3.17 Vessel Traffic

This section describes vessel traffic in the study area, including characteristics of Grays Harbor and the Grays Harbor Navigation Channel; vessel types, uses, and destinations; vessel traffic; and traffic management. It then describes impacts on vessel traffic that could result under the no-action alternative or as a result of the construction and routine operation[1] of the proposed action. Finally, this section presents any measures identified to mitigate impacts of the proposed action and any remaining significant and unavoidable impacts.

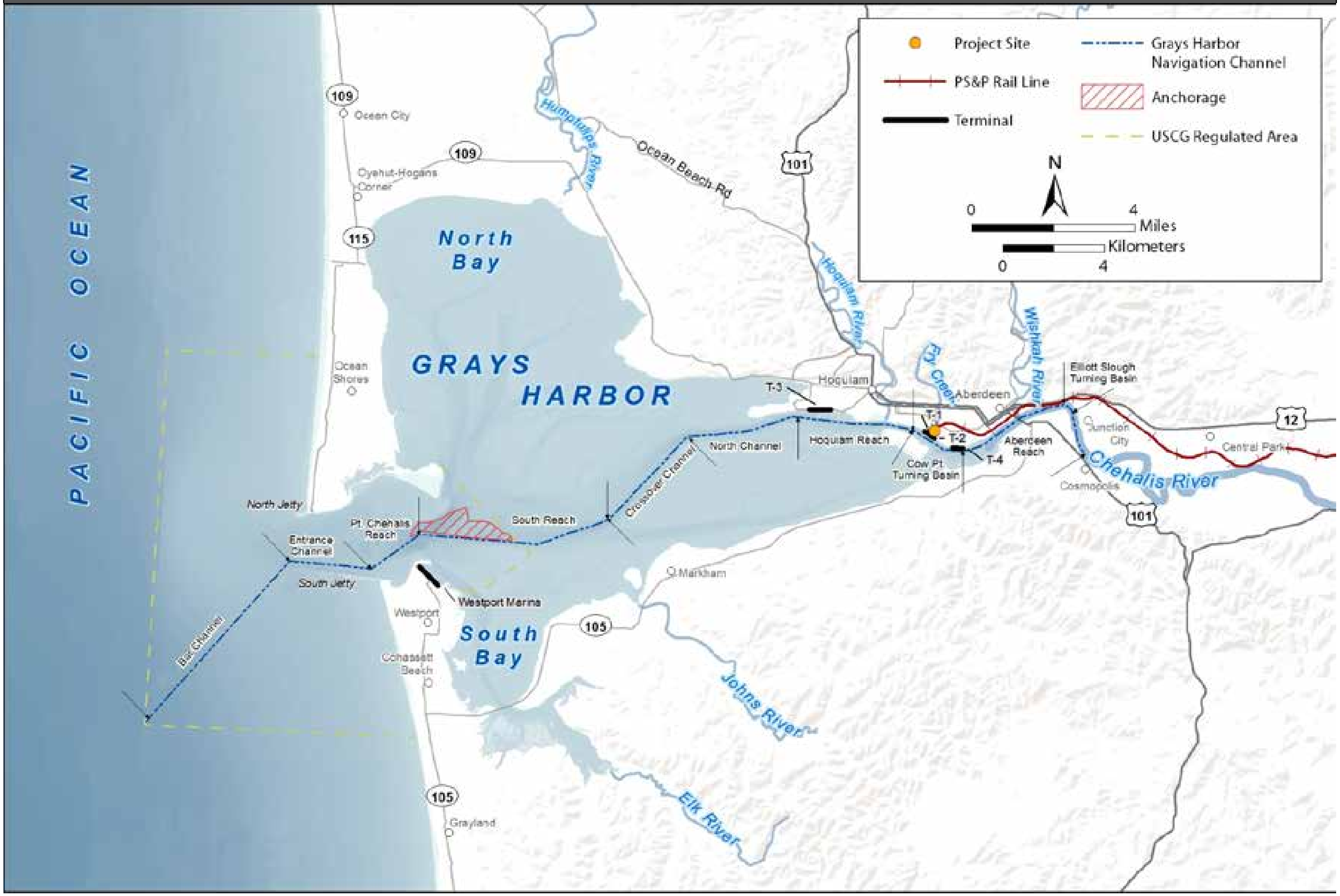
3.17.1 What is the study area for vessel traffic?

The study area for vessel traffic consists of the Terminal 1 berth and the entirety of Grays Harbor, including the navigation channel[2] into and out of the harbor out to 3 nautical miles from the mouth of the harbor (Figure 3.17-1). Chapter 5, *Extended Rail and Vessel Transport*, addresses impacts related to vessel transportation beyond this study area.

[1] Chapter 4, *Environmental Health and Safety*, addresses the potential impacts from increased risk of accidents (e.g., storage tank failure, train derailments, vessel collisions) and related consequences (e.g., release of crude oil or other proposed bulk liquids). Chapter 4 also addresses impacts related to vessel safety.

[2] The Grays Harbor Navigation Channel provides access for deep-draft vessels to Port of Grays Harbor facilities in the harbor. Nearly 23 nautical miles long, it begins approximately 4 miles offshore, runs in a predominantly easterly direction past Westport, Hoquiam, and Aberdeen, and ends at Cosmopolis near the mouth of the Chehalis River. The depth of the channel is maintained by the U.S. Army Corps of Engineers.

Figure 3.17-1. Port of Grays Harbor



3.17.2 What laws and regulations apply to vessel traffic?

Laws and regulations for determining potential impacts on vessel traffic are summarized in Table 3.17-1. More information about these laws and regulations is provided in Appendix B, *Laws and Regulations*.

Table 3.17-1. Laws and Regulations for Vessel Traffic

Laws and Regulations	Description
Federal	
Ports and Waterways Safety Act of 1972 (31 U.S.C. 1221 et seq.)	Authorizes USCG to provide for navigation and vessel safety; protect the marine environment; and protect life, property, and structures in, on, or immediately adjacent to the navigable waters of the United States.
Port and Tanker Safety Act of 1978 (33 U.S.C. 1221 et seq.)	Grants USCG broad and extensive authority to supervise and control all types of vessels, foreign and domestic, operating in U.S. navigable waters.
Navigation and Navigable Waters, Subchapter E: Inland Navigation Rules (33 CFR 83–90)	Apply to all vessels on the inland waters of the United States and complement the International Regulations for Preventing Collisions at Sea 1972, which are applicable in International Waters.
Federal Pilotage Requirements (46 CFR 15.610 and 15.812)	Identifies the type of vessels that require a federally licensed master or mate and identifies federal pilotage requirements for U.S.-inspected vessels on coastwise voyages.[a]
State	
Washington State Pilotage Act (RCW 88.16)	Establishes requirements for compulsory pilotage provisions in certain waters of the state, including Grays Harbor.
Local	
No local laws or regulations apply to vessel traffic.	

[a] A coastwise voyage by sea is a voyage in which a U.S.-flagged vessel proceeds from one port or place in the United States to another port or place in the U.S. while engaged in trade (46 CFR 46.05-15).

U.S.C. = United States Code; USCG = U.S. Coast Guard; CFR = Code of Federal Regulations; RCW = Revised Code of Washington

3.17.3 How were impacts on vessel traffic evaluated?

This section describes the sources of information and methods used to evaluate impacts.

3.17.3.1 Information Sources

Information about vessel traffic in the study area, including characteristics of Grays Harbor and the navigation channel; vessel types, uses, and destinations; vessel traffic; and traffic management was obtained from the following sources.

- *Vessel Traffic Impact Analysis for Westway and Imperium* (WorleyParsons 2014).
- Nautical charts and data on observed water levels at tidal station 9441102 in Westport, Washington (National Oceanic and Atmospheric Administration 2014a).
- National Oceanic and Atmospheric Administration. 2014b. *U.S. Coast Pilot 7 Pacific Coast*. 2014 (46th Edition). August 31, 2014.

- U.S. Army Corps of Engineers (USACE) Waterborne Commerce Statistics Center (U.S. Army Corps of Engineers 2014b).
- *Navigation Improvement Project General Investigation Feasibility Study, Grays Harbor, Washington* (U.S. Army Corps of Engineers 2014).
- *Washington State 2014 Marine and Rail Oil Transportation Study* (Washington State Department of Ecology 2014, 2015).
- Laws and regulations granting the U.S. Coast Guard (USCG) authority to provide for navigation and vessel safety in navigable waters of the United States.
- *Harbor Safety Plan for Grays Harbor* (Grays Harbor Safety Committee 2014).
- Personal communication with Port of Grays Harbor (Port) pilots and staff
- Information on commercial, recreational, and tribal fishing obtained from the Washington Department of Fish and Wildlife and Quinault Indian Nation.

3.17.3.2 Impact Analysis

The vessel traffic analysis evaluated the capacity of the navigation channel, Terminal 1 berth, and pilot and escort tugs relative to the increase in large commercial vessel trips under the proposed action, and potential conflicts of these vessels with smaller recreational and fishing vessels in the harbor.

- **Channel capacity.** The channel capacity analysis was completed by first determining existing and future traffic related to large commercial vessels[3] over the 20-year analysis period (2017 to 2037) without the proposed action. Future vessel traffic was determined by applying moderate compound annual growth rates to vessel trips associated with the present commodity volumes shipped from the Port. The growth rates used for commercial product forecasts were 1.2% for forest products (including wood chips), 0.7% for food and farm products, 3.9% for manufactured equipment (machinery and auto), and 6.8% for chemicals (e.g., methanol). Forecast volumes of vegetable oil and biofuels were kept constant.

  The channel capacity analysis compared forecast vessel trips to the navigable windows available for these vessels to assess whether the capacity of the navigation channel would be exceeded on an annual basis with the addition of traffic anticipated under the proposed action. The channel capacity analysis considered a mix of vessel types for transport of bulk liquids under the proposed action and channel capacity constraints under three channel depth scenarios.
- **Berth capacity.** The berth capacity analysis compared berth occupancy at Terminal 1 under the proposed action to berth availability.
- **Pilot and escort tug capacity.** The pilots and escort tug analysis was completed by qualitatively assessing whether the potential increase in demand for state-licensed pilots and escort tugs could be met with the pilots and tugs currently under contract with the Port.
- **Conflicts with recreational and fishing vessels.** Potential conflicts of large commercial vessels with smaller recreational and fishing vessels in the harbor were evaluated by determining the

[3] The channel capacity analysis considers the large commercial vessels, which are restricted to the navigation channel due to the depth of their drafts.

extent of traffic related to these smaller vessels in the harbor (number of vessels, nature, geographic extent, and timing of operations) and qualitatively assessing the extent of the disruption to these vessel operations because of large commercial vessel traffic within the navigation channel.

3.17.4 What vessel traffic currently occurs in the study area?

Vessel traffic in the study area includes a mix of large commercial vessels and smaller fishing (commercial, tribal, and recreational) and recreational vessels. Depending on the type of operation, the vessel traffic in the study area varies in intensity, both geographically and seasonally. This section describes existing vessel traffic and navigational considerations, including the vessel traffic management system.

