

**FOURTH QUARTER 2019 PROGRESS REPORT / THIRD QUARTER 2019  
GROUNDWATER PERFORMANCE MONITORING REPORT  
SITE: FORMER BP HARBOR ISLAND TERMINAL  
CLEANUP SITE ID: 4426  
1652 SW LANDER STREET  
SEATTLE, WASHINGTON**

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

**JANUARY 2020**

Prepared for  
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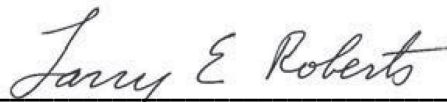
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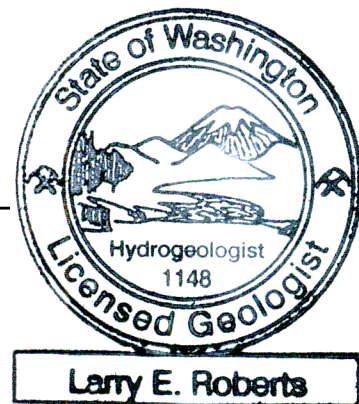
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## **1. INTRODUCTION**

TLP Management Services LLC is submitting this report prepared by TechSolve Environmental, Inc. (TechSolve) to summarize the Third Quarter 2019 Groundwater Monitoring event and operation and maintenance of the waterfront remediation system during the fourth quarter (October through December) of 2019 for the Former BP Harbor Island Terminal Site. 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). Throughout 2019, a waterfront groundwater/Light Non-Aqueous Phase Liquid (LNAPL) remediation system has 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 per Consent Decree and EDR requirements. Reports were submitted to Ecology summarizing 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 and Contingency Program (GWCMCP) (TechSolve, 1999), 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 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 the 2008 5-year Review meeting and summarized in the 2008 Annual Site Report (TechSolve, 2009).

Combined LNAPL recovery (free-phase, residual, and dissolved) from final SVE and groundwater/LNAPL recovery systems is approximately 14,555 gallons (October 2002 to December 2019) (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 29,779 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<sub>2</sub>. SVE system shutdown in 2008 was based, in part, on concentrations of CO<sub>2</sub> reaching atmospheric (background) levels.

Groundwater/LNAPL recovery system data presented in Table 1 show influent concentrations of dissolved benzene, diesel, and gasoline in recovered groundwater (i.e. untreated water pumped from recovery wells screened in shallow groundwater) fluctuate slightly throughout the year and have decreased over time. In 2019, influent concentrations of dissolved benzene, diesel, and gasoline in all monitoring events were below associated surface water cleanup levels, which are applicable to confirmational monitoring wells screened where groundwater and surface water exchange is occurring. 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. These data correspond with the lack of free LNAPL observed in recovery wells used by the groundwater/LNAPL recovery system. Lack of free LNAPL in wells and limited free LNAPL recovery by the groundwater/LNAPL recovery system indicate that the recovery system has captured most available free LNAPL. Evaluations were conducted during the fourth quarter of 2019, as part of a voluntary probing investigation, to determine if free LNAPL is still present and recoverable along the waterfront, or if LNAPL has been recovered to the extent practicable, as further discussed in Section 5.

Effluent discharges from the groundwater/LNAPL recovery system to the sanitary sewer have been within KCDNR's permitted ranges (Table 1) in 2019. Average monthly effluent flow rates ranged from 1.66 to 1.01 gallons per minute (gpm) in 2019, below KCDNR's maximum permitted flow of 17.5 gpm, consistent with past rates that have decreased over time.

Maintenance and repair activities of remediation systems and wells are conducted to maintain integrity, effective operation, capture, and hydraulic control along the waterfront. Notable activities conducted in the fourth quarter of 2019 include:

- Cleanout and service of remediation system groundwater treatment system process equipment.
- Piping and system back flushing and preventative maintenance to maintain conveyance piping and pumping wells.

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 from 2008 through 2014 to improve soil and groundwater conditions along the southern boundary of Plant 1. The SVE system was shut down in December 2014 as data indicated the system no longer recovered measurable concentrations of petroleum hydrocarbons and induced airflow was no longer affecting biodegradation. Additional information regarding shutdown of the Inland SVE system was provided in the 2015 Annual Site Report (TechSolve, 2016). In 2018, a plan (TechSolve, 2018) was submitted to and approved by Ecology (Ecology 2018) to decommission the mechanical and electrical components of the Inland SVE System that required ongoing maintenance. These components were subsequently decommissioned. The in-ground SVE piping and control manifold for this system remain onsite as a contingency in case operation of the system is warranted in the future.

Groundwater monitoring data collected along Plant 1's southern boundary indicate the system improved groundwater conditions in this area of the Site, as discussed in the following section.

## **3. SUMMARY OF GROUNDWATER PERFORMANCE MONITORING PROGRAM**

The Third Quarter 2019 Groundwater Monitoring Event was conducted in accordance with requirements of the Consent Decree, CAP, and GWCMCP. The GWCMCP 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, as highlighted below. The current groundwater monitoring schedule is summarized in Table 2. Monitoring well locations are shown on Figure 2 for Plant 1.

