procedures for bulk cargo carriers.
International Regulations for Preventing Collisions at Sea, 1972	Rules on safe navigation for vessels in international waters. Also referred to as 72 COLREGS.
Standards of Training, Certification, and Watchkeeping 1978 revised in 1995 and 2010	Standards for training, certification, and watchkeeping requirements for seafarers.
Federal	
International Navigational Rules Act of 1977 (Public Law 95-75; 91 Statute 308; 33 USC 1601-1608) (33 CFR 80-82)	Navigation rules for international waters.
Inland Navigational Rules Act of 1980 (Public Law 96-591) known as "Rules of the Road" (33 CFR 84-90)	Navigation rules for U.S. waters.
46 USC (Shipping) Chapter 33 (Inspection)	Consolidates the laws governing the inspection and certification of vessels by the U.S. Coast Guard.

Convention, Regulation, Statute, Guideline	Description
Ports and Waterways Safety Act of 1972 (33 USC 1221 et seq.)	Provides for the protection and “safe use” of a U.S. port (includes the marine environment, the navigation channel, and structures in, on, or immediately adjacent to the navigable waters) and for the protection against the degradation of the marine environment.
Maritime Transportation Security Act of 2002 (46 USC 701). Relevant regulations are 33 CFR 101 and 105.	Requirements for maritime security.
Federal Water Pollution Control Act, as amended by Section 4202 of the Oil and Pollution Act of 1990 (33 USC 1321). Relevant regulations are the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) and 33 CFR 155.5010–5075.	40 CFR 300 establishes a national response system for oil spills and hazardous material releases. Provides a framework and establishes guidelines for area contingency planning for oil spills and hazardous material releases. 33 CFR 155.5010-5075 requires cargo (referred to as nontank vessels) vessels to prepare and submit oil or hazardous substance discharge response plans when operating on the navigable waters of the United States.
The Act to Prevent Pollution from Ships (33 USC 1901 et. seq.)	Implementing U.S. legislation for MARPOL and Annexes I and II.
Maritime Transportation Act of 2004; and the Coast Guard and Maritime Transportation Act of 2006. Amended 311(a) and (j) of the Federal Water Pollution Control Act. Relevant regulations are 33 CFR 151, 155, and 160.	Requires cargo vessel owners or operators to prepare and submit oil or hazardous substance discharge response plans.
33 CFR, 46 CFR, and 49 CFR	These regulations incorporate international laws to which the United States is signatory as well as various classification society and industry technical standards governing the inspection, control, and pollution prevention requirements for vessels.
Washington State	
Washington State Bunkering Operations (WAC 317-40) (RCW 88.46.170)	Establishes minimum standards for safe bunkering (transfer of fuel to a vessel) operations.
Washington State Oil Spill Contingency Plan Requirements (WAC 173-182) (RCW 88.46, 90.56, and 90.48)	Requires that cargo vessels 300 or more gross tons be covered by a contingency plan for the containment and cleanup of oil.
Washington State Vessel Oil Transfer Advance Notice and Containment Requirements (WAC 173-184)	Requires facility or vessel operators who transfer oil to provide the state with a 24-hour advance notice of transfer.
Washington State Cargo Vessel Boarding and Inspection (WAC 317-31)	Cargo vessels 300 or more gross tons shall submit a notice of entry at least 24 hours before the vessel enters state waters and be subject to boarding and inspection by state inspectors to ensure compliance with accepted industry standards.
Oregon State	
Oregon Administrative Rules (OAR) 856-010-0003 through 0060 and 856-030-0000 through 0045 (Statutory Authority: ORS Title 58 Chapter 776).	Oregon State Board of Maritime Pilots Rules for pilotage of vessels in Oregon state waters, including the Columbia River.

Convention, Regulation, Statute, Guideline	Description
OAR 340-141 (Statutory Authority: ORS 468.020, 468B.345–468B-390).	Oregon Department of Environmental Quality (DEQ) State Oil Spill Contingency Plan requirements for cargo vessels (self-propelled ships in commerce) 300 or more gross tons (other than a tank vessel or a passenger vessel).
Local	
There are no local laws and regulations relevant to vessel transportation.	
<p>Notes: SOLAS = International Convention for the Safety of Life at Seas; COLREGS = International Regulations for Preventing Collisions at Seas; MARPOL = International Convention for the Prevention of Pollution from Ships; STCW = Standards of Training, Certification, and Watchkeeping; USC = United States Code; CFR = Code of Federal Regulations; WAC = Washington Administrative Code; OAR = Oregon Administrative Rule; ORS = Oregon Revised Statute</p>	

5.4.2 Study Area

The study area for direct impacts is the area surrounding the proposed docks (Docks 2 and 3) where vessel loading would occur. The study area for indirect impacts includes the waterways that would be used by, or could be affected by, vessels calling at the project area. It includes the waters out to 3 nautical miles seaward of the mouth of the Columbia River, the Columbia River Bar, the Columbia River upstream to Vancouver, Washington,¹ and the Willamette River upstream to the Port of Portland.

5.4.3 Methods

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

5.4.3.1 Information Sources

The following sources of information were used to define the existing conditions relevant to vessel transportation and identify the potential impacts of the Proposed Action and No-Action Alternative on vessel transportation in the study area.

Information for the vessel traffic analysis was obtained from stakeholder interviews and the following sources of information.

- Detailed vessel traffic data from the Columbia River Bar Pilots (Bar Pilots) included in information provided by the Applicant (URS Corporation 2014) was validated during a meeting with the Bar Pilots. That report and other data obtained from the pilots are the basis for historical vessel traffic type and volumes. Washington State Department of Ecology (Ecology) Vessel Entries and Transits (VEAT) data were used for comparison with the Bar Pilot data.
- The Columbia River Pilots (River Pilots) representatives provided information on vessel traffic management within the Columbia River and vessel docking issues for the existing dock (Dock 1) at the project area.

¹ The Port of Vancouver is the furthest upriver port receiving large commercial vessels.

- Merchants Exchange of Portland, Oregon (PDXMEX), provided Automatic Identification System (AIS) data and a synopsis of its operations.
- Port of Portland provided information on the LOADMAX channel reporting and forecasting system.
- *Coast Pilot 7 (Pacific Coast: California, Oregon, Washington, Hawaii, and Pacific Islands)* (National Oceanic and Atmospheric Administration 2014) and the *Lower Columbia Region Harbor Safety Plan* (Lower Columbia Region Harbor Safety Committee 2013) provided information on the vessel transportation characteristics of the study area.
- The following data were used as part of the risk analysis.
 - AIS data to establish baseline (2014) vessel types, sizes, routes, and transit frequencies between the Columbia River mouth and Longview.
 - Historical data on vessel incidents and severity, based on the U.S. Coast Guard (USCG) Marine Information for Safety and Law Enforcement (MISLE) database for 2001 to 2014.
 - Data on reported oil spills within the Columbia and Willamette Rivers from the following three databases for the period between January 1, 2004, and December 31, 2014²: USCG MISLE database, Ecology’s Environmental Report Tracking System (ERTS) database, which records all incidents reported to the state, and Ecology’s Spills Program Incident Information (SPIIS) database, which records spills reported to the state.
- Information also was collected during visits to the project area on October 14, 2014.

5.4.3.2 Impact Analysis

The following methods were used to identify the potential impacts of the Proposed Action and No-Action Alternative on vessel transportation.

For the purposes of this analysis, construction impacts were based on peak construction period and operations impacts were based on maximum coal export terminal throughput capacity (up to 44 million metric tons per year). The following methods were used to evaluate the potential impacts of the Proposed Action and No-Action Alternative on vessel transportation.

- The vessel transportation route, navigational considerations, historical and current vessel traffic patterns, and the systems in place to monitor and control vessel traffic along that route were described based on information gathered through the sources described in Section 5.4.3.1, *Information Sources*.
- Construction-related impacts were qualitatively assessed based on the relative increase in activity in and around the project area and the potential to disturb ongoing vessel transportation.
- Operations-related impacts at the project area (direct impacts) were qualitatively evaluated in terms of the increased potential for vessel-related incidents to occur.

² When the information from these three datasets were combined all duplicate entries were removed and only incidents with actual reported spills of petroleum or petroleum products were considered in the development of the baseline oil spill frequency for the study area.

- Operations-related impacts during vessel transit (indirect impacts) were evaluated both qualitatively and quantitatively to determine the potential for increased risks. Historical vessel incident data were evaluated to characterize the nature and magnitude of vessel incidents that have occurred on the Columbia River to the project area. This information was used to provide context for interpreting operational impacts.
- The potential for vessel incidents (i.e., allisions³ at the project area, collisions, groundings, and fire/explosions by Proposed Action-related vessels during transit) was modeled for existing conditions, the Proposed Action, and No-Action Alternative. The potential for allisions during transit was qualitatively assessed.
 - The incident frequencies were estimated using the Marine Accident Risk Calculation System (MARCS) model and were limited to the area evaluated in the study (DNV GL 2016).
 - The number of trips for non-Proposed Action-related vessels were derived from 2014 AIS data for all vessel types. An increase of 1% per year was applied to the 2014 AIS data through 2028 for the No-Action Alternative. The number of vessels under the Proposed Action was added to this total to determine the incremental increase in the likelihood of the modeled incidents occurring.
- To provide context for understanding the relative consequences of a collision, grounding or allision incident, a survey of USCG Marine Information for Safety and Law Enforcement (MISLE) database was conducted for years 2001 to 2014. This data coverage period was chosen because it covers over 99% of all reported collision, grounding, and allision incidents in the dataset. Data surveys were conducted for the national dataset and for the study area separately to test for differences in the distribution of incident severity between the two.
- Increased risks of bunker oil spills were addressed quantitatively and qualitatively.
 - The potential for a bunker oil spill to occur as the result of an incident was modeled using the Naval Architecture Package (NAPA model) (DNV GL 2016). Using Monte Carlo simulations, in accordance with International Maritime Organization Resolution MEPC.110(49)⁴ – Probabilistic Methodology for Calculating Oil Outflow, the model estimates oil outflow volumes based on the number of damaged cargo tanks and interaction with tidal influences. Monte Carlo simulations were run for 50,000 damage cases to estimate the potential variability in impact and in oil outflow volumes.
 - The potential for releases to occur during bunkering was qualitatively assessed based on the relative increase in vessel traffic.
- Vessel activity in general also has the potential to result in impacts on other resources. Therefore, the relative increase in vessel activity to and from the project area was also described and qualitatively assessed to provide the basis for related analysis in other sections of this EIS.

5.4.4 Existing Conditions

This section addresses the existing conditions related to vessel transportation and safety in the study area, including the natural and built environment, types and volumes of vessel traffic, vessel

³ An allision occurs when a vessel strikes a fixed structure, such as a dock or a vessel at berth.

⁴ The Marine Environment Protection Committee (MEPC) is a subsidiary body of the International Maritime Organization Council.

traffic management, vessel incident frequency and severity, and incident management and response systems.

5.4.4.1 Natural and Built Environment

This section describes the marine environment and facilities and other physical features relevant to marine navigation in the study area. Figure 5.4-1 illustrates the location of the features discussed in this section.

Marine Environment

Conditions of the marine environment in the study area that can affect vessel transportation include winds, longshore and tidal currents, river flows, swells and waves, and extreme weather (National Oceanic and Atmospheric Administration 2014). These elements are described below.

Conditions in the Pacific Ocean near the mouth of the Columbia River can vary greatly depending on the time of year. Prevailing winds and seasonal patterns have the greatest effect on offshore conditions. Longshore currents that generally flow to the north in winter and to the south in summer also affect vessel navigation, although not as much as tidal current and river flows near the river system. Offshore swells can vary more than several feet with the current flow and can result in breaking waves.

Average winter temperatures range from 35 to 49 degrees Fahrenheit (°F) near the mouth of the river and from 32 to 39°F near the upstream extent of the study area; while average summer temperatures are below 70 and 80°F, respectively. Snowfall is not common in the study area.

Although winds are strongest in late fall and winter, they seldom reach gale force along the Columbia River. The strongest winds are usually out of the south or southwest. Wind flow is generally from the east through southeast in winter, and wind speeds reach 17 knots or more about 5 to 10% of the time. Spring and summer typically have northwest and west wind patterns that often clash with river outflows. The volume of water flowing from the Columbia River and the force of impact with ocean conditions can combine to create daunting sea conditions. Nevertheless, summer winds generally remain light and have a cooling effect keeping average daytime temperatures nearly 10 degrees lower at Astoria than at Portland.

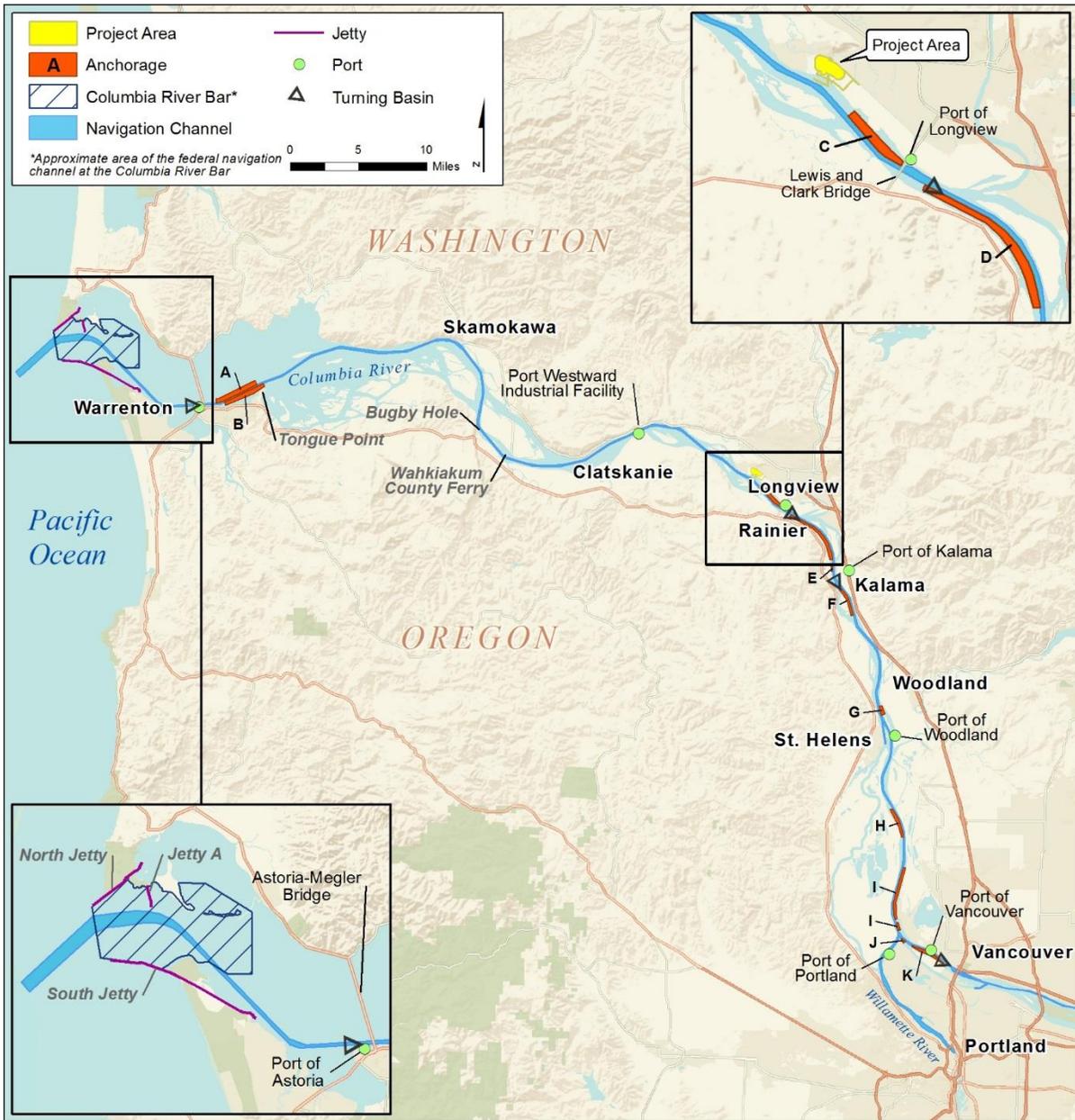
Fog is a hazard during late summer and fall with visibilities below 0.5 mile on 4 to 8 days per month on average.

