SECOND QUARTER 2016 PROGRESS REPORT / FIRST QUARTER 2016 GROUNDWATER PERFORMANCE MONITORING REPORT BP WEST COAST PRODUCTS TERMINAL, HARBOR ISLAND 1652 SW LANDER STREET SEATTLE, WASHINGTON

CONSENT DECREE NO. 00-2-05714-8SEA

JULY 2016

Prepared for Atlantic Richfield Company 4 Centerpointe Drive, Suite 200 Room LPR 4-222 La Palma, CA 90623

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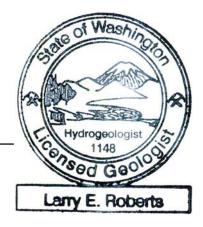


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1. INTRODUCTION

Atlantic Richfield Company is submitting this report prepared by TechSolve Environmental, Inc. (TechSolve) to summarize the First Quarter 2016 Groundwater Monitoring event and operation and maintenance of the waterfront remediation system through the second quarter (June) of 2016 for the BP West Coast Products Terminal (formerly known as the ARCO Terminal 21T). Groundwater monitoring and remediation system reporting periods are staggered due to the time required to receive and validate laboratory reports from groundwater monitoring events. The combination of these two summary reports was based upon the recommendation of the Washington State Department of Ecology (Ecology) project manager (Ecology, 2004a). This progress report satisfies reporting schedule submittal requirements pursuant to Ecology Consent Decree No. 00-2-05714-8SEA, entered into court March 24, 2000 (Ecology, 2000b).

2. REMEDIATION SYSTEM OPERATIONS

Remediation systems were installed and completed at the Site in accordance with specifications outlined in the Engineering Design Report (EDR) (TechSolv and AG&M, 2000) and Cleanup Action Plan (CAP) (Ecology, 1999). During the first six months of 2016 a waterfront groundwater/Light Non-Aqueous Phase Liquid (LNAPL) remediation system operated to remove free-phase LNAPL and dissolved petroleum hydrocarbons from groundwater at Plant 1 (Figure 1).

2.1. WATERFRONT SYSTEM OPERATIONS

Installation and startup of the final waterfront remediation system was completed in 2002 and operational testing was conducted through 2003. Standard operation began once testing showed the system operated as designed and in accordance with Consent Decree and EDR requirements. Reports submitted to Ecology summarized both construction and operation & maintenance (O&M) of the remediation system. The Construction Completion Report (CCR) (TechSolve, 2003b) summarized construction, installation, and startup testing of the final remediation system, and documented that systems met design criteria, attained desired capture, and hydraulic control along the waterfront. The Final O&M Manual (TechSolve, 2003c) contains procedures to operate and maintain systems, vendor-supplied manuals for components, and health and safety practices. Ecology stated that the CCR and O&M Manual complied with the requirements of the Consent Decree, the Groundwater Compliance Monitoring Program, and the Model Toxics Control Act (WAC 173-340-400) and, as such, were approved (Ecology, 2004b). The O&M Manual is updated as practices or procedures change, or as systems are altered.

O&M activities are conducted on systems weekly to ensure they operate as designed and in accordance with applicable permits. These activities include, but are not limited to:

- Weekly checks of groundwater recovery system pumping rates.
- Weekly inspections of system components and waste storage containers for integrity per the requirements of WAC 173-303-320.
- Monthly sampling of recovered groundwater influent and effluent streams to ensure compliance with King County Department of Natural Resources and Parks (KCDNR) Discharge Permit 7592-05 for discharge A43262.

- Monthly monitoring and calculation of system LNAPL recovery.
- Monthly sampling of system flow rates and hydrocarbon concentrations.

Additional maintenance activities are conducted as needed to maintain system operational integrity and to ensure discharges are within permitted ranges.

Operation of waterfront air sparging and SVE systems were discontinued in May 2008, as the bulk of available hydrocarbons had been recovered. System data collected during 5 years of operation prior to shutdown were presented in previous reports, and support system shutdown. These findings were presented to Ecology in a 5-year Review meeting, conducted October 8, 2008, and summarized in the 2008 Annual Site Report (TechSolve, 2009).

Combined LNAPL recovery (free-phase, residual, and dissolved) from final SVE and groundwater and LNAPL recovery systems is approximately 14,542 gallons (October 2002 to June 2016) (Table 1). Interim systems, operating from 1992 through 2002, recovered an additional 15,223 gallons of LNAPL, for a combined LNAPL recovery from interim and final remediation systems of 29,766 gallons. The majority of LNAPL recovered by interim remediation systems was free-phase LNAPL. The majority of LNAPL recovered by final remediation systems was from enhanced biodegradation, calculated from SVE vapor sampling for CO_2 . SVE system shutdown in 2008 was based, in part, on concentrations of CO_2 reaching atmospheric (background) levels.

Groundwater/LNAPL recovery system data in Table 1 show influent concentrations of dissolved benzene, diesel, and gasoline in recovered groundwater fluctuate slightly throughout the year but have decreased over time. Table 1 also shows that measurable volumes of free LNAPL have not been generated since 2008, which was the last time sufficient quantities of LNAPL were recovered to warrant off-site shipment. This data corresponds with the lack of free LNAPL observed in recovery wells utilized by the groundwater/LNAPL recovery system. Lack of free LNAPL in wells and limited free LNAPL recovery by the groundwater/LNAPL recovery system indicates that the recovery system has captured most available free LNAPL.

Effluent discharges from the groundwater/LNAPL recovery system to sanitary have been within KCDNR's permitted ranges (Table 1) in 2016 and system recovery rates have been effective in preventing sheens from occurring on the adjacent Duwamish Waterway. Average monthly effluent flow rates ranged from 2.49 to 1.52 gallons per minute (gpm) in 2016, below KCDNR's maximum permitted flow of 17.5 gpm, consistent with past rates.

Reductions in dissolved hydrocarbon concentrations through a diffused air stripper (DAS) (Table 1) show it effectively treats recovered groundwater and meets permit requirements. DAS Influent concentrations of dissolved hydrocarbons continue to be below permitted effluent discharge levels, indicating DAS operation is not necessary to achieve permit compliance. However, the DAS continues to operate, as influent concentrations of dissolved hydrocarbons vary over time and concentrations in individual recovery wells exceed permitted discharge levels at times.

