May 28, 2015

Rod Schmall
Washington Department of Ecology
2108 Grand Boulevard
Vancouver, Washington 98661-4624

Re: March 2015 Groundwater Monitoring Results and Groundwater Investigation Work Plan
NuStar Vancouver Annex Terminal
Vancouver, Washington
1569-05

Dear Mr. Schmall:

Apex Companies LLC. (Apex) has prepared this March 2015 Groundwater Monitoring Results and Groundwater Investigation Work Plan letter for the NuStar Terminals Operations Partnership, L.P. (NuStar) Annex Terminal located at 5420 NW Fruit Valley Road, Vancouver, Washington (the Site; Figure 1). On July 29, 2014, the Washington State Department of Ecology (Ecology) submitted the Project Coordinator's Decision (the Decision) to NuStar, documenting steps for additional investigation and monitoring to support the Feasibility Study of the Site. One of the provisions of the Decision was that Site groundwater monitoring wells would be sampled for four quarters, with results being submitted to Ecology in quarterly letter reports. This second quarterly letter summarizes the results of the March 2015 groundwater monitoring event. Additionally, in an April 16, 2015 meeting, NuStar agreed to Ecology's request for further investigation of groundwater in the vicinity of monitoring wells MW-5 and MW-6 in the western portion of the Site. A work plan for additional groundwater investigation is also included in this letter.

GROUNDWATER MONITORING

On March 25, 2015, Apex conducted groundwater monitoring of Site monitoring wells MW-1 through MW-6, including gauging depth to groundwater and groundwater sampling and analysis; locations of the wells are shown on Figure 2. Measurements of the depth to groundwater were collected from the wells prior to groundwater sampling and were measured to the nearest 0.01 foot using an electronic probe. Prior to groundwater sampling, wells were purged with a peristaltic pump while water quality parameters (pH, temperature, and specific conductance) were recorded. Purging was considered complete when the field parameters stabilized. Following purging, groundwater samples were collected using a peristaltic pump and dedicated tubing. Field notes are included in Attachment A.

The groundwater samples were analyzed for gasoline-range and diesel-range total petroleum hydrocarbons (TPHg and TPHd, respectively; with silica gel cleanup); benzene, toluene, ethylbenzene, and total xylenes (BTEX); and methyl tert-butyl ether (MTBE) by Pace Analytical of Davis, California. Laboratory reports and a quality assurance/quality control (QA/QC) review are included in Attachment B.

Groundwater Elevations

Depth to groundwater ranged between 15.25 and 28.76 feet, corresponding to groundwater elevations ranging from 11.39 to 11.41 feet above mean sea level (MSL). Groundwater elevations were within historical levels that have ranged from approximately 7.5 feet to 12 feet above MSL (Table 1). Monitoring wells MW-5 and MW-6 have not been surveyed, so well elevation, and therefore groundwater elevation information, for these wells is not available. The groundwater gradient measured during the March 2015 monitoring event was flat. This is consistent with

historical groundwater potentiometric maps which depict a flat gradient to slight gradient to the south (AMEC, 2002; SECOR, 2003; and Ash Creek, 2009, 2010). Groundwater elevation data are shown on Figure 3.

Analytical Results

Analytical results from the March 2015 groundwater monitoring event are summarized in Table 2 and on Figures 4 and 5. MTBE was not detected in groundwater samples from wells MW-1 through MW-6. MTBE historically exceeded the MTCA Method A cleanup level in well MW-2; however, it has rapidly naturally attenuated and has been below cleanup levels for two consecutive quarters.

TPHd and oil-range total petroleum hydrocarbons (TPHo) were at or below detection limits in the groundwater samples from wells MW-1 through MW-6. TPHg was not detected in the groundwater samples from wells MW-1 through MW-4. TPHg in wells MW-5 and MW-6 were detected at concentrations of 18.1 and 13.7 milligrams per liter [mg/L], respectively, which exceeds the MTCA Method A cleanup level for TPHg of 0.800 mg/L.

BTEX results were non-detect in the groundwater samples from wells MW-1 through MW-4. Benzene was detected at a concentration of 0.516 mg/L in the groundwater sample from MW-6, which exceeds the MTCA Method A cleanup level of 0.005 mg/L. Total xylenes in wells MW-5 and MW-6 were detected at concentrations of 1.45 and 2.26 mg/L, respectively, exceeding the MTCA Method A cleanup level of 1 mg/L and ethylbenzene in well MW-6 exceeded the cleanup level of 0.7 mg/L with a concentration of 1.4 mg/L.

ADDITIONAL GROUNDWATER INVESTIGATION

As previously discussed, a groundwater investigation event will be conducted to evaluate the extent of total petroleum hydrocarbons (TPH) and petroleum-related volatile organic compounds (VOCs) in the vicinity of monitoring wells MW-5 and MW-6. A representative from Apex will oversee the installation of a minimum of eight push-probe borings for the purpose of collecting grab groundwater samples, at the approximate locations shown on Figures 6. The investigation will be conducted in accordance with Apex standard operating procedures (SOPs) for direct-push explorations, included in Attachment C.

Preparatory Activities

Prior to the investigation, the public utility notification center will be contacted and a private utility locator will be contracted to check for the presence of buried utilities or infrastructure in the work area. It should be noted that the presence of buried utilities or infrastructure, or other access issues, may result in the relocation of the proposed borehole locations from those presented on Figure 6. At each probe location, the borehole will be cleared with a hand auger down to 8 feet to verify that no utilities or other buried materials are present in the subsurface.

Field Screening and Sample Collection

Continuous soil samples will be collected during push-probe activities for the purpose of documenting lithologic descriptions and for field screening using a photoionization detector (PID). Up to three groundwater grab samples will be collected from each borehole, in accordance with sampling procedures outlined in the SOP provided in Attachment C.

Depth-to-groundwater levels will be measured in wells MW-5 and MW-6 to determine the water table elevation in the vicinity of Tank #5503 and the Trans Mix tank, respectively. Each probe will be advanced approximately two feet deeper than the center of the water column, as measured in the nearest monitoring well (MW-5 or MW-6). A temporary well with a 4-foot long well screen will be installed in the borehole so that the center of the temporary screen is at the approximate elevation of the central point of the saturated screened interval as measured in the nearest monitoring well. The first (shallowest) groundwater sample in each borehole will be collected at the center

point of the temporary screen. Based on water levels from the last two monitoring events, we estimate the shallowest groundwater sample to be collected from a depth of approximately 20 feet below ground surface (bgs).

PID measurements collected during borehole screening activities will be used to evaluate if additional groundwater grab samples are necessary to delineate the vertical extent of VOCs in groundwater. If PID measurements are elevated in saturated soils in contact with the first encountered groundwater, then a second grab groundwater sample will be collected at the depth at which PID measurements fall below 5 parts per million (ppm). A temporary well with a 4-foot long screen will be inserted into the borehole, with the sample intake point positioned at the target depth where saturated soil has been measured as less than 5 ppm. A third groundwater grab sample will be collected from approximately 10 feet below the second sample location.

If PID measurements from saturated soil associated with first encountered groundwater are less than 5 ppm, then a grab sample will be collected from first encountered groundwater as described above; however, additional deeper grab samples may not be collected for laboratory analysis.

Additional Probe Locations

If field observations indicate the potential presence of fuel-related impacts to groundwater, then NuStar/Apex may decide to advance additional boreholes, presumably in the downgradient direction, to further delineate the horizontal extent of petroleum hydrocarbon impacts. It should be noted that additional delineation to the north or west of the Tanks #5503 and Trans Mix Tank locations will be restricted by the presence of the stormwater ponds and tank farm berms (see Figure 6).

Analytical Program

Grab groundwater samples will be submitted to a Washington accredited laboratory for analysis of the following:

- BTEX and MTBE by U.S. Environmental Protection Agency (EPA) Method 8260B; and
- TPHg by Method NWTPH-Gx and TPHd by Method NWTPH-Dx (with silica gel cleanup).

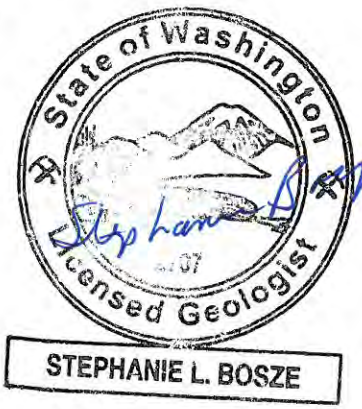
FUTURE WORK

Monitoring wells MW-5 and MW-6 will be surveyed, with elevation results presented in the subsequent results report following the survey event. Monitoring wells MW-1 through MW-6 will be gauged and sampled in June 2015 using the same procedures summarized in the “Scope and Procedures” section, and the analytical results will be provided to Ecology in a quarterly results report within 45 days of receipt of analytical data from the laboratory. The results of the push-probe groundwater investigation will also be included in the next quarterly results report.

After four quarters of groundwater monitoring, the monitoring well and grab groundwater data will be used to support the submittal of a Revised Feasibility Study.

If you have any questions regarding the contents of this letter, please do not hesitate to call either of the undersigned.

Sincerely,



Stephanie Bosze Salisbury, L.G.
Project Geologist

Amanda Spencer
Principal Hydrogeologist

cc: Mr. Aaron Flett, NuStar Terminals Operations Partnership, L.P. (electronic deliverable)
Ms. Renee Robinson, NuStar Energy, L.P. (electronic deliverable)
Mr. Stephan Rosen, NuStar Energy, L.P. (electronic deliverable)

ATTACHMENTS

Table 1 – Groundwater Elevation Data
Table 2 – Analytical Results from Groundwater Monitoring Wells

Figure 1 – Site Location Map
Figure 2 – Site Plan
Figure 3 – Groundwater Elevations – March 2015
Figure 4 – March 2015, TPH Concentrations in Groundwater
Figure 5 – March 2015 BTEX and MTBE Concentrations in Groundwater
Figure 6 – Proposed Borehole Locations

Attachment A – Field Notes
Attachment B – Laboratory Analytical Results and Quality Assurance/Quality Control Review
Attachment C – Apex Standard Operating Procedures for Direct-Push Exploration Procedures

REFERENCES

AMEC, 2002a. *Phase II Environmental Site Assessment*, Cenex Harvest State Cooperatives. May 2002.

Apex Companies, LLC. (Apex), 2012. (*Draft) Feasibility Study*. Vancouver Annex Terminal, Vancouver, Washington, July 12, 2012.

Ash Creek Associates (Ash Creek), 2009. *Remedial Investigation Work Plan*. October 2009.

Ash Creek, 2010. *Remedial Investigation/Risk Assessment Report*. December 29, 2010.

SECOR, 2003. *Results of Phase II Environmental Site Assessment*. June 6, 2003.

Table 1
Groundwater Elevation Data
NuStar Terminals Operations Partnership, L.P. – Annex Terminal
Vancouver, Washington

Well Number	Date of Measurement	Top of Casing Elevation (feet above MSL)[1]	Depth to Water (feet BTOC)	Groundwater Elevation (feet)
MW-1	05/14/02	NS	16.00	NS
	05/25/07	26.66	14.92	11.74
	08/24/07	26.66	18.67	7.99
	11/26/07	26.66	17.91	8.75
	02/27/08	26.66	16.92	9.74
	03/30/10	26.66	17.09	9.57
	09/01/10	26.66	19.19	7.47
	12/16/14	26.66	16.19	10.47
	03/25/15	26.66	15.25	11.41
MW-2	05/14/02	NS	27.46	NS
	05/25/07	38.21	26.46	11.75
	08/24/07	38.21	30.17	8.04
	11/26/07	38.21	29.42	8.79
	02/27/08	38.21	28.50	9.71
	03/30/10	38.21	28.66	9.55
	09/01/10	38.21	30.74	7.47
	12/16/14	38.21	27.77	10.44
	03/25/15	38.21	26.79	11.42
MW-3	05/14/02	NS	28.15	NS
	05/25/07	39.11	27.17	11.94
	08/24/07	39.11	31.04	8.07
	11/06/07	39.11	30.36	8.75
	02/27/08	39.11	28.71	10.40
	03/30/10	39.11	29.55	9.56
	09/01/10	39.11	31.65	7.46
	12/16/14	39.11	28.54	10.57
	03/25/15	39.11	27.72	11.39
MW-4	05/14/02	NS	29.40	NS
	05/25/07	40.17	28.35	11.82
	08/24/07	40.17	32.12	8.05
	11/06/07	40.17	31.40	8.77
	02/27/08	40.17	30.40	9.77
	03/30/10	40.17	30.77	9.40
	09/01/10	40.17	32.62	7.55
	12/16/14	40.17	29.63	10.54
	03/25/15	40.17	28.76	11.41
MW-5	12/16/14	NS	16.60	NS
	03/25/15	NS	15.37	NS
MW-6	12/16/14	NS	16.93	NS
	03/25/15	NS	15.73	NS

Notes:
1. Survey elevations determined by Statewide Land Surveying, October, 2007.
2. feet above MSL = feet above mean sea level.
3. feet BTOC = feet below top of casing.
4. NS = Not surveyed.

