SYNOPSIS OF CHANGING VESSEL TRAFFIC TRENDS

ESHB 1578 – Reducing Threats to Southern Resident Killer Whales by Improving the Safety of Oil Transportation

DECEMBER 2021

WASHINGTON STATE
BOARD OF PILOTAGE COMMISSIONERS
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Table of Contents

Figures and Tables

Figures

Tables

Executive Summary

Overview

On September 1, 2020, new tug escort requirements took effect for certain tank vessels carrying oil as cargo in Rosario Strait and connected waterways to the east (RCW 88.16.190).

This synopsis answers questions about changes in vessel traffic and oil transfers after the new tug escort requirements took effect.

Legislative Direction

In 2019 the Washington state legislature passed Engrossed Substitute House Bill (ESHB) 1578: Reducing Threats to Southern Resident Killer Whales by Improving the Oil Transportation Safety Act. The act amended RCW 88.16, 88.46, and 90.56.

Among other actions, the amendments to RCW 88.16 requires tug escorts for oil tankers between 5,000 and 40,000 deadweight tons (DWT) that are laden (carrying cargo onboard), and for laden Articulated Tug Barges (ATB) and oil barges greater than 5,000 DWT when operating in Rosario Strait and connected waterways to the east. (RCW 88.16.190). An ATB is a tank barge and a towing vessel joined by hinged or articulated fixed mechanical equipment affixed or connecting to the stern of the tank barge. The requirement does not apply to vessels providing bunkering or refueling services. The tug escort requirement took effect on September 1, 2020.

Additionally, amendments to RWC 88.16.260 direct the Board of Pilotage Commissioners (BPC) to complete a synopsis of changing vessel traffic trends (RCW 88.16.260(1)(d)(ii)).

Roles and Responsibilities

The BPC and the Washington State Department of Ecology (Ecology) entered into an Interagency Agreement (IAA), provided in Appendix B. This agreement establishes guidelines, roles, and responsibilities for collaboration between Ecology and the BPC in the effective implementation of the amended sections of 88.16 and 88.46 (Ecology & Board of Pilotage Commissioners, 2019).

The IAA includes the following responsibilities for the vessel trends synopsis (Ecology & Board of Pilotage Commissioners, 2019):

- The BPC Staff: Develop scope of changing vessel traffic trends synopsis and submit final synopsis to the legislature.
- Washington State Department of Ecology: Provide technical assistance to the BPC in the development of the scope. Develop report of synopsis of changing vessel traffic trends.
- The Board of Pilotage Commissioners: Vote to approve scope. Review and approve the Synopsis of Changing Vessel Traffic Trends.

Study Area

Figure EX-1 shows the boundaries of the study area, which includes Washington waters east of a line extending from Discovery Island lighthouse south to New Dungeness lighthouse, and the transboundary waters of Haro Strait, Boundary Pass, and the southern Strait of Georgia (Board of Pilotage Commissioners, 2020b).

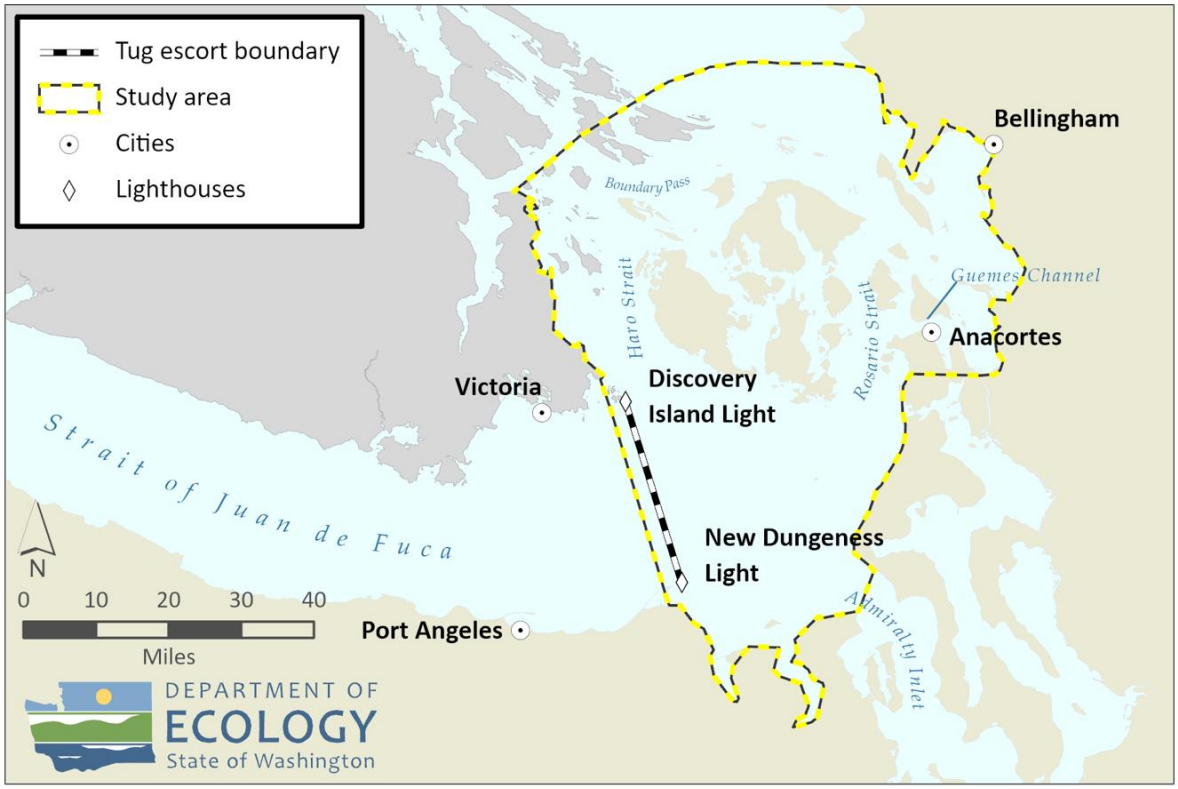

Figure EX- 1 Map of Study area

Scope of Work

The BPC worked collaboratively with Ecology to create the scope of work, provided in Appendix D. The scope of work was approved at a public hearing of the Board of Pilotage Commissioners on May 21, 2020 (Board of Pilotage Commissioners, 2020d).

Additionally, the BPC developed the State of Washington Board of Pilotage Commissioners Interpretive Statement (Revised September 17, 2020), to create definitions for interpreting terms as they relate to the Act (Board of Pilotage Commissioners, 2020b). The interpretive statement is provided in Appendix E. Further definitions for terms used in the synopsis are included in Appendix F.

Purpose

The intent of the synopsis is to review vessel transits pre- and post-bill implementation to identify changes after Section 2 (tug escort requirement) of the Bill was implemented on September 1, 2020 (Board of Pilotage Commissioners, 2020b).

Research questions

The scope of work identifies the following questions (Board of Pilotage Commissioners, 2020b):

- What changing vessel traffic trends do we see for vessels that newly fall under an escort requirement?
- What changing vessel traffic trends do we see for deep draft and tug traffic that have no additional escort requirements?
- What changing vessel traffic trends do we see for tug escorts?
- How does the overall number of transits (by vessel type) change pre- and post-bill implementation?

Deliverables

The scope of work identifies the following deliverables (Board of Pilotage Commissioners, 2020b)

- Route selection and number of vessel transits pre-and post-bill implementation for the following vessel types. Ecology will explore ways to compare transits on a common scale.
    - vessels that newly fall under an escort requirement
    - deep draft and tug traffic that have no additional escort requirement
    - vessels that are providing bunkering or refueling services
- Routes compared will include, but will not be limited to transits of Rosario Strait and Haro Strait/Boundary Pass.
- Review of tugs engaged in escorting tank vessels in Rosario and connected waterways east, including but not limited to number of transits, names of vessels, and operating companies.
- Number of oil transfers per refinery and per anchorage pre- and post-bill implementation.
- A review of the last five years of existing vessel transit data, to provide context as to the overall trend in vessel movements, based on vessel types. Determining the laden/unladen status of tank vessels, deadweight tonnage of vessels, and details on vessel occupation (i.e., bunkering) would require a manual evaluation of each transit, and is outside the scope of this review.

The scope of work did not include an assessment of the impact of vessel traffic, including escort tugs, on treaty-protected interests and fishing rights of potentially affected federally recognized Indian tribes. The scope of work also did not include an assessment of underwater noise from vessels nor determine volumes of oil transferred during the synopsis period.

Methods

To meet the synopsis deliverables and answer the research questions, Ecology created a series of steps and designed methodologies to achieve the desired outcomes for each step.

Synopsis Steps

1. Research data sources
2. Create lists of vessels
3. Create a record of vessel transits and a determination of transit type
4. Collect data on escort tug activity
5. Collect data on oil transfers
6. Collect data on tanker movements
7. Write a review of the last 5 years of existing vessel transit data

Methodologies

Ecology:

- Researched available data resources in Ecology and industry databases, and vessel tracking systems to identify data sources for use in the synopsis.
- Created lists of vessels newly falling under an escort requirement and vessels with no additional escort requirements.
- Used oil transfer and vessel transit data to determine the route selection and the number of vessel transits by vessel type.
- Reviewed vessel transit data to compile a list of tugs performing escort duties. To determine changes in activity, Ecology compared the number of times these specific escort tugs crossed virtual lines that were placed in key locations within the study area.
- Gathered data on the number of oil transfers in the study area at refineries and anchorages, pre- and post-escort implementation to determine changes in the number of oil transfers in the study area.
- Reviewed data on vessel transits within the study area over the last five years to identify vessel traffic trends.

Data Sources

Ecology's Advance Notice of Oil Transfer (ANT) system provided data on oil transfers in the study area, and data for assisting in determining the laden or unladen status of transits between transfers.

A subscription service through the Marine Exchange of Puget Sound was used to collect vessel Automatic Identification System (AIS) history data for determining individual vessels and transit routes, and crossing line report data to determine tanker and escort tug movements in the study area.

Ecology's Spills Program Integrated Information System (SPIIS) web-based application provided data on vessel entry transits, and oil transfers counts at anchorages and facilities in the study area.

Ecology collected data for one year before and one year after tug escort implementation. Year 1 of data collection comprised September 1, 2019 through August 31, 2020. Year 2 was September 1, 2020 through August 31, 2021.

Ecology reviewed data from the past five years of Vessel Entries and Transits in Washington Waters (VEAT) reports. VEAT data are reported for calendar years and use a different methodology than the synopsis, so the number of transits do not match the Year 1 and Year 2 results of the synopsis. The review of VEAT data provided context to the traffic changes which occurred from the year prior to tug escort requirements to the year after the requirements went into effect.

Data Challenges

Four data challenges were identified in the synopsis scope of work. Ecology identified an additional seven during data analysis. Ecology developed mitigation methods for eight of the 11 data challenges. The remaining three challenges involving ANT and AIS data had an effect on Ecology's ability determine if a vessel's transit was likely loaded with oil (laden).

However, once data collection was complete, Ecology was able to use ANT data to make a reasonable determination of the laden or unladen status for 27 of the 32 Haro Strait transits which Ecology reviewed for the potential influence of the new tug escort requirement in Year 2. The available ANT data did not allow Ecology to determine the laden or unladen status for the remaining five transits.

Overview of Results

Table EX – 1 shows the number and percentage of transits for vessels newly subject to the tug escort requirements.

Table EX - 1 Number and percentage of transits for vessels newly subject to the tug escort requirements in Year 1 (September 1, 2019 to August 31, 2020) and Year 2 (September 1, 2020 to August 31, 2021), in Haro and Rosario Straits.

ATB	Rosario	Haro	Total Transits
Year 1	787 (94%)	48 (6%)	835 (100%)
Year 2	841 (91%)	79 (9%)	920 (100%)
Barge > 5,000 DWT	**Rosario**	**Haro**	**Total Transits**
Year 1	315 (97%)	11 (3%)	326(100%)
Year 2	333 (95%)	16 (5%)	349(100%)
Tankers < 40,000 DWT	**Rosario**	**Haro**	**Total Transits**
Year 1	15 (68%)	7 (32%)	22 (100%)
Year 2	26 (65%)	14 (35%)	40 (100%)

Determining whether the tug escort requirement affected route selection

Ecology used a series of questions to assess whether the tug escort requirement affected route selection for vessel transits. For each Haro Strait transit in Year 2 by tank vessels subject to the new tug escort requirements, Ecology asked:

- Was the selection of Haro Strait a change from previous passages between the same origin and destination by vessels from the same company?
- Would transiting through Rosario Strait be a reasonable option, given the origin and destination? For example, has the tank vessel used Rosario Strait in the past for the same origin and destination?
- Did the vessel transit both Haro and Rosario Straits during a single passage?
- Was the tank vessel likely laden, as determined by the process Ecology used for the synopsis?

Using these questions, Ecology counted a tank vessel's Haro Strait transit as influenced by the new tug escort requirements if:

- The selection of Haro Strait was a change from previous passages
- A transit through Rosario Strait was a reasonable option
- The passage did not utilize both Haro and Rosario Straits
- The tank vessel was likely laden

Ecology did not count a tank vessel's Haro Strait transit as influenced by the tug escort requirements in the following situations:

- The vessel's company had a history of using this route in previous years
- Transiting through Rosario Strait was not a reasonable option, given the origin and destination (e.g., a transit from Victoria, B.C., to Vancouver, B.C.)
- The vessel transited both Haro and Rosario Straits, since laden tank vessels would still require an escort through the Rosario Strait portion of the route
- Ecology could not make a reasonable assumption about the laden or unladen status of a vessel, as an unladen transit through Rosario would not require an escort

Response to Research Questions

Ecology re-ordered the research questions for clarity.

- How does the overall number of transits (by vessel type) change pre- and post-bill implementation?
    - In Year 2, transits by tank vessels subject to the new tug escort requirements increased in both Rosario and Haro Straits.
    - Most of these changes were not related to the tug escort requirement. Some were likely the result of business decisions by companies, the year-to-year variation in the market for crude oil and refined product, and the effects of the global pandemic.

- What changing vessel traffic trends do we see for vessels that newly fall under an escort requirement?
    - The new tug escort requirement did not appear to have affected the route selection of tankers between 5,000 and 40,000 DWT from Year 1 to Year 2.
    - Ecology identified 16 transits through Haro Strait in Year 2 by ATBs and barges greater than 5,000 DWT where the tug escort requirements may have been in factor in deciding the route.
        - ATBs: five of 79 Haro Strait transits may have been affected by the tug escort requirement. These five transits represent 6 percent of the 79 Year 2 Haro Strait transits, and 0.5 percent of the 920 Year 2 total transits through Rosario and Haro Straits.
        - Barges greater than 5,000 DWT: 11 of 16 transits may have been affected by the tug escort requirement. These 11 transits represent 69 percent of the 16 Year 2 Haro Strait transits, and 3 percent of the 349 Year 2 total transits through Rosario and Haro Straits.
- What changing vessel traffic trends do we see for deep draft and tug traffic that have no additional escort requirements?
    - For tankers greater than 40,000 DWT, transits decreased between Year 1 and Year 2 in Rosario Strait, both in the number of crossing line transits and the number of tankers making transits. In Haro Strait and Boundary pass, the change in tankers and crossing line transit numbers was negligible from Year 1 to Year 2.
    - For barges less than 5,000 DWT, there was a decrease in Rosario Strait transits between Year 1 and Year 2. There were no transits through Haro Strait by barges less than 5,000 DWT in Year 1 or Year 2.
    - For barges engaged in bunkering within the study area, there was an overall decrease in transits: an increase of six transits by barges greater than 5,000 DWT and a decrease of 26 transits by barges less than 5,000 DWT. The overall 20 transit decrease may reflect vessels receiving fuel at a location outside of the study area, rather than a decrease in bunkering in the Puget Sound.
- What changing vessel traffic trends do we see for tug escorts?
    - Tug escort movements in the study area increased significantly following the implementation of the new escort requirements, especially for three tugs that were observed both performing escort duties as well as towing oil barges (termed 'multi-purpose' tugs for this synopsis).
    - Purpose-built escort tug crossing line transits in the study area increased from 5,991 in Year 1 to 7,321 in Year 2, an increase of 1,330 transits or 22 percent.
    - Multi-purpose tug crossing line transits in the study area increased from 71 in Year 1 to 1,745 in Year 2, an increase of 1,674 transits or over 2,000 percent.
    - Total tug crossing line transits in the study area increased from 6,062 in Year 1 to 9,066 in Year 2, an increase of 3,004 transits or 50 percent.

Detailed responses for each deliverable identified in the scope of work are provided in the Results section of the synopsis.

Conclusions

The purpose of this synopsis was to review vessel transits to identify changes after tug escort requirements were implemented on September 1, 2020 for laden ATBs and oil barges greater than 5,000 DWT, and tankers between 5,000 and 40,000 DWT transiting in Rosario Strait and connected waterways to the east. Unladen tank vessels and barges engaged in bunkering are excluded from the new tug escort requirements.

The most significant findings were:

- The new tug escort requirements did not significantly change tank vessel traffic. Most transits in the study area by tank vessels subject to the tug escort requirement were through Rosario Strait both before and after the tug escort requirement took effect.
    - 94 percent of transits by these tank vessels in Year 1 were through Rosario Strait (1,117 of the 1,183 total transits in Rosario and Haro Straits).
    - 92 percent of transits by these tank vessels in Year 2 were through Rosario Strait (1,200 of the 1,309 total transits in Rosario and Haro Straits).
- In Year 2, five of the 79 Haro Strait transits by ATBs, and 11 of the 16 Haro Strait transits by barges greater than 5,000 DWT were identified where the new tug escort requirements may have been a factor in deciding the route.
- Unrelated to the new tug escort requirement, the border closure between Washington and Canada caused by the pandemic produced a change in traffic patterns for ATBs using pilots.
    - Prior to the pandemic there were no transits by ATBs between Vancouver, B.C., and the study area which used both Rosario and Haro Straits in one passage.
    - After the border closure, the pilots embarked and disembarked in Port Angeles and Victoria, B.C., requiring a transit in both Rosario and Haro Straits if transiting between the study area and Vancouver, B.C. (PPA, 2020).
    - There were 53 of these transits, 17 in Year 1 and 36 in Year 2.
- Escort tug transits increased significantly following the implementation of the new requirements.
    - This was especially notable for multi-purpose tugs, or tugs that performed escort duties as well as towed oil barges.
    - Transits by purpose-built escort tugs over crossing lines in the study area increased by 1,330 transits, from 5,991 in Year 1 to 7,321 in Year 2, an increase of 22 percent.
    - Transits by multi-purpose escort tugs over crossing lines in the study area increased by 1,674 transits, from 71 in Year 1 to 1,745 in Year 2, an increase of over 2,000 percent.
    - The total of transits by all tugs performing escort duties over crossing lines in the study area increased by 3,004 transits, from 6,062 in Year 1 to 9,066 transits in Year 2, an increase of 50 percent.
    - Vessels can transit over multiple crossing lines in a single trip, so the total number of transits over crossing lines does not represent the number of escort trips.

Introduction

Legislative direction

In 2019 the Washington state legislature passed Engrossed Substitute House Bill (ESHB) 1578: Reducing Threats to Southern Resident Killer Whales by Improving the Safety of Oil Transportation Act (the Act). The act amended RCW 88.16, 88.46, and 90.56 with the goal of closing safety gaps related to carrying oil in bulk.

Section 2 of the Act amends RCW 88.16.190 to require tug escorts for laden[1] tankers between 5,000 and 40,000 DWT[2], and laden Articulated Tug Barges (ATB)[3] and oil barges greater than 5,000 DWT[4] when operating in Rosario Strait and connected waterways to the east (RCW 88.16.190[5]). The tug escort requirement became effective September 1, 2020. Section 1, 2 and 3 of the Act are provided in Appendix A.

Section 3 of the Act amends RCW 88.16.260, and directs the BPC to complete a synopsis of changing vessel traffic trends. The relevant portion of RCW 88.16.260 states:

> (1)(a) By December 31, 2025, the board of pilotage commissioners, in consultation with the department of ecology, must adopt rules regarding tug escorts to address the peculiarities of Puget Sound for the following:
>
> (i) Oil tankers of between 5,000 and 40,000 deadweight tons; and
>
> (ii) Both articulated tug barges and towed waterborne vessels or barges that are: (A) Designed to transport oil in bulk internal to the hull; and (B) greater than five thousand deadweight tons.
>
> (b) The requirements of this section do not apply to:
>
> (i) A towed general cargo deck barge; or
>
> (ii) A vessel providing bunkering or refueling services.
>
> (c) The rule making pursuant to (a) of this subsection must be for operating in the waters east of the line extending from Discovery Island light south to New Dungeness light and all points in the Puget Sound area. This rule making must address the tug escort requirements applicable to Rosario Strait and connected waterways to the east established in RCW 88.16.190(2)(a)(ii), and may adjust or suspend those requirements based on expertise developed under subsection (5) of this section.

[1] The term 'laden' means the vessel is carrying cargo onboard. See Appendix G Maritime Definitions.
[2] Deadweight tonnage is a measure of how much weight a ship can carry. Abbreviated to DWT, D.W.T., d.w.t., or dwt See Appendix G Maritime Definitions
[3] An Articulated Tug Barge is a tank barge and a towing vessel joined by hinged or articulated fixed mechanical equipment affixed or connecting to the stern of the tank barge.
[4] The tug escort requirement does not apply to ATB or oil barges when providing bunkers or refueling services.
[5] https://app.leg.wa.gov/RCW/default.aspx?cite=88.16.190

(d) To achieve the rule adoption deadline in (a) of this 2 subsection, the board of pilotage commissioners must adhere to the following interim milestones:

(i) By September 1, 2020, identify and define the zones, specified in subsection (3)(a) of this section, to inform the analysis required under subsection (5) of this section

(ii) By December 31, 2021, complete a synopsis of changing vessel traffic trends;

Ecology and the Board of Pilotage Commissioners Roles

The Washington State Board of Pilotage Commissioners (BPC) and the Washington State Department of Ecology (Ecology) entered into an Interagency Agreement (IAA), provided in Appendix B. This agreement establishes guidelines, roles, and responsibilities for collaboration between Ecology and the BPC in the effective implementation of Sections 2, 3, 4, and 5 of the Act (RCW 88.16.260)(Ecology & Board of Pilotage Commissioners, 2019).

The IAA includes the following responsibilities for the vessel trends synopsis (Ecology & Board of Pilotage Commissioners, 2019):

- The BPC Staff: Develop scope of changing vessel traffic trends synopsis and submit final synopsis to the legislature.
- Washington State Department of Ecology: Provide technical assistance to the BPC in the development of the scope. Develop report of synopsis of changing vessel traffic trends.
- Board of Pilotage Commissioners: Vote to approve scope. Review and approve the Synopsis of Changing Vessel Traffic Trends.

The BPC established a new committee, the Oil Transportation Safety Committee to conduct analysis and provide recommendations for the Board concerning the responsibilities outlined in RCW 88.16. The Oil Transportation Safety Committee charter is provided in Appendix C.

Committee membership included representatives from tribes, the BPC, Ecology, Puget Sound Pilots, the oil industry, the tug industry, and the environmental community (Board of Pilotage Commissioners, 2019). A duty of the committee was to provide recommendations about the synopsis to the BPC (Board of Pilotage Commissioners, 2019).

The committee met 13 times between December 2019 and December 2021. Minutes from Oil Transportation Safety Committee meetings are available on the BPC website[6].

Study area

Figure 1 shows the boundaries of the study area, which includes Washington waters east of a line extending from Discovery Island lighthouse south to New Dungeness lighthouse and the transboundary waters of Haro Strait, Boundary Pass, and the southern Strait of Georgia (Board of Pilotage Commissioners, 2020b).

[6] https://pilotage.wa.gov/resources.html

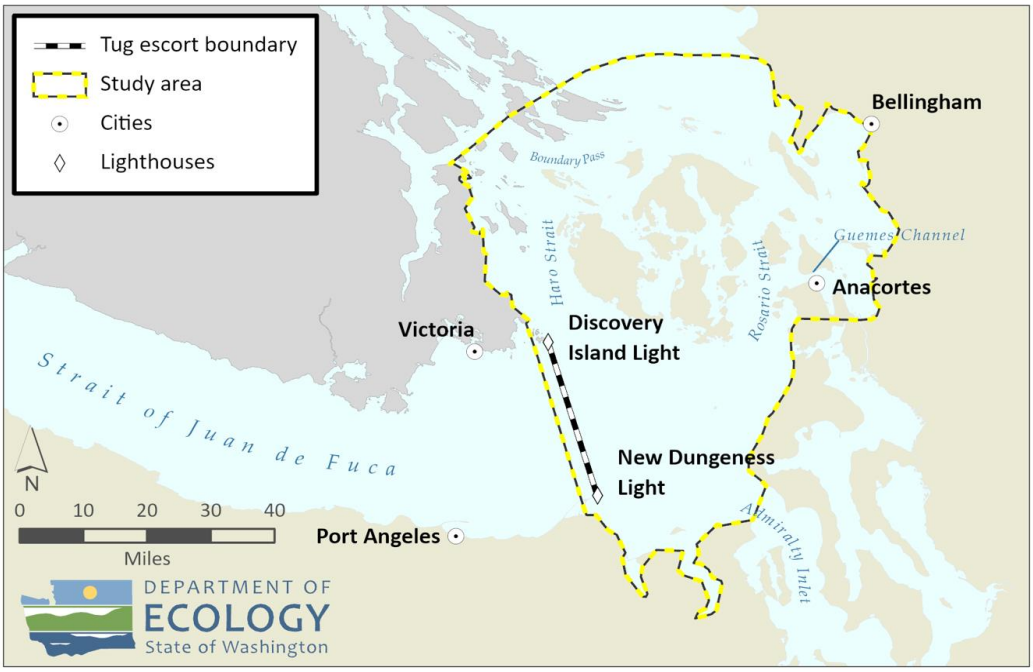

Figure 1 Map of study area

Figure 2 shows a portion of the study area in greater detail, including several of the geographic zones defined by the BPC (Board of Pilotage Commissioners, 2020b). The new tug escort requirement applies to Rosario Strait and connected waterways east.

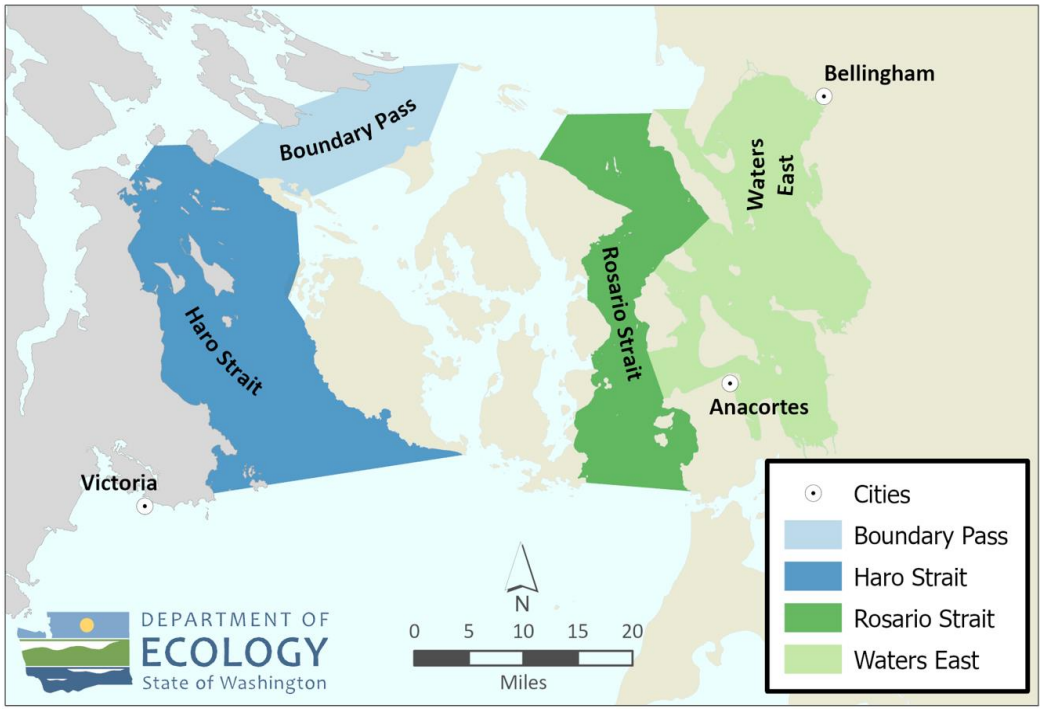

Figure 2 Map of selected waterways and geographic areas in the study area

Scope of Work

The BPC worked collaboratively with Ecology to create the scope of work, provided in Appendix D. The scope for the changing traffic trends synopsis was approved at a public hearing of the Board of Pilotage Commissioners on May 21, 2020 (Board of Pilotage Commissioners, 2020d).

The scope of work defines the roles and responsibilities for the BPC and Ecology, states the purpose of the synopsis, defines the research questions, and identifies the methods, data sources and challenges, data collection timeline, and deliverables. The scope describes opportunities for the BPC to review and comment on the synopsis, a process for amending the scope, and the overall timeline for the project (Board of Pilotage Commissioners, 2020b).

Additionally, the BPC developed the State of Washington Board of Pilotage Commissioners Interpretive Statement (Revised September 17, 2020), to create definitions for interpreting terms as they relate to the Act (Board of Pilotage Commissioners, 2020b). The interpretive statement is provided in Appendix E. Further definitions for terms used in the synopsis are provided in Appendix F.

Ecology provided technical assistance to the BPC by preparing the synopsis to meet the scope of work. Ecology used the BPC's Interpretive Statement to inform decisions on data collection, data analysis methods, and interpretation of data results. Ecology collected data on tank vessels, tank vessel and escort tugs movements, and oil transfers within the study area. Ecology worked collaboratively with the BPC on the process of data collection, data interpretation, and writing the synopsis.

The Scope of Work did not include an assessment of the impact of vessel traffic, including escort tugs, on treaty-protected interests and fishing rights of potentially affected federally recognized Indian tribes. The Scope of Work also did not include an assessment of underwater noise from vessels nor determine volumes of oil transferred during the synopsis period.

Purpose

The intent of the synopsis is to review vessel transits pre- and post-bill implementation to identify changes after Section 2 (tug escort requirement) of the Act was implemented (Board of Pilotage Commissioners, 2020b). The synopsis reports on vessel trends for Washington waters east of a line extending from Discovery Island lighthouse south to New Dungeness lighthouse. It also includes vessel trends for the transboundary waters of Haro Strait, Boundary Pass, and the southern Strait of Georgia.

Research questions

The scope of work identifies the following questions (Board of Pilotage Commissioners, 2020b):

- What changing vessel traffic trends do we see for vessels that newly fall under an escort requirement?
- What changing vessel traffic trends do we see for deep draft and tug traffic that have no additional escort requirements?
- What changing vessel traffic trends do we see for tug escorts?

- How does the overall number of transits (by vessel type) change pre- and post-bill implementation?

Deliverables

The scope of work identifies the following deliverables (Board of Pilotage Commissioners, 2020b)

- Route selection and number of vessel transits pre-and post-bill implementation for the vessel types below. Ecology will explore ways to compare transits on a common scale.
    - vessels that newly fall under an escort requirement
    - deep draft and tug traffic that have no additional escort requirement
    - vessels that are providing bunkering or refueling services
- Routes compared will include, but will not be limited to transits of Rosario Strait and Haro Strait/Boundary Pass.
- Review of tugs engaged in escorting tank vessels in Rosario and connected waterways east, including but not limited to number of transits, names of vessels, and operating companies.
- Number of oil transfers per refinery and per anchorage pre- and post-bill implementation.
- A review of the last five years of existing vessel transit data, to provide context as to the overall trend in vessel movements, based on vessel types. Determining the laden/unladen status of tank vessels, deadweight tonnage of vessels, and details on vessel occupation (i.e., bunkering) would require a manual evaluation of each transit, and is outside the scope of this review.

Analysis Methods

Ecology created seven synopsis steps to produce the deliverables.

Synopsis Steps

1. Research data sources
2. Create lists of vessels to meet research questions and deliverables
3. Create a record of vessel transits and a determination of transit type
4. Collect data on escort tug activity
5. Collect data on oil transfers
6. Collect data on tanker movements
7. Write a review of the last five years of existing vessel transit data

Table 1 Synopsis Step matched to Outcome, Data Source and Analysis Method

Synopsis Step	Outcome	Data Source	Analysis Method
1. Research data sources	List of sources to support next steps in synopsis	• Ecology databases • Industry websites and databases	Review of available data sources
2. Create lists of vessels to meet research questions and deliverables	• Vessels which newly fall under escort requirement • Vessels with no additional escort requirement	• Ecology VEAT[1] data • Ecology ANT[2] System • Ecology SPIIS[3] System	VEAT/SPIIS/ANT data review
3. Create a record of vessel transits and a determination of transit type	Spreadsheet with route selection and transit type	• Ecology ANT System • Ecology SPIIS System • Marine Exchange of Puget Sound Web-Based AIS[4]	Manual Method
4. Collect data on escort tug activity	Data on tugs engaged in escort duties in Rosario and connected waterways east	• Marine Exchange of Puget Sound Web-Based AIS	AIS Crossing line method
5. Collect data on oil transfers	Data on number of oil transfers per refinery and per anchorage	• Ecology ANT System	SPIIS data report
6. Collect data on movements of tankers with no additional escort requirement	Data on tanker movements in Rosario, connected waterways east, Haro Strait, and Boundary Pass	• Marine Exchange of Puget Sound Web-Based AIS	AIS Crossing line method
7. Write a review of the last five years of existing vessel transit data	A broad overview of past traffic to provide context for the overall trend in vessel movements	• Ecology VEAT data	VEAT data review

[1] Vessel Entries and Transit report (VEAT)
[2] Advance Notice of oil Transfer (ANT)
[3] Spills Integrated Information System (SPIIS)
[4] Automatic Identification System (AIS)

Ecology used the outcomes from the synopsis steps to answer the research questions and provide the synopsis deliverables. The following paragraphs provide a detailed description of the methods Ecology used to produce the outcome for each synopsis step.

Synopsis Step 1: Research Data Sources

Ecology researched available data resources in Ecology and industry databases, and vessel tracking systems and identified the following data sources for use in the synopsis. Data were either publicly available, bought, or owned by Ecology.

Ecology's Advanced Notice of Oil Transfer (ANT) system

Federal and state regulations require advance notification of oil transfers. 33 CFR 156.118 – Advance Notice of Oil Transfer[7] (1990) describes the federal rules regarding notification prior to the transfer of oil over water to or from facilities to vessels, and vessel to vessel transfers. To help prepare for and prevent oil spills, Washington State also requires advance notice of oil transfers[8] (Ecology, n.d.-b) for transfers over water per WAC 173-184-100[9].

Ecology's Advance Notice of Oil Transfer (ANT) system is a web-based application that captures and administers ANT information submitted for oil transfer activities. The application satisfies oil transfer reporting requirements of both Ecology and the U.S. Coast Guard (Ecology, n.d.-b). The system contains data on over-water bulk oil transfers of more than 100 gallons from vessels and shore-based facilities that transfer to non-recreational vessels or facilities (Ecology, n.d.-b). ANT data contains the name of the deliverer and receiver as well as the transfer time, location, product, and volume (Ecology n.d.-b).

The Marine Exchange of Puget Sound Web-Based Automatic Identification System (AIS) data

The Automatic Identification System (AIS) broadcast system, as described by the U.S. Coast Guard Navigation Center[10] webpage, is a maritime navigation safety and communications tool. Information transmitted by AIS comprises stable vessel data (e.g., type of vessel, and a unique 9-digit identification number or MMSI); dynamic vessel data (e.g., heading, course, and speed); and voyage-related data (e.g., destination, navigational status, estimated time of arrival) (Transportation Research Board & National Research Council, 2003). AIS messages can be stored and analyzed, representing an excellent source of data for vessel activities (Le Tixerant M., Le Guyader D., Gourmelon F., Queffeiec B., 2018).

All of the vessels of interest in this synopsis are required to have a properly functioning AIS (33 C.F.R. §164.46) with the exception of towed oil barges. Ecology tracked the movement of oil

[7] https://www.ecfr.gov/cgi-bin/text-idx?SID=9e21a1e5cbf2aeec745b992af156f72a&mc=true&node=se33.2.156_1118&rgn=div8
[8] https://ecology.wa.gov/Regulations-Permits/Reporting-requirements/Advance-notice-of-oil-transfer
[9] https://apps.leg.wa.gov/wac/default.aspx?cite=173-184&full=true#173-184-010
[10] https://www.navcen.uscg.gov/?pageName=aismain

barges by combining AIS data from tugs, and oil transfer data from ANT as described below in Synopsis Step 3: Record of vessel transits and determination of transit type.

The Marine Exchange of Puget Sound[11] is an association that serves as an information clearinghouse for the maritime industry and waterway users and provides access to AIS data through a program called SiiTech[12] (Marine Exchange, n.d.).

SiiTech uses a web-based maritime traffic monitoring system called Web VTS which is designed for ship traffic and monitoring centers. It allows complete interface with AIS data and has features such as AIS vessel track history and zone report creation (SiiTech, n.d.).

Ecology accessed SiiTech via a web-based subscription service through the Marine Exchange of Puget Sound.

Ecology Spills Program Integrated Information System (SPIIS) Database

The Spills Program Integrated Information System (SPIIS) is a web-based application supporting the business practices of the Ecology Spills Program (Ecology, n.d.-e). Among other functions, SPIIS provides the following (Ecology, n.d.-e):

- Vessel arrival details for vessels bound for Washington ports
- Advance Notice of Oil Transfer (ANT) details for oil transfers in Washington waters
- An integrated report center to support program reporting and performance measure requirements

Ecology Vessel Entries and Transit (VEAT) data

For over 20 years, Ecology's Spills Program has published annual Vessel Entries and Transit (VEAT) reports[13]. These reports provide information about individual vessels and entering transits for cargo and passenger vessels 300 gross tons[14] and larger, and tank ships, ATBs, and tank barges of any tonnage (Ecology, n.d.-a).

VEAT reports also include data on barge transits[15] in Washington waters (Ecology, n.d.-a). In 2011 the VEAT report began counting ATB transits separately from tank barge transits, and created a subcategory of entering transits[16] for ATBs and tank barges. VEAT data includes the names and operating companies for ATBs and oil barges which transit Washington waters (Ecology, n.d.-a).

VEAT reports list data by vessel destination and vessel type and do not reflect specific products or commodities transported or delivered (Ecology, n.d.-a).

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[11] https://marexps.com/
[12] https://www.siitech.com/
[13] https://ecology.wa.gov/Spills-Cleanup/Spills/Oil-spill-prevention/Preventing-spills
14 Gross tons (GT) is the volumetric measurement of the enclosed space in a vessel, usually used for ship's manning regulations, safety rules, registration fees, and port dues (Maritime Industrial Foundation, n.d.)
15 For VEAT, a tank barge/ATB transit is defined as any significant move between two locations in Washington state waters, while transporting oil.
16 For VEAT, an entering transits is defined as the passage of a vessel from sea or from Canadian waters into Washington state waters, regardless of destination. An entering transit is a subset of the overall number of transits.

Synopsis Step 2: Create lists of vessels to meet research questions and deliverables

Using data from Ecology's SPIIS and ANT databases, Ecology performed a series of steps to determine which vessels should be included in analysis. These steps were used to create lists of:

- Vessels newly subject to the new escort tug requirements
    - Tankers between 5,000 and 40,000 DWT
    - ATBs and oil barges over 5,000 DWT
- Vessels with no additional escort requirements
    - Tankers over 40,000 DWT
    - ATBs and oil barges less than 5,000 DWT

Vessels that newly fall under an escort requirement

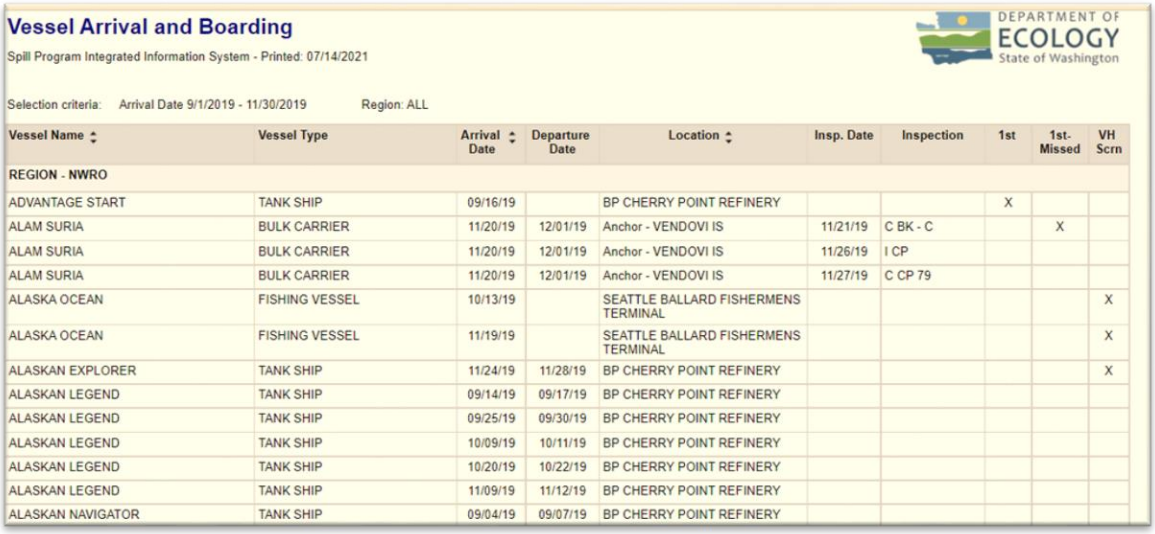
Tankers between 5,000 and 40,000 DWT

To compare traffic trends for tankers that newly fall under the tug escort requirements, Ecology created a list of tankers between 5,000 and 40,000 DWT that operated in the study area during the synopsis period. This list does not include liquefied natural gas tankers (LNG) or liquefied petroleum gas (LPG) tankers as these cargos do not meet the definition of oil in the scope of work[17] (Board of Pilotage Commissioners 2020c). Creating the list involved three steps:

Step 1. Produce a Vessel Arrival and Boarding Report in SPIIS for the study area with the synopsis period as the date range.

Figure 3 is an example of the Vessel Arrival and Boarding report. The report results include the vessel name, vessel type, arrival date, departure date, location, and inspection information, if available.

17 It is the interpretation of the Board [BPC] that, as per RCW 90.56.010 (19), the definition of "oil" or "oils" means oil of any kind that is liquid at twenty-five degrees Celsius and one atmosphere of pressure and any fractionation thereof.



Vessel Arrival and Boarding

Spill Program Integrated Information System - Printed: 07/14/2021

DEPARTMENT OF ECOLOGY State of Washington

Selection criteria: Arrival Date 9/1/2019 - 11/30/2019 Region: ALL

Vessel Name	Vessel Type	Arrival Date	Departure Date	Location	Insp. Date	Inspection	1st	1st-Missed	VH Scrn
REGION - NWRO									
ADVANTAGE START	TANK SHIP	09/16/19		BP CHERRY POINT REFINERY			X		
ALAM SURIA	BULK CARRIER	11/20/19	12/01/19	Anchor - VENDOVI IS	11/21/19	C BK - C		X	
ALAM SURIA	BULK CARRIER	11/20/19	12/01/19	Anchor - VENDOVI IS	11/26/19	I CP			
ALAM SURIA	BULK CARRIER	11/20/19	12/01/19	Anchor - VENDOVI IS	11/27/19	C CP 79			
ALASKA OCEAN	FISHING VESSEL	10/13/19		SEATTLE BALLARD FISHERMENS TERMINAL					X
ALASKA OCEAN	FISHING VESSEL	11/19/19		SEATTLE BALLARD FISHERMENS TERMINAL					X
ALASKAN EXPLORER	TANK SHIP	11/24/19	11/28/19	BP CHERRY POINT REFINERY					X
ALASKAN LEGEND	TANK SHIP	09/14/19	09/17/19	BP CHERRY POINT REFINERY					
ALASKAN LEGEND	TANK SHIP	09/25/19	09/30/19	BP CHERRY POINT REFINERY					
ALASKAN LEGEND	TANK SHIP	10/09/19	10/11/19	BP CHERRY POINT REFINERY					
ALASKAN LEGEND	TANK SHIP	10/20/19	10/22/19	BP CHERRY POINT REFINERY					
ALASKAN LEGEND	TANK SHIP	11/09/19	11/12/19	BP CHERRY POINT REFINERY					
ALASKAN NAVIGATOR	TANK SHIP	09/04/19	09/07/19	BP CHERRY POINT REFINERY					

Figure 3 Example of Spills Program Integrated Information System (SPIIS) Vessel Arrival and Boarding report for September 1, 2019, to November 30, 2019

Step 2. Export the Vessel Arrival and Boarding reports into Excel, sort and manipulate data.

Next, Ecology exported the SPIIS report into Excel, and sorted the list of vessels by vessel type. All vessels with types other than 'tank ship' (tankers) were removed. The resultant list of tanker arrival reports was then sorted by location, and all arrivals that were outside the study area were removed.

Step 3. Determine each vessel type and deadweight tonnage.

To determine which of these tankers met the new escort tug requirement of an oil tanker with a deadweight tonnage between 5,000 and 40,000 tons, Ecology determined the type of tanker and deadweight tonnage for each individual tanker using the website Marine Traffic[18].