In 2005, Wells MW-1-T9, MW-2-T9, MW-3-T9, and MW-4-T9 were installed along the southern property boundary of Plant 1 (Figure 2) to evaluate groundwater trends due to cleanup level exceedances in Monitoring Well AR-03. These wells were monitored quarterly from December 2005 through March 2018, which aided in evaluating the effectiveness of the Inland SVE system in meeting cleanup objectives. In 2018, a monitoring revision plan (TechSolve, 2018a) was submitted to and approved by Ecology (Ecology 2018) to eliminate monitoring of Well MW-4-T9 and reduce the monitoring frequency in Wells AR-03, GM-15S, MW-1-T9, MW-2-T9, and MW-3-T9 from quarterly to semi-annual. Contingency actions were detailed in the plan to resume quarterly monitoring of Wells AR-03, GM-15S, MW-1-T9, MW-2-T9, and MW-3-T9 for specified periods if cleanup levels are exceeded in these wells.

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.

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

Revisions to the groundwater monitoring program approved by Ecology in 2009 (Ecology, 2009), reduced monitoring frequencies and required analyses. These revisions reduced the monitoring frequency from Wells GM-16S, and 17S from quarterly to semi-annual. The monitoring frequency from 16S, and 17S was reduced due to consistent monitoring data for total petroleum hydrocarbons (TPH) and benzene below cleanup levels. Additionally, 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 conducted in the fourth quarter of 2019 and the results will be provided in the 2019 Annual Site Report.

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. As such, Wells AR-03, GM-15S, GM-16S, GM-17S, MW-1-T9, MW-2-T9, and MW-3-T9 were sampled in the third quarter of 2019. These wells will next be sampled in the first quarter of 2020.

The Third Quarter 2019 Groundwater Monitoring event was conducted September 24<sup>th</sup> and 25<sup>th</sup>, 2019. Overall, third quarter 2019 groundwater elevations (Table 3) were lower compared to elevations measured in the first and second quarters of 2019. These data indicate that the seasonal groundwater high occurred in late 2018 to early 2019, which corresponds with historic trends showing groundwater elevations rise to seasonal highs in the winter and spring and fall to seasonal lows in the summer and autumn.

Third Quarter 2019 Groundwater Monitoring Event samples were submitted to ALS Laboratories of Everett, Washington (Ecology Accreditation # C601) 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 Third Quarter 2019 Groundwater Monitoring Event are included in Table 4 and Figure 2. The only detection of an IHS (benzene, TPH-G, TPH-D, or TPH-O) above a cleanup level was gasoline (TPH-G) in well GM-14S. Concentrations of IHSs from all other samples analyzed in the third quarter of 2019 were below associated cleanup levels. Data trend evaluations will be presented in the 2019 Annual Site Report, in accordance with Consent Decree requirements.

Three wells (GM-11S, GM-12S, and GM-13S) have been examined monthly for the presence of LNAPL (free product) and sheens. Historically, gauging for free LNAPL at Plant 1 was conducted at

four wells; however, gauging of Well GM-14S 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 sheen or measurable LNAPL were detected in Wells GM-11S, GM-12S, and GM-13S in 2019. LNAPL and sheen monitoring results are presented in Table 5. The results of LNAPL and sheen monitoring for 2019 indicate that these wells met both the GWCMCP's LNAPL performance standard of no measurable LNAPL and the LNAPL cleanup standard for confirmational monitoring of no visible sheen for a period of 1 year. The GWCMCP stipulates that once the performance standard has been met in these wells, groundwater shall be sampled for concentrations of IHSs. As such, these wells shall be added to the quarterly IHS monitoring program in 2020. These three wells will continue to be gauged for sheen and LNAPL in 2020, until Ecology concurs that the GWCMCP product performance standard has been met.

#### **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, limited data were qualified with J (the associated value is approximate) or UJ (the non-detected result is undetected at an approximate quantitation limit) qualifiers. 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. ADDITIONAL ACTIVITIES**

Work plans were submitted to Ecology in 2019 for a probing investigation and a hydraulic evaluation to be conducted at the Site (TechSolve, 2019a and TechSolve, 2019b). The results of the voluntary probing investigation are being used to evaluate if ongoing remedial actions along the Plant 1 waterfront have achieved cleanup objectives. The hydraulic evaluation work plan proposed conducting a background water level assessment as the first step in satisfying a regulatory driven (Ecology, 2015) evaluation of how a new seawall, installed along the Plant 1 waterfront in 2018, has affected site hydrology. Negotiations are ongoing with Ecology relating to the scope of the hydraulic evaluation.

Ecology approved the voluntary probing investigation work plan with a few minor modifications in May 2019 (Ecology, 2019). Soil probing was conducted July 22<sup>nd</sup> through July 31<sup>st</sup>, 2019. A total of 41 direct push soil borings were completed by licensed driller during the investigation and 11 of the borings were completed as temporary piezometer wells. Soils from all borings were logged, field screened for petroleum contamination, and sampled for IHSs as proposed in the associated work plan. The temporary piezometer wells were then developed, and groundwater was sampled from the wells on September 26<sup>th</sup> and 27<sup>th</sup> for concentrations of IHSs and to evaluate the wells for the presence of LNAPL. The locations of soil borings and piezometer wells are shown on Figure 3. The results of the probing investigation have been reviewed and a standalone report is currently being finalized to document the findings and conclusions of the investigation. This report is anticipated to be submitted to Ecology in early 2020.



## **6. SUMMARY**

This report summarizes operation of remediation systems during the fourth quarter of 2019 (October through December 2019) and the Third Quarter 2019 Groundwater Monitoring Event. In accordance with the Consent Decree, the 2019 Annual Site Report will be the next report submitted to Ecology. This report will be submitted to Ecology by April 15, 2020.