Table 2
Analytical Results from Groundwater Monitoring Wells
NuStar Terminals Operations Partnership, L.P. – Annex Terminal
Vancouver, Washington

Well Number	Sample Date	Screened Interval (feet bgs)	Concentrations in mg/L (ppm)																						
			TPHg	TPHd	TPHho	Benzene	Toluene	Ethylbenzene	Xylenes	1,2-Dibromoethane	1,2-Dichloroethane	Ethanol	Tert-Butyl alcohol	Ethyl tert-Butyl Ether (ETBE)	Diisopropyl Ether (DIPE)	Methyl tert-butyl ether (MTBE)	Tert-Amyl Methyl Ether (TAME)	Naphthalene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Isopropyl-benzene	n-Propylbenzene	n-Butyl-benzene	sec-Butyl-benzene	Chloroform	Methanol
MW-1	05/14/02	14.5-24.5	<0.080	0.455 [5]	<0.500	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	--	--	<0.002	--	<0.002	<0.001	<0.0005	<0.002	<0.0005	--	--	--	--
	05/19/03		--	--	--	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001					<0.001		<0.002	<0.001	<0.001	<0.002	<0.001	<0.05	<0.001	<0.001	--
	05/25/07		<0.080	<0.238	<0.476	<0.0002	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.150	<0.025	<0.001	<0.001	<0.002	<0.001	<0.002	<0.001	<0.0005	<0.002	<0.0005	--	--	--	--
	08/24/07		<0.1	<0.238	<0.476	<0.001	<0.002	<0.002	<0.006	<0.0005	<0.0005	<0.100	<0.020	<0.0005	<0.0005	<0.0005	<0.0005	<5.0	<0.001	<0.001	<0.002	<0.001	--	--	--	--
	11/26/07		<0.080	<0.236	<0.472	<0.001	<0.002	<0.002	<0.006	<0.0005	<0.0005	<0.100	<0.020	<0.0005	<0.0005	<0.0005	<0.0005	<5.0	<0.001	<0.001	<0.002	<0.001	--	--	--	--
	02/27/08		<0.080	<0.294	<0.588	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.100	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--	--	--	--
	03/31/10		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0015	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--
	09/01/10		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0015	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--
	12/16/14		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0005	--	--	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	--	--	--	--	--	--	--	--	<0.050
	03/25/15		<0.250	<0.046	<0.093	<0.0005	<0.0005	<0.0005	<0.001	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
MW-2	05/14/02	20-35	41.4	<0.250	<0.500	4.35	2.68	1.84	8.72	<0.025	<0.025	--	--	--	--	0.7	--	0.106	0.665	0.194	<100	0.071	--	--	--	--
	05/19/03		--	--	--	0.534	0.00975	0.194	0.876	<0.05	<0.05	--	--	--	--	0.0776	--	0.015	0.16	0.0624	0.0099	0.0158	0.0033	<0.05	<0.05	--
	05/25/07		0.439	<0.238	<0.476	0.071	0.00114	0.0361	0.0453	<0.0005	<0.0005	<0.150	<0.025	<0.001	<0.001	0.0182	<0.001	<0.002	0.04	0.0335	0.003	0.00249	--	--	--	--
	08/24/07		0.102	<0.238	<0.476	<0.001	<0.002	<0.002	<0.006	<0.0005	<0.0005	<0.100	<0.020	<0.0005	<0.0005	0.059	<0.0005	<0.05	<0.001	<0.001	0.0032	<0.001	--	--	--	--
	11/26/07		<0.080	<0.236	<0.472	<0.001	<0.002	<0.002	<0.006	<0.0005	<0.0005	<0.100	<0.020	<0.0005	<0.0005	0.083	<0.0005	<0.05	<0.001	<0.001	<0.002	<0.001	--	--	--	--
	02/27/08		0.0817	<0.294	<0.588	0.005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.100	<0.0010	<0.0005	<0.0005	0.015	<0.0005	<0.0005	<0.0005	<0.0005	0.00034 J	<0.0005	--	--	--	--
	03/31/10		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0015	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	0.045	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00051	<0.0005	--
	09/01/10		<0.250	<0.250	<0.500	0.0016	<0.0005	<0.0005	<0.0015	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	0.081	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00051	<0.0005	--
	12/16/14		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0005	--	--	<0.005	<0.005	<0.0005	<0.0005	0.008	<0.0005	--	--	--	--	--	--	--	--	<0.050
	03/25/15		<0.250	<0.046	<0.091	<0.0005	<0.0005	<0.0005	<0.001	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
MW-3	05/14/02	24.5-34.5	4.5	<0.250	<0.500	0.0419	0.0096	0.293	0.521	<0.001	<0.001	--	--	--	--	<4.00	--	0.0489	0.296	0.106	0.0213	0.0591	--	--	--	--
	05/19/03		--	--	--	0.0908	0.0097	0.338	0.5382	<0.05	<0.05	--	--	--	--	0.0037	--	0.0308	0.315	0.0895	0.0194	0.0623	--	--	--	--
	05/25/07		0.361	<0.238	<0.476	<0.0005	<0.0005	0.0132	0.0145	<0.0005	<0.0005	<0.150	<0.025	<0.001	<0.001	<0.002	<0.001	<0.002	0.0107	0.00348	0.00532	0.0093	0.0068	<0.05	<0.05	--
	08/24/07		<0.1	<0.238	<0.476	<0.001	<0.002	<0.002	<0.006	<0.0005	<0.0005	<0.100	<0.020	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.001	<0.001	<0.002	<0.001	--	--	--	--
	11/26/07		<0.080	<0.236	<0.472	0.0011	<0.002	0.0066	<0.006	<0.0005	<0.0005	<0.100	<0.020	<0.0005	<0.0005	0.0069	<0.0005	<0.05	<0.001	<0.001	0.0031	0.0012	--	--	--	--
	02/27/08		2.14	0.387 [6]	<0.500	<0.0005	<0.0005	0.17	0.17	<0.0005	<0.0005	<0.100	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	0.0064	0.21	0.051	0.022	0.056	--	--	--	--
	03/31/10		2.10	<0.250	<0.500	<0.0005	<0.0005	0.018	0.021	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	0.0018	0.24	<0.0005	0.019	0.050	0.0052	0.012	<0.0005	--
	09/01/10		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0015	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--
	12/16/14		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0005	--	--	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	--	--	--	--	--	--	--	--	<0.050
	03/25/15		<0.418	<0.046	<0.092	<0.0005	<0.0005	<0.0005	<0.001	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
MW-3 DUP	02/27/08	24.5-34.5	1.85	0.342	<0.485	0.0011	<0.0005	0.19	0.2	<0.0005	<0.0005	<0.100	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	0.0076	0.23	0.058	0.026	0.066	--	--	--	--
	03/31/10		1.90	<0.250	<0.500	<0.0015	<0.0015	0.018	0.020	<0.0015	<0.0015	<0.015	<0.007	<0.0015	<0.0015	<0.0015	<0.0015	0.0019	0.27	<0.0015	0.018	0.048	0.0050	0.012	<0.0015	--
	09/01/10		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0015	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--
MW-4	05/14/02	20-35	<0.080	0.358 [5]	<0.500	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	--	--	--	--	<0.002	--	<0.002	<0.001	<0.0005	<0.002	<0.0005	--	--	--	--
	05/19/03		--	--	--	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	--	--	--	--	<0.001	--	<0.002	<0.001	<0.001	<0.002	<0.001	--	--	--	--
	05/25/07		<0.080	<0.238	<0.476	<0.0002	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.150	<0.025	<0.001	<0.001	<0.002	<0.001	<0.002	<0.001	<0.0005	<0.002	<0.0005	<0.05	<0.001	<0.001	--
	08/24/07		<0.1	<0.238	<0.476	<0.001	<0.002	<0.002	<0.006	<0.0005	<0.0005	<0.100	<0.020	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.001	<0.001	<0.002	<0.001	--	--	--	--
	11/26/07		<0.080	<0.236	<0.472	<0.001	<0.002	<0.002	<0.006	<0.0005	<0.0005	<0.100	<0.020	<0.0005	<0.0005	<0.0005	<0.0005	<0.05	<0.001	<0.001	<0.002	<0.001	--	--	--	--
	02/27/08		<0.080	<0.248	<0.495	<0.0005	<0.0005	<0.0005	<0.001	<0.0005	<0.0005	<0.100	<0.0010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--	--	--	--
	03/31/10		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0015	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--
	09/01/10		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0015	<0.0005	<0.0005	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	--
	12/16/14		<0.250	<0.250	<0.500	<0.0005	<0.0005	<0.0005	<0.0005	--	--	<0.005	<0.005	<0.0005	<0.0005	<0.0005	<0.0005	--	--	--	--	--	--	--	--	<0.050
	03/25/15		<0.250	0.074	<0.091	<0.0005	<0.0005	<0.0005	<0.001	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
MW-5	12/16/14	10-25	15	0.350	<0.500	0.00070	0.00066	0.12	1.2	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
	03/25/15		18.1	<0.045	<0.091	<0.00050	0.00061	0.218	1.45	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
MW-5 DUP	12/16/14	10-25	15	<0.250	<0.500	0.00088	0.00081	0.18	1.3	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
	03/25/15		17.2	<0.046	<0.092	0.0005	0.00065	0.236	1.22	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
MW-6	12/16/14	10-25	15	<0.250	<0.500	0.47	0.065	1.3	2.6	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
	03/25/15		13.7	0.047	<0.092	0.516	0.0756	1.4	2.26	--	--	--	--	--	--	<0.0005	--	--	--	--	--	--	--	--	--	--
Washington DOE MTCA Method A cleanup level [9]			0.800 [8]	0.5	0.5	0.005	1	0.7	1	NA	0.005	NA	NA	NA	NA	0.02	NA	0.16	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1. TPHg = Total petroleum hydrocarbons in gasoline carbon range by NW-TPHgx method.
2. TPHd = Total petroleum hydrocarbons in diesel carbon range by NW-TPHdx method with silica gel cleanup.
3. TPHho = Total petroleum hydrocarbons ion heavy oil carbon range NW-TPHdx method with silica gel cleanup.
4. Boldface values represent concentration that exceeds MTCA Method A cleanup le\
5. Analysis completed without silica gel cleanup. Lab detected hydrocarbons with non-petroleum peaks or elution pattern that suggests the presence of biogenic interference.
6. Hydrocarbon pattern most closely resembles a blend of heavy gas-/light diesel-range components.
7. mg/L (ppm) = Milligrams per liter (parts per million).
8. TPHg cleanup level dependent on presence of benzene in groundwater. Cleanup level = 0.800 mg/L if benzene is present and 1.00 mg/L if benzene is not present.
9. Washington DOE MTCA Method A cleanup level = Washington Department of Ecology Model Toxics Control Act Method A cleanup level.
10. < = Not detected at or above the specified laboratory method reporting limit (MRL)
11. bgs = below ground surface

Note: Base map prepared from USGS 7.5-minute quadrangle of Vancouver, WA, dated 2014 as provided by USGS.gov.