[18] https://www.marinetraffic.com/en/ais/home/centerx:-11.9/centery:25.0/zoom:4

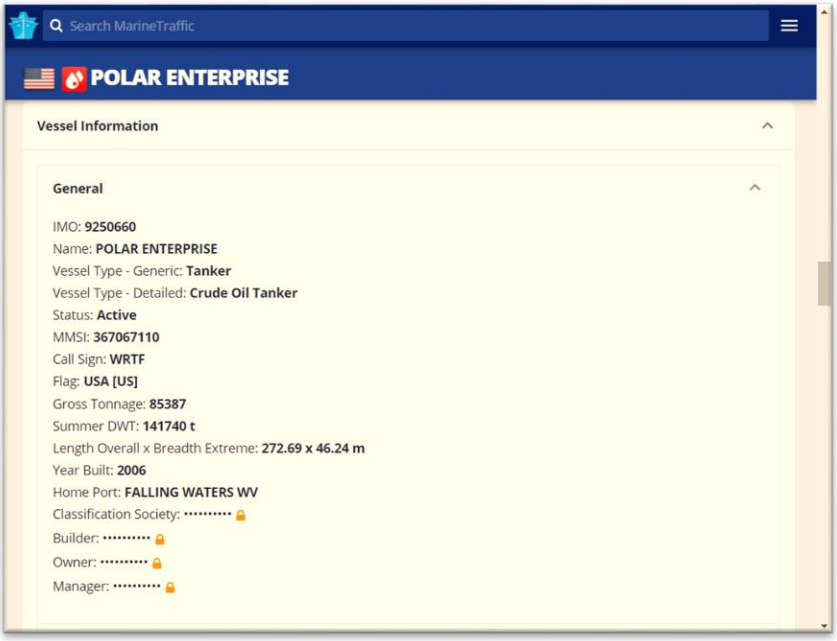


Figure 4 Example of vessel information from the website Marine Traffic

All LNG/LPG tankers and all tankers with a deadweight tonnage less than 5,000 or greater than 40,000 tons were removed from the list.

The complete list of tankers newly subject to the escort tug rule implementation in Year 1 and Year 2 is provided in Appendix O.

ATBs and oil barges

Ecology used VEAT and ANT data to identify ATBs and towed oil barges that operated within the study area and met the new tug escort requirement. This involved four steps:

Step 1. Identify ATBs and oil barges that transited Washington waters using VEAT data

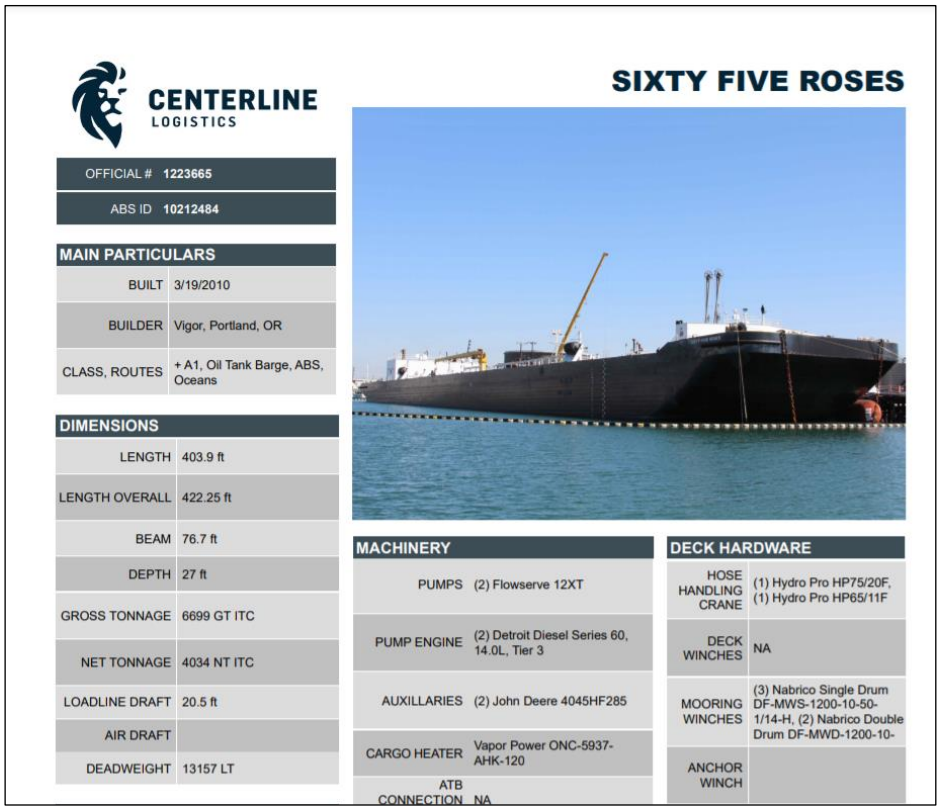
VEAT data includes an annual count of all ATBs and oil barges that transited Washington waters, by barge and company name. Ecology created a list of ATBs and oil barges, excluding any barges that transited only in the Columbia River, for the year prior to tug escort implementation and the year after tug escort implementation.

Step 2. Compare ANT data with VEAT data to identify any additional ATBs or oil barges from January 1, 2021 to August 31, 2021

VEAT data for 2021 will be published in March 2022. The 2020 VEAT includes information about transits between January 1, 2020, and December 31, 2020. Ecology reviewed ANT oil transfer data to determine if any ATB or oil barges not included in 2019 and 2020 VEAT data transited the study area between January 1, 2021, and August 31, 2021. There were two additional ATBs and one oil barge to add to the list created from VEAT data.

Step 3. Determine the deadweight tonnage for each ATB barge and oil barge on the list

The new escort tug requirement include a deadweight tonnage limit. Barges less than 5,000 DWT do not require escort tugs. Ecology determined which ATB and oil barges met the escort tug 5,000 DWT requirement by using vessel owner/operator websites (Figure 5), commercial websites such as Marine Intelligence,[19] and by contacting companies directly.



CENTERLINE LOGISTICS

SIXTY FIVE ROSES

OFFICIAL #	1223665
ABS ID	10212484

MAIN PARTICULARS	
BUILT	3/19/2010
BUILDER	Vigor, Portland, OR
CLASS, ROUTES	+ A1, Oil Tank Barge, ABS, Oceans

DIMENSIONS	
LENGTH	403.9 ft
LENGTH OVERALL	422.25 ft
BEAM	76.7 ft
DEPTH	27 ft
GROSS TONNAGE	6699 GT ITC
NET TONNAGE	4034 NT ITC
LOADLINE DRAFT	20.5 ft
AIR DRAFT	
DEADWEIGHT	13157 LT

MACHINERY	
PUMPS	(2) Flowserve 12XT
PUMP ENGINE	(2) Detroit Diesel Series 60, 14.0L, Tier 3
AUXILLARIES	(2) John Deere 4045HF285
CARGO HEATER	Vapor Power ONC-5937-AHK-120
ATB CONNECTION	NA

DECK HARDWARE	
HOSE HANDLING CRANE	(1) Hydro Pro HP75/20F, (1) Hydro Pro HP65/11F
DECK WINCHES	NA
MOORING WINCHES	(3) Nabrico Single Drum DF-MWS-1200-10-50-1/14-H, (2) Nabrico Double Drum DF-MWD-1200-10-
ANCHOR WINCH	

Figure 5 Example of an oil barge company website with vessel-specific information

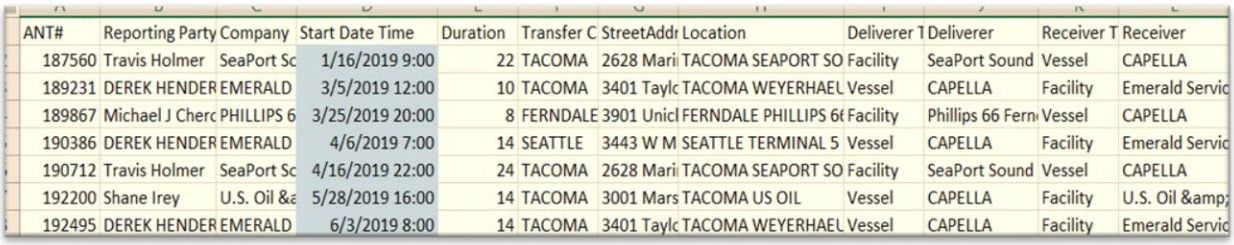
The results of this step are included as appendices:

- Appendix L – Articulated Tug Barges
- Appendix M – Oil barges greater than 5,000 DWT
- Appendix N – Oil barges less than 5,000 DWT

Step 4. Determine if the ATBs and oil barges on the list transited in the study area during the synopsis period.

Appendices L, M and N include all ATBs and barges that transited in the Puget Sound. To refine the list to only ATBs and barges that transited the study area during the synopsis period, Ecology referred to VEAT data, which includes each ATB and oil barge transfer date and location (Figure 6).

[19] https://intelligence.marinelink.com/vessels/vessel/cascades-331676



ANT#	Reporting Party	Company	Start Date Time	Duration	Transfer C	StreetAddr	Location	Deliverer T	Deliverer	Receiver T	Receiver
187560	Travis Holmer	SeaPort Sc	1/16/2019 9:00	22	TACOMA	2628 Mari	TACOMA SEAPORT SO	Facility	SeaPort Sound	Vessel	CAPELLA
189231	DEREK HENDER	EMERALD	3/5/2019 12:00	10	TACOMA	3401 Tayl	TACOMA WEYERHAEU	Vessel	CAPELLA	Facility	Emerald Servic
189867	Michael J Cherc	PHILLIPS 6	3/25/2019 20:00	8	FERNDALE	3901 Unicl	FERNDALE PHILLIPS 6	Facility	Phillips 66 Fern	Vessel	CAPELLA
190386	DEREK HENDER	EMERALD	4/6/2019 7:00	14	SEATTLE	3443 W M	SEATTLE TERMINAL 5	Vessel	CAPELLA	Facility	Emerald Servic
190712	Travis Holmer	SeaPort Sc	4/16/2019 22:00	24	TACOMA	2628 Mari	TACOMA SEAPORT SO	Facility	SeaPort Sound	Vessel	CAPELLA
192200	Shane Irey	U.S. Oil &a	5/28/2019 16:00	14	TACOMA	3001 Mars	TACOMA US OIL	Vessel	CAPELLA	Facility	U.S. Oil &
192495	DEREK HENDER	EMERALD	6/3/2019 8:00	14	TACOMA	3401 Tayl	TACOMA WEYERHAEU	Vessel	CAPELLA	Facility	Emerald Servic

Figure 6 2019 VEAT data for barge Capella showing transfer dates and locations

This step resulted in the following lists of ATBs and oil barges (Tables 2-4).

Table 2 Articulated Tug Barge (ATB) units that transited the study area in the synopsis period

ATB Barge Name	ATB Tug Name	Operating Company
550-2	Sound Reliance	Crowley Shipping
550-3	Ocean Reliance	Crowley Shipping
650-2	Gulf Reliance	Crowley Shipping
650-6	Commitment	Crowley Shipping
650-8	Achievement	Crowley Shipping
650-10	Vision	Crowley Shipping
All Aboard For A Cure	Bill Gobel	Centerline Logistics Corp.
Dr. Robert J Beall	Emery Zidell	Centerline Logistics Corp.
Edward Itta	Todd E. Prophet	Centerline Logistics Corp.
Fight ALS	Barry Silverton	Centerline Logistics Corp.
Fight Fanconi Anemia	Min Zidell	Centerline Logistics Corp.
Onedream	Jake Shearer/Min Zidell	Centerline Logistics Corp.
Petro Mariner	Dale R Lindsey	Centerline Logistics Corp.
Zidell Marine 277	One Cure	Centerline Logistics Corp.
ITB Island Trader	Island Monarch	Island Tug and Barge (Canada)
DBL 78	Cape Ann	Kirby Offshore Marine
DBL 185	Dublin Sea	Kirby Offshore Marine
DBL 185-01	Nancy Peterkin	Kirby Offshore Marine
OSG 204	OSG Endurance	OSG Ship Management
Petrochem Supplier	Corpus Christi	U.S. Shipping

Table 3 Oil barges greater than 5,000 DWT that transited the study area in the synopsis period

Barge > 5,000 DWT Name	Operating Company
Betsy Arntz	Centerline Logistics Corp.
Dottie	Centerline Logistics Corp.
Dr. Bonnie W Ramsey	Centerline Logistics Corp.
Dugan Pearsall	Centerline Logistics Corp.
Lovel Briere	Centerline Logistics Corp.
Nathan Schmidt	Centerline Logistics Corp.

Table 3 Oil barges greater than 5,000 DWT that transited the study area, continued

Barge > 5,000 DWT Name	Operating Company
Olympic Spirit	Centerline Logistics Corp.
Shauna Kay	Centerline Logistics Corp.
Sixty Five Roses	Centerline Logistics Corp.
Antril S.	Cook Inlet Tug And Barge
Cascades	Kirby Offshore Marine
Sasanoa	Kirby Offshore Marine
Pb-32	Marine Petrobulk (Canada)
Pb-34	Marine Petrobulk (Canada)
Petrobulker	Marine Petrobulk (Canada)
Drakes Bay	Sause Bros
Commencement Bay	Sause Bros
Seaspan 880 (Ex. Leo)	Seaspan
Double Skin 311 (DS 311)	Vane Brothers
Double Skin 313 (DS 313)	Vane Brothers
Double Skin 505 (DS 505)	Vane Brothers
Double Skin 501 (DS 501)	Vane Brothers

Table 4 Oil barges less than 5,000 DWT that transited the study area in the synopsis period

Barge < 5,000 DWT Name	Operating Company
HMS 26-1	Centerline Logistics Corp.
Professor Karen Ann Brown	Centerline Logistics Corp.
ITB Supplier	Island Tug and Barge (Canada)
ITB Vancouver	Island Tug and Barge (Canada)
Global Pilot	Maxum Petroleum
Global Provider*	Maxum Petroleum
Seaspan 827	SEASPAN

* The Global Provider is a self-propelled tank vessel less than 5,000 DWTs. Ecology considers the Global Provider an oil barge for purposes of regulation, enforcement, and for VEAT vessel counts.

Synopsis Step 3: Create a record of vessel transits and a determination of transit type

The synopsis purpose is to compare vessel traffic trends by vessel type from the year prior to tug escort implementation to the year after. To accomplish this, Ecology used a manual method to determine the route selection and the number of vessel transits by vessel type using ANT data and AIS data.

Ecology combined the two data sources to determine transit route and the transit type, which was based on the estimated amount of oil carried as cargo onboard vessels. Transit types were defined as ‘likely laden’, ‘likely unladen’, ‘unknown’, or ‘engaged in bunkering’.

The combined methods of determining route selection and transit type involved four steps:

Step 1. Ecology searched the ANT system to create a list of all transfers which occurred in the study area.

Ecology used the "Search Vessel Transfer" query tool in ANT to identify transfers involving the barges in tables 2-4 as either the deliverer or receiver of oil, using the synopsis period for the transfer dates (Figure 7).

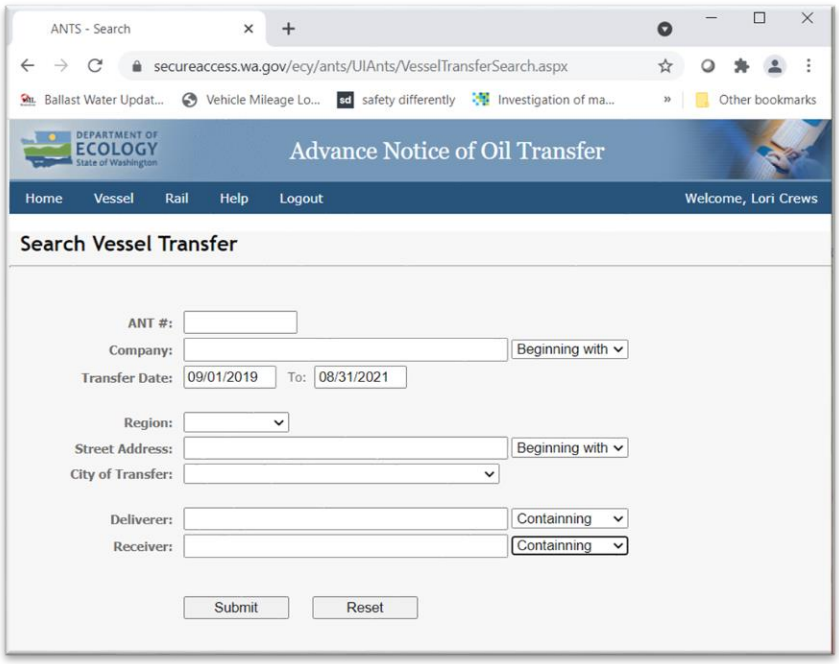


Figure 7 Advance Notice of Oil Transfer (ANT) search page

The search results were exported to Excel. Figure 8 shows an example of search results for the oil barge Sixty Five Roses over the period September 1, 2019, to November 30, 2019.

In Figure 8, the first group of rows in the spreadsheet are the result of the search for Sixty Five Roses as the deliverer. The second group of rows in the spreadsheet are for the Sixty Five Roses as the receiver.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
ANT#	Reporting	Company	Start Date Time	Duration	Transfer C	StreetAddr	Location	Deliverer T	Deliverer	Receiver T	Receiver	Transfer T	Product	Quantity(G
198800	KinderMor	Kinder Mo	11/4/2019 7:00	6	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	1050000
198780	KinderMor	Kinder Mo	11/3/2019 6:00	15	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	CUTTER S1	2100000
198619	Brian Heal	OLYMPIC T	10/30/2019 7:00	2	SEATTLE	3225 E MA	SEATTLE TERMIN/	Vessel	SIXTY FIVE	Vessel	DR. BONN	Lightering	BUNKER C	250320
198511	Harley Ma	OLYMPIC T	10/26/2019 4:00	6	TACOMA	2628 Mari	TACOMA SEAPOR	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	CUTTER S1	1386000
198505	KinderMor	KINDER-M	10/25/2019 2:30	14	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	1163400
198500	KinderMor	KINDER-M	10/24/2019 21:30	3	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	CUTTER S1	546000
198417	KinderMor	Kinder Mo	10/23/2019 1:00	4	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	420000
198188	KinderMor	Kinder Mo	10/15/2019 12:00	8	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	735000
198096	KinderMor	Kinder Mo	10/12/2019 13:00	18	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	882000
198077	Harley Ma	OLYMPIC T	10/11/2019 6:00	6	TACOMA	2628 Mari	TACOMA SEAPOR	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	BUNKER C	1680000
197905	Harley Ma	OLYMPIC T	10/6/2019 18:00	9	TACOMA	2628 Mari	TACOMA SEAPOR	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	BUNKER C	1680000
197296	Brian Heal	OLYMPIC T	9/19/2019 18:00	15	TACOMA	2628 Mari	TACOMA SEAPOR	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	BUNKER C	3276000
ANT#	Reporting	Company	Start Date Time	Duration	Transfer C	StreetAddr	Location	Deliverer T	Deliverer	Receiver T	Receiver	Transfer T	Product	Quantity(G
198801	KinderMor	Kinder Mo	11/4/2019 13:00	12	SEATTLE	2720 13th	SEATTLE KINDER-	Facility	Kinder Mo	Vessel	SIXTY FIVE	Cargo	BUNKER C	1203132
198799	KinderMor	Kinder Mo	11/3/2019 21:00	10	SEATTLE	2720 13th	SEATTLE KINDER-	Facility	Kinder Mo	Vessel	SIXTY FIVE	Cargo	BUNKER C	1680000
198607	Michael J (	PHILLIPS 6	11/1/2019 13:00	29	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	CUTTER S1	1050000
198657	Michael J (	PHILLIPS 6	10/31/2019 7:30	12	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	DIESEL LO	2100000
198501	KinderMor	KINDER-M	10/25/2019 0:30	2	SEATTLE	2720 13th	SEATTLE KINDER-	Facility	Kinder Mo	Vessel	SIXTY FIVE	Cargo	BUNKER C	239400
198455	Michael J (	PHILLIPS 6	10/23/2019 17:00	18	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	BUNKER C	1890000
198150	Michael J (	PHILLIPS 6	10/16/2019 12:00	12	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	BUNKER C	3192000
197902	Travis Holi	SeaPort Sc	10/14/2019 18:00	10	TACOMA	2628 Mari	TACOMA SEAPOR	Facility	SeaPort Sc	Vessel	SIXTY FIVE	Cargo	BUNKER C	714000
197671	Michael J (	PHILLIPS 6	10/2/2019 12:00	51	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	CUTTER S1	3360000

Figure 8 Example of Advanced Notice of Oil Transfer (ANT) search results for the oil barge Sixty Five Roses

In Figure 9 the two groups of rows for deliverer and receiver were combined and sorted by date. The red box highlights several transfers occurring sequentially outside the study area. Due to the volume of data, consecutive transfers between areas outside the study area were removed.

Transfers before and after the transfer in the study area were not removed. The locations for these transfers were used in the following step to assist in identifying transits and transit types between transfers.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	ANT#	Reporting	Company	Start Date Time	Duration	Transfer C	StreetAddr	Location	Deliverer T	Deliverer	Receiver T	Receiver	Transfer T	Product	Quantity(Ga
2	197296	Brian Heal	OLYMPIC T	9/19/2019 18:00	15	TACOMA	2628 Mari	TACOMA SEAPOR	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	BUNKER C	3276000
3	197671	Michael J (	PHILLIPS 6	10/2/2019 12:00	51	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	CUTTER S1	3360000
4															
5	198077	Harley Ma	OLYMPIC T	10/11/2019 6:00	6	TACOMA	2628 Mari	TACOMA SEAPOR	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	BUNKER C	1680000
6	198096	KinderMor	Kinder Mo	10/12/2019 13:00	18	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	882000
7	197902	Travis Holi	SeaPort Sc	10/14/2019 18:00	10	TACOMA	2628 Mari	TACOMA SEAPOR	Facility	SeaPort Sc	Vessel	SIXTY FIVE	Cargo	BUNKER C	714000
8															
9	198150	Michael J (	PHILLIPS 6	10/16/2019 12:00	12	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	BUNKER C	3192000
10	198417	KinderMor	Kinder Mo	10/23/2019 1:00	4	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	420000
11	198455	Michael J (	PHILLIPS 6	10/23/2019 17:00	18	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	BUNKER C	1890000
12	198500	KinderMor	KINDER-M	10/24/2019 21:30	3	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	CUTTER S1	546000
13	198501	KinderMor	KINDER-M	10/25/2019 0:30	2	SEATTLE	2720 13th	SEATTLE KINDER-	Facility	Kinder Mo	Vessel	SIXTY FIVE	Cargo	BUNKER C	239400
14	198505	KinderMor	KINDER-M	10/25/2019 2:30	14	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	1163400
15	198511	Harley Ma	OLYMPIC T	10/26/2019 4:00	6	TACOMA	2628 Mari	TACOMA SEAPOR	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	CUTTER S1	1386000
16	198619	Brian Heal	OLYMPIC T	10/30/2019 7:00	2	SEATTLE	3225 E MA	SEATTLE TERMIN/	Vessel	SIXTY FIVE	Vessel	DR. BONN	Lightering	BUNKER C	250320
17	198657	Michael J (	PHILLIPS 6	10/31/2019 7:30	12	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	DIESEL LO	2100000
18	198607	Michael J (	PHILLIPS 6	11/1/2019 13:00	29	FERNDALE	3901 Unicl	FERNDALE PHILLII	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	CUTTER S1	1050000
19	198780	KinderMor	Kinder Mo	11/3/2019 6:00	15	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	CUTTER S1	2100000
20	198799	KinderMor	Kinder Mo	11/3/2019 21:00	10	SEATTLE	2720 13th	SEATTLE KINDER-	Facility	Kinder Mo	Vessel	SIXTY FIVE	Cargo	BUNKER C	1680000
21	198800	KinderMor	Kinder Mo	11/4/2019 7:00	6	SEATTLE	2720 13th	SEATTLE KINDER-	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	1050000
22	198801	KinderMor	Kinder Mo	11/4/2019 13:00	12	SEATTLE	2720 13th	SEATTLE KINDER-	Facility	Kinder Mo	Vessel	SIXTY FIVE	Cargo	BUNKER C	1203132

Figure 9 Example in Figure 8 with data combined and sorted by date.

Figure 10 shows the final result of the ANT transfer data for the oil barge Sixty Five Roses with consecutive transfers outside the study area removed. This data was used to populate a new

spreadsheet, which combined ANT data and information about transits from AIS as described in Step 2.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	ANT#	Reporting	Company	Start Date Time	Duration	Transfer City	StreetAddr	Location	Deliverer T	Deliverer	Receiver T	Receiver	Transfer T	Product	Quantity(Gal)
2	197296	Brian Heal	OLYMPIC TU	9/19/2019 18:00	15	TACOMA	2628 Mari	TACOMA S	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	BUNKER C	3276000
3	197671	Michael J (	PHILLIPS 66 -	10/2/2019 12:00	51	FERNDALE	3901 Unicl	FERNDALE	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	CUTTER ST	3360000
4	197905	Harley Ma	OLYMPIC TU	10/6/2019 18:00	9	TACOMA	2628 Mari	TACOMA S	Vessel	SIXTY FIVE	Facility	SeaPort Sc	Cargo	BUNKER C	1680000
5	198188	KinderMor	Kinder Morg	10/15/2019 12:00	8	SEATTLE	2720 13th	SEATTLE KI	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	735000
6	198150	Michael J (	PHILLIPS 66 -	10/16/2019 12:00	12	FERNDALE	3901 Unicl	FERNDALE	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	BUNKER C	3192000
7	198417	KinderMor	Kinder Morg	10/23/2019 1:00	4	SEATTLE	2720 13th	SEATTLE KI	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	BUNKER C	420000
8	198455	Michael J (	PHILLIPS 66 -	10/23/2019 17:00	18	FERNDALE	3901 Unicl	FERNDALE	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	BUNKER C	1890000
9	198500	KinderMor	KINDER-MOI	10/24/2019 21:30	3	SEATTLE	2720 13th	SEATTLE KI	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	CUTTER ST	546000
10	198619	Brian Heal	OLYMPIC TU	10/30/2019 7:00	2	SEATTLE	3225 E MA	SEATTLE TE	Vessel	SIXTY FIVE	Vessel	DR. BONN	Lightering	BUNKER C	250320
11	198657	Michael J (	PHILLIPS 66 -	10/31/2019 7:30	12	FERNDALE	3901 Unicl	FERNDALE	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	DIESEL LO	2100000
12	198607	Michael J (	PHILLIPS 66 -	11/1/2019 13:00	29	FERNDALE	3901 Unicl	FERNDALE	Facility	Phillips 66	Vessel	SIXTY FIVE	Cargo	CUTTER ST	1050000
13	198780	KinderMor	Kinder Morg	11/3/2019 6:00	15	SEATTLE	2720 13th	SEATTLE KI	Vessel	SIXTY FIVE	Facility	Kinder Mo	Cargo	CUTTER ST	2100000

Figure 10 Example of Advanced Notice of Oil Transfer (ANT) search results with consecutive transfers outside of study area removed.

Step 2. ANT transfer data was used to populate a spreadsheet

To compare traffic trends for ATBs and oil barges, Ecology created a new spreadsheet to document transfer data and the number and type of transits for each barge in Tables 2-4.

Figure 11 shows an expanded view of all columns on the spreadsheet

Information Source	Barge /Tug	Company	Date	SJDF Transit	Transit Origin	Transit Destination	Rosario Transit	Area East of Rosario Transit	Haro Transit

Transfer Deliverer	Transfer Receiver	Transfer Type	Product Transferred	Quantity Transferred	95% Barge Capacity	Engaged in Bunkering?	Barge activity	Activity Summary

Figure 11 Spreadsheet columns

The ANT data from Step 1 was entered into the spreadsheet and organized alphabetically by the name of the barge and then chronologically oldest to newest.

Figure 12 shows the transfer data for the oil barge Sixty Five Roses from Figure 10 entered into the spreadsheet.

INFO source	Tug/Barge	Company	Date	SJDF Transit	Transit ORIGIN	Transit DESTINATION	ROSARIO Transit	Area East of Rosario Transit	Rosario and waters east	HARO Transit	Transfer Deliverer	Transfer Receiver	Transfer Type	Product Transferred	Quantity Transferred (Gallons)	95% Barge Capacity (Gallons)	Engaged in Bunkering?	Barge activity/laden/unladen
ANT	SIXTY FIVE RC	CENTERLII	9/19/2019	0	TACOMA	TACOMA	0	0	0	0	SIXTY FIVE	SeaPort Sc	Cargo	BUNKER C	3,276,000	3,516,666	NO	Barge deliver to terminal
ANT	SIXTY FIVE RC	CENTERLII	10/2/2019	0	FERNDALE	FERNDALE	0	0	0	0	Phillips 66	SIXTY FIVE	Cargo	CUTTER S1	3,360,000	3,516,666	NO	barge receive from terminal
ANT	SIXTY FIVE RC	CENTERLII	10/6/2019	0	TACOMA	TACOMA	0	0	0	0	SIXTY FIVE	SeaPort Sc	Cargo	BUNKER C	1,680,000	3,516,666	NO	Barge deliver to terminal
ANT	SIXTY FIVE RC	CENTERLII	10/15/2019	0	SEATTLE	SEATTLE	0	0	0	0	SIXTY FIVE	Kinder Mo	Cargo	BUNKER C	735,000	3,516,666	NO	Barge deliver to terminal
ANT	SIXTY FIVE RC	CENTERLII	10/16/2019	0	FERNDALE	FERNDALE	0	0	0	0	Phillips 66	SIXTY FIVE	Cargo	BUNKER C	3,192,000	3,516,666	NO	barge receive from terminal
ANT	SIXTY FIVE RC	CENTERLII	10/23/2019	0	SEATTLE	SEATTLE	0	0	0	0	SIXTY FIVE	Kinder Mo	Cargo	BUNKER C	420,000	3,516,666	NO	Barge deliver to terminal
ANT	SIXTY FIVE RC	CENTERLII	10/23/2019	0	FERNDALE	FERNDALE	0	0	0	0	Phillips 66	SIXTY FIVE	Cargo	BUNKER C	1,890,000	3,516,666	NO	barge receive from terminal
ANT	SIXTY FIVE RC	CENTERLII	10/24/2019	0	SEATTLE	SEATTLE	0	0	0	0	SIXTY FIVE	Kinder Mo	Cargo	CUTTER S1	546,000	3,516,666	NO	Barge deliver to terminal
ANT	SIXTY FIVE RC	CENTERLII	10/30/2019	0	SEATTLE	SEATTLE	0	0	0	0	SIXTY FIVE	DR. BONN	Lightering	BUNKER C	250,320	3,516,666	NO	barge lightering to vessel
ANT	SIXTY FIVE RC	CENTERLII	10/31/2019	0	FERNDALE	FERNDALE	0	0	0	0	Phillips 66	SIXTY FIVE	Cargo	DIESEL LO	2,100,000	3,516,666	NO	barge receive from terminal
ANT	SIXTY FIVE RC	CENTERLII	11/1/2019	0	FERNDALE	FERNDALE	0	0	0	0	Phillips 66	SIXTY FIVE	Cargo	CUTTER S1	1,050,000	3,516,666	NO	barge receive from terminal
ANT	SIXTY FIVE RC	CENTERLII	11/3/2019	0	SEATTLE	SEATTLE	0	0	0	0	SIXTY FIVE	Kinder Mo	Cargo	CUTTER S1	2,100,000	3,516,666	NO	barge receive from terminal

Figure 12 Example of the transfer data from Step 1 (Figure 10) entered into the spreadsheet

Each row of the spreadsheet organizes Sixty Five Roses' transfer data as follows:

The information source was the ANT database. The transit columns 'SJDF (Strait of Juan de Fuca) Transit', Rosario Transit', 'area east of Rosario Transit' and 'Haro Transit' were filled in with a zero, meaning a transit did not occur through these areas.

The 'Transit Origin' and 'Transit Destination' columns were both filled in with the city the transfer occurred in.

Because the 'Transfer Type' column in this example indicates all of the transfers were either cargo or lightering[20] transfers, the 'Engaged in Bunkering?' column was filled in with 'NO'.

The column 'Barge Activity' was filled in by reviewing the 'Transfer Deliverer' and 'Transfer Receiver' columns. For the first row in Figure 12, the barge Sixty Five Roses was in the 'Transfer Deliver' column and SeaPort (Tacoma) was in 'Transfer Receiver' column. The 'Barge Activity' column for this row was entered as: 'Barge deliver to terminal'.

Step 3. AIS data was used to determine the vessel's transit route between transfers

Using SiiTech WEB VTS to access the AIS history function, Ecology determined vessel transit routes, and added transit data to the spreadsheet.

Because oil barges are not required to have an AIS unit onboard (CFR 33.164.46(b)), Ecology tracked the tug which was paired with the barge at the time of the transit. Many tug and barge combinations were fairly static; however, some companies used several different tugs interchangeably with their barges. If it was necessary to determine which tug was paired with the barge, the ANT transfer data from before or after the transit was referenced for the date, time, and location. The AIS history function was used to identify the tug paired with the barge at the location and time of the transfer.

[20] The term 'lightering' means the transfer of a cargo of hazardous material in bulk from one vessel to another. See Appendix G Maritime Definitions

Figure 13 is an example of a section of the spreadsheet with the AIS and ANT data for barge Sixty Five Roses and tug Ann T Cheramie, for September 1, 2019, to November 30, 2019. Each row represents a unique transfer or transit.

16	INFO source	Tug/Barge	Company	Date	SJDF Transit	Transit ORIGIN	Transit DESTINATION	ROSARIO Transit	Area East of Rosario Transit	HARO Transit	Transfer Deliverer	Transfer Receiver
17	AIS	SIXTY FIVE RC	CENTERLII	10/2/2019	0	SEATTLE	FERNDALE	1	0	0	Transit/No	Transfer
18	ANT	SIXTY FIVE RC	CENTERLII	10/2/2019	0	FERNDALE	FERNDALE P	0	0	0	Phillips 66	SIXTY FIVE
19	AIS	SIXTY FIVE RC	CENTERLII	10/5/2019	0	FERNDALE	ANCHOR AN	1	0	0	Transit/No	Transfer
20	AIS	SIXTY FIVE RC	CENTERLII	10/11/2019	0	ANCHOR AN	TACOMA	1	0	0	Transit/No	Transfer
21	ANT	SIXTY FIVE RC	CENTERLII	10/11/2019	0	TACOMA	TACOMA SE/	0	0	0	SIXTY FIVE	SeaPort Sc
22	ANT	SIXTY FIVE RC	CENTERLII	10/15/2019	0	SEATTLE	SEATTLE KIN	0	0	0	SIXTY FIVE	Kinder Mo
23	AIS	SIXTY FIVE RC	CENTERLII	10/16/2019	0	SEATTLE	FERNDALE	1	0	0	Transit/No	Transfer
24	ANT	SIXTY FIVE RC	CENTERLII	10/16/2019	0	FERNDALE	FERNDALE P	0	0	0	Phillips 66	SIXTY FIVE
25	AIS	SIXTY FIVE RC	CENTERLII	10/19/2019	0	FERNDALE	SEATTLE	1	0	0	Transit/No	Transfer
26	ANT	SIXTY FIVE RC	CENTERLII	10/23/2019	0	SEATTLE	SEATTLE KIN	0	0	0	SIXTY FIVE	Kinder Mo
27	AIS	SIXTY FIVE RC	CENTERLII	10/23/2019	0	SEATTLE	FERNDALE	1	0	0	Transit/No	Transfer
28	ANT	SIXTY FIVE RC	CENTERLII	10/23/2019	0	FERNDALE	FERNDALE P	0	0	0	Phillips 66	SIXTY FIVE
29	AIS	SIXTY FIVE RC	CENTERLII	10/24/2019	0	FERNDALE	SEATTLE	1	0	0	Transit/No	Transfer
30	ANT	SIXTY FIVE RC	CENTERLII	10/24/2019	0	SEATTLE	SEATTLE KIN	0	0	0	SIXTY FIVE	Kinder Mo
31	ANT	SIXTY FIVE RC	CENTERLII	10/30/2019	0	SEATTLE	SEATTLE TEF	0	0	0	SIXTY FIVE	DR. BONN
32	AIS	SIXTY FIVE RC	CENTERLII	10/31/2019	0	SEATTLE	FERNDALE	1	0	0	Transit/No	Transfer
33	ANT	SIXTY FIVE RC	CENTERLII	10/31/2019	0	FERNDALE	FERNDALE P	0	0	0	Phillips 66	SIXTY FIVE
34	ANT	SIXTY FIVE RC	CENTERLII	11/1/2019	0	FERNDALE	FERNDALE P	0	0	0	Phillips 66	SIXTY FIVE
35	AIS	SIXTY FIVE RC	CENTERLII	11/2/2019	0	FERNDALE	SEATTLE	1	0	0	Transit/No	Transfer
36	ANT	SIXTY FIVE RC	CENTERLII	11/3/2019	0	SEATTLE	SEATTLE KIN	0	0	0	SIXTY FIVE	Kinder Mo
37	AIS	SIXTY FIVE RC	CENTERLII	11/8/2019	1	SEATTLE	OCEAN	0	0	0	Transit/No	Transfer

Figure 13 Example of a section of the spreadsheet showing transit and transfer information for the barge Sixty Five Roses and tug Ann T Cheramie

Using the data from Figure 13, the following three examples show a typical sequence of events, including the transit of the tug and barge to a transfer location, an oil transfer, and the transit from the transfer location to another destination.

Transit from Seattle to Ferndale

ANT data shows the barge Sixty Five Roses transferring cargo in Ferndale on October 2, 2019. AIS data shows the tug Ann T Cheramie in transit from Seattle to Ferndale on October 2, and Ecology determined the Ann T Cheramie was pared with the barge Sixty Five Roses.

Figure 13, line 17: The columns from left to right show:

- 'Info Source' was AIS.
- 'Transit Origin' was determined either by the site of the last transfer or the tug's track line using the AIS history function. In this example, the 'Transit Origin' was Seattle.
- 'Transit Destination' was determined by the site of the next transfer or the tug's track line using the AIS history function. In this example, the 'Transit Destination' was Ferndale.

- Ecology reviewed AIS history to observe the routes used by the transiting vessel. The columns 'SJDF Transit', 'Rosario Transit', 'area east of Rosario Transit', and 'Haro Transit' were used to indicate the transit route. In this example, the tug and barge used Rosario Strait for the transit from Seattle to Ferndale, and did not transit in the other areas. Row 17 indicates this by recording '0' for the 'SJDF Transit', 'area east of Rosario Transit[21]', and 'Haro Transit', and a '1' for 'Rosario Transit'.
- The 'Transfer Deliverer' and 'Transfer Receiver' columns were filled in with 'Transit/no transfer.'

Transfer at Ferndale

Figure 13, Row 18: ANT data show barge Sixty Five Roses received oil as cargo from Ferndale Phillips 66 on October 2, 2019.

Transit from Ferndale to anchorage

Figure 13, Row 19: AIS data show the tug Ann T Cheramie in transit from Ferndale on October 5, 2019. Ecology determined the tug was paired with the barge Sixty Five Roses. The columns from left to right show:

- 'Info Source' was AIS.
- 'Transit Origin' was determined by the site of the last transfer or the tug's track line using the AIS history function. In this example, the 'Transit Origin' was Ferndale.
- 'Transit Destination' was determined by the site of the next transfer or the tug's track line using the AIS history function. In this example, the 'Transit Destination' was Anchor Anacortes.
- Ecology reviewed AIS history to observe the routes used by the transiting vessel. In this example, the tug and barge used Rosario Strait for the transit from Ferndale to the Anacortes anchorage, and did not transit in the other areas. Row 19 indicates this by recording '0' for the 'SJDF Transit', 'area east of Rosario Transit[22]', and 'Haro Transit', and a '1' for 'Rosario Transit'.
- 'Transfer Deliverer' and 'Transfer Receiver' were filled in with 'Transit/no transfer'

Transit from anchorage to Tacoma

Figure 13, Row 20: AIS data shows the tug Ann T Cheramie (with barge Sixty Five Roses) in transit from the Anacortes anchorage on October 11, 2019.

- 'Info Source' was AIS.
- 'Transit Origin' was determined by the site of the last transfer or the tug's track line using the AIS history function. In this example, 'Transit Origin' was Anchor Anacortes.
- 'Transit Destination' was determined by the site of the next transfer or the tug's track line using the AIS history function. In this example, 'Transit Destination' was Tacoma.
- Ecology reviewed AIS history to observe the routes used by transiting vessels. In this example, the tug and barge used Rosario Strait for the transit from the Anacortes

[21] If marked this would indicate the vessel only transited in the connected waterways east of Rosario Strait.
[22] This is filled in with a zero because the vessel did not transit exclusively in the waterways east of Rosario

anchorage to Tacoma, and did not transit in the other areas. Row 20 indicates this by recording '0' for the 'SJDF Transit', 'area east of Rosario Transit', and 'Haro Transit', and a '1' for 'Rosario Transit'.

- 'Transfer Deliverer' and 'Transfer Receiver' are filled in with 'Transit/no transfer'

Gaps in dates indicates the vessel was either not underway or was in transit outside the study area.

Step 4. Determine transit type

The tug escort requirement covers a laden transit for ATBs and oil barges greater than 5,000 DWT which are not engaged in bunkering operations (RCW 88.16.260).

Definitions of laden and unladen:

In the scope of work, the BPC uses a definition from an existing Statement of Policy as adopted by the Board of Pilotage Commissioners in regular session on March 15, 2005 and modified on April 21, 2005 to determine when a tank vessel is in ballast. This statement of policy was used for interpreting the terms laden or in ballast for RCW 88.16.190 and WAC 363-116-500. It describes a tank vessel 40,000 deadweights tons or more as in ballast when the clingage, residue, or other applicable cargo onboard is less than 0.5 percent of the vessel's maximum cargo carrying capacity or 3,000 barrels, whichever is less (Board of Pilotage Commissioners, 2005).

In the scope of work the BPC further describes a tank vessel below 40,000 deadweight tons, as in ballast when the clingage, residue, or other applicable cargo onboard is less than 2 percent of the vessel's maximum cargo carrying capacity or 3,000 barrels, whichever is less (Board of Pilotage Commissioners, 2020b). With the ANT data available, Ecology was not able to calculate the precise amount of cargo left onboard a vessel after discharge.

Ecology was able to determine each vessel's maximum cargo carrying capacity[23] and determine the percent of the maximum capacity for each transfer based on ANT cargo data. For instance a vessel whose maximum loaded capacity is 2,246,250 gallons loads 2,100,000 gallons of diesel. This vessel is loading 93.5 percent of its maximum capacity.

Ecology determined a vessel's laden or unladen status based on a common industry practice of loading no more than 95 percent of the maximum loaded capacity of the tank vessel. In the example above this vessel is loading a partial load, because it is loading less than 95 percent of its maximum capacity.

Ecology assigned a type to each transit, e.g., 'likely laden', 'likely unladen', or 'engaged in bunkering', by consulting the oil transfers prior to and after each transit.

A vessel's transit type was considered 'likely laden' if the vessel loaded a partial (less than 95 percent of maximum cargo capacity) or full load (equal or greater than 95 percent of maximum

[23] assuming a medium density oil such as #2 fuel oil with an API gravity at 60°F between 30 and 42 and a specific gravity, at 60/60°F, and the density, at 15.6°C, between 0.88 and 0.82

cargo capacity) at the transfer prior to the transit or discharged a partial or full load at the transfer after the transit.

A vessel's transit was considered 'likely unladen' if the vessel discharged a full capacity load prior to the transit or loaded a full capacity load after the transit.

A transit was considered 'engaged in bunkering' if it was a transit either to or from a bunkering.

In some cases Ecology was unable to make a determination of transit type. In these cases the transit type was labeled 'unknown'.

Figure 14 describes how a determination of the transit status was made.