Maintenance and repair activities of remediation systems are conducted to maintain effective operation and system capture and hydraulic control along the waterfront. Notable activities conducted to date in 2016 include:

- Conveyance piping line snaking and jetting to remove scale and biofouling.
- Annual corrosion inspection of conveyance piping by corrosion engineer to verify integrity.
- Jetting of recovery wells' screened intervals to remove scale and biofouling.

Well jetting and well rehabilitation items listed above are conducted to enhance production of recovery wells. Pumping rates from individual recovery wells are evaluated and well rehabilitation actions are conducted as necessary to maintain effective capture. Data show that the system continues to operate as designed and in accordance with permit requirements.

2.2. INLAND SYSTEM OPERATIONS

An Inland SVE system operated to improve soil and groundwater conditions along the southern boundary of Plant 1. Past investigations and monitoring near the southern property boundary (Figure 1) showed petroleum hydrocarbons in soil and groundwater exceeded site cleanup levels and, mainly located in the vadose zone (unsaturated soils and capillary fringe).

SVE system designs, similar to the Waterfront SVE system, were submitted to and approved by Ecology in 2007 (TechSolve, 2007 & Ecology, 2007). SVE subsurface components were installed in October 2007. SVE equipment and catalytic oxidation (CATOX) vapor treatment were specified based on pilot testing and installed in August 2008. SVE air discharges were approved under Puget Sound Clean Air Agency (PSCAA) Notice of Construction (NoC) No. 9858.

Data from SVE startup in August 2008 through shutdown in December 2014 show the system captured approximately 7,940 pounds (1,291 gallons) of gasoline range hydrocarbons. Induced airflow from SVE operation also enhanced biodegradation of residual hydrocarbons. Calculations estimate that an additional 4,355 gallons of gasoline-range hydrocarbons were reduced by biodegradation, for a combined (biodegradation and vapor) recovery of gasoline-range hydrocarbons of 5,646 gallons (TechSolve, 2016).

The SVE system is currently shutdown as recovery data indicates the system no longer recovers measurable concentrations of petroleum hydrocarbons and induced airflow is no longer affecting biodegradation. By January 2010, influent hydrocarbon concentrations recovered by the Inland SVE system were routinely below laboratory detection limits and below PSCAA treatment thresholds. By 2012 CO₂ levels had also fallen to background levels (atmospheric), indicating biodegradation rates had decreased as the bulk of available hydrocarbons in this area had been reduced or captured. Additional information regarding the shutdown of the Inland SVE system was provided in the 2015 Annual Site Report (TechSolve, 2016).

System checks are currently conducted to ensure that the system is maintained in an operational state in case site conditions change and future operation of the Inland SVE System is warranted.

Groundwater performance monitoring measures improvements in groundwater quality along Plant 1's southern boundary from operation of the Inland SVE system. Groundwater monitoring data collected following Inland SVE startup in 2008 indicate the system has improved groundwater conditions at the southern property boundary, as discussed in the following section.

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3. SUMMARY OF GROUNDWATER PERFORMANCE MONITORING PROGRAM

The First Quarter 2016 Groundwater Monitoring Event represents the 65rd round of performance monitoring performed under the Consent Decree. Groundwater monitoring is conducted in accordance with requirements of the Consent Decree, CAP, and Groundwater Compliance Monitoring and Contingency Program (TechSolve, 1999). The Groundwater Compliance Monitoring and Contingency Program describes the monitoring well network, sampling frequency, and analytes. Some revisions to the monitoring plan were included in the EDR, per Ecology's approval. Additional revisions have been made with Ecology's approval based on on-going monitoring results. The current groundwater monitoring schedule is summarized in Table 3. Monitoring well locations are shown on Figure 2 for Plant 1 and Figure 3 for Plant 2.

Groundwater monitoring requirements were revised in 2002, with concurrence from Ecology, to exclude sampling Plant 2 Wells MW-18-1, MW-18-2A, GM-21S, and GM-22S (Ecology, 2002). In 2004, remaining Plant 2 Wells GM-19S, GM-19D, MW-03R, and GM-22S were also excluded (Ecology, 2004b). However, Well GM-19S continues to be monitored for benzene and gasoline, as GM-19S has historically contained gasoline range hydrocarbons above cleanup levels, which previous investigations attributed to an unidentified off-site source (TechSolve, 2003a).

In 2005, four wells (MW-1-T9, MW-2-T9, MW-3-T9, and MW-4-T9) were installed at the south end of Plant 1 (Figure 2) to evaluate trends in groundwater due to continuing detections of hydrocarbons above cleanup levels in Monitoring Well AR-03. These wells have been monitored quarterly since December 2005, which has helped evaluate the effectiveness of the Inland SVE system in meeting cleanup objectives in this area, as discussed in the previous section.

Wells GM-16S and GM-17S are hydraulically upgradient from Plant 1 and were removed from most of the monitoring program with approval from Ecology in March 2000 (Ecology, 2000a) as sufficient upgradient data had been collected from these wells. Semiannual monitoring for hydrocarbons was voluntarily reinitiated in these wells in September 2007, as requested by Ecology, to monitor for potential petroleum hydrocarbons migration onto the property from upgradient, off-site sources.

Well GM-14S was historically used to monitor for sheens on groundwater, as discussed below. As sheens are no longer detected in GM-14S, quarterly groundwater monitoring for indicator hazardous substances (IHSs) was initiated in this well in 2007.