0 4,000 8,000

Approximate Scale in Feet

Site Location Map

Groundwater Results Report (March 2015) and
Additional Groundwater Investigation Work Plan
NuStar Terminals Operations Partnership, L.P. - Annex Terminal
Vancouver, Washington

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1569-05	Figure
May 2015		1

Legend:

- **SB-8R** Soil Boring Location (September 2014)
- **MW-1** Groundwater Monitoring Well Location
- DP-1 Grab Groundwater Sample Location
- GP-1 Deeper Direct-Push Geoprobe Location
- GP-1 Historical Direct-Push Boring Location (Approximate)
- PMW-1 Historical Temporary Well Location (Approximate)
- HA-1 Historical Hand Auger Location (Approximate)
- Excavation

N

0 100 200

Scale in Feet

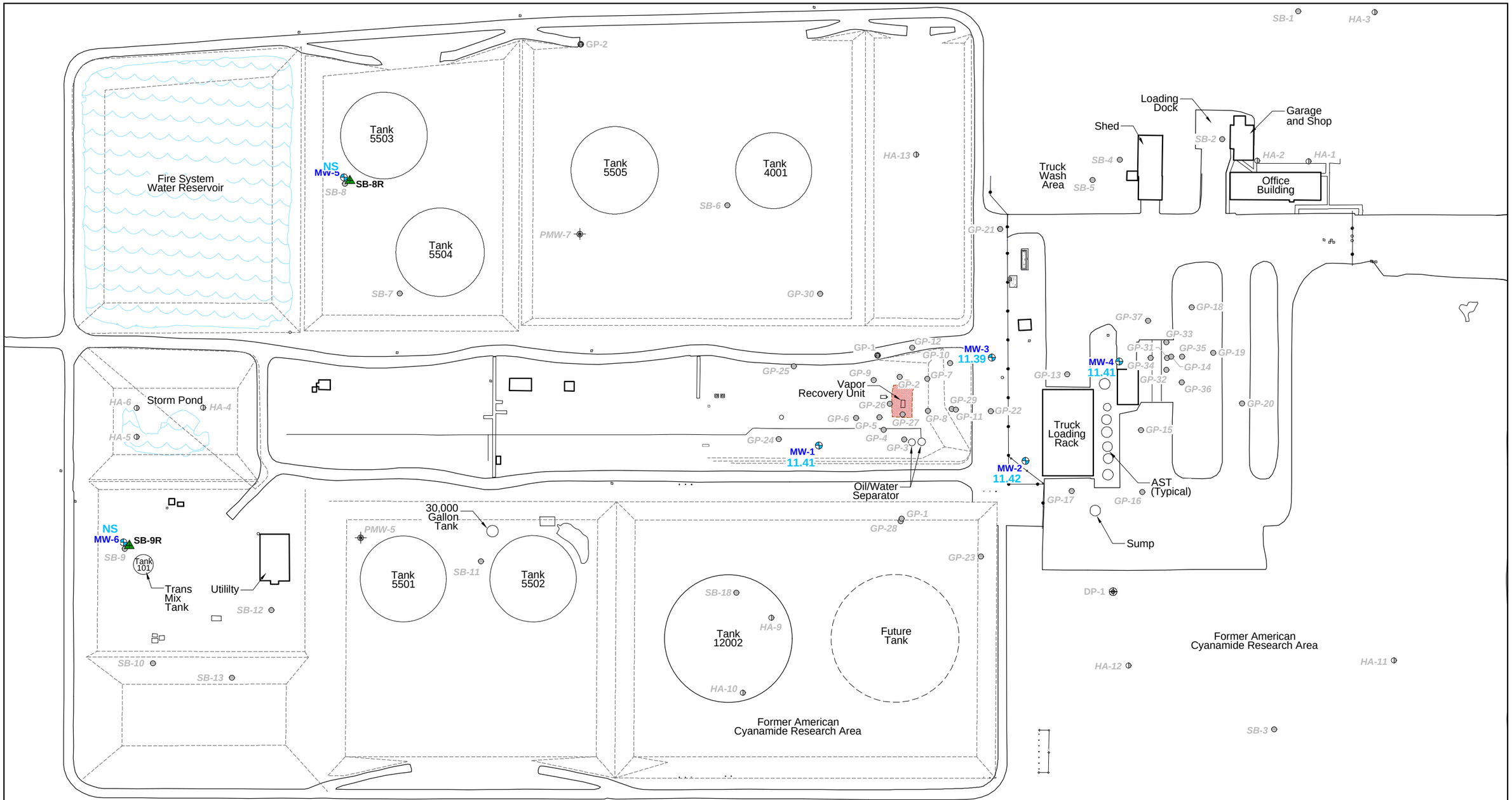
NOTE: Base map completed from a number of sources including but not limited to; Figure VAN1-21-002 provided by NuStar (1/8/2007) and a Monitoring Well Survey by Statewide Land Surveying, Inc.(10/30/2007). Locations of roads and containments are approximate. Aerial photograph from Google Earth Pro (7/14/2014).

Site Plan

Groundwater Results Report (March 2015) and
Additional Groundwater Investigation Work Plan
NuStar Terminals Operations Partnership, L.P. - Annex Terminal
Vancouver, Washington

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1569-05	Figure
May 2015		2



Legend:

MW-1 10.47	Groundwater Monitoring Well Location and Groundwater Elevation in Feet Above Mean Sea Limit (MSL)
NS	Not Surveyed
SB-8R	Direct-Push Geoprobe Location
GP-1	Soil Boring Location (September 2014)
DP-1	Grab Groundwater Sample Location
GP-1	Historical Direct-Push Boring Location (Approximate)
PMW-5	Historical Temporary Well Location (Approximate)
HA-1	Historical Hand Auger Location (Approximate).
	Excavation

N

0 100 200

Scale in Feet

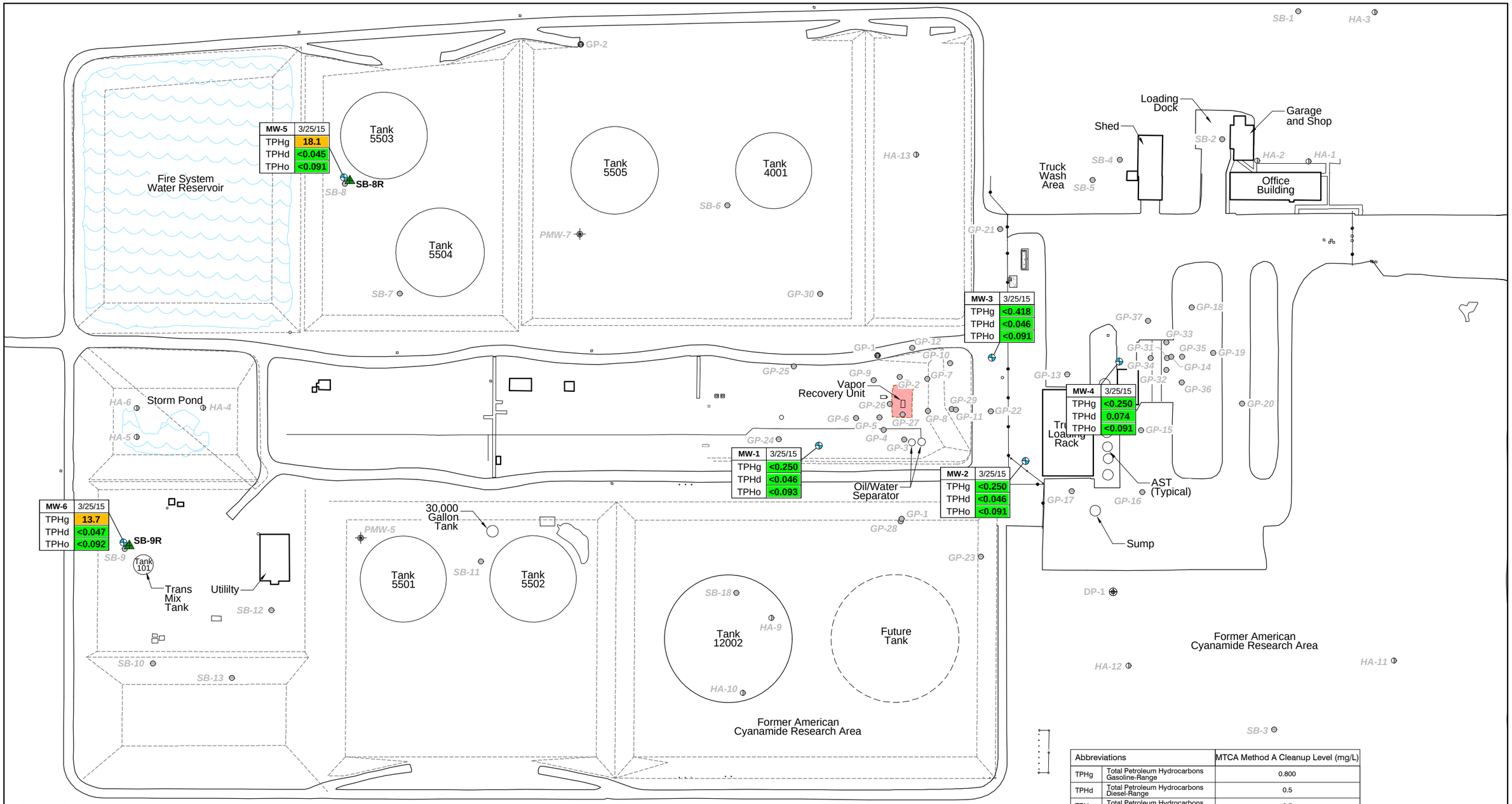
NOTE: Base map completed from a number of sources including but not limited to; Figure VAN1-21-002 provided by NuStar (1/8/2007) and a Monitoring Well Survey by Statewide Land Surveying, Inc (10/30/2007). Locations of roads and containments are approximate.

Groundwater Elevations - March 2015

Groundwater Results Report (March 2015) and
Additional Groundwater Investigation Work Plan
NuStar Terminals Operations Partnership, L.P. - Annex Terminal
Vancouver, Washington

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1569-05	Figure
May 2015		3



Abbreviations		MTCA Method A Cleanup Level (mg/L)
TPHg	Total Petroleum Hydrocarbons Gasoline-Range	0.800
TPHd	Total Petroleum Hydrocarbons Diesel-Range	0.5
TPHo	Total Petroleum Hydrocarbons Heavy Oil-Range	0.5

Legend:

- **SB-8R** Soil Boring Location (September 2014)
- **MW-1** Groundwater Monitoring Well Location
- DP-1 Grab Groundwater Sample Location
- GP-1 Deeper Direct-Push Geoprobe Location
- GP-1 Historical Direct-Push Boring Location (Approximate)
- PMW-5 Historical Temporary Well Location (Approximate)
- HA-1 Historical Hand Auger Location (Approximate)

Excavation

MW-1 3/25/15
TPHg <0.250
TPHd <0.046
TPHo <0.093

- Sample Identification
- Date Sampled
- Concentration in mg/L
- Analyte Sampled

- Concentration is Below MTCA Method A Cleanup Level
- Concentration is Above MTCA Method A Cleanup Level

N

0 100 200
Scale in Feet

NOTE: Base map completed from a number of sources including but not limited to; Figure VAN1-21-002 provided by NuStar (1/8/2007) and a Monitoring Well Survey by Statewide Land Surveying, Inc (10/30/2007). Locations of roads and containments are approximate.

TPH Concentrations in Groundwater - March 2015

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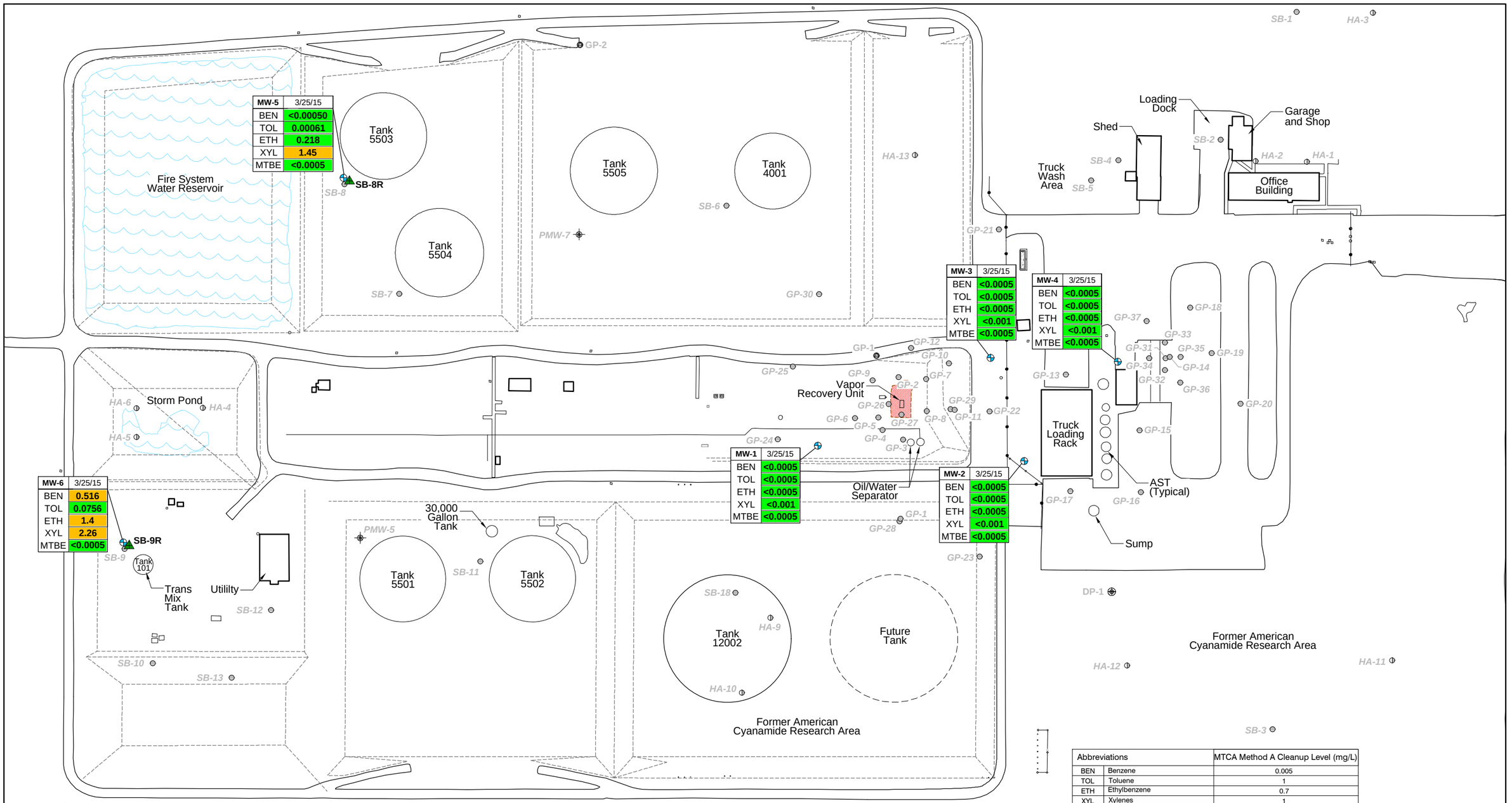
Additional Groundwater Investigation Work Plan
NuStar Terminals Operations Partnership, L.P. - Annex Terminal
Vancouver, Washington

