DEPARTMENT OF ECOLOGY
State of Washington

Crude Oil Movement by Rail and Pipeline

Quarterly Report: January 1, 2021 through March 31, 2021

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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 January 1, 2021 through March 31, 2021.

[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 gravity 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 definition 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 January 1, 2021 through March 31, 2021, representing the 1st Quarter of 2021. 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 1st Quarter of 2021 starting at calendar week 1 and ending at calendar week 14.

Table 1: Crude oil movement by rail

Calendar week 1

Week 27 consists of only two days of reported ANT volumes due to the dates of the reporting period.

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3, 4, 5	North Dakota	Light Crude	72,370	106
1B, 2, 3	Alberta	Heavy Crude	63,400	93
5	Saskatchewan	Light Crude	66,925	98
Weekly totals			**202,695**	**297**

Calendar week 2

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Crude	275,488	405
1A, 2, 3, 4	North Dakota	Light Crude	395,280	581
1A, 2, 3, 4, 5	North Dakota	Light Crude	568,063	835
1B, 2, 3	Alberta	Heavy Crude	59,587	87
5	Alberta	Light Crude	65,490	96
5	Saskatchewan	Light Crude	63,887	93
Weekly totals			**1,427,795**	**2,097**

Calendar week 3

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Crude	68,769	101
1A, 2, 3, 4	North Dakota	Light Crude	131,199	192
1A, 2, 3, 4, 5	North Dakota	Light Crude	562,447	827
1B, 2, 3	Alberta	Heavy Crude	121,584	178
5	Alberta	Light Crude	65,836	96
Weekly totals			**949,835**	**1,394**

Calendar week 4

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Crude	277,637	408
1A, 2, 3, 4	North Dakota	Light Crude	65,253	95
1A, 2, 3, 4, 5	North Dakota	Light Crude	712,607	1,047
1B, 2, 3	Alberta	Heavy Crude	63,172	92
Weekly totals			**1,118,669**	**1,642**

Calendar week 5

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Crude	206,456	303
1A, 2, 3, 4	North Dakota	Light Crude	131,982	194
1A, 2, 3, 4, 5	North Dakota	Light Crude	780,220	1,147
1B, 2, 3	Alberta	Heavy Crude	58,154	85
Weekly totals			**1,176,812**	**1,729**

Calendar week 6

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Crude	137,430	202
1A, 2, 3, 4	North Dakota	Light Crude	130,566	192
1A, 2, 3, 4, 5	North Dakota	Light Crude	638,805	939
1B, 2, 3	Alberta	Heavy Crude	117,327	172
Weekly totals			**1,024,128**	**1,505**

Calendar week 7

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Crude	70,530	103
1A, 2, 3, 4	North Dakota	Light Crude	66,108	97
1A, 2, 3, 4, 5	North Dakota	Light Crude	632,183	929
Weekly totals			**768,821**	**1,129**

Calendar week 8

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Crude	135,923	199
1A, 2, 3, 4	North Dakota	Light Crude	194,082	285
1A, 2, 3, 4, 5	North Dakota	Light Crude	422,493	621
1B, 2, 3	Alberta	Heavy Crude	117,921	173
Weekly totals			**870,419**	**1,278**

Calendar week 9

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Crude	70,529	103
1A, 2, 3, 4	North Dakota	Light Crude	60,692	89
1A, 2, 3, 4, 5	North Dakota	Light Crude	561,251	825
Weekly totals			**692,472**	**1,017**

Calendar week 10

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	137,167	201
1A, 2, 3, 4	North Dakota	Light Crude	260,880	383
1A, 2, 3, 4, 5	North Dakota	Light Crude	207,468	305
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	347,777	511
1B, 2, 3	Alberta	Heavy Sour Crude	57,876	85
Weekly totals			**1,011,168**	**1,485**

Calendar week 11

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	208,638	306
1A, 2, 3, 4	North Dakota	Light Sweet Crude	320,861	471
1A, 2, 3, 4, 5	North Dakota	Light Crude	211,747	311
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	282,646	415
1B, 2, 3	Alberta	Heavy Sour Crude	123,570	181
Weekly totals			**1,147,462**	**1,684**

Calendar week 12

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	137,807	202
1A, 2, 3, 4	North Dakota	Light Sweet Crude	123,203	181
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	774,704	1,139
1B, 2, 3	Alberta	Heavy Sour Crude	63,227	92
Weekly totals			**1,098,941**	**1,614**

Calendar week 13

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	139,303	204
1A, 2, 3, 4	North Dakota	Light Sweet Crude	135,887	199
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	352,263	518
1B, 2, 3	Alberta	Heavy Sour Crude	124,412	182
Weekly totals			**751,865**	**1,103**

Calendar week 14
Week 14 consists of only four days of reported ANT volumes due to the dates of the reporting period.