Additional revisions to the groundwater monitoring program were approved by Ecology in 2009 (Ecology, 2009). Revisions affected monitoring frequencies and required analyses. The monitoring frequency from Wells GM-19S, 15S, 16S, and 17S was reduced from quarterly to semi-annually. The monitoring frequency from GM-19S was reduced based on consistent and stable benzene and gasoline monitoring results. The monitoring frequency from GM-15S, 16S, and 17S was reduced due to consistent monitoring data for total petroleum hydrocarbons (TPH) and benzene below cleanup levels. However, benzene detections above the site cleanup level in GM-15S in 2013 prompted the voluntarily increase of sampling frequency from semi-annually back to quarterly to better evaluate benzene trends in this well, as discussed in previous reports (TechSolve, 2016). The voluntary monitoring frequency of sampling for carcinogenic polynuclear aromatic hydrocarbons (cPAHs) was set to an annual basis in waterfront wells (AMW-01 through AMW-05) as extensive historical sampling does not indicate any significant detection trends. Ecology agreed

that analysis for cPAHs from these wells is voluntary until cleanup objectives are met (Ecology, 2003). Sampling for cPAHs was last conducted in fourth quarter 2015 (TechSolve, 2016)

Wells monitored on a semi-annual basis are sampled in the first and third quarter, which typically correspond with seasonal groundwater highs and lows, respectively. Based upon these seasonal fluctuations in groundwater, wells GM-19S, 16S, and 17s were sampled in the first quarter of 2016. These wells will next be sampled in the third quarter of 2016.

The First Quarter 2016 Groundwater Monitoring event was conducted March 8th and 9th, 2016. First quarter 2016 groundwater elevations (Table 3) were higher overall than third and fourth quarter 2015 elevations. These data indicate that the seasonal groundwater high occurred in early 2016, rising from the previous seasonal low in September 2015. This groundwater elevation trend corresponds with historic trends, which show groundwater elevations rise to seasonal highs in the winter and spring and fall to seasonal lows in the summer and fall.

First Quarter 2016 Groundwater Monitoring Event samples were submitted to Test America Laboratories of Tacoma, Washington for laboratory analysis of IHSs identified in the CAP. The IHSs include TPH as gasoline (TPH-G), TPH as diesel (TPH-D), TPH as oil (TPH-O), and benzene.

Petroleum hydrocarbon monitoring results for the First Quarter 2016 Groundwater Monitoring Event are included in Table 4 and Figures 2 and 3. Detections of IHSs (benzene, TPH-G, TPH-D, or TPH-O) above or at cleanup levels was limited to TPH-G at the cleanup level in Well MW-1-T9. Data were within historical ranges and consistent with historical trends. Data trend evaluations will be presented in the next Annual Site Report, in accordance with Consent Decree requirements.

Three wells (GM-11S, GM-12S, and GM-13S) are examined monthly for the presence of free LNAPL and sheens. Laboratory analysis for IHSs will not be conducted on groundwater from these Wells until they are removed from the monthly LNAPL gauging program, as required by the Groundwater Compliance Monitoring and Contingency Program. Historically, gauging for free LNAPL was conducted at five wells; however, gauging of Wells GM-14S and MW-03R has been discontinued with concurrence from Ecology. LNAPL monitoring of Well MW-03R at Plant 2 was discontinued in 2004 (Ecology, 2004b), as Plant 2 monitoring has been mostly discontinued as discussed above. Monthly monitoring for LNAPL in Monitoring Well GM-14S at Plant 1 was discontinued in 2004, with concurrence from Ecology (Ecology, 2004c), and converted to a monitoring well in 2007, as it has been free of LNAPL since 1999.

No sheens have been detected in Wells GM-11S and GM-12S in 2016. A sheen was detected in Well GM-13S in one (April) of the six monthly 2016 sheen monitoring events. The results of LNAPL monitoring for 2016 are presented in Table 5.

4. SUMMARY OF DATA VALIDATION

Laboratory analytical results were reported with associated laboratory quality assurance/quality control data (QA/QC). Analytical reports were reviewed and data were validated. During this quarter, most data did not require qualification. Limited data were qualified with a J qualifier (an estimated value), with a UJ qualifier (not detected and approximate reporting limit), with a U qualifier (undetected at the reporting limit), or R (rejected). Rejected data were limited to Diesel

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and Oil results from a field duplicate sample from Well AMW-01. Diesel and oil from the other field duplicate sample from Well AMW-01 were reported. A summary of the data qualified during validation, qualifiers assigned, and reasons for data qualification are provided in Table 6. All laboratory reports are retained at the TechSolve office.

5. SUMMARY

This progress report and groundwater monitoring report summarizes operation of remediation systems through the second quarter of 2016 (June 2016) and the First Quarter 2016 Groundwater Monitoring Event. In accordance with the Consent Decree, the Third Quarter 2016 Progress Report / Second Quarter 2016 Groundwater Monitoring Report will be the next report submitted to Ecology. This report will be submitted to Ecology by October 15, 2016 and will contain information on groundwater monitoring conducted during the second quarter of 2016 and discussions on ongoing site activities and remedial actions conducted in the third quarter of 2016. This report will include discussions of activities completed, discussions of data, data validation information, data tables, and laboratory analytical reports for wells in the monitoring well network.

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TABLES

Table 1. Waterfront Groundwater System Petroleum Hydrocarbon Recovery Rates BP West Coast Products Terminal 21T, Harbor Island, Seattle, Washington

