TIDEWATER
TRANSPORTATION & TERMINALS

TIDEWATER TERMINAL COMANY

SAFE AND EFFECTIVE THRESHOLD DETERMINATION REPORT

For:

Tidewater Terminal Company
Snake River Terminal
671 Tank Farm Rd.
Pasco, WA 99301

Tidewater Terminal Company
Tidewater Industrial Center
6305 NW Old Lower River Rd.
Vancouver, WA 98660

Northwest Terminal
2900 Sacajawea Park Rd.
Pasco, WA 99301

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1.0 INTRODUCTION AND SCOPE

Tidewater conducts over-the-water petroleum transfers at three locations subject to WAC 173-180 in Pasco, Washington and Vancouver, Washington. Transfers consist of loading and unloading petroleum tank barges, tug fueling, and tug lube oil transfers. The safety and environmental conditions for each location have been analyzed and we have determined one set of safe and effective threshold values that will be used by Tidewater for all locations. Our personnel conduct transfers at multiple locations so having one set of safe and effective threshold values is intended to avoid confusion and mistakes. This Safe and Effective Threshold Determination report applies to the following locations:

Tidewater Terminal Company Snake River Terminal 671 Tank Farm Rd. Pasco, WA 99301	Tidewater Terminal Company Tidewater Industrial Center 6305 NW Old Lower River Rd. Vancouver, WA 98660	Northwest Terminal 2900 Sacajawea Park Rd. Pasco, WA 99301

2.0 SUMMARY OF SAFE AND EFFECTIVE THRESHOLD VALUES

The following threshold values are used by Tidewater's Person-in-Charge (PIC) to determine if it is safe and effective to pre-boom petroleum transfers. If the PIC determines that pre-booming is not safe or effective, he/she will contact either the Terminals Operations Coordinator or Dispatch who will then document the circumstances supporting the decision to not pre-boom in the Washington Department of Ecology's online transfer notification system (https://secureaccess.wa.gov/). The PIC will ensure that the alternative measures required in WAC 173-180-221 and 173-180-222 are in place.

Tidewater personnel will not pre-boom the transfer if ANY of the following conditions exist:

- Transferring petroleum products that have a flash point ≤ 100°F (i.e., gasoline, ethanol, etc.)
- Current in excess of 0.7 knots
- Air temperature of ≤ 32°F
- Water temperature of ≤ 40 °F
- Waves with whitecaps in the deployment area
- Waves in excess of one foot in the deployment area
- Sustained wind speeds greater than 20 mph
- Wind gusts in excess of 25 mph
- Presence of hazardous debris in or near the deployment area
- Any other conditions that in the judgment of the PIC presents a safety hazard to personnel deploying the boom

3.0 SUPPORTING INFORMATION

3.1 Personnel Safety

The safety of personnel is the highest priority when determining whether or not to pre-boom a barge transfer. The PIC has the ultimate responsibility and authority to determine if it is safe for personnel to deploy boom. The PIC may determine that, even though the environmental threshold values are not exceeded, there are other factors that put the safety of personnel at risk. Conditions that may compromise personnel safety include, but are not limited to:

- Presence of floating or partially submerged debris in or near the deployment area
- Icy conditions
- Heavy fog, rain, or other conditions that reduce visibility to unsafe levels
- Air temperature of ≤ 32°F due to the risk of cold-related illnesses (i.e., hypothermia, frostbite, etc.) if an employee were to get wet.
- Water temperature of ≤ 40 °F due to the risk of cold-related illnesses (i.e., hypothermia, frostbite, etc.) if an employee were to fall overboard.
- High wind speed that effects the operation of the boom deployment vessel (e.g., sustained wind speeds greater than 20 mph).
- High, choppy waves that affect the safe operation of the boom deployment vessel.

NOTE: Safe threshold values for operation of the boom deployment vessel (i.e., wind, waves, etc.) have been established based on the recommendations of our terminal and vessel personnel who have extensive experience operating small watercraft on the Columbia and Snake Rivers.