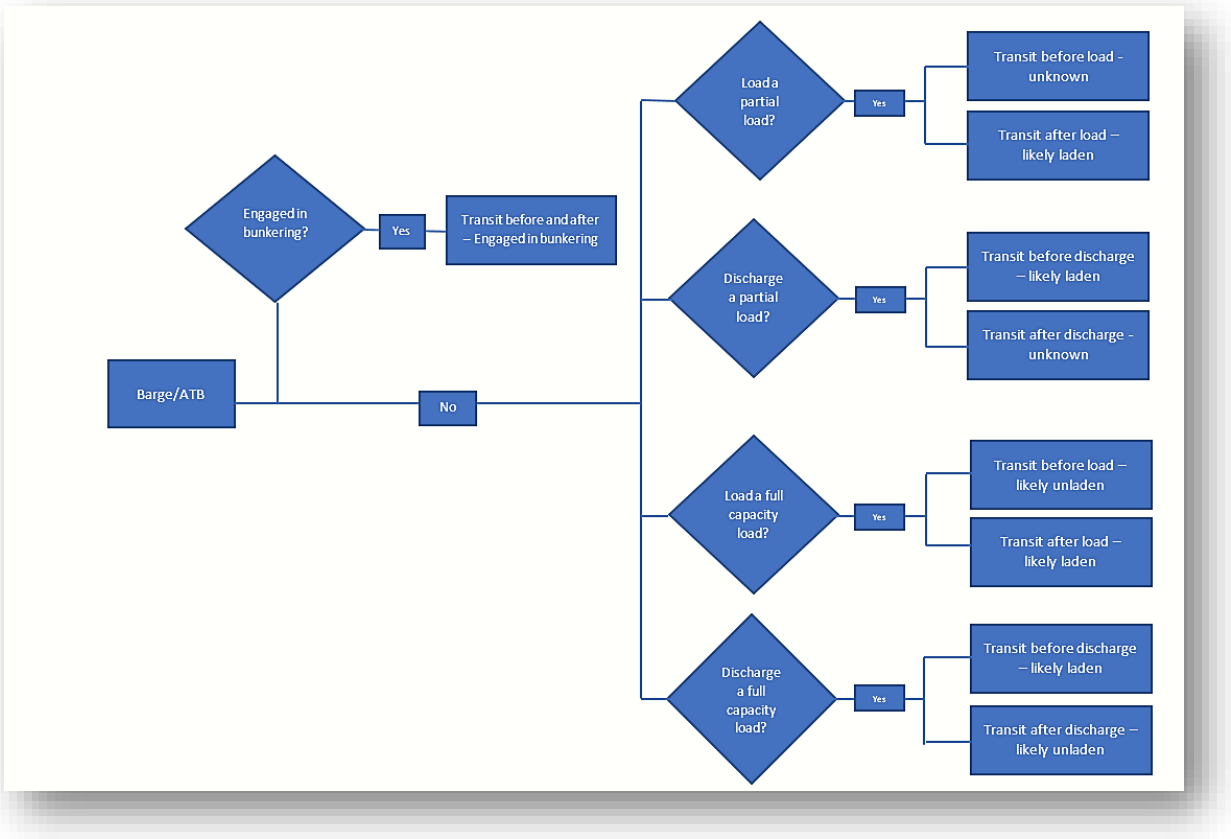
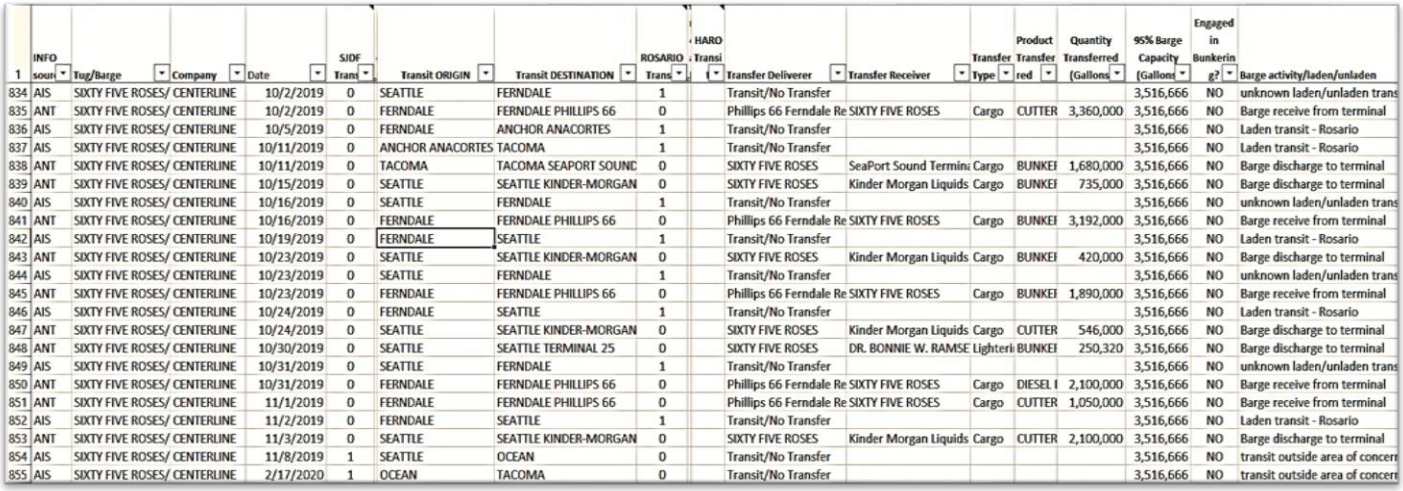


Figure 14 Logic diagram describing how a transit type was determined

In addition to evaluating transits using the logic diagram, Ecology conducted an extended review of specific Haro Strait transits that were identified as 'unknown'. This extended review was conducted to determine if tank vessel transits may have been affected by the new tug escort requirement. In these cases, Ecology reviewed ANT data for the oil transfers before or after the transit to see if the amount transferred was reasonably close to 95 percent of the vessel's cargo capacity.

Figure 15 is a portion of the spreadsheet showing the transfer and transit data for tug Ann T Cheramie and barge Sixty Five Roses using data from steps 2 and 3. Ecology has recorded the barge activity and/or transit type in the column 'Barge Activity/laden/unladen'. This portion of

the spreadsheet records the barge Sixty Five Roses as transiting in the Strait of Juan de Fuca twice, and Rosario Strait nine times. Of the transits in Rosario five were determined to be laden and four were 'unknown'.



1	INFO sour	Tug/Barge	Company	Date	SJDF Trans	Transit ORIGIN	Transit DESTINATION	ROSARIO Trans	HARO Transi (	Transfer Deliverer	Transfer Receiver	Transfer Type	Product Transferred	Quantity Transferred (Gallons	95% Barge Capacity (Gallons	Engaged in Bunkering?	Barge activity/laden/unladen
834	AIS	SIXTY FIVE ROSES/ CENTERLINE		10/2/2019	0	SEATTLE	FERNDALE	1		Transit/No Transfer					3,516,666	NO	unknown laden/unladen trans
835	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/2/2019	0	FERNDALE	FERNDALE PHILLIPS 66	0		Phillips 66 Ferndale Re	SIXTY FIVE ROSES	Cargo	CUTTER	3,360,000	3,516,666	NO	Barge receive from terminal
836	AIS	SIXTY FIVE ROSES/ CENTERLINE		10/5/2019	0	FERNDALE	ANCHOR ANACORTES	1		Transit/No Transfer					3,516,666	NO	Laden transit - Rosario
837	AIS	SIXTY FIVE ROSES/ CENTERLINE		10/11/2019	0	ANCHOR ANACORTES	TACOMA	1		Transit/No Transfer					3,516,666	NO	Laden transit - Rosario
838	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/11/2019	0	TACOMA	TACOMA SEAPORT SOUND	0		SIXTY FIVE ROSES	SeaPort Sound Termina	Cargo	BUNKEI	1,680,000	3,516,666	NO	Barge discharge to terminal
839	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/15/2019	0	SEATTLE	SEATTLE KINDER-MORGAN	0		SIXTY FIVE ROSES	Kinder Morgan Liquids	Cargo	BUNKEI	735,000	3,516,666	NO	Barge discharge to terminal
840	AIS	SIXTY FIVE ROSES/ CENTERLINE		10/16/2019	0	SEATTLE	FERNDALE	1		Transit/No Transfer					3,516,666	NO	unknown laden/unladen trans
841	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/16/2019	0	FERNDALE	FERNDALE PHILLIPS 66	0		Phillips 66 Ferndale Re	SIXTY FIVE ROSES	Cargo	BUNKEI	3,192,000	3,516,666	NO	Barge receive from terminal
842	AIS	SIXTY FIVE ROSES/ CENTERLINE		10/19/2019	0	FERNDALE	SEATTLE	1		Transit/No Transfer					3,516,666	NO	Laden transit - Rosario
843	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/23/2019	0	SEATTLE	SEATTLE KINDER-MORGAN	0		SIXTY FIVE ROSES	Kinder Morgan Liquids	Cargo	BUNKEI	420,000	3,516,666	NO	Barge discharge to terminal
844	AIS	SIXTY FIVE ROSES/ CENTERLINE		10/23/2019	0	SEATTLE	FERNDALE	1		Transit/No Transfer					3,516,666	NO	unknown laden/unladen trans
845	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/23/2019	0	FERNDALE	FERNDALE PHILLIPS 66	0		Phillips 66 Ferndale Re	SIXTY FIVE ROSES	Cargo	BUNKEI	1,890,000	3,516,666	NO	Barge receive from terminal
846	AIS	SIXTY FIVE ROSES/ CENTERLINE		10/24/2019	0	FERNDALE	SEATTLE	1		Transit/No Transfer					3,516,666	NO	Laden transit - Rosario
847	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/24/2019	0	SEATTLE	SEATTLE KINDER-MORGAN	0		SIXTY FIVE ROSES	Kinder Morgan Liquids	Cargo	CUTTER	546,000	3,516,666	NO	Barge discharge to terminal
848	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/30/2019	0	SEATTLE	SEATTLE TERMINAL 25	0		SIXTY FIVE ROSES	DR. BONNIE W. RAMSE	Lighteri	BUNKEI	250,320	3,516,666	NO	Barge discharge to terminal
849	AIS	SIXTY FIVE ROSES/ CENTERLINE		10/31/2019	0	SEATTLE	FERNDALE	1		Transit/No Transfer					3,516,666	NO	unknown laden/unladen trans
850	ANT	SIXTY FIVE ROSES/ CENTERLINE		10/31/2019	0	FERNDALE	FERNDALE PHILLIPS 66	0		Phillips 66 Ferndale Re	SIXTY FIVE ROSES	Cargo	DIESEL I	2,100,000	3,516,666	NO	Barge receive from terminal
851	ANT	SIXTY FIVE ROSES/ CENTERLINE		11/1/2019	0	FERNDALE	FERNDALE PHILLIPS 66	0		Phillips 66 Ferndale Re	SIXTY FIVE ROSES	Cargo	CUTTER	1,050,000	3,516,666	NO	Barge receive from terminal
852	AIS	SIXTY FIVE ROSES/ CENTERLINE		11/2/2019	0	FERNDALE	SEATTLE	1		Transit/No Transfer					3,516,666	NO	Laden transit - Rosario
853	ANT	SIXTY FIVE ROSES/ CENTERLINE		11/3/2019	0	SEATTLE	SEATTLE KINDER-MORGAN	0		SIXTY FIVE ROSES	Kinder Morgan Liquids	Cargo	CUTTER	2,100,000	3,516,666	NO	Barge discharge to terminal
854	AIS	SIXTY FIVE ROSES/ CENTERLINE		11/8/2019	1	SEATTLE	OCEAN	0		Transit/No Transfer					3,516,666	NO	transit outside area of concern
855	AIS	SIXTY FIVE ROSES/ CENTERLINE		2/17/2020	1	OCEAN	TACOMA	0		Transit/No Transfer					3,516,666	NO	transit outside area of concern

Figure 15 Example of the spreadsheet for the barge Sixty Five Roses from October 1, 2019, to February 17, 2020

An example of a determination of 'unknown':

In Figure 15, Row 835 (second from top row): ANT data shows the barge Sixty Five Roses received 3,360,000 gallons of cutter stock from Phillips 66 in Ferndale. This transfer was considered a partial load, since 95 percent of Sixty Five Roses' maximum cargo capacity is 3,516,666 gallons. Using the logic diagram in Figure 14, Ecology entered 'unknown' as the transit type for the transit from Seattle to Ferndale which preceded the transit.

Additional discussion determining the laden or unladen status of tank vessels is provided in the Data Challenges section and Appendix J.

Synopsis Step 4: Collect data on escort tug activity

Ecology reviewed AIS data to compile a list of tugs performing escort duties. To determine changes in activity, Ecology compared the number of times these specific escort tugs crossed virtual lines that were placed in key locations within the study area.

Tugs engaged in escort activities

Identifying tugs used for escort duties involved two steps:

Step 1: Review AIS history to observe tugs performing escort duties

Using SiiTech Web VTS to access the AIS history function, Ecology observed tugs performing escort duties in the study area. Figure 16 shows an example of the AIS history replay screen, with a tug (and oil barge) and an escort tug.

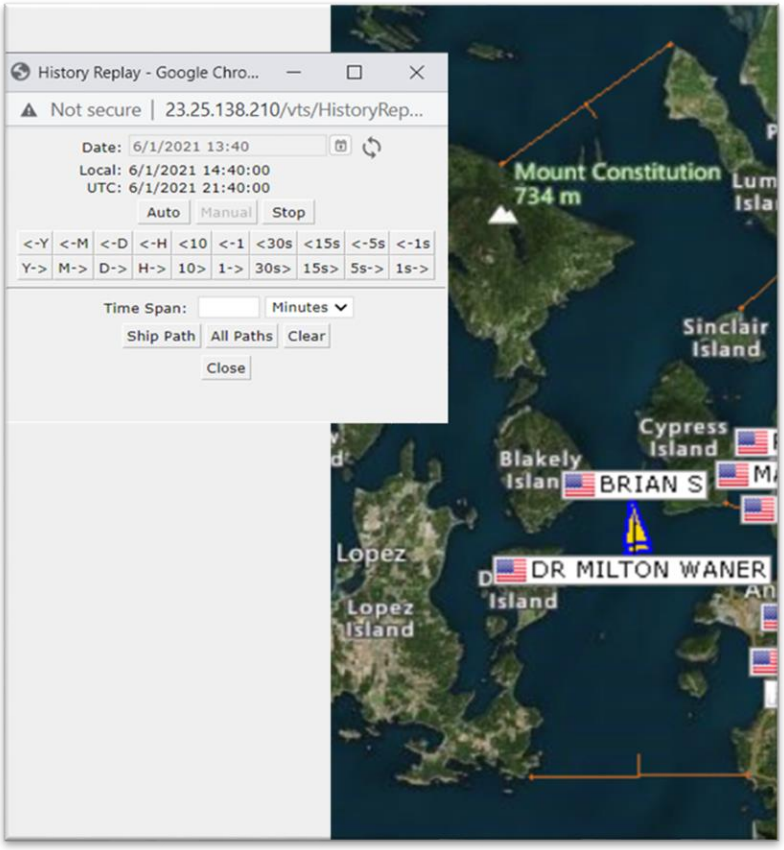


Figure 16 Example of the web-based AIS history replay showing the tug Dr. Milton Waner escorting tug Brian S (with oil barge)

Step 2: Identify purpose-built tugs and multi-purpose tugs

In Puget Sound there are several purpose-built escort and large ship-assist tugs stationed in or near the study area that historically provided escort tug service. There are also coastal and harbor tugs[24] which could be used for tug escort services (Board of Pilotage Commissioners, 2020a) (RCW 88.16.260). For this synopsis, the term multi-purpose tug was used to define a vessel being used for more than one type of service - for instance a coastal or harbor tug, typically used to tow oil barges, also used for escort service.

Ecology researched each tug observed performing escort duties to determine which tugs were purpose-built for escort and ship assist duties. Tug company websites provided information about individual tugs (Figure 17).

[24] For a definitions of escort, ship assist, coastal, and harbor tugs see Appendix G Maritime Definitions

The following tugs are in operation in the Pacific Northwest:

Vessel Name	Horsepower	Bollard Pull	Propulsion
Nanuq	10,192	220,000 lbs	Voith-Schneider Cycloidal
Tan'erliq	10,192	220,000 lbs	Voith-Schneider Cycloidal
Response	7,240	154,000 lbs	Voith-Schneider Cycloidal
Protector	5,500	120,000 lbs	Voith-Schneider Cycloidal
Guard	5,500	120,000 lbs	Voith-Schneider Cycloidal
Guide	4,800	111,500 lbs	Voith-Schneider Cycloidal
Chief	4,800	111,500 lbs	Voith-Schneider Cycloidal

Figure 17 Crowley website[25] information on their ship-assist and escort tug fleet operating in Pacific Northwest

Ecology's AIS review observed purpose-built escort and ship assist tugs exclusively performing escort duties before the new tug escort requirements were implemented. Post-implementation, Ecology observed both purpose-built and multi-purpose tugs performing escort duties.

Ecology developed two lists – a list of purpose-built tugs provided in Appendix P, and a list of multi-purpose tugs provided in Appendix Q.

Escort tug patterns of activity

Ecology used crossing lines to collect data on escort tug movements in the study area. This involved three steps:

Step 1 – Create the crossing lines (zones)

The Marine Exchange AIS system refers to all shapes, including crossing lines, drawn on the AIS chart as 'zones'.[26] To create crossing line zones, Ecology placed two latitude and longitude points on the AIS chart and drew a line between them. Ecology named each crossing line, for example Saddlebag to Guemes Island (Figure 18).

[25] https://www.crowley.com/shipping/sae/fleet/#pacific-northwest

[26] In the Marine Exchange system a 'crossing line' is labeled 'Zone Type - Line L' (drawn from left to right across the chart) or 'Zone Type - Line R' (drawn from right to left across chart). The direction of the drawn line is used to determine the relationship of a vessel's crossing and interpret the vessel 'entering' or 'exiting' the zone.

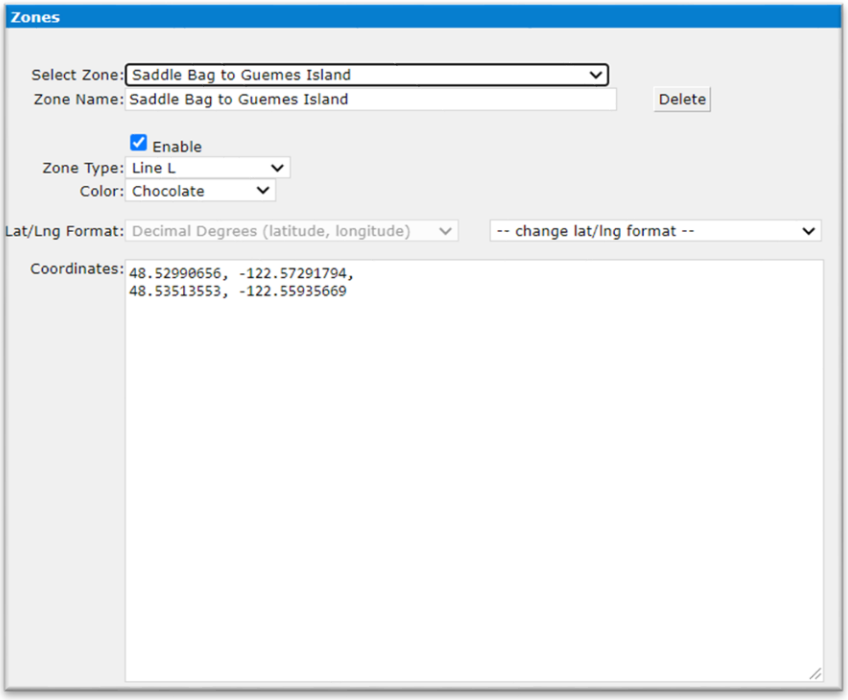


Figure 18 AIS screen used for creating crossing lines

Figure 19 shows the location of the following escort tug crossing lines:

- Rosario Strait North
- Rosario Strait South
- Guemes Channel (Guemes Island to Cap Sante on Fidalgo Island)
- Bellingham Channel (Guemes Island to Cypress Island)
- Sinclair Island to Lummi Island
- Saddlebag Island to Guemes Island

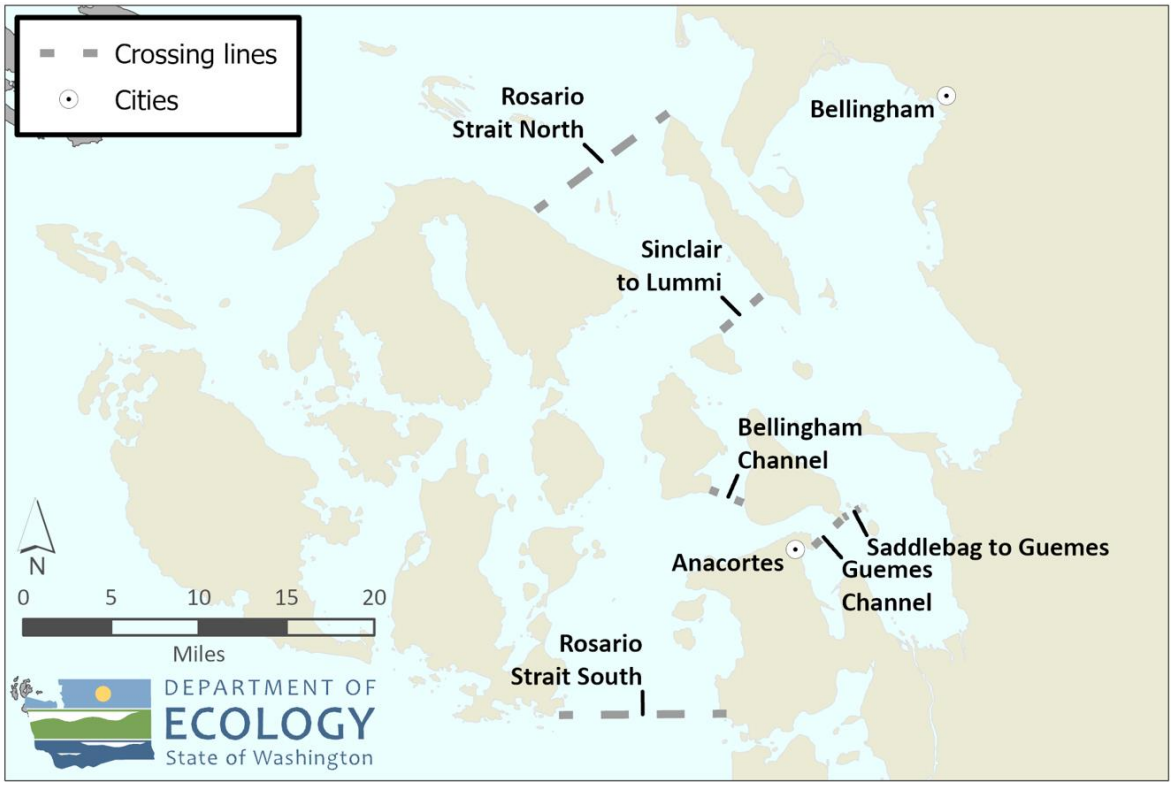


Figure 19 Map showing the crossing lines for escort tug reports

Step 2 - Create a group of vessels (filter)

Ecology used the Maritime Mobile Service Identity (MMSI) number[27] for each tug in Appendix P and Q to define 'groups' in AIS (Figure 20).

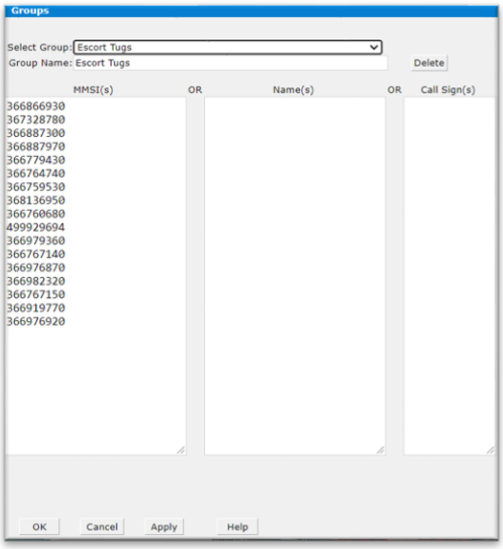


Figure 20 Creating groups using Maritime Mobile Service Identity (MMSI) numbers

[27] The MMSI number uniquely identifies a vessel in AIS. See Appendix G Maritime Definitions.

These groups were then used to create a filter for Enter/Exit reports.

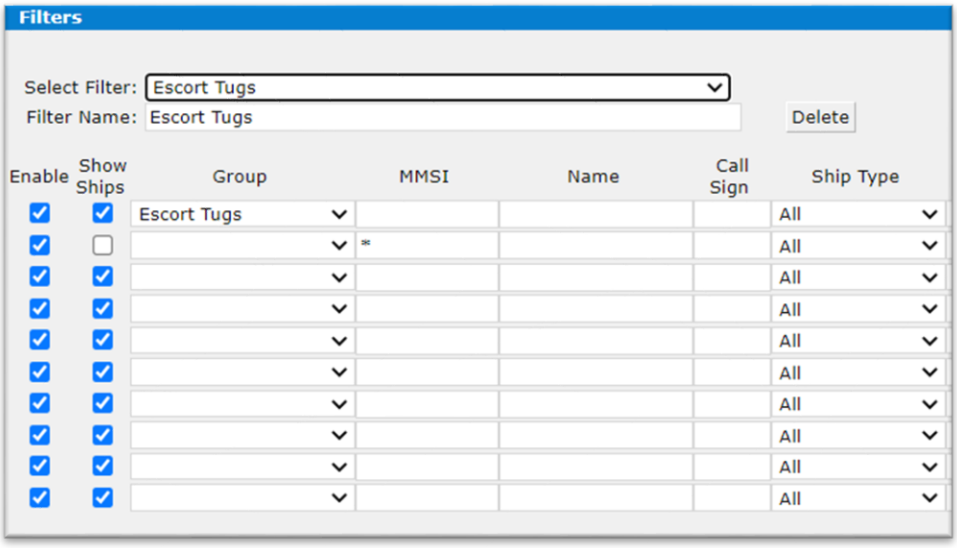


Figure 21 Creating filters using groups

Step 3 - Run AIS reports

Ecology created reports using the zones (crossing line) and filters (group). Figure 22 shows the Saddlebag to Guemes Island Escort Tug report creation. Crossing line reports were each run twice for the synopsis period, once with the purpose-built tugs and once with the multi-purpose tugs.

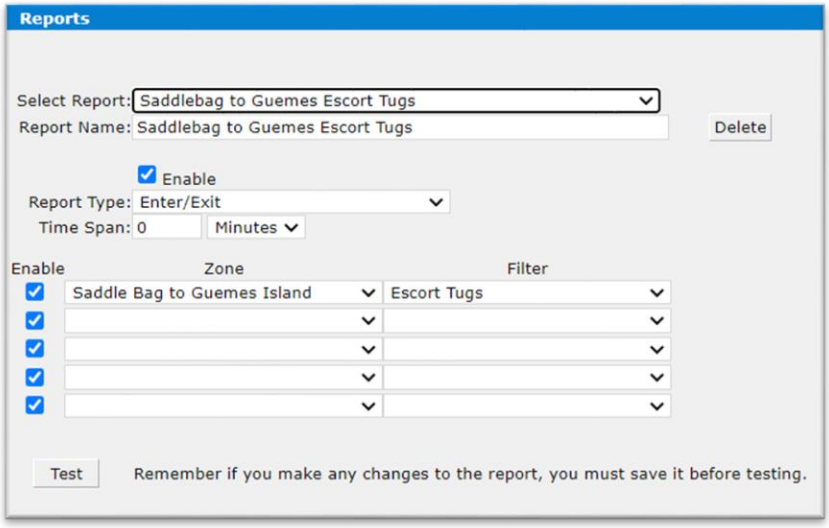


Figure 22 Creating reports using zones and filter groups

Figure 23 shows the reports created for the synopsis. The crossing lines (zones) are named, and the filter of escort tug or multi-purpose tug are available. Reports were run by setting the starting date and time and the ending date and time and then exporting the results to Excel.

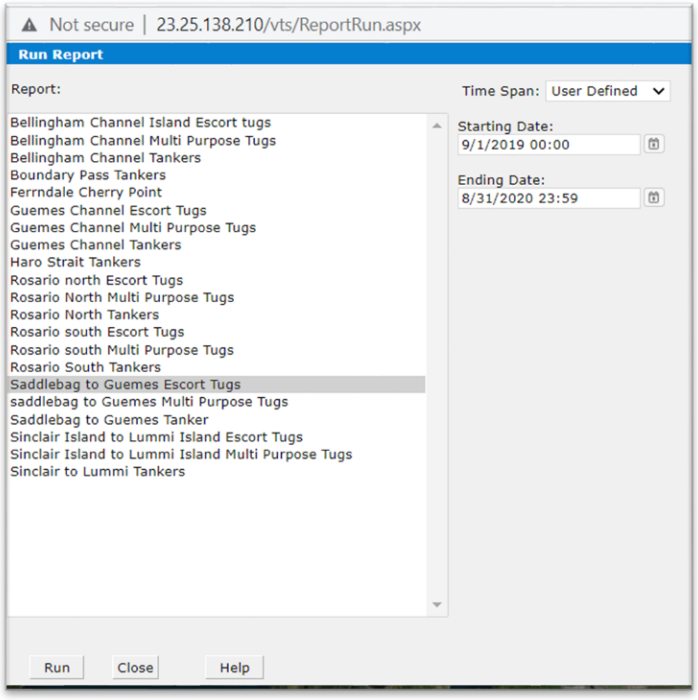


Figure 23 Crossing line reports for escort tugs, multi-purpose tugs, and tankers

A sample of the Saddlebag to Guemes Island Escort Tugs report results for start date July 1, 2020, and end date August 31, 2020, is shown in Figure 24. This portion of the report shows the escort tug, TUG RESPONSE, transiting the Saddlebag to Guemes Island crossing line 30 times between July 6, 2020, and August 31, 2020.

1	Saddlebag Island to Guemes Island Escort Tugs												
2	Enter Time	Exit Time	Name	MMSI	IMO	Call Sign	Type	Length	Destination	ETA	Latitude1	Longitude1	Speed1	Course1
58	7/6/2020 9:15	7/7/2020 0:58	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	CHERRY PT.	########	48°31.981	122°33.75	7.2	181.7°
59	7/7/2020 11:53		TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	ANACORTES	########	48°31.827	122°33.86	12.2	191.8°
60	7/10/2020 2:55	7/10/2020 13:47	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	ANACORTES	########	48°31.952	122°33.83	9.6	186.3°
61	7/12/2020 18:00	7/12/2020 22:22	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	CHERRY PT	########	48°31.870	122°33.96	9.2	202.6°
62	7/13/2020 21:04	7/17/2020 22:24	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	CHERRY PT	########	48°31.874	122°33.87	7.6	184.7°
63	7/20/2020 12:50	7/21/2020 3:54	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	ANACORTES	########	48°31.885	122°33.81	10	188°
64	7/23/2020 4:54		TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	ANACORTES	########	48°31.871	122°33.84	10.1	193.2°
65	7/24/2020 22:41	7/25/2020 4:19	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	ANACORTES	########	48°31.983	122°33.87	7.3	193.2°
66	7/25/2020 12:23	7/26/2020 5:26	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	BP CHERRY POINT	########	48°31.916	122°33.88	8.5	197°
67	7/26/2020 21:55	7/29/2020 23:24	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	BP CHERRY POINT	########	48°31.979	122°33.82	6.8	191.8°
68	8/5/2020 23:41	8/8/2020 4:43	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	BP CHERRY POINT	########	48°31.945	122°33.87	7.5	195.5°
69	8/9/2020 11:07	8/10/2020 1:18	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	SEATTLE P18	########	48°31.895	122°33.87	8.1	196.7°
70	8/15/2020 20:18	8/20/2020 4:37	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	ANACORTES	########	48°31.883	122°33.91	7.9	200.1°
71	8/20/2020 5:52	8/21/2020 15:30	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	ANACORTES	########	48°31.962	122°33.82	6.1	183.7°
72	8/27/2020 16:52	8/28/2020 0:06	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	CHERRY POINT	########	48°31.879	122°33.99	7.9	205.5°
73	8/29/2020 16:39	8/30/2020 0:57	TUG RESPONSE	3.67E+08	9258806	WDA9597	Tug	40	CHERRY POINT	########	48°31.948	122°33.91	8.1	201.2°

Figure 24 Sample of Enter/Exit Report for Saddlebag to Guemes Island Tug Response

A tug performing escort duties can transit several crossing lines in one 'trip'. For this synopsis a trip is defined as the time from when the tug's dispatch assigned the tug to an escort job until the tug returns to station[28]. Tugs performing escort duties may transit crossing lines while waiting for an assigned vessel, while traveling to meet an assigned vessel or traveling back to their assigned station, or while transiting the area for other business purposes.

[28] See Appendix F, Synopsis Terminology

Example for an escort tug stationed near the Cherry Point refinery:

A tug stationed near the northern refinery is assigned an inbound escort for an ATB transiting to the Vendovi anchorage in Anacortes.

The escort tug leaves Cherry Point and transits the Rosario Strait north and south crossing lines to meet the ATB. The tug escorts the ATB to the Vendovi Anchorage, transiting the Rosario Strait south, Guemes Channel, and Saddlebag to Guemes Island crossing lines. After finishing the escort job, the tug transits the Sinclair Island to Lummi Island and the Rosario Strait north crossing lines to return to station near Cherry Point. This trip transited crossing lines seven times.

After this trip the escort tug transited to Seattle and then returned to Cherry Point. The escort tug crossed the Rosario Strait north and south crossing lines twice. Although the tug was not performing escort tug duties, these four crossing line transits are counted using the crossing line method.

Example for an escort tug stationed near Anacortes:

A tug stationed near Anacortes is assigned a tug and oil barge to escort from a March Point refinery to the south end of Rosario Strait. The escort tug got underway and transit the Guemes Channel crossing line five times[29] while waiting for the tug and barge to finish getting underway from the refinery. The escort tug escorts the tug and oil barge through the Guemes Channel and the south end of Rosario Strait transiting the Guemes Channel and Rosario Strait south crossing lines. After finishing the escort the tug returns to station transiting the Rosario Strait south and the Guemes Channel crossing lines. This trip transited crossing lines nine times.

Synopsis Step 5: Collect data on oil transfers

To determine changes in the number of oil transfers in the study area, Ecology gathered data on the number of oil transfers in the study area at refineries and anchorages, pre- and post-escort implementation.

Refineries in study area

There are five major oil refineries in Washington. The four located in the study area are shown in Table 5 and Figure 25. Appendix H has additional information on these refineries.

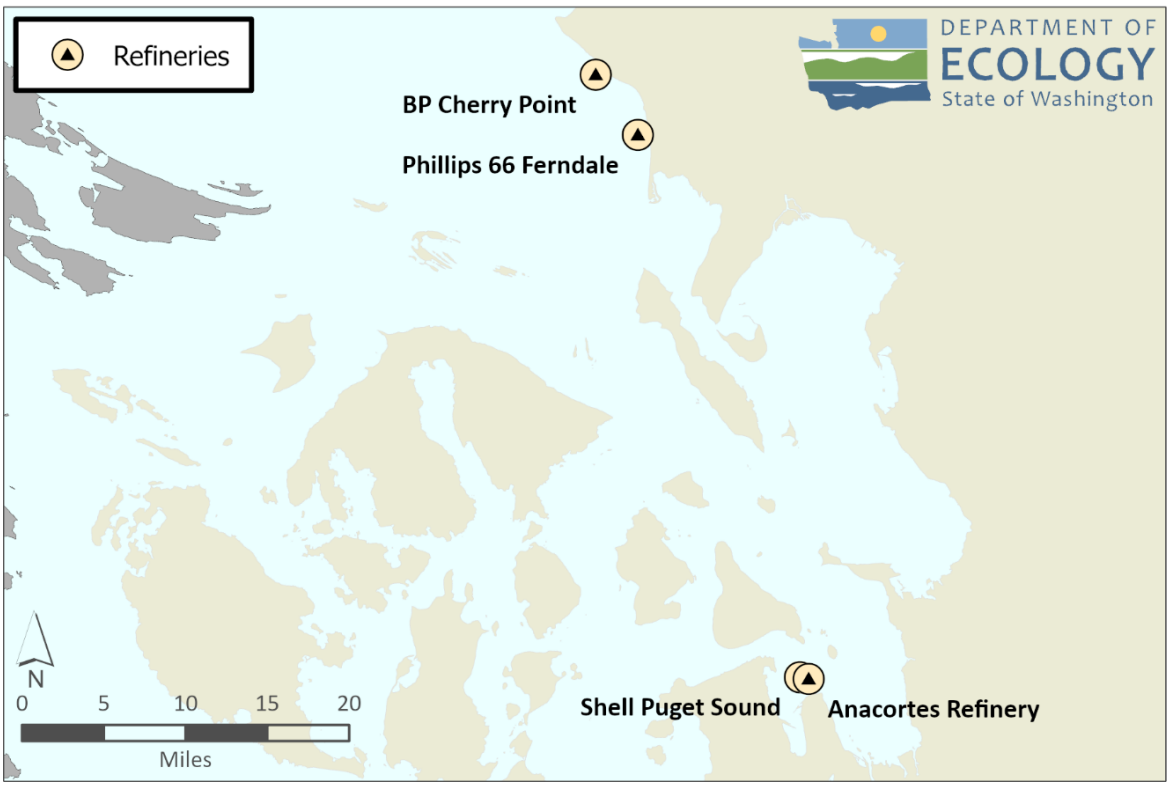
[29] Each transit was greater than five minutes from the previous transit. Crossing line transits closer than five minutes apart were not counted as vessel was assumed holding station near the crossing line rather than purposefully transiting over the crossing line.

Table 5 Oil refineries in study area with common name, year constructed, and current capacity in barrels per day (Smith, 2015).

Refinery Name	Common name	Year constructed	Current Capacity (bbls/day*)
Tesoro Refining & Marketing Company	Anacortes Refinery	1955	119,000
BP Cherry Point Refinery	BP Cherry Point/Cherry Point	1971	225,000
Phillips 66 Ferndale Refinery	Phillips 66 Ferndale	1954	100,000
Shell Puget Sound Refinery[1]	Shell Puget Sound/March Point Shell	1957	145,000

* barrels/day

[1] Shell Puget Sound refinery was sold to HollyFrontier Corporation (Shell US, 2021).



Note: Shell Puget Sound refinery was sold to HollyFrontier Corporation (Shell, US, 2021)

Figure 25 Map of refineries in the study area[30]

[30] On May 4, 2021 Shell, US website (2021) Shell announced it had reached an agreement for the sale of its Puget Sound Refinery near Anacortes, Washington to a subsidiary of HollyFrontier Corporation, an independent refiner headquartered in Texas.

Anchorages in study area

Anchorage areas in the Puget Sound are established in 33 C.F.R. Parts 109-110[31] and specific regulations applicable to each anchorage are contained in 33 C.F.R. 110.230, Subpart B[32]. The General Anchorages in Puget Sound are intended for the use of commercial deep draft vessels greater than 200 feet in length, including Articulated and Integrated Tug Barge (ATB) combinations (Puget Sound Harbor Safety Committee, 2017).

In 2017, the Coast Guard issued a Notice of Proposed Rulemaking for the creation of new anchorage areas (Regulations.gov. 2017). The Coast Guard withdrew the proposed rulemaking in 2018 in response to public comments and to better analyze potential impacts to tribal treaty rights, especially treaty fishing rights (Regulations.gov. 2018).

The Puget Sound Harbor Safety Plan[33] includes a section on anchoring in the Standards of Care portion of the plan with a table of anchorages available for use in Puget Sound. Several of the anchorages identified in the Coast Guard 2017 Notice of Proposed Rulemaking are listed in the Harbor Safety Plan table, as non-designated anchorages.

Table 6 and Figure 26 show anchorages commonly used in the study area for tankers, ATBs, and tug and barge units.

Appendix I has additional information on anchorages in the study area.

[31] https://www.ecfr.gov/current/title-33/chapter-I/subchapter-I/part-109
[32] https://www.ecfr.gov/current/title-33/chapter-I/subchapter-I/part-110/subpart-B#110.228
[33]https://static1.squarespace.com/static/59356b2ce3df280bc208d8b6/t/596ee7365016e13e3f335456/1500440374598/zHSP+Sec+C+-+Anchoring.pdf

Table 6 List of anchorages in study area.

General Anchorages	Abbreviations	Number of Vessels	Max Stay
Bellingham Bay	BB	4	30 days
Cherry Point	CP	1	30 days
Anacortes West	ANW	1	6 days
Anacortes Central	ANC	1	10 days
Anacortes East	ANE	1	10 days
Non-Designated Anchorages			
Vendovi Island East	VIE	4	10 days
Vendovi Island South	VIS	1	10 days
William Point (ATBs only)	WP	2	10 days
Additional ATB Anchorage			
Neptune Beach	NB	N/A	N/A
Additional Barge Anchorage*			
Jack Island North	JIN	N/A	N/A
Jack Island South	JIS	N/A	N/A
Cap Sante	CS	N/A	N/A
Hat Island	HI	N/A	N/A

*Additional anchorages for oil barges are not the Puget Sound Harbor Safety Plan anchorage table, but are noted on nautical chart (NOAA chart 18421).

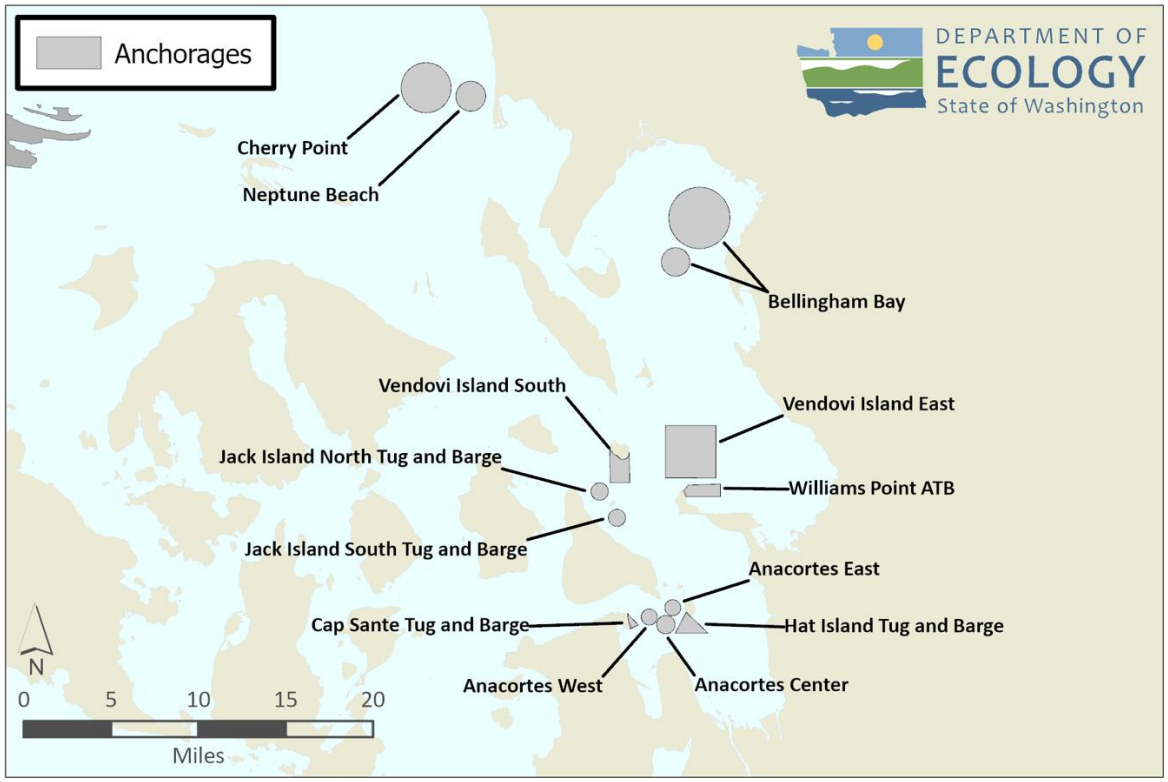


Figure 26 Map of anchorages in the study area

Determining the number of oil transfers

Using reports from SPIIS, Ecology collected data on the number of transfers at the facilities and anchorages in the study area. SPIIS reports share data with the ANT system. The ANT system assigns a unique number to each oil transfer and Ecology used these unique ANT numbers to count oil transfers. Collecting the oil transfer data involved the following steps:

Step 1 Run a vessel oil transfer report in SPIIS for each refinery and anchorage

The SPIIS Vessel Oil Transfer report returns all of the ANT entries for the selected location over the specified date range. Figure 27 is an example of the SPIIS Vessel Oil Transfer report screen for oil transfers at the Ferndale Philipps 66 refinery from September 1, 2019, to September 30, 2019.

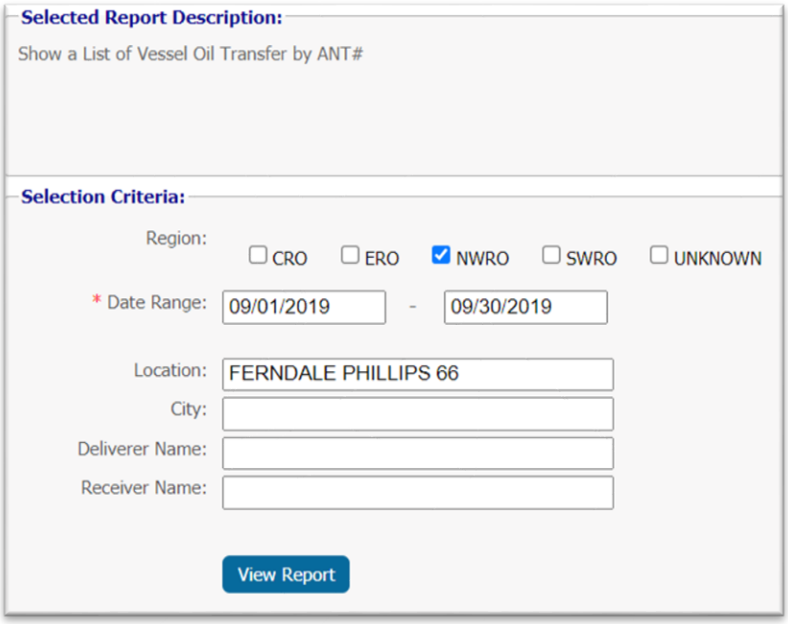


Figure 27 Spills Program Integrated Information System (SPIIS) report Vessel Oil Transfer

Step 2 Export results into Excel and sort by ANT number

Report results were exported from SPIIS into Excel to allow for sorting, as shown in Figure 28.

