DEPARTMENT OF ECOLOGY
State of Washington

Crude Oil Movement by Rail and Pipeline

Quarterly Report: October 1, 2022, through December 31, 2022

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Spill Prevention, Preparedness, and Response Program
Washington State Department of Ecology
Olympia, Washington

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Introduction

To enhance crude oil spill preparedness and response in Washington State, on August 24, 2016, Ecology adopted the rule, Oil Movement by Rail and Pipeline Notification. The rule establishes reporting standards for facilities that receive crude oil by rail and pipelines that transport crude oil in or through the state.[1] Additionally, the rule identifies reporting standards for Ecology to share information with emergency responders, local governments, tribes, and the public.

This rule is the result of 2015 Legislative direction to provide a better understanding of the changing risk picture for crude oil transported in Washington State as a result of the introduction of crude oil transport by rail and the associated changes in both the volume and properties of crude moving through Washington.

Timely notice of oil movement information is necessary for emergency responders and planners to effectively prepare for and respond to oil spills and other incidents associated with transporting crude oil by rail and pipeline. Providing adequate information about the dates, routes, and properties of crude oil can help protect people living and working near railroads and pipelines, the economy, and environmental resources of Washington State.

Ecology is required to publish information collected under the rule to its website on a quarterly basis. The quarterly reports provide:

- Aggregated information on crude oil transported by rail to facilities in Washington.
- Information about crude oil movement by pipeline in or through the state.
- Reported spills during transport and delivery of crude by rail and pipeline.
- Volume of crude oil transported by vessel.

The reports are intended to inform the public about the nature of crude oil movement through their communities.

The reporting period for this quarterly report is October 1, 2022, through December 31, 2022.

[1] Chapter 173-185 WAC, Oil Movement by Rail and Pipeline Notification

Crude Oil by Rail Summary

Movement of crude oil by rail in Washington State began in 2012 and has continued to increase since that time. Rail routes transporting crude oil enter the state from Idaho near Spokane and from British Columbia near Bellingham, and Ecology continues to monitor other potential routes. Large segments of the rail routes travel along the I-5 corridor, and cross or run next to major waterways, including the Columbia River and Puget Sound. (See Appendix A for a map of railroad routes in the state.)

Capturing information on the properties of crude oil, the volume transported, and the routes used to transport it allows for proper planning, placement of resources, and opportunities to provide detailed information to responders in the event of a spill, ensuring a more effective overall response. The rule directs Ecology to gather this information by requiring facilities receiving crude oil by rail to report all scheduled crude oil deliveries to be received by the facility each week for the succeeding seven-day period. Facilities enter this information into Ecology's Advance Notice of Transfer (ANT) database.

Information reported by facilities on scheduled crude oil deliveries includes the region of origin of crude oil, the railroad route taken to the facility within the state (if known), scheduled time and volume in barrels (bbls) of the delivery, and the gravity, sulfur content, and vapor pressure of the oil. Ecology uses the standard American Petroleum Institute (API) gravity ranges to define the crude type in the ANT database. (See Appendix B for the API gravity and sulfur content definitions and crude type ranges.)

Ecology is required to aggregate the information provided on a statewide basis by route, week, and type of crude oil. Aggregate information from the ANT database is provided in Table 1 for the period October 1, 2022, through December 31, 2022, representing the 4th Quarter of 2022. Each week is numbered by calendar week and is aggregated by route and type of crude. The information provided includes:

- Total weekly volume in barrels (bbls) of crude oil transported by rail
- Route
- Region of origin
- Crude type (combining API gravity range and sulfur content)
- Route volume
- Estimated number of railcars per route delivering crude oil (assumes each car holds 680 bbls)

Fourteen calendar weeks are reported in the 4th Quarter of 2022 starting at calendar week 40 and ending at calendar week 53.

Table 1: Crude oil movement by rail

Calendar week 40

Week 40 consists of only one day of reported ANT volumes due to the dates of the reporting period.