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1569-05	Figure
May 2015		4



Abbreviations		MTCA Method A Cleanup Level (mg/L)
BEN	Benzene	0.005
TOL	Toluene	1
ETH	Ethylbenzene	0.7
XYL	Xylenes	1
MTBE	Methyl Tert-Butyl Ether	0.02

Legend:

- **SB-8R** ▲ Soil Boring Location (September 2014)
- **MW-1** ⊕ Groundwater Monitoring Well Location
- DP-1 ⊕ Grab Groundwater Sample Location
- GP-1 ◎ Deeper Direct-Push Geoprobe Location
- *GP-1* ○ Historical Direct-Push Boring Location (Approximate)
- *PMW-5* ⊕ Historical Temporary Well Location (Approximate)
- *HA-1* ◐ Historical Hand Auger Location (Approximate)

Excavation

MW-1	3/25/15
BEN	<0.0005
TOL	<0.0005
ETH	<0.0005
XYL	<0.001
MTBE	<0.0005

Sample Identification
Date Sampled
Concentration in mg/L
Analyte Sampled

Concentration is Below MTCA Method A Cleanup Level

Concentration is Above TCA Method A Cleanup Level

N

0 100 200

Scale in Feet

NOTE: Base map completed from a number of sources including but not limited to; Figure VAN1-21-002 provided by NuStar (1/8/2007) and a Monitoring Well Survey by Statewide Land Surveying, Inc (10/30/2007). Locations of roads and containments are approximate.

BTEX and MTBE Concentrations in Groundwater - March 2015

Groundwater Results Report (March 2015) and
Additional Groundwater Investigation Work Plan
NuStar Terminals Operations Partnership, L.P. - Annex Terminal
Vancouver, Washington

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1569-05	Figure
May 2015		5

Fire System Water Reservoir
Tank 5503
Tank 5504
Tank 5505
Tank 4001
Tank 5501
Tank 5502
Tank 12002
Future Tank
30,000 Gallon Tank
Tank 101
Trans Mix Tank
Utililty
Storm Pond
Vapor Recovery Unit
Oil/Water Separator
Truck Wash Area
Truck Loading Rack
Loading Dock
Shed
Garage and Shop
Office Building
AST (Typical)
Sump
Former American Cyanamide Research Area
Former American Cyanamide Research Area

MW-1 MW-2 MW-3 MW-4 MW-5 MW-6
SB-8R SB-9R
SB-1 SB-2 SB-3 SB-4 SB-5 SB-6 SB-7 SB-8 SB-9 SB-10 SB-11 SB-12 SB-13
PMW-5 PMW-7
HA-1 HA-2 HA-3 HA-4 HA-5 HA-6 HA-9 HA-10 HA-11 HA-12 HA-13
GP-1 GP-2 GP-3 GP-4 GP-5 GP-6 GP-7 GP-8 GP-9 GP-10 GP-11 GP-12 GP-13 GP-14 GP-15 GP-16 GP-17 GP-18 GP-19 GP-20 GP-21 GP-22 GP-23 GP-24 GP-25 GP-26 GP-27 GP-28 GP-29 GP-30 GP-31 GP-32 GP-33 GP-34 GP-35 GP-36 GP-37

Legend:

- Proposed Borehole Location
- SB-8R — Soil Boring Location (September 2014)
- MW-1 — Groundwater Monitoring Well Location
- DP-1 — Grab Groundwater Sample Location
- GP-1 — Deeper Direct-Push Geoprobe Location
- GP-1 — Historical Direct-Push Boring Location (Approximate)
- PMW-1 — Historical Temporary Well Location (Approximate)
- HA-1 — Historical Hand Auger Location (Approximate)
- Excavation

N

0 100 200

Scale in Feet

NOTE: Base map completed from a number of sources including but not limited to; Figure VAN1-21-002 provided by NuStar (1/8/2007) and a Monitoring Well Survey by Statewide Land Surveying, Inc.(10/30/2007). Locations of roads and containments are approximate. Aerial photograph from Google Earth Pro (7/14/2014).

Proposed Borehole Locations

Groundwater Results Report (March 2015) and
Additional Groundwater Investigation Work Plan
NuStar Terminals Operations Partnership, L.P. - Annex Terminal
Vancouver, Washington

Apex Companies, LLC
3015 SW First Avenue
Portland, Oregon 97201

Project Number	1569-05	Figure
May 2015		6

Attachment A

Field Notes

WELL GAGING DATA SHEET

APEX		Job Number:	
Client:	MUSTAR	Date:	3/25/15
Project:	VAN. ANNEX	Sampler:	C. CLOUGH
Weather:	OVERCAST	Time In/Out:	

WATER LEVEL DATA

Well I.D.	Time	Depth to Free Product (feet)	Depth to Water (feet)	Depth to Well Bottom (feet)	Product Thickness (feet)	Water Column Height (feet)	Notes/Other Remarks
MW-1	0957		15.25				
MW-2	0950	—	26.79		—		
MW-3	0953	—	27.72		—		
MW-4	0945	—	28.76		—		
MW-5	1008	—	15.37		—		SLIGHT ODOR
MW-6	1002	—	15.73		—		SLIGHT ODOR

APEX

3015 SW First Avenue
Portland, Oregon 97201-4707
(503) 924-4704 Phone
(503) 943-6357 Fax

PROJECT NUMBER
FIELD REPORT NUMBER
PAGE 1 OF
DATE 3/25/15

PROJECT	VANCOUVER ANNEX	ARRIVAL TIME	
LOCATION	VANCOUVER WA	DEPARTURE TIME	
CLIENT	NUSTAR	WEATHER	RAIN, OVERCAST, COOL
PURPOSE OF OBSERVATIONS			
APEX REPRESENTATIVE	C. CLOUGH	APEX PROJECT MANAGER	S. BOZZE
CONTRACTOR	NA	PERMIT NO.	NA
CONTRACTOR REP.	NA	H&S REVIEW	✓

Our firm's professionals are represented on site solely to observe operations of the contractor identified, to form opinions about the adequacy of those operations, and to report those opinions to our client. The presence and activities of our field representative do not relieve any contractor from its obligation to meet contractual requirements. The contractor retains sole responsibility for site safety and the methods, operations, send sequence of construction. Unless signed by the Ash Creek Associates Project Manager, this report is preliminary. A preliminary report is provided solely as evidence that field observation was performed. Observations and/or conclusions and/or recommendations conveyed in the final report may vary from and shall take precedence over those included in a preliminary report.

0915 - C. CLOUGH ONSITE. REVIEW H&S & DAILY PTE
0920 - PERMIT ISSUED. START OPENING WELL MONUMENTS
0945 - WELLS ALL OPEN. START GAUGING
1010 - GAUGING COMPLETED.
1055 - MW-5 & MW-5 DUP COLLECTED.
1140 - MW-6 SAMPLED.
1215 - MW-4 SAMPLED
1255 - MW-2 SAMPLED.
1330 - MW-1 SAMPLED.
1405 - MW-3 SAMPLED.
1435 - C. CLOUGH OFFSITE.

BY

APEX REPRESENTATIVE

REVIEWED BY

APEX PROJECT MANAGER

WELL MONITORING DATA SHEET

APEX

Well I.D.	MW-5	Job Number:	
Client:	NUSTAR	Date:	3/25/15
Project:	VAN. ANNEX	Sampler:	C. CLOUGH
Weather:	OVERCAST/COOL	Time In/Out:	

WELL DATA

Well Depth:		Well Diameter:	2"	Water Height	
Depth to Water:	15.35	Screened Interval:		x Multiplier	
Water Column Length:		Depth to Free Product:		x Casing Volumes	
Purge Volume:		Free Product Thickness:		= Purge Volume	
Water Height Multipliers (gal)	1-inch = 0.041	2-inch = 0.162	4-inch = 0.653	1 gallon = 3.785 liters	

PURGING DATA

Purge Method:	PERI.	Pump Intake Depth:	MS	Comments	
Sampling Method:	~~RE~~ LOW FLOW	Tubing Type:	NEW		

Time	Volume Purged (liters)	Cumulative Volume Purged (liters)	DTW (btc)	Purge Rate (L/min)	pH	Temp (°C)	Cond (µS/cm)	DO (ppm)	ORP (mV)	Turbidity (NTUs)	Clarity/Color Other Remarks
					+/-0.1	+/-0.5° C	+/-5%	+/- 0.5 ppm	+/-20mV	+/-10%	<-- Stabilization Criteria
1038	1L		16.05	0.15	7.48	12.98	1419	1.78	-12.4	—	C
1041			16.24	0.15	7.49	12.98	1273	1.61	-20.6	—	C
1044			16.45	0.15	7.46	13.01	1207	0.80	-29.8	—	C
1047			16.61	0.15	7.50	13.00	1179	0.66	-40.1	—	C
1050			16.72	0.15	7.49	12.97	1171	0.61	-42.1	—	C

Clarity: VC = very cloudy, Cl = Cloudy, SC = slightly cloudy, AC = almost clear, C = clear

SAMPLING DATA

Sample ID:	MW-5	Sampling Flow Rate	~0.15	Analytical Laboratory:	PACE
Sample Time:	1055	Final Depth to Water:	16.05	Did Well Dewater?	NO

# Containers/Type	Preservative	Analysis/Method	Field Filtered	Filter Size	MS/MSD	Duplicate ID
6x VOA	HCl	VOC/DX	yes (no)	—	—	—
6x VOA	HCl	VOC/DX	yes (no)	—	—	MW-5 DUP
			yes no			
			yes no			
			yes no			
			yes no			

COMMENTS

WELL MONITORING DATA SHEET

APEX

Well I.D.	MW-6	Job Number:	
Client:	NUSTAR	Date:	3/25/15
Project:	VAN ANNEX	Sampler:	CC
Weather:	OVERCAST/COOL	Time In/Out:	

WELL DATA

Well Depth:		Well Diameter:	2"	Water Height	
Depth to Water:	15.66	Screened Interval:		x Multiplier	
Water Column Length:		Depth to Free Product:		x Casing Volumes	
Purge Volume:		Free Product Thickness:		= Purge Volume	
Water Height Multipliers (gal)	1-inch = 0.041	2-inch = 0.162	4-inch = 0.653	1 gallon = 3.785 liters	

PURGING DATA

Purge Method:	PERI	Pump Intake Depth:	MS	Comments
Sampling Method:	LF	Tubing Type:	NEW	

Time	Volume Purged (liters)	Cumulative Volume Purged (liters)	DTW (btc)	Purge Rate (L/min)	pH	Temp (°C)	Cond (µS/cm)	DO (ppm)	ORP (mV)	Turbidity (NTUs)	Clarity/Color Other Remarks
					+/-0.1	+/-0.5° C	+/-5%	+/- 0.5 ppm	+/-20mV	+/-10%	<-- Stabilization Criteria
1127	1L		16.53	ND.18	7.43	12.54	1498	6.04	-66.5	—	C
1130			16.96	↓	7.55	12.65	1507	1.01	-70.6	—	C
1133			17.07	↓	7.54	12.68	1512	0.77	-75.1	—	C
1136			17.21	↓	7.51	12.70	1516	0.68	-75.2	—	C

Clarity: VC = very cloudy, Cl = Cloudy, SC = slightly cloudy, AC = almost clear, C = clear

SAMPLING DATA

Sample ID:	MW-6	Sampling Flow Rate	ND.18	Analytical Laboratory:	PACE
Sample Time:	1140	Final Depth to Water:	16.74	Did Well Dewater?	NO

# Containers/Type	Preservative	Analysis/Method	Field Filtered	Filter Size	MS/MSD	Duplicate ID
6x VOA	HCl	VOC/DX	yes (no)	—	—	—
			yes no			
			yes no			
			yes no			
			yes no			
			yes no			