	ANT#	Company	Start Date Time	Duration (Hrs)	Deliverer	Receiver	Location	Lat	Long	City	County	Product
2	196407	PHILLIPS 66 - I	09/02/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	BUNKER OIL/HFO
3	196407	PHILLIPS 66 - I	09/02/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL/MARINE GAS O
4	196411	PHILLIPS 66 - I	09/02/19 22:00	25	NATHAN SCHMIDT	Phillips 66 Ferndale Refinery	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	CUTTER STOCK
5	196417	PHILLIPS 66 - I	09/01/19 08:30	48	Phillips 66 Ferndale Refinery	ATB BARGE 550-2	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE
6	196417	PHILLIPS 66 - I	09/01/19 08:30	48	Phillips 66 Ferndale Refinery	ATB BARGE 550-2	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL LOW SULPHUR
7	196418	PHILLIPS 66 - I	09/01/19 18:00	8	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE
8	196418	PHILLIPS 66 - I	09/01/19 18:00	8	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL LOW SULPHUR
9	196549	PHILLIPS 66 - I	09/05/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	BUNKER OIL/HFO
10	196549	PHILLIPS 66 - I	09/05/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL/MARINE GAS O
11	196550	PHILLIPS 66 - I	09/06/19 07:00	9	Phillips 66 Ferndale Refinery	PB-34	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	BUNKER OIL/HFO
12	196550	PHILLIPS 66 - I	09/06/19 07:00	9	Phillips 66 Ferndale Refinery	PB-34	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL/MARINE GAS O
13	196646	PHILLIPS 66 - I	09/06/19 21:00	15	Phillips 66 Ferndale Refinery	ATB BARGE ALL ABOARD F(	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	CUTTER STOCK
14	196658	PHILLIPS 66 - I	09/05/19 23:00	5	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE
15	196748	PHILLIPS 66 - I	09/08/19 02:30	12	POLAR ENTERPRISE	Phillips 66 Ferndale Refinery	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	CRUDE OIL
16	196749	PHILLIPS 66 - I	09/09/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	BUNKER OIL/HFO
17	196749	PHILLIPS 66 - I	09/09/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL/MARINE GAS O
18	196762	PHILLIPS 66 - I	09/10/19 18:00	6	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL LOW SULPHUR
19	196762	PHILLIPS 66 - I	09/10/19 18:00	6	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE
20	196782	PHILLIPS 66 - I	09/08/19 18:00	6	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE

Figure 28 Export of SPIIS Vessel Oil Transfer report results for Ferndale Phillips 66 refinery

Step 3 Verify each unique ANT number is counted once, for transfers with multiple types of oil

The ANT system assigns a unique number for each oil transfer. If more than one product is entered for the transfer, each transfer type, product, and quantity will be assigned to this unique ANT number. Transfers involving multiple products at the same time may have more than one entry using the same ANT number. For the synopsis, each transfer operation was only counted once. In Figure 29, the duplicate ANT numbers are highlighted in gray.

	ANT#	Company	Start Date Time	Duration (Hrs)	Deliverer	Receiver	Location	Lat	Long	City	County	Product
2	196407	PHILLIPS 66 - I	09/02/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	BUNKER OIL/HFO
3	196407	PHILLIPS 66 - I	09/02/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL/MARINE GAS (
4	196411	PHILLIPS 66 - I	09/02/19 22:00	25	NATHAN SCHMIDT	Phillips 66 Ferndale Refinery	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	CUTTER STOCK
5	196417	PHILLIPS 66 - I	09/01/19 08:30	48	Phillips 66 Ferndale Refinery	ATB BARGE 550-2	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE
6	196417	PHILLIPS 66 - I	09/01/19 08:30	48	Phillips 66 Ferndale Refinery	ATB BARGE 550-2	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL LOW SULPHUI
7	196418	PHILLIPS 66 - I	09/01/19 18:00	8	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE
8	196418	PHILLIPS 66 - I	09/01/19 18:00	8	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL LOW SULPHUI
9	196549	PHILLIPS 66 - I	09/05/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	BUNKER OIL/HFO
10	196549	PHILLIPS 66 - I	09/05/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL/MARINE GAS (
11	196550	PHILLIPS 66 - I	09/06/19 07:00	9	Phillips 66 Ferndale Refinery	PB-34	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	BUNKER OIL/HFO
12	196550	PHILLIPS 66 - I	09/06/19 07:00	9	Phillips 66 Ferndale Refinery	PB-34	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL/MARINE GAS (
13	196646	PHILLIPS 66 - I	09/06/19 21:00	15	Phillips 66 Ferndale Refinery	ATB BARGE ALL ABOARD F(	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	CUTTER STOCK
14	196658	PHILLIPS 66 - I	09/05/19 23:00	5	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE
15	196748	PHILLIPS 66 - I	09/08/19 02:30	12	POLAR ENTERPRISE	Phillips 66 Ferndale Refinery	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	CRUDE OIL
16	196749	PHILLIPS 66 - I	09/09/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	BUNKER OIL/HFO
17	196749	PHILLIPS 66 - I	09/09/19 07:00	9	Phillips 66 Ferndale Refinery	PB-32	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL/MARINE GAS (
18	196762	PHILLIPS 66 - I	09/10/19 18:00	6	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	DIESEL LOW SULPHUI
19	196762	PHILLIPS 66 - I	09/10/19 18:00	6	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE
20	196782	PHILLIPS 66 - I	09/08/19 18:00	6	Phillips 66 Ferndale Refinery	PROFESSOR KAREN ANN B	FERNDALE PHILLIPS	48.82638	-122.72111	FERNDALE	WHATCOM	GASOLINE

Figure 29 Spills Program Integrated Information System (SPIIS) report Vessel Oil Transfer. Unique ANT numbers showing on more than one row signify more than one product transferred, and are highlighted in grey.

Step 4 Count unique ANTs for each refinery and anchorage

Each unique ANT number is counted. In Figure 29, the oil transfer count for the Ferndale Phillips 66 refinery from September 1, 2019, to September 8, 2019 is 12 unique ANT transfers.

Synopsis Step 6: Collect data on movements of tankers with no additional escort requirements

In addition to comparing the transits of tugs pre- and post-tug escort implementation, the scope of work required Ecology to determine any changes in the transits of deep draft vessels with no additional escort requirements. Ecology consulted with the BPC to define 'deep draft vessels with no additional escort requirement' as oil tankers which already required tug escort within the study area (i.e., oil tankers greater than 40,000 DWT). LNG and LPG tankers were not considered as they did not meet the definition of oil tanker as given in the scope of work[34] (Board of Pilotage Commissioners, 2020b).

Oil Tanker Movements

To determine if the tug escort rule implementation had any effect on traffic patterns for oil tankers over 40,000 DWT, Ecology used crossing lines to collect data on tanker movements. This was similar to the method used to gather data on escort tug patterns of activity. The Crossing Line method for tankers with no additional escort requirements had four steps:

Step 1 – Create crossing lines (zones)

In consultation with the BPC and Puget Sound pilots the crossing lines below were created to count tanker transits in Haro Strait and Boundary Pass, Rosario Strait, and connected waterways east of Rosario Strait.

- Bellingham Channel (Guemes Island to Cypress Island)
- Boundary Pass
- Guemes Channel (Guemes Island to Cap Sante on Fidalgo Island)
- Haro Strait
- Rosario Strait north
- Rosario Strait south
- Saddlebag Island to Guemes Island
- Sinclair Island to Lummi Island

The crossing lines are the same as those used for escort tug movements, with the addition of Haro Strait and Boundary Pass. Because deep draft tankers frequently use Haro Strait and Boundary Pass, these crossing lines were added to the data set.

[34] Oil - It is the interpretation of the Board that, as per RCW 90.56.010 (19), the definition of "oil" or "oils" means oil of any kind that is liquid at twenty-five degrees Celsius and one atmosphere of pressure and any fractionation thereof.

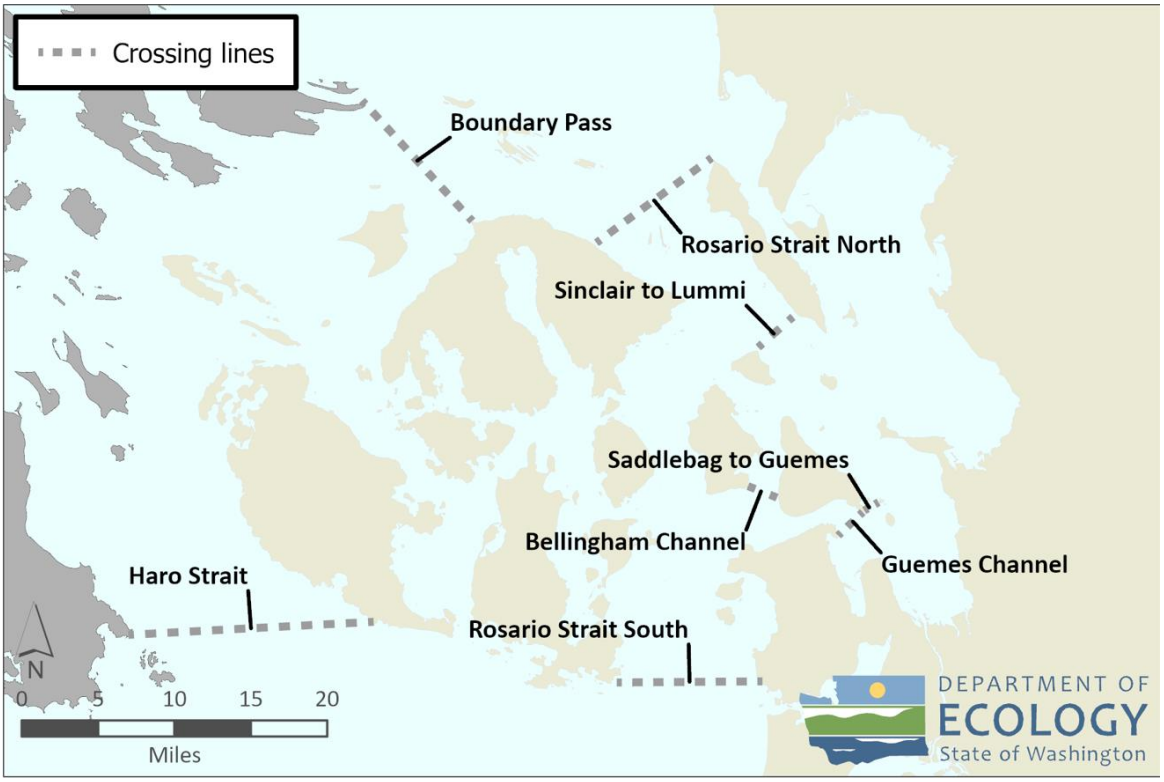


Figure 30 Map showing crossing lines for tankers not subject to the new tug escort requirements

Step 2 Create a filter using vessel type 'tanker'

The Marine Exchange Web-based AIS program allows the user to select a ship type as a filter. Figure 31 is a screenshot of the filter showing tanker as ship type.

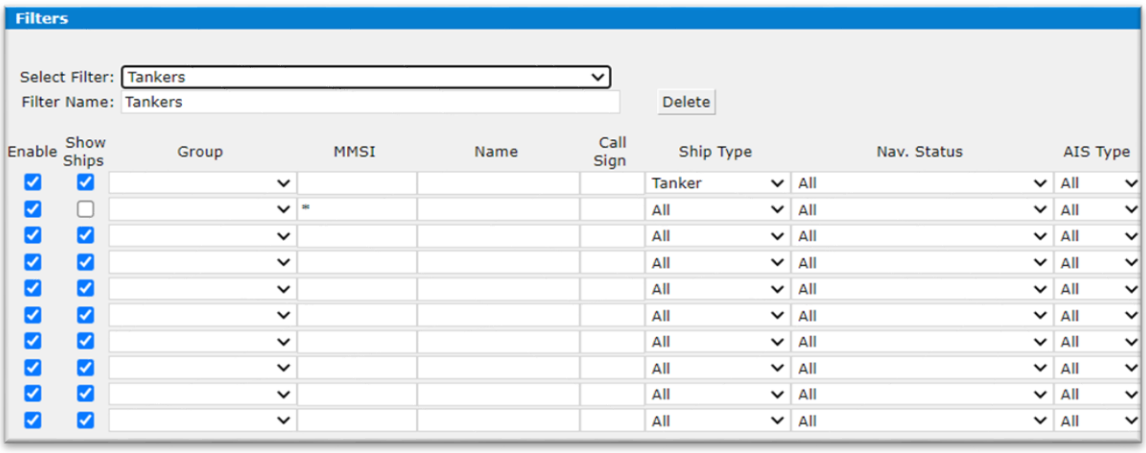


Figure 31 Create AIS report filter for 'tankers'

Step 3 Run AIS reports

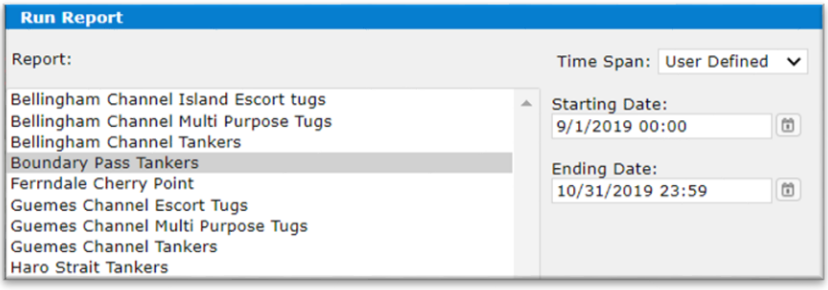


Figure 32 Run AIS crossing line reports

Step 4 Delete tankers less than 40,000 DWT

The crossing line report results were exported into Excel. Each tanker's type and deadweight tonnage was determined using the Marine Traffic[35] website. LNG and LPG as well as vessels with deadweight tonnage less than 40,000 tons were removed and not counted in the crossing line report. In Figure 33 four tankers over 40,000 DWT transited the crossing line 'Boundary Pass' eight times.

1	Boundary Pass Tankers								
2	Enter Time	Exit Time	Name	MMSI	IMO	Call Sign	Type	Length	Destination
3	9/15/2019 14:42		ALASKAN LEGEND	3.04E+08	9271432	WDD2074	Tanker	287	USCLM
4		1/3/2020 11:58	ALASKAN NAVIGATOR	3.68E+08	9244673	WDC6644	Tanker	287	US CP4
5	9/20/2019 11:22		ALASKAN NAVIGATOR	3.68E+08	9244673	WDC6644	Tanker	287	US VDZ
6	11/24/2019 5:34		ALASKAN NAVIGATOR	3.68E+08	9244673	WDC6644	Tanker	287	US CLM
7		9/21/2019 10:19	ALESSANDRO DP (17,096 dwt)	3.11E+08	9384162	C6AT7	Tanker:DG	130	CA VAN
8	9/23/2019 19:19		ALESSANDRO DP	3.11E+08	9384162	C6AT7	Tanker	130	GT PRQ
9		10/19/2019 10:45	AQUADISIAC	6.36E+08	9396713	D5MY7	Tanker:DG	183	CABAN
10	10/25/2019 8:26		AQUADISIAC	6.36E+08	9396713	D5MY7	Tanker:DG	183	ULSAN
11		3/31/2020 0:28	ARDMORE CHEROKEE (25,215 dwt)	5.38E+08	9707845	V7HR9	Tanker	159	VANCOUVER,BC
12	4/6/2020 16:33		ARDMORE CHEROKEE	5.38E+08	9707845	V7HR9	Tanker	159	GRAYS HARBOR
13		1/15/2020 19:00	ARDMORE CHIPPEWA (25,211 dwt)	5.38E+08	9707871	V7HS4	Tanker	159	VANCOUVER
14	1/18/2020 7:59		ARDMORE CHIPPEWA	5.38E+08	9707871	V7HS4	Tanker	159	KR PTK
15		11/9/2019 14:20	ARDMORE DAUNTLESS (37,764 dwt)	5.38E+08	9707388	V7JI3	Tanker	184	CA VAN VANCOU
16	11/11/2019 15:07		ARDMORE DAUNTLESS	5.38E+08	9707388	V7JI3	Tanker	184	US STH S HELENS
17		3/10/2020 8:39	ARDMORE ENGINEER	5.38E+08	9654787	V7AY5	Tanker	183	VANCOUVER, CA
18	3/12/2020 20:06		ARDMORE ENGINEER	5.38E+08	9654787	V7AY5	Tanker	183	LOS ANGELES
19		9/8/2019 11:40	ARGENT ASTER 35,058 dwt)	3.73E+08	9379959	3ELI8	Tanker	174	CA VAN
20	9/13/2019 9:49	11/14/2019 13:40	ARGENT ASTER	3.73E+08	9379959	3ELI8	Tanker	174	JP YOK
21	11/16/2019 22:37	11/29/2019 2:00	ARGENT ASTER	3.73E+08	9379959	3ELI8	Tanker	174	US LAX
22	12/3/2019 7:25	2/19/2020 8:43	ARGENT ASTER	3.73E+08	9379959	3ELI8	Tanker	174	CN NNB

Figure 33 Example of Boundary Pass tanker crossing line report. Tankers less than 40,000 deadweight tons are highlighted in blue.

Synopsis Step 7: Write a review of the last 5 years of existing vessel transit data

Ecology used VEAT data to review traffic trends for synopsis vessel types over the last five years. The review is a broad overview of the use of Rosario Strait, connected waterways east, Haro Strait, and Boundary Pass by ATBs, oil barges and tankers. This review is meant to provide a measure to compare to the changes which occurred in the traffic prior to tug escort requirements to the year after the requirements went into effect.

[35] https://www.marinetraffic.com/en/ais/home/centerx:-12.0/centery:25.0/zoom:4

Data Challenges

The Synopsis of Changing Vessel Traffic Trends Scope of Work (Appendix D) identifies four data challenges (Board of Pilotage Commissioners, 2020b):

- ANTs use barge names and AIS tracks tug but not barges
- Towed oil barges are not always towed by the same vessel
- Linking vessel routes to ANTs could be prohibitively time consuming if not automated
- Marine Exchange crossing line data does not provide route information, or information on laden or unladen status

Ecology identified an additional seven challenges related to data. Three data challenges involving ANT and AIS data had an effect on Ecology's ability determine a vessel transit type, i.e., if was 'likely laden' or 'likely unladen'.

Table 7 provides the combined list of data challenges, and an evaluation of their impact on the results of the synopsis. Appendix J describes all of the data challenges and mitigation methods in more detail.

Table 7 Synopsis data source matched to its challenge, issue, mitigation method, and evaluation of effect on synopsis results

Data Source	Challenge/	Issue	Mitigation Method	Effect on Results
AIS	AIS transmits on Very High Frequency (VHF) wavelengths which are line of sight	Signal can be blocked or lost	AIS history function was used to move forward or backward through time in one hour increments until the signal reestablished	None
AIS	Some AIS data is self-reported by operator	Inaccuracies in AIS data	Vessel's unique MMSI numbers were used for creating filters or performing vessel searches	None
AIS/ANT	Transfer data was retrieved from the ANT system and transit data was retrieved from the AIS system	ANTs use barge names and AIS uses vessel names, and towed oil barges are not always towed by the same vessel	Many tug/barge combinations were stable. If determining a match was necessary, Ecology compared ANT and AIS data	None
AIS/ANT	Transfer data was retrieved from the ANT system and transit data was retrieved from the AIS system	Linking vessel routes to ANTs could be prohibitively time consuming if not automated	The manual method devised by Ecology made linking AIS data to ANT data manageable for this synopsis	None

Table 7 Synopsis data source matched to its challenge, issue, mitigation method, and evaluation of effect on synopsis results, continued

Data Source	Challenge/	Issue	Mitigation Method	Effect on Results
AIS/ANT	Marine Exchange crossing line data does not provide route information, or information on laden or unladen status	No single data source provides information about whether a tank vessel meets the definition of laden or unladen for a particular transit	The manual method and a logic diagram were used to determine the transit type where possible, and a transit type of 'unknown' was assigned if the status could not be determined	Uncertainty in determining transit type
ANT	Ecology's ANT system only includes oil transfers that take place in Washington waters	Incomplete information about oil onboard vessels	None	Uncertainty in determining transit type
ANT	ANT data is entered by the oil deliverer	Inaccuracies in ANT data	Ecology uses a quality assurance process for ANT data to identify and correct inaccuracies	None
ANT	The ANT database uses volume (gallons) rather than weight to express the quantity of cargo transferred	Oil volumes change with temperature and density, introducing error into determining the vessel's loaded capacity	None	Uncertainty in determining transit type
SPIIS	SPIIS only contains arrival data for vessels bound for Washington ports	Gaps in SPIIS data	AIS crossing lines were used for data collected in Haro Strait and Boundary Pass	None
SPIIS	SPIIS vessel entry data can be affected by incomplete, inaccurate, or incorrectly entered Marine Exchange data	Inaccuracies in SPIIS data	Ecology ensures SPIIS data which is incomplete, duplicated, or inaccurate is corrected or removed as appropriate	None
VEAT	VEAT data was not available for the beginning of 2021	Gap in VEAT data	ANT data was substituted for VEAT data for the missing 2021 period	None

Result of data challenges on ability to determine transit type

Ecology combined two data sources to determine transit route and estimate the amount of oil carried as cargo onboard vessels. Transit were defined as 'likely laden', 'likely unladen', 'unknown', or 'engaged in bunkering'.

Ecology was able to determine:

- A vessel's route 100 percent of the time using AIS
- The transit type 'engaged in bunkering' 100 percent of the time using ANT data
- The transit type 'likely laden' or 'likely unladen'
    - 48 percent of the time for the time for ATB
    - 65 percent of the time for barges greater than 5,000 DWT
    - 73 percent of the time for barges less than 5,000 DWT

Once data collection was complete, Ecology used a series of questions to set a criteria for evaluating if a Haro Strait transit was influenced by the new tug escort requirements. See additional discussion in the Results section.

Of 109 Haro Strait transits by vessels newly subject to the tug escort requirements, 38 were between the Strait of Juan de Fuca and Vancouver, B.C., and two between Victoria, B.C. and Vancouver, B.C. This is the usual route for these vessels. 44 transits used both Haro and Rosario Straits, and because a laden tank vessels would still require an escort through the Rosario Strait portion of the route, these transits were not counted as influenced by the escort tug requirement. Altogether, 84 of the 109 Haro Strait transits did not meet the criteria for likely influenced by the new tug escort requirement.

Ecology used the logic diagram (Figure 14) to assess whether a transit was likely laden or unladen for the remaining 25 transits. Ecology found the available information allowed a determination of the likely laden or unladen status for 16 of the 25 transits.

For the other nine transits, Ecology could not determine whether the tank vessel was likely laden or unladen using the logic diagram. In these cases, Ecology reviewed ANT data for the oil transfers before or after the transit to see if the amount loaded was reasonably close to 95 percent of the vessels cargo capacity. Ecology identified four transits where a reasonable assumption could be made based on this expanded review. In the remaining five cases, Ecology could not determine whether the vessel was laden or unladen. Four of these transits were by ATBs, and one was by a barge greater than 5,000 DWT.

The data challenges did not impact Ecology's ability to identify a vessel's selection of a Rosario Strait or Haro route. The final impact of all data challenges was the inability to determine the likely laden or unladen status of five Haro Strait transits, limiting Ecology's ability to make a determination on whether these five transits were affected by the new tug escort requirements when making route selection.

Results for Deliverables

The deliverables in the scope of work were:

- Route selection and number of vessel transits for pre-and post-bill implementation for the following vessel types. Ecology will explore ways to compare transits on a common scale. These include:
    - Vessels that newly fall under an escort requirement
    - Deep draft and tug traffic that have no additional escort requirement
    - Vessels that are providing bunkering or refueling services
- Routes compared will include, but will not be limited to transits of Rosario Strait and Haro Strait/Boundary Pass.
- Review of tugs engaged in escorting tank vessels in Rosario and connected waterways east, including but not limited to number of transits, names of vessels, and operating companies.
- Number of oil transfers per refinery and per anchorage pre- and post-bill implementation.
- A review of the last five years of existing vessel transit data, to provide context as to the overall trend in vessel movements, based on vessel types. Determining the laden/unladen status of tank vessels, deadweight tonnage of vessels, and details on vessel occupation (i.e., bunkering) would require a manual evaluation of each transit, and is outside the scope of this review.

The following sections discuss each deliverable in detail. The results for the synopsis research questions and a summary of Ecology's findings are presented at the end of this chapter.

Results for route selection and number of vessel transits for vessels which newly fall under escort requirements

Overview

Ecology used the manual process described in the Data Analysis Methods section, and a review of VEAT data to evaluate route selection for vessels which newly fall under escort requirements. These vessels are laden ATBs and oil barges greater than 5,000 DWT[36], and tankers between 5,000 and 40,000 DWT.

Criteria for determining the effect of the tug escort requirement on route selection

Ecology used a series of questions to evaluate whether the tug escort requirement affected route selection for vessel transits. For each Haro Strait transit in Year 2 by tank vessels subject to the new tug escort requirement, Ecology asked:

- Was the selection of Haro Strait a change from previous transits between the same origin and destination by vessels from the same company?

[36] Barges less than 5,000 DWT are exempt from the new tug escort requirements.

- Would transiting through Rosario Strait be a reasonable option, given the origin and destination? For instance, has the vessel used Rosario Strait in the past for the same origin and destination?
- Did the vessel's passage include a transit through both Haro and Rosario Straits? The transit through Rosario Strait by a laden vessel would require a tug escort.
- Was the tank vessel likely laden, as determined by the process Ecology used for the synopsis?

Using these questions, Ecology counted a tank vessel's Haro Strait transit as influenced by the new tug escort requirements if:

- The selection of Haro Strait was a change from previous passages
- A transit through Rosario Strait was a reasonable option
- The passage did not utilize both Haro and Rosario Straits
- The tank vessel was likely laden

Ecology did not count a tank vessel's Haro Strait transit as influenced by the tug escort requirements in the following situations:

- The vessel's company had a history of using this route in previous years
- Transiting through Rosario Strait was not a reasonable option, given the origin and destination (e.g., a transit from Victoria, B.C., to Vancouver, B.C.)
- The vessel transited both Haro and Rosario Straits, since laden tank vessels would still require an escort through the Rosario Strait portion of the route
- Ecology could not make a reasonable assumption about the laden or unladen status of a vessel, as an unladen transit through Rosario would not require an escort

In cases where Ecology's process for determining whether a tank vessel was likely laden resulted in a designation of 'unknown', Ecology reviewed ANT data to identify whether a reasonable assumption could be made about the status of the transit.

Using these criteria, Ecology observed five transits by ATBs and 11 transits by barges greater than 5,000 DWT through Haro Strait in Year 2 where the tug escort requirements may have been a factor in deciding the route. Ecology did not observe any transits by tankers less than 40,000 DWT where the tug escort requirements may have been a factor in deciding the route. Additional information on these transits is provided below.

Summary of Transits

Table 8 shows the number of transits by vessels subject to the new tug escort requirements in Year 1 and Year 2 by vessel type, for Rosario Strait and Haro Strait. Transits for all three types of vessels (ATBs, barges, and tankers) increased in Year 2 compared to Year 1, for both Rosario Strait and Haro Strait.

This increase from September 1, 2020, to August 31, 2021, may be a reflection of the recovering economy in Year 2, during the third quarter of 2020. After a drop of 31.4 percent in gross domestic product (GDP) in the second quarter of 2020 the economy rebounded by an annual rate of 33.1 percent in the third quarter of 2020, according to the 'advance' estimate released by the Bureau of Economic Analysis (2020). VEAT data for these vessels shows an

overall decline between calendar year 2019 and 2020, reflecting the economic disruptions earlier in the pandemic.

Ecology reviewed VEAT data for the past five calendar years to determine whether the changes in the number of vessel transits from Year 1 to Year 2 represented a significant change for year-over-year transits. VEAT data has been collected for over 20 years, and can provide useful context for considering the changes in transits shown in the synopsis data. VEAT data are reported for calendar years and use a different methodology than the synopsis, so the number of transits do not match the Year 1 and Year 2 results of the synopsis. Additional discussion is provided in the VEAT data overview section.

ATB route selection

Table 8 shows ATB transits in Rosario Strait increased by 54 transits from Year 1 to Year 2. In Haro Strait, Year 2 transits were 31 higher than in Year 1.

Table 8 Route selection for vessels that fall under new escort requirements with change in the number of transits from Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021)

Vessel Type / Route Selection	Year 1	Year 2	Transits
Vessel Type	**ATB**	**ATB**	**Change**
Rosario Strait	787	841	+54
Haro Strait	48	79	+31
Vessel type	**Barges > 5,000 DWT**	**Barges > 5,000 DWT**	**Change**
Rosario Strait	315	333	+18
Haro Strait	11	16	+5
Vessel Type	**Tankers < 40,000 DWT**	**Tankers < 40,000 DWT**	**Change**
Rosario Strait	15	26	+11
Haro Strait	7	14	+7

Table 9 shows the annual change in the number of ATB transits in both Rosario Strait and Haro Strait based on VEAT data. ATB transits through both straits demonstrate considerable change year-over-year.

Table 9 VEAT data showing the annual increase or decrease in the number of ATB transits year-over-year for Rosario and Haro Straits.

Year	Rosario transits	Change	Haro Transits	Change
2016	707	-	11	-
2017	625	-82	21	+10
2018	684	+59	12	-9
2019	776	+92	56	+20
2020	667	-109	83	+24

Rosario Strait

VEAT data show between 2016 and 2020, transits through Rosario ranged from a low of 625 to a high of 776. Yearly changes are between -109 and +92. Overall, this data suggests that ATB transit patterns reflect business changes in the market for refined product transport. In the context of the last five years, the addition of 54 ATB transits in Rosario Strait between Year 1 and Year 2 does not appear to be unusual.

Haro Strait

VEAT data show in Haro Strait between 2016 and 2020 the lowest number of transits was 11 and the highest was 83. Yearly changes range from -9 to +24. The increase in ATB transits by 31 in Year 2 is higher than any year-over-year change observed between 2016 and 2020.

Table 10 shows ATB transits in more detail. In Year 1, out of 48 total Haro transits, 27 were between Vancouver, B.C., and the Strait of Juan de Fuca, and 21 were between Vancouver, BC and locations including Anacortes, Seattle, Tacoma, and Bellingham. 17 of the transits between Vancouver, B.C., and locations in the study area used both Haro and Rosario Straits, all of which occurred after the border closure between Canada and Washington in 2020 due to the pandemic.

In Year 2, 31 of the 79 Haro Strait transits were between Vancouver, B.C., and the Strait of Juan de Fuca, and 45 between Vancouver, B.C., and the study area. Two additional transits were between Vancouver, B.C., and Victoria, B.C. and one was between the ocean and Cherry Point. 35 transits between Vancouver, B.C and the study area used both Haro and Rosario Strait.

Table 10 Data for Haro Strait ATB transits Year 1 (September 1, 2019, to August 31, 2020) and Year 2 (September 1, 2020, to August 31, 2021)

	Between Strait of JdF[1] And Vancouver, BC	Between Vancouver, BC And Study Area	Total Haro Strait Transits	Transits using Both Haro and Rosario
Year 1	27	21	48	17
Year 2	31	45	79[2]	35

[1] Strait of Juan de Fuca [2] Three transits in Year 2 are not included in columns one and two of this table; two were between Vancouver and Victoria, one was from the ocean to Cherry Point

Canadian and Washington border closure

Much of the change in Haro Strait traffic patterns is likely a result of the pandemic border closure. Prior to the closure, VEAT data show zero transits between Vancouver, B.C., and the study area using both Rosario Strait and Haro Straits in a single passage. ATBs transiting from Washington's northern refineries to British Columbia could embark or disembark British Columbia Coast Pilots while at refinery docks in Washington and transit to British Columbia by going north through Rosario Strait.

When the COVID-19 pandemic closed the border between Washington and Canada, the Pacific Pilotage Authority suspended out of district assignments for British Columbia Coast Pilots (PPA,

2020). This caused a change in transit patterns by ATBs electing to use pilots.[37] After the border closed, Puget Sound Pilots boarded ATBs for a transit south through Rosario Strait to the Puget Sound Pilot Station off of Port Angeles, Washington. The ATB then turned north and boarded British Columbia Coast Pilots at the pilot station off of Victoria, B.C. to transit through Haro Strait to Vancouver, B.C. This change took effect March 23, 2020, and therefore affected both years of synopsis data.

ATB transits that may have been influenced by the tug escort requirement in Year 2

Ecology determined 74 of the 79 Haro Strait transits were likely not affected by the tug escort requirement based on the following:

- 35 transits used both Haro and Rosario Straits, and laden tank vessels would still require an escort through the Rosario Strait portion of the route.
- 31 transits were between the Strait of Juan de Fuca and Vancouver, B.C., and this was a usual route used by the companies' vessels in previous years.
- For four transits, Ecology could not determine if the transit was 'likely laden', or make a reasonable assumption about the status of the transit based on ANT data, as the average amount transferred was 52 percent of the vessel's full capacity load, well below the vessel's 95 percent fully laden capacity.
- Two transits were between Victoria, B.C. and Vancouver B.C., making the Haro Strait transit the reasonable option.
- Ecology made an assumption of unladen for one transit between Strait of Juan de Fuca and the refinery at Cherry Point based on ANT data showing the vessel loaded 95 percent of its full load capacity on arrival.
- Ecology made an assumption of unladen for one transit between Tacoma and Vancouver, B.C. based on ANT data. ANT data show the vessel entered the Puget Sound and sat idle for nearly two months, before the barge was vacuumed, the tug fueled and the vessel transited to Vancouver, B.C.

Ecology identified five of the 79 transits through Haro Strait where the tug escort requirements may have been a factor in deciding the route.

Ecology used the series of questions to evaluate the five Haro Strait transits between Vancouver B.C. and Tacoma:

- VEAT data show this company's ATBs have a history of using Rosario Strait for similar transits.
- Rosario Strait would be a reasonable option for transiting between Vancouver, B.C. and Tacoma, as evidenced by past transits.

[37] The use of pilots is voluntary for ATBs in Rosario Strait and Haro Strait. RCW § 88.16.070 (2018) automatically exempts the following vessels:

1. Any U.S. flag vessel on a voyage in which it is operating exclusively on its coastwise, fishery, and/or recreational (pleasure) endorsement.
2. Any U.S. or Canadian flag vessel engaged exclusively in the coasting (coastwise) trade on the west coast of the Continental United States (including Alaska) and/or British Columbia (BC).
3. Any flag vessel in/outbound to/from Canadian ports which employs a pilot licensed by the Pacific Pilotage Authority (BC Pilots); uses the CVTS; and has appropriate charts (within certain geographic limits)

- The passage did not involve a transit of both Rosario and Haro Straits.
- These five transits were likely laden, based on ANT data and Ecology's logic diagram.

Ecology determined the five likely laden transits through Haro Strait from Vancouver, B.C. to Tacoma in Year 2 may have been influenced by the tug escort requirement, since there was an observed change in the route selection between Year 1 and Year 2 for this ATB.

Barges greater than 5,000 DWT

Table 8 shows an increase of 18 transits in Rosario by barges greater than 5,000 DWT from Year 1 to Year 2. There was also a five transit increase in Haro Strait between Year 1 and Year 2.

Table 11 shows the annual change in transits in Rosario and Haro Strait for the last five years based on VEAT data. Between 2016 and 2020, transits through Rosario ranged from a low of 288 to a high of 656. Yearly changes are between -167 and +15. In Haro Strait, the lowest number of transits was 0 and the highest was 13.

Table 11 VEAT data showing the annual increase or decrease in the number of transits for barges greater than 5,000 DWT, and year-over-year changes, for Rosario and Haro Straits

Year	Rosario Transits	Change	Haro Transits	Change
2016	656	-	0	0
2017	486	-167	0	0
2018	501	+15	0	0
2019	412	-89	13	+13
2020	288	-124	9	-4

Rosario Strait

The increase of 18 transits in Rosario Strait between Year 1 and Year 2 does not appear to indicate a significant change in transits when compared to VEAT data showing year-over-year changes for the last five years as shown in Table 11.

Haro Strait

Synopsis data show barges greater than 5,000 DWT had relatively few transits through Haro Strait in both Year 1 and Year 2. There were eleven transits through Haro Strait in Year 1 by barges of this size, and sixteen transits in Year 2.

VEAT data in Table 11 show zero transits for barges of this size in Haro Strait for years 2016, 2017, and 2018. In February of 2019 a barge began transiting between Vancouver, B.C., and the Strait of Juan de Fuca, and made ten transits in that year. VEAT data show a total of thirteen Haro transits in 2019 and nine in 2020.

The synopsis data show a change in Haro Strait transits between Year 1 and Year 2 after the tug escort requirements were in place for Rosario Strait. In Year 1, the eleven Haro Strait transits were exclusively between Vancouver, B.C., and the Strait of Juan de Fuca. In Year 2, only one transit was between Vancouver, B.C., and the Strait of Juan de Fuca. Table 12 shows the Haro Strait transits for Year 1 and Year 2 in detail.

Table 12 Barges greater than 5,000 DWT Haro Strait transits, Year 1 (September 1, 2019 to August 31, 2020) and Year 2 (September 1, 2020 to August 31, 2021)

Barge > 5,000 DWT	Between SJdF and Vancouver, BC	Between SJdF and Cherry Point/Ferndale	Between Seattle and Cherry Point/Ferndale	Vancouver, BC Anacortes/Seattle /Tacoma
Year 1 transits	11	0	0	0
Year 2 transits	1	5	3	7*
Change	**-10**	**+5**	**+3**	**+7**

*Includes two transits from Vancouver, BC to Anacortes that used Haro and Rosario Straits
Note: SJdF is Strait of Juan de Fuca

In Year 2, four barges from three companies made 16 transits through Haro Strait.

Barges greater than 5,000 DWT: transits that may have been influenced by the tug escort requirement in Year 2

Ecology counted five of the 16 Haro Strait transits as not affected by the tug escort requirement based on the following:

- Two transits used both Haro and Rosario Straits, and laden tank vessels would still require an escort through the Rosario Strait portion of the route
- Ecology made an assumption based on ANT data that two transits between the Strait of Juan de Fuca and a northern refinery were likely unladen based on the vessel loading 90 percent and 84 percent of its full load capacity of a heavy oil on arrival.
- One transit was from the Strait of Juan de Fuca to Vancouver, B.C. Because Haro Strait is a reasonable option this transit, and Ecology could not determine whether the barge was laden, the transit did not meet Ecology's evaluation criteria.

Ecology identified 11 of 16 transits through Haro Strait where the tug escort requirements may have been a factor in deciding the route.

One barge greater than 5,000 DWT made six transits through Haro Strait in Year 2. Four of these transits were carrying a cargo of gasoline from Vancouver, B.C., to Tacoma with a return likely unladen transit through Rosario Strait. The remaining two of the six transits through Haro Strait comprised a passage from Vancouver, B.C., to Anacortes, and back to Vancouver, BC using both Haro Strait and Rosario Strait.

Using the evaluation criteria Ecology found:

- This barge was bought by a different company in 2019, and there was no history of previous transits between the same origin and destination.
- Rosario Strait would be a reasonable option for transiting between Vancouver, B.C. and Tacoma, as evidenced by the four return unladen transits through Rosario Strait.
- Two passages involved transits in both Rosario and Haro Straits.
- Of the six transits through Haro Strait, the barge was likely laden for four of these transits and unladen for two as determined by Ecology's logic diagram.

Ecology found the four likely laden transits from Vancouver, B.C., to Tacoma were likely influenced by the tug escort requirements.

Two barges greater than 5,000 DWT from another company made nine transits through Haro Strait. One barge had four transits from the Strait of Juan de Fuca to a refinery north of Rosario Strait. Two of these transits were laden. One barge transited Haro Strait five times carrying either crude oil, heavy oil, or bunker fuel. One transit was from Vancouver, B.C., to Tacoma, three transits were between Seattle and Ferndale, and one was from Ferndale to the Strait of Juan de Fuca. All five transits appear to have been laden as the barge loaded and discharged cargo at each transfer.

Using the series of questions to evaluate the first barge's four transits between the Strait of Juan de Fuca to the refineries north of Rosario Ecology found:

- VEAT data show this company's barges have a history of using Rosario Strait for similar transits.
- Rosario Strait is a reasonable option for transiting between the Strait of Juan de Fuca and refineries north of Rosario Strait as evidenced by using this route in the past.
- The passages between the Strait of Juan de Fuca and the northern refineries did not include transits through both Rosario and Haro Straits.
- The barge was likely laden for two of the four transits.

Ecology found the two likely laden Haro Strait transits were likely influenced by the tug escort requirements in Rosario Strait.

Using the series of questions to evaluate the other barge's five transits: one from Vancouver, B.C. to Tacoma, three between Seattle and Ferndale, and one from Ferndale to the Strait of Juan de Fuca, Ecology found:

- VEAT data show this company's barges have a history of using Rosario Strait for similar transits.
- Rosario Strait is a reasonable option for these transits based on past transit history.
- These passages did not include transits through both Rosario and Haro Straits.
- The barge was likely laden for all five of these transits.

Ecology found the five likely laden Haro Strait transits were likely influenced by the new tug escort requirement in Rosario Strait.

One barge from a third company made a transit between the Strait of Juan de Fuca and Vancouver, B.C. Ecology used the series of questions to evaluate this transit, finding:

- VEAT data does not show this company's barges have a history of using Haro Strait.
- Haro Strait is a reasonable option for transiting between the Strait of Juan de Fuca and Vancouver, B.C., based on the number of vessels using this route.
- This passage did not include a transit through both Rosario and Haro Straits.
- Ecology was not able to make a determination of the vessel's laden status based on ANT data, as the transfer prior to the transit and transfer after the transit were outside Washington waters.

Because Haro Strait is a reasonable option this transit, and Ecology could not determine whether the barge was laden, the transit did not meet Ecology's evaluation criteria.

In summary, Ecology determined 11 of the transits through Haro Strait by barges greater than 5,000 DWT in Year 2 may have been influenced by the tug escort requirement:

- Four transits from Vancouver, B.C. to Tacoma
- Two transits from the Strait of Juan de Fuca to a refinery north of Rosario Strait by a second barge, and
- Five transits by a third barge between: Vancouver, B.C. and Tacoma, Seattle and Ferndale, and Ferndale to the Strait of Juan de Fuca.

Tankers less than 40,000 DWT

As shown in Table 8, Tankers less than 40,000 DWT had an increase of 11 transits, from 15 to 26, in Rosario Strait in Year 2. This appears to reflect an increase in export of nonene from an Anacortes refinery. In Year 1, there were two nonene transfers compared to nine in Year 2. Haro Strait transits rose by seven transit from seven in Year 1 to fourteen in Year 2.

Haro Strait

These smaller tankers tend to be parcel or chemical tankers[38] and synopsis data show a significant link between Vancouver, B.C., and refineries in the study area. In Year 1, of the seven transits to refineries in the study area, five also included transits between the study area and Vancouver, B.C. – one of these five transits used Rosario Strait and two of the five included transits in both Haro and Rosario Straits.[39] In Year 2, of the eleven transits to refineries in the study area, seven also included transits between the study area and Vancouver, B.C., using both Rosario and Haro Straits. The Rosario and Haro Strait route was used to pick up and drop off the pilots at the Puget Sound Pilot Port Angeles pilot station, and the British Columbia Coast Pilot station off Victoria, B.C., following the closure of the US/Canadian border.

Tankers between 5,000 and 40,000 DWT Haro Strait transit evaluation Year 2

Ecology did not identify changes to vessel transit patterns for tankers between 5,000 and 40,000 DWT that appear to be the result of the tug escort requirement in Rosario Strait and connected waters east.

There were 14 Haro Strait transits in Year 2, seven were between the Strait of Juan de Fuca and Vancouver, B.C. and seven were between Vancouver B.C. and the study area. All seven of the transits between Vancouver, B.C. and the study area used both Rosario and Haro Straits.

[38] Parcel chemical tanker – A chemical tanker capable of carrying many kinds of chemical cargoes including petroleum products. Chemical tankers usually range from 5,000 to 59,000 DWT, smaller than the average size of other tankers types. See Appendix G – Maritime Definitions.

[39] Two of these transits were between Vancouver, B.C. and the Ferndale Refinery, which did not include either Haro or Rosario Strait.

Ecology concluded that these 14 Haro Strait transits were not affected by the tug escort requirement based on the following:

- Seven transits were between the Strait of Juan de Fuca and Vancouver, B.C. VEAT data show this is the usual route for tanker transits.
- Haro Strait is a reasonable option for transiting between the Strait of Juan de Fuca and Vancouver, B.C.
- Seven transits used both Haro and Rosario Straits, and laden tank vessels would still require an escort through the Rosario Strait portion of the route.
- Ecology could not determine if the seven transits between the Strait of Juan de Fuca and Vancouver, B.C. were 'likely laden', based on the logic diagram.

Because Ecology concluded the 14 transits were not affect by the tug escort requirements based on the above, the likely laden or unladen status of the transits were not subjected to additional scrutiny.

Additional data comparing transit data by month for vessel which fell under the new tug escort requirements can be found in Appendix K – Transit Data.