Route Segments	Region of Origin	Crude Type	Volume (bbls)	Est # Cars
1A, 2, 3	North Dakota	Light Sweet Crude	139,597	205
1A, 2, 3, 4	North Dakota	Light Sweet Crude	190,975	280
1A, 2, 3, 4, 5	North Dakota	Light Sweet Crude	355,000	522
Weekly totals			**685,572**	**1,007**

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.*

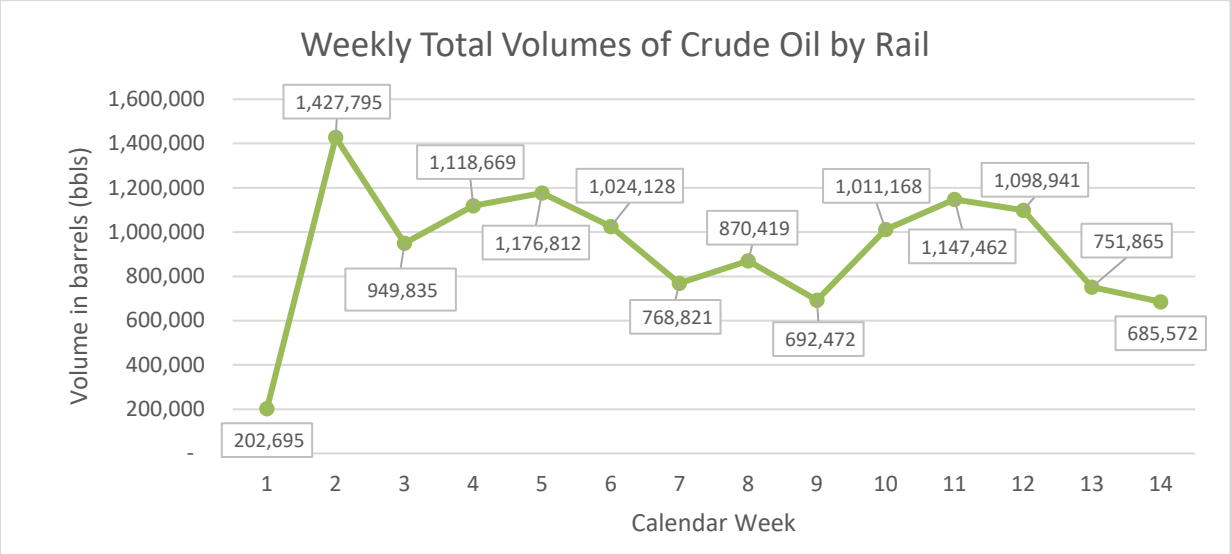
2021 Quarter 1 total volume (bbls): 12,926,654

A summary of the data shows:

- Three regions of origin were reported: North Dakota, Alberta, and Saskatchewan.
- Two types of crude oil were reported: light and heavy. Sulfur content was added to the crude type reporting requirements beginning on March 5th. All subsequent deliveries of light crude were reported as being sweet (less than or equal to 0.5 percent sulfur by weight). All subsequent deliveries of heavy crude were reported as being sour (greater than 0.5 percent sulfur content by weight).
- Routes 1A, 1B, and 2 through 5 were used to transport crude by rail.
- The total volume of crude oil transported by rail during the quarter was 12,926,654 barrels (542,919,468 gallons).
- The average weekly volume of crude oil transported by rail was 1,005,406 barrels (42,227,070 gallons).
- The total number of rail cars moving crude oil by rail was 18,981 cars.
- The average number of rail cars per week moving crude oil by rail was 1,476 cars.
- 92.5 percent of crude oil transported by rail was light crude.
  7.5 percent of crude rail transported by rail was heavy crude.
- For crude oil where sulfur content was reported:
  90.8 percent was sweet crude.
  9.2 percent was sour crude.