3.17.4.1 Grays Harbor

Grays Harbor is a large, naturally formed bay on the west coast of Washington State. It is an estuary fed by multiple rivers and creeks, the most significant being the Chehalis River. Offshore, extending approximately 2 miles from the mouth of the bay is an entrance bar[4] composed of sand and silt, which is subject to the effects of tide, current, and ocean forces. The bay enclosed in Grays Harbor is filled by many shoals[5] and flats, some of which are bare at low water and are cut by numerous channels. Grays Harbor experiences semidiurnal tides, meaning that it has two uneven tidal cycles each day (two high tides and two low tides). The harbor has two jetties at its entrance approximately 1.17 nautical miles (7,120 feet) apart (Figure 3.17-1). The two jetties were originally constructed from 1889 to 1913 for harbor navigation.

The entrance bar, coupled with strong and sometimes erratic currents, can present a navigational challenge to vessels entering or leaving Grays Harbor. Periods of limited visibility due to fog, rain, or darkness can add to this challenge. Submerged sections of the north and south jetties at the harbor entrance extend seaward about 0.2 and 0.9 mile, respectively. Hazardous breakers can occasionally be present near these jetties, especially during periods of heavy weather (National Oceanic and Atmospheric Administration 2014b:459).

Figure 3.17-1 shows the navigation channel through Grays Harbor and out to the Pacific Ocean, identifying individual reaches and Port terminals.

3.17.4.2 Large Commercial Vessels

Large commercial vessels traveling in Grays Harbor call at facilities maintained by the Port or at privately owned wharfs located farther east (Figure 3.17-2). Bulk exports (especially shipments of grain, soybeans, and other agricultural products) are the largest volume of commodity handled at Port facilities (Washington State Department of Ecology 2015). The Port terminals, terminal operators, vessels, and products transported are described below (Grays Harbor Safety Committee 2014:9; National Oceanic and Atmospheric Administration 2014b:462; U.S. Army Corps of Engineers 2012:74, 156).

[4] A bar is a large mass of sand or earth, formed by the surge of the sea. Bars located at the entrance of a harbor often render navigation extremely dangerous, but confer tranquility once inside.
[5] Shoals are an accumulation of sand and silt that reduce the depth of the navigation channel for transiting vessels.

- Terminal 1 is a bulk liquid storage and marine and rail transfer facility. It has one deepwater berth and access to the Puget Sound & Pacific Railroad (PS&P) rail line. The applicant and Westway Terminal Company LLC receive tank vessels transporting bulk liquids.
- Terminal 2 is a loading facility for both dry and bulk liquid products and is served by the Port's loop track. Ag Processing, Inc. receives dry-cargo vessels transporting bulk agricultural materials (e.g., grain) and Dkoram and Willis Enterprises receive dry-cargo vessels transporting wood products.
- Terminal 3 is a 150-acre industrial site with vessel and rail access. This terminal is currently unoccupied; it the proposed site of a Grays Harbor Rail Terminal development.
- Terminal 4 is the largest of the four terminals. It is a storage and transfer facility with two deepwater berths and on-dock rail service. Terminal 4 serves as the primary terminal for automobiles and bulk cargo. It is currently operated by Siem Car Carriers and Pasha Group.

Most of the large commercial vessels operating in Grays Harbor comprise the following types of vessels.

- **Tank vessels** carry bulk liquids, including oil, methanol, nontoxic vegetable oils, and biodiesel. They consist of self-propelled **tankers** and **tank barges** that require an escort tug.
- C**argo vessels** carry grain, wood, and other dry projects. They consist of self-propelled **cargo ships**, **cargo barges** that require an escort tug, and **RoRo vessels** (roll-on/roll-off) that carry wheeled vehicles (Figure 3-17-3). In this document, the term *cargo vessel* refers to vessels carrying dry cargo only (not liquid cargo).

All of the large commercial vessels, except for the cargo barges, are considered deep-draft[6] vessels. Because of their draft depths, these vessels are restricted in their ability to maneuver in Grays Harbor area and are limited to transit in the navigation channel and at the Port terminal berths. The shallower-draft cargo barges are not restricted to the navigation channel and can travel to locations at the mouth of the Chehalis River and further upstream (see Section 3.17.5.2, *Proposed Action,* for further discussion of typical tank vessels and their design drafts).

[6] Vessel draft is the vertical distance between the water line and the bottom of the vessel.

Figure 3.17-2. Sources of Large Commercial Vessel Activity in the Study Area

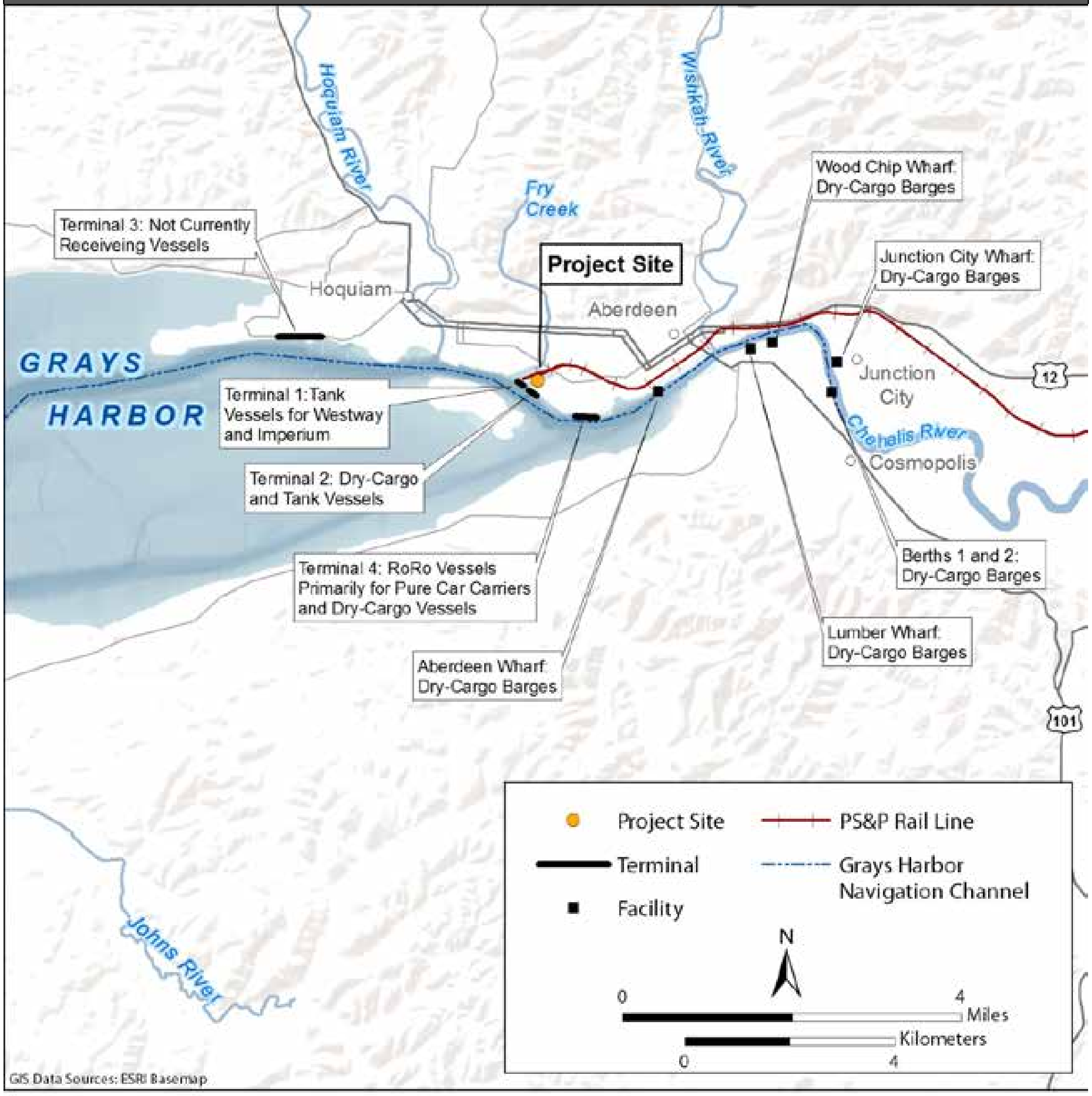


Figure 3.17-2
Sources of Vessel Activity in Grays Harbor

Figure 3.17-3. Typical Large Commercial Vessels Using Grays Harbor

Tanker
Primary use: bulk liquid transfer
Deadweight tonnage: 53,100 metric tons
Capacity: 320,000 barrels
Length: 612 feet; Breadth: 106 feet

Tank Barge
Primary use: bulk liquid transfer
Deadweight tonnage: 20,000 metric tons
Capacity: 155,000 barrels
Length: 604 feet; Breadth: 75 feet

Cargo Ship
Primary use: dry bulk cargo
Deadweight tonnage: 43,000 metric tons
Length: 656 feet; Breadth: 105 feet

Cargo Barge
Primary use: dry bulk cargo
Deadweight tonnage: 11,000 metric tons
Length: 512 feet; Breadth: 85 feet

RoRo Vessel (Cargo Ship)
Primary use: automobiles
Deadweight tonnage: 11,760 metric tons
Length: 600 feet; Breadth: 103 feet

Commercial Fishing Vessel
Primary use: fishing
Deadweight tonnage: 100–2,000 metric tons
Length: 82–262 feet; Breadth: 20–40 feet

Source: WorleyParsons 2014

Large Commercial Vessel Operations

This section describes the operational considerations relevant to large commercial vessels in the study area.

Vessel Operator and Crew Responsibilities

The vessel operator is responsible for scheduling—in advance of the vessel arriving at the Port—all activities associated with navigation, berthing, vessel safety, and security while in Grays Harbor. The vessel operator procures the state-licensed pilot through the Port consistent with applicable federal and state regulations, if required (Federal Pilotage Requirements 46 Code of Federal Regulations [CFR] 15.610 and 16.812 and Washington State Pilotage Act Revised Code of Washington [RCW] 88.16). The role of the Port, pilots, and the Port's tenants and vessel agents in facilitating large commercial vessel traffic in Grays Harbor is further described in Section 3.17.4.4, *Vessel Traffic Management*.

The vessel operator also contracts with an approved ship's stevedore[7] to handle the vessel side of the operations during vessel loading and unloading. The ship's crew handles all of the underway tasks, including berthing and departure activities, under the direction of the pilot and or ship's master. The crew is also responsible for maintaining the anchor watch when a vessel is anchored in Grays Harbor. When the incoming or outgoing vessel is a laden tank barge, it is escorted by a tug according to harbor safety guidelines; the escort tug's captain brings the vessel all the way to the terminal. A Grays Harbor pilot is not required when the arriving or departing vessel is a tank barge on a coastwise voyage, but a pilot is typically employed (WorleyParsons 2014).