Results for vessels with no additional escort requirements

Tankers greater than 40,000 DWT

Ecology used the crossing line process described in the Data Analysis Methods section to compare route selections and number of transits for tankers greater than 40,000 DWT pre-and post-tug escort implementation.

Tables 13 and 14 provide the number of tankers and number of tanker transits across eight crossing lines. Transit line locations are shown in Figure 30. Transits in any direction are reported for each crossing line. For example, 86 tankers crossed the Rosario Strait N line in Year 1. Transits may have been from south to north across the line, or north to south.

Table 13 Number of tankers greater than 40,000 DWT that transited crossing lines, including change in number of tankers, from Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021)

Crossing Line Data: Number of Tankers > 40,000 DWT								
Crossing Line	**Bellingham Channel**	**Boundary Pass**	**Guemes Channel**	**Haro Strait**	**Rosario Strait N**	**Rosario Strait S**	**Saddlebag Guemes**	**Sinclair Lummi**
Year 1 # tankers	32	92	38	92	86	108	18	59
Year 2 # tankers	23	80	36	80	64	85	12	48
Change in # tankers	**-10**	**-12**	**-2**	**-12**	**-22**	**-23**	**-6**	**-11**

Table 14 Crossing line transit data for tankers greater than 40,000 DWT, including change in number of transits, from Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021)

Crossing Line Data: Transits of Tankers > 40,000 DWT									
Crossing Line	**Bellingham Channel**	**Boundary Pass**	**Guemes Channel**	**Haro Strait**	**Rosario Strait N**	**Rosario Strait S**	**Saddlebag Guemes**	**Sinclair Lummi**	**Total Transits**
Year 1 Transits	51	212	287	212	399	613	31	137	1,942
Year 2 Transits	38	208	274	208	284	488	18	98	1,616
Change in transits	**-13**	**-4**	**-13**	**-4**	**-115**	**-125**	**-13**	**-39**	**-326**

Year 1 and Year 2 tankers greater than 40,000 DWT transit data

The highest number of transits for both years occurred at the crossing line located at the southern end of Rosario Strait. Tankers crossed this line when transiting to and from both Washington's northern refineries and the refineries located in the connected waterways east of Rosario Strait. Vessels can transit over multiple crossing lines in a single leg of its voyage, so the total number of transits over crossing lines is not the same as the total number of tanker arrivals.

Guemes Channel was the usual route for tankers entering the connected waterways east of Rosario while the tankers going to the northern refineries transited to the northern end of Rosario Strait. The Guemes Channel crossing line transits and the northern end of Rosario Strait crossing line transits added together equal a number greater than the Rosario Strait south crossing line. This number accounts for tankers entering Rosario Strait's southern entrance and additional movement between the northern refineries and the anchorages and refineries in the connected waterways east of Rosario.

The number of tankers transiting the crossing line at Haro Strait equals the number at Boundary Pass, indicating all vessels transited through this area without deviation.

Changes in traffic patterns

Both the number of transits and the number of tankers making Rosario Strait transits decreased from Year 1 to Year 2. The largest change was the number of tankers transiting the crossing line at the southern end of Rosario Strait.

Although VEAT data in Figure 34 shows a decline in tanker traffic to Washington ports over the last ten years, this does not appear to account for the large decrease in tanker traffic in the study area from Year 1 to Year 2.

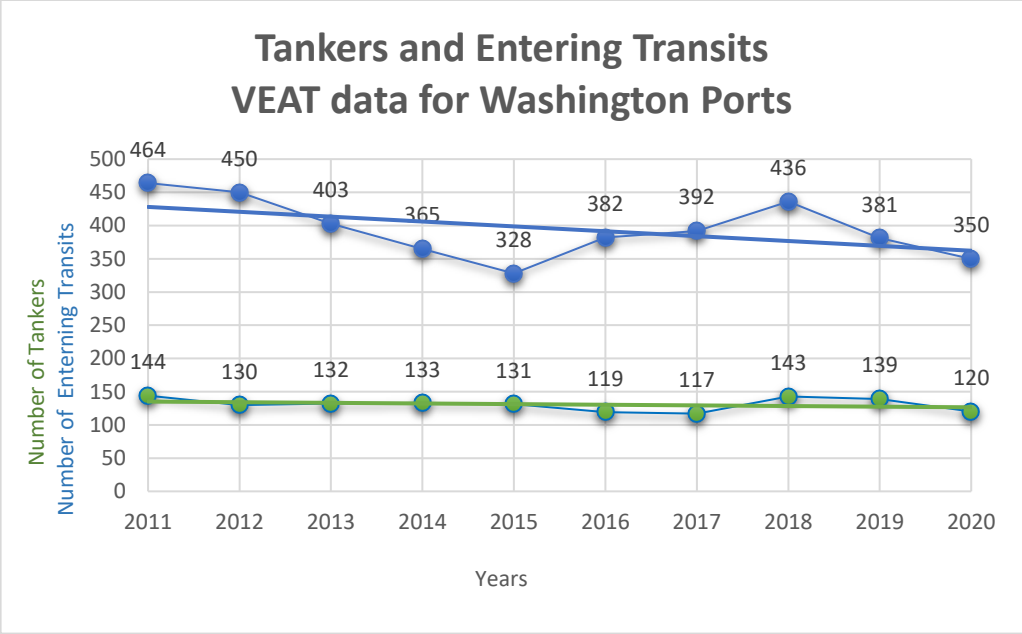


Figure 34 VEAT data for tankers entering for Washington ports over the last ten years

The overall drop in transits by tankers greater than 40,000 DWT may be due to the effect the pandemic had on oil use and refinery output. According to the U.S. Energy Information Administration the demand for transportation fuels in the United States fell beginning in mid-March 2020 because of the spread of coronavirus and efforts to mitigate it. As the demand for gasoline and jet fuel fell to its lowest level in years, U.S. refineries reduced their operations. Beginning in April 2020, refiners responded to less demand for transportation fuels by decreasing overall refinery runs (Colletti & Ricker, 2020).

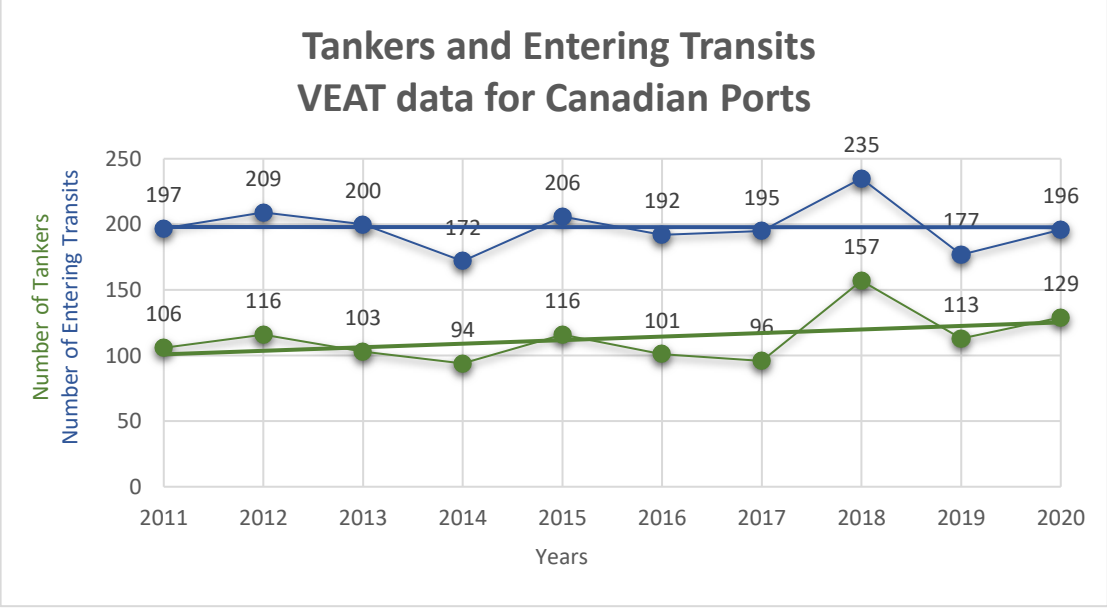


Figure 35 VEAT data for tankers entering for Canadian ports over the last ten years

The change in tankers and tanker transits in Haro Strait and Boundary pass was negligible from Year 1 to Year 2, indicating Canadian tanker traffic was fairly consistent and matched VEAT data.

Most of the gasoline consumed in British Columbia comes from Alberta, delivered primarily via the Trans Mountain Pipeline. Gasoline is also produced in B.C.'s two refineries. Less than ten percent of the gasoline consumed in British Columbia is imported via ship or barge from the U.S. Pacific Northwest (Canadian Energy Regulator, 2021). The majority of the tankers transiting to Canada are exporting crude oil. Although crude production was cut (Carpenter, S. 2020), the pandemic did not have the same impact on British Columbia tanker traffic as traffic to the refineries in the study area.

Barges less than 5,000 DWT

Barges less than 5,000 DWT are exempt from the new escort rules. Table 15 shows a decrease of 150 transits in Rosario Strait between Year 1 and Year 2. There were no transits through Haro Strait by barges of this size in Year 1 or Year 2.

Table 15 Transit data for barges less than 5,000 DWT in Rosario and Haro Straits for Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021)

Vessel Type / Route Selection	Year 1	Year 2	Transits
Vessel Type	Barge < 5,000 DWT	Barge < 5,000 DWT	Change
Rosario Strait	368	218	-150
Haro Strait	0	0	0

Year 1 to Year 2 Transit Data

In Year 1, seven barges less than 5,000 DWT made 368 transits through Rosario Strait, three were dedicated bunker barges and three were barges transiting between Vancouver, B.C., and terminals in either the study area or Tacoma/Seattle. The other barge transited between Tacoma/Seattle and the study area.

In Year 2, five barges made 218 transits through Rosario Strait. Three were dedicated bunker barges, one barge transited between Vancouver, B.C., and the study area, and one barge transited between Tacoma/Seattle and the study area.

Changes in Traffic Patterns

A major change occurred between Year 1 and Year 2 when two small Canadian barges moving bunker oil from Washington refineries to Vancouver, B.C., stopped transiting in May 2020. This may have been due to the loss of cruise ship bunkering opportunities caused by the U.S. Center for Disease Control (CDC) No Sail Order for cruise ships, issued on March 24, 2020 (CDC, 2020). Because these barges stopped transiting in May, 2020, this affected the end of Year 1 and all of Year 2. These two vessels accounted for 30 transits in Year 1.

Synopsis data also show a decrease of 26 bunkering transits in the study area anchorages between Year 1 and Year 2, from 153 to 127. This appears to be a similar to the year-over-year change in as shown in Table 16.

Barges providing bunkering or refueling services

Barges less than 5,000 DWT are exempt from the new escort requirements for all bunkering and cargo transits. Barges greater than 5,000 DWT are exempt from the new escort requirements when 'engaged in bunkering', including transits to or from a bunkering operation (Board of Pilotage Commissioner, 2020a). Bunkering operations in the study area occur at the anchorages and in Bellingham. The majority of vessels in the anchorages are tank vessels awaiting transfers at the refineries in the study area.

Table 16 shows the number of Rosario Strait 'engaged in bunkering' transits for barges greater than 5,000 DWT and barges less than 5,000 DWT and the change in the number of transits from Year 1 to Year 2.

Table 16 Rosario 'engaged in bunkering' transits for Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021) with change in number of transits

Vessel Type / Route Selection	Year 1	Year 2	Change
Vessel Type	**Barge > 5,000 DWT**	**Barge > 5,000 DWT**	**Change**
Rosario Strait	64	70	+6
Vessel Type	**Barge < 5,000 DWT**	**Barge < 5,000 DWT**	**Change**
Rosario Strait	153	127	-26
Total bunkering transits	**217**	**197**	**-20**

Engaged in bunkering transits for barges greater than 5,000 DWT increased by 6 transits, from 64 to 70. For barges less than 5,000 DWT the number of engaged in bunkering transits decreased by 26, from 153 to 127 transits.

Year 1 to Year 2 'Engaged in Bunkering' Transit Data for Barges greater than 5,000 DWT

Of the 19 barges greater than 5,000 DWT which transited Rosario in Year 1, 10 were engaged in a mix of bunkering and cargo transits. In Year 2, this number decreased to six of 13 barges.

Of the 64 engaged in bunkering transits in Year 1, 33 were transits to a bunker operation in the study area and 31 were transits to a bunker operation outside the study area. Of the 33 bunker operations in the study area, 32 were providing fuel to tankers, and one was bunkering an ATB.

In Year 2, 30 of the 70 engaged in bunkering transits were to a bunkering operation in the study area, and 40 were transits to a bunker operation outside of the study area. Of the 30 bunker operations, 22 were providing fuel to tankers, six were to ATBs, and two were bunkering container ships in Bellingham Bay.

Year 1 to Year 2 'engaged in bunkering' transit for data barges less than 5,000 DWT

Of the seven barges less than 5,000 DWT which transited Rosario Strait in Year 1, three were dedicated bunker barges, and in Year 2 three of five barges were dedicated bunker barges.

There were 153 bunkering transits by barges less than 5,000 DWT in Year 1. Of these, 94 transits were for bunkering operations in the study area, and 59 transits for bunkering operations outside. Bunkering operations inside the study area included 39 tankers, 47 ATBs, and 8 fishing vessels in Bellingham.[40]

There were 127 bunkering transits in Year 2. Of these, 92 transits were for bunkering operations in the study area and 35 for bunkering operations outside. Bunkering operations inside the study area included 29 tankers, 59 ATBs, and 4 fishing vessels.[41]

Changes in Traffic Patterns

Although there was an increase of six bunkering transits for barges greater than 5,000 DWT, there was an overall decrease of 20 transits by barges engaged in bunkering. AIS data show tankers and ATBs usually bunker in Port Angeles or one of the anchorages in the study area. The overall decrease in bunker transits may reflect a change in bunker location, rather than a decrease in overall bunkering in the Puget Sound.

Result for transits of tugs engaged in escort duties

The deliverable for the number of transits for tugs engaged in escorting duties in Rosario Strait and connected waterways east was accomplished using the crossing line method as described in the Data Analysis Methods section.

In the year prior to tug escort implementation, only tugs purpose-built for escort or ship assist duties were observed performing escort services in the study area. In the year after tug escort implementation, several tugs previously observed towing oil barges were also observed performing escort duties. Ecology labeled these 'multi-purpose tugs' as they were used for more than one type of job. The list of tugs and their operating companies can be found in Appendix P and Q.

Transits in any direction are reported for each crossing line. For example, 13 purpose-built escort tugs crossed the Rosario Strait N line in Year 1 as shown in Table 17. Transits may have been from south to north across the line, or north to south. Transit line locations are shown in Figure 18.

A tug performing escort duties can transit several crossing lines in one 'trip'. For this synopsis a trip is defined as the time from when the tug's dispatch assigned the tug to an escort job until the tug has returned to its station.[42] Tugs performing escort duties may transit crossing lines for a variety of reasons (e.g., while waiting for an assigned vessel, while traveling to meet an assigned vessel or traveling back to their assigned station, or while transiting the area for other business purposes).

Example of crossing line transit count for an escort tug stationed near the Cherry Point refinery:

[40] These eight fishing vessels were bunkered alongside the dock
[41] These four fishing vessels were bunkered alongside the dock
[42] See Appendix F, Synopsis Terminology

A tug stationed near the northern refinery is assigned an inbound escort for an ATB transiting to the Vendovi anchorage in Anacortes.

The escort tug leaves Cherry Point and transits the Rosario Strait north and south crossing lines to meet the ATB. The tug escorts the ATB to the Vendovi Anchorage, transiting the Rosario Strait south, Guemes Channel, and Saddlebag to Guemes Island crossing lines. After finishing the escort job, the tug transits the Sinclair Island to Lummi Island and the Rosario Strait north crossing lines to return to station near Cherry Point. This trip transited crossing lines seven times.

After this trip the escort tug transited to Seattle and then returned to Cherry Point. The escort tug crossed the Rosario Strait north and south crossing lines twice. Although the tug was not performing escort tug duties, these four crossing line transits are counted using the crossing line method.

Crossing line data for purpose-built escort tugs

Tables 17 and 18 provide the number of purpose-built escort tugs and transits across the six crossing lines.

Table 17 Number of purpose-built escort tugs and change from Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021)

Crossing Line Data: Number of Purpose-Built Escort Tugs						
Crossing Lines	Bellingham Channel	Guemes Channel	Rosario Strait N	Rosario Strait S	Saddlebag Guemes	Sinclair Lummi
Year 1 # Tugs	10	15	12	13	12	11
Year 2 # Tugs	10	14	13	13	12	11
Change in # of tugs	**0**	**-1**	**+1**	**0**	**0**	**0**

Table 18 Crossing line transits for purpose-built escort tugs, and change from Year 1 to Year 2

Crossing Line Data: Purpose-Built Escort Tug Transits							
Crossing Lines	Bellingham Channel	Guemes Channel	Rosario Strait N	Rosario Strait S	Saddlebag Guemes	Sinclair Lummi	Total Transits
Year 1 Transits	186	1,970	1,264	1,209	1,019	343	5,991
Year 2 Transits	210	2,181	1,471	1,510	966	983	7,321
Change in # of transits	**+24**	**+211**	**+207**	**+301**	**-53**	**+640**	**+1,330**

Transits by purpose-built escort tugs over crossing lines in the study area increased by 1,330 from Year 1 to Year 2. Vessels can transit over multiple crossing lines in a single trip, so the total number of transits over crossing lines is not the same as the total number of escort trips.

All crossing line transits increased from Year 1 to Year 2 with the exception of the Saddlebag to Guemes Island line which decreased by 53 transits. The Saddlebag to Guemes Island crossing

line data for tankers greater than 40,000 DWT show six fewer tankers and thirteen fewer transits across this line from Year 1 to Year 2. As indicated in Figure 19, vessels transiting between Guemes Channel or Anacortes and Vendovi or Bellingham anchorages, use the passage between Saddlebag and Guemes Islands. It may be this decrease in large tanker transits through the Saddlebag Guemes passage impacted the number of larger purpose-built escort tug transits across this line.

The greatest increase (640 transits) was the Sinclair-Lummi crossing line. ATBs and oil barges transiting between anchorages and refineries in the waterways east of Rosario and the north end of Rosario Strait, frequently use the passage between Sinclair and Lummi Islands.

Crossing line data for multi-purpose tugs

Tables 19 and 20 provide the number of multi-purpose tugs and transits across the six crossing lines.

Table 19 Number of Multi-Purpose tugs, and change, from Year 1 (September 1, 2019, to August 31, 2020) to Year 2 (September 1, 2020, to August 31, 2021)

Crossing Line Data: Number of Multi-Purpose Tugs						
Crossing Lines	Bellingham Channel	Guemes Channel	Rosario Strait N	Rosario Strait S	Saddlebag Guemes	Sinclair Lummi
Year 1 # Tugs	1	3	2	3	3	2
Year 2 # Tugs	3	3	3	3	3	3
Change in # of tugs	**2**	**0**	**1**	**0**	**0**	**1**

Table 20 Multi-purpose crossing line transits, and change, from Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021)

Crossing Line Data: Multi-Purpose Tug Transits							
Crossing Lines	Bellingham Channel	Guemes Channel	Rosario Strait N	Rosario Strait S	Saddlebag Guemes	Sinclair Lummi	Total Transits
Year 1 Transits	11	9	18	27	4	2	71
Year 2 Transits	164	164	521	519	143	234	1,745
Change in # of transits	**+153**	**+155**	**+503**	**+484**	**+139**	**+232**	**+1,674**

Transits by multi-purpose escort tugs over crossing lines in the study area increased by 1,674 from Year 1 to Year 2. Vessels can transit over multiple crossing lines in a single trip, so the total number of transits over crossing lines is not the same as the total number of escort trips.

One company elected to use their tugs for escort duty rather than hiring purpose-built escort tugs. Prior to the tug escort requirement going into effect, these tugs were used to tow oil barges, therefore none of the transits in the Year 1 crossing line data were tugs performing escort duties. The transit data for Year 2 does not indicate if the vessel was performing tug

escort duties, transiting without a barge, or towing an oil barge. However, the large increase in transits between Year 1 and Year 2 suggests that many of the additional transits were likely related to the tugs performing escort duties.

Combined crossing line data for purpose-built escort and multi-purpose tugs

Table 21 shows the combined crossing line data for both purpose-built and multi-purpose tugs for Year 1 and Year 2 with the change in transit numbers between years.

Table 21 Crossing line transits all tugs for Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021) with change in number of crossing transits

Crossing Line Data: All Tug Transits							
Crossing Lines	Bellingham Channel	Guemes Channel	Rosario Strait N	Rosario Strait S	Saddlebag Guemes	Sinclair Lummi	Total Transits
Year 1 Transits	197	1,979	1,282	1,236	1,023	345	6,062
Year 2 Transits	374	2,345	1,992	2,029	1,109	1,217	9,066
Change in # of transits	**+177**	**+366**	**+710**	**+785**	**+86**	**+872**	**+3,004**

For Year 1 there was a total of 6,062 crossing line transits across all six crossing line in the study area. For Year 2, the total number of crossing line transits across all six lines in the study area was 9,066, an increase of 3,004 transits. The largest increase was 872 transits across the Sinclair to Lummi Island crossing line, and the smallest increase was 86 transits across the Saddlebag to Guemes Island crossing line.

Results for number of oil transfers at facilities & anchorages

Ecology reviewed ANT data to address the scope of work deliverable for the number of oil transfers per refinery and per anchorage pre- and post-bill implementation. Results are shown in Tables 22 and 23. Appendix H has additional information on facilities in the study area and Appendix I has information on anchorages.

Facilities

Table 22 shows an overall decrease of 141 transfers at facilities in the study area. This may be a result of the effect the pandemic had on oil use and refinery output. According to the U.S. Energy Information Administration the demand for transportation fuels in the United States fell beginning in mid-March 2020 because of the spread of coronavirus and efforts to mitigate it. As the demand for gasoline and jet fuel fell to its lowest level in years, U.S. refineries reduced their operations. Beginning in April 2020, refiners responded to less demand for transportation fuels by decreasing overall refinery runs (Colletti & Ricker, 2020).

Table 22 Number of oil transfers at facilities in the study area and change from Year 1 (September 1, 2019 to August 31, 2020) and Year 2 (September 1, 2020 to August 31, 2021)

Facility	Year 1 Number of Transfers	Year 2 Number of Transfers	Change in Number of Transfers
Shell Anacortes[1]	242	199	-43
Tesoro Marketing & Refining Company	184	248	+64
Phillips 66 Ferndale	330	217	-113
BP Cherry Point	328	279	-49
Total Transfers	**1,084**	**943**	**-141**

[1] Shell Puget Sound refinery was sold to HollyFrontier Corporation (Shell US, 2021)

Anchorages

Table 23 shows oil transfers conducted at anchorages within the study area. Anchorage locations are shown on Figure 36

Table 23 Number of oil transfers in study area anchorages and change from Year 1 (September 1, 2019 to August 31, 2020) and Year 2 (September 1, 2020 to August 31, 2021)

Anchorage	Year 1 Number of Transfers	Year 2 Number of Transfers	Change in Number of Transfers
Anacortes	30	52	+22
Bellingham Bay	1	3	+2
March Point	17	19	+2
Vendovi Island	63	46	-17
Total Oil Transfers	**111**	**120**	**+9**

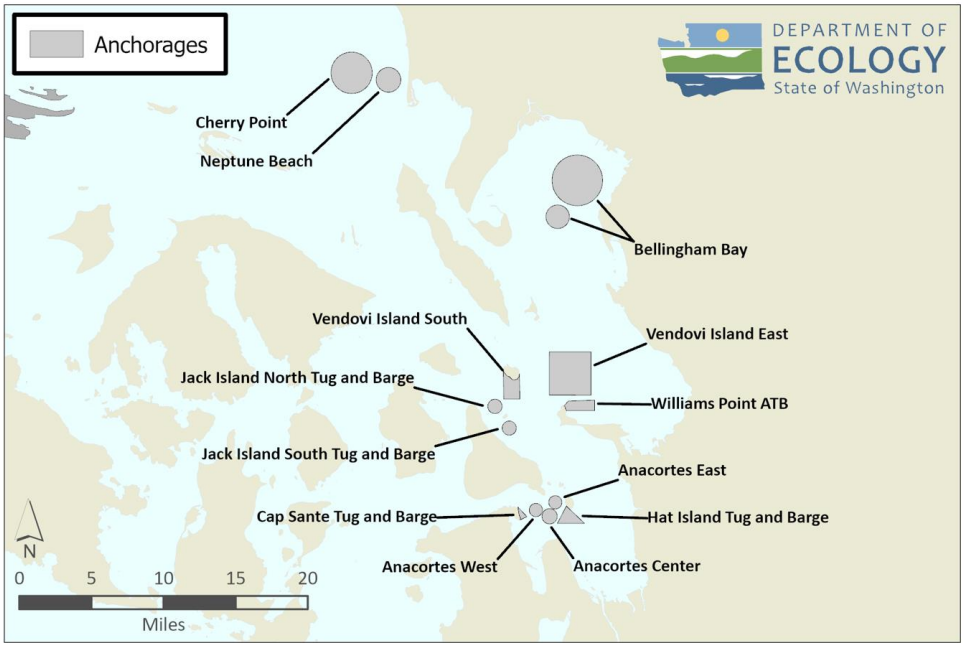


Figure 36 Map of anchorages in study area

Transfers increased from Year 1 to Year 2 by 22 transfers in Anacortes anchorage, 2 each in the Bellingham and March Point anchorages, and decreased by 17 in the Vendovi Island anchorage. Overall the number of oil transfer in all anchorages increased by 9 transfers.

Changes in bunkering patterns

In Year 1 of the 111 bunkers at anchorages in the study area, ATBs bunkered 46 times, foreign flag vessels bunkered 44 times, U.S. flagged tankers bunkered 20 times, and one fishing vessel bunkered at dock in Bellingham Bay.

In Year 2, of the 121 bunkers at anchorages in the study area, ATBs bunkered 66 times, foreign flag tankers bunkered 30 times, U.S. flag tankers bunkered 23 times, and two containerships bunkered in Bellingham Bay anchorage.

There were zero lightering operations (cargo oil transfers between tankers and oil barges) at anchor in Year 1. In Year 2 there were three lightering operations, two in the Vendovi anchorage and one in the Anacortes anchorage.

Review of the last five years of vessel entry data

Effect of global crises in maritime trade

The COVID-19 pandemic had a profound effect on international shipping as well as traffic trends in the Puget Sound and Salish Sea. The United Nations Conference on Trade and Development (UNCTAD) in a November 2020 article (UNCTAD, 2020) describes the unprecedented disruptions. As shown by a chart from the article (Figure 37) the steep downturn in seaborne trade from the pandemic was similar to the disruptions caused by the 2008 global economic crisis.

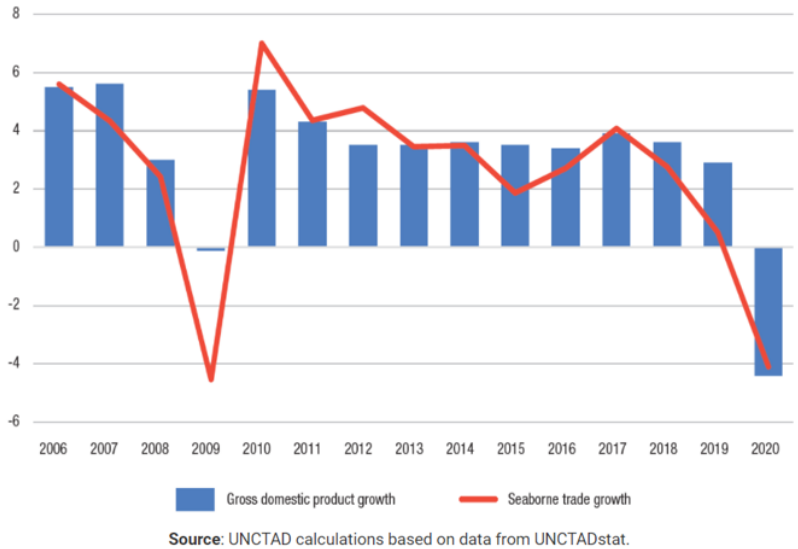


Figure 37 Development of international maritime trade and global output, 2006 – 2020 (UNCTAD, 2020)

VEAT data overview

VEAT is an annual report counting vessel entering transit data, and ATB and barge movements within Washington waters. The Marine Exchange of Puget Sound and the Chamber of Shipping of British Columbia provide Strait of Juan de Fuca entry data for tankers, and Ecology uses the Advanced Notice of Oil Transfer (ANT) database to count ATB and oil barge movements.

Ecology used the VEAT data to compare year-over-year changes in tank vessel transit numbers to the change in transit numbers, from the year prior to the tug escort requirement to the year after the requirement went into effect, in order to provide context for changes in the number of transits.

Synopsis data does not match VEAT transit numbers, as synopsis data for Year 1 starts in September 2019 and ends in August 2020, and Year 2 starts in September of 2020 and ends in August of 2021. VEAT data is for all Washington ports, including those outside the study area and does not segregate oil barges by deadweight tonnage.

Table 24 shows VEAT entering transits for tankers, ATBs, and oil barges[43] for the last five years.

Table 24 Vessel entering and transit report (VEAT) entering transit data from 2016 to 2020

Entering transits by VEAT vessel type	2016	2017	2018	2019	2020
Tanker bound for Washington ports	382	392	436	381	350
Tanker bound for Canadian ports	192	195	235	177	196
ATB bound for Washington ports	283	266	250	296	285
ATB bound for Canadian ports (Haro)	2	8	1	5	36
Oil barge bound for Washington ports	249	234	193	195	151
Oil barge bound for Canadian ports (Haro)	0	0	0	13	11

Vessel entering and transit report (VEAT) tanker data

The number of tanker entering transits to Washington and Canadian ports for the past ten years is shown in Figure 38 (Ecology, n.d. -a).

[43] VEAT does not differentiate barges by deadweight tonnage

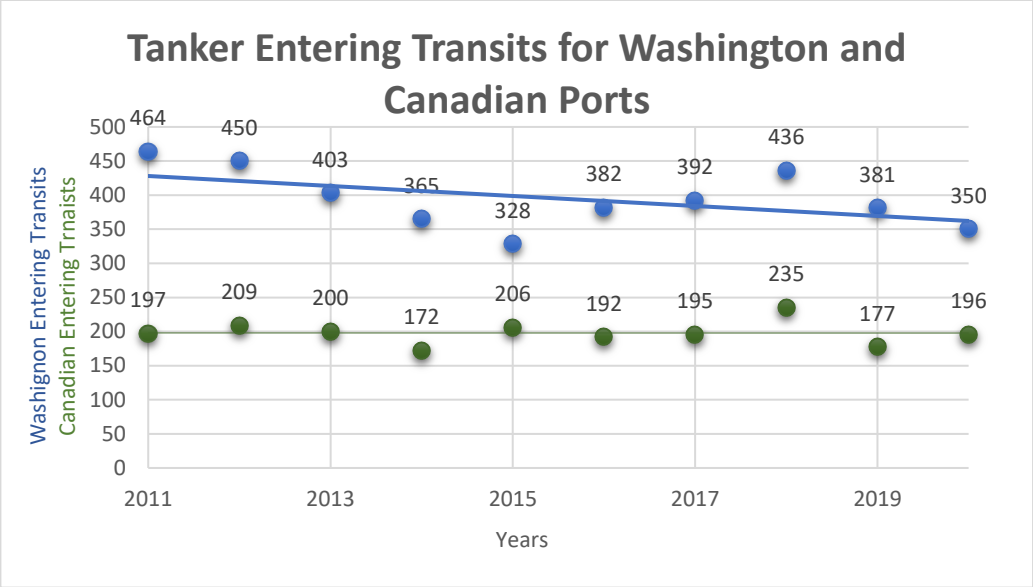


Figure 38 Number of entering transits for tankers to Washington and Canadian ports over the past ten years (Ecology, n.d.-a)

Tanker entering transits for Washington ports

Over the past ten years the number of individual tankers bound for Washington ports has stayed fairly consistent, as the majority of these tankers are U.S. flag Jones Act[44] vessels transiting between Alaska, or west coast ports, and Washington refineries (Ecology, n.d.-a). However, the number of entering transits for tankers has been declining, from 464 in 2011, to 350 in 2020. Part of this decline can be attributed to a decreased in the supply of North Slope crude and an increase in crude by rail (Ecology, 2019). Washington refineries operate at close to maximum output and, without upgrades to improve or expand product types, tanker entering transits are not expected to rise (Ecology, 2019). The synopsis results for tanker crossing line transits coincide with the general downward trend in tanker traffic.

Tanker entering transits to Canadian ports

Tanker entering transits to Vancouver, B.C., rose between 2006 and 2007 as the Transmountain pipeline increased capacity from 260,000 to 300,000 barrels per day (bpd). Since 2007 the number of entering transits has remained relatively stable (Ecology, 2019). The additional expansion project for the pipeline is expected to raise the capacity from 300,000 to 890,000 bpd (Transmountain, n.d.). This expansion is expected to be completed in December 2022, and is anticipated to increase the number of tanker entering transits to that facility to 52 a month (Ecology, 2019)(Transmountain, n.d.). Synopsis crossing line results for tankers using Haro Strait

[44] The Jones Act (46 U.S.C. § 55102), is a section of the 1920 Merchant Marine Act that applies to cargo being transported by water between U.S. points. The law requires this cargo is to be shipped aboard vessels that are U.S.-built, U.S.-citizen owned, registered in the U.S., and crewed by Americans. This encourages a strong U.S. Merchant Marine for both economic security and national defense by fostering a U.S.-flag fleet that contributes to our financial wellbeing, and acts as a sealift resource for the transportation of supplies in time of contingency (Department of Transportation, Maritime Administration, 2021).

and Boundary pass show a negligible change in transit numbers, this is consistent with VEAT data.

Vessel entering and transit report (VEAT) ATB data

VEAT data tracks ATB and barge transits[45] within Washington waters using Ecology's ANT system. VEAT tracks ATB entering transits into Washington waters as a subset of the total transits.

Figure 39 shows the annual number of ATB transits in the Puget Sound for the last ten years and the number of entering transits, a subset of the total number of transits (Ecology, n.d. -a).

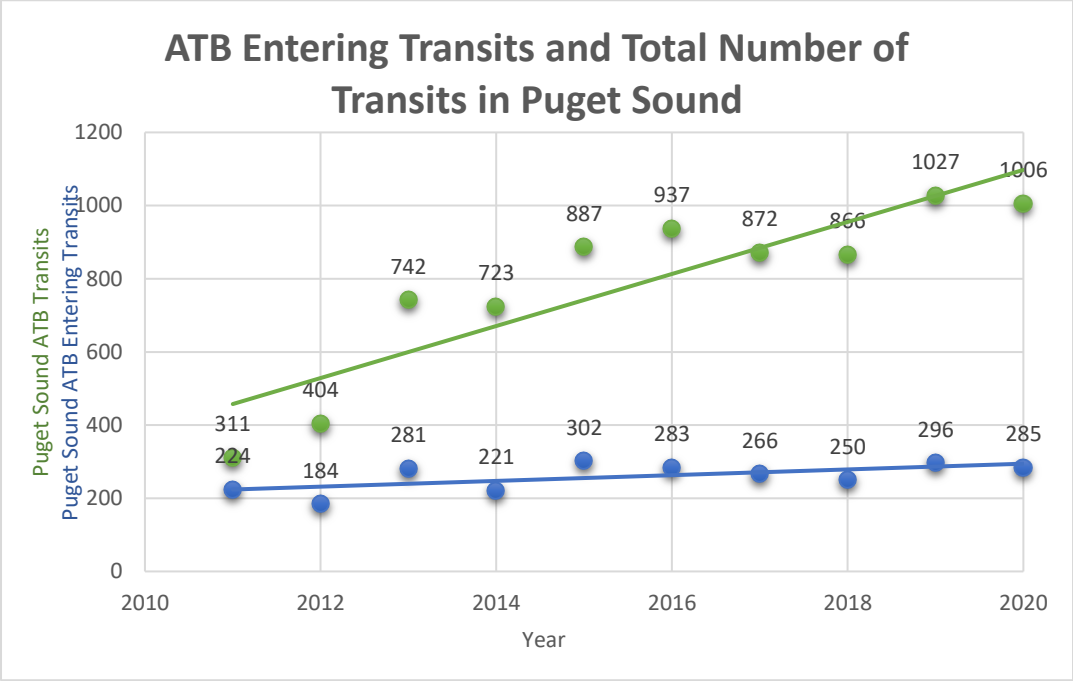


Figure 39 Vessel entering and transit report (VEAT) data showing ATB transits and entering transits in Puget Sound for the last 10 years

The first four ATBs began operating on the west coast in 2002 (Buchanan, 2014). Ecology began counting ATBs separately from towed oil barges in the 2011 VEAT report. In 2011 there were three companies with a total of nine ATBs transiting in the Puget Sound, one company had seven ATBs and two companies had one ATB. These ATBs made 311 transits in the Puget Sound in 2011. In 2020, 1,006 transits were made by 16 ATBs, operated by five companies. This is an increase of 45 percent in the number of ATBs and 69 percent in the number of transits.

The synopsis data shows an increase of 54 transits from Year 1 to Year 2 in Rosario Strait. This change appears to be well within the VEAT year-over-year Rosario Strait change in ATB transits.

[45] For VEAT, an ATB or tank barge transit is defined as any significant move between two locations in Washington state waters, while transporting oil.

The synopsis data for ATB transits in Haro showed an increase of 31 transits from Year 1 to Year 2, this was above the VEAT year-over-year change in ATB transits and indicated a change in ATB traffic trends for Haro Strait and Boundary Pass. This change can be attributed in large part to the change in pilotage routes due to the pandemic border closure.

Vessel entering and transit report (VEAT) tank barge data

VEAT data tracks barge transits within Washington waters using Ecology's ANT system. Figure 40 shows the annual number of transits made by oil barges in the Puget Sound for the last ten years, and the number of entering transits made by these barges as a subset of the total number of transits.

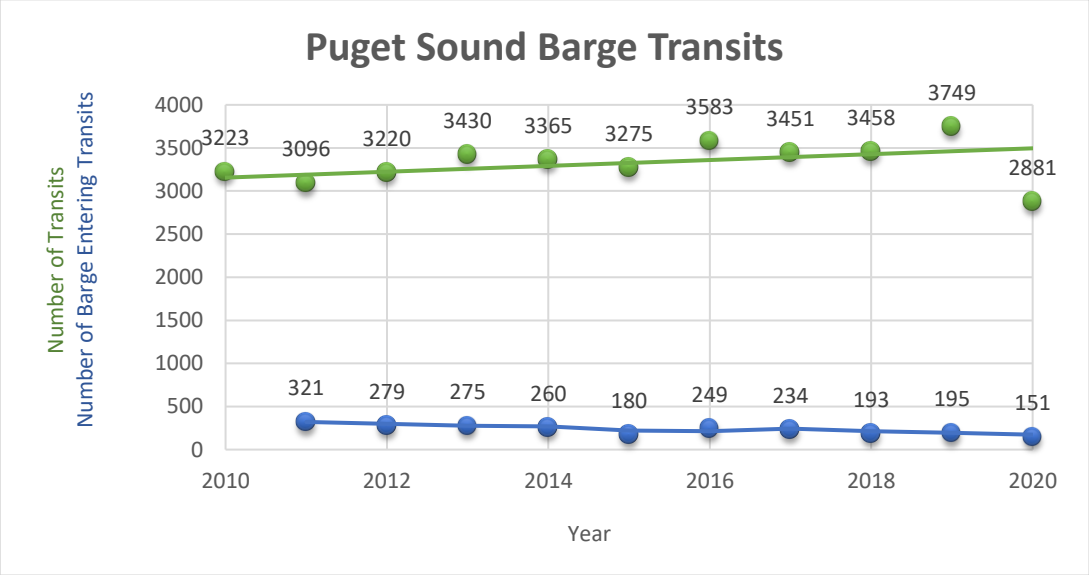


Figure 40 Puget Sound barge transits and entering transits for Puget Sound

VEAT data show significant fluctuations in the number of barge transits between years, from an increase of 308 between 2015 and 2016 to a decrease of 868 between 2019 and 2020.

Synopsis transits for the sum of barges greater than 5,000 DWT and less than 5,000 DWT in the study area from Year 1 to Year 2 show a decrease of 150 transits in Rosario Strait, and an increase of five transits in Haro Strait. This appears to be within the year-over-year changes in the number of transits within the Puget Sound.

Additional information about vessel traffic trends from 2008 to 2018 is available in Ecology's Report of Vessel Traffic and Vessel Traffic Safety (Ecology, 2019).

Answers to Research Questions

Ecology re-ordered the research questions for clarity.

- How does the overall number of transits (by vessel type) change pre- and post-bill implementation?
    - In Year 2, transits by tank vessel subject to the new tug escort requirements increased in both Rosario and Haro Straits.
    - Most of these changes were not related to the tug escort requirement. Some were likely the result of business decisions by companies, the year-to-year variation in the market for crude oil and refined product, and the effects of the global pandemic.
- What changing vessel traffic trends do we see for vessels that newly fall under an escort requirement?
    - The new tug escort requirement did not appear to have affected the route selection of tankers between 5,000 and 40,000 DWT from Year 1 to Year 2.
    - Ecology identified 16 transits through Haro Strait in Year 2 by ATBs and barges greater than 5,000 DWT where the tug escort requirements may have been a factor in deciding the route.
        - ATBs: five of 79 Haro Strait transits may have been affected by the tug escort requirement. These five transits represent 6 percent of the 79 Year 2 Haro Strait transits, and 0.5 percent of the 920 Year 2 total transits through Rosario and Haro Straits.
        - Barges greater than 5,000 DWT: 11 of 16 transits may have been affected by the tug escort requirement. These 11 transits represent 69 percent of the total 16 Year 2 transits, and 3 percent of 349 Year 2 total transits through both Rosario and Haro Straits.
- What changing vessel traffic trends do we see for deep draft and tug traffic that have no additional escort requirements?
    - For tankers greater than 40,000 DWT, crossing line transits decreased between Year 1 and Year 2 in Rosario Strait, both in the number of transits and the number of tankers making transits. In Haro Strait and Boundary pass, the change in tankers and crossing line transit numbers was negligible from Year 1 to Year 2.
    - For barges less than 5,000 DWT, there was a decrease in Rosario Strait transits between Year 1 and Year 2. There were no transits through Haro Strait by barges less than 5,000 DWT in Year 1 or Year 2.
    - For barges engaged in bunkering within the study area, there was an overall decrease in transits: an increase of six transits by barges greater than 5,000 DWT and a decrease of 26 transits by barges less than 5,000 DWT. The overall 20 transit decrease may reflect vessels receiving fuel at a location outside of the study area, rather than a decrease in bunkering in the Puget Sound.
- What changing vessel traffic trends do we see for tug escorts?
    - Tug escort movements in the study area increased significantly following the implementation of the new escort requirements, especially for a few tugs that were observed performed escort duties as well as towing oil barges (termed ‘multi-purpose’ tugs for this synopsis).

Summary of Findings

Key findings are summarized below. Detailed responses for each deliverable identified in the scope of work are provided in the Results section of the synopsis.

Changes in traffic patterns for vessels newly subject to escort tug requirements

Transits in both Rosario and Haro Strait increased from Year 1 to Year 2 for ATBs and oil barges greater than 5,000 DWT and tankers between 5,000 and 40,000 DWT.

ATBs

- Rosario Strait transits increased by 54 transits (7 percent), from 787 in Year 1 to 841 in Year 2.
- Haro Strait transits increased by 31 transits (65 percent), from 48 in Year 1 to 79 in Year 2.
- In Year 2, five of 79 transits through Haro Strait may have been affected by the tug escort requirement. These five transits represent 6 percent of the 79 Haro Strait in Year 2, and 0.5 percent of the 920 total transits through both Rosario and Haro Straits in Year 2.
- Transits using both Rosario and Haro Straits increased after May, 2020 as a result of changes in embarkation and disembarkation locations for Canadian maritime pilots due to the pandemic border closure (PPA, 2020). In Year 1 there were 17 transits between Vancouver, B.C., and the study area using both Rosario and Haro Straits, there were 36 in Year 2.
- Transits in Haro Strait between Vancouver, B.C., and Tacoma or Seattle increased from four in Year 1 to 11 in Year 2.

Barges greater than 5,000 DWT

- Rosario Strait transits increased by 18 transits (6 percent), from 315 in Year 1 to 333 in Year 2.
- Haro Strait transits increased by five transits (45 percent), from 11 in Year 1 to 16 in Year 2.
- In Year 2, 11 of 16 transits through Haro Strait may have been affected by the tug escort requirement. These 11 transits represent 69 percent of the 16 Haro Strait in Year 2, and 3 percent of the 333 total transits through both Rosario and Haro Straits in Year 2.

Tankers less than 40,000 DWT

- Rosario Strait transits increased by 73 percent, from 15 in Year 1 to 26 in Year 2.
- Haro Strait transits increased by 14 percent, from seven in Year 1 to eight in Year 2.
- In Year 2, zero of the eight transits through Haro Strait were identified where the tug escort requirement may have been a factor in deciding the route.