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
5	Alberta	Heavy Sour Crude	58,898	86
Weekly totals			**58,898**	**86**

Calendar week 41

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	211,491	311
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	72,352	106
4, 5	British Columbia	Heavy Sour Crude	59,511	87
5	Alberta	Heavy Sour Crude	176,992	260
Weekly totals			**520,346**	**764**

Calendar week 42

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	135,357	199
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	144,366	212
4, 5	British Columbia	Heavy Sour Crude	175,706	258
5	Alberta	Heavy Sour Crude	59,099	86
5	Alberta	Light Sour Crude	133,119	195
Weekly totals			**647,647**	**950**

Calendar week 43

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	210,990	310
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	72,383	106
4, 5	British Columbia	Heavy Sour Crude	115,892	170
5	Alberta	Heavy Sour Crude	58,954	86
5	Alberta	Light Sweet Crude	67,007	98
Weekly totals			**525,226**	**770**

Calendar week 44

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	138,165	203
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	211,994	311
4, 5	British Columbia	Heavy Sour Crude	68,900	101
5	Alberta	Heavy Sour Crude	59,099	86
5	Alberta	Light Sweet Crude	134,246	197
Weekly totals			**612,404**	**898**

Calendar week 45

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	71,049	104
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	288,350	424
4, 5	British Columbia	Heavy Sour Crude	115,757	170
Weekly totals			**475,156**	**698**

Calendar week 46

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	270,818	398
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	282,174	414
4, 5	British Columbia	Heavy Sour Crude	117,559	172
Weekly totals			**670,551**	**984**

Calendar week 47

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	70,563	103
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	282,129	414
4, 5	British Columbia	Heavy Sour Crude	117,468	172
5	Alberta	Medium Sweet Crude	120,882	177
Weekly totals			**591,042**	**866**

Calendar week 48

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	268,797	395
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	360,473	530
4, 5	British Columbia	Heavy Sour Crude	58,358	85
5	Alberta	Medium Sour Crude	120,211	176
Weekly totals			**807,839**	**1,186**

Calendar week 49

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	282,429	415
5	Alberta	Medium Sour Crude	60,701	89
Weekly totals			**343,130**	**504**

Calendar week 50

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	339,539	499
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	145,303	213
4, 5	British Columbia	Heavy Sour Crude	116,358	171
5	Alberta	Medium Sour Crude	60,047	88
Weekly totals			**661,247**	**971**

Calendar week 51

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	70,516	103
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	290,253	426
4, 5	British Columbia	Heavy Sour Crude	59,454	87
Weekly totals			**420,223**	**616**

Calendar week 52

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	267,047	392
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	215,663	317
4, 5	British Columbia	Heavy Sour Crude	58,179	85
Weekly totals			**540,889**	**794**

Calendar week 53

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	63,195	92
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	212,561	312
4, 5	British Columbia	Heavy Sour Crude	116,216	170
5	Alberta	Light Sweet Crude	66,610	97
Weekly totals			**458,582**	**671**

Note: *The data provided in Table 1 was reported to Ecology by the receiving facility into the ANT database as required by Chapter 173-185 WAC. Ecology cannot confirm the data or verify its accuracy.*