Escort Tug Services

The Port provides various services such as pilotage, ship assistance (with escort tugs), line handling, and terminal stevedoring (WorleyParsons 2014) to large commercial vessels operating in the study area. The Port has a contract with Brusco Tug & Barge through 2016 for tug escorting and docking services; the contract specifies requirements for bollard strength and engine capacity. Brusco Tug & Barge has three harbor tugs stationed in Grays Harbor that are exclusively available for commercial vessel assistance in the harbor. These three tugs manage the escorts required for the current numbers and types of commercial vessels transiting Grays Harbor. Two of the escort tugs are Z-drive tugs,[8] which are highly maneuverable. Each has a towing power of over 100,000 pounds and a fire monitor. One of these two tugs has an installed tank to carry foam for spraying from the fire monitor, if necessary. The third tug is a highly maneuverable ship-assist tug (Campbell pers. comm.) The Z-drive tugs are capable of leaving Grays Harbor to assist a disabled or damaged vessel at sea.

The existing emergency response towing vessel at Neah Bay, located at the far northwest corner of Washington State, is available to assist vessels off the coast of Washington and in Puget Sound. It could assist with vessels in a difficult situation in or near Grays Harbor; however, under normal weather conditions, it could take an average of 12 hours to reach the harbor. Under adverse weather conditions, transit time to Grays Harbor could be as much as 18 hours.

[7] Stevedores (longshore workers) connect hoses for bulk liquid transfer operations and provide assistance for vessels at the terminal.
[8] A Z-drive tug is so named because of the appearance of the mechanical transmission used to connect the driving energy to the thruster device.

Anchorage Areas

Incoming vessels may be anchored near the entrance to Grays Harbor while awaiting a vessel to leave Terminal 1 or to transit through the navigation channel. Vessels may also be anchored after loading if entrance bar conditions are not suitable for immediate transit seaward. Vessel anchorage areas are located just inside the harbor, as shown on Figure 3.17-1.

Anchorage areas available in Grays Harbor for commercial vessels are frequently reevaluated and assigned through a joint effort assessment by the pilots, USCG, and USACE. The pilots and USCG monitor conditions at the anchorage areas based on their daily observations while navigating Grays Harbor and the continuously updated sounding data for Grays Harbor and its navigation channel, which they receive from USACE (WorleyParsons 2014). The current deep-draft vessel anchorage areas can accommodate three large deep-draft vessels with adequate capacity for the vessel to swing on the anchor in response to wind or currents (D'Angelo pers. comm.). The Grays Harbor Safety Plan includes standards of care for anchorage operations (Grays Harbor Safety Committee 2014).

Grays Harbor Navigation Channel

The navigation channel provides access for deep-draft vessels to Port facilities in the harbor. Nearly 23 nautical miles long, it begins approximately 4 miles offshore, runs in a predominantly easterly direction past Westport, Hoquiam, and Aberdeen, and ends at Cosmopolis near the mouth of the Chehalis River. The bar area outlined by yellow lines in Figure 3.17-1 is the Regulated Navigation Area established by USCG. Grays Harbor has a complex navigation route due to the bar at the entrance, a constrained channel, and limited depth. Constrained by shoals and flats, the navigation channel narrows to 0.6 mile wide with a number of turns where course changes are required (Washington State Department of Ecology 2015). USACE is responsible for maintaining the navigation channel by periodically dredging and removing obstructions. The depths at which USACE maintains the channel reaches are referred to as project depths. Because of shoaling, actual channel depths may vary considerably from project depths between maintenance dredging. Shoaling in the middle of the channel restricts a vessel's draft, while shoaling along the edges of the channel can affect vessel squat[9] and the ability of vessels to pass in the channel. The following sections describe the terms used for channel depths in this analysis.

The following navigation rules (Inland Navigation Rules, Rules 9, 13, and 18) apply to the navigation channel, which gives tankers and tank barges the right-of-way within the channel (WorleyParsons 2014).

- A vessel of less than 20 meters in length, a sailing vessel, or a vessel engaged in fishing shall not impede the passage of any other vessel navigating within a narrow channel or fairway.
- A vessel shall not cross a narrow passage or fairway if such crossing impedes the passage of a vessel that can safely navigate only within such channel or fairway.
- In a narrow channel or fairway, any overtaking has to be permitted by the vessel being overtaken.

[9] Vessel squat is the tendency of a vessel to draw more water astern (i.e., behind or toward the rear of the vessel) when it is moving through a water body. The streamlines of return flow are speeded up under the ship. This causes a drop in the pressure, resulting in the ship dropping vertically in the water and, effectively, increasing draft.

- All sailing, fishing vessels and power-driven vessels shall keep out of the way of a vessel restricted in her ability to maneuver.

2014 Controlling Depths

The National Oceanic and Atmospheric Administration is responsible for maintaining navigational charts. Periodic surveys by USACE and the National Oceanic and Atmospheric Administration determine the actual or *controlling* depth of water in the navigation channel at the time of the survey. Controlling depths are the depths that dictate the maximum draft of vessels (based on the minimum depths of the water). Controlling depths for each reach (section) of the navigation channel, based on surveys from December 2013 and corrected through August 2014, are presented in Table 3.17-2. According to the latest surveys, there is a substantial difference between the project or design depth (described below) of the navigation channel and the actual surveyed depth, referring to as controlling depth, in some reaches.[10] Based on the latest surveys, the Crossover Channel Reach, with a controlling depth of 27 feet mean lower low water (MLLW), is currently limiting vessel draft in Grays Harbor. Therefore, 27 feet MLLW represents the 2014 controlling depth.

2014 Project Depth

Each reach (section) of the navigation channel has project dimensions (depth, width, height), as authorized by Congress. Project dimensions for each reach of the navigation channel are presented in Table 3.17-2. Project depths range from 46 feet MLLW in the Bar Channel Reach to 36 feet MLLW in the North Channel, Hoquiam, and Cow Point Reaches. Vessels traveling between the Bar Channel Reach and terminals are limited by the shallowest reach of the navigation channel. Therefore, 36 feet MLLW represents the 2014 project depth.

[10] For example, a controlling channel depth of 27 feet mean lower low water (MLLW) in the middle half of the Crossover Channel Reach of the navigation channel (Table 3.17-2) is 9 feet less than the federally authorized project depth of 36 feet MLLW. Controlling depths in the middle half of the North Channel and Hoquiam Reaches of the navigation channel (Figure 3.17-1) are 6 feet and 4 feet less than the project depth, respectively.

Table 3.17-2. Port of Grays Harbor Navigation Channel Controlling Depths and Project Dimensions

	Controlling Depths at MLLW (feet)			Project Dimensions		
Channel Reach	Left Outside Quarter	Middle Half	Right Outside Quarter	Width (feet)	Length (nautical miles)	Depth MLLW (feet)
Bar Channel	45	46	46	1,000	4.6	46
Entrance Channel	35	41	30	900–600	1.8	42
Pt. Chehalis Reach	37	35	28	600	1.2	40
South Reach	29	35	35	600–350	4.1	36
Crossover Channel	22	27	23	350–450	2.5	36
North Channel	27	30	23	450–350	2.4	36
Hoquiam Reach	19.	32	26	350	1.9	36
Cow Point Reach	24	36	33	350–900	1.8	36
Aberdeen Reach	18	22	26	550–200	2.6	32
Turning Basin	30	29	23	200–550	0.3	32
Thence to Cosmopolis	23	25	27	200	0.8	32

MLLW = mean lower low water

2017 Project Depth

The USACE Seattle District recently completed a General Investigation Feasibility Study (U.S. Army Corps of Engineers 2014a:21) at the request of the Port to investigate deepening the navigation channel to a legislatively authorized depth of 38 feet MLLW. The project would deepen the navigation channel to a new project depth of 38 feet MLLW between South Reach and Cow Point Reach. Dredging for channel deepening is anticipated to occur between 2016 and 2017. Upon completion of the project, the limiting depth for the transit between the Bar Channel Reach and Port terminals would be 38 feet MLLW. Therefore, 38 feet MLLW represents the 2017 project depth.

Channel Depth Constraints

Channel depth constraints must be considered when large commercial vessels navigate the channel. Pilots are responsible for knowledge of local conditions, including channel depth and tides, and must account for changes in conditions when guiding vessels through the harbor. Vessel operators planning to transit Grays Harbor must consider many factors when planning arrival times to ensure there is sufficient water under the ship's keel[11] at all times to keep the vessel from touching the bottom. To prevent vessel grounding, the pilot and vessel operator must know the vessel's maximum draft (accounting for vessel squat), margins of safety for under-keel clearance, and the anticipated depth of the water in the navigation channel (based on charted depths and tidal corrections). Each of these considerations is discussed further below.

Vessel Draft

Vessel draft is the vertical distance between the water line and the bottom of the keel (Figure 3.17-4). Drafts for large commercial vessels vary depending on the vessel and degree that

[11] The keel runs in the middle of the ship, from the bow to the stern and serves as the primary source of structural strength of the hull.

the vessel is loaded or in ballast.[12] Cargo vessels tend to have a deeper draft than cargo barges. Tankers such as the Panamax-size vessels accommodated in Grays Harbor tend to have a deeper draft than tank barges. In addition to vessel type, vessel loading is a primary determinant of vessel draft, with fully or partially loaded vessels having deeper drafts than empty vessels.

Vessel Squat

Vessel squat describes the tendency of a ship to sink vertically toward the seabed when it is moving through shallow water or a channel. Vessel squat increases the draft of the vessel and reduces under-keel clearance. Figure 3.17-4 shows that at 0 feet of tide height, a deep-draft vessel actually has less under-keel clearance due to squat as the vessel moves through the navigation channel. The effect of squat in the figure is represented by a 1-foot vertical drop and an overall reduction in under-keel clearance by that same amount. Ship speed is a main factor for vessel squat.

Under-Keel Clearance

Under-keel clearance is the vertical distance between the deepest point of the vessel's hull and the seabed (Figure 3.17-4). When entering Grays Harbor, an under-keel clearance of 10% after squat is recommended to ensure sufficient water under the keel and reduce the risk of vessel grounding (D'Angelo pers. comm.). For example, if the vessel's maximum draft is 33 feet, an additional 3.3 feet of water should be maintained under the keel, meaning the channel depth would need to be no less than 36.3 feet deep to accommodate safe passage of the vessel.

Tidal Influences on Channel Depth

Grays Harbor experiences two high tides and two low tides each day of different heights. Water depth on the charts (nautical maps) and surveys for the west coast is referenced in terms of MLLW[13]. To determine the depth of water available at any given time, the calculated height of the tide is added to the number listed on the chart. For example, if the chart lists the depth at 36 feet and the current height of the tide is 5 feet, the depth of water at that time and place would be 41 feet. Figure 3.17-4 shows that when a vessel with 32 feet of draft transits a channel that is 36 feet deep during a tide height of 5 feet, there are 9 feet of clearance under the keel. Because the tide is in a near-constant state of ebb and flow, the pilot and vessel operator must plan the vessel transit with knowledge of the level of the tide at all points along the intended route.