River current always flows out, but with wide variations in flow rate and volume. The outflow from the Columbia River is a combination of tidal currents with river discharge. At times, currents reach a velocity of over 5 knots on the ebb; on the flood they seldom exceed a velocity of 4 knots.

Columbia River Bar

The Columbia River Bar is seaward of the mouth of the Columbia River (Figure 5.4-1). The bar is about 3 miles wide and 6 miles long. The bar is where the energy of the river's current dissipates into the Pacific Ocean, often as large standing waves (1 meter/3.28 feet or more) (Jordan pers. comm. B). The waves result from the bottom contours of the bar area as well as the mixing of fresh and saltwater and environmental conditions.

Figure 5.4-1. Ports, Anchorages, and other Features in the Study Area



Note: Letters correspond to anchorages described in Table 5.4-3.

Tide, current, swell, and wind—direction and velocity—all affect the bar conditions. Current velocity typically ranges from 4 to 7 knots westward into the predominantly westerly winds and ocean swells, creating significant disturbances of the water column and waves. There are two full tidal current ebb and flood cycles each day, and conditions at the bar can change drastically in a very short time period with the tidal flow. Worst-case conditions typically occur when onshore winds and tidal ebb combine with the river flow; when this happens, the effects can change unpredictably in a very short time as the tidal flow cycles (National Oceanic and Atmospheric Administration 2014).

Columbia River

The tidal range at the mouth of the Columbia River is approximately 5.6 feet with mean higher high water measured at 7.5 feet in 2013 (National Oceanic and Atmospheric Administration 2014). At Portland and Vancouver the tidal range is approximately 2.3 feet with mean higher high water measured at 8.7 feet in 2013 (NOAA tides and water levels station 9440083). The Columbia River experiences a mixed semidiurnal tide cycle. This means that there are two high and two low high tides of different size every lunar day. Moreover, the river flow combines with the tides to influence tidal heights. For example, during the spring when the river flow peaks, tidal height is increased by additional water flowing through the river. This phenomena is referred to as freshet (National Oceanic and Atmospheric Administration 2009).

Annual freshets have little effect on the tide range at the mouth of the Columbia River; however, at Portland and Vancouver they average about 12 feet with the highest known level of 33 feet at Portland. Typically tidal influence reaches as far as the Portland/Vancouver area. However, tidal effects can be felt to as far as 140 miles upriver under low-flow conditions (National Oceanic and Atmospheric Administration 2015).

The average annual flow for the Columbia River at Beaver Army Terminal near Quincy, Oregon,⁵ is approximately 236,600 cubic feet per second (cfs).⁶ The river's annual discharge rate fluctuates with precipitation and ranges from 63,600 cfs in a low water year to 864,000 cfs in a high water year (U.S. Geological Survey 2014). The flow is driven primarily by the outflow from the dams on the upper portion of the river, which varies with both snowmelt and rainfall.

Navigation Channel

The Oregon–Washington border follows the Columbia River (Figure 5.4-1). The navigation channel in the study area includes two U.S. Army Corps of Engineers (Corps) projects: the Columbia and Lower Willamette River Project and the Mouth of the Columbia River Project. The navigation channel is described by the three following areas.

- **Mouth of the Columbia River.** The portion of the channel at the mouth of the Columbia River, referred to as the Columbia River Bar, is 6 miles long, extending 3 nautical miles⁷ into the Pacific Ocean from the mouth of the river to 3 miles upriver. This segment of the channel varies from 2,000 feet wide and 55 feet deep to 640 feet wide and 48 feet deep. Waters in this area are

⁵ Approximately 12 river miles downriver of the project area.

⁶ 1 cfs = 448.8 gallons per minute.

⁷ Offshore distances are recorded in terms of nautical miles and inshore distances and river distances are given in terms of statute miles.

considered treacherous and large vessels require a licensed pilot.⁸ The Corps maintains three jetties at the mouth of the Columbia River (Figure 5.4-1) to keep the channel at the mouth of the river clear.

- **Columbia River.** From the upriver extent of the bar (river mile 3) to Vancouver (river mile 106.5), the channel is generally maintained to a depth 43 feet and a width of 600 feet (U.S. Army Corps of Engineers 2015).⁹
- **Willamette River.** Along the lower 11.6 miles of the Willamette River, the channel has a depth of 40 feet.

Traffic in the channel moves in a two-way pattern: one lane inbound and one lane outbound. Although some areas of the navigation channel are dredged into rock, the channel sides consist primarily of loose, unconsolidated sediments. However, there may be areas of submerged objects or rocky bottom.

Ports

Table 5.4-2 lists the ports in the study area with berthing for large vessels along with their locations and facilities. Figure 5.4-1 shows the locations of these ports.

Table 5.4-2. Port Facilities in the Study Area

Port	Location	Facilities
Port of Astoria, OR	RM 12	Three deep-draft berths; additional berths for small commercial fishing vessels and research vessels; two marinas and a boatyard; two anchorages
Port of St. Helens, Port Westward Industrial Facility, near Clatskanie, OR	RM 53	Port Westward Industrial Facility. One dock and one deep-water berth
Port of Longview, WA	RM 65	Eight marine terminals containing a total of eight berths
Port of Kalama, WA	RM 75	Seven marine terminals: two grain elevators, one general cargo dock, one barge dock, one liquid bulk facility, one lumber barge berth, and one deep-draft wharf
Port of Portland, OR	RM 100	Four marine terminals containing a total of 18 berths
Port of Vancouver, WA	RM 106.5	Four marine terminals containing a total of 13 berths
Notes: RM = river mile		

Anchorage and Turning Basins

This section describes anchorages and turning basins in the study area.

⁸ Oregon Administrative Rule 856-010-0060 exempts the following vessels from compulsory pilotage on the Columbia River Bar: (a) Foreign fishing vessels not more than 100 feet or 250 gross tons international; (b) Recreational vessels not more than 100 feet long.

⁹ Near Vancouver, depth varies between 35 and 43 feet and width varies between 400 and 500 feet.

Vessels anchor within the Columbia River system for a variety of reasons, planned (e.g., to take on fuel, to wait for a berth) or unplanned (e.g., mechanical repairs, to wait for better weather conditions). In anticipation of this need, USCG has designated 11 locations for vessels to anchor. Each location has specific characteristics with which vessel masters, crews, and pilots must be familiar. Designated anchorages, as identified by USCG and described in 33 CFR 110.228 (Columbia River, Oregon and Washington), are listed in Table 5.4-3 and depicted in Figure 5.4-1. Table 5.4-3 identifies the locations of the anchorages, the number and maximum size of vessels that can be accommodated, and whether stern buoys are provided to help prevent vessels from swinging while at anchorage.

Table 5.4-3. Anchorages in the Study Area

ID^a	Anchorage Name	River Miles	Range of Depth(s) (feet)	Maximum Vessel Size	Vessel Capacity	Stern Buoy?^b
A	Astoria North ^c	14–17.8	24–45+	Panamax	6	No
B	Astoria South	15–18.2	20–45+	Handymax	4	No
C	Longview	64–66	29–40+	Handymax	5	No
D	Cottonwood Island	66.7–71.2	19–40+	Handymax	13	No
E	Prescott	72.1–72.5	52–65+	Panamax	1	Yes (1)
F	Kalama	73.2–76.2	26–40+	Panamax	7	No
G	Woodland ^d	83.6–84.3	8–40+	<600 feet LOA	3	No
H	Henrici Bar ^d	91.6–93.9	22–33+	<600 feet LOA	8	No
I	Lower Vancouver	96.2–101.0	Minimum of 50	<600 feet LOA	14	No
J	Kelly Point	101.6–102.0	25–40+	Panamax	1	No
K	Upper Vancouver	102.6–105.2	35–50+	Panamax or larger	7	Yes (2)

Notes:

- ^a Identification letter corresponds to letters in Figure 5.4-1.
- ^b Number in parentheses reflects the number of stern buoys maintained at the anchorage.
- ^c This anchorage is generally reserved for large and deeply laden vessels as determined by Columbia River Pilots.
- ^d Remote and not currently in use.

Source: Lower Columbia Region Harbor Safety Committee 2013 and U.S. Army Corps of Engineers 2015

LOA = length overall

The Corps' regulations establish the operational rules for the anchorages, including a requirement that vessels desiring to anchor must contact the pilot office that manages the anchorage to request a position assignment. The Bar Pilots manage Astoria North and Astoria South anchorages. The River Pilots manage the anchorages upriver from Astoria. The rules also specify that no vessel may occupy a designated anchorage for more than 30 consecutive days without permission from the USCG Captain of the Port.

The Lower Vancouver and Upper Vancouver anchorages are the only anchorage areas maintained by the Corps as part of the Columbia River navigation channel. The other designated anchorages are at

sites identified as naturally deep locations, although shoaling does occur to some extent and dredging is occasionally necessary.

Although the anchorages downstream of the project area (Astoria North and South) can accommodate deep-draft vessels, use by vessels with drafts of more than 28 feet at Astoria North and more than 26 feet at Astoria South are not recommended due to the probability of dragging anchor. However, a deep anchorage position at Astoria North, referred to as “The Hole,” is normally kept vacant for deep-draft vessels in unusual situations or emergencies or for short-term anchoring (Lower Columbia Region Harbor Safety Committee 2013). Bunkering¹⁰ operations are normally permitted in all anchorages.

Four turning basins are located in the study area (Figure 5.4-1). Turning basins are generally wider areas along a channel dredged to the same depth as the channel where vessel masters and pilots have maneuvering room to turn vessels for the purposes of pointing the bow of the vessel in the direction of transit. Only the Longview turning basin, which is located at river mile 66.5 and encompasses the proposed berths at the project area, can accommodate Panamax-sized vessels.

Bridges

Two bridges cross the navigation channel at and downstream of the Longview area (Figure 5.4-1).

- Lewis and Clark Bridge crosses the Columbia River between Longview, Washington, and Rainier, Oregon. It has a vertical clearance of 187 feet and a horizontal clearance of 1,120 feet. This bridge is upstream from the project area, and Proposed Action-related vessels would not pass through this bridge under normal operations.
- Astoria-Megler Bridge crosses the Columbia River between Astoria, Oregon, just inland of the Port of Astoria, and Point Ellice, near Megler, Washington. It has a vertical clearance of 205 feet and a horizontal clearance of 1,070 feet.

Ferries

One ferry, the Wahkiakum County Ferry, crosses the navigation channel on the Columbia River between Puget Island, Washington and Westport, Oregon, at river mile 37.4 (Figure 5.4-1). It is the only ferry crossing downstream of the project area.

5.4.4.2 Vessel Traffic

Vessels transiting the study area include commercial cargo, fishing, and passenger vessels; recreational vessels; and service vessels (including tugs, pilot boats, and USCG vessels), as well as a small number of other vessels such as military ships, research vessels, and industrial construction vessels. The cargo vessels and large passenger vessels (cruise ships) are generally restricted to the navigation channel and maintain a predictable two-way traffic pattern (one lane inbound and one lane outbound). For the purposes of this EIS, cargo vessels (ships and barges) and cruise ships are referred to as *large commercial vessels*. The other vessels are generally not restricted to movement in the navigation channel. For the most part, these vessels are more agile and less predictable in their movements. Data sources and availability regarding these two broad categories of vessels

¹⁰ The transfer of fuel onto a vessel.

differ. For these reasons, the following discussion of vessel traffic has been separated into two sections: Large Commercial Vessels and Other Vessels.

Large Commercial Vessels

This section focuses on large commercial vessels calling at ports in the study area. Cargo vessels comprise over 99% of large commercial vessels¹¹ and include ships and barges carrying various cargo including dry bulk, automobiles, containers, bulk liquids, and other general cargo. Large commercial vessels comprise most deep-draft vessel traffic in the study area.¹²

The following sections describe types of large commercial vessels, types and amounts of cargo transported, and traffic volumes in the study area.

Vessel Types

The types of large commercial vessels in the study area are listed below by three broad categories: cargo ships, barges, and passenger cruise ships.

- Cargo ships
 - Dry bulk carriers carrying forest products and steel, ore, grain, potash, and other dry bulk cargoes
 - Container ships carrying containerized cargo
 - General cargo ships carrying steel, machinery, and other general cargo that is not containerized or bulk.
 - Tankers carrying bulk liquids
 - Automobile carriers
- Barges¹³
 - Tank barges (including articulated tug barges [ATBs]¹⁴) carrying bulk liquids
 - Other cargo barges carrying dry bulk, containerized and other cargo
- Passenger cruise ships

Table 5.4-4 presents typical specifications for these vessels and example images.

¹¹ Cruise ships comprise less than 1% of large commercial vessel traffic in the study area. *Historical Traffic Volumes* provides a detailed discussion of vessel traffic by vessel type over a recent 11-year period.

¹² A small number of deep-draft military ships and research vessels also transit the study area.

¹³ A barge has no onboard propulsion; it is towed or pushed by one or more tugs.

¹⁴ An articulated tug barge, or ATB, is a tank barge that is propelled and maneuvered by a high-powered tug positioned in a notch in its stern.