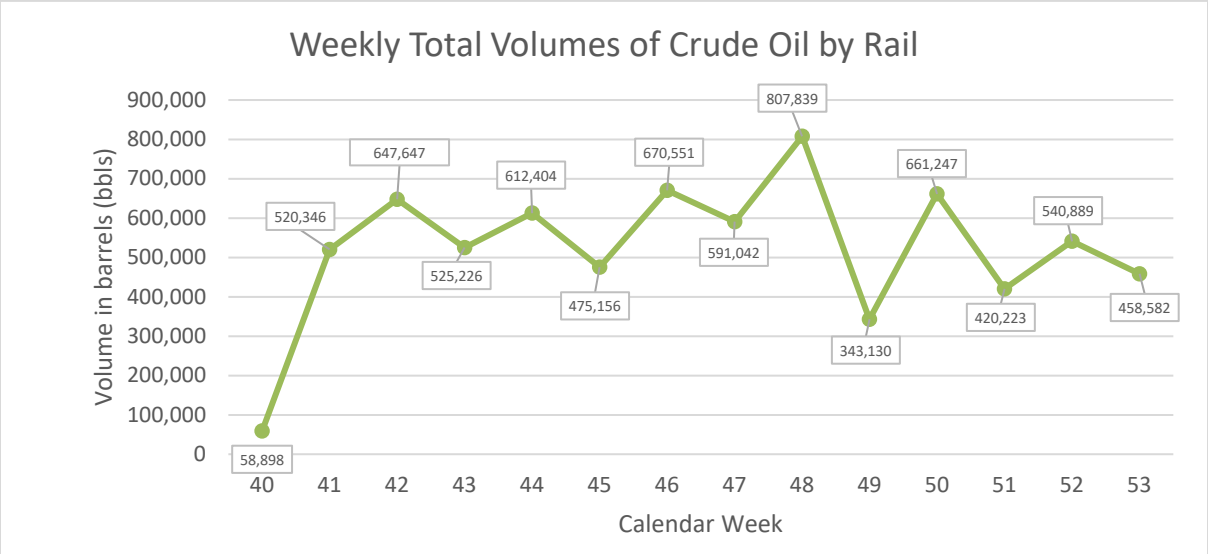
2022 Quarter 4 total volume (bbls): 7,333,180

A summary of the data shows:

- Three regions of origin were reported: North Dakota, British Columbia, and Alberta.
- Three types of crude oil were reported: light, heavy, and medium.
- Routes 1A and 2 through 5 were used to transport crude by rail.
- The total volume of crude oil transported by rail during the quarter was 7,333,180 barrels (307,993,560 gallons).
- The average weekly volume of crude oil transported by rail was 557,959 barrels (23,434,293 gallons).

- The total number of rail cars moving crude oil by rail was 10,758 cars.
- The average number of rail cars per week moving crude oil by rail was 819 cars.
- 73.4 percent of crude oil transported by rail was light crude.
  4.93 percent of crude oil transported by rail was medium crude.
  21.71 percent of crude rail transported by rail was heavy crude.
- 28.5 percent of crude oil transported by rail was sweet crude.
  71.5 percent of crude oil transported by rail was sour crude.
- North Dakota was the region of origin for 67.88 percent of crude oil transported by rail.
  British Columbia was the region of origin for 16.08 percent of crude oil transported by rail.
  Alberta was the region of origin for 16.03 percent of crude oil transported by rail.
- Crude oil originating in North Dakota had reported vapor pressure ranging from 2.7 to 11.3 pounds per square inch.
  Crude oil originating in British Columbia had reported vapor pressure ranging from 6.6 to 10.1 pounds per square inch.
  Crude oil originating in Alberta had reported vapor pressure ranging from 7.1 to 11.9 pounds per square inch.

Figure 1 shows the weekly total volumes of crude transported by rail for each calendar week in the 4th Quarter of 2022.



Note: *Week 40 consists of only 1 days of reported ANT volumes due to the dates of the reporting period.*

Figure 1: Weekly total volumes of crude oil by rail for the 4th Quarter of 2022

The lowest weekly volume was 343,130 barrels (14,411,460 gallons) in Week 49. The highest weekly volume of crude transported by rail was 807,839 barrels (33,929,238 gallons) in Week 48.

Figure 2 displays crude transported by rail, by route, for the 4th Quarter of 2022.