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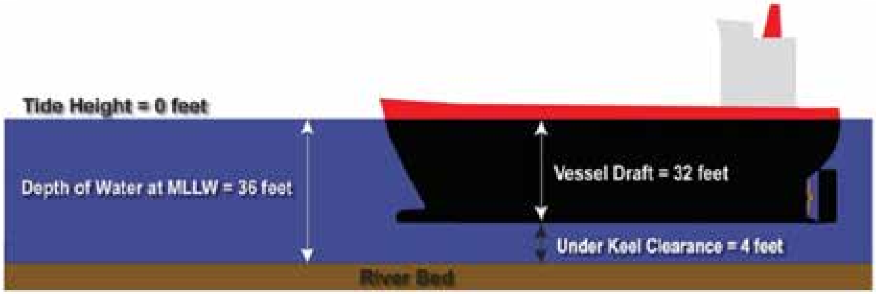
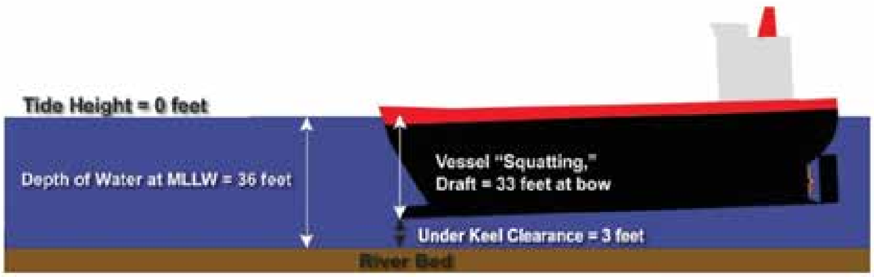
[12] Vessels *in ballast* have had their tanks loaded with seawater to increase vessel stability.

[13] Mean lower low water (MLLW) is the average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch. The number of navigable windows available at a tidal elevation equal to or more than 8 feet includes windows available at tidal elevations equal to or more than 9 and 10 feet. Therefore, the number of navigable windows declines with increasing tidal elevation. While an estimated 1,627 navigable windows per year occur when the tide is 4 or more feet MLLW, only an estimated 21 navigable windows per year occur when the tide is 10 or more feet MLLW.

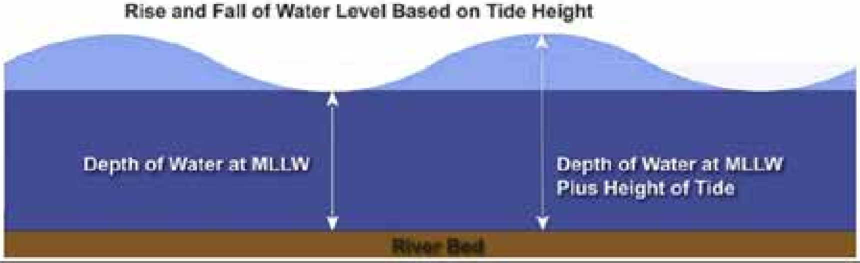
Figure 3.17-4. Example of Factors Affecting Under-Keel Clearance



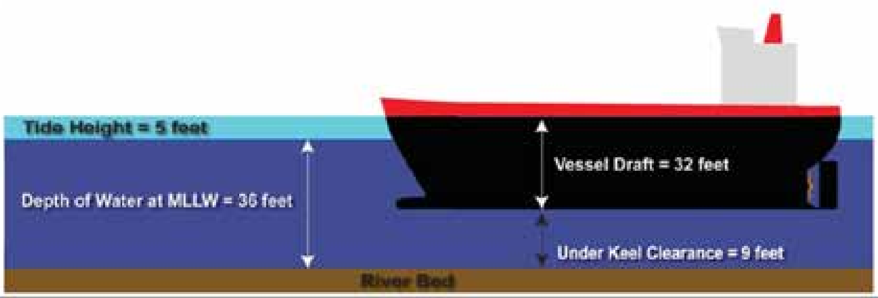
If the vessel has a 32-foot draft, the channel is at project depth of 36 feet MLLW, and tide is at 0 feet, under-keel clearance is 4 feet.



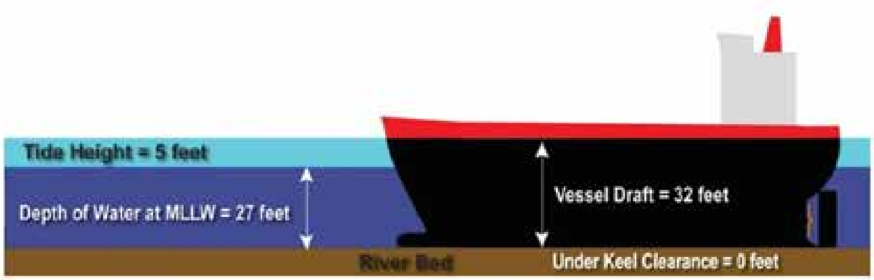
This vessel is squatting. It is down 1 foot at the bow, reducing under-keel clearance to 3 feet.



To determine the depth of water available at any given time, the calculated height of the tide is added to the charted depth.



If a vessel has a 32-foot draft, the channel is ai project depth of 36 feet MLLW, and tide is at 5 feet, under-keel clearance is 9 feet.



In the Crossover Channel, channel depth is 27 feet MLLW. A vessel with 32-foot draft will run aground at tides under 5 feet.

Navigable Windows and Maximum Vessel Draft

Entry into Grays Harbor by large commercial vessels is scheduled and arranged by the Port and pilots. Pilots consider factors such as tides, weather, channel depth, pier availability, and vessel type when preparing to enter a port. It takes approximately 2 hours for vessels to transit the navigation channel between the entrance buoy (3 nautical miles outside the channel) and Terminal 1. As stated above, Grays Harbor experiences two high tides and two low tides each day of different heights. According to the U.S. Coast Pilot 7, the mean rise of the tide in Grays Harbor is about 9 feet (National Oceanic and Atmospheric Administration 2014b:259).[14]

Transit by deep-draft vessels through the navigation channel is typically planned when tidal elevations are close to high tides. This provides an additional measure of safety because the distance between the bottom of the ship and the bottom of the channel is greater. Pilots scheduled most deep-draft vessel transits (between 74 and 94% over 8 years, from 2005 to 2012) through the navigation channel when tidal elevations were at 5 feet or above MLLW (U.S. Army Corps of Engineers 2014a:21).

Table 3.17-3 summarizes the number of 2-hour windows, referred to as navigable windows, available at tidal elevations between 4 and 10 feet, based on monthly tidal data for 2012 for the Westport tidal station (National Oceanic and Atmospheric Administration 2014c).

Table 3.17-3. Number of Navigable Windows per Year by Tidal Elevation

	Tidal Elevation (feet MLLW)						
	≥4	**≥5**	**≥6**	**≥7**	**≥8**	**≥9**	**≥10**
Navigable windows per year[a]	1,627	1,274	904	593	298	102	21

[a] Navigable (2-hour) windows are cumulative. For example, the number of navigable two-hour windows available at a tidal elevation of ≥8 feet, includes windows available at tidal elevations ≥9 feet and ≥10 feet.
MLLW = mean lower low water

Table 3.17-4 describes limitations on vessel draft during transit through the navigation channel at tidal elevations between 4 and 10 feet, under three channel depth scenarios.

- 2014 controlling depth: 27 feet MLLW
- 2014 project depth: 36 feet MLLW
- 2017 project depth: 38 feet MLLW

Channel depth is the primary limitation for transiting deep-draft vessels, because it establishes the maximum depth of water available within the range of tidal elevation. For each combination of tidal elevation and channel depth, the depth of water available in the channel is calculated, as well as the maximum vessel draft that could transit the channel. The estimated maximum vessel draft able to transit the channel is conservative, and accounts for tidal influences, vessel squat, and a 10% margin of safety for under-keel clearance, as described above in *Channel Depth Constraints.* Actual maximum vessel draft able to navigate the channel at each channel depth and tidal elevation may vary from

[14] To estimate the frequency that vessels with varying drafts would be able to navigate the channel under different channel conditions, the number of navigable windows and maximum vessel draft were estimated for each tidal elevation between 4 and 10 feet above MLLW, using 2012 tidal heights.

what is described in Table 3.17-4, depending on actual channel conditions at the time of transit and specifications of the transiting vessel.

Table 3.17-4. Maximum Vessel Draft by Tidal Elevation and Channel Depth

	Tidal Elevation (feet)						
Channel Condition	**≥4**	**≥5**	**≥6**	**≥7**	**≥8**	**≥9**	**≥10**
2014 Controlling Depth (27 feet MLLW)							
Water depth (feet)[a]	31	32	33	34	35	36	37
Maximum vessel draft (feet)[b]	27	28	29	29.5	30	31	32
2014 Project Depth (36 feet MLLW)							
Water depth (feet)[a]	40	41	42	43	44	45	46
Maximum vessel draft (feet)[b]	35	36	37	38	39	39.5	40
2017 Project Depth (38 feet MLLW)							
Water depth (feet)[a]	42	43	44	45	46	47	48
Maximum vessel draft (feet)[b]	37	38	39	39.5	40	41	42

[a] Water depth equals the channel depth at MLLW + tidal elevation.
[b] Maximum vessel draft accounting for vessel squat and a 10% margin of safety for under-keel clearance.
MLLW = mean lower low water

These tables show that as vessel draft increases, the number of navigational windows available for transiting Grays Harbor decreases. For example, at the current controlling depth, vessels with a 32-foot draft require a tidal elevation of 10 feet or more. This amount of water is available only 21 times a year. However, pilots may find greater flexibility at the time of navigation, based on current conditions and expert knowledge of local waters.

Under the 2014 project depth of 36 feet MLLW or 2017 project depth of 38 feet MLLW, maximum vessel draft at each tidal elevation increases (Table 3.17-4), providing more navigable windows for deeper-draft vessels.

Large Commercial Vessel Traffic

Recent trends in large commercial vessel traffic at the Port were considered over a 5-year period from 2008to 2012 (U.S. Army Corps of Engineers 2014b). Over this period, there were a total of 1,448 cargo vessel trips and 67 tank vessel trips.[15]

Table 3.17-5 details annual cargo vessel trips by vessel draft. Over this 5-year period, cargo barge trips declined by 77%, while cargo ships trips roughly doubled.

[15] A trip represents one-way travel; in other words, an inbound trip and an outbound trip are counted as two trips.

Table 3.17-5. Distribution of Cargo Vessel Trips by Vessel Draft (2008–2012)

	Cargo Barge Trips						Cargo Ship Trips[a]					
Vessel Draft (feet)	2008	2009	2010	2011	2012	Total	2008	2009	2010	2011	2012	Total
0–5	209	103	89	145	37	583	0	0	0	0	0	0
6–9	16	3	0	3	5	27	2	0	0	0	12	14
10–12	37	30	28	15	16	126	3	0	0	0	27	30
13–14	18	6	9	10	10	53	26	8	0	0	10	44
15–17	12	2	0	0	0	14	2	0	1	0	0	3
18–20	0	0	0	0	0	0	12	8	19	12	6	57
21–23	0	0	0	0	0	0	18	22	27	12	28	107
24–26	0	0	0	0	0	0	2	13	24	32	31	102
27–29	0	0	0	0	0	0	7	6	15	28	40	96
30–32	0	0	0	0	0	0	10	6	20	10	14	60
33–35	0	0	0	0	0	0	18	12	15	13	11	69
36–38	0	0	0	0	0	0	5	10	10	6	15	46
39–40	0	0	0	0	0	0	0	1	1	2	13	17
Total	**292**	**144**	**126**	**173**	**68**	**803**	**105**	**86**	**132**	**115**	**207**	**645**

Source: U.S. Army Corps of Engineers 2014b
[a] This source uses the term *dry-cargo;* includes RoRo vessels.