## 7. REFERENCES

TechSolve Environmental, Inc. (Techsolve) (formerly TechSolv Consulting Group, Inc.). 1999. Groundwater Compliance Monitoring and Contingency Program (GWCMCP), ARCO Harbor Island Terminal 21T, Seattle, Washington. November 19, 1999.

\_\_\_\_\_. 2003b. Groundwater Remedy Final Construction Completion Report, BP West Coast Products Company Terminal 21T. September 2003.

\_\_\_\_\_. 2003c. Final Operations and Maintenance Manual, BP West Coast Products Company Terminal 21T. September 2003.

\_\_\_\_\_. 2007. Tank 9 Soil Vapor Extraction (SVE) System Expansion. Atlantic Richfield Company. BP Terminal 21 T. Harbor Island. Consent Decree No. 00-2-05714-8SEA. September 2007.

\_\_\_\_\_. 2009. 2008 Annual Site Report, BP West Coast Products Terminal, 1652 SW Lander Street, Seattle, Washington. April 2009.

\_\_\_\_\_. 2016. 2015 Annual Site Report, BP West Coast Products Terminal, 1652 SW Lander Street, Seattle, Washington. April 2016.

\_\_\_\_\_. 2018a. Email from Scott Larsen to Jerome Cruz. RE: BP Harbor island SVE decommissioning petition (SL 2/2). February 15, 2018 9:31 AM.

\_\_\_\_\_. 2018b. 2017 Annual Site Report, BP West Coast Products Terminal, 1652 SW Lander Street, Seattle, Washington. April 2018.

\_\_\_\_\_. 2019a. Plant 1 Waterfront Probing Work Plan, Site: Former BP Harbor Island Terminal Site, Cleanup Site ID: 4426. December 2018. Submitted: January 7, 2019.

\_\_\_\_\_. 2019b. Hydraulic Evaluation Work Plan, Site: Former BP Harbor Island Terminal Site, Cleanup Site ID: 4426. December 2018. Submitted: April 24, 2019.

TechSolv Consulting Group, Inc. and ARCADIS Geraghty & Miller (TechSolv and AG&M). 2000. Engineering Design Report, ARCO Harbor Island Terminal 21T, Seattle, Washington. September 2000.

Washington State Department of Ecology (Ecology). 1999. Cleanup Action Plan (CAP), ARCO Terminal 21T, Seattle, Washington. November 19, 1999.

\_\_\_\_\_. 2000a. Meeting with Nnamdi Madakor, Project Manager, Northwest Regional Office. Personal communication to L. Roberts and C. Lybeer, TechSolv Consulting Group, Inc. March 16, 2000.

\_\_\_\_\_. 2000b. Consent Decree No. 00-2-05714-8SEA. March 24, 2000.

\_\_\_\_\_. 2002. Letter from Nnamdi Madakor, Northwest Regional Office, to Ralph Moran, ARCO. June 29, 2002.

\_\_\_\_\_. 2003. Meeting with Roger Nye, Project Manager, Northwest Regional Office. Personal communication to L. Roberts, TechSolv Consulting Group, Inc. March 14, 2003.

\_\_\_\_\_. 2004a. Annual Site Review Meeting with Roger Nye, Project Manager, Northwest Regional Office. Personal communication to Ralph Moran, BP, and L. Roberts and S. Larsen, TechSolv Consulting Group, Inc. April 14, 2004.

\_\_\_\_\_. 2004b. Letter from Roger K. Nye, Northwest Regional Office, to Ralph Moran, BP. June 8, 2004.

\_\_\_\_\_. 2004c. Proposal approval email from Roger K. Nye, Northwest Regional Office, to Larry E. Roberts, TechSolv Consulting Group, Inc. June 15, 2004.

\_\_\_\_\_. 2007. Tank 9 Soil Remediation System email from Roger K. Nye, Northwest Regional Office, to Larry E. Roberts, TechSolv Consulting Group, Inc. August 23, 2007.

\_\_\_\_\_. 2009. Letter from Roger Nye to Larry E. Roberts. RE: Revisions to Monitoring. April 3, 2009.

\_\_\_\_\_. 2015. Letter from Maura S. O'Brien to Paul Supple. Subject: Ecology Comments for Proposed Bulkhead Replacement at BP West Coast Products Terminal Harbor Island, former ARCO Site at 1652 SW Lander Street, Seattle, WA Consent Decree No. 00-2-05714-8SEA and Cleanup Id No. 4426. September 3, 2015.

\_\_\_\_\_. 2018. Email from Jerome Cruz to Scott Larsen. RE: BP Harbor Island inland SVE decommissioning petition (SL 2/2). February 15, 2018 11:29 AM.

\_\_\_\_\_. 2019. Email from Jerome Cruz to Scott Larsen. RE: Hydraulic Evaluation Work Plan for Former BP Harbor Island Terminal Site. May 28, 2019 9:57 AM.