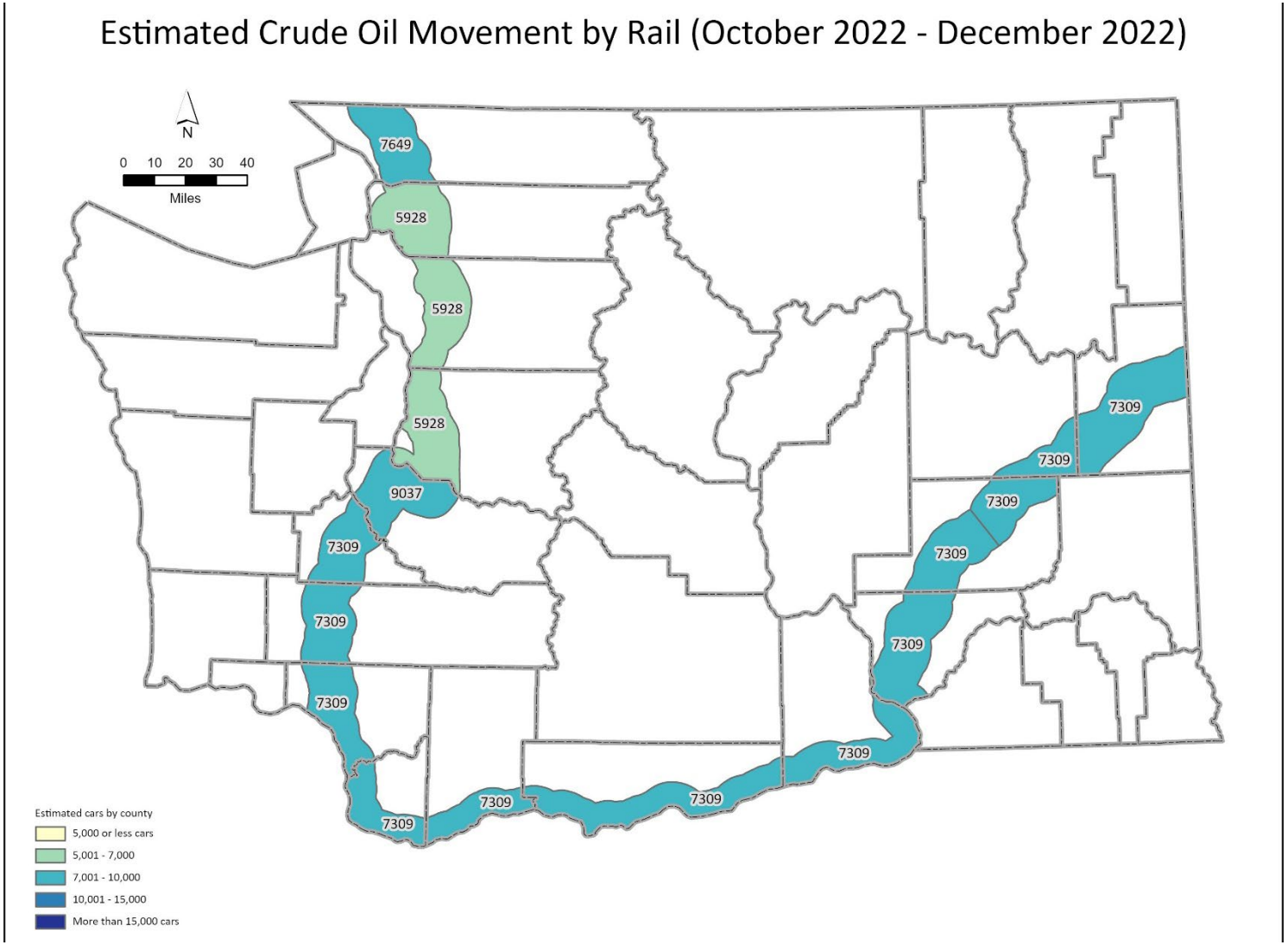


Figure 2: Crude oil movement by route for the 4th Quarter of 2022

Crude Oil by Pipeline Summary

Pipelines exist inland and may be located near waterbodies and populated areas. Knowing the types and quantities of crude oil transported through pipelines in Washington State helps Ecology properly plan for and execute a rapid, aggressive, and well-coordinated response to a spill.

Under the rule, transmission pipelines that transport crude oil in or through the state must provide Ecology biannual notice of all crude oil transported in or through the state.[2] Biannual notice must be submitted each year by July 31 for the period from January 1 through June 30, and by January 31 for the period from July 1 through December 31. Biannual notice provided by pipelines includes contact information for the pipeline and the total volume of crude oil transported in or through the state during the reporting period by state or province of origin.