Table 3.17-6 summarizes annual tank vessel trips by vessel draft. Over the 5-year period, 65 of the 66 trips were made by tankers.

Table 3.17-6. Distribution of Tank Vessel Trips by Vessel Draft (2008–2012)

	Tank Barge Trips						Tanker Trips					
Vessel Draft (feet)	2008	2009	2010	2011	2012	Total	2008	2009	2010	2011	2012	Total
15–17	0	0	0	1	0	1	0	0	0	2	0	2
18–20	0	0	0	0	0	0	1	1	0	7	0	9
21–23	0	0	0	0	0	0	3	3	1	3	0	10
24–26	0	0	0	0	0	0	5	0	1	6	0	12
27–29	0	0	0	0	0	0	4	1	1	5	4	15
30–32	0	0	0	0	0	0	4	1	0	4	0	9
33–35	0	0	0	0	0	0	3	2	0	0	2	7
36–38	0	0	0	0	0	0	0	1	0	1	0	2
Total	**0**	**0**	**0**	**1**	**0**	**1**	**20**	**9**	**3**	**28**	**6**	**66**

Source: U.S. Army Corps of Engineers 2014b

Table 3.17-7 summarizes annual vessel trips by vessel type and ranges of vessel draft over the 5-year period. Vessel data were summarized for three ranges of vessel drafts: less than 21 feet, 21 to 32 feet, and more than 32 feet. These ranges in vessel draft represent different levels of navigational flexibility. Under current channel conditions, vessels that have drafts under 21 feet have minimal navigational constraint; vessels that have drafts between 21 and 32 feet are likely to find navigable windows , especially at higher tidal elevations; and vessels that have drafts deeper than 32 feet would be highly constrained.

An average of 290 cargo vessels transited each year, compared to an average of 13 tank vessels. Cargo vessels typically had a shallower draft than tank vessels. Approximately 66% of cargo vessels had drafts less than 21 feet, but 69% of tank vessels had drafts between 21 and 32 feet. There were an average of 26 trips per year by cargo vessels with drafts more than 32 feet, and an average of only two tank vessels per year with drafts more than 32 feet.

Overall, 1,515 trips were recorded over the 5-year period: 96% cargo vessels and 4% tank vessels. Of all vessel trips, approximately 64% were by vessels with drafts less than 21 feet, 27% by vessels with drafts between 21 and 32 feet, and 9% by vessels with drafts over 32 feet.

Comparing the actual number of trips (Table 3.17-7) to the estimated number of navigable windows by vessel draft confirms that the assumptions of this analysis are conservative. For example, 41 vessels with drafts more than 32 feet transited the harbor in 2012 compared to an estimated 21 navigable windows per year.

Table 3.17-7. Vessel Trips by Year, Vessel Type, and Vessel Draft (2008–2012)

Vessel Type or Draft	Trips by Year 2008	2009	2010	2011	2012	Total	Avg/yr
Cargo Vessels by Type[a]							
Barge	292	144	126	173	68	803	161
Ship	105	86	132	115	207	645	129
Total	397	230	258	288	275	1,448	290
Cargo Vessels by Draft							
<21 feet	337	160	146	185	123	951	190
21–32 feet	37	47	86	82	113	365	73
> 32 feet	23	23	26	21	39	132	26
Tank Vessels by Type							
Tank barge	0	0	0	1	0	1	<1
Tanker	20	9	3	28	6	66	13
Total	20	9	3	29	6	67	13
Tank Vessels by Draft							
< 21 feet	1	1	0	10	0	12	2
21–32 feet	16	5	3	18	4	46	9
> 32 feet	3	3	0	1	2	9	2
All Vessels by Type							
Cargo barges and tank barges	292	144	126	174	68	804	161
Cargo ships and tankers	125	95	135	143	213	711	142
Total	**417**	**239**	**261**	**317**	**281**	**1,515**	**303**
All Vessels by Draft							
< 21 feet	338	161	146	195	123	963	193
21–32 feet	53	52	89	100	117	411	82
> 32 feet	26	26	26	22	41	141	28

Source: U.S. Army Corps of Engineers 2014b
[a] This source uses the term *dry-cargo*: includes RoRo vessels.

3.17.4.3 Fishing and Recreational Vessels

Fishing and recreational vessels are much smaller than the large cargo ships and tank vessels already discussed and can move about the harbor without being restricted to the navigation channel because of their shallower drafts. Recreational and tribal fishing are addressed in more detail in Section 3.10, *Recreation*, and Section 3.12, *Tribal Resources*, respectively.

Commercial Fishing Operations

Commercial fishing in the study area includes gillnetting[16] and crabbing. Commercial salmon gillnetters harvest an average of 4,700 coho and 2,000 chum annually (Scharpf pers. comm.). For Grays Harbor and Chehalis River, state regulations set strict rules and fishing schedules on commercial gillnetting. Commercial fishers are restricted to drift gillnet use where the fisher deploys the net from the bow or stern of the fishing vessel perpendicular to the navigation channel.

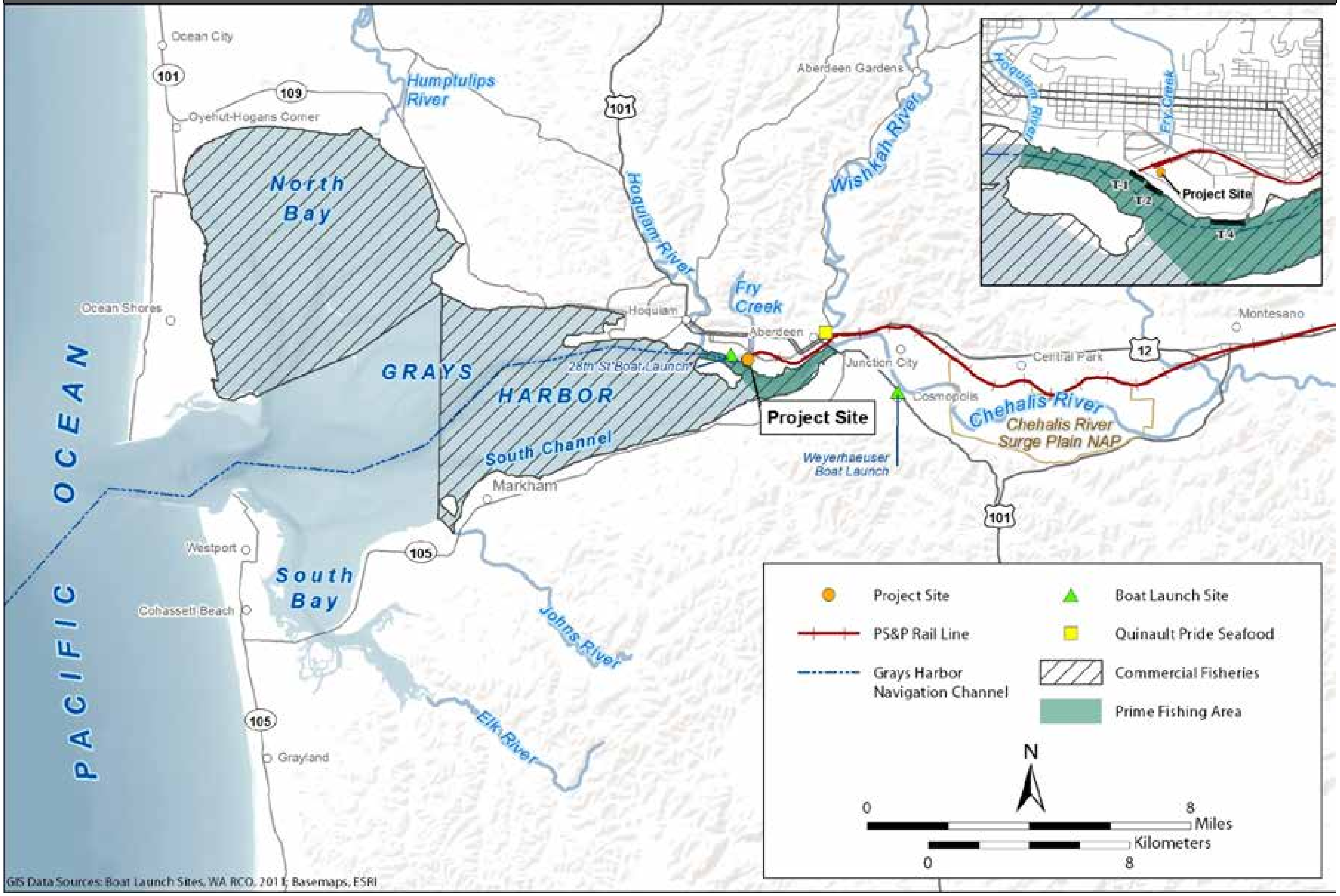
[16] Drift nets only.

Fishers attempt to deploy gillnets to cover as much of the channel as possible to maximize catch. The net is allowed to drift with the currents, sweeping the channel for fish. Fishers need to actively monitor the net and need to be prepared to adjust the net position in the channel to avoid known hazards (e.g., logs, shallow bars, and potentially other vessels).

Commercial regulations for Grays Harbor limit gillnet soak times (from when the net first enters water to when it is completely removed) to less than 45 minutes (Washington Department of Fish and Wildlife 2014). At the end of a drift, the fisher retrieves the net, removing fish at the same time. As reference, information from the Quinault Indian Nation (2015:11) reports time to retrieve a net between 5 minutes at the quickest to 2 hours if the net is loaded with fish.

The commercial gillnet fishing period occurs in the fall (September through November) on permissible days and times in designated areas in the harbor and river (Salmon—Grays Harbor Fall Fishery, WAC 220-36-023). Approximately 15 to 25 boats participate each year up to 5 days per week during the open season (Scharpf pers. comm.) During the open season, permitted areas for commercial gillnetting in the harbor include North Bay and the eastern half of Grays Harbor (Figure 3.17-5). Permitted commercial gillnetting in the Chehalis River occurs from the harbor to the extent shown on Figure 3.17-5, during the same open fishing season as Grays Harbor. However, most commercial fishing occurs in the navigation channel from the Hoquiam River east (Scharpf pers. comm.). The South Bay and central portion of the harbor have been closed to commercial gillnetting since 2005 because of its impacts on Grays Harbor chum and Chehalis River–origin fall Chinook (Washington Department of Fish and Wildlife 2013). Although this area has been closed to commercial fishing for years and is not anticipated to be reopened in the near future, this area could be reopened if salmon stocks increase in numbers (Scharpf pers. comm.).

Figure 3.17-5. Areas of Commercial Fishing in the Study Area



Commercial crabbing occurs along the Washington coast and in Grays Harbor. Over 200 licensed Washington commercial crab fishers participate during the crabbing season (Washington Department of Fish and Wildlife 2015), which is managed by the state. In Grays Harbor, the commercial crabbing season typically runs from December 1 through September 15 (Washington Department of Fish and Wildlife 2015). Unlike gillnetting, all areas of Grays Harbor are permitted for commercial crabbing. Commercial crab harvests in Grays Harbor vary annually and have averaged approximately 71,000 crabs per year over the last 6 years (Washington Department of Fish and Wildlife 2015).