3.2 Environmental Conditions

3.2.1 Sea State Values

Pasco

The Snake River Terminal (SRT) and Northwest Terminal (NWT) located in Pasco, Washington are not subject to tidal influences. The river level is controlled by the Ice Harbor Dam located approximately 7 miles upriver on the Snake River and the McNary Dam located approximately 34 miles downriver on the Columbia River. Daily dam discharge and elevation data for 2011 – 2015 were obtained from the *U.S. Army Corp of Engineers, Northwest Division, Dataquery* tool. Monthly average values are presented in the table below. Note that the outflow discharge and tailwater elevation of the Ice Harbor Dam increase during the spring months.

Month	Ice Harbor Dam		McNary Dam	
	Average Outflow Discharge (KCFS)	Average Tailwater Elevation (ft.)	Average Inflow Discharge (KCFS)	Average Forebay Elevation (FT)
January	31.7	340.7	157	338.8
February	38.7	341.2	159	338.6
March	56.4	342.7	184	338.7
April	84.7	344.1	248	338.8
May	99.7	345.3	300	338.7
June	91.3	344.6	302	338.7
July	51.8	341.6	248	338.9
August	28.7	339.8	175	339.1
September	22.5	340.0	103	339.1
October	20.9	339.7	99	338.9
November	20.6	339.6	118	338.8
December	24.1	339.9	132	338.7

Ice Harbor: http://www.nwd-wc.usace.army.mil/cgi-bin/dataquery.pl?k=id:IHR, McNary: http://www.nwd-wc.usace.army.mil/cgi-bin/dataquery.pl?k=id:MCN

Vancouver

The Tidewater Terminal Company site in Vancouver, Washington is located at river mile 102 on the Columbia River and is tidally influenced. The tides are semidiurnal, meaning there are two highs (high

and high-high) and two lows (low, and low-low). Daily tidal water level values for 2011 – 2015 were obtained from the *NOAA Tides & Currents website (http://www.tidesandcurrents.noaa.gov).* A tide gauge is located at the Port of Vancouver, approximately 2.5 miles upstream from the Tidewater Terminal Company site. Monthly average values are presented in the table below. Note that the river level typically fluctuates between 1 to 2 feet during tidal cycles.

Month	Average Daily River Height (feet, Columbia River Datum)			
	Low-Low Water	***Low Water***	***High Water***	***High-High Water***
January	3.7	4.1	4.9	5.6
February	3.4	3.7	4.5	5.4
March	4.6	4.7	5.5	6.2
April	6.0	6.1	6.7	7.3
May	6.7	6.4	7.0	7.9
June	5.8	5.7	6.0	7.6
July	4.0	4.2	5.0	6.1
August	1.3	1.7	3.1	4.2
September	-0.2	0.1	2.3	3.2
October	0.0	0.4	2.6	3.2
November	1.7	2.0	3.4	4.2
December	3.6	4.0	4.9	5.7

http://www.tidesandcurrents.noaa.gov/waterlevels.html?id=9440083

3.2.2 Water Current Velocity

Significant daily and seasonal variations in current flow conditions can be observed in Pasco and Vancouver. River current can fluctuate because of water being released from the dams along the Snake and Columbia River systems and because of the tidal influence from the mouth of the Columbia River to Bonneville Dam. Releases from the dams are controlled by the Army Corps of Engineers for seasonal changes, fish viability and electrical power generation demands. Historical water current/flow could not be located for the Pasco or Vancouver areas; it is not monitored by NOAA, the USGS, or any other publicly available data sources that could be located. The velocity descriptions below are based on general observation and local knowledge.

Pasco

The surface water velocity in the Snake River at Pasco is variable and dependent on wind in river level. The average surface water velocity is approximately 1 knot. The velocity in at late summer/early fall can be less than 0.5 knots and can exceed 2 knots during spring runoff.