The most recent biannual notices from pipelines covered the period from January 1, 2022, through June 30, 2022. Table 2 below provides the total volume of crude oil transported in or through the state by pipelines during this period.

Table 2: Crude oil movement by pipeline

Period	State/Province of Origin	Mean API Gravity & Range	Sulfur Content	Volume (bbls)
January 1, 2022 – June 30, 2022	Alberta	23.1 (Medium)	Sour (>0.5%)	272,337
January 1, 2022 – June 30, 2022	Alberta	22.1 (Heavy)	Sour (>0.5%)	4,730,517
January 1, 2022 – June 30, 2022	Alberta	41.2 (Light)	Sour (>0.5%)	9,807,615
January 1, 2022 – June 30, 2022	Alberta	37.5 (Light)	Sweet (≤0.5%)	20,989,306

Note: *The data provided in Table 2 was reported to Ecology by the pipelines transporting crude oil in or through the state, as required by Chapter 173-185 WAC. Ecology cannot confirm the data or verify its accuracy.*

The next biannual notices from pipelines will cover the period from July 1, 2022 through December 31, 2022 and must be submitted to Ecology by January 31, 2023.

Crude Oil Spills – Rail and Pipeline

Oil spills can have significant impacts to the public, environment, and economy. Ecology strives to protect Washington's environment, economy, and public health and safety through a comprehensive spill prevention, preparedness, and response program.

The rule directs Ecology to provide the number and volume of spills to the waters of the state during the transport and delivery of crude oil by rail and pipeline in each quarterly report.[3] For the period of October 1, 2022, through December 31, 2022, zero crude oil spills to the environment by rail or pipeline were reported. In the event there are spills to report in the future,

[2] Chapter 173-185 WAC, Oil Movement by Rail and Pipeline Notification
[3] Chapter 173-185 WAC, Oil Movement by Rail and Pipeline Notification

Ecology will provide this information and include the date of the spill, the county where the spill occurred, the source, material, and volume of the spill.

Crude Oil Movement by Vessel

In 2006, the state adopted rules for advance notice of oil transfers for vessels and facilities. Ecology has been receiving advance notice of transfer data for all transfers to or from vessels in Washington State since that time.

In order to provide a full picture of crude oil movement in Washington State, a summary of crude oil movement by vessel is provided below, which is in addition to the requirement for this quarterly report as described in the rule.[4]

Table 3 below provides the total volume of crude oil in barrels of inbound and outbound vessel transfers for the period of October 1, 2022, through December 31, 2022. Inbound vessel transfers refers to crude oil movement from vessels to facilities, while outbound vessel transfers refers to crude oil movement from facilities to vessels.

Table 3: Crude oil movement by vessel

Vessel transfers	Volume (bbls)	Volume (gallons)
Inbound	27,596,540	1,159,054,680
Outbound	162,000	6,804,000
Total	**27,758,540**	**1,165,858,680**

Note: *The data provided in Table 3 was reported to Ecology into the ANT database as required by Chapter 173-180 WAC and Chapter 173-184 WAC. Ecology cannot confirm the data or verify its accuracy.*

A summary of vessel transfer data for the quarter shows:

- There were 72 total vessel transfers of crude oil (inbound or outbound).
- The average volume of crude oil transferred to or from vessels per week was 2,112,063 barrels (88,706,639 gallons).

[4] Chapter 173-185 WAC, Oil Movement by Rail and Pipeline Notification

An Overview of Crude Oil Movement in Washington

A broad view of crude oil movement in Washington State can be seen when comparing the movement of crude oil transported into the state by vessel, rail, and pipeline.