Commercial Fishing Boat Launches and Marinas

The following marinas and public boat launches at the harbor service commercial fishing vessels. The Westport Marina, on the southern peninsula near the entrance to Grays Harbor (Figure 3.17-5), houses more than 200 commercial fishing vessels, including 26 tribal fishing boats, and numerous recreational boats. The marina consists of 21 floats with moorage space for 650 charter, commercial, and sport-fishing vessels (for vessels up to 200 feet). The marina is known as Washington State's largest fish-landing port and, in addition to mooring, provides many boating and fishery services, including loading and fuel docks, a public boat launch, boat manufacturing and repair services, shore-side seafood processing, support service facilities, and fishing supplies.

The Ocean Shores Marina is located on the northern peninsula near the entrance to Grays Harbor but is not currently maintained or open to the public. Additionally, commercial fishing vessels access the harbor via the 28th Street Boat Launch (adjacent to the project site) and the Weyerhaeuser Boat Ramp in Cosmopolis (along the Chehalis River).

Commercial Fishing and Recreational Vessel Traffic

Although there can be as many as 400 or more commercial, tribal and recreational vessels in the harbor during peak fishing times (Scharpf pers. comm.), fishing activities are highly seasonal and occur primarily in the fall with the highest point in September. Commercial and recreational boaters are not limited to the navigation channel and must obey the navigational rules (Inland Navigation Rules 33 CFR 83) to give way to the larger commercial vessels that are limited in their ability to maneuver. All vessels fishing in the navigation channel may have to move gillnets out of the way or risk damage or loss. Under existing conditions, this disruption occurs primarily in the fall during the fall salmon run. In addition, ocean-fishing vessels may use the navigation channel to transport their catch to the harbor. Fishing and recreational vessels move throughout the harbor differently than large commercial vessels. To lessen the danger of hazardous conditions during incoming or outgoing tides, bar crossings are often timed during slack high or low tides, whereas large commercial vessels tend to navigate through the channel when tidal elevations are more than 5 feet.

3.17.4.4 Vessel Traffic Management

The Port, pilots, and USCG are responsible for vessel traffic management in Grays Harbor. Currently, the Port uses an informal vessel management and tracking system for Grays Harbor. The Port monitors and controls vessel movements by routinely communicating with the vessel operators, pilots, and terminals to schedule berths, pilots, and other resources for all arriving and departing vessels. USCG is responsible for establishing navigation rules and for vessel safety in U.S. waters.

Port of Grays Harbor and Washington State Pilots

The Port is involved when vessels call at berths owned and operated by the Port. The Port and Washington State-licensed pilots work closely together when managing vessel movements. The Port's tenants and vessel agents are responsible for providing safe and operationally reliable vessels and commodity information to the Port that directly affects both of the Port's and pilot's traffic management decision-making (WorleyParsons 2014).

For foreign-flagged vessels, a state-licensed pilot is responsible for creating the vessel's itinerary to and from the entrance to Grays Harbor, requesting adequate escort tug services, and navigating the vessels in the channel. For a U.S. vessel operating between U.S. ports, a federally licensed captain is responsible for creating the vessel's itinerary, requesting adequate escort tug services, and navigating the vessels in the channel.

The vessel's agent contacts the Port's on-duty pilot. There are three state-licensed pilots at the Port. Additional pilots for Grays Harbor are currently in training. The vessel's agent provides the pilot with information on vessel characteristics such as size, condition, and the cargo being transported. The pilot then makes an initial assessment of the vessel to schedule the vessel movements and escort tug assistance. The assessment is based on the vessel's physical characteristics and condition, propulsion, commodity type, other known vessel calls, escort tug requirements and availability, forecasted weather, and environmental and tidal conditions, among other factors (WorleyParsons 2014).

Unless a state pilot is requested by the vessel agent, the captain of a U.S.-flagged barge traveling along the coast is authorized to fulfill the above functions. Pilots and ship captains continually reassess environmental conditions and equipment needs before bringing a vessel into Grays Harbor. When approaching Grays Harbor, the vessel calls the pilot over a designated (very high frequency) radio channel. Even as the pilot is transported to board the vessel, the pilot assesses the environment and vessel and decides if conditions are safe to bring the vessel in or if additional tug assistance is needed (WorleyParsons 2014). The pilot is responsible for managing tugs.

Pilots, escort tugs, and captains of commercial vessels and barges inside Grays Harbor communicate using radio channels or sound signals. Commercial vessels and barges are required to maintain watch and carry a properly working radio with back up, in addition to understanding and having the capability to produce sound signals and tones to communicate different meanings (see *Rules of the Road* discussion under *U.S. Coast Guard*).

U.S. Coast Guard

The local USCG station in Grays Harbor (Coast Guard Station Grays Harbor) has authority over the area ranging from Queets River on the Washington coast south to the Long Beach Peninsula, including Willapa Bay. The station has four vessels that perform search-and-rescue missions and has the capability and authority to carry out law enforcement activities within its jurisdiction (U.S. Coast Guard 2015). The station is under the direction of the Captain of the Port for Sector Columbia River, a unit located in Warrenton, Oregon and part of the Thirteenth Coast Guard District.

The Captain of the Port has the authority to close the bar at Grays Harbor if the weather conditions are too severe for vessels to transit. If the entrance to the Port is closed due to weather conditions, the Port, USCG, and state-licensed pilots coordinate ship logistics until the Captain of the Port reopens the entrance (WorleyParsons 2014).

USCG is also responsible for establishing and enforcing Inland Navigation Rules (33 CFR 83), which applies to all vessels in Grays Harbor and off the coast of the U.S. The Rules of the Road are meant to facilitate safe maritime travel. All vessels, including recreational and commercial, are required to understand and comply with the Rules of the Road. USCG works with USACE to determine the navigation channel's physical characteristics, which dictate local rules such as speed, passing clearances, and anchorage locations.

3.17.5 What are the potential impacts on vessel traffic?

This section describes the impacts on vessel traffic that could occur in the study area. Potential impacts of the no-action alternative are described first as a baseline for comparing the potential impacts of the proposed action.

3.17.5.1 No-Action Alternative

Under the no-action alternative, the applicant would continue to operate its existing facility as described in Chapter 2, Section 2.1.2.2, *Existing Operations*. Although the proposed action and related vessel traffic would not occur, it is assumed that growth in the region would continue under the no-action alternative. Large commercial vessel traffic is projected to increase over time in response to anticipated growth. The impacts of this projected increase (unrelated to the proposed action) on berth capacity, channel capacity, and commercial fishing are discussed below. The potential impacts on recreational and tribal fishing are discussed in Section 3.10, *Recreation*, and 3.12, *Tribal Resources*, respectively.

Channel Capacity

Under the no-action alternative, large commercial vessel trips are projected to increase between 2017 and 2037 due to increased trade of commodities, as shown in Table 3.17-8. Cargo vessel trips are projected to increase from 292 to 368 between 2017 and 2037, while tank vessel trips are projected to increase from 46 to 68 over the same period. Total large commercial vessel trips are projected to increase from 338 in 2017 to 436 in 2037 (Table 3.17-8).

Table 3.17-8. Forecast Number of Large Commercial Vessel Trips through Grays Harbor—No-Action Alternative

	Trips[a]	
Type of Vessel	**2017**	**2037**
Cargo vessels		
Ship	220	276
Barge	72	92
Tank vessels		
Tankers and tank barges	46	68
Total	**338**	**436**

[a] A trip represents one-way travel; in other words an inbound and outbound trip are counted as two trips.

Similar to current conditions, a mix mainly cargo vessels and some tank vessels (tankers and tank barges) would be the likely vessel types transporting cargo to the Port terminals and further inland along the Chehalis River.

Cargo barges traveling to destinations at the mouth of the Chehalis River or further inland are forecast to account for approximately 21% of total large commercial vessel trips through Grays Harbor in 2017 (Table 3.17-8). These vessels would likely have drafts between 0 and 17 feet, consistent with vessel data reported between 2008 and 2012 (Table 3.17-5).

Up to half of the cargo ships and tank vessel trips would be made by vessels in ballast, assuming that they are in ballast on either the inbound or the outbound trip. Vessels transiting in ballast would have a shallower draft than vessels laden with cargo. Using vessel data (U.S. Army Corps of Engineers 2014a), ballasted vessels are expected to operate at a draft of less than 27 feet.

Based on these assumptions, it is estimated that a substantial proportion (approximately 61%) of the vessel trips under the no-action alternative would be made by vessels that draft less than 27 feet. As described for existing conditions, these vessels are minimally constrained by tidal elevations at any of the three channel depths considered in this analysis.

The remaining vessel trips (approximately 39%) are projected to be laden cargo ships and tank vessels (with drafts between 27 and 39 feet). Pilots schedule most transits of these vessels when tidal elevations are at 5 feet or above MLLW (U.S. Army Corps of Engineers 2014a:21). As described for existing conditions, 1,274 navigable windows are available each year at these tidal elevations, which far exceeds the total number of annual vessel trips projected over the 20-year planning period for the no-action alternative (338 to 436).

Although navigational windows become more restricted at drafts of 30 feet and more under the 2014 controlling depth (or 39 and 40 feet under the 2014 and 2017 project depths, respectively), vessel operators are able to make choices that influence vessel draft to increase navigational opportunities. For example, a vessel operator may choose to use a shallower-draft vessel to ensure greater navigational flexibility or use a larger vessel (or a more heavily laden vessel) for economic or other reasons and time the trip according to accommodate the more restricted opportunities.

Because the number of navigable windows when tidal elevations are at 5 feet (1,274) or more far exceeds the total number of forecast vessel trips in 2017 (338 trips) or 2037 (436 trips), the channel capacity would not be exceeded under the no-action alternative.

Berth Capacity

Berth capacity at Terminal 1, or its availability for vessel calls, is a function of operational downtime, facility storage and production, ideal tidal conditions for vessel movement, adverse weather conditions, and maintenance. Berth availability is distinct from berth utilization. Berth utilization is the amount of time the berth is actually occupied by a vessel, while berth availability refers to the amount of time that the berth is available for occupancy. Consistent with standard industry best practices for bulk liquid terminals, the average annual operational berth downtime when a berth is unavailable for use is around 10%. In other words, a berth is available up to 90% of the time. This equates to 328 days per year that the Terminal 1 berth would be available to receive vessel calls. As long as the anticipated number of vessel calls to Terminal 1 do not require more than 90% berth availability, the Terminal 1 berth capacity is more than adequate for growth under the no-action alternative (WorleyParsons 2014).

Vessels calling at Terminal 1 to load bulk liquids would be either tank barges or tankers. The operational assumption is that a tank barge would occupy the berth for 24 hours, accounting for plant start-up, prebooming[17], production, and closedown, before the berth becomes available again. A tanker would occupy the berth for 48 hours (conservatively), accounting for the same berthing conditions but a longer berth occupancy time, which would include waiting for an appropriate tide window for turning and exiting (WorleyParsons 2014). Under the no-action alternative, up to approximately 34 vessels would call at the Terminal 1 berth, which would result in approximately 58 days of berth occupancy[18] of the available 328 days. Therefore, berth capacity would not be exceeded under the no-action alternative of the available 328 days. Therefore, berth capacity would not be exceeded under the no-action alternative.