Vancouver

The average surface water velocity for the lower Columbia River at Vancouver is 1-1.5 knots downstream. The velocity at low summer/fall flow is 0.5 knots upstream on an incoming high tide and 1.0 knots downstream on an outgoing low tide. During spring flows and late fall/early winter rain velocity may exceed 5 knots.

Current Velocity Determination

The current speed at the time of transfer is determined by the barge tankerman. Each barge has measurements marked on the deck. A floating object is placed in the water and then timed between the

deck marks. This provides a feet per second measurement which is then converted to knots to determine current velocity.

3.2.3 Weather Conditions

Historic weather data for Pasco and Vancouver from 2011 – 2015 was obtained from the *Weather Underground website (www.wundergound.com)*. The Pasco weather station (at the Tri-Cities Airport) is located approximately 5 miles from the Pasco sites and the Vancouver weather station (at the Pearson Airport) is located approximately 4.5 miles upriver from the Vancouver site. Monthly data summaries are provided in the tables below.

Prior to each transfer Tidewater utilizes real-time weather monitoring equipment to make the safe and effective determination at each location. This equipment is located at the shoreline at each facility. The equipment provides the following information: temperature, humidity, barometric pressure, wind, rainfall, dew point, wind-chill, and heat index data. The wind sensor provides information on wind speed, gusts, and direction. The PIC will verify current weather conditions using the weather monitoring equipment and compare them to the established safe and effective thresholds to determine whether or not to pre-boom. The established safe and effective thresholds are guidelines. The ultimate decision whether or not to pre-boom rests with the Tidewater PIC.

Pasco

Month	Daily Wind Speed (mph)			Average Wind Direction	Daily Temperature (°F)			Daily Precip.(in.)	
	Average	*Max*	*Peak Gust*		*Min*	*Average*	*Max*	*Average*	*Max*
January	5.2	49	60	WSW	8	35	64	0.024	0.37
February	6.8	40	52	SW	6	39	67	0.018	0.30
March	7.5	40	52	SW	15	47	79	0.028	0.35
April	7.5	52	62	SW	22	52	91	0.019	0.41
May	6.7	40	48	SW	28	61	97	0.029	0.57
June	6.6	36	47	SW	39	69	111	0.033	1.10
July	5.4	43	52	SW	44	76	109	0.005	0.50
August	5.3	49	63	WSW	43	75	105	0.008	0.45
September	4.8	40	51	WSW	33	65	97	0.009	0.32
October	4.9	41	55	SW	22	54	88	0.020	0.24
November	5.6	41	53	SW	8	40	71	0.024	0.35
December	5.4	54	68	SW	2	34	69	0.034	0.62

http://www.wunderground.com/history/airport/KPSC/2016/01/25/DailyHistory.html?req_city=Pasco&req_state=WA&reqdb.zip=99301&reqdb.magic=1&reqdb.wmo=99999

Vancouver

Month	Daily Wind Speed (mph)			Average Wind Direction	Daily Temperature (°F)			Daily Precip.(in.)	
	Average	*Max*	*Peak Gust*		*Min*	*Average*	*Max*	*Average*	*Max*
January	3.5	28	38	S	19	41	60	0.14	1.73
February	4.5	26	42	S	17	43	65	0.13	1.46
March	4.7	31	55	S	25	48	78	0.18	1.34
April	4.2	25	36	SW	29	52	83	0.10	0.78
May	4.3	23	37	WSW	35	59	92	0.08	0.78
June	4.4	20	27	WSW	43	64	96	0.05	0.66
July	5.0	20	36	WNW	0	69	103	0.02	0.66
August	4.5	23	36	WNW	47	71	103	0.01	0.27
September	3.9	28	38	WSW	40	65	96	0.05	1.07

October	3.4	28	43	SSW	31	57	85	0.11	1.70
November	4.1	32	48	S	19	46	68	0.16	2.37
December	4.3	32	60	SSE	9	41	64	0.24	2.39

http://www.wunderground.com/history/airport/KVUO/2016/01/11/DailyHistory.html?req_city=Pearson&req_state=WA&reqdb.zip=98660&reqdb.magic=3&reqdb.wmo=99999

The following tables can be used by the PIC to determine wave height conditions using wind direction and wind speed at the time of the transfer. This data was generated using the USGS Fetch- and Depth-Limited Wave Calculations (http://woodshole.er.usgs.gov/staffpages/csherwood/sedx_equations/RunSPMWave.html).