Figure 3 shows the estimated percentage of crude oil transported by vessel (inbound only), rail, and pipeline for the last four quarters, covering the period of January 1, 2022, through December 31, 2022.[5]

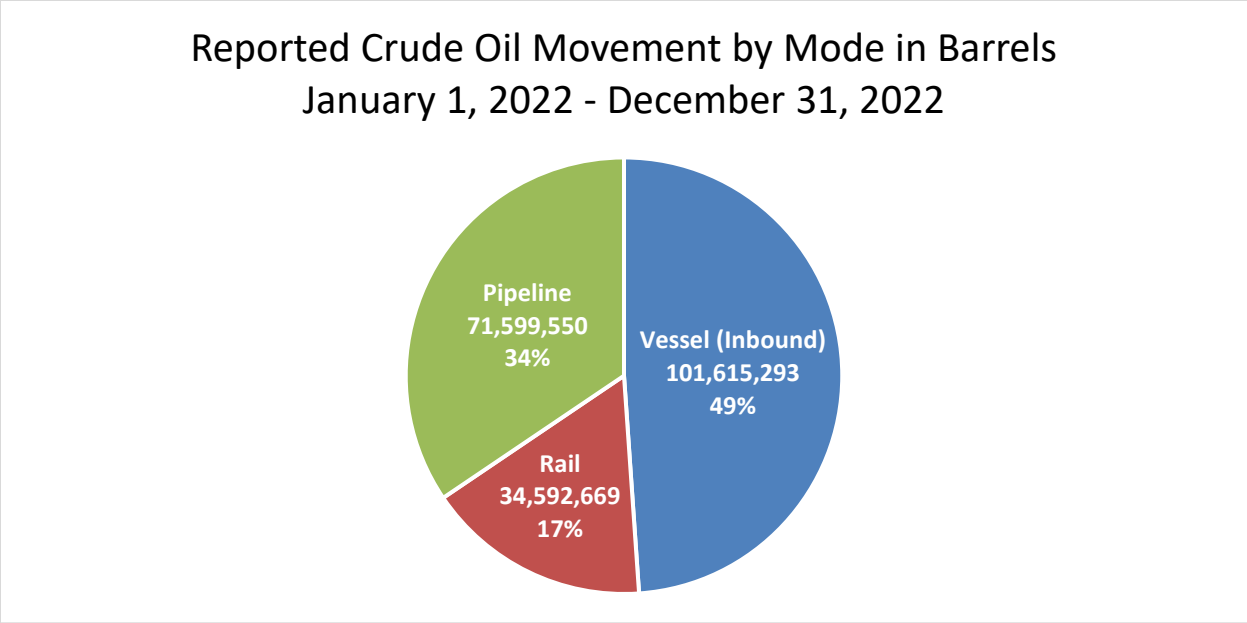
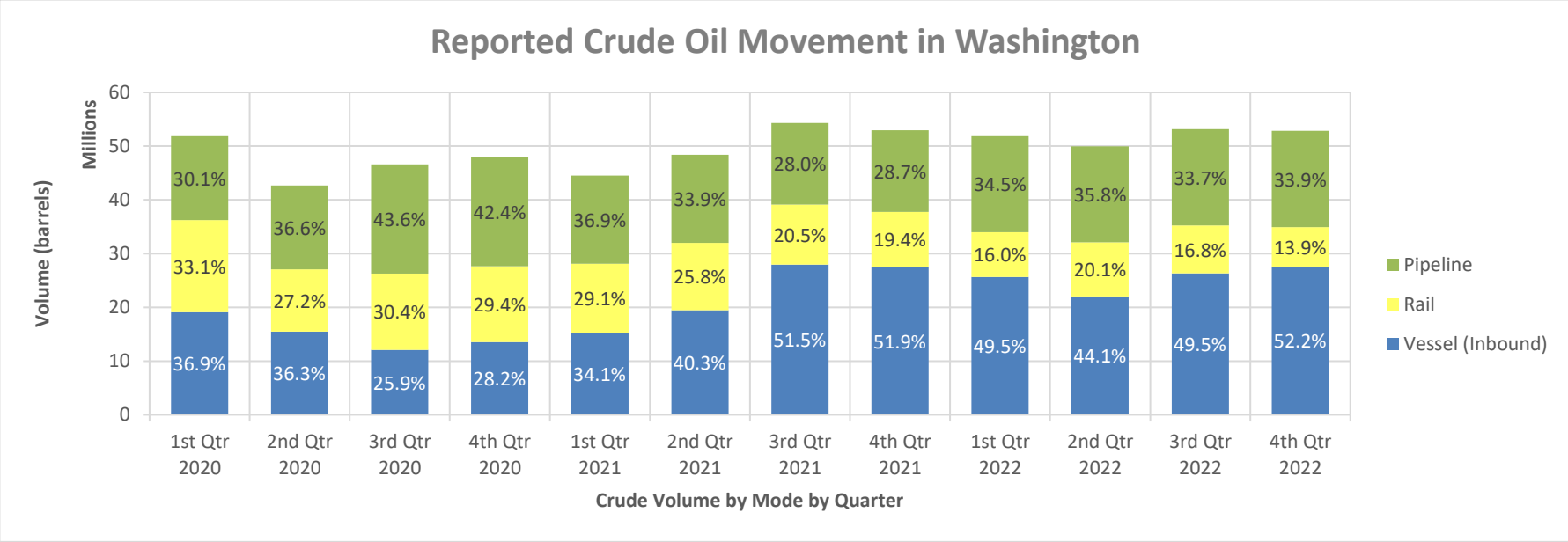