Pilot and Escort Tug Capacity

Under the no-action alternative, the total number of trips by large commercial vessels is forecast to reach 338 trips in 2017 and 436 trips in 2037. The Port currently employs three state-licensed pilots, which allows two pilots to be on duty at any given time. Foreign-flagged ships and U.S. vessels engaged in foreign trade are required to use a state-licensed pilot by law. While not required, many U.S. vessels engaged in coastwise trade also use a state-licensed pilot on a voluntary basis, or as a matter of company policy because of the state-licensed pilot's expertise and experience guiding vessels in local waters.

Even if all large commercial vessels hired a state-licensed pilot to navigate to and from the Port under the no-action alternative, this would result in a maximum of 436 annual assignments, or approximately 145 annual assignments for each of the three state-licensed pilots employed by the Port. Under this scenario, each state-licensed pilot would pilot vessels to or from the Port a maximum of 145 days out of 365 days, which would not exceed the capacity of state-licensed pilots to pilot large commercial vessels in Grays Harbor.

Brusco Tug & Barge has three harbor tugs stationed in Grays Harbor that are exclusively available for commercial vessel assistance within the harbor. These three tugs are sufficient to escort the projected commercial vessel traffic transiting Grays Harbor. Therefore, the availability of state-licensed pilots and escort tugs is not anticipated to limit the number of vessels transiting the navigation channel under the no-action alternative.

Conflicts with Commercial Fishing

Under the no-action alternative, large commercial vessel trips in the navigation channel are projected to increase from 338 in 2017 to 436 in 2037 (Table 3.17-8). This traffic could slightly increase the potential for impacts on commercial fishing compared to existing conditions. However, as noted in Section 3.17.4.3, *Fishing and Recreational Vessels*, and shown in Figure 3.17-5, no major access points for fishing and recreational vessels would be close enough to be affected by large commercial vessel traffic under the no-action alternative. Additionally, although vessels would occupy the berth more frequently, the potential impacts related to vessel traffic would be limited to the time required for a vessel to move through the navigation channel (approximately 2 hours one way).

[17] Deploying containment booming equipment or alternative measures.

[18] Assumes 7 tankers related to 2017 activities (14 days) and 16 tankers related to 2017 activities (32 days), and 1 tanker (2 days) and 10 tank barges (10 days) related to 2037 activities at the adjacent Westway Terminal Company facility.

3.17.5.2 Proposed Action

This section describes the impacts that could occur in the study area as a result of construction and routine operation of the proposed action. First, this section describes impacts from construction of the proposed action. It then describes impacts of routine operation at the project site and of routine vessel transport to and from the project site.

Construction

Construction of the proposed action would involve no in-water work and no transport of materials by vessel. Therefore, it would have no impact on vessel traffic.

Operations

Under the proposed action, the maximum throughput of bulk liquids at would be 30 million barrels annually. Specifications of the typical vessels that could be used to transport bulk liquids, including tank barges and tankers, are summarized in Table 3.17-9. The table shows how many vessels would be needed for the proposed annual throughput amounts of bulk liquids based on vessel capacity.

Table 3.17-9. Typical Vessels Used for Transport of Bulk Liquids and Number of Calls or Trips Necessary to Transport Proposed Throughput—Proposed Action

			Number of Vessels to Transport Proposed Throughput[a]	
Vessel Type	Capacity (barrels)	Design Draft (feet)	Individual Vessels Calls at Terminal 1 Dock	Vessel Trips[a]
Crowley 550-Class tank barge	150,000	27.5	200	400
Crowley 650-Class tank barge	185,000	30	163	326
Crowley 750-Class tank barge	330,000	35	91	182
Panamax tanker[b]	350,000	39.5	86	172

[a] At maximum throughput; number assumes transport of total throughput is undertaken by a single vessel type.
[b] Capacity can range from 300,000 to 600,000; however, larger Panamax class tankers are typically loaded in the 350,000-barrel range.

Any combination of tank barges and tankers, including those listed in Table 3.17-9, could be used to transport bulk liquids from Terminal 1. While the type of ship is expected to be determined by the Applicant's customer, the ships will be identified in advance as described earlier and would be required to meet all vessel regulations for U.S. and Washington waters. The type of ship used will also be based on the controlling depth of the navigation channel. While vessels with a larger capacity tend to be more economical, their deeper drafts may limit their opportunities to transit the navigation channel, causing waiting periods and inefficiencies. Because of the channel depth limitations, the Panamax tanker (965 feet long, 106 feet wide, with a 39.5-foot draft) would be the largest vessel expected to enter Grays Harbor.

Barges have a smaller capacity and more flexibility to transit the navigation channel due to their shallower draft, but more vessel trips are required to transport the same volume of bulk liquids that the larger tankers could transport (Table 3.17-9).

This analysis assumes that tank barges such as the Crowley 550-Class tank barge, or similar vessel, would be used to transport bulk liquids from Terminal 1. The Crowley 550-Class tank barge has a length of 605 feet, width of 78 feet and draft of 27 feet 6 inches. This barge is designed for an escort tug to fit into a specially articulated notch in the stern of the barge to allow the tug and barge to move together.

Using this type of tank barge for the analysis results in the most vessel trips and is the most likely scenario under current channel conditions (controlling depth of 27 feet MLLW). Under this scenario, operation of the proposed action at maximum throughput would result in a total of 200 annual vessel calls at Terminal 1 or a total of 400[19] vessel trips through the navigation channel. This annual vessel traffic would correspond to an average of 1.09 trips on a daily basis or an average of 7.7 trips on a weekly basis (Table 3.17-10). If vessels with a higher capacity call at Terminal 1, the number of vessel trips would be reduced.

Table 3.17-10. Vessel Trips—Proposed Action

Average Daily	Average Weekly	Maximum Annual
1.09	7.7	400

[a] Assumes highest level of vessel traffic using Crowley 550-Class tank barges.

Table 3.17-11 presents increases in tank vessel trips under the proposed action in the context of forecast increases in baseline trips of large commercial vessels over the 20-year analysis period (2017 to 2037). Between 2017 and 2037, under the no-action alternative, cargo vessel trips are forecast to increase from 292 to 368 per year due to annual growth in trade of commodities, and tank vessel trips are forecast to increase from 46 to 68 per year. Adding the proposed action tank vessel trips to forecasted growth in vessel traffic would increase to 724 in 2017 and 822 in 2037. This equals approximately 2.0 vessel trips a day in 2017 and 2.3 vessel trips a day in 2037.

Table 3.17-11. Forecast Number of Large Commercial Vessel Trips—Proposed Action (2017–2037)

Type of Vessel	2017	2037
Baseline		
Cargo ships	220	276
Cargo barges	72	92
Tank vessels[a]	32	54
Proposed Action		
Tank vessels	400	400
Total trips	**724**	**822**

[a] Number includes existing and projected vessels related to the Westway project only; Imperium no-action vessels not counted, because the proposed action includes total for facility.

Channel Capacity

Approximately 56% of the trips would be cargo barges traveling to locations along the Chehalis River or unladen vessels in ballast. As described under the no-action alternative, these vessels would likely draft less than 27 feet and would be minimally constrained by tidal elevations at any of the three channel depths considered in this analysis.

[19] Proposed vessel trips are total for the facility so are not in addition to trips attributable to the applicant under the no-action alternative (approximately 14 per year).

The remaining vessels trips (approximately 44%) are projected to be laden cargo ships and tank vessels (with drafts between 27 and 39 feet). As described for the no-action alternative, pilots typically schedule transits of these vessels when tidal elevations are at 5 feet or above MLLW (U.S. Army Corps of Engineers 2014a:21). At these tidal elevations, 1,274 navigable windows are available each year, which exceeds the total number of trips in 2017 and 2037 (724 to 822).

Although navigational windows become more restricted at drafts of 30 feet and more under the 2014 controlling depth (or 39 and 40 feet under the 2014 and 2017 project depths, respectively), vessel operators are able to make choices that influence vessel draft to increase navigational opportunities. For example, a vessel operator may choose to use a shallower-draft vessel to ensure greater navigational flexibility or use a larger vessel (or a more heavily laden vessel) for economic or other reasons and time the trip according to accommodate the more restricted opportunities.

Because the number of navigable windows exceeds the total number of vessel trips, the channel capacity would not be exceeded under the proposed action.

Berth Capacity

Berth capacity at Terminal 1, as discussed for the no-action alternative, is adequate as long as the total days of occupation do not exceed 328 days per year. When tank vessels call at the Terminal 1 berth, they are estimated to occupy the berth for 24 hours (tank barges) to 48 hours (tankers). If only tank barges call at Terminal 1, the 200 vessels per year for the proposed action at maximum throughput would result in 200 days of berth occupancy, out of 328 days that the berth would be available. If tankers call at Terminal 1 instead of tank barges, the berth occupancy time would increase, but the number of vessel calls would decrease. For example, if only Panamax tankers call at Terminal 1, approximately 86 vessel calls per year would be required (Table 3.17-8), and the berth would be occupied for a total of 172 out of 328 days.

Adding days of Terminal 1 berth occupancy related to the proposed action (a maximum of 200 days) to 44 days[20] for existing and projected vessels engaged by the adjacent methanol facility, the berth would be occupied for a maximum of 244 days. This occupancy level is well below the 328 days of estimated berth availability. Therefore, the proposed action would not have a substantial impact on berth capacity.

Pilot and Escort Tug Capacity

State-Licensed Pilots

As discussed for the no-action alternative, only foreign-flagged vessels and U.S. vessels engaged in foreign trade are required to use a state-licensed pilot by regulation. However, many U.S. vessels calling at Washington State ports seek the assistance of a state-licensed pilot on a voluntary basis, or as a matter of company policy, even though it is not required by regulation. The Port currently employs three state-licensed pilots and two pilots are on duty at any given time.

Under the proposed action, the total number of trips (proposed action and baseline) by large commercial vessels is forecast to reach 724 trips in 2017 and 822 trips in 2037. If all large

[20] Assumes 16 tankers related to existing activities (32 days), and 1 tanker (2 days) and 10 tank barges (10 days) related to projected activities at the adjacent Westway Terminal Company facility; Imperium no-action vessels not counted, because the proposed action includes total for facility.

commercial vessels hire a state-licensed pilot to navigate to and from the Port, this would result in a maximum of 822 annual assignments in 2037, or approximately 274 annual assignments for each of three state-licensed pilots employed by the Port. Under this scenario, each state-licensed pilot would pilot vessels to or from the Port a maximum of 274 days out of 365 days, which would not exceed the capacity of state-licensed pilots currently employed by the Port.

Additionally, pilots may pilot more than one vessel per day. Pilot trips in Grays Harbor are approximately 2 hours Because Grays Harbor has a semidiurnal tidal cycle (two high tides per day), there is more than one navigable window each day to pilot a vessel to or from the Port.