		Influent	Effluent	%	Influent	Effluent	%	Influent	Effluent	%	Influent	Effluent	%	Influent	Effluent	%	Influent	Effluent	%	Influent	Effluent	%
SAMPLE DATE	UNITS	Benzene	Benzene	Reduction	Diesel	Diesel	Reduction	Ethylbenzene	Ethylbenzene	Reduction	Gasoline	Gasoline	Reduction	Oil	Oil	Reduction	Toluene	Toluene	Reduction	Xylenes	Xylenes	Reduction
2002 Averages	µg/L	225.3	14.3	91%	7,315	7,020	4%	55.2	6.2	75%	1,770	336	82%	831	804	5%	17.0	2.5	88%	88.8	9.9	87%
2003 Averages	µg/L	137.7	19.5	76%	4,945	4,648	-1%	44.5	12.9	69%	1,854	678	62%	760	763	0%	42.7	5.4	61%	154.1	50.3	68%
2004 Averages	µg/L	93.5	3.2	82%	10,285	9,342	-6%	76.8	4.7	79%	4,383	840	59%	762	1,026	-8%	116.6	2.2	82%	356.6	23.0	75%
2005 Averages	µg/L	76.7	14.5	84%	4,162	5,987	-9%	170.8	45.4	81%	10,090	3,229	70%	864	750	15%	566.9	121.0	84%	1,327.7	367.9	78%
2006 Averages	µg/L	38.9	1.2	89%	11,263	2,174	42%	42.1	0.9	90%	4,944	202	94%	665	666	0%	55.6	0.8	77%	485.1	5.2	96%
2007 Averages	µg/L	8.8	1.5	60%	1,223	906	18%	6.6	0.8	56%	407	115	63%	598	598	0%	1.0	0.5	21%	19.8	1.9	50%
2008 Averages	µg/L	10.0	1.1	70%	540	468	6%	5.5	0.7	39%	279	76	61%	505	504	0%	0.7	0.5	40%	10.6	1.6	65%
2009 Averages	µg/L	5.2	1.0	48%	369	561	8%	4.1	1.6	31%	407	182	46%	497	489	2%	0.8	0.7	44%	15.2	7.4	33%
2010 Averages	µg/L	3.9	0.7	76%		2,193	NA	6.8	1.7	78%	915	336	65%		410	NA	0.9	0.9	NA	26.3	6.7	69%
2011 Averages	µg/L	3.2	0.5	80%		1,714	NA	2.4	1.0	53%	439	89	69%		492	NA	1.0	1.0	NA	7.1	3.0	29%
2012 Averages	µg/L	3.6	1.3	48%		2,787	NA	1.9	1.2	37%	362	144	61%		636	NA	1.0	1.0	NA	5.7	3.4	48%
2013 Averages	µg/L	1.0	0.5	45%		1,333	NA	1.1	0.5	49%	356	124	57%		433	NA	0.5	0.5	NA	2.4	1.0	78%
2014 Averages	µg/L	1.7	0.3	61%		1,699	NA	0.6	0.3	46%	539	122	79%		236	NA	0.5	0.3	NA	1.5	0.5	61%
2015 Averages	µg/L	2.3	0.4	66%		5,175	NA	1.6	0.4	60%	1,146	406	64%		396	NA	0.5	0.4	NA	2.8	0.5	74%
1/13/2016	µg/L	7.1	0.76	89%		370	NA	16.00	2.20	86%	3,900	2100	46%		87	NA	1.10	0.44	60%	19.00	2.60	86%
2/10/2016	µg/L	0.71	0.42	41%		430	NA	2.40	0.51	79%	2,100	900	57%		33	NA	0.44	0.44	NA	3.40	0.50	85%
3/16/2016	µg/L	1.3	0.03	98%		2,000	NA	0.26	0.03	88%	1,300	670	48%		160	NA	0.06	0.07	-17%	0.87	0.06	93%
4/13/2016	µg/L	0.42	0.42	NA		1,500	NA	0.21	0.21	NA	970	73	92%		140	NA	0.18	0.18	NA	0.49	0.49	NA
5/18/2016	µg/L	0.42	0.42	NA		1,900	NA	0.21	0.21	NA	440	86	80%		350	NA	0.18	0.18	NA	0.49	0.49	NA
6/16/2016	µg/L	0.2	0.20	NA		2,000	NA	0.20	0.20	NA	420	100	76%		450	NA	0.20	0.20	NA	0.50	0.50	NA
SURFACE WATER CLEAR	NUP LEVELS	71 µg/L			10,000 µg/L			NA			1,000 µg/L			10,000 µg/L			NA			NA		-
KCDNR DISCHA	RGE LIMITS		70 µg/L			100,000 µg/L			1,700 µg/L			NA			100,000 µg/L			1,400 µg/L			NA	
2015	Averages	1.7 µa/L	.37 µg/L	76%	NA	1,367 µg/L	NA	3.21 µg/L	.56 µg/L	84%	1,522 µg/L	655 µg/L	67%	NA	203 µg/L	NA	.36 µg/L	.25 µg/L	NA	4.1 µa/L	.77 µa/L	88%

METRO DISCHARGE DATA

	Days Operational since last	Average flow	Total Flow Between Observation dates	Pounds of Benzene	Pounds of Gasoline	Pounds of Diesel	Pounds of Oil	Pounds of Toluene	Pounds of Ethylbenzene	Pounds of Xylenes	Total Gallons Gas, Diesel,	Oil Wate	er Separator Data	Manufacture
Observation Date	monitoring reading	(GPM)	(gallons)	Removed	Removed	Removed	Removed	Removed	Removed	Recovered	and Oil		Observation Date	Monthly LN
2002 Totals and Averages	65	4.18	322,785	0.62	4.99	19.42	2.30	0.05	0.13	0.22	3.90		February-03	
2003 Totals and Averages	361	8.03	4,114,867	4.43	62.20	169.14	26.05	1.18	1.47	5.05	37.76		April-03	
2004 Totals and Averages	338	9.58	4,570,461	3.54	175.70	419.25	28.95	5.35	3.16	14.66	92.43		May-03	
2005 Totals and Averages	359	11.17	5,827,144	3.43	447.43	155.78	41.55	25.29	7.69	59.98	100.52		July-03	
2006 Totals and Averages	365	6.40	3,220,733	0.80	192.72	663.65	19.09	2.85	1.89	20.04	128.92		December-03	
2007 Totals and Averages	360	3.17	1,599,607	0.15	9.08	18.30	8.40	0.02	0.11	0.48	5.20		January-04	
2008 Totals and Averages	363	3.19	1,645,810	0.14	3.95	7.21	6.95	0.01	0.08	0.15	2.59		June-04	
2009 Totals and Averages	369	2.98	1,569,390	0.07	5.75	7.81	6.40	0.01	0.06	0.22	2.89		August-04	
2010 Totals and Averages	372	2.17	1,185,127	0.04	8.62	18.84	4.26	0.01	0.05	0.19	4.66		September-04	
2011 Totals and Averages	356	1.90	949,880	0.03	5.13	17.55	3.54	0.01	0.03	0.13	3.81		November-04	
2012 Totals and Averages	371	1.89	948,600	0.03	3.97	25.92	3.47	0.01	0.02	0.04	4.81		December-04	
2013 Totals and Averages	365	1.33	700,450	0.01	2.26	8.80	3.43	0.00	0.01	0.02	2.08		January-05	
2014 Totals and Averages	332	1.62	761,480	0.01	3.43	10.95	1.55	0.00	0.00	0.01	2.33		February-05	
2015 Totals and Averages	358	1.71	874,680	0.02	6.56	36.53	2.92	0.00	0.01	0.02	6.68		July-05	
January-16	34	2.49	122,070	0.0072	4.89	5.79	0.31	0.0008	0.0132	0.0153	1.67		February-06	
February-16	28	2.41	97,270	0.0032	2.43	0.32	0.05	0.0006	0.0075	0.0091	0.45		March-06	
March-16	35	2.11	106,500	0.0009	1.51	1.08	0.09	0.0002	0.0012	0.0019	0.41		December-06	
April-16	28	1.74	70,300	0.0005	0.67	1.03	0.09	0.0001	0.0001	0.0004	0.27		March-08	
May-16	35	1.55	78,030	0.0003	0.46	1.11	0.16	0.0001	0.0001	0.0003	0.25		Total Gallons LNAPI	L Recovered
June-16	29	1.52	63,330	0.0002	0.23	1.03	0.21	0.0001	0.0001	0.0003	0.21			
2016 Totals and Averages	189	1.97	537,500	0.01	10.19	10.36	0.90	0.00	0.02	0.03	3.26			
		TOTALS:	28,828,514 gal	13.32	941.97	1589.50	159.78	34.80	14.74	101.24				
	Maximum permitted GPM:	17.5	Gallons Gas, Die	esel, & Oil Recovered	: 153.17	227.72	20.94	T	OTAL GALLONS	RECOVERED	401.83			