Figure 3: 12-month crude oil movement by mode

Between January 1, 2022 and December 31, 2022, vessels were responsible for 49 percent of reported crude oil movement into the state, rail was responsible for 17 percent, and pipeline for 34 percent.

[5] The most recent biannual notices from pipelines were submitted to Ecology for the period from January 1, 2022 through June 30, 2022. The next biannual notices submitted by pipelines will cover the period from July 1, 2022 through December 31, 2022, and must be submitted to Ecology by January 31, 2023.

Figure 4 shows crude oil movement, by mode, covering the period of January 1, 2020, through December 31, 2022.



Mode	1st Qtr 2020	2nd Qtr 2020	3rd Qtr 2020	4th Qtr 2020	1st Qtr 2021	2nd Qtr 2021	3rd Qtr 2021	4th Qtr 2021	1st Qtr 2022	2nd Qtr 2022	3rd Qtr 2022	4th Qtr 2022
Vessel (Inbound)	36.9%	36.3%	25.9%	28.2%	34.1%	40.3%	51.5%	51.9%	49.5%	44.1%	49.5%	52.2%
Rail	33.1%	27.2%	30.4%	29.4%	29.1%	25.8%	20.5%	19.4%	16.0%	20.1%	16.8%	13.9%
Pipeline	30.1%	36.6%	43.6%	42.4%	36.9%	33.9%	28.0%	28.7%	34.5%	35.8%	33.7%	33.9%

**Note*: *The most recent biannual notices from pipelines were submitted to Ecology for the period from January 1, 2022, through June 30, 2022. For more recent quarters, Ecology estimated crude oil movement by pipeline for the period based on data provided in that previous biannual notice.*

Figure 4: Quarterly crude oil movement by mode, January 2020 – December 2022

Ecology will continue to receive information about crude oil movement and use the data to summarize changes over time.

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Appendix A – Washington Railroad Routes