The Puget Sound Pilot Commission is responsible for Washington State licensed pilots and evaluates the need for pilots regularly. If additional pilots were needed, they could be hired and trained. It takes approximately 9 months for a new pilot to obtain a state license to handle smaller vessels and approximately 2.5 years to get fully qualified. If necessary, due to an unanticipated pilot shortage, the Puget Sound Pilot Commission could provide support to the Port by temporarily reassigning a qualified state-licensed pilot from Puget Sound to Grays Harbor (Larson pers. comm.).

Based on interviews with the Port, the Pilotage Commission, and a Grays Harbor state-licensed pilot and on forecasted vessel numbers under the proposed action, the current number of state-licensed pilots available for Grays Harbor[21] is adequate for the pilotage services required by the Port under current and foreseeable vessel traffic conditions.

Escort Tugs

Brusco Tug & Barge has three harbor tugs stationed in Grays Harbor that are exclusively available for commercial vessel assistance in the harbor. During normal operations, two escort tugs (one at the bow and one at the stern) assist large commercial vessels (cargo ships and tank vessels) with docking and undocking at the terminal berths. A third escort tug may be used when conditions warrant, such as when there are high winds (D'Angelo pers. comm.).

Including vessels under the proposed action at maximum throughput, inbound or outbound trips by large commercial vessels through the navigation channel are forecast to reach 724 in 2017 and 822 in 2037, which is equal to approximately 2.0 vessel trips a day in 2017 and 2.3 vessel trips a day in 2037. Both inbound and outbound vessels would use escort tugs during docking (inbound vessels) or undocking (outbound vessels). Escort tugs can be moved between the Port terminals to assist with docking and undocking, and their availability would not limit vessel operations at the Port under the proposed action.

Escort tugs are not currently required for tank vessels in Grays Harbor. Oil tankers carrying product to or from the Imperium project site do use escort tugs as part of their Washington State-approved facility operations plan. However, the Harbor Safety Plan for Grays Harbor has a standard of care (similar to a best management practice) that recommends escort tugs for all laden tank vessels carrying oil. The standards recommend the following practices.

- At least one escort tug will meet an arriving laden tank vessel or barge carrying oil at the Grays Harbor entrance and escort it to the Hoquiam River where two tugs will assist the vessel during mooring procedures.

[21] Allowing for reassignment of pilots from Puget Sound.

- At least one escort tug will accompany a departing laden tank vessel carrying oil from the terminal to the entrance of Grays Harbor.

At maximum throughput, the proposed action would result in 200 annual tank vessel calls at Terminal 1 to transport bulk liquids. Adding the proposed action tank vessel calls to baseline forecasts would increase the total number of forecast tank vessel calls to 216 in 2017 and 227 in 2037. A single vessel call includes an inbound and an outbound vessel transit, and it is assumed that the vessel is laden (and therefore requires an escort) in only one direction. Under this scenario, less than one tank vessel call per day, on average, would require an escort tug, which would not exceed the capacity of tugs to escort laden tank vessels.

Escort tugs reduce the potential for a vessel incident such as loss of steering or loss of propulsion that could affect vessel traffic and pose a safety risk. Mitigation measures related to escort tugs are described in Section 3.17.7.2, *Applicant Mitigation*.

In addition, mitigation related to reducing the risk of a vessel incident as related to spills is described in Chapter 4.

Conflicts with Commercial Fishing

Increased vessel traffic related to the proposed action could affect commercial fishing activities by restricting access to certain areas in the harbor. Because vessel traffic under the proposed action would be limited to the navigation channel and Terminal 1 berth, impacts on commercial fishing in the harbor but outside the channel are not expected.

As described above, adding proposed action vessels to baseline vessels would result in occupancy of the Terminal 1 berth up to approximately 244 days per year compared to 58 days per year under the no-action alternative. On average, vessels related to the proposed action would be at the dock approximately 4 days per week compared to an average of 1 day per week without the proposed action. Additionally, operation of the proposed action at maximum throughput would result in an average of approximately one tank vessel trip per day (a maximum of 400 per year[22]) along the navigation channel to the 436 large commercial vessel trips per year under the no-action alternative.

As noted in Section 3.17.4.3, *Fishing and Recreational Vessels,* one of the prime commercial fishing areas is located in the navigation channel east of the Hoquiam River. Access to this area would be restricted during vessel loading and tank vessel transits. During periods of maximum catch for Chinook, coho, or chum salmon, the fall fishery may be open 2 to 4 days per week. Approximately 15 to 25 boats participate each year up to 5 days per week during the open season (Scharpf pers. comm.).

Assuming a 24-hour maximum berth occupancy and vessels evenly dispersed over the week, it is likely a vessel would be at the dock or traveling through the navigation channel during a portion of the open fishing season. Depending on the specific circumstances of each interaction (e.g., chance of a vessel calling during an open fishing window, distribution of the fish within the channel, number of fishers on any given day), it is difficult to predict whether increased occupancy at Terminal 1 would significantly affect any single fisher's daily catch. However, if a vessel is at berth during the fall

[22] Proposed vessel trips are total for the facility so are not in addition to trips attributable to the applicant under the no-action alternative (approximately 14 per year).

fishery, fishers would have the option to fish longer (complete more drifts) or may choose to fish other preferred locations in Grays Harbor (such as other portions of the navigation channel, farther away from the shoreline or father upstream). However, opportunities to relocate during intense fishing periods may be limited if the other areas are occupied by fishers. Implementation of the mitigation described in Section 3.12.7.2, *Applicant Mitigation,* would reduce the potential impacts on commercial fishing.

Vessel traffic at other times of the year likely would have less of an impact because fewer fishers are participating in the fishery and fishers would therefore likely have more options to adjust their fishing efforts to other preferred areas in Grays Harbor and the Chehalis River. As noted in Section 3.12.7.2, *Applicant Mitigation*, providing advance notice of incoming vessels related to the proposed action could reduce potential conflicts. Although it is difficult to predict whether the increased vessel traffic would result in an overall inability of a fisher to reach their limit, increased traffic would limit access to commercial fishing areas. Implementation of the mitigation described in Section 3.12.7.2, *Applicant Mitigation*, would help address this impact.

As noted in Section 3.17.4.3, *Fishing and Recreational Vessels,* ocean-fishing vessels may use the navigation channel to transport their catch to the harbor. To lessen the danger of hazardous conditions during incoming or outgoing tides, bar crossings are often timed during slack high or low tides, whereas large commercial vessels tend to navigate through the channel when tidal elevations are more than 5 feet. Additionally, as noted previously, commercial fishers can navigate around larger vessels limited to the navigation channel to avoid potential impacts.

An analysis of impacts from increased risk of accidents (e.g., vessel collisions) and related consequences (e.g., oil spills) is provided in Chapter 4, *Environmental Health and Safety.*

3.17.6 What required permits apply to vessel traffic?

No required permits or plans apply to vessel traffic.

3.17.7 What mitigation measures would reduce impacts on vessel traffic?

This section describes the applicant mitigation that would reduce impacts on vessel traffic from construction and routine operation of the proposed action.

3.17.7.1 Applicant Mitigation

The applicant will implement the following mitigation.

- Due to sensitivity of the local environment, tribal resources, and the potential presence of special-status species, to reduce potential risk of incident due to loss of propulsion, loss of steering, grounding, or severe weather, the applicant will not receive or load crude oil to tankers or tank barges unless the vessels have escort tugs through Grays Harbor as described below. This requirement will remain in place until rules are implemented pursuant to Engrossed Substitute House Bill 1449, Section 12, at which time the rules will apply to the project. At least one escort tug must accompany a laden tanker or tank barge carrying oil between the Hoquiam River and Grays Harbor entrance, and two tugs (one escort tug and one assist tug) must assist the vessel during mooring procedures.

  - For laden tankers, the escort tug must be appropriately tethered while transiting Grays Harbor.
  - Escort tugs must have an aggregate shaft horsepower equivalent to at least 5% of the deadweight tons of the escorted oil tanker or tank barge.
  - Escort tugs must have sufficient mechanical capabilities to provide for safe escort.
- To ensure adequate safety for escort tug operations and thereby reduce the risk of an incident, the applicant will not receive or load crude oil to tankers or tank barges unless the vessels supply Grays Harbor pilots and tug companies with bollard pull capacities of the vessels prior to entering Grays Harbor.
- To reduce potential risk of incident of vessel collision or allision in Grays Harbor, the applicant will work with U.S. Coast Guard, Ecology, Port of Grays Harbor, and Grays Harbor Safety Committee to propose, develop, and implement a formal vessel management system. The vessel management system will include the ability to schedule, track, and monitor vessel movements in the harbor and off the entrance to the harbor. The vessel management system will be active prior to the applicant beginning the proposed operations.
- To reduce potential risk of incident of vessel collision while in Grays Harbor, the vessel management system will take the following actions.
  - Ensure vessel traffic is limited while a laden tank vessel is in the navigation channel.
  - Prohibit the transit of any other deep-draft vessels within the south channel (just off Westport) to Terminal 1 in both directions whenever a laden tank vessel is transiting within the same channel.
  - Include real-time automatic identification system tracking and monitoring.
- To reduce the risk of an incident, the applicant will coordinate with the Port of Grays Harbor and as a member of the Grays Harbor Safety Committee, work to develop and implement specific procedures for escorting, tethering, and emergency maneuvering to control laden tank vessels. The procedures must be drafted prior to the proposed operations beginning. These procedures should be included in the Grays Harbor Safety Plan. At a minimum, these must include the following elements.
  - Escort configurations and maneuvering characteristics of escorted tankers and tank barges.
  - Specific emergency connection and tethering procedures for connection of escort tugs to tankers and tank barges.
  - Specific maneuvers necessary for the escort tug to maintain control of the tanker while transiting Grays Harbor waters specifically during incidents of loss of propulsion or steering or in bad weather.
  - Appropriate safe speed of transit in Grays Harbor when escort tugs are tethered.
  - Guidelines for tanker or tank barge bridge team to rapidly recognize and respond to a loss of power or steering. By improving recognition and reaction time, the escort tugs can more effectively steer the vessel through the navigation channel upon incident.
  - Requirement for a pretransit conference.
  - Requirements for refueling of the vessel.

- While commercial fishing boats are required to follow the U.S. Coast Guard navigation rules, to improve awareness of vessel traffic in the navigation channel, the applicant will work with the Grays Harbor Safety Committee, including the U.S. Coast Guard and Port of Grays Harbor, to establish procedures to announce project related vessel traffic arrivals and departures over a designated very high frequency (VHF) marine radio channel.

3.17.8 Would the proposed action have unavoidable significant adverse impacts on vessel traffic?

Under existing fishing conditions, increased vessel traffic would cause a disruption when commercial fishers are in the navigation channel. This conflict is most likely to occur related to harvest of salmon, steelhead, and sturgeon during the fall fishery. Although vessel operations related to the proposed action are reasonably certain, it is not possible to determine how the proposed action could affect a commercial fisher's daily catch because of other unpredictable factors (number of fishers, fish distribution, timing, and duration of fishing window on any given day of any given week). However, it is anticipated that because there are alternate fishing areas and because there would be additional days/windows to fish uninterrupted, impacts would not be significant.