COMMENTS

WELL MONITORING DATA SHEET

APEX

Well I.D.	MW-4	Job Number:	
Client:	NUSTAR	Date:	3/25/15
Project:	VAN. ANNEX	Sampler:	C. CLOUGH
Weather:	OVERCAST / COOL	Time In/Out:	

WELL DATA

Well Depth:		Well Diameter:	2"	Water Height	
Depth to Water:	28.74	Screened Interval:		x Multiplier	
Water Column Length:		Depth to Free Product:		x Casing Volumes	
Purge Volume:		Free Product Thickness:		= Purge Volume	
Water Height Multipliers (gal)	1-inch = 0.041	2-inch = 0.162	4-inch = 0.653	1 gallon = 3.785 liters	

PURGING DATA

Purge Method:	PERI	Pump Intake Depth:	MS	Comments	
Sampling Method:	LF	Tubing Type:	NEW		

Time	Volume Purged (liters)	Cumulative Volume Purged (liters)	DTW (btc)	Purge Rate (L/min)	pH	Temp (°C)	Cond (µS/cm)	DO (ppm)	ORP (mV)	Turbidity (NTUs)	Clarity/Color Other Remarks
					+/-0.1	+/-0.5° C	+/-5%	+/- 0.5 ppm	+/-20mV	+/-10%	<-- Stabilization Criteria
1205	1L		28.75	0.17	6.58	13.13	560	7.94	29.1	—	AC/C
1208			28.75	"	6.44	13.18	562	1.71	32.1	—	C
1211			28.75	"	6.39	13.25	553	1.60	34.4	—	C
1214			28.75	↓	6.37	13.29	542	1.43	36.2	—	C

Clarity: VC = very cloudy, Cl = Cloudy, SC = slightly cloudy, AC = almost clear, C = clear

SAMPLING DATA

Sample ID:	MW-4	Sampling Flow Rate	0.17	Analytical Laboratory:	PACE
Sample Time:	1215	Final Depth to Water:	28.74	Did Well Dewater?	NO

# Containers/Type	Preservative	Analysis/Method	Field Filtered	Filter Size	MS/MSD	Duplicate ID
6x VOA	HCl	VOC/DX	yes (no)	—	—	—
			yes no			
			yes no			
			yes no			
			yes no			
			yes no			

COMMENTS

WELL MONITORING DATA SHEET

APEX

Well I.D.	MW-2	Job Number:	
Client:	NUSTAR	Date:	3/25/15
Project:	VAN. ANNEX	Sampler:	C. CLOUGH
Weather:	LIGHT RAIN	Time In/Out:	

WELL DATA

Well Depth:		Well Diameter:	2"	Water Height	
Depth to Water:	26.73	Screened Interval:		x Multiplier	
Water Column Length:		Depth to Free Product:		x Casing Volumes	
Purge Volume:		Free Product Thickness:		= Purge Volume	
Water Height Multipliers (gal)	1-inch = 0.041	2-inch = 0.162	4-inch = 0.653	1 gallon = 3.785 liters	

PURGING DATA

Purge Method:	PERI.	Pump Intake Depth:	MS	Comments	
Sampling Method:	LF	Tubing Type:	NEW		

Time	Volume Purged (liters)	Cumulative Volume Purged (liters)	DTW (btc)	Purge Rate (L/min)	pH	Temp (°C)	Cond (µS/cm)	DO (ppm)	ORP (mV)	Turbidity (NTUs)	Clarity/Color Other Remarks
					+/-0.1	+/-0.5° C	+/-5%	+/- 0.5 ppm	+/-20mV	+/-10%	<-- Stabilization Criteria
1241	1L		26.74	0.19	6.65	13.63	372	7.16	36.6	—	C
1244			26.75	0.16	6.32	13.68	385	0.90	51.9	—	C
1247			26.74	↓	6.29	13.66	389	0.77	51.0	—	C
1250			26.74	↓	2.24	13.66	394	0.60	50.6	—	C

Clarity: VC = very cloudy, Cl = Cloudy, SC = slightly cloudy, AC = almost clear, C = clear

SAMPLING DATA

Sample ID:	MW-2	Sampling Flow Rate	0.19	Analytical Laboratory:	PACE
Sample Time:	1255	Final Depth to Water:	26.74	Did Well Dewater?	NO

# Containers/Type	Preservative	Analysis/Method	Field Filtered	Filter Size	MS/MSD	Duplicate ID
6x VOA	HCl	VOC/Dx	yes (no)	—	—	—
			yes no			
			yes no			
			yes no			
			yes no			
			yes no			

COMMENTS

WELL MONITORING DATA SHEET

APEX

Well I.D.	MW-1	Job Number:	
Client:	NUSTAR	Date:	3/25/15
Project:	VAN. ANNEX	Sampler:	C. CLOUGH
Weather:	RAIN / COOL	Time In/Out:	

WELL DATA

Well Depth:		Well Diameter:	2"	Water Height	
Depth to Water:	15.23	Screened Interval:		x Multiplier	
Water Column Length:		Depth to Free Product:		x Casing Volumes	
Purge Volume:		Free Product Thickness:		= Purge Volume	
Water Height Multipliers (gal)	1-inch = 0.041	2-inch = 0.162	4-inch = 0.653	1 gallon = 3.785 liters	

PURGING DATA

Purge Method:	PERI	Pump Intake Depth:	MS	Comments	
Sampling Method:	LF	Tubing Type:	NEW		

Time	Volume Purged (liters)	Cumulative Volume Purged (liters)	DTW (btc)	Purge Rate (L/min)	pH	Temp (°C)	Cond (µS/cm)	DO (ppm)	ORP (mV)	Turbidity (NTUs)	Clarity/Color Other Remarks
					+/-0.1	+/-0.5° C	+/-5%	+/- 0.5 ppm	+/-20mV	+/-10%	<-- Stabilization Criteria
1317	1L		15.23	~0.15	6.69	13.56	829	3.18	34.8	—	AC/C
1320			15.24	↓	6.62	13.56	836	2.60	38.0	—	C
1323			15.24	↓	6.55	13.56	842	2.49	41.5	—	C
1326			15.24	↓	6.53	13.56	845	2.34	42.2	—	C

Clarity: VC = very cloudy, Cl = Cloudy, SC = slightly cloudy, AC = almost clear, C = clear

SAMPLING DATA

Sample ID:	MW-1	Sampling Flow Rate	~0.15	Analytical Laboratory:	PACE
Sample Time:	1330	Final Depth to Water:	15.23	Did Well Dewater?	NO

# Containers/Type	Preservative	Analysis/Method	Field Filtered	Filter Size	MS/MSD	Duplicate ID
6 x VOA	HCl	VOC/DX	yes (no)	—	—	—
			yes no			
			yes no			
			yes no			
			yes no			
			yes no			

COMMENTS

WELL MONITORING DATA SHEET

APEX

Well I.D.	MW-3	Job Number:	
Client:	NUSTAR	Date:	3/25/15
Project:	VAN. ANNEX	Sampler:	C. CLOUGH
Weather:	RAIN	Time In/Out:	

WELL DATA

Well Depth:		Well Diameter:	2"	Water Height	
Depth to Water:	27.69	Screened Interval:		x Multiplier	
Water Column Length:		Depth to Free Product:		x Casing Volumes	
Purge Volume:		Free Product Thickness:		= Purge Volume	
Water Height Multipliers (gal)	1-inch = 0.041	2-inch = 0.162	4-inch = 0.653	1 gallon = 3.785 liters	

PURGING DATA

Purge Method:	PERI	Pump Intake Depth:	MS	Comments	
Sampling Method:	LF	Tubing Type:	NEW		

Time	Volume Purged (liters)	Cumulative Volume Purged (liters)	DTW (btc)	Purge Rate (L/min)	pH	Temp (°C)	Cond (µS/cm)	DO (ppm)	ORP (mV)	Turbidity (NTUs)	Clarity/Color Other Remarks
					+/-0.1	+/-0.5° C	+/-5%	+/- 0.5 ppm	+/-20mV	+/-10%	<-- Stabilization Criteria
1354	1 L		27.77	~0.14	6.86	13.86	362	1.33	29.1	—	C
1357			27.79	↓	6.74	13.85	363	1.32	33.8	—	C
1400			27.78	↓	6.65	13.87	364	1.47	36.9	—	C
1403			27.79	↓	6.68	13.86	365	1.41	37.8	—	C

Clarity: VC = very cloudy, Cl = Cloudy, SC = slightly cloudy, AC = almost clear, C = clear

SAMPLING DATA

Sample ID:	MW-3	Sampling Flow Rate	~0.14	Analytical Laboratory:	PACE.
Sample Time:	1405	Final Depth to Water:	27.70	Did Well Dewater?	NO

# Containers/Type	Preservative	Analysis/Method	Field Filtered	Filter Size	MS/MSD	Duplicate ID
6x VOA	HCl	VOC/Dx	yes (no)	—	—	—
			yes no			
			yes no			
			yes no			
			yes no			
			yes no			

COMMENTS

Attachment B

Laboratory Analytical Results and Quality Assurance/Quality Control Review

Attachment B – Laboratory Analytical Reports and Data Quality Review

This appendix documents the results of a quality assurance/quality control (QA/QC) review of the analytical data for groundwater samples collected during the March 2015 groundwater sampling event for the NuStar Terminals Operations Partnership, L.P. (NuStar) Vancouver Annex Facility (Facility) in Vancouver, Washington. Pace Analytical in Davis, California performed the analyses. A copy of each analytical laboratory report is included in this appendix.

The QA review included examination and validation of the laboratory summary report, including:

- Analytical methods;
- Detection limits;
- Sample holding times;
- Custody records;
- Surrogates, spikes, and blanks; and
- Duplicates.

The QA review did not include a review of raw data.

Analytical Methods

Chemical analyses on collected water samples consisted of select volatile organic compounds (VOCs) and fuel oxygenates by U.S. Environmental Protection Agency (EPA) Method 8260B and total petroleum hydrocarbons – gasoline and diesel range (TPHg and TPHd) by Method NWTPH-Gx and NWTPH-Dx (with silica gel cleanup), respectively.

Quality Assurance Objectives and Review

The general QA objectives for this project were to develop and implement procedures for obtaining, evaluating, and confirming the usability of data of a specified quality for monitoring groundwater quality trends and SVE monitoring data at the site. To collect such information, analytical data must have an appropriate degree of accuracy and reproducibility, samples collected must be representative of actual field conditions, and samples must be collected and analyzed using unbroken chain-of-custody procedures.

Reporting limits and analytical results were compared to action levels for each parameter in the media of concern. Precision, accuracy, representativeness, completeness, and comparability parameters used to indicate data quality are defined below.

Reporting Limits. Detection limits are set by the laboratory and are based on instrumentation abilities, sample matrix, and suggested detection limits by the EPA or the Washington State Department of Ecology (Ecology). In some cases, the detection limits may be raised due to high concentrations of analytes in the samples or matrix interferences. Detection limits were generally consistent with industry standards and below promulgated regulatory standards when possible (if not raised, as previously discussed). Reporting limits were reviewed and are generally acceptable for this project.

Holding Times. Sample were analyzed within the holding times specified for the VOC and analyses, with one exception. Sample MW-6 was analyzed within hold time; however, benzene and ethylbenzene results were initially outside of the method calibration range. The sample was reanalyzed for those analytes outside of the method hold time. The results were consistent with the initial analysis; therefore, no data were flagged.

Method Blanks. A method, or laboratory, blank is a sample prepared in the laboratory along with the actual samples and analyzed for the same parameters at the same time. It is used to assess if detected contaminants may have been the result of contamination of the samples in the laboratory. No analytes were detected in the laboratory method blanks.

Laboratory Control Samples and Laboratory Control Sample Duplicate. Laboratory Control Samples (LCS) were also analyzed by the laboratory to assess the accuracy of the analytical equipment. LCS are prepared from an analyte-free matrix that is then spiked with known levels of the constituents of interest (COI; i.e., a standard). The concentrations are measured and the results compared to the known spiked levels. This comparison is expressed as percent recovery. The LCS percent recovery was within control limits for all analytes, with the exception of TPH-Dx. The recovery limit for TPH-Dx was below control limits for the LCS sample associated with the project samples. Because TPH-Dx was not detected in the project samples, no data were flagged.

In addition, a second laboratory control sample (the Laboratory Control Sample Duplicate [LCSD]) is prepared as above and analyzed. This is compared to the initial laboratory control sample to assess the precision of the analytical method (RPD). The percent recovery and RPD were within acceptable control limits.

Matrix Spike Analyses. Matrix Spike (MS) analyses are performed on samples submitted to the laboratory that are of the same matrix as the actual sample. The MS is spiked with known levels of the COI. These analyses are used to assess the potential for matrix interference with recovery or detection of the COI and the accuracy of the determination. The spiked sample results are compared to the expected result (i.e., sample concentration plus spike amount) and reported as percent recovery. MS recoveries were within control limits.