TOTAL PETROLEUM RECOVERY	
Total Ibs Dissolved Gas, Diesel, and Oil Recovered in Groundwater (2002-Present)	2,691 lbs
Total Gallons Dissolved Gas, Diesel, and Oil Recovered in Groundwater (2002-Present)*	402 gal
Total Gallons LNAPL Recovered by Final Recovery System (2002-Present)	395 gal
Total Gallons LNAPL Recovered by Interim Recovery System (1992-2002)	9,312 gal
Total Gallons of TPH Vapor Recovered by Final SVE System (2003-2008)**	2,334 gal
Total Gallons of TPH Vapor Recovered by Interim SVE System (1996-2002)**	1,248 gal
Total Gallons TPH Recovered from Final SVE System due to Biodegradation (2003-2008)***	11,411 gal
Total Gallons TPH Recovered from Interim SVE System due to Biodegradation (1996-2002)***	4,664 gal
Total Gallons Recovered by Final Recovery Systems (2002-Present)	14,542 gal
Total Gallons Recovered by Interim Recovery Systems (1992-2002)	15,223 gal
Total Gallons of Petroleum Removed (1992-Present)	29,766 gal

Notes:

LNAPL Recovery is recorded periodically when sufficient product has been accumulated to be transported off-site for disposal.

Influent diesel and oil samples are no longer analyzed, as influent and effluent samples are collected before and after, respectively, a diffused air stripper, which is not intended or effective at removing diesel or oil.

Effluent sample data are representative of the outflow water to King County Metro sanitary sewer.

The average $\mu g/L$ of the preceding month and the month of reference are used to calculate pounds of compound removed.

If the influent concentrations are below the laboratories method detection limit, the percent reduction is calculated using the method detection limit. The actual percent reduction is > the reported value.

* Calculation of lbs of Recovered Product:

To convert µg/L to lbs/gallon - (µg/L)x(3.785l/gal)=ug/gal, (ug/gal)x(ug/(2.2046x10-9lbs))=lbs/gal

lbs/gal of chemical constituent x total gallons recovered =lbs of chemical recovered

Density of Gasoline utilized for conversions from pounds to gallons is 6.15 lbs/gal

Density of Diesel utilized for conversions from pounds to gallons 6.98 lbs/gal

Density of Oil utilized for conversions from pounds to gallons 7.63 lbs/gal

Benzene, toluene, ethylbenzene, and xylenes volumes are not included in the Total Gallons calculations, as they are assumed to be included in TPH as gasoline.

** / *** SVE Recovery Calculations for TPH and Biodegradation, which are maintained in separate tables.

C = Average Influent TPH concentration (ppmv) Q = Influent Flow Rate (SCFM) Mc = Molecular wt. of Carbon Dioxide = 44 Mg = Molecular wt. of Gasoline = 87 Density of Gasoline for conversions is 6.15 lbs/gal

** TPH recovered by SVE system was calculated in lbs/hr = C x Q x Mg x 1.583 x 10^{-7}

1.583 x 10⁻⁷ is a constant and is derived as follows: 10⁻⁶ ppmv x 60min/1hr x 1 lb Mole/379 cu.ft.

SVE TPH recovery calculations are based on TPH concentrations in the SVE stream, SVE hrs of operation, and SVE measured flow rates.

Definitions:

gal - gallons GPM - Gallons per minute NA - Not available LNAPL - Light non-aqueous phase liquid (oil) SVE - Soil vapor extraction TPH - Total petroleum hydrocarbons µg/L - micrograms per liter

LNAPL Recovery (gal)
19.6
6.9
2.5
2
20
25
35
50
8
10
3.5
0
35
110
5
2
30
30
395

		Analyses Condu	ucted by Quarter	
Well	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Plant 1				
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,
MW-1-T9	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,
MW-2-T9	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,
MW-3-T9	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,
MW-4-T9	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,
GM-14S	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,
GM-15S	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O
	Benzene, TPH-G,		Benzene, TPH-G,	
GM-17S	TPH-D, TPH-O		TPH-D, TPH-O	
	Benzene, TPH-G,		Benzene, TPH-G,	
GM-16S	TPH-D, TPH-O		TPH-D, TPH-O	
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,
GM-24S	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,
AR-03	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O
				Benzene, TPH-G,
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	TPH-D, TPH-O,
AMW-01	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	cPAHs
				Benzene, TPH-G,
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	TPH-D, TPH-O,
AMW-02	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	cPAHs
				Benzene, TPH-G,
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	TPH-D, TPH-O,
AMW-03	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	cPAHs
				Benzene, TPH-G,
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	TPH-D, TPH-O,
AMW-04	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	cPAHs
				Benzene, TPH-G,
	Benzene, TPH-G,	Benzene, TPH-G,	Benzene, TPH-G,	TPH-D, TPH-O,
AMW-05	TPH-D, TPH-O	TPH-D, TPH-O	TPH-D, TPH-O	cPAHs
Plant 2				
GM-19S	Benzene, TPH-G		Benzene, TPH-G	

Table 2.Groundwater Performance Monitoring ScheduleBP West Coast Products Terminal 21T, Seattle, Washington

Notes: Field Duplicate and QA/QC samples collected from wells highlighted in bold.