Table 5.4-4. Types of Large Commercial Vessels in the Study Area

Vessel Category	Vessel Types	Typical Vessel Specifications	Example Photos
Cargo ships	Dry bulk cargo ships (bulk carriers), container ships, general cargo ships, automobile carriers	<p>Dry bulk, container, and general cargo ships: DWT: 50,000–80,000, Length: 650–965 feet Beam: 100- 106 feet Draft: 33–39.5 feet</p>	
		<p>Automobile Carriers: DWT: 18,638 Length 650 feet Beam: 105 feet Draft: 27 feet</p>	
		<p>Container ships: DWT: 57,088 Length: 260 feet Beam: 33 feet Draft: 12.5 feet</p>	

Bulk cargo ship (bulk carrier)

Automobile Carrier

Container Ship

Vessel Category	Vessel Types	Typical Vessel Specifications	Example Photos
		Tankers DWT: 65,000–80,000 Length: 965 feet Beam: 106 feet Draft: 41 feet	
	Tanker		
Barges	Cargo barges including tank barges, dry cargo barges and container barges	Length: 132–286 feet Beam: 40–55 feet Draft: 8–17 feet DWT: N/A (Gross tons: 559–2,700)	
			Dry cargo barge
Passenger cruise ships		Length: 560–965 feet Beam: 78–125 feet Draft: 18–29 feet DWT: 2,700–13,290	
			Cruise ship
Notes: Photo sources: MarineTraffic.com except for tanker, worldmaritimeneews.com; and dry cargo barge, Tidewater.com. DWT = deadweight tons; ATB = articulated tug barge			

The vessels discussed in this section come in various sizes, as reflected by the ranges (e.g., width, draft) shown in Table 5.4-4. Cargo ships are categorized¹⁵ by their capacity and dimensions. The vessel classes that can be accommodated in the study area are listed in Table 5.4-5 with their typical dimensions and cargo capacities.

Table 5.4-5. Vessel Classes in Use on the Columbia River Navigation Channel

Vessel Class	Deadweight (tons)	Length (feet)	Beam (feet)	Design Draft (feet)
Handymax	10,000–49,999	490–655	75–105	36–39
Panamax	50,000–79,999	965	106	39.5
Post-Panamax ^a	Over 80,000	965 or greater	106 or greater	39.5 or greater

Notes:

^a The Post-Panamax class, also referred to as New Panamax, is a new vessel class that reflects the expanded Panama Canal dimensions.

Source: INTERCARGO 2015

Cargo Types and Tonnages

Table 5.4-6 presents the types and amounts of cargo transported along the Columbia River. The amounts and percentages in the table reflect average annual gross tonnage for the period 2004 to 2014, based on Bar Pilots' data (Jordan pers. comm. A). The primary growth areas in recent years have been in the dry bulk and automobile traffic.

Table 5.4-6. Cargo Types and Corresponding Average Annual Gross Tonnage (2004–2014)

Cargo Type	Gross Tonnage	Percentage^a of Total Cargo Moved
Dry bulk	44,551,063	47.3
Automobiles	20,986,525	22.3
Containers	11,187,455	11.9
General cargo	7,447,913	7.9
Bulk liquid	4,127,333	4.4
Other ^b	5,912,903	6.3
	94,213,193 ^c	100

Notes:

^a Percentages refer to gross tonnage to better represent the approximate quantities of various commodities moved along the Columbia River.

^b Miscellaneous gross tonnage accounting for vessel movements from one berth to another, passenger vessels, tugs, and empty barge movements.

^c Numbers do not sum due to rounding.

Source: Bar Pilots data (Jordan pers. comm. A).

¹⁵ These category names often reflect the canal through which the vessels are designed to travel.

Tug Assistance

Cargo and cruise ships require tugs (generally a minimum of two) to provide assistance during docking and undocking, because these vessels lack adequate maneuverability at slower speeds. These vessels also may rely on tugs in emergency situations to assist, escort, and in some cases, provide fire suppression. Tug escorts on the Columbia River are generally engaged only in unusual conditions (e.g., electronic equipment issue that would prevent safe navigation or inoperable vessel propulsion system at normal power levels) that can be mitigated by the tug escort. Most likely an unusual condition that requires a tug escort would be in effect for all portions of the transit (from crossing the bar to the final destination).

Shaver Transportation Company, Foss Maritime, and Olympic Tug and Barge, all based in Portland, provide tugs suitable for assisting large commercial vessels in the study area. Nine of Shaver's 13 study area tugs would be appropriate to assist vessels calling at the project site (Rich pers. comm.). Six of Foss's study area tugs (Hendriks pers. comm.) and 13 of Olympic's study area tugs would be suitable for assisting Panamax and Handymax ships (Bonnin pers. comm.) at the project site.

Tugs also are used to tow and push barges between destinations in the study area for bunkering, fuel transport, and hauling cargo. The following companies provide barge towing in the study area: Bernert Barge Lines, Brusco, and Tidewater.

Vessel Speed and Travel Times

The vessels discussed in this section are primarily restricted to the navigation channel, in which traffic moves in two lanes: one lane inbound and one lane outbound. Their speeds generally range between 9 and 15 knots in the study area, with the slower speeds in that range occurring while passing port areas; still slower speeds of between 6 and 9 knots occur while passing through anchorages (DNV GL 2016).

Travel time across the bar, between the offshore Pilot Station and Tongue Point, takes approximately 2 hours in either direction. River transits depend on the study area terminal origination or destination. As an example, the travel time from Tongue Point to Longview is approximately 5 hours inbound (generally vessels in ballast¹⁶) and about 6 hours outbound (generally loaded vessels). Outbound transits generally take longer than inbound transits for two reasons: The majority of outbound vessels are loaded and, therefore, travel at reduced speeds and outbound transits are scheduled during high-tide conditions to maximize under-keel clearance¹⁷ and thus usually are running against the force of a flood (incoming) tide.

Existing and Historical Vessel Traffic

This section describes existing (2014) vessel activity and distribution in the study area and existing and historical traffic volumes over the past 11 years in the context of historical peak volumes prior to this period.

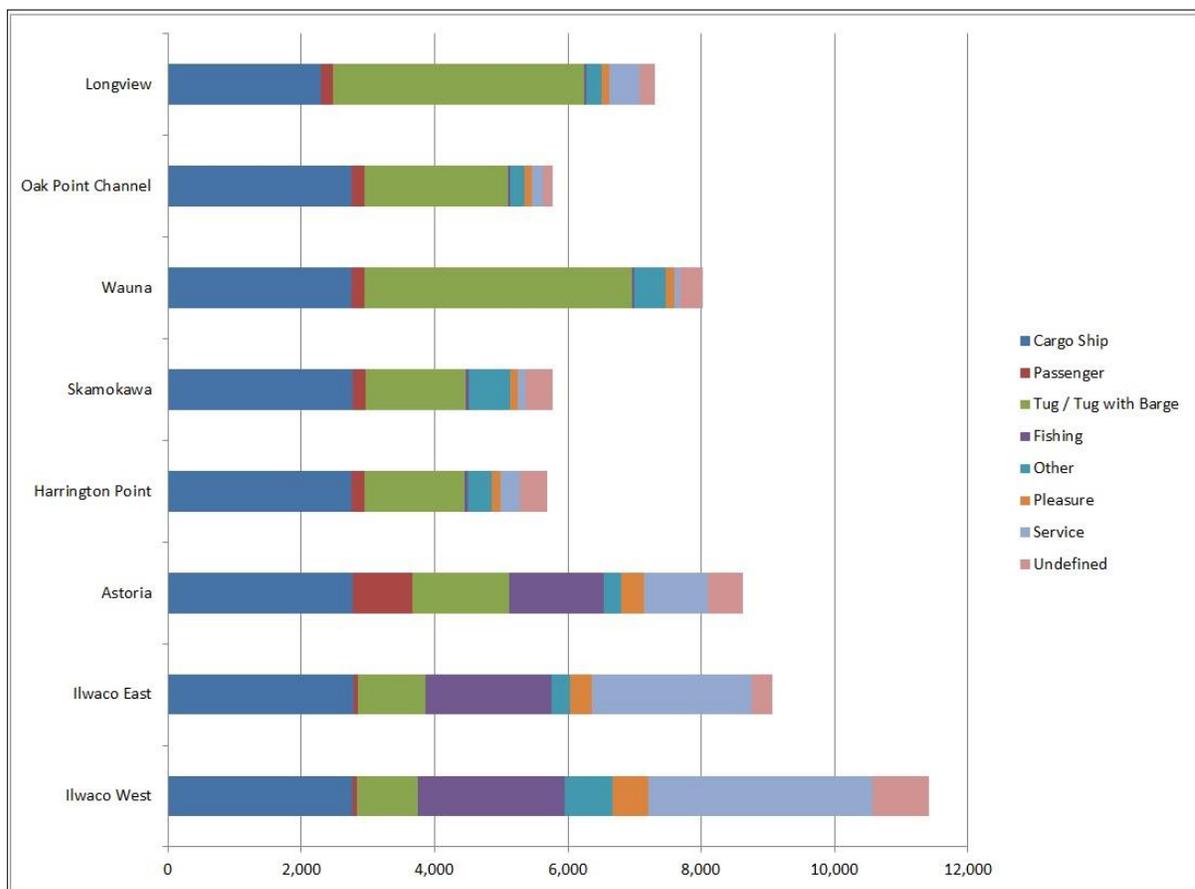
¹⁶ Vessels *in ballast* are not loaded with cargo, but have had their tanks loaded with water to increase vessel stability; these vessels have less of a draft than when loaded.

¹⁷ *Under-keel clearance* is the amount of space between the hull of the vessel and the bottom of the channel.

Existing Vessel Traffic and Distribution

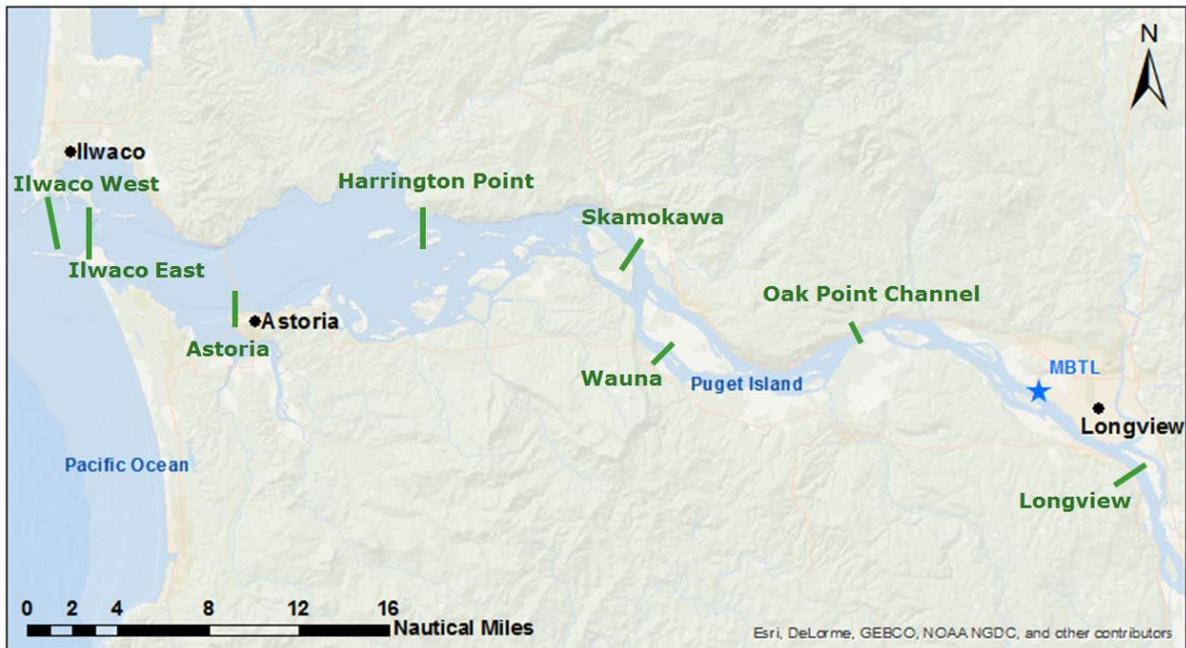
Figure 5.4-2 depicts activity by vessel type at eight locations (Figure 5.4-3) on the lower Columbia River based on 2014 AIS data (DNV GL 2016). The categories shown in Figure 5.4-2 that apply to large commercial vessels are Cargo Ships, Passenger (cruise ships and other large commercial passenger vessels), and, Tug/Tug with Barge.¹⁸ As shown in the figure, vessel activity is greatest near the mouth of the Columbia River. Much of this increased activity at these locations (Ilwaco West, Ilwaco East, and Astoria) is related to service and fishing vessel activity. Cargo ship activity is fairly consistent between the project area and the mouth of Columbia River.

Figure 5.4-2. Number of Transits per Location by Vessel Type (2014 AIS Data)



¹⁸ Because barges do not have AIS receivers, barge numbers are captured as part of the tug data. The tug numbers include tugs traveling independently and tugs towing or pushing barges. Only the latter are considered large commercial vessels. The number of tug and barge units (cargo barges), including ATBs, entering and exiting the river are best represented by transits recorded for the Ilwaco locations; the increased tug activity in the upriver portions of the study area, especially near Longview and Wauna, likely represents tugs traveling independently to provide docking services and tugs shifting cargo barges between ports.

Figure 5.4-3. Vessel Data Location Points



Existing Port Activity

Characterizing existing port activity is another way to understand large commercial vessel activity. Types and uses of vessels calling at ports in the study area (Figure 5.4-1) are described below.

- Port of Astoria primarily receives cruise ships, loggers and other cargo vessels, and other types of vessels (e.g., USCG, pollution control, commercial fishing, and recreational vessels). The port reports approximately 230 vessel calls¹⁹ at the Waterfront and Tongue Point berths in 2015 (McGrath pers. comm.).
- Port of St. Helens, Port Westward Industrial Facility receives tankers and tank barges.
- Port of Longview receives cargo ships and barges transporting various types of general and bulk cargo, including steel, lumber, logs, grain, minerals, alumina, fertilizers, pulp, paper, wind energy components, and heavy-lift cargo. The port reported 222 vessel calls in 2015 with a 5-year average of 205 vessel calls per year (Hendriksen pers. comm.).
- Port of Kalama receives cargo ships and barges primarily transporting grain, but also liquid bulk chemicals and general cargo. The Port reported 205 vessel calls in 2014 (Port of Kalama 2015).
- Port of Portland receives cargo ships (mostly Handymax and Panamax) and barges, cruise ships, and other vessel types (e.g., other commercial passenger vessels, dredges, pollution control vessels, USCG). The cargo vessels transport all types of cargo. The port reported 513 and 352 vessel calls in 2014 and 2015, respectively (Myer pers. comm.).
- Port of Vancouver receives cargo ships (Handymax and Panamax) and barges transporting grain, scrap, steel, automobiles, petroleum products, other dry and liquid bulk cargo, and other

¹⁹ A call represents a visit to a port terminal. A vessel call typically results in two vessel transits: one inbound and one outbound.

products. The port also receives commercial passenger vessels (not cruise ships) and dredges. The port reported 450 vessel calls per year in 2014 and 2015 (Uglum pers. comm.).

Historical Traffic Volumes

This section describes historical commercial vessel traffic volumes in the study area. Table 5.4-7 shows annual transits²⁰ of large commercial vessels²¹ in the study area over an 11-year period (2004 to 2014), based on Bar Pilots records of bar crossings (i.e., vessels entries to and exits from the Columbia River).