- North Dakota was the region of origin for 90.47 percent of crude oil transported by rail.
  Alberta was the region of origin for 8.52 percent of crude oil transported by rail.
  Saskatchewan was the region of origin for 1.01 percent of crude oil transported by rail.
- Crude oil originating in North Dakota had reported vapor pressure ranging from 4.0 to 12.8 pounds per square inch (psi).
  Crude oil originating in Alberta had reported vapor pressure ranging from 7.6 to 10.3 psi.

Figure 1 shows the weekly total volumes of crude transported by rail for each calendar week in the 1st Quarter of 2021.



Note: *Week 1 consists of only 2 days of reported ANT volumes due to the dates of the reporting period. Week 14 consists of only 4 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 1st Quarter of 2021

The lowest weekly volume was 692,472 barrels (29,083,824 gallons) in Week 9. The highest weekly volume of crude transported by rail was 1,427,795 barrels (59,967,390 gallons) in Week 2.

Figure 2 displays crude transported by rail, by route, for the 1st Quarter of 2021.

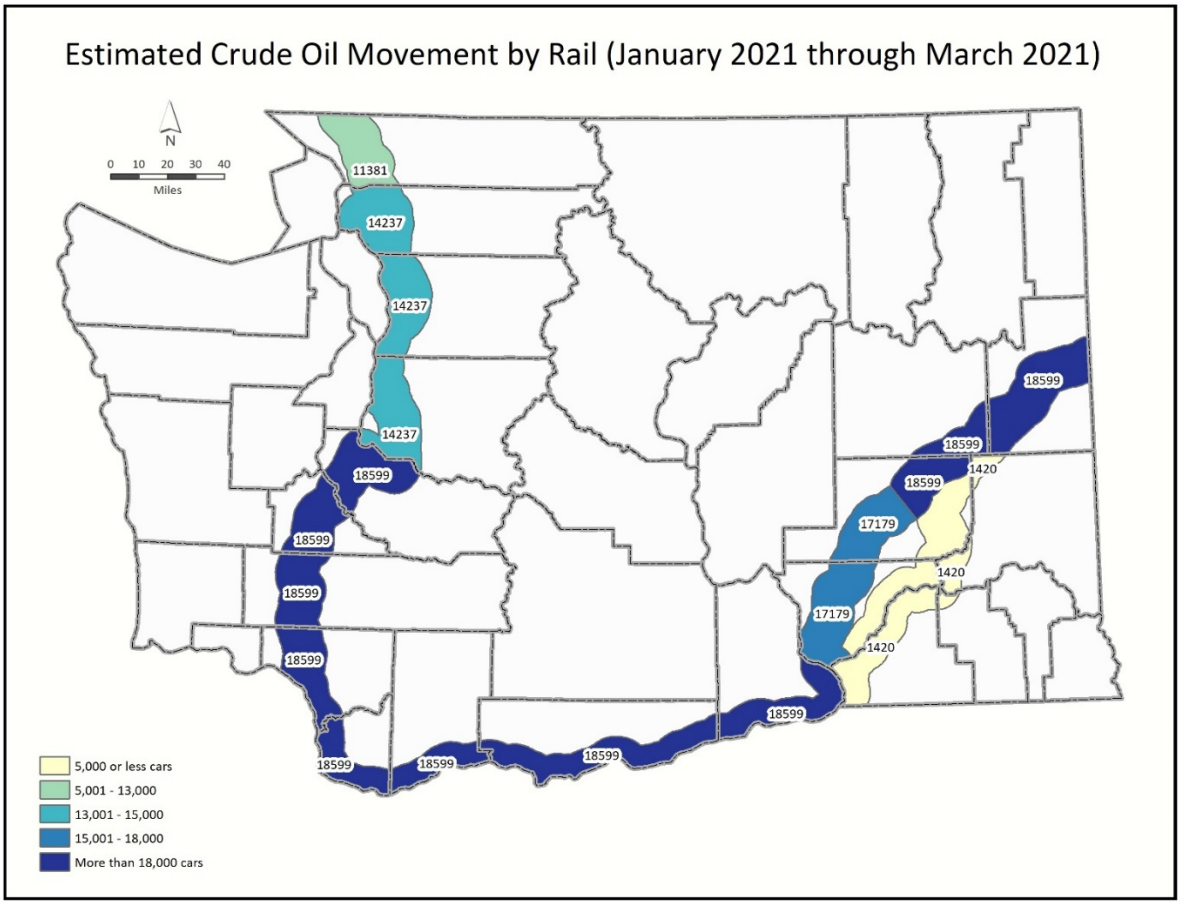


Figure 2: Crude oil movement by route for the 1st Quarter of 2021

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 July 1, 2020 through December 31, 2020. 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 or Province of Origin	Volume (bbls)
July 1, 2020 – December 31, 2020	Alberta	40,665,029

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 January 1, 2022 through June 30, 2022 and must be submitted to Ecology by July 31, 2022.

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 January 1, 2021 through March 31, 2021, zero crude oil spills to the environment by rail or pipeline were reported. In the event there are spills to report in the future, 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.

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

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 January 1, 2021 through March 31, 2021. 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	15,169,409	637,115,178
Outbound	110,000	4,620,000
Total	**15,279,409**	**641,735,178**

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 37 total vessel transfers of crude oil (inbound or outbound).
- The average volume of crude oil transferred to or from vessels per week was 1,188,398 barrels (49,912,736 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 April 1, 2020 through March 31, 2021.[5]