## **TABLES**

**Table 1. Waterfront Groundwater System Petroleum Hydrocarbon Recovery Rates**  
**Site: Former BP Harbor Island Terminal**

**GROUNDWATER SYSTEM EFFICIENCIES**

SAMPLE DATE	UNITS	Influent Benzene	Effluent Benzene	% Reduction	Influent Diesel	Effluent Diesel	% Reduction	Influent Ethylbenzene	Effluent Ethylbenzene	% Reduction	Influent Gasoline	Effluent Gasoline	% Reduction	Influent Oil	Effluent Oil	% Reduction	Influent Toluene	Effluent Toluene	% Reduction	Influent Xylenes	Effluent Xylenes	% Reduction
2002 Averages	µg/L	225.3	14.3	91%	7,315	7,020	4%	55.2	6.2	75%	1,770	336	81%	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%
2016 Averages	µg/L	2.2	0.6	76%		2,292	NA	2.3	0.5	81%	1,282	582	50%		248	NA	0.4	0.4	NA	2.9	1.0	62%
2017 Averages	µg/L	1.9	0.4	74%		4,325	NA	1.0	0.4	63%	1,421	641	56%		349	NA	0.5	0.4	NA	1.0	0.7	55%
2018 Averages	µg/L	1.1	0.7	60%		1,673	NA	0.7	0.7	7%	359	136	62%		346	NA	0.5	0.5	NA	1.3	0.9	30%
1/16/2019	µg/L	0.3	0.2	25%		950	NA	0.2	0.2	NA	340	78	77%		370	NA	0.2	0.2	NA	0.5	0.5	NA
2/13/2019	µg/L	0.8	0.2	74%		2,400	NA	0.2	0.2	NA	750	190	75%		390	NA	0.2	0.2	NA	0.5	0.5	NA
3/20/2019	µg/L	0.5	0.5	NA		900	NA	0.5	0.5	NA	330	77	77%		360	NA	0.5	0.5	NA	0.5	0.5	NA
4/24/2019	µg/L	0.2	0.2	NA		420	NA	0.5	0.5	NA	410	76	81%		370	NA	0.2	0.2	NA	0.5	0.5	NA
5/15/2019	µg/L	0.2	0.2	NA		500	NA	0.2	0.2	NA	230	50	78%		270	NA	0.2	0.2	NA	0.5	0.5	NA
6/11/2019	µg/L	0.5	0.5	NA		1,400	NA	1.0	1.0	NA	170	50	71%		750	NA	1.0	1.0	NA	3.0	3.0	NA
7/10/2019	µg/L	0.5	0.5	NA		5,100	NA	1.0	1.0	NA	140	50	64%		750	NA	1.0	1.0	NA	3.0	3.0	NA
8/14/2019	µg/L	0.5	0.5	NA		810	NA	1.0	1.0	NA	100	50	50%		750	NA	1.0	1.0	NA	3.0	3.0	NA
9/11/2019	µg/L	0.5	0.5	NA		1,200	NA	1.0	1.0	NA	140	50	64%		750	NA	1.0	1.0	NA	3.0	3.0	NA
10/17/2019	µg/L	0.5	0.5	NA		1,700	NA	1.0	1.0	NA	64	50	22%		750	NA	1.0	1.0	NA	3.0	3.0	NA
11/21/2019	µg/L	0.5	0.5	NA		2,700	NA	1.0	1.0	NA	50	50	NA		750	NA	1.0	1.0	NA	3.0	3.0	NA
12/11/2019	µg/L	1.0	0.5	NA		390	NA	1.0	1.0	NA	52	50	4%		750	NA	1.0	1.0	NA	3.0	3.0	NA
SURFACE WATER CLEANUP LEVELS		71 µg/L			10,000 µg/L			NA			1,000 µg/L			10,000 µg/L			NA			NA		
KCDNR DISCHARGE LIMITS			70 µg/L		100,000 µg/L			1,700 µg/L			NA			100,000 µg/L			1,400 µg/L			NA		
2019 Averages:		.5 µg/L	.4 µg/L	50%	NA	1,539 µg/L	NA	.66 µg/L	.72 µg/L	#DIV/0!	231 µg/L	68 µg/L	60%	NA	584 µg/L	NA	.69 µg/L	.69 µg/L	NA	2. µg/L	1.96 µg/L	#DIV/0!