As shown in Table 5.4-7, traffic volumes were similar in 2004 and 2014, but have fluctuated within that time period. For comparison, the historical peak vessel traffic year recorded by the Bar Pilots is 1979 with 4,752 transits²² (Jordan pers. comm. A). Approximately the same level occurred in 1988. In every other year from 1979 to 2000 the number of vessel transits was greater than or very close to 4,000. Since 2001, vessel transits have remained below these levels.

Table 5.4-7. Large Commercial Vessel^a Transits^b in the Study Area (2004–2014)

Year	Transits
2004	3,554
2005	3,436
2006	3,618
2007	3,858
2008	3,782
2009	2,926
2010	3,366
2011	3,162
2012	3,178
2013	3,448
2014	3,638

Notes:

- ^a A small number (approximately 2% annually) of noncommercial vessels (e.g., military ships and research vessels) are reflected in these data.
- ^b Transits recorded in the Bar Pilots data are generally equivalent to bar crossings, (i.e., entries to and exits from the river system); however, a small percentage (approximately 1% annually) reflect in-river vessel movements (e.g., for bunkering or anchorage).

Source: Bar Pilots records (Jordan pers. comm. A)

Although vessel traffic volumes have been considerably lower since 2004 compared to earlier peaks, vessel sizes and total cargo tonnages have increased. The overall decrease in vessel traffic levels can be attributed to general economic conditions. The deepening of the Columbia River channel from 40 to 43 feet has allowed larger vessels with greater drafts to call at river ports, and vessels that

²⁰ Bar Pilots record bar crossings or transits (i.e., entries to and exits from the river system); however, these data include a small percentage (approximately 1% annually) of in-river vessel movements (e.g., for bunkering or anchorage).

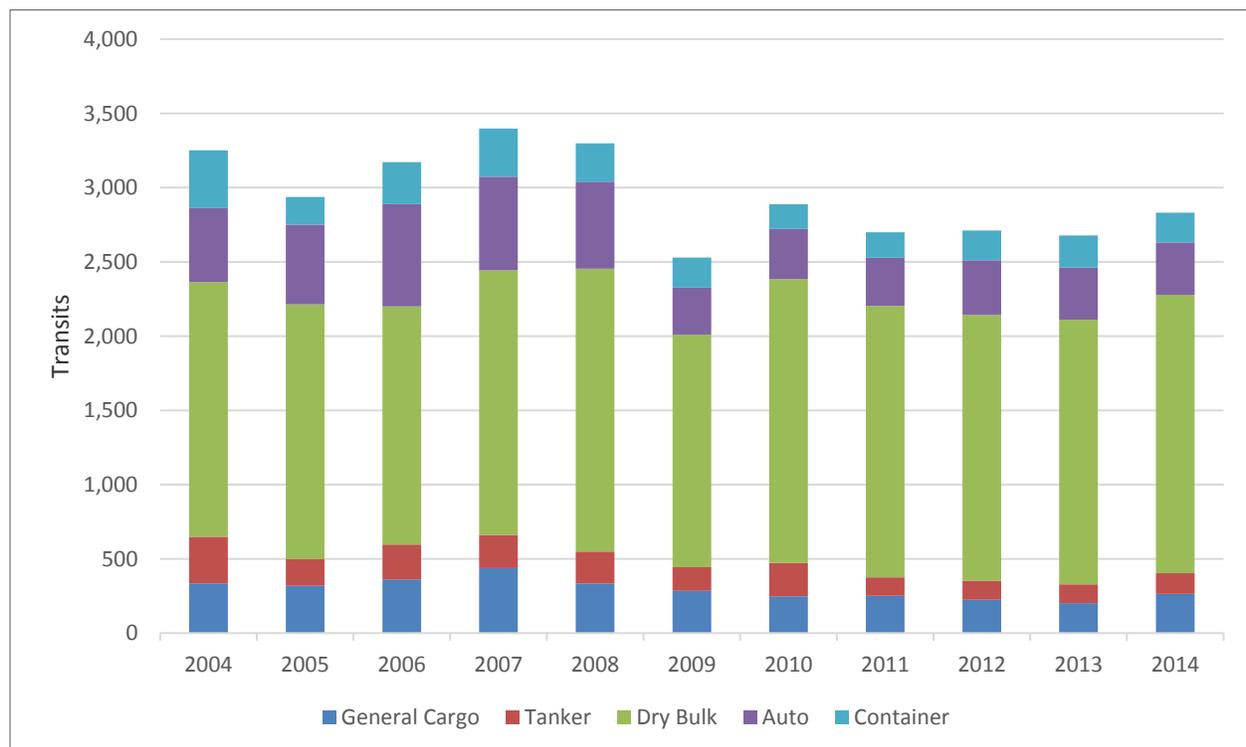
²¹ The Bar Pilot data reflect a small number (approximately 2% annually) of non-commercial vessels (e.g., military ships and research vessels).

²² The peak traffic year for the Columbia River reflected in the VEAT data is 1999 with 2,269 vessels calls or 4,538 transits (Washington State Department of Ecology 2014).

previously had to be light-loaded can now be loaded to deeper drafts. This has resulted in the need for fewer, but larger, vessels to move a given volume of cargo; this is especially the case for the dry bulk cargo vessels that make up a high percentage of the river traffic (Krug and Myer pers. comm.; Amos pers. comm.; Jordan pers. comm. B). The changing nature of vessel design and the likely partial impact on vessel volumes within the study area is illustrative of the multiple factors that can impact vessel numbers over time.

Of the vessel transits recorded by the Bar Pilots (2004 through 2014), cargo ships constitute the largest percentage of vessel traffic in the study area (around 90% on average); while barges represent 3 to 10% and cruise ships less than 1%, on average. Approximately 3%, consists of a mixture of other vessel types.²³ These cargo ships can be broken down further into specific vessel types, based on the Bar Pilots records. Figure 5.4-4 shows transits by vessel type within the cargo ship category. Dry cargo ship transits represent over half (between 50 and 60%) of the cargo ship traffic annually. The remainder (in descending order of magnitude) were automobile carriers, general cargo ships, container ships, and tankers.

Figure 5.4-4. Percentage of Annual Cargo Ships by Vessel/Cargo Type (2004–2014)



²³ Vessels categorized as *other* include vessels recorded in Bar Pilots data as miscellaneous (occasional military vessel, research vessels, industrial/marine construction, dredges), bunkers, shipyard, and shifts.

Vessel Traffic Management

Management of vessel traffic in the study area is primarily a real-time activity involving the pilots, vessel masters, and PDXMEX.²⁴ Large commercial vessel traffic moves along the navigation channel in a two-way pattern: one lane inbound and one lane outbound. This simplistic layout constitutes the foundation of the traffic management system. Oversight and active participation in the traffic management involves coordination of all river stakeholders, including USCG, Corps, Ecology, Oregon Department of Environmental Quality (DEQ), pilots, shipping agents, terminal operators, tug operators, and other associations and services. Large commercial vessels traveling in the study area must adhere to international and inland rules (72 COLREGS and Rules of the Road, respectively), described in Section 5.4.1, *Regulatory Setting*. These rules are intended to facilitate safe maritime travel.

The 64th Washington State Legislature passed House Bill 1449 focused on current regulatory programs covering the over-land and over-water transportation of oil. One of the bill provisions (Section 11) required (contingent on funding) that Ecology complete an evaluation and assessment of vessel traffic management and vessel traffic safety within and near the mouth of the Columbia River. The bill stipulated a date for submittal to the legislature of December 15, 2017, with a final evaluation to be completed by June 30, 2018. The evaluation and assessment must include (but is not limited to) an assessment and evaluation of the following.

- (a) The need for tug escorts for oil tankers, articulated tug barges, and other towed waterborne vessels or barges;
- (b) Best achievable protection; and
- (c) Required tug capabilities to ensure safe escort of vessels within and near the mouth of the Columbia River

Pretransit Planning

Large commercial vessels are required to provide an advance Notice of Arrival²⁵ to USCG at least 96 hours before arrival at the bar in most cases, or upon departure from the last port of call for shorter voyages. This information is provided electronically and shared almost instantaneously with PDXMEX and the Bar Pilots and River Pilots.

Upon receipt of the Notice of Arrival a coordination process is initiated between the pilots and the shipping agent representing the vessel interests. The Bar Pilots and River Pilots work closely together and with PDXMEX during the pretransit scheduling. The pilots use information provided in the Notice of Arrival as well as weather conditions, pilot availability, tidal and river conditions, and anchorage and berth availability to determine scheduling.

²⁴ The Merchants Exchange of Portland (PDXMEX) is an information and communication center for ports and stakeholders along the Columbia River. It provides a monitoring system that allows users to locate vessels in the study area and operates a dispatch center that assists in coordinating with River and Bar Pilot dispatch centers to ensure proper vessel traffic management. PDXMEX is also a central point of contact for vessel agents, who provide necessary shore-side services for vessels.

²⁵ In addition to serving as an arrival notification the Notice of Arrival includes vital information about the vessel, voyage information (e.g., specifics about the last five ports visited, name and telephone number of a 24-hour point of contact), cargo information, information about each crewmember and other people onboard, operational condition of equipment, and documentation specifics.

For inbound vessels, tracking and coordination begins when the vessel is approximately 2 to 3 hours away from the pilot boarding station. Decisions on vessel movements are made by the Bar Pilots alone, although considerations affecting the Columbia River Pilots could result in delaying a vessel's transit.

The Bar Pilots coordinate closely with USCG on navigation conditions and safety. While only the USCG Captain of the Port (COTP) can close the bar to vessel traffic, the Bar Pilots can suspend traffic movements when the overall circumstances dictate. In assessing navigation conditions, the pilots consider if vessel crossing is safe, if the pilot can get on and off the vessel safely, and if the pilot boat or helicopter can return to base safely.

The Bar Pilots give the River Pilots a "window of opportunity" for getting an outbound vessel over the bar. The River Pilots then develop their transit plans to match that window. Transit planning for draft-constrained vessels varies with river flows. For example, during the low-water season, the pilots can only count on having sufficient water under keel during one of the daily high tides. Outbound transit plans are developed at least 8 hours and as much as 24 hours in advance. Vessels may be permitted to sail with the maximum freshwater draft of 43 feet if the river level, tide, and conditions permit (Columbia River Pilots 2016). Pilots operating draft-constrained vessels in the study area have to adjust the time of their transit to allow for at least 2 feet of under-keel clearance on the river plus expected squat²⁶ (Columbia River Pilots 2016).

The decision to sail outbound is more critical than the decision to bring a vessel in. For outbound traffic, once the vessel starts downriver there is no place to stop or turn around unless the vessel is in extremis and requests to anchor; inbound vessels can stop before approaching the bar. Nevertheless, there is a point at which a vessel approaching the bar from sea or from the river is fully committed to the crossing. This is why pretransit planning is key to safe passage across the bar in either direction.

As discussed previously in the *Tug Assistance* section, tug escorts are generally only engaged on the Columbia River in unusual conditions that can be mitigated by the tug escort. Tug escorts in the study area are rare (Gill pers. comm.).

Pilotage

The vessels discussed in this section are required to use a licensed pilot in the study area. The Bar Pilots and River Pilots are highly trained mariners who are experts in vessel navigation and the characteristics of their respective portions of the waterway. They are responsible for safely maneuvering large commercial vessels in the study area with support of the vessel master's knowledge of their own vessel and how it maneuvers.

The Bar Pilots board inbound vessels outside the bar, at a predetermined site suitable for safe boarding, and are responsible for piloting the vessel to Tongue Point, near Astoria. At Tongue Point, the Bar Pilots disembark and the River Pilots board. The River Pilots guide the vessel to the terminal until it is safely moored. For departing vessels, the process is reversed.

²⁶ *Vessel squat* is the tendency of a vessel to draw more water astern (behind or toward the rear of the vessel) when it is moving through a water body. The streamlines of return flow are sped up under the ship, causing a drop in pressure and of the ship, effectively, increasing draft.

Vessel size is a significant factor in transit planning. The River Pilots typically place just one pilot on each vessel, but in some circumstances, including vessels with a beam greater than 140 feet, two pilots are assigned.

As a standard practice, River Pilots avoid meeting and overtaking situations between large commercial vessels in the following areas of the river: Miller Sands (river miles 22 to 25), Skamokawa/Abernathy (river miles 28 to 34), Bugby Hole (river miles 39 to 40), Bunker Hill (river miles 55.5 to 56.5), and Longview Bridge (river miles 65 to 67). The Bar Pilots ensure that large commercial vessels do not pass each other on the bar.

If, at any time during the transit, it becomes necessary to anchor a commercial vessel for an unexpected reason, the USCG COTP is contacted and directs the vessel anchoring in consultation with the pilot and vessel master. The Lower Columbia Region Harbor Safety Plan Anchorage Guidelines provide details about the anchorages and potential hazards that could affect anchorage.

The River Pilots work with the tug companies providing tug services in the study area to ensure that appropriate tugs are available upon request. Tugs are assigned, primarily for docking assistance, based on the minimum bollard pull required for a particular vessel type or operation. Pilots requesting tug support also take into account other tug features such as type of propulsion, deck machinery, or number of propellers.

Pilotage Tools

Pilots use a variety of tools to manage traffic on the river. They rely mostly on Transview 32 (TV32), LOADMAX, AIS towers, and other aids for navigation to monitor real-time vessel traffic and data on current weather and tidal conditions. They carry Portable Pilot Units in conjunction with installed navigation equipment on vessels to access these tools. These tools are described below.

TV32²⁷ is a real-time, vessel traffic information and management system that portrays vessel movements and interactions on the river along with water depth, current flow information and updated bathymetry charts. It combines the following systems to provide extremely high spatial resolution accuracy: AIS,²⁸ NOAA Nautical and Electronic Navigational Charts (ENC) Electronic Chart Display and Information System (ECDIS), NOAA Physical Oceanographic Real-Time System (PORTS²⁹), and differential global positioning system (DGPS). TV32 allows pilots to accurately determine vessel meeting points to facilitate informed decision making regarding navigation, anchorage, and traffic coordination.

²⁷ TV32 is considered to be a vital part of the Columbia River Vessel Traffic Information System (VTIS) consisting of the pilots, the PDXMEX, and the other electronic tools discussed in this section. A VTIS generally requires users to deliberately access information as opposed to a vessel traffic service, as in Puget Sound, which is centrally managed and manned to continuously receive and disseminate navigation safety information to vessel operators on the waterway.

²⁸ AIS is required on large commercial vessels, vessels over 65 feet, and passenger vessels (33 CFR 64.01 and 164.46). AIS technology ensures that basic identification and movement information for these vessels is available to government agencies, cooperative public/private associations, port managers, and pilots with the most basic computer equipment and an internet (or wireless) connection.

²⁹ PORTS measures surface current speeds, water depth, and wind direction and speed. Data are transmitted and displayed on the TV32 interface every 6 minutes.