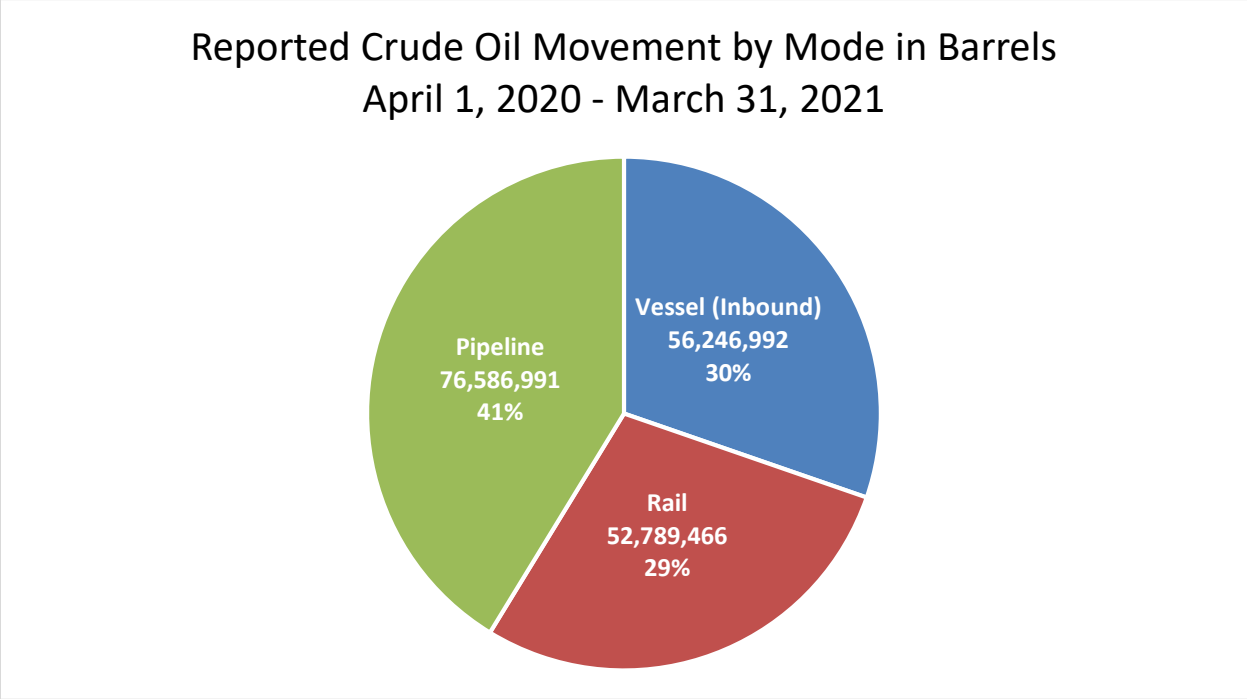
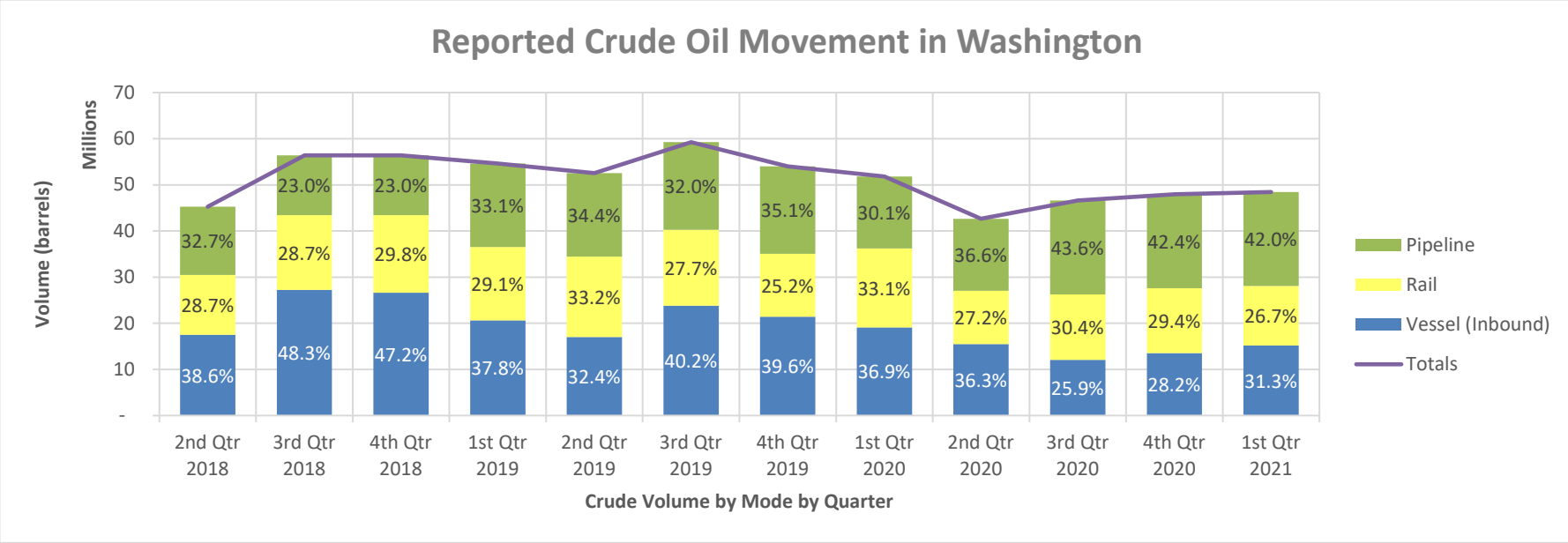


Figure 3: 12-month crude oil movement by mode

Between April 1, 2020 and March 31, 2021, vessels were responsible for 30 percent of reported crude oil movement into the state, rail was responsible for 29 percent, and pipeline for 41 percent.

[5] The most recent biannual notices from pipelines were submitted to Ecology for the period from July 1, 2020 through December 31, 2020. The next biannual notices submitted by pipelines will cover the period from January 1, 2022 through June 30, 2022, and must be submitted to Ecology by July 31, 2022.

Figure 4 shows crude oil movement, by mode, covering the period of April 1, 2018 through March 31, 2021.



Mode	2nd Qtr 2018	3rd Qtr 2018	4th Qtr 2018	1st Qtr 2019	2nd Qtr 2019	3rd Qtr 2019	4th Qtr 2019	1st Qtr 2020	2nd Qtr 2020	3rd Qtr 2020	4th Qtr 2020	1st Qtr 2021
Vessel (Inbound)	38.6%	48.3%	47.2%	37.8%	32.4%	40.2%	39.6%	36.9%	36.3%	25.9%	28.2%	31.3%
Rail	28.7%	28.7%	29.8%	29.1%	33.2%	27.7%	25.2%	33.1%	27.2%	30.4%	29.4%	26.7%
Pipeline	32.7%	23.0%	23.0%	33.1%	34.4%	32.0%	35.1%	30.1%	36.6%	43.6%	42.4%	42.0%