Changes in traffic patterns for vessels not subject to the new tug escort requirements

Transits in both Rosario and Haro Strait decreased from Year 1 to Year 2

Tankers greater than 40,000 DWT

- The number of crossing line transits through the south end of Rosario Strait decreased for both the number of tankers and number of transits. In Year 1, 108 tankers made 613 transits across the Rosario Strait south crossing line. In Year 2, 85 tankers made 488 transits across the Rosario Strait south crossing line, a decrease of 23 tankers and 125 transits.
- Haro Strait and Boundary Pass crossing line transits decreased for both the number of tankers and number of tanker transits, from 92 tankers and 212 transits in Year 1 to 80 tankers and 208 transits in Year 2. This was a decrease of 12 tankers and four transits.

Barges less than 5,000 DWT

- Rosario Strait transits decreased from 368 in Year 1, to 215 in Year 2, a decrease of 150 transits, or 41 percent. Some of this decrease was due to the interruption in cruise ship bunkering caused by the pandemic. Two small bunker barges transiting between Vancouver, B.C., and Washington refineries ceased transits after the Center for Disease Control (CDC) No Sail order in March of 2020.
- Haro Strait - there were no transits in Year 1 or Year 2.

Barges engaged in bunkering

- Transits in Rosario Strait by barges engaged in bunkering decreased overall by 20 transits.
    - Barges greater than 5,000 DWT: transits increased by six, from 64 in Year 1 to 70 in Year 2, a nine percent increase.
    - Barges less than 5,000 DWT: transits decreased by 26, from 153 in Year 1 to 127 in Year 2, 17 percent decrease.

Changes in traffic patterns for tugs engaged in escort duties

Crossing line transit numbers increased from Year 1 to Year 2, both for the number of tugs performing escort duties and the number of crossing line transits.

- Ecology observed only tugs built for the purpose of ship assist and escort duties performing escort duties in the study area in Year 1.
- Ecology observed three tugs that towed oil barges in Year 1 performing tug escort duties in Year 2. As these were not purpose-built ship assist and escort tugs, Ecology labeled these 'multi-purpose tugs'[46]. Multi-purpose tugs were used for both oil barge towing and escort tug duties in Year 2.
- There were 12 purpose-built escort tugs performing escort duties in the study area in both Year 1 and Year 2.

[46] See Appendix F Synopsis Terminology

- There were three multi-purpose tugs that performed escort tug duties in Year 2. Ecology observed these tugs towing oil barges in Year 1 and Year 2.
- Purpose-built escort tug crossing lines transits in the study area increased from 5,991 in Year 1 to 7,321 in Year 2, an increase of 1,330 transits or 22 percent.
- Multi-purpose tug crossing lines transits in the study area increased from 71 in Year 1 to 1,745 in Year 2, an increase of 1,674 transits or over 2,000 percent.
- Total tugs crossing line transits in the study area increased from 6,062 in Year 1 to 9,066 in Year 2, an increase of 3,004 transits or 50 percent.
- Vessels can transit over multiple crossing lines in a single trip[47], so the total number of transits over crossing lines does not represent the number of escort trips.

Change in the number of oil transfers in study area

Transfers at facilities in the study area decreased from Year 1 to Year 2. Transfers at anchorages in the study area increased from Year 1 to Year 2.

Oil transfers at refineries

Oil transfers at the four refineries in the study area decreased from 1,084 in Year 1 to 943 in Year 2, a decrease of 141 transfers

Oil transfers at anchorages

Oil transfers at anchorages in the study area increased from 111 in Year 1 to 120 in Year 2, an increase of nine transfers.

There were zero lightering operations (cargo oil transfers between tankers and oil barges) at anchor in Year 1. In Year 2 there were three lightering operations, two in the Vendovi anchorage and one in the Anacortes anchorage.

[47] See Appendix F Synopsis terminology for a definition of 'trip' as it pertains to escort tug crossing line transits in this synopsis

Conclusions

The purpose of this synopsis was to review vessel transits to identify changes after tug escort requirements were implemented on September 1, 2020 for laden ATBs and oil barges greater than 5,000 DWT, and tankers between 5,000 and 40,000 DWT transiting in Rosario Strait and connected waterways to the east. Unladen tank vessels and barges engaged in bunkering are excluded from the new tug escort requirements.

The most significant findings were:

- The new tug escort requirements did not significantly change tank vessel traffic. Most transits in the study area by tank vessels subject to the tug escort requirement were through Rosario Strait both before and after the tug escort requirement took effect.
    - 94 percent of transits by these tank vessels in Year 1 were through Rosario Strait (1,117 of the 1,183 total transits in Rosario and Haro Straits).
    - 92 percent of transits by these tank vessels in Year 2 were through Rosario Strait (1,200 of the 1,309 total transits in Rosario and Haro Straits).
- In Year 2, five of the 79 Haro Strait transits by ATBs, and 11 of the 16 Haro Strait transits by barges greater than 5,000 DWT were identified where the new tug escort requirements may have been a factor in deciding the route.
- Unrelated to the new tug escort requirement, the border closure between Washington and Canada caused by the pandemic produced a change in traffic patterns for ATBs using pilots.
    - Prior to the pandemic there were no transits by ATBs between Vancouver, B.C., and the study area which used both Rosario and Haro Straits in one passage.
    - After the border closure, the pilots embarked and disembarked in Port Angeles and Victoria, B.C., requiring a transit in both Rosario and Haro Straits if transiting between the study area and Vancouver, B.C. (PPA, 2020).
    - There were 53 of these transits, 17 in Year 1 and 36 in Year 2.
- Escort tug transits increased significantly following the implementation of the new requirements.
    - This was especially notable for multi-purpose tugs, or tugs that performed escort duties as well as towed oil barges.
    - Transits by purpose-built escort tugs over crossing lines in the study area increased by 1,330 transits, from 5,991 in Year 1 to 7,321 in Year 2, an increase of 22 percent.
    - Transits by multi-purpose escort tugs over crossing lines in the study area increased by 1,674 transits, from 71 in Year 1 to 1,745 in Year 2, an increase of over 2,000 percent.
    - The total of transits by all tugs performing escort duties over crossing lines in the study area increased by 3,004 transits, from 6,062 in Year 1 to 9,066 transits in Year 2, an increase of 50 percent.
    - Vessels can transit over multiple crossing lines in a single trip, so the total number of transits over crossing lines does not represent the number of escort trips.

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Appendix A
Improving the Safety of Oil Transportation Act Sections 1, 2, and 3

NEW SECTION. Sec. 1. The legislature finds that a variety of 8 existing policies designed to reduce the risk of oil spills have helped contribute to a relatively strong safety record for oil moved by water, pipeline, and train in recent years in Washington state. Nevertheless, gaps exist in our safety regimen, especially deriving from shifts in the modes of overwater transportation of oil and the increased transport of oils that may submerge or sink, contributing to an unacceptable threat to Washington waters, where a catastrophic spill would inflict potentially irreversible damage on the endangered southern resident killer whales. In addition to the unique marine and cultural resources in Puget Sound that would be damaged by an oil spill, the geographic, bathometric, and other environmental peculiarities of Puget Sound present navigational challenges that heighten the risk of an oil spill incident occurring. Therefore, it is the intent of the legislature to enact certain new safety requirements designed to reduce the current, acute risk from existing infrastructure and activities of an oil spill that could eradicate our whales, violate the treaty interests and fishing rights of potentially affected federally recognized Indian tribes, damage commercial fishing prospects, undercut many aspects of the economy that depend on the Salish Sea, and otherwise harm the health and well-being of Washington residents. In enacting such measures, however, it is not the intent of the legislature to mitigate, offset, or otherwise encourage additional projects or activities that would increase the frequency or severity of oil spills in the Salish Sea. Furthermore, it is the intent of the legislature for this act to assist in coordinating enhanced international discussions among federal, state, provincial, first nation, federally recognized Indian tribe, and industry leaders in the United States and Canada to develop an agreement for an additional emergency rescue tug available to vessels in distress in the narrow Straits of the San Juan Islands and other boundary waters, which would lessen oil spill risks to the marine environment in both the United States and Canada.

Sec. 2. RCW 88.16.190 and 1994 c 52 s 1 are each amended to read as follows:

(1) Any oil tanker, whether enrolled or registered, of greater than one hundred ((~~and~~)) twenty-five thousand deadweight tons shall be prohibited from proceeding beyond a point east of a line extending from Discovery Island light south to New Dungeness light, unless authorized by the United States coast guard, pursuant to 33 C.F.R. Sec. 165.1303.26 27

(2) ~~((An oil tanker, whether enrolled or registered, of forty to one hundred and twenty-five thousand deadweight tons may proceed beyond the points enumerated in subsection (1) if such tanker possesses all of the following standard safety features:~~

~~(a) Shaft horsepower in the ratio of one horsepower to each two and one-half deadweight tons; and~~
~~(b) Twin screws; and~~
~~(c) Double bottoms, underneath all oil and liquid cargo compartments; and~~
~~(d) Two radars in working order and operating, one of which must be collision avoidance radar; and~~

~~(e) Such other navigational position location systems as may be prescribed from time to time by the board of pilotage commissioners:~~
~~PROVIDED, That, if such forty to one hundred and twenty-five thousand deadweight ton tanker is in ballast or is under escort of a tug or tugs with an aggregate shaft horsepower equivalent to five percent of the deadweight tons of that tanker, subsection (2) of this section shall not apply: PROVIDED FURTHER, That additional tug shaft horsepower equivalencies may be required under certain conditions as established by rule and regulation of the Washington utilities and transportation commission pursuant to chapter 34.05 RCW: PROVIDED 9 FURTHER, That))~~ (a)(i) An oil tanker of forty to one hundred twenty five thousand deadweight tons may operate in the waters east of a line extending from Discovery Island light south to New Dungeness light and all points in the Puget Sound area, including but not limited to the San Juan Islands and connected waterways and the waters south of Admiralty Inlet, to the extent that these waters are within the territorial boundaries of Washington, only if the oil tanker is under the escort of a tug or tugs that have an aggregate shaft horsepower equivalent to at least five percent of the deadweight tons of the escorted oil tanker.

(ii) Effective September 1, 2020, the following may operate in Rosario Strait and connected waterways to the east only if under the escort of a tug or tugs that have an aggregate shaft horsepower equivalent to at least five percent of the deadweight tons of a forty thousand deadweight ton oil tanker: (A) Oil tankers of between five thousand and forty thousand deadweight tons; and (B) both articulated tug barges and towed waterborne vessels or barges that are: (I) Designed to transport oil in bulk internal to the hull; and (II) greater than five thousand deadweight tons.

(iii) The requirements of (a)(ii) of this subsection: (A) Do not apply to vessels providing bunkering or refueling services; (B) do not apply to a towed general cargo deck barge; and (C) may be adjusted or suspended by rule by the board of pilotage commissioners, consistent with section 3(1)(c) of this act.

(b) An oil tanker, articulated tug barge, or towed waterborne vessel or barge in ballast or when unladen is not required to be under the escort of a tug.

(c) A tanker assigned a deadweight of less than forty thousand deadweight tons at the time of construction or reconstruction as reported in Lloyd's Register of Ships is not subject to the provisions of RCW 88.16.170 ((~~through 88.16.190~~)) and 88.16.180.

(3) The definitions in this subsection apply throughout this section unless the context clearly requires otherwise.

(a) "Articulated tug barge" means a tank barge and a towing vessel joined by hinged or articulated fixed mechanical equipment affixed or connecting to the stern of the tank barge.

(b) "Oil tanker" means a self-propelled deep draft tank vessel designed to transport oil in bulk. "Oil tanker" does not include an articulated tug barge tank vessel.

(c) "Towed general cargo deck barge" means a waterborne vessel or barge designed to carry cargo on deck.

(d) "Waterborne vessel or barge" means any ship, barge, or other watercraft capable of traveling on the navigable waters of this state and capable of transporting any crude oil or petroleum product in quantities of ten thousand gallons or more for purposes other than providing fuel for its motor or engine.

NEW SECTION. Sec. 3. A new section is added to chapter 88.16 RCW to read as follows:

(1)(a) By December 31, 2025, the board of pilotage commissioners, in consultation with the department of ecology, must adopt rules regarding tug escorts to address the peculiarities of Puget Sound for the following:

(i) Oil tankers of between 5,000 and 40,000 deadweight tons; and

(ii) Both articulated tug barges and towed waterborne vessels or barges that are: (A) Designed to transport oil in bulk internal to the hull; and (B) greater than five thousand deadweight tons.

(b) The requirements of this section do not apply to:

(i) A towed general cargo deck barge; or

(ii) A vessel providing bunkering or refueling services.

(c) The rule making pursuant to (a) of this subsection must be for operating in the waters east of the line extending from Discovery Island light south to New Dungeness light and all points in the Puget Sound area. This rule making must address the tug escort requirements applicable to Rosario Strait and connected waterways to the east established in RCW 88.16.190(2)(a)(ii), and may adjust or suspend those requirements based on expertise developed under subsection (5) of this section.

(d) To achieve the rule adoption deadline in (a) of this 2 subsection, the board of pilotage commissioners must adhere to the following interim milestones:

(i) By September 1, 2020, identify and define the zones, specified in subsection (3) (a) of this section, to inform the analysis required under subsection (5) of this section;

(ii) By December 31, 2021, complete a synopsis of changing vessel traffic trends; and

(iii) By September 1, 2023, consult with potentially affected federally recognized Indian treaty fishing tribes, other federally recognized treaty tribes with potentially affected interests, and stakeholders as required under subsection (6) of this section and complete the analysis required under subsection (5) of this section. By September 1, 2023, the department of ecology must submit a summary of the results of the analysis required under subsection (5) of this section to the legislature consistent with RCW 43.01.036.

(2) When developing rules, the board of pilotage commissioners must consider recommendations from potentially affected federally recognized Indian treaty fishing tribes, other federally recognized treaty tribes with potentially affected interests, and:

(a) The results of the most recently completed vessel traffic risk assessments;

(b) The report developed by the department of ecology as required under section 206, chapter 262, Laws of 2018;

(c) The recommendations included in the southern resident orca task force report, November 2018, and any subsequent research or reports on related topics;

(d) Changing vessel traffic trends, including the synopsis required under subsection (1) (d)(ii) of this section; and

(e) For any formally proposed draft rules or adopted rules, identified estimates of expected costs and benefits of the rule to:

(i) State government agencies to administer and enforce the rule; and

(ii) Private persons or businesses, by category of type of person or business affected.

(3) In the rules adopted under this section, the board of pilotage commissioners must:

(a) Base decisions for risk protection on geographic zones in the waters specified in subsection (1) (c) of this section. As the initial foci of the rules, the board of pilotage commissioners must equally prioritize geographic zones encompassing:

(i) Rosario Strait and 2 connected waterways to the east; and

(ii) Haro Strait and Boundary Pass

(b) Specify operational requirements, such as tethering, for tug escorts;

(c) Include functionality requirements for tug escorts, such as aggregate shaft horsepower for tethered tug escorts;

(d) Be designed to achieve best achievable protection, as defined in RCW 88.46.010, as informed by consideration of:

(i) Accident records in British Columbia and Washington waters;

(ii) Existing propulsion and design standards for covered tank vessels; and

(iii) The characteristics of the waterways; and

(e) Publish a document that identifies the sources of information that it relied upon in developing the rules, including any sources of peer-reviewed science and information submitted by tribes.

(4) The rules adopted under this section may not require oil tankers, articulated tug barges, or towed waterborne vessels or barges to be under the escort of a tug when these vessels are in ballast or are unladen.

(5) To inform rule making, the board of pilotage commissioners must conduct an analysis of tug escorts using the model developed by the department of ecology under section 4 of this act. The board of pilotage commissioners may:

(a) Develop scenarios and subsets of oil tankers, articulated tug barges, and towed waterborne vessels or barges that could preclude requirements from being imposed under the rule making for a given zone or vessel

(b) Consider the benefits of vessel safety measures that are newly in effect on or after July 1, 2019, and prior to the adoption of rules under this section; and

(c) Enter into an interagency agreement with the department of ecology to assist with conducting the analysis and developing the rules, subject to each of the requirements of this section.

(6) The board of pilotage commissioners must consult with the United States coast guard, the Puget Sound harbor safety committee, potentially affected federally recognized Indian treaty fishing tribes, other federally recognized treaty tribes with potentially affected interests, ports, local governments, state agencies, and other appropriate entities before adopting tug escort rules applicable to any portion of Puget Sound. Considering relevant information elicited during the consultations required under this subsection, the board of pilotage commissioners must also design the rules with a goal of avoiding or minimizing additional underwater noise from vessels in the Salish Sea, focusing vessel traffic into established shipping lanes, protecting and minimizing vessel traffic impacts to established treaty fishing areas, and respecting and preserving the treaty-protected interests and fishing rights of potentially affected federally recognized Indian tribes.

(7) Rules adopted under this section must be periodically updated consistent with section 5 of this act.

(8) The definitions in this subsection apply throughout this 13 section unless the context clearly requires otherwise.

(a) "Articulated tug barge" means a tank barge and a towing vessel joined by hinged or articulated fixed mechanical equipment 16 affixed or connecting to the stern of the tank barge.

(b) "Oil tanker" means a self-propelled deep draft tank vessel designed to transport oil in bulk. "Oil tanker" does not include an articulated tug barge tank vessel.

(c) "Towed general cargo deck barge" means a waterborne vessel or barge designed to carry cargo on deck.

(d) "Waterborne vessels or barges" means any ship, barge, or other watercraft capable of traveling on the navigable waters of this state and capable of transporting any crude oil or petroleum product in quantities of ten thousand gallons or more for purposes other than providing fuel for its motor or engine.

Appendix B
Interagency Agreement between the State of Washington, Department of Ecology and Washington Board of Pilotage Commissioners

THIS INTERAGENCY AGREEMENT ("Agreement" or "IAA") is made and entered into by and between the state of Washington, Department of Ecology, hereinafter referred to as "ECOLOGY," and the Washington State Board of Pilotage Commissioners, hereinafter referred to as "BPC," pursuant to the authority granted by Chapter 39.34 RCW and RCW 88.16.260.

THE PURPOSE OF THIS AGREEMENT is to establish guidelines, roles, and responsibilities for collaboration between ECOLOGY and BPC in the effective implementation of Sections 2, 3, 4, and 5 of Reducing Threats to Southern Resident Killer Whales by Improving the Safety of Oil Transportation Act, ESHB 1578 (Laws of 2019, ch. 289) (hereinafter referred to as the "Act").

WHEREAS, the Act authorized ECOLOGY and BPC to enter into an Interagency Agreement allowing ECOLOGY to assist BPC with modeling and rulemaking activities authorized by the Act.

WHEREAS, close coordination and consultation between ECOLOGY and BPC is essential to ensure successful and effective implementation of these activities given legislative direction for consultation and interdependence of outcomes.

WHEREAS, the Legislature provided funding to ECOLOGY in the 2019-21 Operating Budget to support activities required by the Act.

THEREFORE, IT IS MUTUALLY AGREED THAT:

1) RESPONSIBILITIES AND COORDINATION OF WORK

ECOLOGY and BPC will work together to:

Develop project plans to accomplish the requirements of the Act Sections 2, 3, and 5, including projects to help inform the requirements of the Act.
Coordinate on communication, consultation and outreach activities.
Provide technical assistance to plan and prepare for activities.

ECOLOGY and BPC Meetings:

ECOLOGY and BPC will meet in-person quarterly and via conference call monthly, or as needed to accomplish these related projects. ECOLOGY and BPC may change the meeting schedule by mutual agreement. Each organization is responsible for keeping their respective leadership (e.g., the full Board of Pilotage Commissioners) apprised about the status of the projects and associated meetings, as appropriate. Meeting topics will include:

- project planning
- status updates
- monitoring and evaluation of outcomes

Decision-making:

a) **Coordination and project details decision**: decided by consensus of the portfolio management team and documented in meeting notes.

a. The portfolio management team: will consist at a minimum of BPC Executive Director, ECOLOGY Spills Program Prevention and Statewide Resources Section Managers, and the ECOLOGY BPC representative.

b) **Policy decisions**: made by ECOLOGY Spills Program Manager and/or a formal Board of Pilotage Commissioners vote. Decision-makers may elevate decisions within their organizations when appropriate.

Project-specific responsibilities:

In this section 'BPC' refers to BPC staff and 'Board' refers to the full Board of Pilotage Commissioners. Additional responsibilities will be assigned through mutually agreed upon project plans.

a) **BPC to Implement Rosario Tug Escort Requirements** (due September 1, 2020)
Act Sec.2.(1)(a)(ii)

• Roles:

- BPC: Outreach to and inform tribes and stakeholders about tug escort requirements; determine monitoring and enforcement procedures; implement tug escort requirements.
- Board: Vote on decisions including interpretive and policy statements.
- ECOLOGY: Provide technical assistance to BPC.

b) **BPC to Identify and define geographic waterway zones** (due September 1, 2020)
Act Sec.3.(1)(d)(i)

• Roles:

- BPC: Lead a process to define geographic regions, or zones, encompassing these waters.
- Board: Make final decision on identifying and defining zones.
- ECOLOGY: Provide technical assistance to BPC.

c) **ECOLOGY to Develop and maintain risk model**
Act Sec.4.(1)

• Roles:

- ECOLOGY: Develop and maintain a vessel traffic risk model in consultation with the parties listed in 88.46.250. Consult with tribes and stakeholders.
- BPC: Provide technical assistance to ECOLOGY as requested.

d) **ECOLOGY to Report to the Legislature on the quantitative assessment of the Emergency Response Towing Vessel** (due September 1, 2023)
Act Sec.4.(2)

• Roles:

- ECOLOGY: Quantitatively assess whether an emergency response towing vessel serving Haro Strait, Boundary Pass, Rosario Strait, and connected navigable waterways will reduce oil spill risk; report findings to the Legislature (due September 1, 2023).
- BPC: Provide technical assistance to ECOLOGY.

e) **BPC to conduct an analysis of tug escorts using the model developed by ECOLOGY** (due September 1, 2023)
Act Sec.3.(1)(d)(iii)

• Roles:

- BPC: Develop scope of tug escort analysis using the model developed by ECOLOGY. Scope should include related outreach activities.
- ECOLOGY: Provide technical assistance to BPC in the development of the scope. Perform tug escort analysis and related outreach activities based on the scope with input from BPC. Write and submit a summary of the tug escort analysis to the legislature by September 1, 2023.
- Board: Vote to approve the analysis scope.

f) **BPC to complete a synopsis of changing vessel traffic trends** (due December 2021)

Act Sec.3.(1)(d)(ii)
• Roles:

- BPC: Develop scope of changing vessel traffic trends synopsis and submit final synopsis to the legislature.
- ECOLOGY: Provide technical assistance to BPC in the development of the scope. Develop report of Synopsis of changing vessel traffic trends.
- Board: Vote to approve scope. Review and approve the Synopsis of changing vessel traffic trends.

g) **BPC to conduct Tug escort rulemaking** (due December 2025)
Act Sec.3.(1)(a)
• Roles:

- Board: Make final decisions regarding tug escort requirements and adopt rules.
- ECOLOGY: Lead rulemaking process and outreach efforts for BPC. Conduct regulatory analyses required by the Administrative Procedure Act, State Environmental Policy Act and the Regulatory Fairness Act.
- BPC: Provide technical assistance to ECOLOGY as needed related to rulemaking process, outreach, and technical expertise.

External Communications:

ECOLOGY and BPC will create a joint Communications plan. External communications (e.g., emails, presentations and letters) will align with the joint Communications plan and will be coordinated between ECOLOGY and BPC. Whenever possible and appropriate, communications products will be joint messages from both ECOLOGY and BPC.

Consultation responsibilities:

The Act directs ECOLOGY and BPC to consult with tribes and stakeholders during model development, risk analysis, and rulemaking. Consultation requirements will be incorporated into the joint Communications plan and project plans.

2) PERIOD OF PERFORMANCE

The period of performance of this IAA shall commence on December 1, 2019, (or the date of final signature, whichever comes later,) and be completed by December 31, 2025, unless terminated sooner as provided herein. Amendments extending the period of performance, if any, shall be mutually agreed upon in writing by ECOLOGY and BPC.

3) ALTERATIONS AND AMENDMENTS

This Agreement may be amended by mutual agreement of the parties. Such amendments shall not be binding unless they are in writing and signed by personnel authorized to bind each of the parties. This agreement may be continually renewed via amendment for time periods that are mutually agreed upon.

4) FUNDING AVAILABILITY

ECOLOGY's and BPC's ability to perform work pursuant to the agreement is contingent on availability of funding. In the event funding from state, federal, or other sources is withdrawn, reduced, or limited in any way after the effective date and prior to completion or expiration date of this Agreement, ECOLOGY or BPC, at their sole discretion, may elect to terminate the Agreement, in whole or part, for convenience or to renegotiate the Agreement subject to new funding limitations and conditions. ECOLOGY or BPC may also elect to suspend performance of the Agreement until ECOLOGY or BPC determines the funding insufficiency is resolved. ECOLOGY or BPC may exercise any of these options with no notification restrictions, although ECOLOGY or BPC will make a reasonable attempt to provide notice.

5) ORDER OF PRECEDENCE

In the event of an inconsistency in the terms of this Agreement, or between its terms and any applicable statute or rule, the inconsistency shall be resolved by giving precedence in the following order:

a. Applicable federal and state of Washington statutes, regulations, and rules.
b. Mutually agreed upon written amendments to this Agreement.
c. This Agreement, number C2000090.
d. Any other provisions or term of this Agreement, including materials incorporated by reference or otherwise incorporated.

6) RECORDS MAINTENANCE

The parties to this Agreement shall each maintain books, records, and other documents, related to the activities covered by this agreement consistent with the records retentions requirements and procedures of their agency. Each party will utilize reasonable security procedures and protections for all materials related to this Agreement. All materials are subject to state public disclosure laws.

7) **RESPONSIBILITIES OF THE PARTIES**

Each party of this Agreement hereby assumes responsibility for claims and/or damages to persons and/or property resulting from any act or omissions on the part of itself, its employees, its officers, and its agents. Neither party will be considered the agent of the other party to this Agreement.

8) RIGHTS IN DATA

Unless otherwise provided, data which originates from this Agreement shall be owned by state of Washington, ECOLOGY. Data shall include, but not be limited to, reports, documents, pamphlets, advertisements, books magazines, surveys, studies, computer programs, films, tapes, and/or sound reproductions. Ownership includes the right to copyright, patent, register, and the ability to transfer these rights.

9) SEVERABILITY

If any provision of this Agreement or any provision of any document incorporated by reference shall be held invalid, such invalidity shall not affect the other provisions of this Agreement which can be given effect without the invalid provision, if such remainder conforms to the requirements of applicable law and the fundamental purpose of this Agreement, and to this end the provisions of this Agreement are declared to be severable.

10) TERMINATION FOR CAUSE

If for any cause, either party does not fulfill in a timely and proper manner its obligations under this Agreement, or if either party violates any of these terms and conditions, the aggrieved party will give the other party written notice of such failure or violation. The responsible party will be given the opportunity to correct the violation or failure within fifteen (15) business days. If failure or violation is not corrected, this Agreement may be terminated immediately by written notice of the aggrieved party to the other.

11) WAIVER

A failure by either party to exercise its rights under this Agreement shall not preclude that party from subsequent exercise of such rights and shall not constitute a waiver of any other rights under this Agreement unless stated to be such in a written amendment to this Agreement signed by an authorized representative of the parties.

12) AGREEMENT MANAGEMENT

The representative for each of the parties shall be responsible for and shall be the contact person for all communications, notifications, and billings questions regarding the performance of this Agreement. The parties agree that if there is a change in representatives that they will promptly notify the other party in writing of such change, such changes do not need an amendment.

13) ALL WRITINGS CONTAINED HEREIN

This Agreement contains all the terms and conditions agreed upon by the parties. No other understandings, oral or otherwise, regarding the subject matter of this Agreement shall be deemed to exist or to bind any of the parties hereto.

The signatories to this Agreement represent that they have the authority to bind their respective organizations to this Agreement.

IN WITNESS WHEREOF, the parties below, having read this Agreement in its entirety, including all attachments, do agree in each and every particular as indicated by their signatures below.

The ECOLOGY Representative is:	BPC Representative is:
Name: Brian Kirk, Prevention Section Manager Address: 3190 160th Ave SE, Bellevue WA 98008-5452 Phone: 425-649-7292 Email: brian.kirk@ecy.wa.gov Fax: 425-649-7098	Name: Jaimie C. Bever, Executive Director Address: 2901 3rd Avenue, Suite 500 Seattle, WA 98121 Phone: (206) 515-3887 Email: BeverJ@wsdot.wa.gov Fax: (206) 515-3906

Appendix C
Oil Transportation Safety Committee Charter

STATE OF WASHINGTON

BOARD OF PILOTAGE COMMISSIONERS

2901 Third Avenue, Suite 500 | Seattle, Washington 98121 | (206) 515-3904 | www.pilotage.wa.gov

OIL TRANSPORTATION SAFETY COMMITTEE CHARTER

I. Statement of Purpose The purpose of the Board of Pilotage Commissioners' (Board or BPC) Oil

Transportation Safety Committee (Committee or OTSC) is to conduct analysis and provide recommendations for the Board concerning the responsibilities outlined in the 2019 legislation The Reducing Threats to Southern Resident Killer Whales by Improving the Transportation of Oil Act (The Act).

II. Membership

The OTSC shall consist of:

- one (1) Chair, who is affiliated with the Board of Pilotage Commissioners;
- three (3) members of the Board of Pilotage Commissioners including:
  - the Department of Ecology the representative; and
  - the marine environment representative
- one (1) Puget Sound Pilot representative;
- one (1) oil industry representative;
- one (1) tug industry representative;
- one (1) environmental community representative; and
- at least one (1) tribal representative

Committee members may identify one (1) specific alternate, representing the same or similar organization. If a committee member is unavailable to attend a scheduled meeting, the alternate shall attend in their place.

The OTSC Chair, members and alternates shall be appointed by the Board for an initial term of one (1) year and may be re-appointed by the Board annually. The Committee will ensure that committee members and considerations represent the diverse maritime interests in the Salish Sea. The Committee may consult with additional subject matter experts as needed.

III. The Role of Chair

The Chair of the OTSC will preside at meetings and work with BPC and Department of Ecology staff to prepare committee materials. The Chair will provide monthly updates of OTSC activities, coordinate and communicate with committee members and outside interests, and deliver recommendations to the Board.

IV. Authority

The OTSC is an advisory committee to the Board. It will not make policy decisions. Committee recommendations will be agreed upon by consensus.

V. Guidelines & Responsibilities:

Committee members will commit to the following:

- For Rosario Strait and connected waterways east tug escort requirement implementation and geographic zone identification, meet/ at a minimum, monthly for two (2) hours between February 2020 and May 2020. Time and frequency of meetings for other responsibilities outlined in The Act will be determined on a case-by-case basis and updated in the Charter as needed.
- Meetings start and end on time
- All meeting attendees come prepared to meetings.
- Be productive at each meeting
- One person talks at a time. Express your point of view and then let others speak (i.e. don't talk over other people and no side discussions at the table).
- Disagreements are understandable, but be solution focused.
- Be open to new ideas and ways of doing things.
- Everyone's contributions are valued. Be respectful and support each other's role.
- Provide, via consensus, recommendations to the Board for the responsibilities outlined in The Act.

VI. Activities & Duties

The OTSC will analyze and make recommendations to the Board on the following directives and deadlines from The Act:

1. September 1, 2020 — Rosario Strait and connected waterways east tug escort implementation (Section 2(2)(a)(ii))
2. September 1, 2020 — Development of geographic zones (Section 3(1)(d)(i)
3. December 31, 2021— Preparation of synopsis of changing vessel traffic trends (Section 3(1)(d)(ii))
4. September 1, 2023 — Analysis of tug escorts using the model developed by the Department of Ecology (Section 3(1)(d)(iii))
5. December 31, 2025 — Tug Escort Rulemaking (Section 3 (l)(a))
6. October 1, 2028 — Consider updating tug escort rules (Section 5(1))

In order to meet the first two legislative deadlines, the Committee should present recommendations to the Board at the May 21, 2020 meeting of the BPC, to allow the Board to adopt interpretive statements and identify geographic zones at their June 18, 2020 meeting.

Committee work will be project-based in concert with the directives outlined in The Act. As a result, membership may change at the Board's discretion as the Committee works through the multiyear initiatives laid out in The Act.

VII. Meetings/Time Commitment

The work of the OTSC is associated with The Act, which directs the Board of Pilotage Commissioners to adopt tug escort rules for Puget Sound by December 31, 2025. Meetings will occur bi-weekly, monthly, bi-monthly, or quarterly, as needed, and will last up to two (2) hours. Locations may vary.

Meeting summaries will be reviewed and accepted by the Committee, and will be available on the BPC website. The first meeting of the Committee will be scheduled for early February 2020.

The OTSC will review its charter at least annually and recommend any proposed changes to the Board for review.

This charter was adopted by the Board of Pilotage Commissioners on December 16, 2019.

Sheri J. Tonn, Chair

Edmund I. Kiley, Vice Chair

Commissioner Timothy J. Farrell

Absent

Commissioner Philip Morrell

Commissioner Rik Krombeen

Commissioner John Scragg

Commissioner Michael Anthony

Commissioner Eleanor Kirtley

Commissioner Sara Thompson

Appendix D
Synopsis of Changing Vessel Traffic Trends Scope of Work

Background: ESHB 1578 requires vessel trends synopsis

ESHB 1578 requires tug escorts for laden tankers between 5,000 – 40,000 DWT, and laden ATBs and oil barges greater than 5,000 DWT operating in Rosario Strait and connected waterways to the east, starting September 1, 2020.

ESHB 1578 Section 3(ii) requires that "By December 31, 2021, [Board of Pilotage Commissioners] complete a synopsis of changing vessel trends." The intent of the synopsis is to look at how vessel traffic patterns change following the implementation of the Rosario tug escort requirement.

BPC and Ecology roles and responsibilities

BPC and Ecology signed an interagency agreement (IAA) for work related to ESHB 1578. For the vessel trends synopsis, the IAA includes the following responsibilities:

- BPC Staff will develop the scope.
- Ecology will provide technical assistance to BPC by producing a draft of the scope.
- BPC Board will vote to approve the scope.
- Ecology will draft the synopsis.
- BPC Board will review and approve the synopsis.
- BPC Staff will submit the final synopsis to the legislature.

Purpose

The intent of the synopsis is to review vessel transits pre- and post-bill implementation to identify changes after Section 2 of the bill is implemented. The synopsis will report on vessel trends for Washington waters east of a line extending from Discovery Island light south to New Dungeness light. It will also include vessel trends for the transboundary waters of Haro Strait, Boundary Pass, and the southern Strait of Georgia.

Research questions

- What changing vessel traffic trends do we see for vessels that newly fall under an escort requirement?
- What changing vessel traffic trends do we see for deep draft and tug traffic that have no additional escort requirements?
- What changing vessel traffic trends do we see for tug escorts?
- How does the overall number of transits (by vessel type) change pre- and post-bill implementation?

Methods

Use Geographic Information System analysis of Automatic Identification System (AIS) data to determine the routes and number of transits of vessels.

Combine Advance Notice of Transfer (ANT) reports, AIS data, and known tug-barge pairings to estimate the routes and number of transits of laden tank vessels (towed oil barges, Articulated Tug Barges, and tank ships).
Compare number of vessels acting as escort tugs pre-and post-bill implementation.

Data sources

Advance Notice of Transfer (ANT)
- Under WAC 173-184-100, delivering vessels involved in an oil transfer of more than one hundred gallons must provide prior notice of the oil transfer to ecology.

Automatic Identification System (AIS) Data
- AIS transceivers on vessels transmit basic information like location, course, destination, and other vessel characteristics. The data can be requested from the USCG.

Vessel characteristics and deadweight tonnage
- Deadweight tonnage is specified in the WAC to be "the maximum summer deadweight tonnage that was assigned to the vessel at the time of construction as reported in Lloyd's Register of Ships." WAC 363-116-500
- For some vessels and barges deadweight tonnage can be identified using commercially available databases. Deadweight tonnage may be available from vessel operating companies. Where deadweight tonnage data is not available, Ecology will attempt to determine whether vessels require escorts based on information such as gross tonnage, ANT data, and observations of vessel transits (i.e., did the vessel travel with an escort?).

Marine Exchange Crossing Line Data
- The Marine Exchange compiles data on vessel counts for specific crossing lines, organized by vessel type, for the passage of vessels past a series of geographic "gates." Ecology will consider whether this data could inform the synopsis.

Data Challenges

ANTs use barge names and AIS uses vessel names.
Towed oil barges are not always towed by the same vessel.
Linking vessel routes to ANTs could be prohibitively time consuming if not automated.
Marine Exchange crossing line data does not provide route information, or information on laden or unladen status.

Data Timeline

The synopsis will compare a year of pre-bill implementation data (September 1, 2019 – August 31, 2020) to a year of post-bill implementation data (September 1, 2020 – August 31, 2021).

Deliverables

The synopsis will comprise a report describing:

- Route selection and number of vessel transits for pre-and post-bill implementation for the following vessel types. Ecology will explore ways to compare transits on a common scale.

    - vessels that newly fall under an escort requirement
    - deep draft and tug traffic that have no additional escort requirement o vessels that are providing bunkering or refueling services
- Routes compared will include, but will not be limited to transits of Rosario Strait and Haro Strait/Boundary Pass.
- Review of tugs engaged in escorting tank vessels in Rosario and connected waterways east, including but not limited to number of transits, names of vessels, and operating companies.
- Number of oil transfers per refinery and per anchorage pre- and post-bill implementation.
- A review of the last 5 years of existing vessel transit data, to provide context as to the overall trend in vessel movements, based on vessel types. Determining the laden/unladen status of tank vessels, deadweight tonnage of vessels, and details on vessel occupation (i.e., bunkering) would require a manual evaluation of each transit, and is outside the scope of this review.

Opportunities for Review and Comment

Ecology will be available to provide updates to the BPC as requested. Potential updates include:

Progress report after 6 months of post implementation data collection
Presentation after post implementation data collection is complete

Ecology will address one set of comments from the BPC after submitting the draft report. Comments will be incorporated to the extent possible and will be included in the final report to the Board. No new data collection or analysis will result from review comments.

Amendments

The BPC board must approve by vote any additions or other changes to this scope of work. Any changes approved by the BPC will be attached to this scope of work.

Timeline

September 1, 2019	Start of pre-implementation data collection timeframe
August 31, 2020	End of pre-implementation data collection timeframe
September 1, 2020	Implementation of new tug escort requirements
September 1, 2020	Start of post-implementation data collection timeframe
August 31, 2021	Data collection complete
October 14, 2021	Submitted for internal Spills Program review
November 4, 2021	Ecology delivers initial draft synopsis to BPC
November 11, 2021	BPC Board Meeting
December 2, 2021	Ecology delivers final draft to BPC
December 9, 2021	BPC Board Meeting
December 31, 2021	BPC publishes the Synopsis and submits to the legislature

Appendix E
Board of Pilotage Commissioners Interpretive Statement Regarding ESHB 1578

Adopted in regular session on September 17, 2020 by the State of Washington Board of Pilotage Commissioners.

STATE OF WASHINGTON BOARD OF PILOTAGE COMMISSIONERS INTERPRETIVE STATEMENT (Revised 17 September 2020) REGARDING: ESHB 1578 Terms

It is the policy of the Board to use the following definitions when interpreting terms as they relate to ESHB 1578 Reducing threats to southern resident killer whales by improving the safety of oil transportation and RCW 88.16.190[1]. For the sake of consistency, justification, and efficiency; the Board sought and relied on published references to inform, adapt, or adopt definitions for this specific interpretation of RCW 88.16.190, Section 2, Rosario Strait and Connected Waterways East Tug Escort Implementation.

1. **Under the Escort of a Tug or Tugs**

It is the interpretation of the Board that, as per 33 CFR 168.05[2] "escort vessel means any tug that is assigned and dedicated to a tank vessel during the escort transit". It is further the interpretation of the Board that, as per the Puget Sound Harbor Safety Plan Tanker Escort Section B[3], "all escorts must be in close proximity for timely and effective response taking into consideration" the proximity to hazards, "ambient sea and weather conditions, escort configuration, maneuvering characteristics of the vessels, emergency connection procedures, surrounding vessel traffic and other factors that may affect response capability".

2. **Rosario Strait**

It is the interpretation of the Board that "Rosario Strait" is defined as the waters connecting the Strait of Juan de Fuca and the Strait of Georgia bounded on the West by Lopez Island, Decatur Island, Blakeley Island and Orcas Island, and on the East by Fidalgo Island, Cypress Island, Sinclair Island and Lummi Island. The northern entrance to Rosario Strait, as defined by the USGS[4] , is bounded by a line from Pt. Thompson on Orcas Island to Puffin Island light and then to Point Migley on Lummi Island. The southern entrance to Rosario Strait is bounded by a line from Davidson Rock light, southeast to position Lat. 48° 24.0'N, Long. 122° 47.15'W then East to the shore of Whidbey Island at Lat. 48° 24.0'N, Long. 122° 39.9'W (near W. Point).

Note: this definition is different from the VTS Special Area as defined in 33 CFR 161.55. 5

[1] Pilotage Act, 88.16, R.C.W § 190 (2019)
[2] 33 C.F.R. § 168.05 (2013)
[3] Puget Sound Harbor Safety Plan, PUGET SOUND HARBOR SAFETY COMMITTEE, (April 28, 2020, 1:35PM) https://pshsc.org/puget-sound-harbor-safety-plan
[4] Feature Detail Report for: Rosario Strait, U.S. GEOLOGICAL SURVEY (April 28, 2020, 1:50pm) https://geonames.usgs.gov/apex/f?p=gnispq:3:0::NO::P3_FID:1507915

3. **Connected Waterways East**

It is the interpretation of the Board that "connected waterways east" is defined as all connected channels, waterways, bays and anchorages East of Rosario Strait and north of 48° 30.0' N Latitude. These waters include but are not limited to Guemes Channel, Bellingham Channel, the channels around Sinclair, Vendovi and Saddlebag islands as well as Bellingham Bay, Samish Bay, Padilla Bay and Fidalgo Bay.

Note: this definition is different from the VTS Special Area as defined in 33 CFR 161.5[5].

4. **Oil**

It is the interpretation of the Board that, as per RCW 90.56.010 (19)[6] , the definition of "oil" or "oils" means oil of any kind that is liquid at twenty-five degrees Celsius and one atmosphere of pressure and any fractionation thereof, including, but not limited to, crude oil, bitumen, synthetic crude oil, natural gas well condensate, petroleum, gasoline, fuel oil, diesel oil, biological oils (see note 2 below) and blends, oil sludge, oil refuse, and oil mixed with wastes other than dredged spoil. Oil does not include any substance listed in Table 302.4 of 40 CFR 302 adopted August 14, 1989, under section 102(a) of the federal comprehensive environmental response, compensation, and liability act of 1980, as amended by P.L. 99-499."

Notes: (1) The Board considers diluted bitumen to be a part of this definition; (2) The Board considers biological oils to include: "fats, oils, or greases of animal, fish, or marine mammal origin; vegetable oils, including oils from seeds, nuts, fruits, or kernels" in alignment with Federal Regulations.[7]

5. **Laden/Unladen (In Ballast)**

It is the interpretation of the Board that, as per the Board's existing Statement of Policy[8], "any tank vessels 40,000 deadweights tons or more whose clingage, residue, or other applicable cargo onboard is greater than 0.5percent of the vessel's maximum cargo carrying capacity or 3,000 barrels, whichever figure is less, shall be considered laden and therefore not in ballast. The term "Tank Vessel" in this interpretation refers to oil tankers, articulated tug and barge units and towed barges designed to carry oil in bulk".

It is further the interpretation of the Board that any tank vessels below 40,000 deadweight tons whose clingage, residue, or other applicable cargo onboard is greater than 2percent of the vessel's maximum cargo carrying capacity or 3,000 barrels, whichever figure is less, shall be considered laden and therefore not in ballast.

Note: This interpretation was developed to acknowledge most tank vessels are capable of pumping their tanker down to 0.5percent of their capacity. However, some 5,000 – 40,000

[5] 33 C.F.R. § 161.55 (2019)
[6] Oil and Hazardous Substance Spill Prevention and Response, 90.56, R.C.W. § 010 (2015)
[7] 40 C.F.R § 112.2 (2020)
[8] Statement of Policy Regarding Interpretation of the Term "In Ballast" used in RCW 88.16.190 and WAC 363-116-500. BOARD OF PILOTAGE COMMISSIONERS, (May 1, 2020) https://pilotage.wa.gov/policystatements.html

deadweight ton bunker barges to not have the pumping capacity to reach the 0.5percent threshold in order to be considered unladen.

In addition, that "for the purpose of interpreting the above referenced RCW and WAC section, "in ballast" is defined when an LPG carrier is deemed to be in a ballast condition if the vessel has retained on board only the minimum cargo necessary plus a safety factor to arrive at its next load port in a cold condition. This quantity is not to exceed 1.5percent of the cargo carrying capacity". [9]

6. **Vessels Providing Bunkering or Refueling Services**

It is the interpretation of the Board that bunkering means an oil transfer operation to replenish a self-propelled vessel with fuel or bunkers used for ship services or propulsion of the vessel.[10] It is further the interpretation of the Board that "vessels providing bunkering or refueling services" means tank vessels that are conducting bunkering, which includes the transit of the tank vessel to the bunker location, the oil transfer operation, and the return transit of the tank vessel.