In addition, a second matrix spike sample (the Matrix Spike Duplicate [MSD]) is prepared as above and analyzed. This is compared to the initial matrix spike sample to assess the precision of the analytical method (RPD). The percent recovery and RPD were within acceptable control limits.

The MS/MSD analyzed for Method 8260B was analyzed outside of the recommended method hold time.

Laboratory Duplicate. A laboratory duplicate is a second analysis of the QA/QC sample, which serves as an internal check on laboratory quality, as well as potential variability of the sample matrix. The laboratory duplicate is analyzed and compared to the primary sample analysis to assess the precision of the analytical method. This comparison can be expressed by the RPD between the original and duplicate samples. No laboratory duplicate was analyzed.

Surrogate Recovery. Surrogates are organic compounds that are similar in chemical composition to the COI and spiked into environmental and batch quality control samples prior to sample preparation and analysis. Surrogate recoveries for environmental samples are used to evaluate matrix interference on a sample-specific basis. Surrogate recoveries were within control limits.

Field Duplicate. A field duplicate is a second field sample collected from a selected monitoring well. Field duplicate samples serve as a check on laboratory quality as well as potential variability of the sample matrix. The field duplicate is analyzed and compared with the first sample to assess the precision of the analytical method. This comparison can be expressed by the RPD between the original and duplicate samples. One field duplicate was analyzed (MW-5 DUP; the analytes were below the RPD limit of +/-30 percent.

Field Blank. A field blank is a sample of analyte-free water poured into a clean sample container in the field, preserved, and shipped to the laboratory with field samples. Field blanks assess the potential for contamination from field conditions during sampling. No field blank was analyzed.

Trip Blank. A trip blank is a clean sample of a matrix that is taken from the laboratory to the sampling site and transported back to the laboratory without having been exposed to sampling procedures. Trip blanks assess contamination introduced during shipping and field-handling activities. No trip blank was analyzed.

Conclusion. In conclusion, the overall QA objectives have been met, and the data are of adequate quality for use in this project.

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April 14, 2015

Ian Maguire
Apex Companies, LLC
3015 SW 1st Ave.
Portland, OR 97201

RE: Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Dear Ian Maguire:
Enclosed are the analytical results for sample(s) received by the laboratory on March 27, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Scott Forbes

Scott M Forbes
scott.forbes@pacelabs.com
Project Manager

Enclosures

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
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CERTIFICATIONS

Project:	NuStar Vacouver GWM
Pace Project No.:	1244968

Davis Cerification IDs

2795 Second Street Suite 300 Davis, CA 95618
North Dakota Certification #: R-214
Oregon Certification #: CA300002
Washington Certification #: C926-14a
California Certification #: 08263CA

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Lab ID	Sample ID	Matrix	Date Collected	Date Received
1244968001	**MW-1**	Water	03/25/15 13:30	03/27/15 10:30
1244968002	**MW-2**	Water	03/25/15 12:55	03/27/15 10:30
1244968003	**MW-3**	Water	03/25/15 14:05	03/27/15 10:30
1244968004	**MW-4**	Water	03/25/15 12:15	03/27/15 10:30
1244968005	**MW-5**	Water	03/25/15 10:55	03/27/15 10:30
1244968006	**MW-5 DUP**	Water	03/25/15 10:55	03/27/15 10:30
1244968007	**MW-6**	Water	03/25/15 11:40	03/27/15 10:30

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SAMPLE ANALYTE COUNT

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Lab ID	Sample ID	Method	Analysts	Analytes Reported
1244968001	**MW-1**	NWTPH-Dx	DRM	3
		EPA 8260B	SAC	8
		NWTPH-Gx	JCP	4
1244968002	**MW-2**	NWTPH-Dx	DRM	3
		EPA 8260B	SAC	8
		NWTPH-Gx	JCP	4
1244968003	**MW-3**	NWTPH-Dx	DRM	3
		EPA 8260B	SAC	8
		NWTPH-Gx	JCP	4
1244968004	**MW-4**	NWTPH-Dx	DRM	3
		EPA 8260B	SAC	8
		NWTPH-Gx	JCP	4
1244968005	**MW-5**	NWTPH-Dx	DRM	3
		EPA 8260B	SAC	8
		NWTPH-Gx	JCP	4
1244968006	**MW-5 DUP**	NWTPH-Dx	DRM	3
		EPA 8260B	JMB	8
		NWTPH-Gx	JCP	4
1244968007	**MW-6**	NWTPH-Dx	DRM	3
		EPA 8260B	JMB, SAC	8
		NWTPH-Gx	JCP	4

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ANALYTICAL RESULTS

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Sample: MW-1 **Lab ID: 1244968001** Collected: 03/25/15 13:30 Received: 03/27/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
NWTPH-Dx GCS, Silica Gel	Analytical Method: NWTPH-Dx Preparation Method: EPA 3510							
Diesel Fuel Range	ND	mg/L	0.046	1	04/01/15 17:47	04/12/15 11:07		L2
Motor Oil Range	ND	mg/L	0.093	1	04/01/15 17:47	04/12/15 11:07		
Surrogates								
n-Octacosane (S)	104	%.	70-130	1	04/01/15 17:47	04/12/15 11:07	630-02-4	
8260 MSV UST	Analytical Method: EPA 8260B							
Methyl-tert-butyl ether	ND	ug/L	0.50	1		04/08/15 20:40	1634-04-4	
Benzene	ND	ug/L	0.50	1		04/08/15 20:40	71-43-2	
Toluene	ND	ug/L	0.50	1		04/08/15 20:40	108-88-3	
Ethylbenzene	ND	ug/L	0.50	1		04/08/15 20:40	100-41-4	
Xylene (Total)	ND	ug/L	1.0	1		04/08/15 20:40	1330-20-7	
Surrogates								
1,2-Dichloroethane-d4 (S)	100	%.	70-130	1		04/08/15 20:40	17060-07-0	
Toluene-d8 (S)	100	%.	70-130	1		04/08/15 20:40	2037-26-5	
4-Bromofluorobenzene (S)	93	%.	70-130	1		04/08/15 20:40	460-00-4	
NWTPH-Gx MSV	Analytical Method: NWTPH-Gx							
TPH as Gas	ND	ug/L	250	1		04/01/15 20:48		
Surrogates								
1,2-Dichloroethane-d4 (S)	100	%.	70-130	1		04/01/15 20:48	17060-07-0	
Toluene-d8 (S)	98	%.	70-130	1		04/01/15 20:48	2037-26-5	
4-Bromofluorobenzene (S)	123	%.	70-130	1		04/01/15 20:48	460-00-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Sample: MW-2 **Lab ID: 1244968002** Collected: 03/25/15 12:55 Received: 03/27/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
NWTPH-Dx GCS, Silica Gel	Analytical Method: NWTPH-Dx Preparation Method: EPA 3510							
Diesel Fuel Range	ND	mg/L	0.046	1	04/01/15 17:47	04/12/15 11:42		L2
Motor Oil Range	ND	mg/L	0.091	1	04/01/15 17:47	04/12/15 11:42		
Surrogates								
n-Octacosane (S)	122	%.	70-130	1	04/01/15 17:47	04/12/15 11:42	630-02-4	
8260 MSV UST	Analytical Method: EPA 8260B							
Methyl-tert-butyl ether	ND	ug/L	0.50	1		04/08/15 21:05	1634-04-4	
Benzene	ND	ug/L	0.50	1		04/08/15 21:05	71-43-2	
Toluene	ND	ug/L	0.50	1		04/08/15 21:05	108-88-3	
Ethylbenzene	ND	ug/L	0.50	1		04/08/15 21:05	100-41-4	
Xylene (Total)	ND	ug/L	1.0	1		04/08/15 21:05	1330-20-7	
Surrogates								
1,2-Dichloroethane-d4 (S)	97	%.	70-130	1		04/08/15 21:05	17060-07-0	
Toluene-d8 (S)	99	%.	70-130	1		04/08/15 21:05	2037-26-5	
4-Bromofluorobenzene (S)	91	%.	70-130	1		04/08/15 21:05	460-00-4	
NWTPH-Gx MSV	Analytical Method: NWTPH-Gx							
TPH as Gas	ND	ug/L	250	1		04/02/15 21:40		
Surrogates								
1,2-Dichloroethane-d4 (S)	100	%.	70-130	1		04/02/15 21:40	17060-07-0	
Toluene-d8 (S)	101	%.	70-130	1		04/02/15 21:40	2037-26-5	
4-Bromofluorobenzene (S)	128	%.	70-130	1		04/02/15 21:40	460-00-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Sample: MW-3 **Lab ID: 1244968003** Collected: 03/25/15 14:05 Received: 03/27/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
NWTPH-Dx GCS, Silica Gel	Analytical Method: NWTPH-Dx Preparation Method: EPA 3510							
Diesel Fuel Range	ND	mg/L	0.046	1	04/01/15 17:47	04/12/15 12:17		L2
Motor Oil Range	ND	mg/L	0.092	1	04/01/15 17:47	04/12/15 12:17		
Surrogates								
n-Octacosane (S)	97	%.	70-130	1	04/01/15 17:47	04/12/15 12:17	630-02-4	
8260 MSV UST	Analytical Method: EPA 8260B							
Methyl-tert-butyl ether	ND	ug/L	0.50	1		04/08/15 21:30	1634-04-4	
Benzene	ND	ug/L	0.50	1		04/08/15 21:30	71-43-2	
Toluene	ND	ug/L	0.50	1		04/08/15 21:30	108-88-3	
Ethylbenzene	ND	ug/L	0.50	1		04/08/15 21:30	100-41-4	
Xylene (Total)	ND	ug/L	1.0	1		04/08/15 21:30	1330-20-7	
Surrogates								
1,2-Dichloroethane-d4 (S)	94	%.	70-130	1		04/08/15 21:30	17060-07-0	
Toluene-d8 (S)	98	%.	70-130	1		04/08/15 21:30	2037-26-5	
4-Bromofluorobenzene (S)	94	%.	70-130	1		04/08/15 21:30	460-00-4	
NWTPH-Gx MSV	Analytical Method: NWTPH-Gx							
TPH as Gas	ND	ug/L	418	1.67		04/02/15 23:19		
Surrogates								
1,2-Dichloroethane-d4 (S)	99	%.	70-130	1.67		04/02/15 23:19	17060-07-0	
Toluene-d8 (S)	100	%.	70-130	1.67		04/02/15 23:19	2037-26-5	
4-Bromofluorobenzene (S)	126	%.	70-130	1.67		04/02/15 23:19	460-00-4	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Sample: MW-4 **Lab ID: 1244968004** Collected: 03/25/15 12:15 Received: 03/27/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
NWTPH-Dx GCS, Silica Gel	Analytical Method: NWTPH-Dx Preparation Method: EPA 3510							
Diesel Fuel Range	**0.074**	mg/L	0.046	1	04/01/15 17:47	04/14/15 06:57		L2
Motor Oil Range	ND	mg/L	0.091	1	04/01/15 17:47	04/14/15 06:57		
Surrogates								
n-Octacosane (S)	99	%.	70-130	1	04/01/15 17:47	04/14/15 06:57	630-02-4	
8260 MSV UST	Analytical Method: EPA 8260B							
Methyl-tert-butyl ether	ND	ug/L	0.50	1		04/08/15 21:55	1634-04-4	
Benzene	ND	ug/L	0.50	1		04/08/15 21:55	71-43-2	
Toluene	ND	ug/L	0.50	1		04/08/15 21:55	108-88-3	
Ethylbenzene	ND	ug/L	0.50	1		04/08/15 21:55	100-41-4	
Xylene (Total)	ND	ug/L	1.0	1		04/08/15 21:55	1330-20-7	
Surrogates								
1,2-Dichloroethane-d4 (S)	95	%.	70-130	1		04/08/15 21:55	17060-07-0	
Toluene-d8 (S)	98	%.	70-130	1		04/08/15 21:55	2037-26-5	
4-Bromofluorobenzene (S)	92	%.	70-130	1		04/08/15 21:55	460-00-4	
NWTPH-Gx MSV	Analytical Method: NWTPH-Gx							
TPH as Gas	ND	ug/L	250	1		04/02/15 19:35		
Surrogates								
1,2-Dichloroethane-d4 (S)	96	%.	70-130	1		04/02/15 19:35	17060-07-0	
Toluene-d8 (S)	98	%.	70-130	1		04/02/15 19:35	2037-26-5	
4-Bromofluorobenzene (S)	124	%.	70-130	1		04/02/15 19:35	460-00-4	