**METRO DISCHARGE DATA**

Observation Date	Days Operational since last monitoring reading	Average flow (GPM)	Total Flow Between Observation dates (gallons)	Pounds of Benzene Removed	Pounds of Gasoline Removed	Pounds of Diesel Removed	Pounds of Oil Removed	Pounds of Toluene Removed	Pounds of Ethylbenzene Removed	Pounds of Xylenes Recovered	Total Gallons Gas, Diesel, and Oil	
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	
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	
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	
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	
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	
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	
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	
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	
2010 Totals and Averages	372	2.17	1,185,127	0.037	8.62	18.84	4.26	0.01	0.05	0.19	4.66	
2011 Totals and Averages	356	1.90	949,880	0.026	5.13	17.55	3.54	0.01	0.03	0.13	3.81	
2012 Totals and Averages	371	1.89	948,600	0.034	3.97	25.92	3.47	0.01	0.02	0.04	4.81	
2013 Totals and Averages	365	1.33	700,450	0.014	2.26	8.80	3.43	0.003	0.01	0.02	2.08	
2014 Totals and Averages	332	1.62	761,480	0.010	3.43	10.95	1.55	0.003	0.00	0.01	2.33	
2015 Totals and Averages	358	1.71	874,680	0.015	6.56	36.53	2.92	0.004	0.01	0.02	6.68	
2016 Totals and Averages	370	1.90	999,770	0.021	13.12	20.02	1.94	0.004	0.03	0.03	5.26	
2017 Totals and Averages	364	1.65	866,030	0.014	11.96	33.39	2.62	0.004	0.01	0.01	7.52	
2018 Totals and Averages	371	1.20	641,740	0.006	2.16	9.61	1.79	0.002	0.004	0.007	1.96	
January-19	28	1.55	62,470	0.0002	0.17	1.21	0.23	0.0001	0.0001	0.0003	0.23	
February-19	28	1.66	66,790	0.0003	0.30	0.93	0.21	0.0001	0.0001	0.0003	0.21	
March-19	35	1.01	50,760	0.0003	0.23	0.70	0.16	0.0001	0.0001	0.0002	0.16	
April-19	35	1.26	63,300	0.0002	0.20	0.35	0.19	0.0002	0.0003	0.0003	0.11	
May-19	21	1.02	30,950	0.0001	0.08	0.12	0.08	0.0001	0.0001	0.0001	0.04	
June-19	27	1.15	44,770	0.0001	0.07	0.35	0.19	0.0002	0.0002	0.0007	0.09	
July-19	29	1.09	45,620	0.0002	0.06	1.24	0.29	0.0004	0.0004	0.0011	0.22	
August-19	35	1.03	51,770	0.0002	0.05	1.28	0.32	0.0004	0.0004	0.0013	0.23	
September-19	28	1.13	45,540	0.0002	0.05	0.38	0.29	0.0004	0.0004	0.0011	0.10	
October-19	36	1.35	54,160	0.0002	0.05	0.66	0.34	0.0005	0.0005	0.0014	0.15	
November-19	35	1.42	50,600	0.0002	0.02	0.93	0.32	0.0004	0.0004	0.0013	0.18	
December-19	20	1.48	44,770	0.0003	0.02	0.58	0.28	0.0004	0.0004	0.0011	0.12	
2019 Totals and Averages	357	1.26	611,500	0.00	1.30	8.72	2.89	0.00	0.00	0.01	1.84	
<b>TOTALS:</b>			<b>31,410,054 gal</b>	<b>13.4</b>	<b>960.3</b>	<b>1650.9</b>	<b>168.1</b>	<b>34.8</b>	<b>14.8</b>	<b>101.3</b>		
<b>Maximum permitted GPM:</b>			<b>17.5</b>	<b>Gallons Gas, Diesel, &amp; Oil Recovered:</b>			<b>156.2</b>	<b>236.5</b>	<b>22.0</b>	<b>TOTAL GALLONS RECOVERED:</b>		<b>415.14</b>

Observation Date	Monthly LNAPL Recovery (gal)	
February-03	19.6	
April-03	6.9	
May-03	2.5	
July-03	2	
December-03	20	
January-04	25	
June-04	35	
August-04	50	
September-04	8	
November-04	10	
December-04	3.5	
January-05	0	
February-05	35	
July-05	110	
February-06	5	
March-06	2	
December-06	30	
March-08	30	
<b>Total Gallons LNAPL Recovered</b>		<b>395</b>

TOTAL PETROLEUM RECOVERY	
Total lbs. Dissolved Gas, Diesel, and Oil Recovered in Groundwater (2002-Present)	2,779 lbs
<b>Total Gallons Dissolved Gas, Diesel, and Oil Recovered in Groundwater (2002-Present)*</b>	<b>415 gal</b>
<b>Total Gallons LNAPL Recovered by Final Recovery System (2002-Present)</b>	<b>395 gal</b>
<b>Total Gallons LNAPL Recovered by Interim Recovery System (1992-20</b>	

Table 2. Groundwater Performance Monitoring Schedule  
 Site: Former BP Harbor Island Terminal

Analyses Conducted by Quarter				
Well	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
<b>Plant 1</b>				
MW-1-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
MW-2-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
MW-3-T9	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
GM-14S	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O
GM-15S	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
GM-16S	Benzene, TPH-G, TPH-D, TPH-O		Benzene, TPH-G, TPH-D, TPH-O	
GM-17S	Benzene, TPH-G, TPH-D, TPH-O		Benzene, TPH-G, TPH-D, TPH-O	
<b>GM-24S</b>	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O
AR-03	Benzene, TPH-G, TPH-D, TPH-O	(1)	Benzene, TPH-G, TPH-D, TPH-O	(1)
<b>AMW-01</b>	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-02	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-03	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-04	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs
AMW-05	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O	Benzene, TPH-G, TPH-D, TPH-O, cPAHs

**Plant 2**

All Plant 2 monitoring has been discontinued.

- 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  
 (1) - If a groundwater cleanup level exceedance occurs in first or third quarter in any of these highlighted wells, all (1) wells will be sampled the following quarter. Wells exceeding cleanup levels will continue quarterly monitoring until four consecutive quarters below cleanup level are achieved.

Table 3. Groundwater Performance Monitoring Groundwater Elevations  
 Third Quarter 2019  
 Site: Former BP Harbor Island Terminal

Well	Date	TOC Elevation (ft msl)	Depth to Water (ft below TOC)	Groundwater Elevation (ft msl)
<b>Plant 1</b>				
GM-14S	9/25/2019	8.57	5.18	3.39
GM-15S	9/24/2019	8.92	6.01	2.91
GM-16S	9/25/2019	8.53	5.63	2.90
GM-17S	9/25/2019	9.19	5.88	3.31
GM-24S	9/25/2019	7.62	4.45	3.17
AR-03	9/24/2019	9.35	6.68	2.67
AMW-01	9/24/2019	8.88	10.73	-1.85
AMW-02	9/24/2019	12.14	14.42	-2.28
AMW-03	9/24/2019	12.07	14.47	-2.40
AMW-04	9/24/2019	8.00	6.85	1.15
AMW-05	9/24/2019	8.14	7.19	0.95
MW-1-T9	9/25/2019	9.07	6.45	2.62
MW-2-T9	9/25/2019	9.23	6.34	2.89
MW-3-T9	9/25/2019	8.73	5.86	2.87

ft Feet

msl Mean sea level

NA Not available. Well elevations have not been surveyed.