Pasco - Tidewater Terminal Company Snake River Terminal

Wind Direction SW (February-July, October-December)									
Wind Velocity		**Fetch**		**Water Depth**		**Wave Height**			**Wave Period**
mph	***m/s***	***ft***	***km***	***ft***	***m***	***ft***	***inches***	***m***	***sec***
10	4.47	5,500	1.68	25	7.62	0.30	3.65	0.09	1.16
20	8.94	5,500	1.68	25	7.62	0.71	8.55	0.22	1.57
25	11.18	5,500	1.68	25	7.62	0.94	11.22	0.29	1.72
30	13.41	5,500	1.68	25	7.62	1.17	14.00	0.36	1.86
35	15.65	5,500	1.68	25	7.62	1.41	16.87	0.43	1.98
40	17.88	5,500	1.68	25	7.62	1.65	19.81	0.50	2.09
45	20.12	5,500	1.68	25	7.62	1.90	22.82	0.58	2.19
50	22.35	5,500	1.68	25	7.62	2.16	25.88	0.66	2.29
55	24.59	5,500	1.68	25	7.62	2.42	28.99	0.74	2.38

*Wind direction WSW (January, August-September), blows overland or parallel to the shoreline

Pasco - Northwest Terminal

Wind Direction SW (February-July, October-December)									
Wind Velocity		**Fetch**		**Water Depth**		**Wave Height**			**Wave Period**
mph	***m/s***	***ft***	***km***	***ft***	***m***	***ft***	***inches***	***m***	***sec***
10	4.47	250	0.076	30	9.14	0.07	0.78	0.020	0.43
20	8.94	250	0.076	30	9.14	0.15	1.84	0.047	0.58
25	11.18	250	0.076	30	9.14	0.20	2.42	0.062	0.63
30	13.41	250	0.076	30	9.14	0.25	3.03	0.077	0.68
35	15.65	250	0.076	30	9.14	0.31	3.67	0.093	0.73
40	17.88	250	0.076	30	9.14	0.36	4.32	0.11	0.77
45	20.12	250	0.076	30	9.14	0.42	4.99	0.13	0.80
50	22.35	250	0.076	30	9.14	0.47	5.68	0.14	0.84
55	24.59	250	0.076	30	9.14	0.53	6.39	0.16	0.87

*Wind direction WSW (January, August-September), blows overland or parallel to the shoreline

Vancouver

Wind Direction S (January-March, November)									
Wind Velocity		**Fetch**		**Water Depth**		**Wave Height**			**Wave Period**
mph	***m/s***	***ft***	***km***	***ft***	***m***	***ft***	***inches***	***m***	***sec***
10	4.47	2,140	0.65	50	15.24	0.25	3.06	0.08	1.04
20	8.94	2,140	0.65	50	15.24	0.60	7.19	0.18	1.41
25	11.18	2,140	0.65	50	15.24	0.79	9.45	0.24	1.55