While operating, every pilot has access to the Corps' survey data that includes channel depths, the 43-foot contour, and cross-sections along with NOAA PORTS and LOADMAX data, as well as the vessel's own navigation system information displays. Using this information, pilots can predict vessel meeting points and display those locations when two ships are as much as 70 miles apart. The pilots can then adjust vessel speeds to ensure that the meetings take place in suitable locations and avoid the few places on the river where meeting situations must be avoided. The River Pilots also monitor shoaling developments and assess how those might affect transit plans. LOADMAX is a system of seven computer-connected PORTS gages along the Columbia River that measure real-time water levels. It produces daily email forecasts of river stage and velocity at 1-hour intervals, with a forecast horizon of 10 days. Pilots routinely use these data to time river transits.

The River Pilots have specifically credited AIS towers and virtual aids as important to their navigation. Pilots have two relay towers that allow them to see the entire length of the route and monitor traffic using the waterway. Aids to navigation allow vessels to identify and locate other vessels and increase situational awareness of hazards and route features that are not otherwise physically marked (or would require extra time and resources to mark). USCG is responsible for maintaining the aids to navigation systems on the Columbia River. The aids include a series of fixed and floating aids, which are visual (e.g., buoys, beacons, lights), aural (e.g., bells, fog signals), electronic or any combination.

Other Vessels

Other vessels include commercial fishing, recreational, smaller commercial passenger, and service vessels. These vessels are generally much smaller than the vessels discussed in the previous section and have different activity and transit patterns. Most can move about the river without being restricted to the navigation channel. Table 5.4-8 presents typical specifications for these vessels and example images.

Table 5.4-8. Other Vessel Types in the Study Area

Vessel Type	Typical Specifications	Example Image
Fishing vessels	Length: 20–180 feet Beam: 8–45 feet Draft: 3–15 feet	
Other commercial passenger vessels: car ferries, inland passenger ships, passenger ferries	<p>Car ferry: Length: 109.2 feet Breadth: 47.5 feet Draft: 6 feet</p> <p>Other commercial passenger vessel: Gross Tons: < 100 Length: 80–150 feet Beam: 30–40 feet Draft: 6–12 feet</p>	
		

Fishing (gillnetter) vessel

Car ferry “Oscar B”

River cruise vessel

Vessel Type	Typical Specifications	Example Image
Recreational vessels, including pleasure boats, yachts, sailing vessels	Length: 20–150 feet Beam: 8–40 feet Draft: 3–15 feet	 <p data-bbox="812 621 889 657">Gulbrandsen ffic.com</p>
<p data-bbox="201 701 375 728">Service vessels</p> <p data-bbox="201 772 435 894">Military (USCG), law enforcement, pilot vessels, Aids to Navigation vessels</p>		
<p data-bbox="501 701 776 793">U.S. Coast Guard vessels range in length from 22 feet to over 300 feet.</p> <p data-bbox="501 837 675 932">Vessel shown: Length: 47 feet Beam: 14 feet</p>		<p data-bbox="812 1192 1281 1220">U.S. Coast Guard search and rescue vessel</p>  <p data-bbox="812 1608 927 1642">© Beth E. Parrish MarineTraffic.com</p>
<p data-bbox="501 1503 695 1560">Pilot vessel (shown):</p> <p data-bbox="501 1570 716 1629">Length: 72 feet Beam: 20 feet</p> <p data-bbox="501 1503 716 1629">Pollution control vessels: Length: 20–40 feet Beam: 6–20 feet</p>		<p data-bbox="812 1646 1073 1673">Pilot vessel COLUMBIA</p>

Vessel Type	Typical Specifications	Example Image
Tugs	Length: 50–150 feet Beam: 26–35 feet Draft: 9–16 feet	 <p data-bbox="812 611 927 636">© KB MarineTraffic.com</p>
Dredge vessels	Vessel shown: Length: 200 feet Beam: 58 feet Draft: 16 feet	 <p data-bbox="812 1062 927 1087">© Stan56 MarineTraffic.com</p>

General tug

Dredge vessel YAQUINA

Notes:

Photo sources: MarineTraffic.com, except fishing (gillnetter) vessel, WDFW Image Gallery: car ferry “Oscar B,” Daily Astorian; search and rescue vessel, News Lincoln County.

Commercial Fishing

Columbia River

The Columbia River is divided into six commercial fishery management zones; of these, Zones 1 through 3, and a portion of Zone 4 occur in the study area (NOAA Fisheries 2016). The commercial fisheries in these zones are managed by the states of Oregon and Washington.

Zones 1, 2, and 3 support important commercial shad, anchovy, herring, smelt, and salmon fisheries. Commercial fishers deploy gillnets, tangle-nets, or seines depending on species, season, and zone. Anchovies and herring may be taken for commercial purposes at any time in the Columbia River seaward of the Astoria-Megler Bridge (Figure 5.4-1). Commercial salmon seasons and authorized fishing gear are shown in Table 5.4-9. Shad typically can be taken for commercial purposes from the study area zones during commercial salmon seasons with the same fishing gear authorized for the taking of salmon. The retention of green sturgeon and white sturgeon was prohibited in the Columbia River downstream of Bonneville Dam beginning in 2006 and 2014, respectively.

Table 5.4-9. Major Columbia River Commercial Salmon Fishery Seasons in the Study Area

Season ^a	Primary Species	Areas	Authorized Method/Gear
Winter (February–March)	Spring Chinook	Select Area Fisheries ^b	Gillnets and tangle-nets
Spring (April–June)	Spring Chinook	Select Area Fisheries ^b and Columbia River mainstem ^c	Gillnets and tangle-nets
Summer (June–July) ^c	Sockeye and Summer Chinook	Columbia mainstem and Select Area Fisheries ^b	Gillnets
Early Fall (August–mid-September)	Summer and Fall Chinook	Columbia River mainstem and Select Area Fisheries ^b	Gillnets
Late Fall (mid-September–mid-November)	Fall Chinook and Coho	Columbia River mainstem and Select Area Fisheries ^b	Gillnets, tangle nets, and experimental seines

Notes:

^a Dates and areas subject to stock abundance and management decisions.

^b Select Area Fisheries include Youngs Bay, Blind Slough/Knappa Slough, Tongue Point/South Channel, and Deep River.

^c Columbia River mainstem areas include Zones 1 (Columbia River mouth) to 5 (Beacon Rock at RM 142).

Source: Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife 2015a (winter, spring and summer) and 2015b (fall fisheries).

Approximately 2,046,747 pounds of shad and salmon (Chinook, coho, pink, and sockeye) were harvested (160,821 landings) on the Columbia River in 2015; the late-fall salmon season accounted for approximately 85% of this total harvest, making the late-fall salmon season the busiest time of year for commercial fishing on the lower Columbia River (Oregon Department of Fish and Wildlife 2015b).

Coastal, Nearshore, and Ocean Commercial Fishing

Several coastal, nearshore, and offshore open-ocean fisheries, including groundfish, halibut, salmon, albacore, pacific whiting, sardines, and shellfish (primarily Dungeness crab and pink shrimp) are present within or adjacent to the study area. Activities range from harvesting to delivery to shore-based processors, depending on the fishery. The mouth of the Columbia River is the busiest part of the study area for commercial fishing vessel traffic, though numbers of operating vessels fluctuate by season and license by fishery.

Tribal Fishing

The treaties of 1855 between the United States and individual tribal governments reserved tribal rights to fish, hunt, and gather traditional foods and medicines throughout ceded lands identified within the treaties. The Columbia River and its tributaries support a variety of tribal resources, including six species of salmon and Pacific lamprey, which have been a reliable and important source of food and trade items to tribes of the Columbia River Compact. The Confederated Tribes and Bands of the Yakama Nation, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of Warm Springs, and Nez Perce Tribe are the tribes in the Columbia River Basin that have reserved rights to anadromous fish in treaties with the United States (Columbia River Inter-Tribal Fish Commission 2016). Zone 6, upstream of the study area from just downstream of Bonneville Dam to McNary Dam, is managed as an exclusive treaty commercial fishing zone. Tribal fishing resources are described in more detail in Chapter 3, Section 3.5, *Tribal Resources*.

Recreational Fishing and Boating

The Columbia and Willamette Rivers are popular areas for recreational boating (motorized and nonmotorized), fishing, and other recreational activities (Port of Portland 2010). Over 30 water access and boat launch sites along the Columbia and Willamette Rivers within the study area provide public and private river access for recreational boating and fishing.

The Columbia River is the most boated waterbody in the State of Oregon with 524,091 boat use days, followed by the Willamette River with 281,176 boat use days. Hayden Island, which is located on the Columbia River, between Vancouver, Washington, and Portland, Oregon, serves as a key location for recreational boaters traveling to different sections of the Columbia and Willamette Rivers. Marinas in the vicinity report that recreational boating is highest during summer months and that 100% of 3,600 boat slips on Hayden Island are leased between April and October (Port of Portland 2010). The Columbia River Water Trail is a designated area for canoes and kayaks that travels through the study area to the mouth of the river.

The Columbia and Willamette Rivers support numerous aquatic species including salmon, steelhead, small mouth bass, shad, and sturgeon fisheries. Greenling, rockfish, lingcod and perch are caught from the jetties, and flounder are common on sandy flats. Recreational fishing seasons vary by target species, but fishing occurs year-round for many species. Recreational catch and release fishing for green and white sturgeon is currently allowed year-round (Oregon Department of Fish and Wildlife 2015c). Warm-water game fish species season is also year-round in the study area (Oregon Department of Fish and Wildlife 2015c). The spring Chinook and steelhead fishery for the Columbia River may be open from January to March depending on fishery management decisions, and Chinook and coho salmon fishing season runs from August to December.

The spring Chinook fishery in the Hayden Island area of the Columbia River is extremely popular and fishing participation rates have increased over recent years. During the spring Chinook season, between 135,000 and 145,000 angler days are documented on this section of the Columbia River between March 1 and June 1 (Port of Portland 2010). Also, the area between the mouth of the river and Tongue Point, which includes Youngs Bay, is a popular area for recreational fishing year-round, (Oregon Department of Fish and Wildlife 2016). This area is popular especially during the fall Chinook and coho salmon season, which generally peaks in the last 2 weeks of August (Washington Department of Fish and Wildlife 2016).

Dungeness crabs are caught in the estuary and in nearshore and offshore areas beyond the mouth of the river, and razor clams are harvested along the ocean beaches north and south of the mouth of the river.

Commercial Passenger Vessels (Non-Cruise Ships)

Commercial passenger (non-cruise ship) vessels transit from one port to another within the Columbia River; they include a range of vessels up to 100 gross tons carrying from six to over 150 passengers. Examples of these vessels include the Portland Spirit and Columbia Gorge Sternwheeler, which provide dinner cruises and day trips, respectively, and the Waikikum County ferry, the only ferry on the lower Columbia River, which shuttles passengers and up to 12 cars at a time between Puget Island, Washington and Westport, Oregon.

Service Vessels

Service vessels, including military, law enforcement, search and rescue, pilot, pollution control, and tugs operate throughout the study area and could be found anywhere on the lower Columbia River at any time. The vessel types and activities are summarized below.

- USCG vessels in the study area consist of vessels stationed primarily at the Port of Astoria, Cape Disappointment, and Portland, Oregon. These vessels are used for search and rescue, maritime law enforcement, boating safety, Aids to Navigation, and homeland security.
- Oregon State Police and Washington State Police also operate vessels on the Columbia River to coordinate the enforcement of commercial fishery and sport angling regulations, and for special investigations. County governments along the Columbia River also staff full-time deputies assigned to patrol the waters of the Columbia River and conduct boat inspections. These local law enforcement vessels can be found operating within their respective jurisdictions of the Columbia River and its adjacent waterways.
- Pilot vessels are used to transport Bar and River Pilots to large vessels for pilotage duties described above in *Large Commercial Vessels, Vessel Traffic Management*. The Bar Pilots use one of two Pilot boats, the Astoria or the Columbia, both 72-feet long, for offshore transfers.³⁰ For transfers within the Columbia River, the River Pilots and the Bar Pilots use the Connor Foss, a 63-foot-by-17-foot aluminum vessel designed specifically for pilot transfers. The Bar Pilots make approximately 3,600 vessel crossings of the bar each year with vessels ranging from 100-foot tugs to 1,100-foot cargo ships. River Pilots pilot vessels upriver from Astoria including along 13 miles of the Willamette River from its confluence with the Columbia to the seawall in downtown Portland (Columbia River Pilots 2014).
- Three marine spill response vessels are staged in the study area at the Port of Astoria.
- Tugs operating in the study area include those towing or pushing barges from or to destinations beyond the study area and those from tug companies located along the Columbia River. The latter tug companies provide cargo barge movement services between ports along the river; move bunkers (fuel oil barges) to vessels requiring fuel; and provide docking, escort, and other assistance, as described above under *Large Commercial Vessels, Tug Assistance*.
- Dredges are used to maintain the navigation channel by removing excess sand, silt, and mud that naturally settles to the bottom and on the sides of the channel over time. Dredging operations are advertised to vessel operators transiting in the Columbia River and are conducted in such a manner as to generally not impede vessel traffic.

Recreational and Commercial Fishing Vessel Traffic Management

The USCG is the primary federal maritime law enforcement agency on the Columbia River. Oregon State Police and Oregon county law enforcement (Clatsop County Sheriff Marine Patrol) also patrol on the Columbia River (Oregon.gov 2016). Vessels in these state and local law enforcement units are used to regulate recreational and fishing vessel traffic on the river in accordance with state and local laws.

³⁰ Embarking and disembarking of Columbia River Bar Pilots offshore can be by boat or helicopter. It is the individual pilot's choice whether to use the boat or helicopter for transfers offshore, with the helicopter being used about 70% of the time (Rodino pers. comm.:52).

The USCG boards commercial fishing vessels at sea to ensure compliance with safety equipment requirements required by the Commercial Fishing Industry Vessel Safety Act of 1988. The USCG auxiliary conducts dockside inspections of commercial fishing vessels to supplement the at sea boardings and educate fishermen on safety equipment and training requirements (Kemerer and Castrogiovanni 2008). USCG vessels participate with state and local law enforcement in joint operations on a periodic basis to manage vessel traffic and maintain recreational boater safety (U.S. Coast Guard 2016). For example, during the months of August and September each year, the Coast Guard Auxiliary, in conjunction with USCG Station Cape Disappointment, Clatsop County Sheriff’s Office, and Oregon State Police, engage in a Recreational Boating Safety surge operation to educate and inform boaters participating in Columbia River recreational salmon season. USCG also hosts Operation Make Way, a yearly joint recreational boater education and enforcement campaign, to educate recreational boat users about the need to give way and stay clear of large commercial vessels operating within the Columbia and Willamette navigation channels. The program aligns with state’s and counties’ recreational boating safety missions.

5.4.4.3 Ship Casualty Survey

The information presented in this section is based on data obtained from the USCG MISLE database and covers all available data from 2001 through 2014. The data are collected for 26 vessel incident types and are not predictive of cargo vessel casualties. Three primary incident types—collision, allision, and a combination of grounding/set adrift—are representative of the navigational incidents that could occur and compare best to the results of the incident modeling (Table 5.4-10).