[9] Statement of Policy Regarding Interpretation of the Term "In Ballast" used in RCW 88.16.190 and WAC 363-116-500. BOARD OF PILOTAGE COMMISSIONERS, (May 1, 2020) https://pilotage.wa.gov/policystatements.html
[10] Bunkering Operations , 317-40, W.A.C. § 030 (1994)

Appendix F
Synopsis Terminology

Appendix F contains terminology which is specific to the synopsis. Some terms are defined by the BPC's Interpretive Statement Regarding the Act (Appendix E). Ecology developed some terms to define synopsis locations, dates, and methods. In some cases synopsis terminology differs from standard maritime definitions.

Escort Vessel

Any tug that is assigned and dedicated to a tank vessel during the escort transit.

> It is further the interpretation of the Board that, as per the Puget Sound Harbor Safety Plan Tanker Escort Section B[1], "all escorts must be in close proximity for timely and effective response taking into consideration" the proximity to hazards, "ambient sea and weather conditions, escort configuration, maneuvering characteristics of the vessels, emergency connection procedures, surrounding vessel traffic and other factors that may affect response capability" (Board of Pilotage Commissioners, 2020a).

Full Capacity Load

A measure of volume, 95 percent of the maximum cargo carrying capacity of the barge, ATB, or tanker.

Multi-Purpose Tug

A tug designed for a singular purpose but used for several different ones, e.g., a coastal tug used as a ship assist or escort tug. (BC Shipping News & Allen, R., 2012)

Study area

Figure F-1 shows the boundaries of the study area, which includes Washington waters east of a line extending from Discovery Island lighthouse south to New Dungeness lighthouse and the transboundary waters of Haro Strait, Boundary Pass, and the southern Strait of Georgia (Board of Pilotage Commissioners, 2020b).

[1] Puget Sound Harbor Safety Plan, PUGET SOUND HARBOR SAFETY COMMITTEE, (April 28, 2020, 1:35PM) https://pshsc.org/puget-sound-harbor-safety-plan

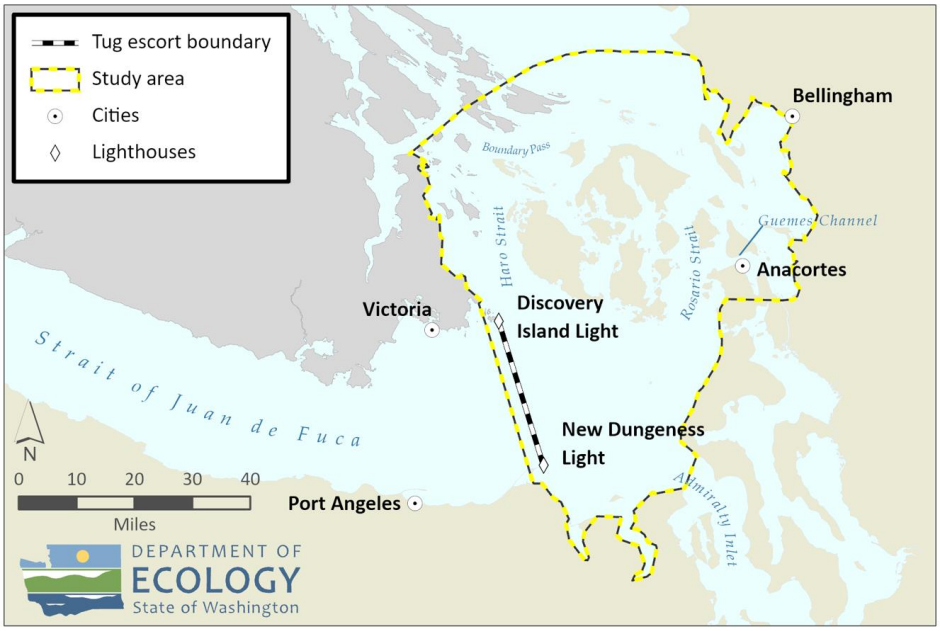


Figure F - 1 Map of study area

Synopsis Period

The synopsis period covers two years.

Year 1 - year prior to tug escort implementation, September 1, 2019 thru August 31, 2020
Year 2 - year after tug escort implementation September 1, 2020 thru August 31, 2021

Transit

A significant movement by a vessel between two locations in Washington waters.

Transit Types

'Likely Laden', Likely Unladen', 'Unknown', & 'Engaged in Bunkering'

'Likely laden' transit: A transit by a vessel of interest carrying oil as cargo.

It is the interpretation of the Board that, as per the Board's existing Statement of Policy[2], "any tank vessels 40,000 deadweights tons or more whose clingage, residue, or other applicable cargo onboard is greater than 0.5percent of the vessel's maximum cargo carrying capacity or 3,000 barrels, whichever figure is less, shall be considered laden and therefore not in ballast (Board of Pilotage Commissioners, 2020).

It is further the interpretation of the Board that any tank vessels below 40,000 deadweight tons whose clingage, residue, or other applicable cargo onboard is greater than 2percent of the vessel's maximum cargo carrying capacity or 3,000

[2] Statement of Policy Regarding Interpretation of the Term "In Ballast" used in RCW 88.16.190 and WAC 363-116-500. BOARD OF PILOTAGE COMMISSIONERS, (May 1, 2020) https://pilotage.wa.gov/policystatements.html

barrels, whichever figure is less, shall be considered laden and therefore not in ballast (Board of Pilotage Commissioners, 2020).

Note: Criteria for categorizing a transit as 'likely laden' in this analysis were (Figure F-2):

- Vessel received less than a full load from the facility - transit leaving the facility is categorized as likely laden (as stated below, transit arriving would be unknown)
- Vessel received a full capacity load - transit leaving the facility is categorized as likely laden, transit arriving categorized as likely unladen
- Vessel discharged less than a full load to the facility - transit arriving at the facility is categorized as likely laden (as stated below, transit departing would be unknown)

'Likely unladen' transit: A transit by a vessel of interest without oil as cargo. See the BPC above interpretation of laden.

Note: Criteria for categorizing a transit as 'likely unladen' in this analysis were (Figure F-2):

- Vessel discharged a full capacity load to the facility- transit leaving the facility is categorized as likely unladen
- Vessel received a full capacity load from the facility - transit arriving at the facility is categorized as likely unladen

Unknown transit: A transit where there was not enough information available to determine whether it was 'likely laden' or 'likely unladen'.

Note: Criteria for categorizing a transit as 'unknown' in this analysis were (Figure F-2):

- Vessel received less than a full load from the facility – transit arriving at the facility is unknown (as stated above, transit departing facility would be likely laden)
- Vessel discharged less than a full load to the facility - transit leaving the facility is unknown (as stated above, transit arriving at the facility would be likely laden)

Engaged in bunkering transit: A transit by a vessel of interest for the purpose of bunkering or refueling another vessel. See Vessels Engaged in Bunkering for BPC interpretation of engaged in bunkering.

Note: Criteria for categorizing a transit as 'engaged in bunkering' in this analysis were (Figure F-2):

- Vessel is enroute to the bunker location
- Vessel is returning from the bunker location

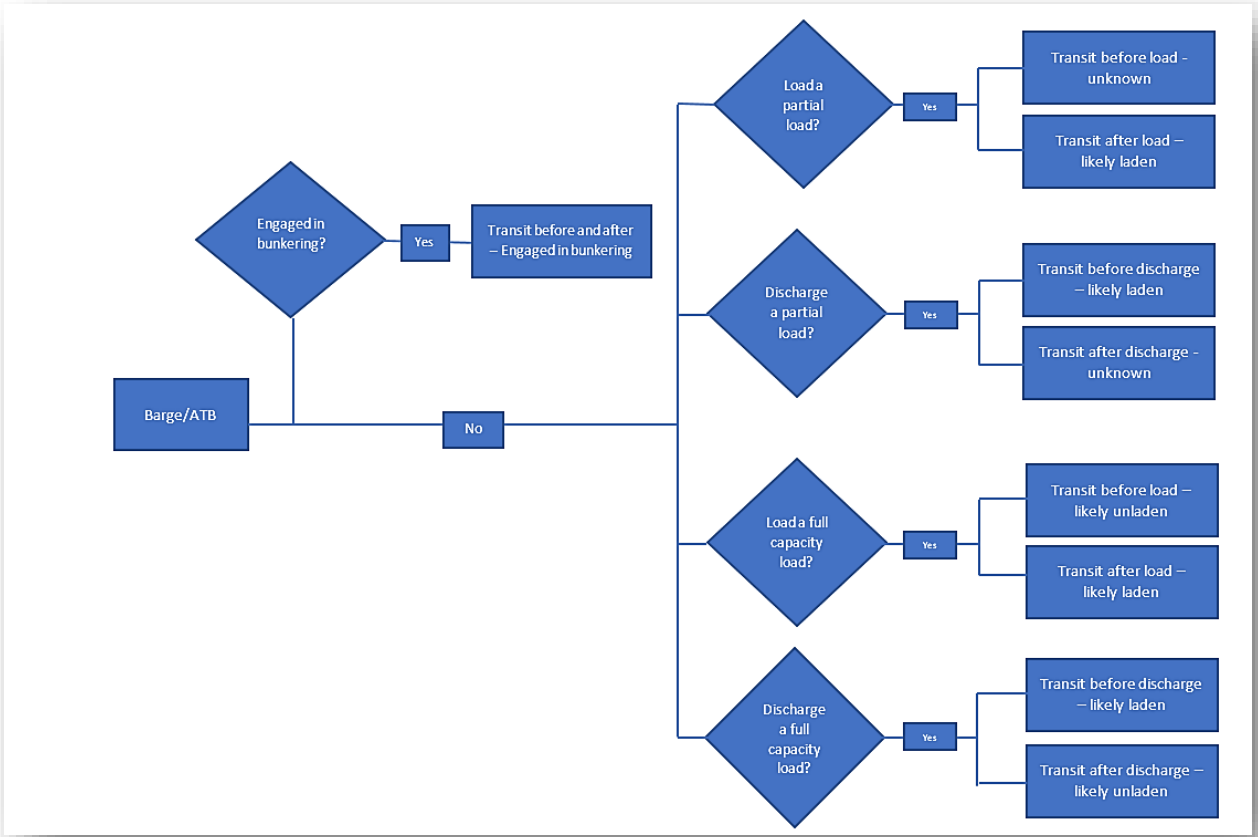


Figure F - 2 Logic diagram for determining transit type

Trip

A movement by an escort tug from start of job to return to standby station. One trip by an escort tug can cross multiple crossing lines.

Vessels engaged in bunkering

A tank vessels engaged in bunkering includes the transit of the tank vessel to the bunker location, the oil transfer operation, and the return transit of the tank vessel.

> It is the interpretation of the Board that bunkering means an oil transfer operation to replenish a self-propelled vessel with fuel or bunkers used for ship services or propulsion of the vessel.[3] (Board of Pilotage Commissioners, 2020a)

Vessels of Interest

The vessel types that were evaluated in the synopsis. They include the vessels that newly fall under escort requirements and vessels with no additional escort requirements.

[3] Bunkering Operations , 317-40, W.A.C. § 030 (1994)

- **Vessels that newly fall under escort requirement**: Laden oil tankers between 5,000 and 40,000 DWT, Articulated Tug and Barge (ATB) units and oil barges over 5,000 DWT.

- **Vessels with no additional escort requirement:**
    - **ATB:** Oil carrying ATBs less than 5,000 DWT
    - **Barges:** Oil carrying barges less than 5,000 DWT
    - **Barges**: Oil carrying barges greater than 5,000 DWT engaged in bunkering
    - **Deep draft vessels**: Tankers greater than 40,000 DWT

Appendix G Maritime Definitions

Appendix G contains definitions and maritime terminology used in the synopsis

Automatic Identification System (AIS)

The Automatic Identification System (AIS) is broadcast system which transmits vessel data for maritime navigational safety and communications. All of the vessels of interest in this synopsis are required to have a properly functioning AIS (33 C.F.R. §164.46) with the exception of towed oil barges. Ecology tracked the movement of oil barges by combining AIS data from tugs, and oil transfer data from ANT as described in Synopsis Step 3: Record of vessel transits and determination of transit type.

Articulated Tug Barge

A tank barge and a towing vessel joined by hinged or articulated fixed mechanical equipment affixed or connecting to the stern of the tank barge. (RCW 88.16.190)

Ballast

Material, usually seawater, placed in a vessel not carrying cargo to obtain or maintain proper stability, trim or draft. A ship so laden with ballast is determined to be 'in ballast' and the voyage is described as 'in ballast'. The term can also be used as a verb, as "The vessel will be 'ballasting' at the next port". (Maritime Industry Foundation, n.d.)

Board of Pilotage Commissioners (the), Washington State –

The Board of Pilotage Commissioners was created by the 1935 Legislature and includes members who are appointed by the Governor, confirmed by the Senate and serve staggered four-year terms. The members include a designee of the Director of Washington State Ferries, who is the chairperson, (2) public members, (1) American shipping representative, (1) foreign shipping representative, (2) licensed Pilots, (1) environmental member, and (1) Department of Ecology member (Board of Pilotage Commissioners, n.d.).

The mission of the Board is to ensure against the loss of lives, loss of or damage to property and vessels, and to protect the marine environment by maintaining efficient and competent pilotage service on our State's inland waters (Board of Pilotage Commissioners, n.d.).

The Board develops and proposes statutory language for legislative adoption to ensure safe and compulsory pilotage, adopts rules to administer State pilotage laws, and enforces pilot and public adherence to the Pilotage Act, which may include discipline and/or prosecution of violators. The Board also administers testing, training and licensing of marine pilots, and establishes standards for reporting and investigating incidents involving state-piloted vessels (Board of Pilotage Commissioners, n.d.)

Bunkering or fueling

An oil transfer operation to replenish a self-propelled vessel with fuel or bunkers used for ship services or propulsion of the vessel. (Ecology, n.d. -f)

Chemical Tanker

A tanker constructed to carry a cargo of noxious liquid substances in bulk. There are two kinds of chemical tankers: one is an exclusive chemical tanker for carriage of an exclusive cargo, and the other one is a parcel chemical tanker capable of carrying many kinds of chemical cargoes. Chemical tankers usually range from 5,000 to 59,000 DWT (Wartsila, n.d.).

Coastal Tug

A tug designed for towing barges between coastal ports. Coastal tugs are generally single or twin screw, have less fendering, and can handle more weather than a harbor tug. (BC Shipping News & Allen, R., 2012)

Department of Ecology, Washington State (Ecology)

Ecology is Washington state's environmental regulatory agency created to carry out and coordinate the state's pollution control and water management programs.

Note: Enhanced Substitute House Bill 1578 gave the BPC authority to partner with the Department of Ecology on Rosario Strait tug escort requirements.

Deadweight Tons

Is a measure of how much weight a ship can carry and is the sum of the weights of cargo, fuel, fresh water, ballast water, provisions, passengers, and crew. (Department of Transportation, 2008)

Note: Also known as deadweight; abbreviated to DWT, D.W.T., d.w.t., or dwt

Escort Tug

A tug purpose-built for ship assist and escort service. These tugs generally have Z-drive[1] or Voith[2] propulsion and unique hull forms designed to maximize indirect steering and braking forces. (BC Shipping News & Allen, R., 2012)

Lightering

Lightering or Lightering operation means the transfer of a cargo of oil in bulk from one oil tanker less than 150 gross tons to another oil tanker less than 150 gross tons, or a cargo of hazardous material in bulk from one vessel to another, including all phases of the operation

1 Z-drive is short for an azimuth thruster marine drive, propellers placed in pods that can be rotated to any horizontal angle (azimuth), making a rudder unnecessary. The pod can rotate 360 degrees allowing for rapid changes in thrust direction and thus vessel direction.

2 VSP generates thrust by profiled blades that project from the bottom of the ship mounted in a rotor casing.

from the beginning of the mooring operation to the departure of the service vessel from the vessel to be lightered, except when that cargo is intended only for use as fuel or lubricant aboard the receiving vessel (33CFR156.205(b)).

MMSI Number

Maritime Mobile Service Identities (MMSIs) are nine digit numbers used by maritime digital selective calling (DSC), automatic identification systems (AIS), and certain other equipment to uniquely identify a ship or a coast radio station. (Coast Guard, 2021a)

Multi-Purpose Tug

A tug designed for a singular purpose but used for several different ones, e.g., a coastal tug used as a ship assist or escort tug. (BC Shipping News & Allen, R., 2012)

Oil Tanker

A self-propelled deep draft tank vessel designed to transport oil in bulk. "Oil tanker" does not include an articulated tug barge (ATB) tank vessel. (RCW 88.16.260)

The global crude oil and refined product tanker fleet uses a classification system to standardize contract terms, costs, port/canal and strait access. This system is known as the Average Freight Rate Assessment (AFRA) system, and was established by Royal Dutch Shell six decades ago.

AFRA uses a scale that classifies tanker vessels according to deadweight tons, a measure of a ship's capacity to carry cargo. The approximate capacity of a ship in barrels is determined by using an estimated 90 percent of a ship's deadweight tonnage, and multiplying that by a barrel to metric ton conversion factor specific to each type of petroleum product and crude oil, as liquid fuel densities vary by type and grade (U.S. Energy Information Administration, 2014).

Figure G -1 Shows the Average Freight Rate Assessment (AFRA) tanker scale.

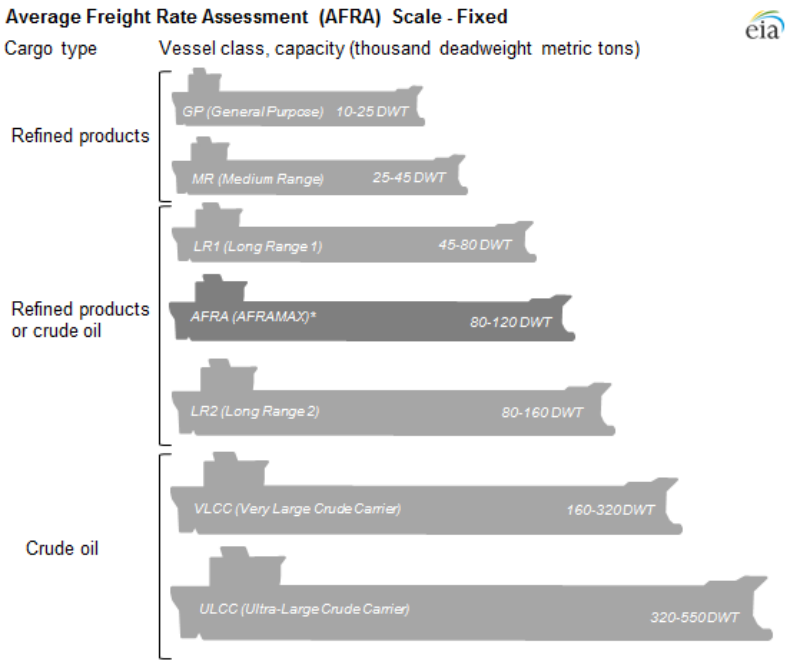


Figure G - 1 Tanker size scale based on Average Freight Rate Assessment (U.S. Energy Information Administration, 2014).

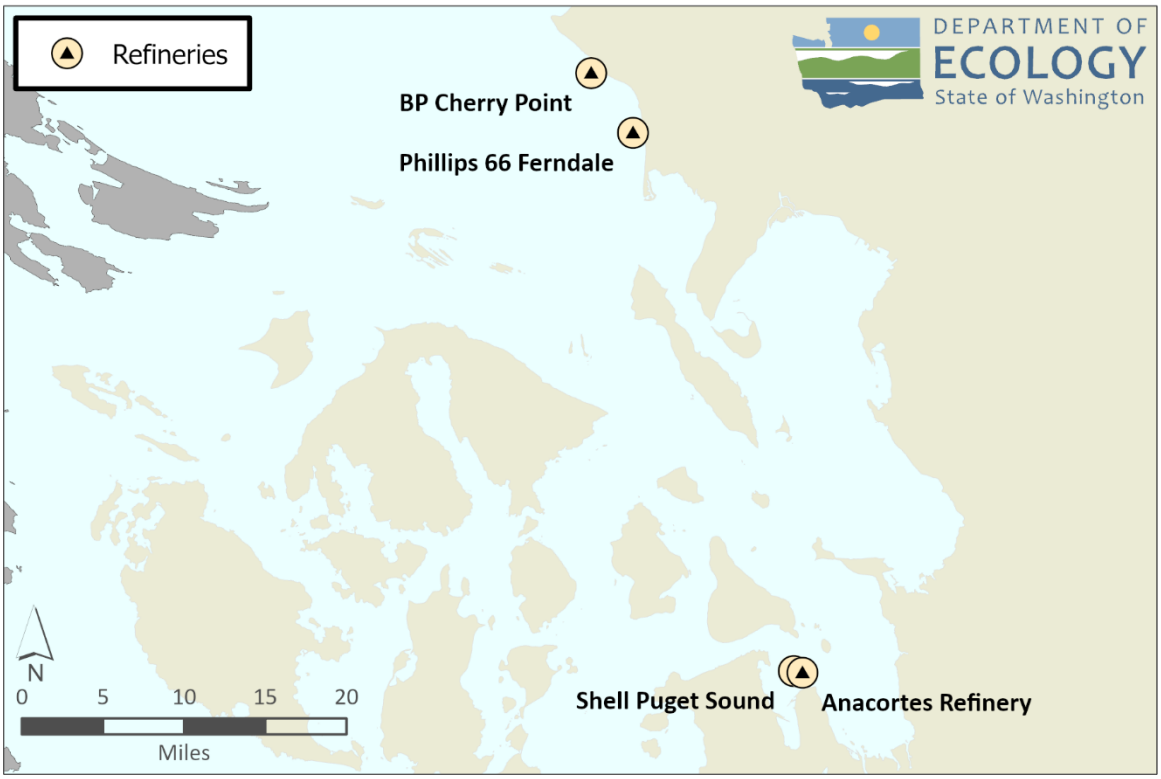
Ship Assist or Harbor Tug

A tug designed for assisting large ships onto and off of a berth by pushing and pulling as required. These tugs are very maneuverable and generally have Z-drive or Voith propulsion. (BC Shipping & Allen, R., 2012)

Appendix H Refineries in Study Area

Washington's refineries provide energy that fuels the regional economy (Smith, 2015). The facilities' location allows them to source crude from the Bakken shale in North Dakota, Alberta's oil sands, and Alaska's North Slope, as well as foreign crude, and to supply to markets along the West Coast and Asia (Smith, 2015).

There are 5 major oil refineries in Washington, 4 of which are located in the study area.



Note: Shell Puget Sound refinery was sold to HollyFrontier Corporation in 2021 (Shell US, 2021).

Figure H 1 Map showing refinery locations in study area.

Table H 1 Refineries in study area including common name, year constructed and capacity in barrels per day

Refinery Name	Common name	Year constructed	Current Capacity (bbls/day)
Tesoro Refining & Marketing Company	Anacortes Refinery	1955	119,000
BP Cherry Point	BP Cherry Point	1971	225,000
Phillips 66 Ferndale Refinery	Ferndale	1954	100,000
Shell Puget Sound Refinery[1]	SPSR or Shell March Point	1957	145,000

[1] Shell Puget Sound refinery was sold to HollyFrontier Corporation (Shell US, 2021)

Tesoro Refining and Marketing Company[1] (Anacortes Refinery) is located in Skagit County on March Point near Anacortes. The refinery has a total crude oil processing capacity of approximately 119,000 barrels per day. The refinery processes Canadian crude, domestic crude from North Dakota and Alaska North Slope, and international crudes to manufacture gasoline, distillates, heavy fuel oil and propane. The refinery distributes products through pipeline connected refineries terminals and MPC's marine terminal via ships and barges (Marathon, n.d.).

- Over the last 5 years, Tesoro had an average of 72 tanker visits (Ecology, n.d.-a).
- Over the last 5 years, Tesoro had an average of 119 barge visits (Ecology, n.d.-a).

Cherry Point Refinery[2] (BP Cherry Point) is located in Whatcom County near Bellingham. The refinery can process approximately 250,000 barrels of crude oil per day and supplies a broad range of fuels, including gasoline, diesel and jet fuel, and other specialty products. Most of Cherry Point's crude oil is from the Alaska North Slope and is brought in by oil tankers (BP Cherry Point, n.d.).

- Over the last 5 years, Cherry Point had an average of 194 tanker visits (Ecology, n.d.-a).
- Over the last 5 years, Cherry Point had an average of 112 barge visits (Ecology, n.d.-a).

Phillips 66 Ferndale Refinery[3] (Ferndale) is located in Whatcom County, in Ferndale, about 20 miles south of the U.S.-Canada border. The refinery can process approximately 100,000 barrels of crude per day from a variety of domestic and foreign crude oils, including Alaskan North Slope, Canadian and U.S. shale crudes.

The refinery produces gasoline and diesel. Other products include residual fuel oil, which supplies the northwest marine transportation market. Most of Ferndale's refined products are distributed by pipeline and barge to major markets in the northwest United States (Phillips 66, n.d.).

- Over the last 5 years, Ferndale had an average of 43 tanker visits (Ecology, n.d.-a).
- Over the last 5 years, Ferndale had an average of 343 barge visits (Ecology, n.d.-a).

Shell Puget Sound Refinery[4] (Shell Puget Sound or Shell March Point) is located in Skagit County on March Point near Anacortes. The refinery has an average annual processing rate of approximately 145,000 barrels of crude oil per day. When the refinery first began operating, most of its crude oil came from Canada via pipeline. Although it continues to receive crude from central and western Canada, feedstock also arrives by tanker from oilfields on Alaska's North Slope.

On an annual basis, the refinery produces multiple types of gasoline in addition to fuel oil, diesel fuel, propane, jet fuel, butane, and petroleum coke. It also produces two chemicals – nonene and tetramer – that are used in a variety of plastic products (Shell, n.d.).

[1] https://www.marathonpetroleum.com/Operations/Refining/Anacortes-Refinery/
[2] https://www.bp.com/en_us/united-states/home/where-we-operate/washington/cherry-point-refinery.html
[3] https://www.phillips66.com/refining/ferndale-refinery
[4] https://www.shell.us/about-us/projects-and-locations/puget-sound-refinery/about-shell-puget-sound-refinery.html

- Over the last 5 years, SPSR had an average of 120 tanker visits.
- Over the last 5 years, SPSR had an average of 119 barge visits (Ecology, n.d.-a).

A May 4, 2021 announcement on Shell, US website[5] (2021) was made indicating Equilon Enterprises LLC, Shell Oil Products U.S. (Shell), a subsidiary of Royal Dutch Shell plc, reached an agreement for the sale of its Puget Sound Refinery near Anacortes, Washington to a subsidiary of HollyFrontier Corporation, an independent refiner headquartered in Texas (Shell US, 2021).

[5] https://www.shell.us/media/2021-media-releases/shell-sells-washington-puget-sound-refinery-to-hollyfrontier.html

Appendix I Anchorages in Study area

Anchorage areas in the Puget Sound are established in 33 C.F.R. Parts 109-110[1] and specific regulations applicable to each anchorage are contained in 33 C.F.R. 110.230, Subpart B[2]. The General Anchorages in Puget Sound are intended for the use of commercial deep draft vessels greater than 200 feet in length, including Articulated and Integrated Tug Barge (ATB) combinations (Puget Sound Harbor Safety Committee, 2017).

In 2017, the Coast Guard issued a Notice of Proposed Rulemaking for the creation of new anchorage areas (Regulations.gov., 2017). The Coast Guard withdrew the proposed rulemaking in 2018 in response to public comments and to better analyze potential impacts to tribal treaty rights, especially treaty fishing rights (Regulations.gov., 2018).

The Puget Sound Harbor Safety Plan[3] includes a section on anchoring in the Standards of Care portion of the plan with a table of anchorages available for use in Puget Sound. Several of the anchorages identified in the Coast Guard 2017 Notice of Proposed Rulemaking are listed in the Harbor Safety Plan table, as non-designated anchorages.

Figure I-1 and Table I-1 show anchorages commonly used in the study area for tankers, ATBs, and tug and barge units.

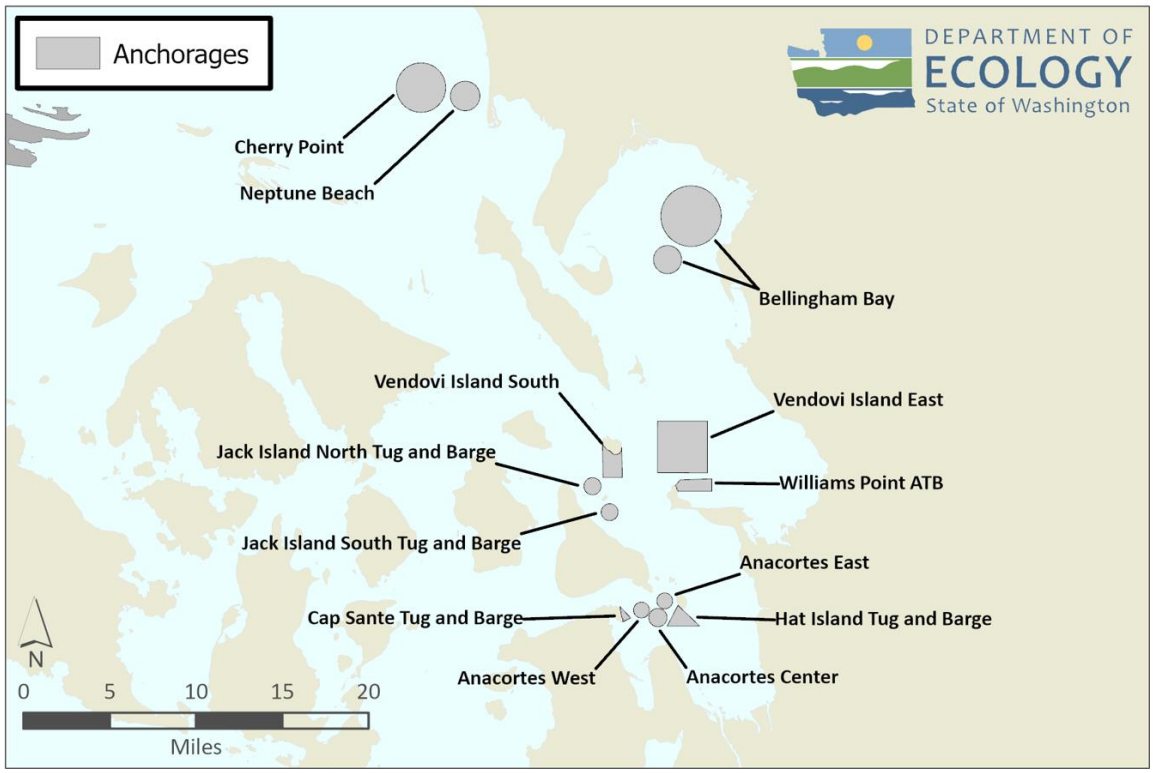


Figure I 1 Map showing anchorages in the study area

[1] https://www.ecfr.gov/current/title-33/chapter-I/subchapter-I/part-109
[2] https://www.ecfr.gov/current/title-33/chapter-I/subchapter-I/part-110/subpart-B#110.230
[3]https://static1.squarespace.com/static/59356b2ce3df280bc208d8b6/t/596ee7365016e13e3f335456/1500440374598/zHSP+Sec+C+-+Anchoring.pdf

Table I 1 Anchorages in study area, with abbreviation, number of vessels allowed, and maximum number of days allowed

General Anchorages	Abbreviations	Number of Vessels	Max Stay
Bellingham Bay	BB	4	30 days
Cherry Point	CP	1	30 days
Anacortes West	ANW	1	6 days
Anacortes Central	ANC	1	10 days
Anacortes East	ANE	1	10 days
Non-Designated Anchorages			
Vendovi Island East	VIE	4	10 days
Vendovi Island South	VIS	1	10 days
William Point (ATBs only)	WP	2	10 days
Additional ATB Anchorages			
Neptune Beach	NB	N/A	N/A
Additional Barge Anchorages*			
Jack Island North	JIN	N/A	N/A
Jack Island South	JIS	N/A	N/A
Cap Sante	CS	N/A	N/A
Hat Island	HI	N/A	N/A

* These anchorages are not listed in the Harbor Safety Plan but can be found on Nautical Charts (NOAA chart 18421) and 33CFR110.230

CRF 33 110.230, Anchorages, Captain of the Port Puget Sound Zone, WA, describe the anchorages by latitude and longitude.

General Anchorages

- **Bellingham Bay**: The waters of Bellingham Bay within a circular area with a radius of 2,000 yards, having its center at latitude 48°44’14.39”, longitude 122°32’26.62”.
- **Cherry Point:** The waters within a circular area with a radius of 1600 yards, having its center at latitude 48°48’29.39” N, longitude 122°46'04.66” W.
- **Anacortes** -
    - Anacortes East (ANE) Anchorage. The waters within a circular area with a radius of 600 yards, having its center at 48°31’27” N., 122°33’45” W.
    - Anacortes Center (ANC) Anchorage. The waters within a circular area with a radius of 600 yards, having its center at 48°30’54” N, 122°34’06” W.
    - Anacortes West (ANW) Anchorage. The waters within a circular area with a radius of 600 yards, having its center at 48°31’09” N, 122°34’55” W.
- **Cap Sante Tug and Barge**: All waters enclosed by a line connecting the following points: 48°31’16” N, 122°36’00” W, which is approximately the northeast tip of Cap Sante; then southeast to 48°30’53” N, 122°35’28” W; then west southwest to 48°30’45” N, 122°35’52” W, approximately the south tip of Cap Sante; then north along the shoreline to the point of origin.

- **Hat Island Tug and Barge:** All waters enclosed by a line connecting the following points: 48°31’19” N, 122°33’04” W, near the west side of Hat Island; then southwest to 48°30’37” N, 122°33’38” W; then east to 48°30’37” N, 122°32’00” W; then northwest to the point of origin.

For the purposes of this synopsis the following describes the non-designated anchorages

Non-Designated Anchorages

- **Vendovi Island East:** The waters between Vendovi Island and Sinclair Island.
- **Vendovi Island South**: The waters between Vendovi Island and Guemes Island.
- **William Point**: The waters north of Samish Island

Additional Anchorages in Study area

- **Jack Island**: Waters around Jack Island to the east of Guemes Island
- **Neptune Beach**: Waters off Neptune Beach south of the Ferndale Refinery

Bunkering at Anchorages in Puget Sound

The Puget Sound Harbor Safety Plan section on bunkering: *Bunkering Operations within the Waters of Puget Sound and the Strait of Juan de Fuca* includes a standard of care for bunkering at anchor.

> Bunkering operations are normally permitted in Anacortes, Port Angeles, Elliott Bay and Commencement Bay. Bunkering operations at Vendovi Island, Anacortes East, and Smith Cove West anchorages will only be allowed on a case-by-case basis depending on current or forecasted weather conditions. Requests to bunker in other locations should be submitted to Sector Puget Sound at least 72 hours in advance. In Port Angeles, vessels receiving bunkers will be required to be well into the harbor, west of the line drawn from the ITT Rainier Dock north to the red buoy off the tip of Ediz Hook.

Appendix J
Data Challenges and Mitigation Results

Ecology used a variety of methods to manage data challenges. In the majority of cases Ecology was able overcome the challenge and the synopsis results were not impacted.

Once data collection was complete, Ecology used a series of questions to set a criteria for evaluating if a Haro Strait transit was influenced by the new tug escort requirements. See additional discussion in the Results section.

Of 109 Haro Strait transits by vessels newly subject to the tug escort requirements, 38 were between the Strait of Juan de Fuca and Vancouver, B.C., and two between Victoria, B.C., and Vancouver, B.C. This is the usual and accustomed route for these vessels. 44 transits used both Haro and Rosario Straits, and because a laden tank vessels would still require an escort through the Rosario Strait portion of the route, these transits were not counted as influenced by the escort tug requirements. Altogether, 84 of the 109 Haro Strait transits did not meet the criteria for likely influenced by the new tug escort requirements and were not counted as such.

Ecology used the logic diagram (Figure 14) to assess whether a transit was likely laden or unladen for the remaining 25 transits. Ecology found the available information allowed a determination of the likely laden or unladen status for 16 of the 25 transits.

For the other nine transits, Ecology could not determine whether the tank vessel was likely laden or unladen using the logic diagram. In these cases, Ecology reviewed ANT data for the oil transfers before or after the transit to see if the amount loaded was reasonably close to 95 percent of the vessels cargo capacity. Ecology identified four transits where a reasonable assumption could be made based on this expanded review. In the remaining five cases, Ecology could not determine whether the vessel was laden or unladen. Four of these transits were by ATBs, and one was by a barge greater than 5,000 DWT.

The data challenges did not impact Ecology's ability to identify a vessel's selection of a Rosario Strait or Haro route. The final impact of all data challenges was the inability to determine the likely laden or unladen status of five Haro Strait transits, limiting Ecology's ability to make a determination on whether these five transits were affected by the new tug escort requirements when making route selection.

Data Challenges and Mitigation Methods

AIS uses Very High Frequency (VHF) wavelengths

This data challenge did not affect synopsis results.

AIS transmissions are line-of-sight and can be blocked or lost (Campbell 2016).

Some loss of signal in the northern part of the Strait of Georgia, British Columbia's Vancouver Harbor, and, infrequently, at refineries in the study area was noted. Ecology successfully tracked the vessel by using the AIS history function to move forward or backward through time in one hour increments until the signal was reestablished.

AIS data received is only as accurate as the information transmitted

This data challenge did not affect synopsis results.

Some AIS transponder data is self-reported by the AIS operator (e.g., type of vessel, destination, navigational status). Data accuracy can be affected if this information is missing, inaccurate, or in a code known only to the operator.

Ecology overcame this data challenge by using the vessel's MMSI number[1] when creating filters or performing a vessel search. Further inaccuracies were overcome by using the AIS history function to determine information such as 'destination' or 'navigational status'.

ANTs use barge transfer data, AIS uses tug transit data &

Towed oil barges are not always towed by the same vessel

This data challenge did not affect synopsis results.

To determine the transit routes between transfers, Ecology used SiiTech AIS history funtion to track the vessel. This presented a challenge as oil barges are not required by regulations to carry AIS transponders. (CFR 33.164.46)

To overcome this challenge, Ecology used the AIS history for the tug assigned to the barge for route tracking. Many tug/barge combinations were stable, for instance many of the ATBs did not switch tug and barge units, and for these tug/barge combinations Ecology used the known tug AIS data.

For tug/barge combinations which changed based on company needs, Ecology matched AIS signals for tugs used by the company to the barge ANT information at a specific time and location. This method generally produced good results. Occasionally determining tug/barge combinations was difficult due to inaccuracies in the projected ANT date and time versus the actual date and time of the transfer combined with the number of tugs arriving and departing from the anchorage or facility; however, in all instances Ecology was able to match a barge with its attending tug.

In the first year synopsis data:

- ATB – 14 total, 2 switched tugs
- Barges greater than 5,000 DWT – 19 total, 5 switched tugs
- Barges less than 5,000 DWT – 7 total, 2 switched tugs

In the second year synopsis data:

- ATB – 19 total, 2 switched tugs
- Barges greater than 5,000 DWT – 13 total, 8 switched tugs
- Barges less than 5,000 DWT – 5 total, 3 switched tugs

[1] The MMSI (Maritime Mobile Service Identity) number is used by an AIS system to uniquely identify a vessel

Linking vessel routes to ANTs could be prohibitively time consuming if not automated

This data challenge did not affect synopsis results.

Because crossing line data does not provide route information, using this data to link vessel routes to ANTs was not feasible without an automated system. The manual method devised by Ecology made linking AIS data to ANT data manageable for this synopsis

Marine Exchange crossing line data does not provide route information or information on laden or unladen status

This data challenge did not affect synopsis results.

The data challenge did result in the determination of 'unknown' for transit types when Ecology was unable to determine if a transit was likely laden or likely unladen using ANT transfer data. Ecology's success in determining transit type varied by vessel type, due in part to the success in determining if a vessel's transit was engaged in bunkering, and how frequently different vessel types were engaged in bunkering activities[2]. Table J 1 demonstrates how the percent of unknown transits increases or decrease in inverse correlation to the percent of engaged in bunkering transits.

Table J 1 Engaged in bunkering and unknown transits as a percent of total transits

Oil Barges	Total Transits	Percent Engaged in Bunkering Transit	Percent Unknown Transit
Greater than 5,000 Year 1	326	19	36
Greater than 5,000 Year 2	349	21	43
Less than 5,000 Year 1	367	42	27
Less than 5,000 Year 2	218	58	21

Ecology's ANT system only includes oil transfers that take place in Washington waters

This data challenge did not affect synopsis results.

This data challenge impacted Ecology's ability to determine if a transits was likely laden or likely unladen, and increased the number of transit type unknown. In Year 1 this data challenge resulted in an increase of 32 percent in unknown transits for ATBs, an increase of four percent for barges greater than 5,000 DWT, and an increase of three percent for barges less than 5,000 DWT. In Year 2 this data challenge resulted in an increase of 21 percent for ATBs, 0.04 percent for barges greater than 5,000 DWT, and 0.5 percent for barges less than 5,000 DWT.

Because the ANT system does not include data from transfers which occur outside of Washington, data was not available for transfers which occurred prior to a vessel's entry

[2] ATB units do not provide bunkering or fueling to other vessels

transit. In some cases this resulted in the entering transit being assigned the transit type 'unknown.'

To determine how the lack of ANT data for transfers outside of Washington waters affected the number of 'unknown' transits, Ecology counted the number of entering transits which resulted in transit type 'unknown.'

Year 1

- ATB 184 'unknown' entering transits
- Barges > 5,000 DWT 14 'unknown' entering transits
- Barges < 5,000 DWT 11 'unknown' entering transits

Year 2

- ATB 196 'unknown' entering transits
- Barges > 5,000 DWT 14 'unknown' entering transits
- Barges < 5,000 DWT 11 'unknown' entering transits

Ecology then determined the number of entering transits labeled 'unknown' as a percent of:

- Total of all entering transits
- Total of all 'unknown' transit
- Total of all transits

Table J 2 shows the 'unknown' entering transits as a percent of the total number of entering transits, all 'unknown' entering transits, and all transit types.

Table J 2 Number of unknown entering transits as a percentage of all entering transits, all unknown transits, and total number of all transit types by vessel type for year 1 and year 2

Vessel Type	Percent 'unknown' Entering Transits / All Entering Transits	Percent 'unknown' Entering Transits / All 'unknown' Transits	Percent 'unknown' Entering Transit / All Transit Types
Year 1			
ATB	74	45	32
Barges > 5,000 DWT	54	15	4
Barges < 5,000 DWT	61	11	3
Year 2			
ATB	89	39	21
Barges > 5,000 DWT	74	1	.04
Barges < 5,000 DWT	9	2	.5

Table J 2 shows a greater percent of entering transits for ATBs are categorized as 'unknown' compared to the barges. In Year 1, for ATBs 74 percent of all entering were 'unknown' compared to 54 percent for barges greater than 5,000 DWT and 61 percent for barges less than 5,000 DWT.

This combined with the greater number of entering transits for ATBs, enlarges the percent of 'unknown' entering transits to the total number of 'unknown' transits and total number of all transit types. In Year 1 for ATBs, 45 percent of all unknown transits were entering transits compared to 15 percent for barges greater than 5,000 DWT and 11 percent for barges less than 5,000 DWT. And in Year 1, for ATBs 32 percent of transits types were 'unknown' entering transits compared to 4 percent for barges greater than 5,000 DWT and 3 percent for barges less than 5,000 DWT.

Because the ANT system does not include transfer data for transfers occurring outside of Washington waters, the number of 'unknown' entering transits and thus the total number of 'unknown' transits increased more for ATBs than for barges.

Inaccuracies in ANT data

This data challenge did not affect synopsis results.

Ecology uses a quality assurance process to ensure ANT data which is incomplete, duplicated, or inaccurate is corrected or removed as appropriate (Ecology n.d.-b). This mitigates the issues of incorrect or incomplete data as detailed below.

ANT data reliability is dependent on entries typically made by the delivering vessel or facility involved in a transfer. ANT data can be entered incorrectly, it can be entered twice if both the deliverer and receiver enter the transfer information, or the advanced notice of oil transfer information may differ from the actual transfer date, time, and product types and quantities.

Errors that remain in the ANT data after the vetting process are likely due to inaccuracies in the projected date and time of the transfer versus the date and time of the actual transfer. Changes in the day or time of a transfer may be due to operational reasons on the part of one of the companies involved, or may be due to environmental factors (e.g., weather, tide). This inaccurate data may remain in the ANT database unless the deliverer edits the ANT data or an Ecology employee[3] visually confirms the date and time of the transfer and corrects the ANT entry. This challenge in the ANT data did not directly affect the synopsis results, as the estimated date and time of the transfer was sufficient to create the spreadsheet.

The ANT database uses volume (gallons) to express the quantity of cargo transferred.

This data challenge did not affect synopsis results.

This data challenge impacted Ecology's ability to determine if a transit was likely laden or likely unladen, and resulted in additional unknown transits. Ecology cannot determine how many transfers may have been affected by this.