TPH-G - Gasoline Range organics utilizing NWTPH-Gx method

TPH-D - Diesel Range Organics utilizing NWTPH-Dx

TPH-O - Extended Range Organics (Motor Oil) utilizing NWTPH-Dx

Benzene is analyzed for utilizing EPA 8021 or 8260B.

cPAHs - Carcinogenic Polycyclic Aromatic Hydrocarbons utilizing EPA 8270SIM Field Parameters (pH, Temperature, Conductivity, Turbidity, Water Level, & Product Level) are recorded from all wells sampled

Well	Date	TOC Elevation (ft msl)	Depth to Water (ft below TOC)	Groundwater Elevation (ft msl)
Plant 1				
GM-14S	3/9/2016	8.57	2.87	5.70
GM-15S	3/8/2016	8.92	3.99	4.93
GM-16S	3/9/2016	8.53	3.56	4.97
GM-17S	3/9/2016	9.19	3.31	5.88
GM-24S	3/9/2016	7.62	1.82	5.80
AR-03	3/8/2016	9.35	4.66	4.69
AMW-01	3/8/2016	8.88	6.83	2.05
AMW-02	3/8/2016	12.14	9.04	3.10
AMW-03	3/8/2016	12.07	8.39	3.68
AMW-04	3/8/2016	8.00	5.28	2.72
AMW-05	3/8/2016	8.14	5.89	2.25
MW-1-T9	3/9/2016	9.07	4.52	4.55
MW-2-T9	3/9/2016	9.23	4.26	4.97
MW-3-T9	3/9/2016	8.73	3.82	4.91
MW-4-T9	3/8/2016	10.65	6.08	4.57
Plant 2 GM-19S	3/9/2016	7.68	1.26	6.42
ft	Feet			
nsl	Mean sea level			
NA	Not available. V	Vell elevations have no	t been surveyed.	
NM		Well was not gauged o levelopment activities.	r sampled due to inacc	essibility caused

Table 3.Groundwater Performance Monitoring Groundwater ElevationsFirst Quarter 2016BP West Coast Products Terminal 21T , Seattle, Washington

Elevations measurements are calculated using NGVD29 Datum.

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Table 4.Summary of Analytical Results for Groundwater - TPH-G, TPH-D, TPH-O, and Benzene
First Quarter 2016

Well	Date	TPH-G WTPH-G (μg/L)	TPH-D WTPH-DX (μg/L)	TPH-O WTPH-DX (μg/L)	Benzene (μg/L)
Plant 1	0/0/00 4.0	450	740		
GM-14S	3/9/2016	150	710	ND	ND
GM-15S	3/8/2016	100	ND	ND U	ND
GM-16S	3/9/2016	170	660	ND U	ND
GM-17S	3/9/2016	ND	ND	ND U	ND
GM-24S	3/9/2016	440	290 J	ND	ND
AR-03	3/8/2016	ND	680	ND U	ND
AMW-01	3/8/2016	ND	320 J	ND UJ	24
AMW-02	3/8/2016	ND	290	ND	1.9
AMW-03	3/8/2016	ND	250	ND U	ND
AMW-04	3/8/2016	ND	390	ND U	ND
AMW-05	3/8/2016	ND	ND	ND	ND
MW-1-T9	3/9/2016	310	2,900	ND	ND
MW-2-T9	3/9/2016	660	960	ND	ND
MW-3-T9	3/9/2016	1,000	1,400	ND U	0.87
MW-4-T9	3/8/2016	ND	ND U	ND U	ND
Plant 2 GM-19S	3/9/2016	ND	NR	NR	ND
Cleanup Level		1,000	10,000	10,000	71
Method Reportin	ng Limit	50	250	750	0.5

BP West Coast Products Terminal 21T , Seattle, Washington

Note: Values in bold exceed th	e cleanup level.
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µg/L	Micrograms	per	liter.

ND Constituent not detected above reporting limit.

NR	Not required. Well was not tested for these analyses, as per Ecology approval.
	redevelopment activities.

TPH Total petroleum hydrocarbons.

TPH-D Total petroleum hydrocarbons as diesel.

TPH-G Total petroleum hydrocarbons as gasoline.

TPH-O Total petroleum hydrocarbons as oil.

WTPH-DX Washington State Method for Analysis of Diesel in Soil and Water - Extended.

WTPH-G Washington State Method for Analysis of Gasoline in Soil and Water.

J Estimated value.

UJ Not detected at an estimated value.

R Rejected value.