Table 5.4-10. Incident Severity by Incident Type for Study Area (Total Incidents, 2001–2014)

Incident Type	Total Loss (% of Total)	Damaged (% of Total)	Undamaged (% of Total)	Total
Allision	3 (5%)	24 (43%)	29 (52%)	56
Collision	1 (5%)	9 (47%)	9 (47%)	19
Grounding /Adrift	1 (1%)	16 (21%)	59 (78%)	76
Total^a	5 (3%)	49 (32%)	97 (64%)	151

Notes:

^a Total may not sum due to rounding.

Source: DNV GL 2016

The database notes the severity of each incident and describes potential vessel damage. Table 5.4-11 presents the outcome distribution in three categories—total loss,³¹ damaged, and undamaged—for marine incidents that took place between the Columbia River mouth and the Port of Portland.

The results of these data surveys are very similar to those from nationwide incidents in that approximately two-thirds of incidents resulted in no damage, one-third in some damage, and slightly less than 3% in total loss.

³¹ For the purposes of this analysis, *actual total loss*, *total constructive loss: salvaged*, and *total constructive loss: unsalvaged* were combined into a single *total loss* category.

Table 5.4-11. Outcome Distribution for All Incidents in the Study Area by Vessel Type (2001–2014)

Vessel Type	Total Loss (%)	Damaged (%)	Undamaged (%)	Total (%)
Bulk Carrier	0%	2%	16%	18%
General Dry Cargo Ship	0%	1%	3%	4%
Ro-Ro Cargo Ship	0%	1%	1%	2%
Tank Ship	0%	0%	2%	2%
Barge	0%	2%	7%	9%
Passenger Ship	1%	8%	7%	15%
Towing Vessel	0%	7%	13%	20%
Fishing Vessel	2%	5%	13%	21%
Recreational	1%	3%	0%	3%
Military ship	0%	1%	0%	1%
Unspecified	0%	1%	3%	4%
Miscellaneous	0%	1%	0%	1%
Total^a	3%	32%	64%	100%

Notes:

^a Total may not sum due to rounding.

Source: DNV GL 2016

Table 5.4-10 shows that groundings were the most common type of incident, followed by allisions, then collisions. Although collisions represented less than 13% of total incidents during the survey period, they resulted in the highest severity outcomes, followed closely by allisions; groundings resulted in significantly less severe outcomes (78% of grounding resulted in no vessel damage). Table 5.4-11 presents the distribution of incident severity for all incidents by vessel type. The table shows that the higher severity events more typically involved smaller craft (e.g., fishing or recreational vessels).

5.4.4.4 Marine Oil Spill Survey

Vessel-related oil spills that occurred in the study area from 2004 to 2014 are presented in Table 5.4-12 by spill volume and incident type, based on MISLE, SPIIS, and ERTS data. Spill volumes per incident ranged from 0.1 gallon to 1,603 gallons. An average 15.6 oil spills per year occurred during the study period; of these, 84% had a volume of less than 10 gallons. As reflected in Table 5.4-12, most of the spills were not related to a vessel incident. Spills greater than 100 gallons occurred at a frequency of 0.4 per year or once every 2.2 years. The average size of these spills was approximately 630 gallons.

The vessel-related spill survey was largely confined to the specified time period (2004 to 2014) because this was the period of best overlap among all the datasets and because it provides a representation of present risk.

Table 5.4-12. Oil Spill Incident Count and Frequency—Lower Columbia River (2004–2014)

Incident Type	Oil Spill Incident Count by Spill Volume				Total	Oil Spills per Year
	<1 gal gallon	1–10 gallons	10–100 gallons	>100 gallons		
Allision	1	-	-	-	1	0.1
Capsize	1	-	-	-	1	0.1
Damage to the environment ^a	123	57	28	6	214	15.3
Grounding	-	-	1	-	1	0.1
Sinking	-	2	-	-	2	0.1
Total	125	59	29	6	219	15.6
Spills per year	8.9	4.2	2.1	0.4	15.6	

Notes:
^a This category includes all other incident types and undetermined events including but not limited to those causing an oil sheen, which requires reporting under state law.

Larger-scale incidents involving the release of oil have occurred in previous years; however, these events predate legislation targeted at and largely successful in reducing the likelihood of oil spills from vessels or diminishing the impact of a spill should it occur, namely, the enforcement in U.S. waters of the International Convention for the Prevention of Pollution from Ships (MARPOL) and the Oil Pollution Act of 1990. The latter brought about more stringent planning and spill-prevention activities than the previous U.S. legislation (the FWPCA as amended by the Clean Water Act), improved preparedness and response capability (public and private), and established a double hull requirement for tank vessels.

5.4.4.5 Incident Management and Response Systems

The National Contingency Plan, codified in 40 CFR 300, establishes federal on-scene coordinators for oil spills and hazardous material releases within the inland zone and coastal environments. The plan is the foundation document for state, regional, and local planning for pollution response and provides organizational focus for the related emergency situations that can lead to oil spills, such as vessel groundings, collisions, allisions, and fires.³²

USCG is the federal on-scene coordinator in the study area. In Washington State, Ecology is the designated state on-scene coordinator for spill response. The Washington Emergency Management Division functions in this role for natural disasters, and Washington State Patrol or state fire marshal for fires. The Washington State Emergency Response system is designed to provide coordinated state agency response, in cooperation with federal agencies for effective cleanup of oil or hazardous substance spills. Within Oregon, DEQ is the lead agency for oil or hazardous material spills, the Oregon Office of Emergency Management coordinates support from other state agencies, and the state fire marshal provides hazardous materials/fire incident response coordination and support when a situation exceeds local response capabilities.

The Northwest Area Contingency Plan is the regional planning framework for oil and hazardous substance spill response in the states of Washington, Idaho, and Oregon. Representatives from the

³² Washington and Oregon legislative/regulatory requirements for state oil spill contingency plans applicable to vessels calling under the Proposed Action are listed in Table 5.4-1.

federal and state agencies listed above and local governments plan for spill response emergencies and implement response actions according to the plan when an incident occurs.

The plan includes but is not limited to the following elements.

- A description of the area covered by the plan, including the areas of special economic or environmental importance that might be damaged by a spill.
- Roles and responsibilities of an owner or operator and of federal, state, and local agencies in spill response and in mitigating or preventing a substantial threat of a discharge.
- A link to an online list of equipment available to respond to oil spills.
- Site-specific geographic response plans.

Geographic response plans, part of Northwest Area Contingency Plan, are tailored for specific shorelines and waterways. The main objectives of these plans are to identify sensitive resources at risk from oil spills and to direct initial response actions to sensitive resources.

In addition to the national and regional plans, the Lower Columbia Region Harbor Safety Committee maintains the Harbor Safety Plan, which includes incident management guidelines; emergency communications; notification requirements in case of an oil spill; steps to take in case of a vessel grounding, vessel collision, bridge allision, and mechanical or equipment failures.

All of these plans help coordinate response efforts by the responsible party (vessel owner/operator) and federal and state agencies.

Owners/operators of large commercial vessels are required to prepare and submit oil spill response plans under federal (33 CFR 155.5010-155.5075) and state requirements (WAC 173-182 and OAR 340-141) to ensure that resources, including equipment, are in place for a spill of the vessel's fuel oil and of any oil carried as secondary cargo. Moreover, vessel owners/operators are required to retain an oil spill removal organization and a spill management team; this is often accomplished by contracting with cooperative organizations that specialize in oil spill response, such as the Marine Spill Response Organization and National Response Corporation.

Additionally, vessels owners/operators can obtain oil spill response and contingency planning coverage under the Maritime Fire Safety Association (MFSA) response plan, an umbrella plan for enrolled vessels entering the Columbia River.

The incident response system in the study area for vessels covered by the MFSA response plan is described below for oil spills, fires, and collisions and groundings.

- **Oil spill.** If an oil spill occurs in the study area, USCG, Ecology, and DEQ—the federal and state on-scene coordinators—and the responsible party (RP) represent the Unified Command. The Unified Command coordinates responses, mitigation, and cleanup efforts for spills on the lower Columbia River to protect public health and safety, response personnel, and the environment. (Maritime Fire and Safety Association 2013)
- **Shipboard fire.** Under the Federal Fire Prevention and Control Act of 1974, fire prevention remains a local and state responsibility (Northwest Area Committee 2015). The local fire jurisdiction is the first responder to a shipboard fire. If the incident is beyond the local

jurisdiction's capacity, mutual aid resources³³ are requested through the MFSA Fire Protection Agencies Advisory Council (FPAAC). The FPAAC mutual aid network extends to 13 fire agencies along the lower Columbia/Willamette Rivers. If local and mutual aid resources are exhausted, the local fire chief requests assistance from the state emergency management office. With appropriate approvals, the state fire chief (Oregon) or state fire marshal mobilization coordinator (Washington) takes control over response (Office of State Fire Marshal 2015; Office of the State Fire Marshal, Washington State Patrol 2015). The USCG COTP acts as the federal on-scene coordinator, if a shipboard fire occurs outside a fire agency's jurisdiction but within the Sector Columbia River COTP zone, or if a vessel fire is treated as a search-and-rescue case (Northwest Area Committee 2015).

- **Collision and grounding incident response.** For collision and grounding incidents, the vessel operator immediately secures watertight closures and contacts the USCG COTP, Ecology, and DEQ. The USCG COTP may establish a communications schedule, request periodic vessel updates, and issue a safety marine information broadcast. In response to a collision, USCG response personnel and state investigators assess and supervise the incident and may form a Unified Command. Unified Command instructs responsible parties on separating joined vessels and moving vessels to anchorage. The USCG COTP works with the vessel operator and Unified Command to initiate pollution response, as necessary. In most cases, a surveyor is required to inspect damage and verify repairs. In response to a grounding, the objective is to refloat and minimize damage to the vessel and environment. The responsible party may be required to activate the response plan to minimize any pollution threat, at the discretion of the Unified Command.

5.4.5 Impacts

This section describes the potential direct and indirect impacts related to vessel transportation that would result from construction and operation of the Proposed Action and the No-Action Alternative.

5.4.5.1 Proposed Action

This section describes the potential impacts that could occur in the study area as a result of construction and operation of the Proposed Action. The Proposed Action would load an average of 70 vessels per month or 840 vessels per year, which would equate to 1,680 vessel transits in the Columbia River. Proposed Action-related cargo vessels would be required by federal and state law to meet vessel standards and plan requirements. These include structural, fire-fighting and personnel requirements as well as oil spill contingency and response plans as previously described.

Construction—Direct Impacts

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

³³ Local and state firefighting organizations enter into reciprocal agreements to provide mutual aid when a single jurisdiction's resources are overwhelmed.

In-water dock construction (pile-driving, dredging, and general construction of above-water elements) would occur over a 6-month to 1-year period (Grette Associates, LLC 2014). For this work, barges would be located near Docks 2 and 3. The barges would be positioned outside of the navigation channel, so as to not impede vessels traveling within the channel. They would also be placed outside of the area used by vessels accessing Dock 1, so they would not affect these activities. Additional information on dredging and pile driving is included in Chapter 4, Section 4.5, *Water Quality*.

Construction—Indirect Impacts

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

As described in Chapter 2, *Project Objectives, Proposed Action, and Alternatives*, the Applicant has identified three construction-material-delivery scenarios: delivery by truck, rail, or barge. If material is delivered by barge, it is assumed that approximately 1,130 barge trips would be required over the construction period. Approximately two-thirds of the barge trips would occur during the peak construction year, assumed to be 2018. Approximately 750 barge trips in the study area would be required during the peak construction year to deliver construction materials. Because the project area does not have an existing barge dock, the material would be off-loaded at an existing dock elsewhere on the Columbia River and transported to the project area by truck.

Barges are shallower in draft and could transit the Columbia River navigation channel during periods of low water to avoid interference with larger vessel traffic. Coordination would take place with the River Pilots prior to and during transit activity. Moreover, the barges would be transiting a portion of the navigation channel during construction in the vicinity of the project area and not the entire study area. Therefore, impacts on vessel traffic in the study area as a result of construction-related barge traffic would be low because barge traffic would avoid interference with larger vessels and would only traverse a portion of the lower Columbia River.

Operations—Direct Impacts

Operation of the Proposed Action would result in the following direct impacts. Operations-related activities are described in Chapter 2, *Project Objectives, Proposed Action, and Alternatives*. The Proposed Action would load 70 vessels per month or 840 vessels per year, which would equate to 1,680 vessel transits in the Columbia River.

Loading coal onto vessels for export is the only activity proposed for the new docks, Docks 2 and 3. Vessel loading would be performed using an electric-powered shiploader. Each dock would have one shiploader. Each shiploader would have an average capacity of 6,500 metric tons per hour. At maximum throughput, an average of 70 vessels per month (an average of over two per day) would be loaded at Docks 2 and 3. The berths for Docks 2 and 3 are expected to be occupied by Proposed Action-related vessels 365 days per year.

River Pilots would pilot the incoming and outgoing vessels (from Astoria inland and vice versa) and direct docking and undocking maneuvers. At least two tugs would be used to assist with docking and undocking maneuvers for each arriving and departing Proposed Action-related vessel. Therefore, at least two tugs would be active in the vicinity of the docks four times per day on average. The pilot would determine the appropriate size and horsepower of the tugs depending on factors such as the size of the vessel, the weather conditions, and the currents at the time of maneuvers.

Docks 2 and 3 would be designed to accommodate dry bulk cargo ships up to 830 feet long and 130 feet wide, which would accommodate standard Panamax vessels and the somewhat smaller Handymax vessels. The berths at Docks 2 and 3 would be 43 feet deep, which is the depth at which the Columbia River navigation channel is maintained (U.S. Army Corps of Engineers 2015).

The expected fleet mix is 80% Panamax and 20% Handymax vessels. Table 5.4-13 contains the size and dimensions of these types of vessels assumed for the risk analysis.

Table 5.4-13. Vessel Sizes and Dimensions for Panamax and Handymax Vessels Assumed in the Risk Analysis

Vessel Class ^a	Deadweight (tons)	Length Overall (feet)	Beam (feet)	Draft (feet)
Handymax	46,101	600	106	36.1
Panamax	68,541	738	106	43.6

Notes:

^a These specifications chosen to represent the size and dimensions for Panamax and Handymax vessels are representative of an “average-sized” Panamax vessel and an average-sized Handymax vessel.

Source: DNV GL 2016: I-4.

Operations impacts related to the Proposed Action are based on the following assumptions.

- The River Pilots indicate (Gill pers. comm.) that they anticipate turning the ships at the project area in loaded condition (i.e., in preparation for departure, as opposed to turning downstream upon arrival).³⁴ Thus, inbound ships would approach Docks 2 and 3 in ballast (headed upstream), maneuver out of the navigation channel toward the dock, and align parallel to the dock, docking with the assistance of tugs.
- Pilots estimate that operations at the project area (Docks 2 and 3) would require the two assisting tugs to have bollard pull ratings of at least 30 tons operating ahead and at least 22.5 tons operating astern. Those tugs would be in the 3,000-to-4,000-horsepower range (Gill pers. comm.). Pilots would determine tug assistance needs.
- A typical departure of a loaded vessel off the dock (with the assistance of the tugs) would involve moving the bow out into the channel, while keeping the stern near the dock to give the pilot accurate positioning of the vessel during the turn, and allowing the current to rotate the bow until the vessel points downriver and can begin moving downriver. The width of the channel at this point is approximately 1,200 feet, which provides a turning area approximately 1.6 times the length of the vessel.
- Currently, maneuvering a vessel to the existing berth (Dock 1) upstream of the proposed docks can be challenging due to the strong current outflow from the bank (Amos pers. comm.). Pilots expect that conditions for the proposed docks (Docks 2 and 3) would require similar operations as Dock 1 (Gill pers. comm.). Pilots would be aware of this issue and would consider it during planning and operations.