**Note*: *The most recent biannual notices from pipelines were submitted to Ecology for the period from July 1, 2020, through December 31, 2020. 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, April 2018 – March 2021

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

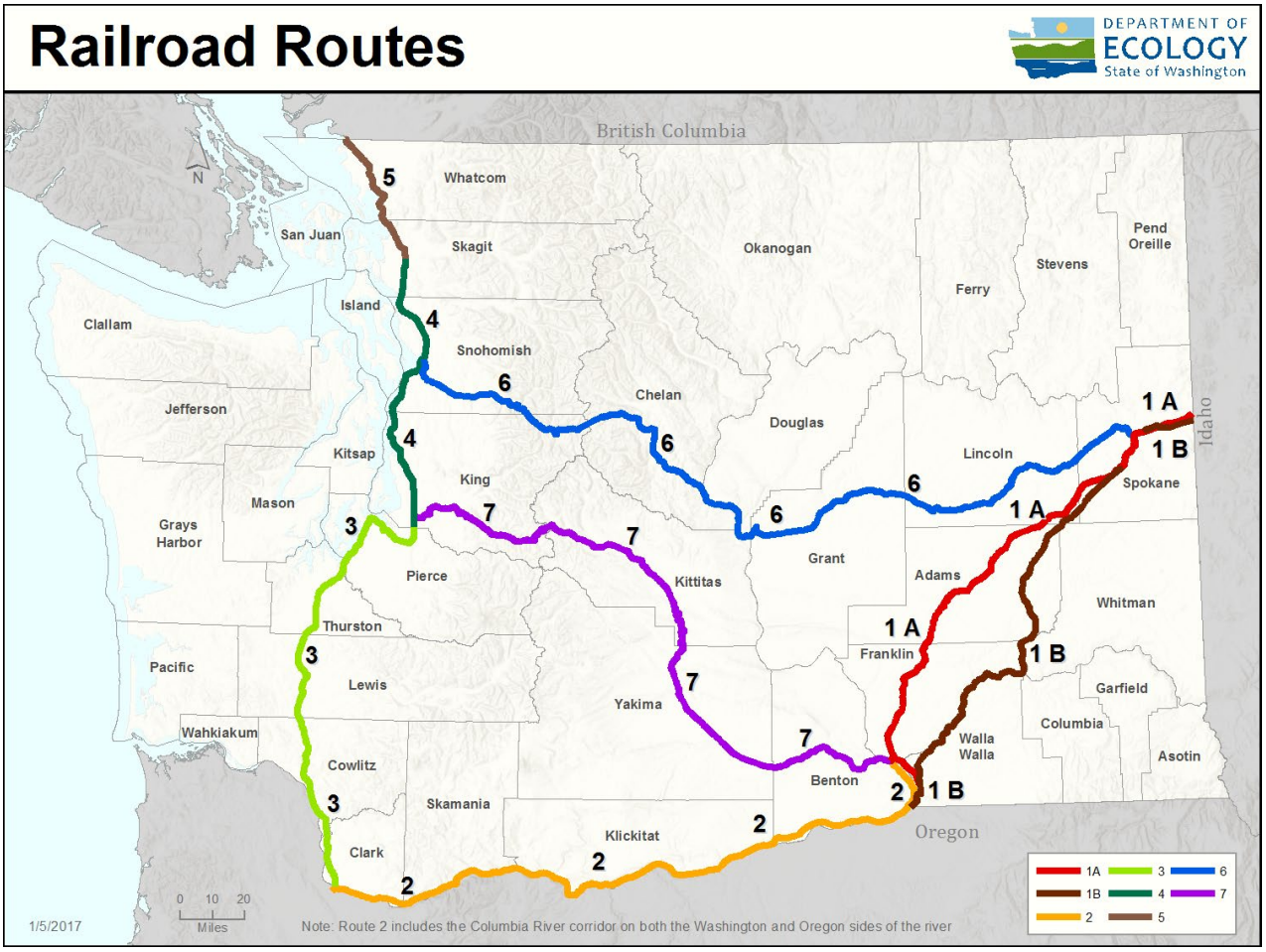

Figure 5: Railroad routes in Washington

Appendix B – API Gravity, Sulfur Content, 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