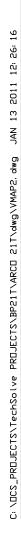
Well	Date	Free Product (feet)
Plant 1		
GM-11S ¹	1/13/2016	None
GM-11S ¹	2/10/2016	None
GM-11S ¹	3/16/2016	None
GM-11S ¹	4/13/2016	None
GM-11S ¹	5/18/2016	None
GM-11S ¹	6/15/2016	None
GM-12S	1/13/2016	None
GM-12S	2/10/2016	None
GM-12S	3/16/2016	None
GM-12S	4/13/2016	None
GM-12S	5/18/2016	None
GM-12S	6/15/2016	None
GM-13S	1/13/2016	None
GM-13S	2/10/2016	None
GM-13S	3/16/2016	None
GM-13S	4/13/2016	Sheen
GM-13S	5/18/2016	None
GM-13S	6/15/2016	None
Cleanup Leve	l	No Sheen
Notes:	Values in bold excee	d the cleanup level.
		en converted to a recovery was measured during pu

Table 5. Summary of Free Product Measurement Results for Groundwater2016 Monitoring DataBP West Coast Products Terminal 21T , Seattle, Washington

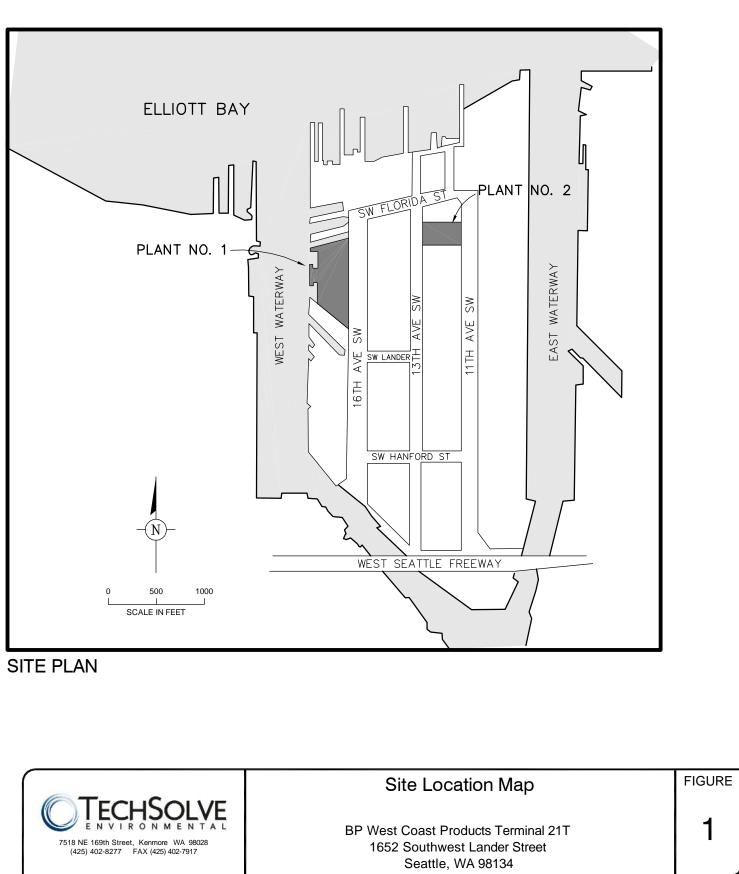
Table 6.Summary of Data Validation Results
Groundwater Performance Monitoring
First Quarter 2016
BP West Coast Products Terminal 21T , Seattle, Washington

Sample ID	Constituent	Qualifier	Reason	
P1-GWAMW-01-116 & P1-GWAMW-201-116, P1-GWGM-224S-116 & P1-GWGM-224S-116	Diesel & Oil	J & UJ	Relative percent difference (RPD) for this field duplicate pair exceeded the control limit of 20%. These results are, therefore, qualified as estimated values (J) or not detected at or above the reporting limit, which is approximate (UJ).	
P1-GWAMW-01-116, P1-GWAMW-03-116, P1-GWAMW-04-116, P1-GWGM-15S-116, P1-GWMW-4-T9-116, P1-GWAR-03-116, P1-GWGM-3-T9-116, P1-GWGM-16S-116, P1-GWGM-17S-116, P1-GWGM-24S-116, P1-GWGM-224S-116 Rinsate-2-116	Diesel & Oil	U	Diesel and Oil were detected in the Method Blank at a concentration below th reporting limit. Associated sample results detected below the reporting limit a therefore, qualfiied as undetected (U) at the reporting limit.	
P1-GWAMW-201-116,	Diesel & Oil	R	Surrogate recovery greatly exceeded the control limit for this field duplicate sample. The sample results for Diesel and Oil would typically be qualified as estimated values (J); however, based on the gross exceedance of the surrogate recovery limit, and the additional quality control issues indicated by the field duplicate results (see first note above), these sample results are qualified as rejected	