³⁴ Currents in the river at the project area are typically directed downriver or ebbing due to the river flow overriding the tidal currents. It is expected to be more efficient and safer to dock the ship heading into the current using the forward power of the engines which is stronger than the vessel’s backing power. When the loaded vessel leaves the dock with the bow pointing upriver, the currents assist the vessel turning in the channel by pushing the bow around and downriver. Pilots are responsible for vessel movements and will determine the appropriate actions for vessel arrivals and departures.

Should an incident occur during operations, it would most likely be attributable to increased risk of a vessel fire at the dock, an increased risk of an oil spill while at the dock, or an increased risk of a vessel allision while at the dock. Each of these situations is discussed below.

Increase the Risk of a Vessel Fire while at the Dock

Coal in any form, is a combustible material, making it susceptible to a variety of ignition scenarios. Coal fires during transfer and loading operations are typically caused by one of two sources of ignition: the coal itself (self-ignition) and the conveyor belt used in the transport of coal (e.g., over-heating due to damaged bearings, roller, belt slip). Safety requirements prohibit open flames near coal loading operations.

A fire in the vessel's machinery spaces or accommodation areas is a potential emergency scenario. Vessel design standards, fire equipment requirements, and crew training would be required to prevent or to facilitate rapid response to a vessel emergency while at the dock. All of these standards and requirements are implemented in accordance with the International Convention for the Safety of Life at Seas (SOLAS) in foreign and domestic cargo vessels (and codified in U.S. regulations) and enforced by USCG.

A bulk carrier such as the Proposed Action-related vessels would have the following fire prevention and response features.

- Structural fire protection, including certain bulkheads constructed to prevent the passage of flame and smoke for one hour. Other bulkheads must be constructed of incombustible materials. Current regulations require that risk of fire hazards be eliminated as much as possible in other construction features of the vessel (46 CFR 92).
- Structural insulation around compartments containing the emergency source of power (such as the ship's service generators). Other approved materials capable of preventing an excessive temperature rise in the space may also be used to eliminate the spread of a fire that originates in this type of compartment (46 CFR 92).
- Fire pumps, hydrants, hoses, and nozzles for the purposes of onboard firefighting. In addition, certain spaces must have approved hand-portable fire extinguishers and semiportable fire extinguishing systems (46 CFR 95).
- Officers and crewmembers with a basic level of training that includes fire prevention and firefighting (U.S. Coast Guard 2014).

Within the hold of a vessel, coal can be susceptible to ignition due primarily to self-heating and/or the creation and subsequent ignition of certain gases, including methane and hydrogen. Fire detection systems including carbon monoxide detection and infrared scanning would be in place to monitor and minimize the potential for onboard coal fires. Additionally, manual scanning by workers would enhance built-in mechanical-detection systems. Automated fire-suppression systems that are activated in the early stages of fire development are critical to reducing the potential for flame spread. These typically include water sprinklers combined with a fire extinguishing agent such as wetting agents or foam. Therefore, an onboard emergency is unlikely to affect resources other than the vessel itself.

Increase the Risk of an Oil Spill while at the Dock

An operational oil spill at the dock would most likely occur during bunkering (i.e., a ship receiving fuel while at the dock). The Applicant has committed to not allowing vessel bunkering at Docks 2 or 3; therefore, there would be no risk of an oil spill at a dock associated with oil transfers under the Proposed Action. Under proposed Mitigation Measure MM VS-2, the Applicant will notify Cowlitz County and Ecology if bunkering is proposed at Docks 2 and 3 in the future, so Cowlitz County and Ecology can determine if additional environmental review is required. Oil spill risks that might occur during transit are addressed under *Operations—Indirect Impacts*.

Increase the Risk of a Vessel Allision at the Dock

An allision occurs when a vessel strikes a fixed structure, such as a Proposed Action-related vessel striking the proposed docks at the project area or another vessel striking a Proposed Action-related vessel at berth.

Pilots sometimes experience difficulties getting a ship to the berth at the existing Dock 1, located just upstream of proposed Docks 2 and 3. Information about maneuvering challenges at Docks 2 and 3 cannot be collected and evaluated until the docks are built and vessel maneuvers take place at the project area. Nevertheless, the pilots' experience at nearby Dock 1 in the Applicant's leased area introduces a certain level of uncertainty associated with the aggregate influence of currents and river flow at Docks 2 and 3. A potential outcome when there are strong currents in the vicinity of the dock during vessel maneuvers is an allision. An allision may also occur if there were a loss of steering or loss of propulsion during transit or maneuvering at the dock. Despite the uncertainty associated with vessel maneuvers at the dock, the likelihood of a vessel allision is lessened due to the presence of tug power while docking and undocking.

Risk of allision could also involve another vessel striking a Proposed Action-related vessel while the Proposed Action-related vessel was at berth. As noted in Chapter 2, *Project Objectives, Proposed Action, and Alternatives*, several ports are located upstream of the project area and other vessels traveling to and from those locations would pass the project area. Based on incident modeling (DNV GL 2016), the likelihood of an allision under the Proposed Action is once in 39 years. However, as noted in Section 5.4.4.3, *Ship Casualty Survey*, most allisions do not result in substantial consequences, such as a total vessel loss. From 2001 and 2014, 5% of allisions resulted in substantial consequences, such as total vessel loss, and all of these events involved fishing vessels only.³⁵

Operations—Indirect Impacts

All large commercial vessel traffic bound for Longview or ports further upriver, including the Port of Portland and Port of Vancouver, pass the project area. Transiting Proposed Action-related vessels could affect or be affected by other vessel movements in the study area. Moreover, increased vessel traffic could result in changes in wake patterns, increased propeller wake, and increased underwater noise, and vessel emissions that could affect other environmental resources. These impacts are addressed in Chapter 4, Section 4.5, *Water Quality*, and Sections 5.5, *Noise and Vibration*,

³⁵ The data also show that between 2001 and 2014, 4% of the allisions resulting in some damage were bulk carrier allisions.

and 5.6, *Air Quality*. Impacts on the vessel transportation system and related environmental resources along the Columbia River navigation channel due to vessel operations are considered to be indirect impacts.

The factors that influence the potential for incidents during vessel transport are complex but are driven largely by changes in the pattern of vessel traffic particularly those vessels limited to the navigation channel. Table 5.4-14 compares large commercial vessel traffic under existing conditions (based on 2014 AIS data), the No-Action Alternative (2028), and with the Proposed Action (2028).

Table 5.4-14. Existing and Projected Large Commercial Vessel Traffic in the Lower Columbia River

Condition	Vessel Transits ^a per Year
Existing Conditions (2014)	3,862
No-Action Alternative (2028)	4,440
Proposed Action (2028)	6,120

Notes:

^a Transit numbers differ slightly from those presented in Table 5.4-7 in the discussion of historical vessel traffic volumes (Section 5.4.4.2, *Vessel Traffic*). The 2004–2014 historical volumes presented in that table are based on Bar Pilot data, whereas the transits presented here, which were the basis for the DNV GL (2016) risk assessment, are based on AIS data. The variance is a result of different recording methods and vessel type designations of the data sources.

Source: Based on 2014 AIS data for Cargo/Carrier, Tanker, Tug, and Passenger vessel types; a projected growth rate of 1% was applied to the 2014 transits to obtain the 2028 vessel transits under the No-Action Alternative; and proposed vessel transits (1,680) were added to the no-action transits to obtain transits with the Proposed Action.

For the purposes of incident modeling, the baseline traffic year of 2014 was selected to represent relatively recent traffic conditions on the river.

The vessel incidents evaluated in the modeling include allision, collision, grounding (powered or drift), and fire/explosion, because they are most likely to result in substantial consequences if they occur (Section 5.4.4.3, *Ship Casualty Survey*). Incident modeling considered the interaction between Proposed Action-related vessels and other large commercial vessels using the channel, as well as smaller vessels (e.g., recreational boats or commercial fishing vessels) not limited to the channel. The potential increase in these risks are discussed below.

Increase the Risk of a Vessel Allision (with a Fixed Object) during Transit

For vessels outbound from the project area, no fixed structures or waterfront facilities are close to the edge of the channel until the Port Westward dock at river mile 53 (Figure 5.4-1) and after that a small barge terminal dock at river mile 36. Thereafter, there are no facilities or structures until reaching the Port of Astoria, and those structures are well clear of the channel.

The Astoria-Megler Bridge is the next structure encountered, and once past that, the remaining structures are the jetties at the entrance of the river.³⁶ Due to the minimal impediments to vessel

³⁶ Since they are piloted, large commercial vessels have an advantage over fishing and recreational vessels because pilots are specifically trained to keep a large commercial vessel from alliding with a known object in the navigation route, including a bridge. There was an allision at the Astoria-Megler Bridge that involved a piloted vessel approximately 30 years ago. Since this incident, Bar Pilots have implemented risk reduction measures to reduce the probability of allisions at the bridge; they avoid meeting other piloted vessels at the bridge, observe weather and river current conditions, and review weather forecasts before transiting under the bridge (DNV GL 2016).

traffic within the navigation channel, the likelihood of a Proposed Action-related vessel alliding with a fixed structure while in transit is low and was not quantitatively evaluated in the risk assessment (DNV GL 2016). As shown in Table 5.4-10, 56 vessel allisions occurred in the study area from 2001 to 2014 (compared to an average of over 3,000 large commercial vessel transits annually during this time). Of these, just over half (52%) resulted in no damage, 43% resulted in some level of damage, and 5% resulted in total loss.³⁷ Therefore, although there would be an increase in risks compared to existing conditions, the overall risk of a Proposed Action-related vessel resulting in an allision to or from the project area would be low.

Increase the Risk of Other Incidents during Transit

Increased risks associated with the Proposed Action also include the potential for more collisions, groundings, or fires/explosions. While a collision may seem like a more likely incident scenario in the two-lane channel, the vessel casualty data (Table 5.4-10) and incident modeling results (Table 5.4-15) show that groundings, specifically powered groundings, are more likely under all traffic scenarios.

As presented in Table 5.4-15, the Proposed Action would increase the potential for incidents compared to both existing condition (2014) and the No-Action Alternative (2028). The predicted increase in incidents is primarily because of the increase in the number of vessels transiting the lower Columbia River. It should be noted that the consequences of a modeled incident can vary greatly from no damage to total loss and that the increase in likelihood alone is not representative of the magnitude of the potential consequences. In other words, not all of these incidents are likely to result in notable damages. For example, of the 151 reported incidents that occurred in the study area from 2001 through 2014 (Table 5.4-10), 64% resulted in no damage, 32% resulted in damage, and 3% resulted in total loss.

Table 5.4-15. Predicted Incident Frequencies per Year in the Study Area

Scenario	Incident Frequency				Total
	Predicted Collision	Predicted Powered Grounding	Predicted Drift Grounding	Predicted Fire/Explosion	
Existing Conditions (2014)	1.94	11.8	2.8	0.0032	16.6
No Action (2028) Conditions	2.53	13.6	3.3	0.0037	19.4
Proposed Action (2028) Conditions	3.06	15.2	3.9	0.0043	22.2

Notes:
Source: DNV GL 2016

Additionally, the incident frequencies predicted for existing conditions are from a single year (2014). While this year accounts for higher vessel traffic compared to the previous few years, it does not account for the wide historical variation in vessel traffic. Further, because the Proposed Action would ramp up over time, comparing the addition of 840 vessels to existing conditions is a conservative approach. Therefore, it is important to also consider how the No-Action Alternative would compare to existing conditions and how the Proposed Action would compare

³⁷ All total losses resulting from allision were to fishing vessels.

to the No-Action Alternative. As shown in Table 5.4-15, a relative increase in the likelihood of all incident types would occur over time unrelated to the Proposed Action.

Collisions

In general, the River Pilots and Bar Pilots avoid overtaking situations where one vessel passes another from behind. Thus, the most likely collision scenario is an inbound vessel meeting an outbound vessel. The River Pilots have identified specific points on the river where conditions are not suitable for vessels to pass each other, and they carefully manage transits to avoid two vessels meeting in those locations and instead manage the vessel transits so if they do need to pass each other, it is at a safe area. Avoidance of these areas was taken into consideration in calculating incident frequencies (i.e., estimating the likelihood of a collision due to the Proposed Action) in the incident modeling.

The most likely collision scenarios are bow-to-bow and side-to-side contact involving two large commercial vessels transiting the navigation channel. Bow-to-side is a possibility, but the channel width and the sizes of the vessels would likely make it more of a glancing impact rather than a straight ahead “T” impact.

Bow-to-bow contact is generally viewed as the easiest type of collision to avoid because the target area is small and either vessel can act independently to avoid it. Also, a vessel’s bow is its strongest structural point and bow-to-bow collisions would not be expected to result in cargo hold damage or fuel oil release. In addition, the hydrodynamic interaction between ships meeting causes the bows to be pushed away from each other as they approach.

Side-to-side or a glancing bow-to-side collision could result in damage to the hull, but the likelihood of catastrophic damage is relatively low. For dry cargo vessels—including bulk carriers—it is unlikely any coal cargo would be released into the water in the event of an angle of impact less than 22.5 degrees (DNV GL 2016). For tank vessels—including ATBs carrying oil in bulk—the risk of an oil spill cannot be ruled out; however, modern tank vessel design standards, including double hull construction of tankers, significantly reduce that potential.

As noted in Section 5.4.4.2, *Vessel Traffic, Other Vessels*, the Columbia and Willamette Rivers provide important fisheries for commercial, tribal, and recreational purposes. Although these smaller vessels are not restricted to the navigation channel, they often cross the river to access various locations in the study area. Particularly during periods of high fishing activity, there would be an increased chance for a vessel incident to occur. However, in general, because these smaller vessels are not restricted to the channel and must by law yield to oncoming large commercial vessels, the potential for a collision between a smaller vessel and a Proposed Action-related vessel would be low. Although it is not possible to predict the types of vessels that might be involved in a future incident, the incident modeling does show a very small increase in the potential for collisions involving fishing (0.04 incident per year) and recreational (0.01 incident per year).