One method Ecology used for determining a transit was 'likely unladen' was to compare oil transfer data to the full capacity load[4] for the vessel. If a vessel loaded a full capacity load Ecology counted the vessel transit preceding the transfer as 'likely unladen'. If a vessel

[3] Ecology Oil Transfer Inspectors visit transfer sites to ensure compliance with Washington state transfer rules.
[4] For the synopsis, a full capacity load is the volume of cargo which fills the vessel to 95 percent of its maximum loaded capacity

discharged a full capacity load, Ecology counted the vessel transit following the transfer as 'likely unladen'.

To identify a when a vessel transferred a 'full capacity load' Ecology identified transfers where the ANT data 'quantity transfer'[5] met or exceeded the vessel's full capacity load.

However, in reality, a tank vessel is fully loaded when **either** the volume of its tanks are filled to a preset maximum of its total capacity[6], **or** when the weight of the cargo brings the vessel down to its load lines[7]. The method of determining a full capacity load based only on the volume of the cargo did not account for transfers where the cargo's weight brought the tank vessel to its maximum loaded capacity prior to the cargo volume reaching the vessel's volumetric capacity. Any transfers that did transfer less than the volumetric amount Ecology used to determine full capacity would have been labeled 'unknown' instead of 'likely unladen'. Ecology cannot determine how many transfers may have been affected by this.

However, once data collection was complete, Ecology used a series of questions to set a criteria for evaluating if a Haro Strait transit was influenced by the new tug escort requirements. See additional discussion in the Results section. Of 109 Haro Strait transits by vessels newly subject to the tug escort requirements, Ecology was able to determine 84 did not meet the criteria.

Ecology used the logic diagram (Figure 14) to assess whether a transit was likely laden or unladen for the remaining 25 transits. Ecology found the available information allowed a determination of the likely laden or unladen status for 16 of the 25 transits.

For the other nine transits, Ecology could not determine whether the tank vessel was likely laden or unladen using the logic diagram. In these cases, Ecology reviewed ANT data for the oil transfers before or after the transit to see if the amount loaded was reasonably close to 95 percent of the vessels cargo capacity. Ecology identified four transits where a reasonable assumption could be made based on this expanded review.

At the end of the data analysis there were five cases where Ecology could not determine whether the vessel was laden or unladen. Four of these transits were by ATBs, and one was by a barge greater than 5,000 DWT.

SPIIS arrival information applies to vessels visiting Washington ports

This data challenge did not affect synopsis results.

Vessel arrivals are not entered into SPIIS for vessels transiting to Canadian ports without visiting Washington ports.

[5] In the ANT system the quantity transferred is measured as a volume (gallons)
[6] Usually determined by the company's policies
[7] A ship's waterline is the line where its hull meets the surface of the water. A load line is a marking on the vessel's hull indicating the extent to which the weight of a load may safely submerge a ship, also known as the 'permissible draft'. The load line is calculated to ensure that a ship has sufficient freeboard (the height from the waterline to the main deck) and thus sufficient reserve buoyancy (volume of ship above the waterline). It should also ensure adequate stability and avoid excessive stress on the ship's hull as a result of overloading. (Load lines, 2013)

SPIIS reports were run to identify tankers arriving at Washington ports in the study area, tankers transiting exclusively to Canadian ports were not part of the data set. For data collected in Haro Strait and Boundary Pass, AIS crossing lines were used.

SPIIS vessel arrival information is only as accurate as the Marine Exchange of Puget Sound arrival information

This data challenge did not affect synopsis results.

SPIIS arrival data is purchased from the Marine Exchange of Puget Sound. SPIIS data can be affected by incomplete, inaccurate, or incorrectly entered Marine Exchange data.

Ecology ensures SPIIS data which is incomplete, duplicated, or inaccurate is corrected or removed as appropriate. Reports run in SPIIS for vessel entries were reviewed for accuracy.

VEAT data was not available for the beginning of 2021

This data challenge did not affect synopsis results.

A gap in VEAT data resulted from 2021 data unavailability for this synopsis. VEAT data is collected at the end of each year and VEAT 2021 data is not available until March 2022.

Ecology overcame this data gap by reviewing ANT vessel transfers for the 2021 period and determined there were two additional ATBs and one barge greater than 5,000 DWT to add to the vessel lists.

Appendix K Transit Data for ATB, Barges > 5,000 DWT and Tankers less than 40,000 DWT

Combined Tank Vessel Data

The manual method was used to count the number of transits made through Rosario Strait and connected waterways east, and Haro Strait. Figure K 1 compares the number of Rosario Strait transits per month in Year 1 to Year 2. Figure K 2 compares the number of Haro Strait transits per month for Year 1 to Year 2.This data does not reflect the laden or unladen status of tank vessels at the time of the transit.

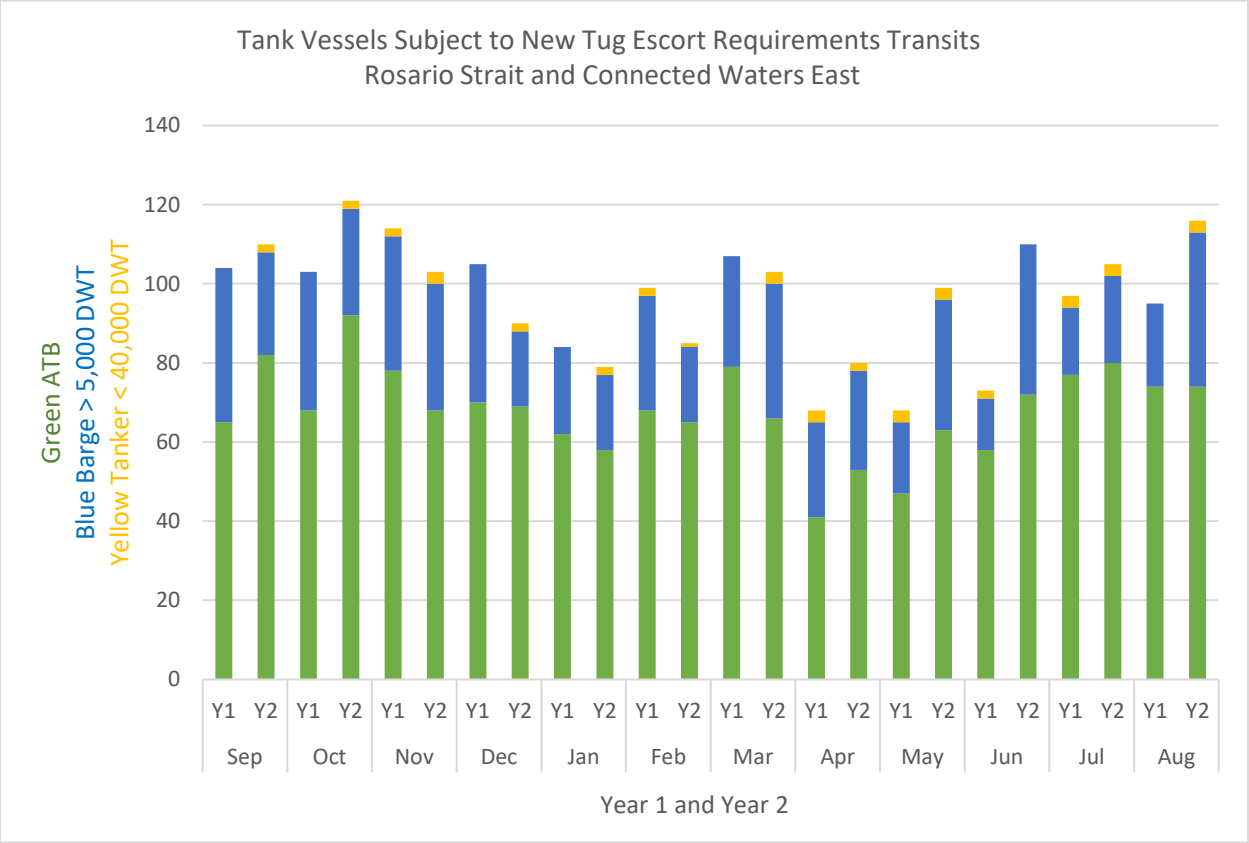


Figure K 1 Rosario Strait transits by vessels newly subject to tug escort requirements, comparing Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021) by month

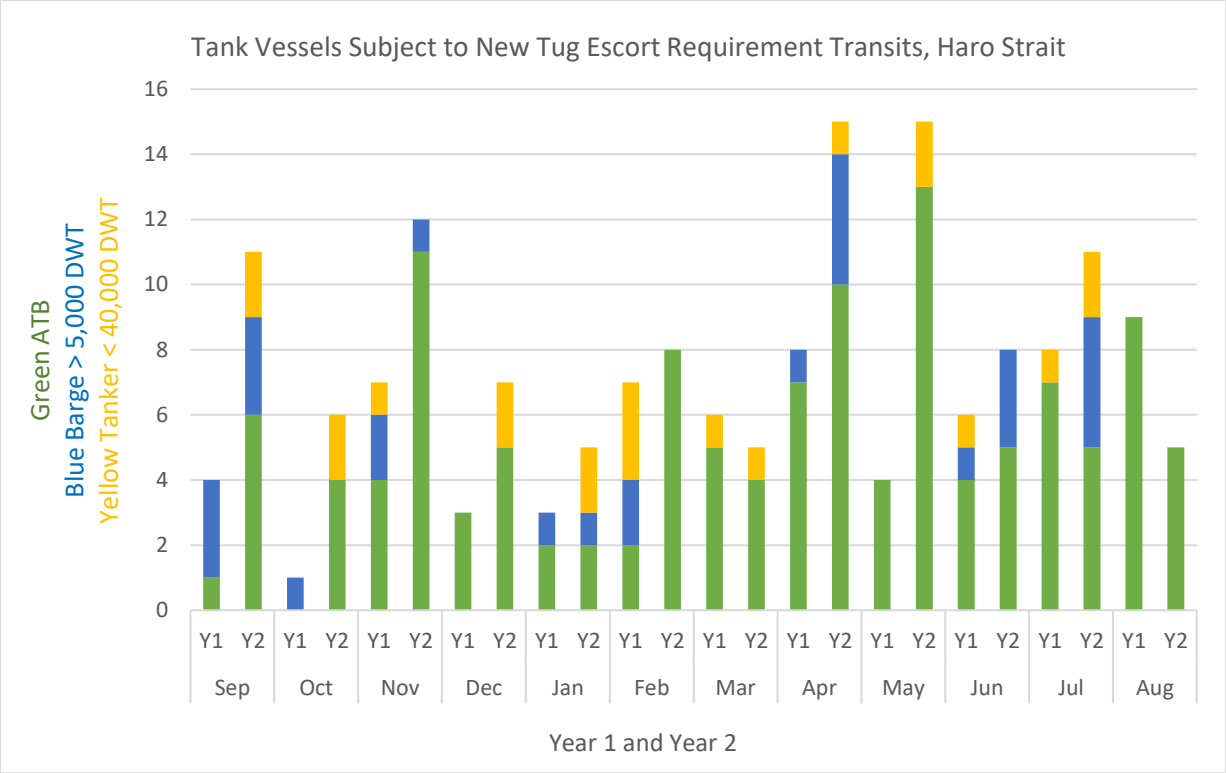


Figure K 2 Haro Strait transits by vessels newly subject to tug escort requirements, comparing Year 1 (September 1, 2019 to August 31, 2020) to Year 2 (September 1, 2020 to August 31, 2021) by month

ATB Data

The manual method was used to count the number of transits ATBs made through Rosario Strait and connected waterways east, and Haro Strait. Figure K 1 compares the number of Rosario Strait transits per month in Year 1 to Year 2. Figure K 2 compares the number of Haro Strait transits per month for Year 1 to Year 2.This data does not reflect the laden or unladen status of the ATB at the time of the transit.

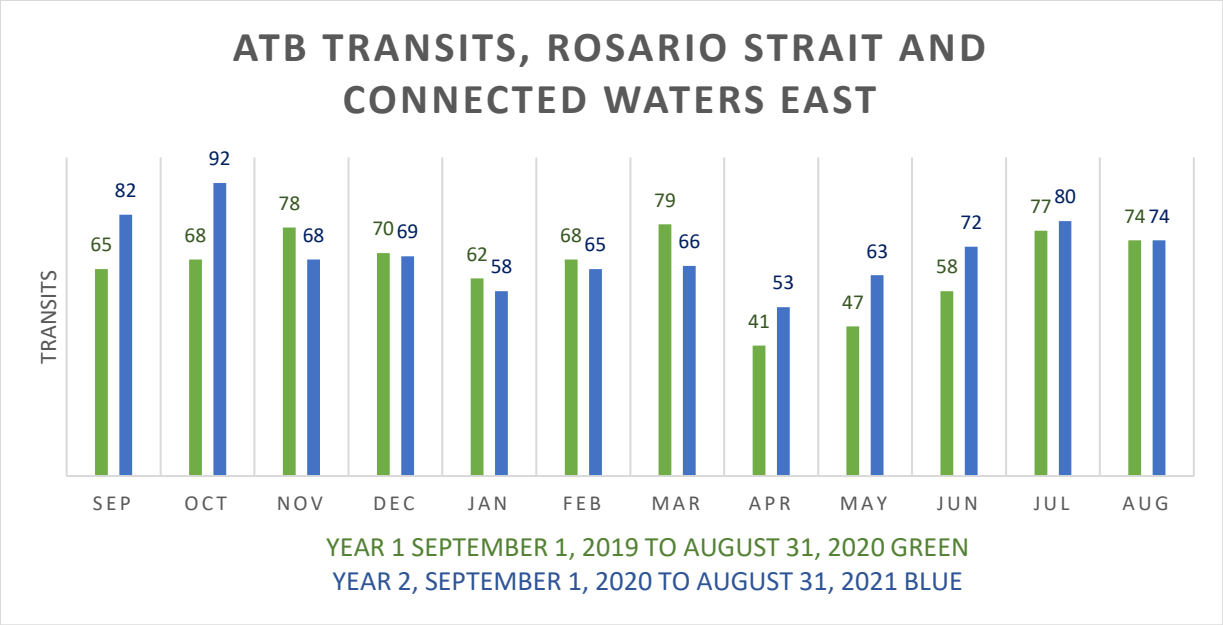


Figure K 3 ATB transits Rosario Strait and connected waterways east Year 1 and Year 2

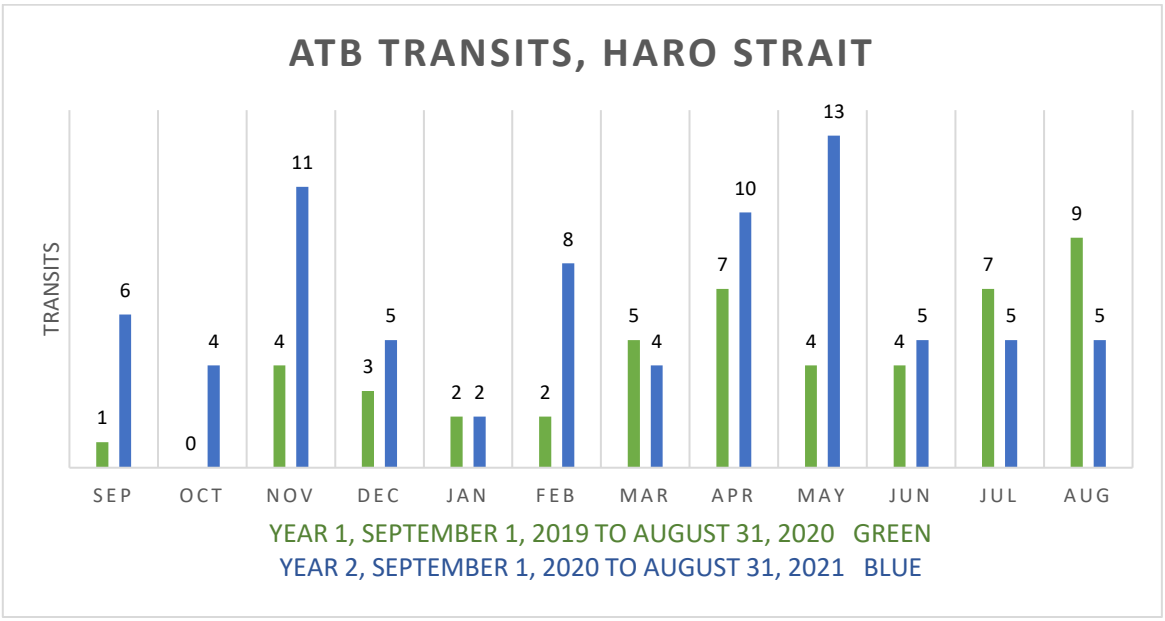


Figure K 4 ATB transits Haro Strait Year 1 and Year 2

Barges greater than 5,000 DWT

The manual method was used to count the number of transits barges greater than 5,000 DWT made through Rosario Strait and connected waterways east, and Haro Strait. Figure K 3 compares the number of Rosario transits by month for Year 1 to the number of transits per month for Year 2. And K 4 compares Haro Strait transits by month for Year 1 and Year 2. This data does not reflect the laden or unladen status of the barge during the transit.

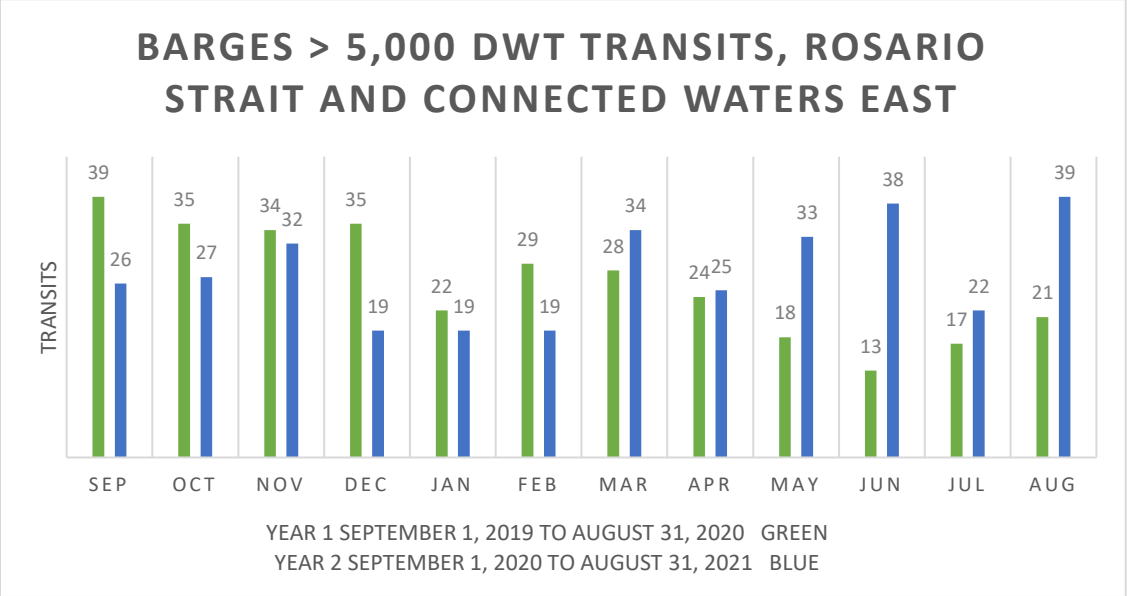


Figure K 5 Barges greater than 5,000 DWT transits in Rosario Strait and connected waterways to the east year 1 and year 2

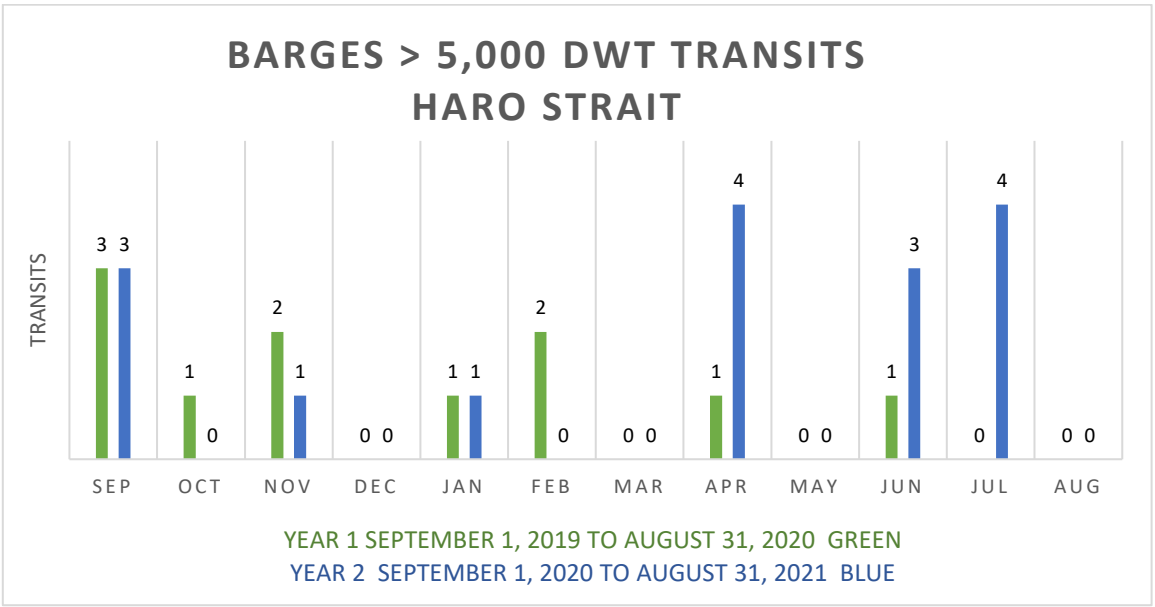


Figure K 6 Barges greater than 5,000 DWT transits Haro Strait Year 1 and Year 2

Tankers less than 40,000 DWT

Ecology's SPIIS and ANT databases were used to count the number of transits for tankers less than 40,000 DWT in Rosario Strait and Haro Strait.

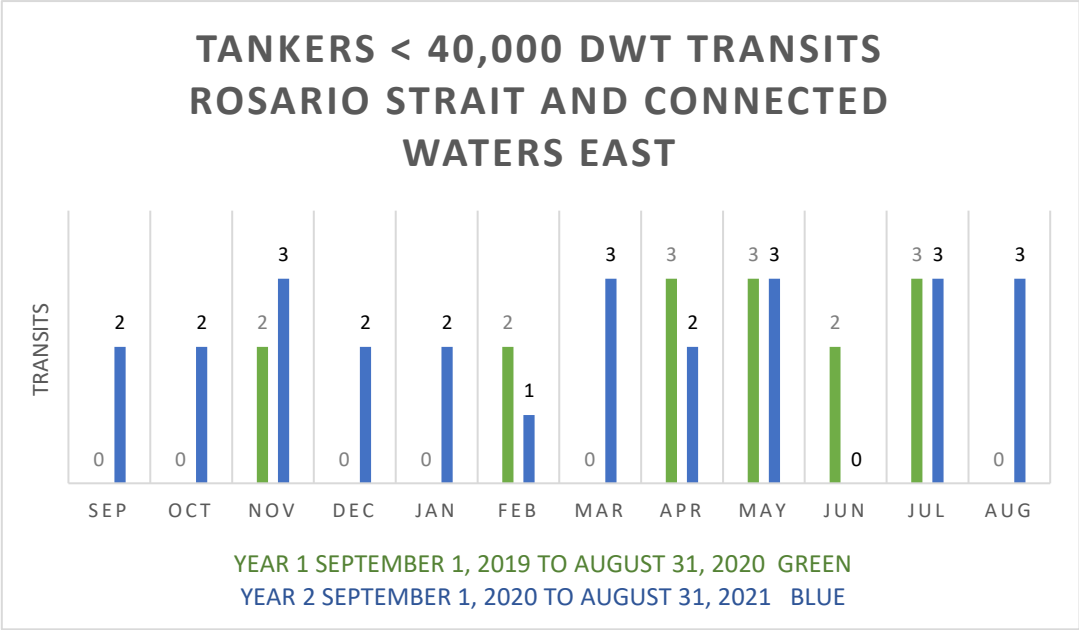


Figure K 7 Tankers less than 40,000 DWT transits Rosario Strait and connected waterways east Year 1 and Year 2

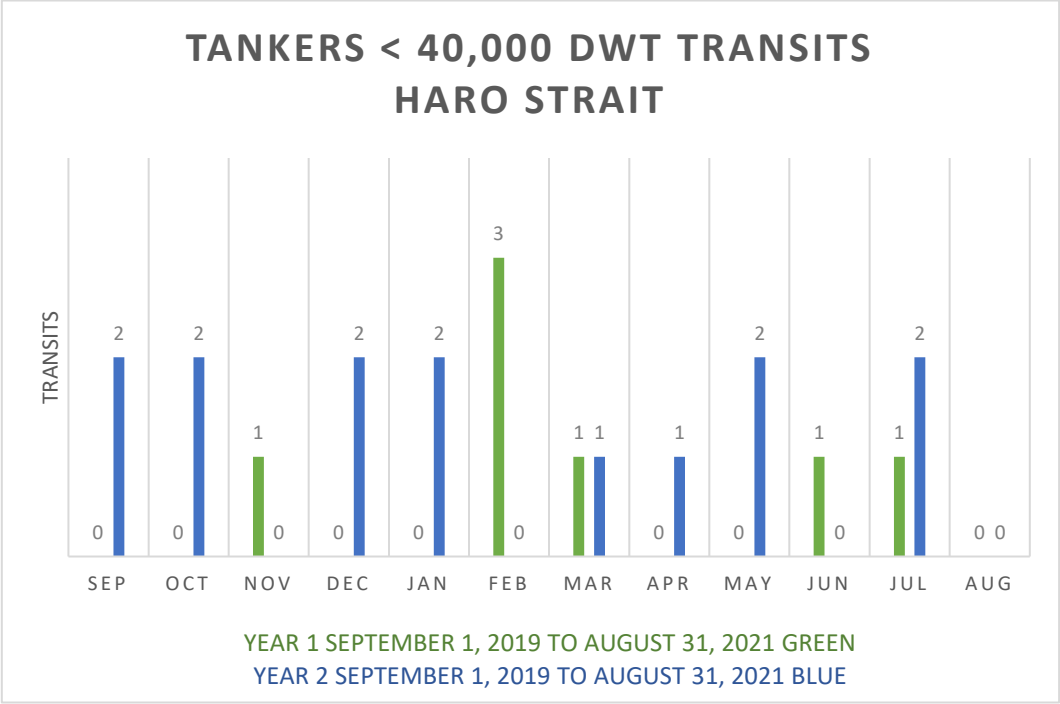


Figure K 8 Tankers less than 40,000 DWT transits in Haro Strait Year 1 and Year 2

Appendix L Articulated Tug/Barge (ATB)

Table L 1 Articulated Tug/Barge (ATB) which operate on the west coast

ATB Barge Name	ATB Tug Name	Operating Company	Barge DWT[1]	Capacity 100% (bbls)[2]	Capacity 95% (gal)	Tug Call Sign	Tug MMSI[3]	Operating Area	Information Source
550-1	Sea Reliance	Crowley	18,148	161,754	6,453,993	WEOB	369567000	W. Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_550ATB_specsheet.pdf
550-2	Sound Reliance	Crowley	18,148	165,921	6,620,208	WXAE	369580000	W. Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_550ATB_specsheet.pdf
550-3	Ocean Reliance	Crowley	19,999	165,921	6,620,208	WADY	369703000	W. Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_550ATB_specsheet.pdf
550-4	Coastal Reliance	Crowley	19,999	165,921	6,620,208	WADZ	369702000	Gulf Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_550ATB_specsheet.pdf
650-1	Pacific Reliance	Crowley	27,000	189,208	7,549,416	WDI7757	367036000	Gulf Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf
650-10	Vision	Crowley	27,000	189,208	7,549,416	WDF6306	366904000	W. Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf
650-2	Gulf Reliance	Crowley	27,000	189,208	7,549,416	WDD2703	303668000	W. Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf
650-3	Resolve	Crowley	27,000	189,208	7,549,416	WDD7117	367336000	Gulf Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf
650-4	Integrity	Crowley	27,000	189,208	7,549,416	WDD7905	368247000	Gulf Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf

[1] Deadweight tonnage [2] Barrels [3] Maritime Mobile Service Identity number

Table L-1 Articulated Tug/Barge (ATB) which operate on the west coast, continued

ATB Barge Name	ATB Tug Name	Operating Company	Barge DWT[1]	Capacity 100% (bbls)[2]	Capacity 95% (gal)	Tug Call Sign	Tug MMSI[3]	Operating Area	Information Source
650-5	Courage	Crowley	27,000	189,208	7,549,416	WDE3893	368413000	Gulf Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf
650-6	Commitment	Crowley	27,000	189,208	7,549,416	WDE3894	338899000	W. Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf
650-7	Pride	Crowley	27,000	189,208	7,549,416	WDE9046	366341000	Gulf Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf
650-8	Achievement	Crowley	27,000	189,208	7,549,416	WDF2728	368515000	Gulf Coast	https://www.crowley.com/wp-content/uploads/sites/7/2020/04/CM_Petro_650ATB_specsheet.pdf
All Aboard For A Cure	Bill Gobel	Centerline	14,102	86,353	3,445,470	WDJ3749	367770980	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/AllAboardforaCure.pdf
Dr. Robert J Beall	Emery Zidell	Centerline	13,945	88,158	3,517,521	WDH7301	367646810	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/DrRobertJBeall.pdf
Edward Itta	Todd E. Prophet	Centerline	13,992	86,132	3,436,627	WDJ8094	368013040	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/EdwardItta.pdf
Fight ALS	Barry Silverton	Centerline	13,867	88,158	3,517,504	WDI2338	367677130	E. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/FightALS.pdf
Fight Fanconi Anemia	Min Zidell	Centerline	13,867	88,158	3,517,504	WDJ3750	367770990	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/FightFanconiAnemia.pdf
Onedream	Jake Shearer	Centerline	13,922	86,346	3,445,218	WDI8655	367740790	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/OneDream.pdf

[1] Deadweight tonnage [2] Barrels [3] Maritime Mobile Service Identity number

Table L-1 Articulated Tug/Barge (ATB) operate on the west coast, continued

ATB Barge Name	ATB Tug Name	Operating Company	Barge DWT[1]	Capacity 100% (bbls)[2]	Capacity 95% (gal)	Tug Call Sign	Tug MMSI[3]	Operating Area	Information Source
Petro Mariner	Dale R Lindsey	Centerline	5226	29,945	1,194,816	WDI8650	367740740	S.E. AK	http://files.centerlinelogistics.com/vessels/spec_sheets/PetroMariner.pdf
Zidell Marine 277	One Cure	Centerline	13,765	84,688	3,379,068	WDJ7457	368006870	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/ZidellMarine277.pdf
ITB Island Trader	Island Monarch	ITB-Canada	9,250	69,518	2,773,806	CFL4938	316001223	Puget Sound	https://www.islandtug.com/island-trader-barge
ITB Reliant*	Island Regent	ITB-Canada	3,700	27,895	1,113,000	CFA2943	316039153	Puget Sound	https://2d7d6843-3813-411c-9fe6-ef910df44c81.filesusr.com/ugd/0642f9_c1c39a777f8d45c4ad1457ac7d444a4a.pdf
ITB Resolution*	Island Raider	ITB-Canada	3,700	27,895	1,113,000	CFA2784	316038089	Puget Sound	https://2d7d6843-3813-411c-9fe6-ef910df44c81.filesusr.com/ugd/0642f9_d1de90587bcc4d969535e5bb0394bece.pdf
DBL 55	various	Kirby	9167.12	52,000	2,074,80			Puget Sound	https://www.bst-tsb.gc.ca/eng/rapports-reports/marine/2016/m16p0378/m16p0378.html
DBL 78	Cape Ann	Kirby	12,525	82,000	3,271,800	WDJ8731	369322000	W. Coast	Pete Pauliky – Kirby Offshore Marine
DBL 185	Dublin Sea	Kirby	27,083	185,000	7,381,500	WDE9779	338616000	W. Coast	Pete Pauliky – Kirby Offshore Marine
DBL 185-01	Nancy Peterkin	Kirby	26,655	185,000	7,381,500	WDI2121	338134000	W. Coast	Pete Pauliky – Kirby Offshore Marine
OSG 204	OSG Endurance	OSG	27,091	204,000	8,139,600	WDF9078	367501540	W. Coast	https://www.q88.com/ViewShip.aspx?id=7999B4CB3B87EB3254A8F70A57A84F9C&vessel=Osg+204
Petrochem Supplier	Corpus Christi	U.S. Shipping	21701	159,539	6,365,597	WDE5099	367362010	W. Coast	https://www.usshipcorp.com/wp-content/uploads/2016/07/Vessel-Spec_Corpus-Christi.pdf

[1] Deadweight tonnage [2] Barrels [3] Maritime Mobile Service Identity number

* ITB Reliant and ITB Resolution did not enter Washington waters in Year 1 or Year 2

Appendix M Oil Barges Greater Than 5,000 DWT

Table M 1 Oil barges greater than 5,000 DWT which operate on the west coast

Barge Name	Operating Company	DWT[1]	Official # / IMO[2]	Capacity 100% (bbls)[3]	Capacity 95% (gal)	Operating Area	Information Source
Sixty Five Roses	Centerline	13,368	1223665	88,137	3,516,660	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/65Roses.pdf
Alsea Bay	Sause	15,242	1234567	89,803	3,583,140	W. Coast	https://intelligence.marinelink.com/vessels/vessel/alsea-bay-335341
Antares	Kirby	11,934	1153165	83,958	3,349,924	Puget Sound	https://intelligence.marinelink.com/vessels/vessel/antares-331674
Antril S.	Cook Inlet Tug & Barge	10,207	1268451	72,959	2,911,071	Puget Sound / AK	http://cookinlettug.com/spec-sheets/Antril-S-Spec%20Sheet.pdf
Betsy Arntz	Centerline	5,304	1235165	33,565	1,339,254	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/BetsyArntz.pdf
Capella	Kirby	11,434	D1129491	71,013	2,833,459	Puget Sound	https://intelligence.marinelink.com/vessels/vessel/capella-331675
Cascades	Kirby	9,995	D990194	58,379	2,329,322	Puget Sound	https://intelligence.marinelink.com/vessels/vessel/cascades-331676
Commencement Bay	Sause	13,454	1127878	82,000	3,271,800	W. Coast	Ross McDonald, Sause Bros
DBL 54	Kirby	9,167	1221438	35,745	2,074,800	Columbia River	https://intelligence.marinelink.com/vessels/vessel/dbl-330389
DBL 77	Kirby	11,447	1209866	82,000	3,271,800	Puget Sound	Pete Pauliky, Kirby Offshore Marine
DBL 79	Kirby	12,102	1209849	82,000	3,271,800	Puget Sound	Pete Pauliky, Kirby Offshore Marine
Deneb	Kirby	11,931	1179418	83,958	3,349,924	Puget Sound	https://intelligence.marinelink.com/vessels/vessel/deneb-331702
Dottie	Centerline	7,417	1109007	50,882	2,030,192	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/Dottie.pdf

[1] Deadweight tonnage [2] International Maritime Organization [3] Barrels

Table M-1 Oil barges greater than 5,000 DWT continued

Barge Name	Operating Company	DWT[1]	Official # / IMO[2]	Capacity 100% (bbls)[3]	Capacity 95% (gal)	Operating Area	Information Source
Double Skin 311 (DS 311)	Vane Brothers	4,694*	1252170	34,768	1,387,243	Puget Sound	http://www.vanebrothers.com/Barges
Double Skin 313 (DS 313)	Vane Brothers	4,973*	1252171	34,851	1,390,555	Puget Sound	http://www.vanebrothers.com/Barges
Double Skin 505 (DS 505)	Vane Brothers	5,696	1214462	56,297	2,246,250	Puget Sound	http://www.vanebrothers.com/Barges
Double Skin 501 (DS 501)	Vane Brothers	8,838	1251823	56,263	2,244,894	Puget Sound	http://www.vanebrothers.com/Barges
Dr. Bonnie W Ramsey	Centerline	5,329	1239386	34,400	1,372,560	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/DrBonnieWRamsey.pdf
Drakes Bay	Sause	14,333	1180901	89,000	3,551,100	W. Coast	Ross McDonald, Sause Bros
Dugan Pearsall	Centerline	6,400	1208933	41,029	1,637,072	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/DuganPearsall.pdf
Kays Point	Kirby	9,964	1088088	65,000	2,593,500	Puget Sound	https://intelligence.marinelink.com/vessels/vessel/kays-point-331703
SEASPAN 880 (ex.Leo)	SEASPAN	12,196	1136725	70,830	2,826,117	Puget Sound	https://intelligence.marinelink.com/vessels/vessel/leo-330354
Lovel Briere	Centerline	8724	1205217	54,312	2,167,089	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/LovelBriere.pdf

[1] Deadweight tonnage [2] International Maritime Organization [3] Barrels

[*] The DS 311 & 313 DWT are just below 5,000 DWT using a medium density cargo with a specific gravity of 0.85. Using a higher density cargo such as bunker C with a specific gravity of .99 the DWT is 5,480 MT. Because the capacity in barrels is similar to Betsey Arntz, Dr. Bonnie W. Ramsey, Nathan Schmidt, PB 32 and PB 34, Petrobulker and Vijay Sea, DS 313 and 311 were included as barges greater than 5,000 DWT in the synopsis data.

Table M-1 Oil barges greater than 5,000 DWT continued

Barge Name	Operating Company	DWT[1]	Official # / IMO[2]	Capacity 100% (bbls)[3]	Capacity 95% (gal)	Operating Area	Information Source
Monterey Bay	Sause	14,589	1193404	109,047	4,350,975	W. Coast	https://intelligence.marinelink.com/vessels/vessel/monterey-bay-335346
Morro Bay	Sause	14,589	1195521	83,716	3,340,268	W. Coast	https://intelligence.marinelink.com/vessels/vessel/morro-bay-335347
Nathan Schmidt	Centerline	5310	1219418	34,157	1,362,858	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/NathanSchmidt.pdf
Olympic Spirit	Centerline	13821	1190827	83,766	3,342,276	W. Coast	http://files.centerlinelogistics.com/vessels/spec_sheets/OlympicSpirit.pdf
Pb-32	Marine Petrobulk	5,437	8646068	32,000	1,340,000	Puget Sound	https://www.marinepetrobulk.com/barge-pb32/
Pb-34	Marine Petrobulk	5,437	833507	32,000	1,340,000	Puget Sound	https://www.marinepetrobulk.com/barge-pb34/
Petrobulker	Marine Petrobulk	5,437	836095	32,000	1,340,000	Puget Sound	https://www.marinepetrobulk.com/barge-petrobulker/
Sasanoa	Kirby	12,000	1110781	80,000	3,192,000	W. Coast	Pete Pauliky, Kirby Offshore Marine
Shauna Kay	Centerline	7,235	1101122	42,224	1,684,746	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/ShaunaKay.pdf
Vijay Sea	Centerline	>5000	1203469	37,141	1,481,928	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/VijaySea.pdf

[1] Deadweight tonnage [2] International Maritime Organization [3] Barrels

Note: Sasanoa was sold in 2020 and did not transit the study area in 2021

Appendix N Oil Barges Less Than 5,000 DWT

Table N 1 List of oil barges less than 5,000 DWT which operate in Washington waters

Barge Name	Company	DWT[1]	Official # / IMO[2]	Capacity 100% (bbls)[3]	Capacity 95% (gal)	Operating Area	Information source
HMS 2000	Centerline	2,730	1026330	20,153	829,500	Puget Sound	https://www.centerlinelogistics.com/fleet
HMS 26-1	Centerline	4,343	1194209	26,310	1,049,769	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/HMS261.pdf
ITB Supplier	Island Tug and Barge	3,550	828529	26,682	1,064,616	Canada/ Puget Sound	https://2d7d6843-3813-411c-9fe6-ef910df44c81.filesusr.com/ugd/0642f9_2cc1284db5814230b6f1fc677bee13d5.pdf
ITB Vancouver	Island Tug and Barge	3,450	820184	26,650	1,056,678	Canada/ Puget Sound	https://2d7d6843-3813-411c-9fe6-ef910df44c81.filesusr.com/ugd/0642f9_d553e685eab6423895d0e269058353fd.pdf
Professor Karen Ann Brown	Centerline	<5,000	1252855	29,525	1,178,029	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/ProfessorKarenAnnBrown.pdf
Puget Sounder	Kirby	<5,000	981972	22,627	902,817	Puget Sound	https://intelligence.marinelink.com/vessels/vessel/puget-sounder-330366
SEASPAN 827	Seaspan	4,201	833151	27,551	1,099,287	Canada/ Puget Sound	https://www.seaspan.com/fleet-listing
Global Pilot	Global	<5,000	1255038	15,633	623,757	Puget Sound	https://intelligence.marinelink.com/vessels/vessel/global-pilot-316511
Global Provider	Global	<5,000	N/A	3,681	151,500	Puget Sound	https://www.workboat.com/shipbuilding/jesse-engineering-delivers-bunker-vessel-maxum-petroleum

[1] Deadweight tonnage [2] International Maritime Organization [3] Barrels

Note: Global Provider is a very small self-propelled vessel; however, Ecology considers it a barge for regulations and enforcement and VEAT barge counts

Appendix O Tankers between 5,000 and 40,000 DWT

Table O 1 List of tankers between 5,000 and 40,000 DWT which operated in the Study Area

TANKER	IMO [1]	Flag[2]	Summer DWT[3]	95% Capacity (bbls)[4]	Information Source
Argent Gerbera	9424596	Marshall Island	35,332	244,692	Marine Traffic
Ensemble	9749453	Singapore	35,058	242,794	Marine Traffic
Fanfare	9760562	Singapore	37,256	258,016	Marine Traffic
Fuji Galaxy	9490301	Marshall Island	26,198	181,434	Marine Traffic
Harbour Pioneer	9572757	Portugal	19,122	132,429	Marine Traffic
Hodaka Galaxy	9791157	Singapore	26,198	181,434	Marine Traffic
Jazz	9804849	Singapore	37,361	258,744	Marine Traffic
Kiso	9379894	Panama	33,641	232,981	Marine Traffic
Naeba Galaxy	9791169	Singapore	16,196	112,165	Marine Traffic
Tsukuba Galaxy	9796834	Panama	26,175	181,275	Marine Traffic

[1] International Maritime Organization [2] Flag State [3] Deadweight tonnage [4] Barrels

Note: 95 percent Capacity = 95 percent of the vessel's maximum cargo carrying capacity

Appendix P Purpose-built Escort and Ship Assist Tugs

Table P 1 List of purpose-built escort and ship assist tugs in Pacific Northwest

Tug Name	Company	Bollard Pull (lbs)	HP[1]	MMSI[2]	Call Sign	Tug Type	Operating Area	Information Source
Response	Crowley	154,000	7,240	366866930	WDA9597	Assist	PNW	https://www.crowley.com/shipping/sae/fleet/#p northwest
Guard	Crowley	120,000	5,500	366887300	WCY2823	Assist	PNW	https://www.crowley.com/shipping/sae/fleet/#p northwest
Protector	Crowley	120,000	5,500	366887970	WCY2824	Assist	PNW	https://www.crowley.com/shipping/sae/fleet/#p northwest
Aware	Crowley	200,000	10,000	366779430	WCZ7336	Assist	PNW	https://www.crowley.com/shipping/sae/fleet/#p northwest
Chief	Crowley	111,500	4,800	366764740	WCZ2047	Assist	PNW	https://www.crowley.com/shipping/sae/fleet/#p northwest
Guide	Crowley	111,500	4,800	366759530	WDE7328	Assist	PNW	https://www.crowley.com/shipping/sae/fleet/#p northwest
Nanuq	Crowley	220,000	10,192	366760680	WDF2026	Escort	PNW	https://www.crowley.com/shipping/sae/fleet/#p northwest
Tan'erliq	Crowley	220,000	10,192	499929694	WDF2025	Escort	PNW	https://www.crowley.com/shipping/sae/fleet/#p northwest
Arthur Foss	Foss	97,680	4,000	366979360	WRB5693	Assist	PNW	https://www.foss.com/fleet/
Garth Foss	Foss	174,000	8,000	366767140	WCE4732	Escort	PNW	https://www.foss.com/fleet/
Henry Foss	Foss	102,540	5,000	366976870	WRB5165	Assist	PNW	https://www.foss.com/fleet/
Marshall Foss	Foss	167,710	6,250	366982320	WDB9762	Assist	PNW	https://www.foss.com/fleet/
Lindsey Foss	Foss	169,400	6,250	366767150	WCC9031	Escort	PNW	https://www.foss.com/fleet/
Lynn Marie	Foss	169,400	6,250	366919770	WDB6192	Assist	PNW	https://www.foss.com/fleet/
Wendell Foss	Foss	114,200	4,700	366976920	WRB3696	Assist	PNW	https://www.foss.com/fleet/

[1] Horse Power [2] Maritime Mobile Service Identity number

Appendix Q Multi-Purpose Tugs

Table Q 1 List of multi-purpose tugs which operated in the Study Area

Tug Name	Company	Bollard Pull (lbs)[1]	HP[2]	MMSI[3]	CALL SIGN	Operating Area	Information Source
Brian S.	Centerline	80,000	6,000	366980250	WCP9410	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/BrianS.pdf
Olympic Scout	Centerline	48,000	4,500	367183360	WDD7216	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/OlympicScout.pdf
Dr. Milton Waner	Centerline	N/A	2,400	367741150	WDI8688	Puget Sound	http://files.centerlinelogistics.com/vessels/spec_sheets/DrMiltonWaner.pdf

[1] Pounds [2] Horse Power [3] Maritime Mobile Service Identity number