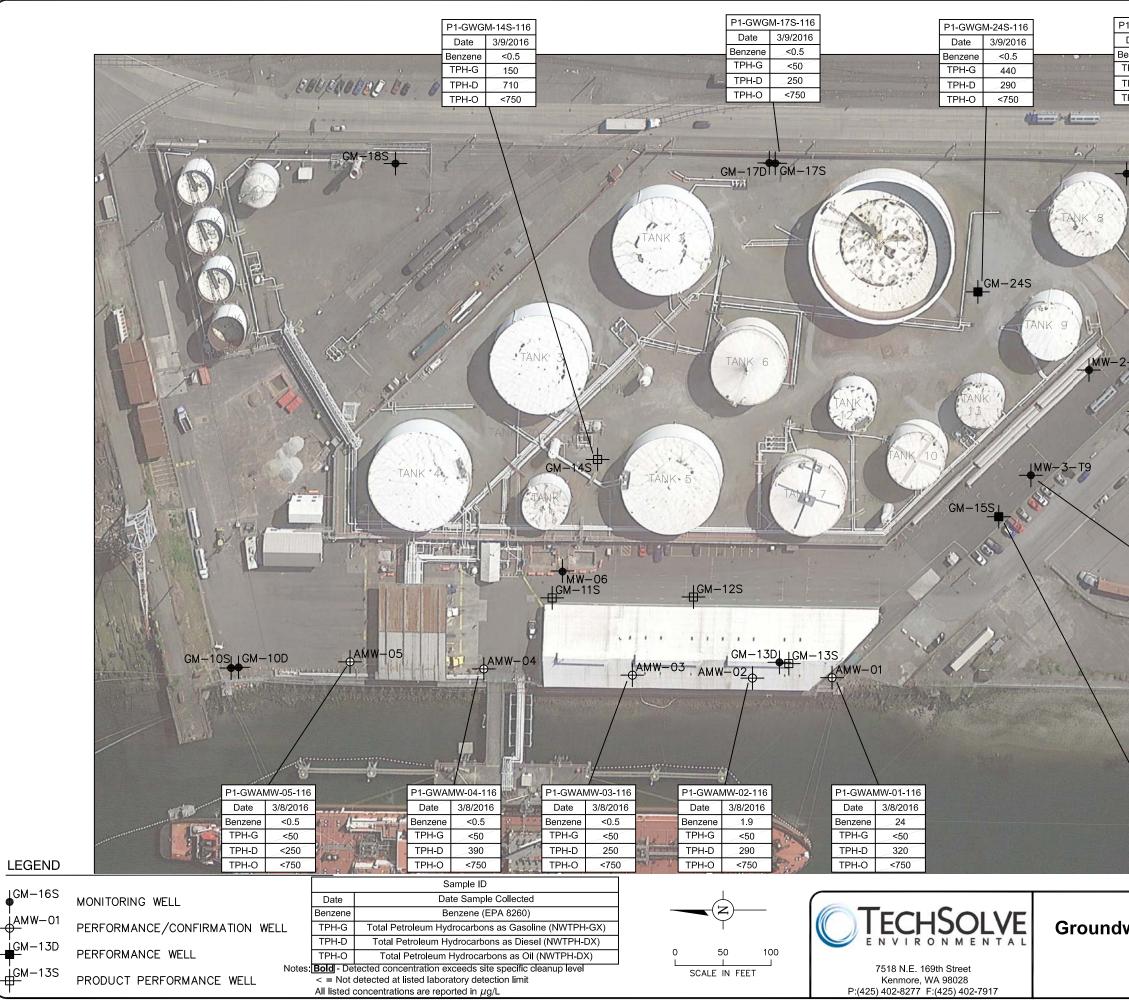
FIGURES



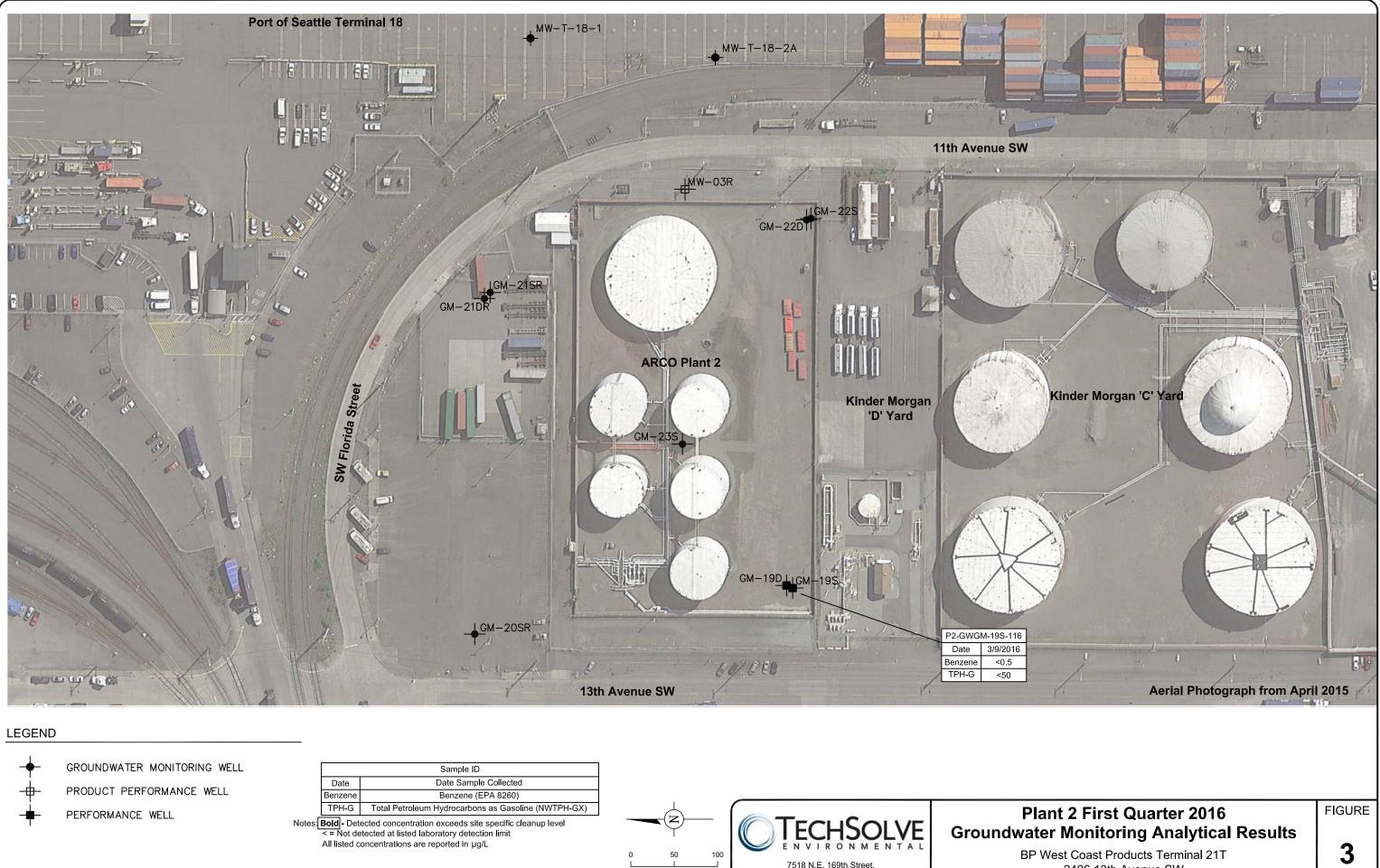








1-GWG	M-16S-116							
Date	3/9/2016							
lenzene	<0.5	Sector Se				COLUMN DE		
TPH-G	170					Transmission		
TPH-D	660							_ ا
TPH-O	<750						W-1-T9-11	
						Date	3/9/2016	<u>;</u>
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						TPH-D		-
1 and 1	100	15	01.	2/		TPH-O	<750	_
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		attle, WA 9						



Sample ID					
Date	Date Sample Collected				
Benzene	Benzene (EPA 8260)				
TPH-G	Total Petroleum Hydrocarbons as Gasoline (NWTPH-GX)				



2406 13th Avenue SW Seattle, WA 98134