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ANALYTICAL RESULTS

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Sample: MW-5 **Lab ID: 1244968005** Collected: 03/25/15 10:55 Received: 03/27/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
NWTPH-Dx GCS, Silica Gel	Analytical Method: NWTPH-Dx Preparation Method: EPA 3510							
Diesel Fuel Range	ND	mg/L	0.045	1	04/01/15 17:47	04/12/15 13:27		L2
Motor Oil Range	ND	mg/L	0.091	1	04/01/15 17:47	04/12/15 13:27		
Surrogates								
n-Octacosane (S)	107	%.	70-130	1	04/01/15 17:47	04/12/15 13:27	630-02-4	
8260 MSV UST	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	0.50	1		04/08/15 22:20	71-43-2	
Ethylbenzene	**218**	ug/L	0.50	1		04/08/15 22:20	100-41-4	
Methyl-tert-butyl ether	ND	ug/L	0.50	1		04/08/15 22:20	1634-04-4	
Toluene	**0.61**	ug/L	0.50	1		04/08/15 22:20	108-88-3	
Xylene (Total)	**1450**	ug/L	5.0	5		04/10/15 17:12	1330-20-7	
Surrogates								
1,2-Dichloroethane-d4 (S)	96	%.	70-130	1		04/08/15 22:20	17060-07-0	
Toluene-d8 (S)	102	%.	70-130	1		04/08/15 22:20	2037-26-5	
4-Bromofluorobenzene (S)	94	%.	70-130	1		04/08/15 22:20	460-00-4	
NWTPH-Gx MSV	Analytical Method: NWTPH-Gx							
TPH as Gas	**18100**	ug/L	250	1		04/02/15 22:05		E
Surrogates								
1,2-Dichloroethane-d4 (S)	99	%.	70-130	1		04/02/15 22:05	17060-07-0	
Toluene-d8 (S)	102	%.	70-130	1		04/02/15 22:05	2037-26-5	
4-Bromofluorobenzene (S)	119	%.	70-130	1		04/02/15 22:05	460-00-4	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
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ANALYTICAL RESULTS

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Sample: MW-5 DUP **Lab ID: 1244968006** Collected: 03/25/15 10:55 Received: 03/27/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
NWTPH-Dx GCS, Silica Gel	Analytical Method: NWTPH-Dx Preparation Method: EPA 3510							
Diesel Fuel Range	ND	mg/L	0.046	1	04/01/15 17:47	04/12/15 14:02		L2
Motor Oil Range	ND	mg/L	0.092	1	04/01/15 17:47	04/12/15 14:02		
Surrogates								
n-Octacosane (S)	115	%.	70-130	1	04/01/15 17:47	04/12/15 14:02	630-02-4	
8260 MSV UST	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	0.50	1		04/08/15 22:38	71-43-2	
Ethylbenzene	**236**	ug/L	0.50	1		04/08/15 22:38	100-41-4	
Methyl-tert-butyl ether	ND	ug/L	0.50	1		04/08/15 22:38	1634-04-4	
Toluene	**0.65**	ug/L	0.50	1		04/08/15 22:38	108-88-3	
Xylene (Total)	**1220**	ug/L	5.0	5		04/11/15 03:39	1330-20-7	
Surrogates								
1,2-Dichloroethane-d4 (S)	97	%.	70-130	1		04/08/15 22:38	17060-07-0	
Toluene-d8 (S)	96	%.	70-130	1		04/08/15 22:38	2037-26-5	
4-Bromofluorobenzene (S)	105	%.	70-130	1		04/08/15 22:38	460-00-4	
NWTPH-Gx MSV	Analytical Method: NWTPH-Gx							
TPH as Gas	**17200**	ug/L	250	1		04/02/15 22:30		E
Surrogates								
1,2-Dichloroethane-d4 (S)	95	%.	70-130	1		04/02/15 22:30	17060-07-0	
Toluene-d8 (S)	102	%.	70-130	1		04/02/15 22:30	2037-26-5	
4-Bromofluorobenzene (S)	124	%.	70-130	1		04/02/15 22:30	460-00-4	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
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Davis, CA 95618
(530) 297-4800

ANALYTICAL RESULTS

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Sample: MW-6 **Lab ID: 1244968007** Collected: 03/25/15 11:40 Received: 03/27/15 10:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
NWTPH-Dx GCS, Silica Gel	Analytical Method: NWTPH-Dx Preparation Method: EPA 3510							
Diesel Fuel Range	**0.047**	mg/L	0.046	1	04/01/15 17:47	04/12/15 14:38		L2
Motor Oil Range	ND	mg/L	0.092	1	04/01/15 17:47	04/12/15 14:38		
Surrogates								
n-Octacosane (S)	77	%.	70-130	1	04/01/15 17:47	04/12/15 14:38	630-02-4	
8260 MSV UST	Analytical Method: EPA 8260B							
Methyl-tert-butyl ether	ND	ug/L	0.50	1		04/08/15 17:21	1634-04-4	
Benzene	**516**	ug/L	2.5	5		04/10/15 01:11	71-43-2	H1
Toluene	**75.6**	ug/L	0.50	1		04/08/15 17:21	108-88-3	
Ethylbenzene	**1400**	ug/L	2.5	5		04/10/15 01:11	100-41-4	H1
Xylene (Total)	**2260**	ug/L	5.0	5		04/10/15 01:11	1330-20-7	ES
Surrogates								
1,2-Dichloroethane-d4 (S)	99	%.	70-130	1		04/08/15 17:21	17060-07-0	
Toluene-d8 (S)	102	%.	70-130	1		04/08/15 17:21	2037-26-5	
4-Bromofluorobenzene (S)	106	%.	70-130	1		04/08/15 17:21	460-00-4	
NWTPH-Gx MSV	Analytical Method: NWTPH-Gx							
TPH as Gas	**13700**	ug/L	250	1		04/02/15 22:54		E
Surrogates								
1,2-Dichloroethane-d4 (S)	99	%.	70-130	1		04/02/15 22:54	17060-07-0	
Toluene-d8 (S)	100	%.	70-130	1		04/02/15 22:54	2037-26-5	
4-Bromofluorobenzene (S)	123	%.	70-130	1		04/02/15 22:54	460-00-4	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

QC Batch: DAOP/1038 Analysis Method: NWTPH-Dx
QC Batch Method: EPA 3510 Analysis Description: NWTPH-Dx GCS, Silica Gel
Associated Lab Samples: 1244968001, 1244968002, 1244968003, 1244968004, 1244968005, 1244968006, 1244968007

METHOD BLANK: 196942 Matrix: Water
Associated Lab Samples: 1244968001, 1244968002, 1244968003, 1244968004, 1244968005, 1244968006, 1244968007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Diesel Fuel Range	mg/L	ND	0.050	04/12/15 10:32	
Motor Oil Range	mg/L	ND	0.10	04/12/15 10:32	
n-Octacosane (S)	%.	79	70-130	04/12/15 10:32	

LABORATORY CONTROL SAMPLE: 196943

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Diesel Fuel Range	mg/L	.88	0.48	54	70-130	L0
n-Octacosane (S)	%.			92	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 197051 197052

Parameter	Units	1244968002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Diesel Fuel Range	mg/L	ND	.81	.81	0.63	0.64	76	78	70-130	3	25	
n-Octacosane (S)	%.						135	133	70-130			S0

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

QC Batch: DAVM/1137 Analysis Method: EPA 8260B
QC Batch Method: EPA 8260B Analysis Description: 8260 MSV UST-WATER
Associated Lab Samples: 1244968001, 1244968002, 1244968003, 1244968004, 1244968005, 1244968006

METHOD BLANK: 198627 Matrix: Water
Associated Lab Samples: 1244968001, 1244968002, 1244968003, 1244968004, 1244968005, 1244968006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	0.50	04/08/15 14:50	
Ethylbenzene	ug/L	ND	0.50	04/08/15 14:50	
Methyl-tert-butyl ether	ug/L	ND	0.50	04/08/15 14:50	
Toluene	ug/L	ND	0.50	04/08/15 14:50	
Xylene (Total)	ug/L	ND	1.0	04/08/15 14:50	
1,2-Dichloroethane-d4 (S)	%.	88	70-130	04/08/15 14:50	
4-Bromofluorobenzene (S)	%.	93	70-130	04/08/15 14:50	
Toluene-d8 (S)	%.	96	70-130	04/08/15 14:50	

LABORATORY CONTROL SAMPLE: 198628

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	40	43.5	109	70-130	
Ethylbenzene	ug/L	40	41.2	103	70-130	
Methyl-tert-butyl ether	ug/L	40	46.4	116	70-130	
Toluene	ug/L	40	42.3	106	70-130	
Xylene (Total)	ug/L	120	120	100	70-130	
1,2-Dichloroethane-d4 (S)	%.			95	70-130	
4-Bromofluorobenzene (S)	%.			87	70-130	
Toluene-d8 (S)	%.			101	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 198629 198630

Parameter	Units	1244971027 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Benzene	ug/L	40.9	40	40	85.2	83.1	111	106	70-130	2	25	H1
Ethylbenzene	ug/L	ND	40	40	40.9	40.2	102	100	70-130	2	25	H1
Methyl-tert-butyl ether	ug/L	62.3	40	40	111	109	122	117	70-130	2	25	H1
Toluene	ug/L	0.96	40	40	42.1	41.4	103	101	70-130	2	25	H1
Xylene (Total)	ug/L	ND	120	120	119	118	99	97	70-130	1	25	
1,2-Dichloroethane-d4 (S)	%.						97	94	70-130			
4-Bromofluorobenzene (S)	%.						90	91	70-130			
Toluene-d8 (S)	%.						101	101	70-130			

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

QC Batch: DAVM/1139
QC Batch Method: EPA 8260B
Analysis Method: EPA 8260B
Analysis Description: 8260 MSV UST-WATER
Associated Lab Samples: 1244968007

METHOD BLANK: 198770 Matrix: Water
Associated Lab Samples: 1244968007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	0.50	04/08/15 15:16	
Ethylbenzene	ug/L	ND	0.50	04/08/15 15:16	
Methyl-tert-butyl ether	ug/L	ND	0.50	04/08/15 15:16	
Toluene	ug/L	ND	0.50	04/08/15 15:16	
Xylene (Total)	ug/L	ND	1.0	04/08/15 15:16	
1,2-Dichloroethane-d4 (S)	%.	96	70-130	04/08/15 15:16	
4-Bromofluorobenzene (S)	%.	101	70-130	04/08/15 15:16	
Toluene-d8 (S)	%.	99	70-130	04/08/15 15:16	

LABORATORY CONTROL SAMPLE: 198771

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	40	44.3	111	70-130	
Ethylbenzene	ug/L	40	43.7	109	70-130	
Methyl-tert-butyl ether	ug/L	40	39.0	98	70-130	
Toluene	ug/L	40	45.2	113	70-130	
Xylene (Total)	ug/L	120	130	108	70-130	
1,2-Dichloroethane-d4 (S)	%.			96	70-130	
4-Bromofluorobenzene (S)	%.			101	70-130	
Toluene-d8 (S)	%.			99	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 198772 198773

Parameter	Units	1244971017 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Benzene	ug/L	ND	40	40	46.1	44.0	115	110	70-130	5	25	
Ethylbenzene	ug/L	ND	40	40	45.4	43.9	113	110	70-130	3	25	
Methyl-tert-butyl ether	ug/L	ND	40	40	42.2	41.1	105	102	70-130	3	25	
Toluene	ug/L	ND	40	40	47.1	45.0	118	112	70-130	5	25	
Xylene (Total)	ug/L	ND	120	120	134	129	112	108	70-130	3	25	
1,2-Dichloroethane-d4 (S)	%.						97	97	70-130			
4-Bromofluorobenzene (S)	%.						103	103	70-130			
Toluene-d8 (S)	%.						99	98	70-130			

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

QC Batch: DAVM/1120
QC Batch Method: NWTPH-Gx
Analysis Method: NWTPH-Gx
Analysis Description: NWTPH-Gx Water MSV
Associated Lab Samples: 1244968001

METHOD BLANK: 197042 Matrix: Water
Associated Lab Samples: 1244968001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH as Gas	ug/L	ND	250	04/01/15 18:41	
1,2-Dichloroethane-d4 (S)	%.	90	70-130	04/01/15 18:41	
4-Bromofluorobenzene (S)	%.	127	70-130	04/01/15 18:41	
Toluene-d8 (S)	%.	100	70-130	04/01/15 18:41	

LABORATORY CONTROL SAMPLE: 197043

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH as Gas	ug/L	480	459	96	70-130	
1,2-Dichloroethane-d4 (S)	%.			93	70-130	
4-Bromofluorobenzene (S)	%.			129	70-130	
Toluene-d8 (S)	%.			102	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 197044 197045

Parameter	Units	1244964016 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
TPH as Gas	ug/L	1360	480	480	1840	1720	101	76	70-130	7	25	
1,2-Dichloroethane-d4 (S)	%.						91	100	70-130			
4-Bromofluorobenzene (S)	%.						126	124	70-130			
Toluene-d8 (S)	%.						106	104	70-130			