Groundings

The River Pilots noted that there are few areas where waterway conditions create a substantial chance for a grounding to occur. They also noted that the nature of the river channel is such that

there is a bank cushion effect that helps to keep vessels away from the channel edges³⁸ (Amos pers. comm.). The vessel drafts assumed in the analysis and presented in Table 5.4-13 are representative of fully loaded vessels; the actual draft of any given transiting vessel would depend on the amount of cargo or ballast water onboard. Actual draft information is provided to pilots prior to transiting the Columbia River. As described in Section 5.4.4.2, *Vessel Traffic, Large Commercial Vessels, Vessel Traffic Management*, pilots have final decisions for vessel movements and determine if the planned operation can be successfully completed. The Columbia River Pilots' Vessel Movement Guidelines (Columbia River Pilots 2016) state "vessels may be permitted to sail with the maximum freshwater draft of 43 feet if the river level, tide, and conditions permit." As stated in Section 4.4.2.2, *Vessel Traffic, Vessel Traffic Management*, pilots operating draft-constrained vessels in the study area have to adjust the time of their transit to allow for at least 2 feet of under-keel clearance on the river plus expected squat to reduce the risk of groundings.

Fires, Explosions, and Other Emergencies

Equipment failure affecting power or steering while the vessel is underway could lead to loss of control of a vessel. A fire in the vessel's machinery spaces or accommodation areas is also a potential emergency scenario. For any of these situations the vessel master would do what is necessary to protect the safety of the crew first and avoid damage to the vessel second. A prudent action would be to remove the vessel from the navigation channel to a "safe haven," a location where appropriate actions can be taken by the vessel crew without compounding the emergency by involving another vessel or structure. Safe haven opportunities on the river are minimal. Marine terminals at the port areas and designated anchorages are the only places where vessels can stop to manage an emergency. Two anchorages at Astoria can accommodate five deep-draft vessels, at most, depending on their sizes. There are no other anchorage areas until reaching Longview (past the project area). Once a loaded vessel gets underway inbound to or outbound from the Longview area, it is committed to completing the planned transit.³⁹

Nothing prevents a vessel's master from anchoring anywhere in the river under emergency conditions; however, there is no way to predict how successful such an action might be in stopping the vessel. Anchoring effectiveness is dependent on factors such as the nature and condition of the waterway bottom, water depth, and vessel speed at the time of the anchoring. Risks include the potential for the anchor to damage the vessel if the water is not sufficiently deep. The vessel's location in or near the channel could also hamper or endanger other vessels depending on its location at the time. Dropping an anchor or anchors in an attempt to stop a vessel would be done only if other control measures failed. Opportunities for these emergency measures would be discussed as part of the pretransit planning between the master and the pilot.

In an emergency, a vessel could anchor in the channel at some locations; however, that presents significant risks for the vessel regarding the narrow channel and most likely would block

³⁸ When the vessel is near to the bank, the water is forced between the narrowing gap between the vessel's bow and the bank. This water tends to create a "cushion" that pushes the vessel away from the bank.

³⁹ A number of potential sites for additional anchorages are being discussed by the waterway stakeholders; however, they generally are shallow water sites. Reportedly, the discussions include the possibility of the Corps maintaining those areas as part of the navigation channel. Provision of additional stern buoys is also being considered.

virtually all other traffic. The likelihood of a vessel emergency causing a collision is low. Safe haven limitations (described above) mean that vessel transit would not begin until everyone involved is satisfied that the vessel is fully capable of completing the transit.

Although a vessel emergency increases the likelihood of indirect impacts on the Columbia River waterway, the likelihood of such an emergency occurring is very small. As shown in Table 5.4-15, the likelihood of fires and explosions is substantially lower than any other type of incident considered in the risk assessment. If such an emergency were to occur, the presence of a qualified vessel master and the pilot, in addition to crew training, vessel design, and equipment would help minimize the harmful impact on human safety and environment.

Increase the Risk of a Bunker Oil Spill during Transit or at Anchorages

An oil spill involving diesel or heavy fuel oil could occur as the result of an incident during transit or during bunkering transfers at locations other than the proposed docks. If an incident occurred that resulted in an impact, there is a possibility that a fuel tank could be damaged and fuel spilled. Oil spills could also occur during bunkering at anchorages within the study area. In general, the risks of spills would increase under the Proposed Action due to an increase in the number of vessels calling at the project area and the resultant increase to overall vessel traffic in the study area. To provide additional information about the relative likelihood of various sized oil spills, the risk assessment also quantitatively evaluated the incremental increase in risks of a spill (in the event of a collision or grounding) due to the Proposed Action.

Tables 5.4-16 and 5.4-17 present the likelihood (in terms of return periods⁴⁰) of representative spill sizes that could occur as the result of the modeled increased risk of collisions or groundings, respectively.

Table 5.4-16. Example Bunker Oil Spill Volumes and Frequencies due to Collisions Related to the Proposed Action (2028 and 2038)

Return Period (years) ^a		Oil Spill Volume (gallons)
2028	2038	
341	224	20,900 or less
581	381	59,300 or less
676	444	107,400 or less
3,748	2,461	166,500 or less

Notes:

^a Frequency of collisions in 2038 is higher compared to 2028 due to an increase in the overall vessel traffic in the study area.

Source: DNV GL 2016

⁴⁰ Estimated period of time between occurrences of an event.

Table 5.4-17. Example Bunker Oil Spill Volumes and Frequencies due to Groundings Related to the Proposed Action (2028 and 2038)

Return Period (years) ^a	Oil Spill Volume (gallons)
140	5,700 or less
182	10,700 or less
403	39,700 or less
4,299	45,800 or less

Notes:

^a Grounding frequencies do not vary from 2028 to 2038 since the number of project vessels remains at 840 in both years.

Source: DNV GL 2016

As shown in the tables, the likelihood of bunker oil spills from a vessel incident is relatively low with the most likely scenarios occurring in the range of once every 224 years for collisions (2038 traffic levels) and once every 140 years for groundings (2028 or 2038 traffic levels). As noted in Section 5.4.4.4, *Marine Oils Spill Survey*, spills that have historically occurred in the study area are much smaller than the quantities indicated in Tables 5.4-16 and 5.4-17 and have ranged from 0.1 gallon to 1,603 gallons.⁴¹ The average number of oil spills within this same timeframe (2004 to 2014) is 15.6 spills per year with 84% having a volume of less than 10 gallons. Spills of more than 100 gallons have occurred at a frequency of 0.4 per year or once every 2.2 years. The average size of these relatively larger spills is approximately 630 gallons.

The reason that the potential spill sizes modeled for the Proposed Action are larger is because the spill scenarios presented above are associated with large-scale vessel incidents: collisions or groundings. For such an incident to result in a release of bunker oil, the energy involved in the initial incident must be great enough to puncture the vessel's tanks. Increases in the types of oil spills of a scale more similar to those that have occurred over the last 10 years or so would also be expected under the Proposed Action to be somewhat commensurate with the relative increase in vessel traffic. Expansion of the casualty survey to a longer (beyond 11 years) timeframe, would include more unlikely events of a larger scale more in line with those addressed by the incident modeling.

An amendment to the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex that went into force in 2007, included a new regulation 12A on oil fuel tank protection. That regulation applies to any ship that has an aggregate oil fuel capacity of 785 cubic yards (3,774 barrels [158,508 gallons] of oil equivalent) or more and was contracted for on or after August 1, 2007; or had a keel laying date on or after February 1, 2008; or was delivered on or after August 1, 2010. The regulation limits an individual fuel tank to a maximum capacity limit of 3,270 cubic yards (15,725 barrels) and also includes requirements for the protected location of the fuel tanks and performance standards for accidental oil fuel outflow. It requires consideration of general safety aspects, including maintenance and inspection needs, when approving the vessel's design and construction. These improvements have helped to reduce the extent of releases in the event of a vessel incident.

⁴¹ Data presented in Section 5.4.4.4, *Marine Oil Spill Survey*, include all reported vessel-related spills from 2004 to 2014, not just those caused by vessel incidents such as groundings and collisions.

Increased vessel traffic associated with the Proposed Action also has the potential to result in increased risk of oil spills during bunkering activities. Causes of oil spills during bunkering transfers include overflow of the tank, parting of the hose due to mooring fault, operator error in connecting the hose, failure of the hose or pipework, and failure of bunker tanks (HSE 2012). Experience from insurance claims (Gard 2002) is that most bunker spills result from an overflow of the bunker tank due to carelessness or negligence, either on the part of those supplying the bunkers, or those on board the vessel receiving them. The main safeguards against the occurrence of bunker spills are use of bunkering best practices, including attentive tank-level monitoring and valve alignment, use of bunkering procedures and checklists, and supervision of the bunkering operation by a qualified person.⁴² Standard/ABS (2012) lists the main features of such procedures.

The consequences of a spill of heavy fuel oil into the marine environment are in general considered to be more severe than for other fuels, although this may depend on the sensitivity of the local environment to acute toxicity (DNV 2011). Undoubtedly, spills of heavy fuel oil will be more persistent, taking longer to weather naturally and being more difficult to clean up. The average cleanup costs per metric ton of oil spilled have been estimated as more than seven times higher for heavy fuel oil⁴³ than for diesel (Etkin 2000).

There were nine oil spills during refueling of large cargo vessels that occurred in the study area from 2004 to 2014. Spills of oil cargoes are better documented than spills from bunkering. Therefore, previous risk analyses have assumed the frequency of spills during bunkering is the same as during transfer of liquid cargoes: $1.8 \text{ by } 10^{-4}$ (one spill every 5,555 years) per bunkering operation for spills exceeding 1 metric ton (7.3 barrels or 308 gallons). The frequency of smaller spills is likely to be much greater. This implies that the annual likelihood depends on the number of bunkering operations. If the ship bunkers 10 times per year, the likelihood of a spill of 1 metric ton or more would be $1.8 \text{ by } 10^{-3}$ per year, or approximately 1 chance in 500 per year. Although it is not possible to predict the number of vessels that may bunker or where they would bunker, the risks of a spill during transfer would slightly increase due to the increase in vessel trips under the Proposed Action.

Increase Vessel Activity

Increased vessel traffic associated with the Proposed Action would also have the potential to result in other impacts from increased activity, vessel wakes, propeller wash, underwater noise and vibration, and vessel emissions. The potential impacts on cultural resources, water quality, and fish are addressed in Chapter 3, Section 3.4, *Cultural Resources*, and Chapter 4, Sections 4.2, *Surface Water and Floodplains*, 4.5, *Water Quality*, 4.6, *Vegetation*, 4.7, *Fish*, and 4.8, *Wildlife*, respectively. The magnitude of these vessel-related impacts would depend on a variety of interrelated factors, including but not limited to, distance of the channel from the shoreline, depth of the intervening riverbed, placement and size of dredged materials, the presence of particularly sensitive species, the speed and size of the vessels, the prevailing river and tidal

⁴² *Bunkering Best Practices: A Reference Manual for Safe Bunkering Operations in Washington State* (Washington State Department of Ecology 2014) and *Bunkering Guidelines in Lower Columbia Region Harbor Safety Plan* (January 2013). These references provide extensive guidelines related to winds, sea states, mooring equipment, tug availability, and regulatory requirements to provide for safe, spill-free bunkering operations.

⁴³ Heavy fuel oil is used in marine main diesel engines. It is a residue from crude oil refining and because of its properties, heavy fuel oil is required be stored and used at a high temperature.

currents, and otherwise naturally occurring wave action. Many of these factors are regulated by the federal government, including dredging activities, the placement of dredged spoils, and vessel traffic management in the study area. In general, the increase in deep-draft vessels associated with the Proposed Action would result in the increased potential for vessel-related impacts to occur.

5.4.5.2 No-Action Alternative

Under the No-Action Alternative, the Applicant would not construct the coal export terminal. The Applicant would continue with current and future increased operations in the project area. The project area could be developed for other industrial uses including an expanded bulk product terminal. The Applicant has indicated that, over the long term, it would expand the existing bulk product terminal and develop new facilities to handle more products such as calcine petroleum coke, coal tar pitch, and cement. No new docks would be built under the No-Action Alternative.

The No-Action Alternative would increase vessel traffic by approximately 20 vessel calls (40 trips) per year. In addition, vessel traffic in the study area in general would continue to increase over time with further industrial development along the river. As assumed for the incident modeling, large commercial vessel traffic would increase to approximately 2,200 vessel calls (4,400 transits) per year by 2028. Therefore, there would be an increase in the number of incidents likely to occur compared to existing conditions unrelated to the Proposed Action.

Management of vessel traffic on the lower Columbia River will be an ongoing concern for federal (USCG and Corps) and state (Ecology and DEQ) agencies, local coastal jurisdictions, the Bar Pilots and River Pilots, maritime associations (such as PDXMEX and MFSA), and private interests. With or without the Proposed Action, vessel traffic volume is expected to be variable along the lower Columbia River due to economic and market fluctuations, changes in port infrastructure, and vessel design modifications. The Columbia River VTIS and the Lower Columbia Region Harbor Safety Committee are both part of a system that functions to adapt the processes currently in place in the Columbia River to changes in the nature and the volume of vessel traffic.⁴⁴ These systems are in place and would continue to operate under the No-Action Alternative and help reduce the impacts related to the anticipated increases in vessel traffic in the lower Columbia River.

5.4.6 Required Permits

No permits related to vessel transportation would be required for the Proposed Action.

5.4.7 Proposed Mitigation Measures

This section describes the mitigation measures that would reduce impacts related to vessel transportation from construction and operation of the Proposed Action. These mitigation measures would be implemented in addition to project design measures, best management practices, and

⁴⁴ The Lower Columbia Region Harbor Safety Committee consists of federal, state, and local government representatives, port employees, vessel and facility operators, vessel agents, spill response cooperatives, and any other stakeholders that meet on a regular basis to exchange information, plan for contingencies, and review current operating procedures in light of any recent incidents. The *Lower Columbia Region Harbor Safety Plan* includes regularly revised guidelines on current traffic management practices and procedures for port users and is available via the Harbor Safety Committee's website (<http://www.lcrhsc.org/>).

compliance with environmental permits, plans, and authorizations that are assumed as part of the Proposed Action.

5.4.7.1 Applicant Mitigation

The Applicant will implement the following mitigation measures.

MM VS-1. Attend Lower Columbia River Harbor Safety Committee Meeting. The Applicant will attend at least one Lower Columbia River Harbor Safety Committee meeting per year before beginning operations and every year during operations. The Applicant will provide notification of attendance to Cowlitz County.

MM VS-2. Notify if Bunkering at Docks Occurs. The risk of an oil spill at Docks 2 and 3 would primarily be during bunkering (refueling) operations. The Applicant has committed to no bunkering at Docks 2 and 3. If this changes and bunkering is proposed at Docks 2 and 3, the Applicant will notify Cowlitz County and Ecology who will determine if additional environmental review is required before bunkering operations are conducted.

5.4.7.2 Other Measures to be Considered

It is recommend that the Applicant participate in regular Lower Columbia River Harbor Safety Committee meetings.

5.4.8 Unavoidable and Significant Adverse Environmental Impacts

Compliance with laws and implementation of the mitigation measures would reduce impacts related to vessel transportation. If a Proposed Action-related vessel incident such as a collision or allision occurred, the impacts could be significant, depending on the nature and location of the incident, the weather conditions at the time, and whether any oil is discharged. Although the likelihood of a serious Proposed Action-related vessel incident occurring is very low, there are no mitigation measures that could completely eliminate the possibility of an incident or the resulting impacts.