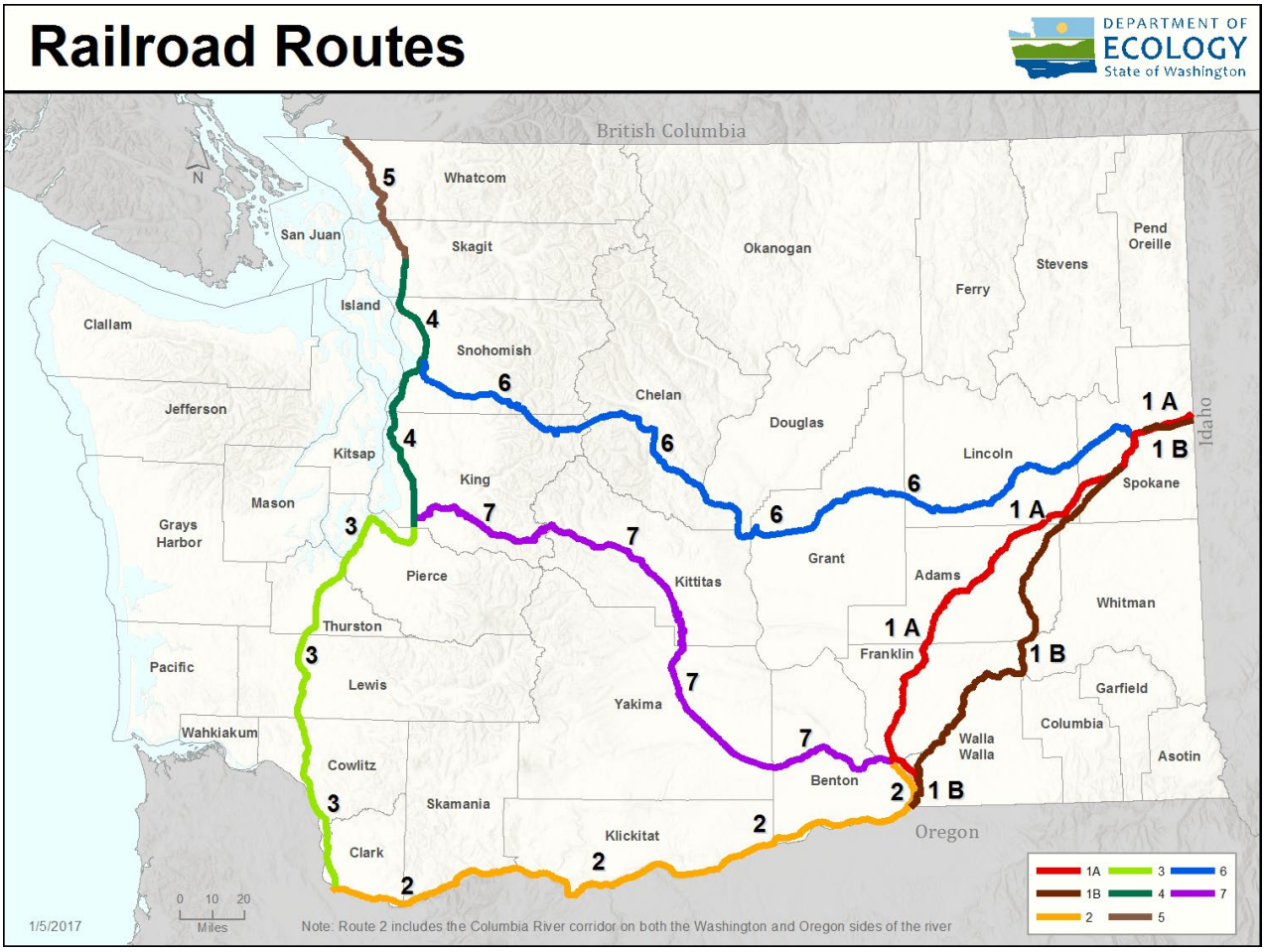

Figure 5: Railroad routes in Washington

Appendix B – API Gravity and Crude Oil Types

Information reported by facilities on scheduled crude oil deliveries includes the gravity and sulfur content of the oil. Ecology uses the standard American Petroleum Institute gravity (API gravity) ranges in combination with the sulfur content to define the crude type in the ANT database.

Sulfur content is measured as the percent of sulfur, by weight, of the crude oil. Oil is categorized by its sulfur content as either sweet or sour. Sour crudes contain greater than 0.5% sulfur. Sweet crudes have less than or equal to 0.5% sulfur.

API gravity is the measure of the density of petroleum liquid in relation to the density of water and is used to classify oils as light, medium, heavy, and extra heavy. The lower the API gravity, the more likely it is to sink in water. Crude type by API gravity is shown in the table below.

Table 4: Crude type by API gravity

Crude Type	API Gravity Range
Light Crude	31.2-50 API
Medium Crude	22.3-31.1 API
Heavy Crude	10-22.2 API
Extra Heavy Crude	0-9.9 API