30	13.41	2,140	0.65	50	15.24	0.98	11.81	0.30	1.67
35	15.65	2,140	0.65	50	15.24	1.19	14.29	0.36	1.78
Wind Direction SW (April)									
Wind Velocity		**Fetch**		**Water Depth**		**Wave Height**			**Wave Period**
mph	***m/s***	***ft***	***km***	***ft***	***m***	***ft***	***inches***	***m***	***sec***
10	4.47	3,025	0.92	65	19.81	0.23	2.72	0.07	0.97
20	8.94	3,025	0.92	65	19.81	0.53	6.40	0.16	1.31
25	11.18	3,025	0.92	65	19.81	0.70	8.42	0.21	1.44
30	13.41	3,025	0.92	65	19.81	0.88	10.53	0.27	1.55
Wind Direction WSW (May-June, September)									
Wind Velocity		**Fetch**		**Water Depth**		**Wave Height**			**Wave Period**
mph	***m/s***	***ft***	***km***	***ft***	***m***	***ft***	***inches***	***m***	***sec***
10	4.47	3,575	1.09	65	19.81	0.25	2.95	0.08	1.02
20	8.94	3,575	1.09	65	19.81	0.58	6.96	0.18	1.38
25	11.18	3,575	1.09	65	19.81	0.76	9.15	0.23	1.52
30	13.41	3,575	1.09	65	19.81	0.95	11.45	0.29	1.64
Wind Direction WNW (July - August)									
Wind Velocity		**Fetch**		**Water Depth**		**Wave Height**			**Wave Period**
mph	***m/s***	***ft***	***km***	***ft***	***m***	***ft***	***inches***	***m***	***sec***
10	4.47	7,115	2.17	55	16.76	0.35	4.14	0.11	1.26
20	8.94	7,115	2.17	55	16.76	0.82	9.78	0.25	1.72
25	11.18	7,115	2.17	55	16.76	1.07	12.86	0.33	1.89
30	13.41	7,115	2.17	55	16.76	1.34	16.08	0.41	2.04
Wind Direction SSW (October)									
Wind Velocity		**Fetch**		**Water Depth**		**Wave Height**			**Wave Period**
mph	***m/s***	***ft***	***km***	***ft***	***m***	***ft***	***inches***	***m***	***sec***
10	4.47	3,450	1.05	45	13.72	0.24	2.90	0.07	1.01
20	8.94	3,450	1.05	45	13.72	0.57	6.83	0.17	1.36
25	11.18	3,450	1.05	45	13.72	0.75	8.98	0.23	1.50
30	13.41	3,450	1.05	45	13.72	0.94	11.22	0.29	1.61
35	15.65	3,450	1.05	45	13.72	1.13	13.56	0.34	1.72
Wind Direction SSE (December)									
Wind Velocity		**Fetch**		**Water Depth**		**Wave Height**			**Wave Period**
mph	***m/s***	***ft***	***km***	***ft***	***m***	***ft***	***inches***	***m***	***sec***
10	4.47	3,360	1.02	50	15.24	0.24	2.86	0.07	1.00
20	8.94	3,360	1.02	50	15.24	0.56	6.74	0.17	1.35
25	11.18	3,360	1.02	50	15.24	0.74	8.86	0.23	1.48
30	13.41	3,360	1.02	50	15.24	0.92	11.08	0.28	1.60
35	15.65	3,360	1.02	50	15.24	1.12	13.39	0.34	1.71
40	17.88	3,360	1.02	50	15.24	1.31	15.77	0.40	1.80

3.3 Other Conditions

Pasco

Commercial vessel traffic in the immediate vicinity of the Pasco facility during an oil transfer is minimal and will typically not restrict the ability to deploy boom. It is possible that a passing commercial vessel (i.e., tug and barge) may create a wake that briefly impacts the safety of pre-booming operations.

Recreational activities (i.e., fishing, water sports, etc.) are common in the immediate vicinity of the dock but should not present a limitation to oil transfer operations and the deployment of boom. Larger recreational vessels passing by the dock may create a wake that briefly impacts the safety of pre-booming operations.

Vancouver

Commercial vessel traffic in the immediate vicinity of the Vancouver facility is more common but will not typically restrict the ability to deploy boom. It is possible that a passing commercial vessel (i.e., freighters, tugs, tug/barge combinations, etc.) may create a wake that briefly impacts the safety of pre-booming operations.

Recreational activities (i.e., fishing, water sports, etc.) are uncommon in the immediate vicinity of the dock and should not present a limitation to oil transfer operations and the deployment of boom. Larger recreational vessels passing by the dock may create a wake that briefly impacts the safety of pre-booming operations.

Man-made structures, including a dock and dry dock, offer some protection from environmental conditions at the transfer site.