NM Not measured. Well was not gauged or sampled due to inaccessibility caused by the Island redevelopment activities.

TOC Top of casing

Elevations measurements are calculated using NGVD29 Datum.

Table 4. Summary of Analytical Results for Groundwater - TPH-G, TPH-D, TPH-O, and Benzene  
 Third Quarter 2019  
 Site: Former BP Harbor Island Terminal

Well	Date	TPH-G WTPH-G (µg/L)	TPH-D WTPH-DX (µg/L)	TPH-O WTPH-DX (µg/L)	Benzene (µg/L)
<b>Plant 1</b>					
GM-14S	9/25/2019	<b>1,800</b>	1,500	ND	ND
GM-15S	9/24/2019	250	ND	ND	ND
GM-16S	9/25/2019	130	970	ND	ND
GM-17S	9/25/2019	ND	ND	ND	ND
GM-24S	9/25/2019	920 J	900	ND	ND
AR-03	9/24/2019	480	570	ND	ND
AMW-01	9/24/2019	ND	350 J	ND UJ	ND
AMW-02	9/24/2019	ND	260	ND	12.0
AMW-03	9/24/2019	ND	ND	ND	ND
AMW-04	9/24/2019	ND	ND	ND	ND
AMW-05	9/24/2019	ND	ND	ND	ND
MW-1-T9	9/25/2019	220	470	ND	ND
MW-2-T9	9/25/2019	440	480	ND	ND
MW-3-T9	9/25/2019	770	530	ND	ND
Cleanup Level		1,000	10,000	10,000	71
Method Reporting Limit		50	250	750	0.5

Note: Values in **bold** exceed the cleanup level.  
 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.



Table 5. Summary of Free Product Measurement Results for Groundwater  
 2019 Monitoring Data  
 Site: Former BP Harbor Island Terminal

Well	Date	Free Product (feet)
<b>Plant 1</b>		
GM-11S	1/16/2019	None
GM-11S	2/15/2019	None
GM-11S	3/20/2019	None
GM-11S	4/24/2019	None
GM-11S	5/14/2019	None
GM-11S	6/10/2019	None
GM-11S	7/10/2019	None
GM-11S	8/13/2019	None
GM-11S	9/10/2019	None
GM-11S	10/16/2019	None
GM-11S	11/20/2019	None
GM-11S	12/11/2019	None
GM-12S	1/16/2019	None
GM-12S	2/15/2019	None
GM-12S	3/20/2019	None
GM-12S	4/24/2019	None
GM-12S	5/14/2019	None
GM-12S	6/10/2019	None
GM-12S	7/10/2019	None
GM-12S	8/13/2019	None
GM-12S	9/10/2019	None
GM-12S	10/16/2019	None
GM-12S	11/20/2019	None
GM-12S	12/11/2019	None
GM-13S	1/16/2019	None
GM-13S	2/15/2019	None
GM-13S	3/20/2019	None
GM-13S	4/24/2019	None
GM-13S	5/14/2019	None
GM-13S	6/10/2019	None
GM-13S	7/10/2019	None
GM-13S	8/13/2019	None
GM-13S	9/10/2019	None
GM-13S	10/16/2019	None
GM-13S	11/20/2019	None
GM-13S	12/11/2019	None
Cleanup Level		No Sheen

Notes: Values in **bold** exceed the cleanup level.

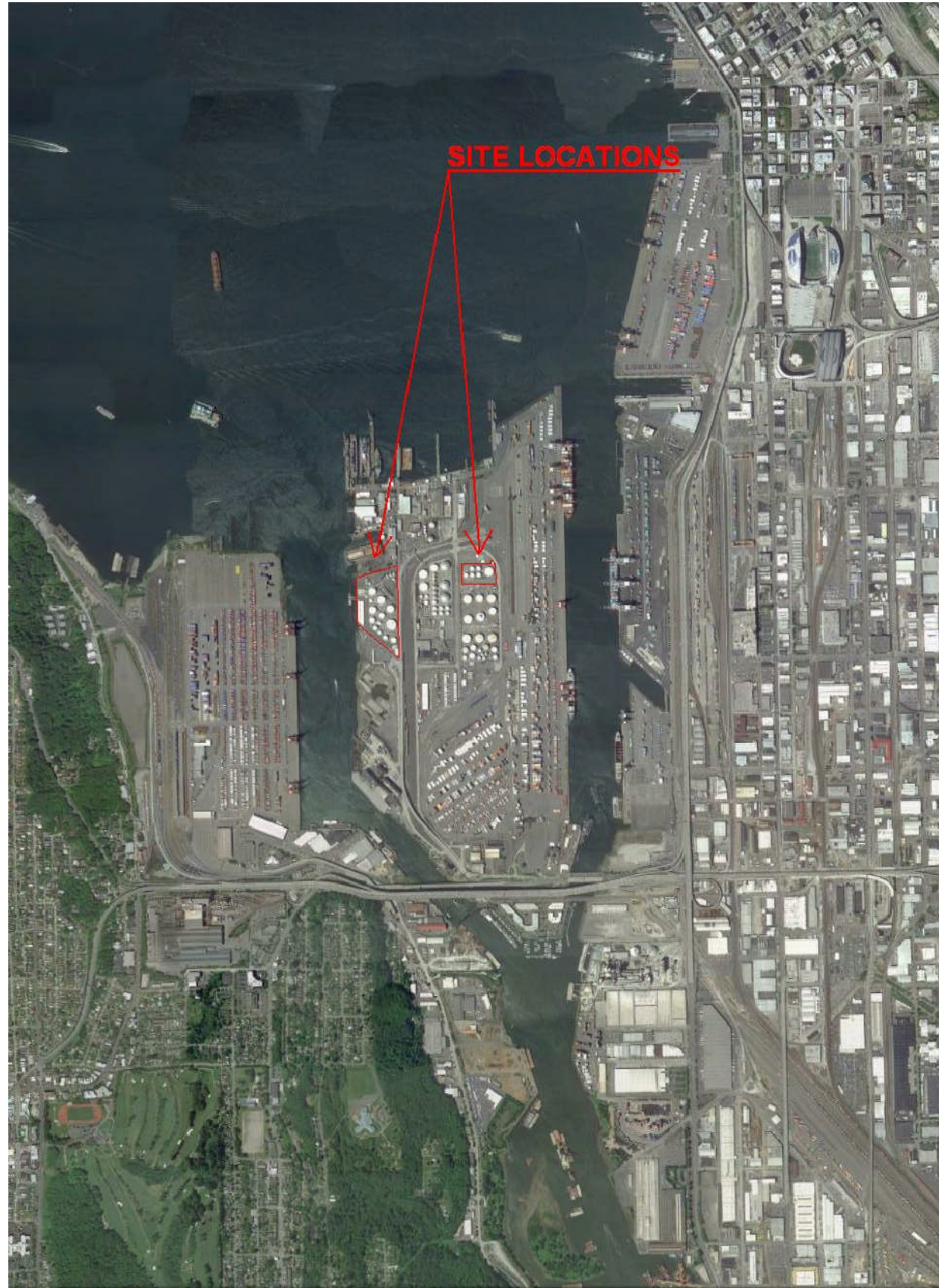
Table 6. Summary of Data Validation Results  
 Groundwater Performance Monitoring  
 Third Quarter 2019  
 Site: Former BP Harbor Island Terminal