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

QC Batch: DAVM/1122 Analysis Method: NWTPH-Gx
QC Batch Method: NWTPH-Gx Analysis Description: NWTPH-Gx Water MSV
Associated Lab Samples: 1244968002, 1244968003, 1244968004, 1244968005, 1244968006, 1244968007

METHOD BLANK: 197458 Matrix: Water
Associated Lab Samples: 1244968002, 1244968003, 1244968004, 1244968005, 1244968006, 1244968007

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
TPH as Gas	ug/L	ND	250	04/02/15 19:09	
1,2-Dichloroethane-d4 (S)	%.	94	70-130	04/02/15 19:09	
4-Bromofluorobenzene (S)	%.	117	70-130	04/02/15 19:09	
Toluene-d8 (S)	%.	101	70-130	04/02/15 19:09	

LABORATORY CONTROL SAMPLE: 197459

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
TPH as Gas	ug/L	480	479	100	70-130	
1,2-Dichloroethane-d4 (S)	%.			96	70-130	
4-Bromofluorobenzene (S)	%.			123	70-130	
Toluene-d8 (S)	%.			102	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 197473 197474

Parameter	Units	1244968004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
TPH as Gas	ug/L	ND	480	480	473	477	93	94	70-130	1	25	
1,2-Dichloroethane-d4 (S)	%.						98	95	70-130			
4-Bromofluorobenzene (S)	%.						129	120	70-130			
Toluene-d8 (S)	%.						101	100	70-130			

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REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

E	Analyte concentration exceeded the calibration range. The reported result is estimated.
ES	The reported result is estimated because one or more of the constituent results are qualified as such.
H1	Analysis conducted outside the recognized method holding time.
L0	Analyte recovery in the laboratory control sample (LCS) was outside QC limits.
L2	Analyte recovery in the laboratory control sample (LCS) was below QC limits. Results may be biased low.
S0	Surrogate recovery outside laboratory control limits.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: NuStar Vacouver GWM
Pace Project No.: 1244968

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
1244968001	**MW-1**	EPA 3510	DAOP/1038	NWTPH-Dx	DASG/1035
1244968002	**MW-2**	EPA 3510	DAOP/1038	NWTPH-Dx	DASG/1035
1244968003	**MW-3**	EPA 3510	DAOP/1038	NWTPH-Dx	DASG/1035
1244968004	**MW-4**	EPA 3510	DAOP/1038	NWTPH-Dx	DASG/1035
1244968005	**MW-5**	EPA 3510	DAOP/1038	NWTPH-Dx	DASG/1035
1244968006	**MW-5 DUP**	EPA 3510	DAOP/1038	NWTPH-Dx	DASG/1035
1244968007	**MW-6**	EPA 3510	DAOP/1038	NWTPH-Dx	DASG/1035
1244968001	**MW-1**	EPA 8260B	DAVM/1137		
1244968002	**MW-2**	EPA 8260B	DAVM/1137		
1244968003	**MW-3**	EPA 8260B	DAVM/1137		
1244968004	**MW-4**	EPA 8260B	DAVM/1137		
1244968005	**MW-5**	EPA 8260B	DAVM/1137		
1244968006	**MW-5 DUP**	EPA 8260B	DAVM/1137		
1244968007	**MW-6**	EPA 8260B	DAVM/1139		
1244968001	**MW-1**	NWTPH-Gx	DAVM/1120		
1244968002	**MW-2**	NWTPH-Gx	DAVM/1122		
1244968003	**MW-3**	NWTPH-Gx	DAVM/1122		
1244968004	**MW-4**	NWTPH-Gx	DAVM/1122		
1244968005	**MW-5**	NWTPH-Gx	DAVM/1122		
1244968006	**MW-5 DUP**	NWTPH-Gx	DAVM/1122		
1244968007	**MW-6**	NWTPH-Gx	DAVM/1122		

APEX

CHAIN OF CUSTODY RECORD

12449168

Client Name:	Apex/Ash Creek	Telephone Number:	503.924.4704
Address:	3015 SW First Ave	Fax No.:	503.943.6357
City/State/Zip:	Portland, OR 97201		

Project Manager: Stephanie Bosze Salisbury 503-924-4704 x1925

Analytical Lab: Pace

Project Name: NuStar Vacouver GWM

Report To: sbosze@apexcos.com

Project Number: 1569-04 T2

Page: 1 of 1

Sampler Name: C. Clough

Sample ID / Description	Date Sampled	Time Sampled	No. of Containers Shipped	Grab	Composite	Field Filtered	Preservative: Ice	Preservative: HNO_3 (Red Label)	Preservative: HCl (Blue Label)	Preservative: NaOH (Orange Label)	Preservative: H_2SO_4 Plastic (Yellow Label)	Preservative: H_2SO_4 Glass(Yellow Label)	Preservative: None (Black Label)	Preservative: Other (Specify)	Matrix: Groundwater	Matrix: Wastewater	Matrix: Drinking Water	Matrix: Sludge	Matrix: Soil	Matrix: Other (specify):	Analyze For: TPH-diesel and heavy oil -NWTPG-Dx with silica gel clea	Analyze For: NWTPH-Gx	Analyze For: BTEX, MTBE ONLY by 8260B	RUSH TAT (Pre-Schedule)	Standard TAT	Fax Results	Send QC with report	
MW-1	3/25/15	1330	6	X			X		X						X						X	X	X		X			001
MW-2	3/25/15	1255	6	X			X		X						X						X	X	X		X			002
MW-3	3/25/15	1405	6	X			X		X						X						X	X	X		X			003
MW-4	3/25/15	1215	6	X			X		X						X						X	X	X		X			004
MW-5	3/25/15	1055	6	X			X		X						X						X	X	X		X			005
MW-5 DUP	3/25/15	1055	6	X			X		X						X						X	X	X		X			006
MW-6	3/25/15	1140	6	X			X		X						X						X	X	X		X			007

Special Instructions:

Laboratory Comments:
Temperature Upon Receipt:
VOCs Free of Headspace? Y N

Method of Shipment: FexEx

Relinquished by: Name/Company	Date	Time	Received by: Name/Company	Date	Time
Chris Clough / Apex Companies	3/26/2015	1000	PACE Analytical	032715	1030
Relinquished by: Name/Company	Date	Time	Received by: Name/Company	Date	Time
Relinquished by: Name/Company	Date	Time	Received by: Name/Company	Date	Time
Relinquished by: Name/Company	Date	Time	Received by: Name/Company	Date	Time

Pace Analytical	Document Name: Sample Condition Upon Receipt Form	Document Revised: 25Feb2015 Page 1 of 1
	Document No.: F-DAV-C-002-rev.02	Issuing Authority: Pace Davis, CA Quality Office

Sample Condition Upon Receipt

Client Name: (APEX) Mustar Vancouver GWM

Project #: WO# : 1244968

1244968

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ OnTrac ☐ Other:

Tracking Number: 7732 2419 2571

Custody Seal on Cooler/Box Present? ☒ Yes ☐ No **Seals Intact?** ☒ Yes ☐ No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐ Bubble Wrap ☒ Bubble Bags ☐ None ☐ Other: **Temp Blank?** ☐ Yes ☒ No

Thermom. Used: ☐ DA1434 ☒ DA2285 **Type of Ice:** ☒ Wet ☐ Blue ☐ Dry Ice ☐ None ☐ Samples on ice, cooling process has begun

Cooler Temp Read(°C): 3.8 **Cooler Temp Corrected(°C):** 3.8 **Biological Tissue Frozen?** ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C **Correction Factor:** 0 **Date and Initials of Person Examining Contents:** EMJ 03/27/15

				Comments:
Chain of Custody Present?	☒ Yes	☐ No	☐ N/A	1.
Chain of Custody Filled Out?	☒ Yes	☐ No	☐ N/A	2.
Chain of Custody Relinquished?	☐ Yes	☒ No	☐ N/A	3.
Sampler Name and/or Signature on COC?	☒ Yes	☐ No	☐ N/A	4.
Samples Arrived within Hold Time?	☒ Yes	☐ No	☐ N/A	5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☒ No	☐ N/A	6.
Rush Turn Around Time Requested?	☐ Yes	☒ No	☐ N/A	7.
Sufficient Volume?	☒ Yes	☐ No	☐ N/A	8.
Correct Containers Used?	☒ Yes	☐ No	☐ N/A	9.
-Pace Containers Used?	☒ Yes	☐ No	☐ N/A	
Containers Intact?	☒ Yes	☐ No	☐ N/A	10.
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☒ N/A	11. Note if sediment is visible in the dissolved container.
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT	☒ Yes	☐ No	☐ N/A	12.
All containers needing acid/base preservation have been checked?	☐ Yes	☐ No	☒ N/A	13. ☐ HNO_3 ☐ H_2SO_4 ☐ NaOH ☐ HCl
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, HCl<2; NaOH >9 Sulfide, NaOH>12 Cyanide)	☐ Yes	☐ No	☒ N/A	Sample #
Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC	☒ Yes	☐ No		Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☒ No	☐ N/A	14.
Trip Blank Present?	☐ Yes	☒ No	☐ N/A	15.
Trip Blank Custody Seals Present?	☐ Yes	☐ No	☒ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

Project Manager Review: Scott Fabus **Date:** 3/31/15

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

Attachment C

Apex Standard Operating Procedures

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods for observing and sampling from push-probes (i.e., GeoProbe™). Subsurface soil cores may be obtained using this system for purposes of determining subsurface soil conditions and for obtaining soil samples for physical and/or chemical evaluation. Grab groundwater samples may be collected using temporary well screens. Soil vapor samples may be obtained using temporary well points. Shallow (less than 50 feet), small-diameter (2-inch max) pre-packed wells may also be installed using push-probe equipment. This procedure is applicable during all Apex Companies, LLC (Apex) push-probe activities.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Traffic cones, measuring tape, spatula, and buckets/drums
- Sampling equipment (water level probe, pumps, tubing) and laboratory-supplied sample containers
- Field documentation materials
- Decontamination materials
- Personal protective equipment (as required by project Health and Safety Plan)

3. METHODOLOGY

Coring Procedure (Conducted by Drilling Subcontractor):

The sampling procedure includes driving a 2-inch outside-diameter, 5-foot-long, push-probe soil sampler to the desired depth using a combination of hydraulic pressure and mechanical hammer blows. When the sampling depth is reached, the pin attaching the sampler's tip is released (if a tip is used), which allows the tip to slide inside the sampler (Macro-Core Sampler with removable plastic liner). The sampler is driven the length of the sampler to collect a soil core, which is then withdrawn from the exploration. When the sampler is retrieved from the borehole the drive head/cutting shoe is detached and the liner is removed. Soil cores are collected continuously to the full depth of the exploration unless otherwise specified in a project-specific sampling and analysis plan (SAP). Verify that the subcontractor decontaminates the sampling device (per SOP 1.2) prior to its initial use and following collection of each soil sample.

Logging and Soil Sample Collection:

Remove the soil core from the sampler for field screening, description, and placement into sample jars. Soil samples will be collected for field screening and possible chemical analysis on two foot intervals unless otherwise specified in a project-specific SAP. The sampling interval will be determined in the field based on recovery, soil variability, and evidence of contamination. Complete field screening as specified in SOP-2.1. Soil samples should be collected using different procedures for volatile on non-volatile analyses, as follows.

- **Volatile Analyses.** Sampling for volatile organics analysis (VOA) is different than other routine physical or chemical testing because of the potential loss of volatiles during sampling. To limit volatile loss, the soil sample must be obtained as quickly and as directly as possible. If a VOA sample is to collected as part of a multiple analyte sample, the VOA sample portion will be obtained first. The VOA sample should be obtained from a discrete portion of the entire collected sample and should not be composited or homogenized. Sample bottles should be filled to capacity, with no headspace. Specific procedures for collecting VOA samples using the EPA Method 5035 are discussed in SOP 2.7.
- **Other Analyses.** Soil samples for non-volatile analyses will be thoroughly homogenized in a stainless steel bowl prior to bottling. Sample homogenizing is accomplished by manually mixing the entire soil

sample in the stainless steel bowl with a clean sampling tool until a uniform mixture is achieved. The sample jar should be filled completely.

Any extra soil generated during probing activities will be placed in Department of Transportation (DOT) approved drums.

Grab Groundwater Sample Collection:

Collect grab groundwater samples using a sampling attachment with a 4 to 5-foot-long temporary screen (specify to drillers whether to use decontaminated stainless steel or disposable PVC. Also, specify whether a filter pack is necessary based on field observations). Obtain samples using a peristaltic pump unless otherwise specified in the SAP with new tubing for each boring. Record field parameters (e.g., temperature, conductivity, and pH) prior to sampling.

Backfilling the Excavation (Conducted by Drilling Subcontractor):

After sampling activities are completed, abandon each exploration in accordance with Oregon Water Resources Department (OWRD) regulations and procedures. The abandonment procedure typically consists of filling the exploration with granular bentonite and hydrating the bentonite with water. Match the surface completion to the surrounding materials.