3.4 Efficacy of Oil Boom Under Environmental Conditions

For pre-booming operations at all facilities Tidewater utilizes 19” (7” float with a 12” skirt) non-absorbent standard foam-filled boom designated by the manufacturer for use in rivers with moderate current. The same type of boom is used at each facility (SRT, Tidewater Industrial Center (TIC), and NWT). High current speeds can cause hydraulic failure on the boom, commonly referred to as entrainment. This renders the containment boom ineffective due to the oil product going under the boom skirt. According to guidance provided by the boom manufacturer, containment boom in general at a 90-degree angle to the current will begin to fail at 0.7 knots. Entrainment can occur as an eddy is generated when the water hits the boom and then it can pull the oil under the skirt of the boom.

Tidewater has determined that it is neither safe nor effective to pre-boom transfers if the current speed is 0.7 knots or greater.

4.0 ALTERNATIVE MEASURES

If the Tidewater PIC determines that it is not safe or effective to pre-boom a transfer, he/she will ensure that the following alternative measures are in place prior to conducting the transfer:

1. Access to boom four times the length of the largest vessel involved in the transfer, or 2000 feet, whichever is less.
    a. The largest vessel that may be involved in a transfer at all locations is one of our New Series barges that measures 284 feet long. Each barge carries 1200 feet of containment boom. Each of our tugboats carries a Barrel-of-Boom that holds 150 feet of containment boom.
    b. Tidewater’s Pasco facility has a mobile response trailer containing 600 feet of boom and a shipping container that currently holds 1200 feet.
    c. Tidewater’s Vancouver facility has two response trailers containing a total of 1200 feet of boom and two shipping containers with a combined 3000 feet of boom.

   d. Northwest Terminal's facility has 2000 feet of boom onsite.
2. Containers suitable for holding the recovered oil and oily water.
   a. Tidewater's Pasco facility has a 29 barrel (bbl) portable storage tank in the response trailer and an 18,000 bbl oily water storage barge onsite at all times dedicated solely to emergency spill response. Tidewater also has the ability to transfer oily water into the above-ground storage tanks located at the facility.
   b. Tidewater's Vancouver facility has two of the 29 bbl portable storage tanks in its trailers and a 23,000 bbl oily water storage barge onsite for emergencies. The Vancouver facility also has above-ground storage tanks available to receive oil and oily water if necessary.
3. Non-sparking hand scoops, shovels, and buckets.
   a. There are sufficient response tools and supplies at all three locations.
4. Enough sorbent material and storage capacity for a seven-barrel oil spill appropriate for use on water and land.
   a. There are sufficient sorbent materials at each location for a seven-barrel oil spill. Sorbent material is available in response trailers, containers, spill kits, and in facility storage spaces. Spill response resources are available use on land and water.
5. Each response trailer is equipped with a lighted oil spill beacon that is used to track spill trajectory at night or in low visibility conditions.
6. Each facility has sufficient containment boom onsite at all times to completely surround the vessel and facility/terminal dock within one hour in the event of a spill.
7. Tidewater can provide additional boom four times the length of the largest vessel involved in the transfer, or two thousand feet, whichever is less, for containment, protection, and recovery within two hours of a spill. Tidewater satisfies this requirement through a combination of nearby facility and vessel spill response resources.
8. Each Tidewater response trailer is equipped with a skimming system that is rated at 480 bbls of estimated daily recovery capacity. The Northwest Terminal facility has several portable skimmers onsite that range from 102 bbls – 1234 bbls of estimated daily recovery capacity.
9. Each Tidewater facility is equipped with boats available to place boom for pre-booming operations as well as emergency response.
   a. SRT has three boats available. A 15-foot boat that is used primary for pre-booming and two emergency spill response boats (one 15-foot boat and one 24-foot boat).
   b. TIC has five boats available. A 22' boat used for pre-booming and four additional emergency spill response boats (two 14-feet boats and two 28-feet boats).Pre-booming at NWT is done by hand without the use of a boat.