Sample ID	Constituent	Qualifier	Reason
P1-GWGM-24S-319 & P1-GWGM-224S-319	Gasoline	J	The relative percent difference (RPD) for this field duplicate pair exceeded the control limit of 20%. These results are, therefore, qualified as estimated values (J).
P1-GWAMW-01-319	Gasoline	J & UJ	The RPD for diesel and oil in laboratory duplicates prepared from this sample exceed the control limit. Therefore, the detected diesel result is qualified as an estimated value (J) and the non-detect oil result is qualified as undetected at an estimated quantitation limit (UJ).

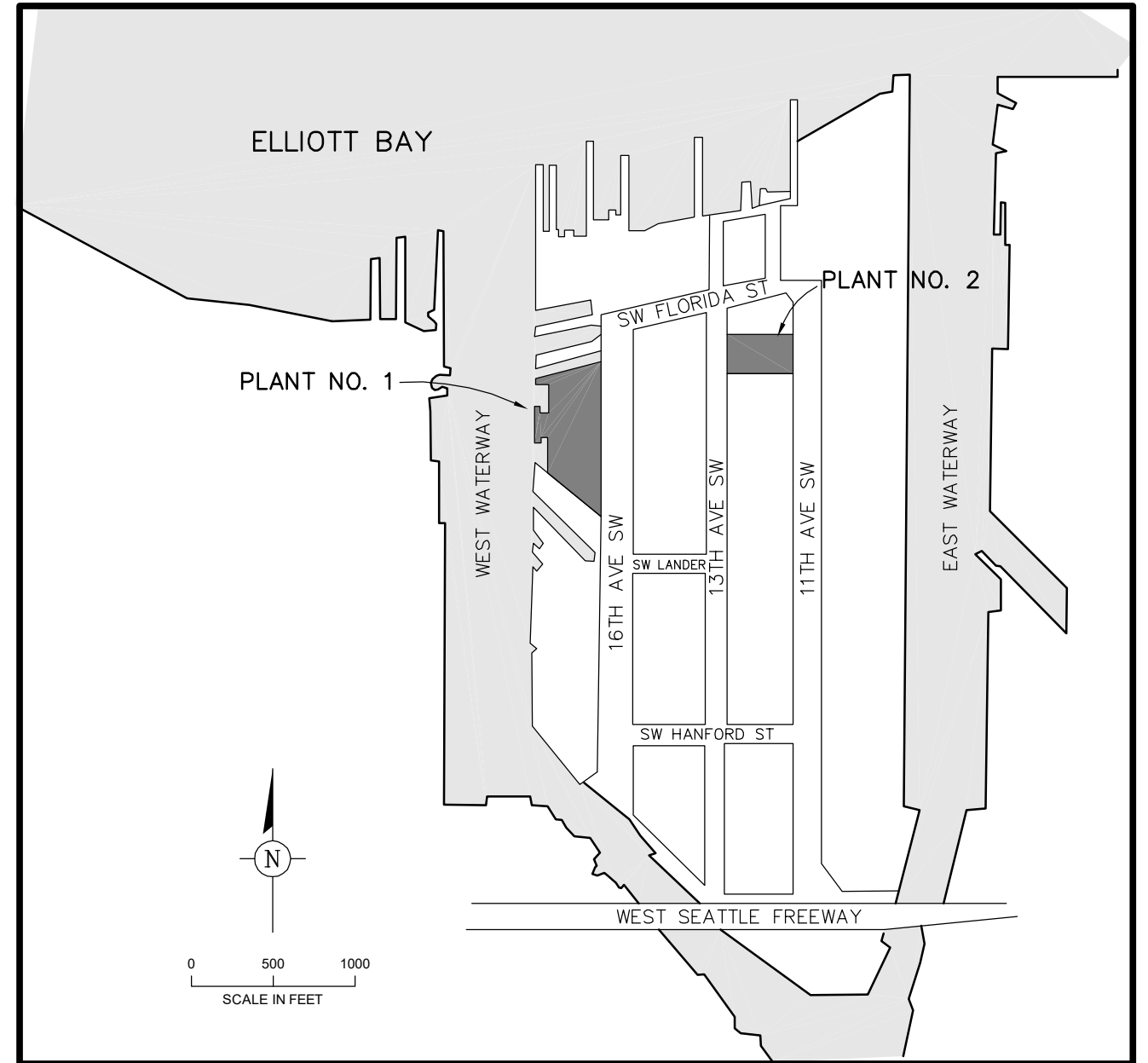
Definitions:

- J The associated value is approximate.
- UJ The non-detected results are undetected at an approximate quantitation limit.
- RPD Relative Percent Difference

## FIGURES



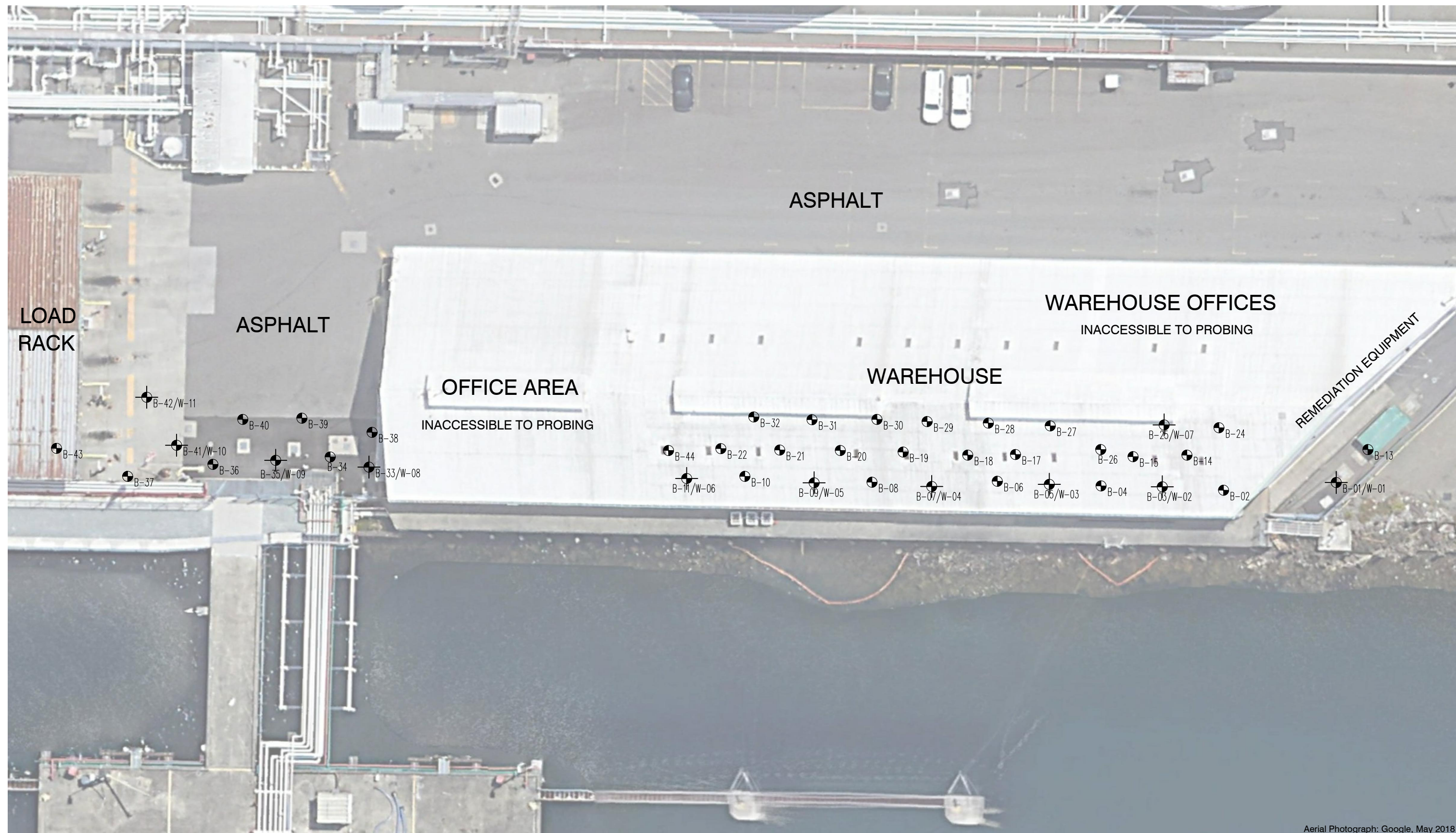
AREA PLAN



SITE PLAN





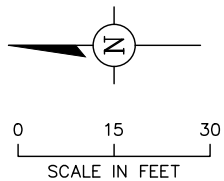
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Aerial Photograph: Google, May 2018

**LEGEND**

-  B-01 PROBING BORING LOCATION
-  B-01/W-01 PROBING BORING LOCATION / TEMPORARY PIEZOMETER WELL



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**Plant 1 Probing Investigation  
Boring Locations**

Site: Former BP Harbor Island Terminal  
1652 Southwest Lander Street  
Seattle, WA 98134

FIGURE

**3**