

**2016 ANNUAL REPORT**  
Remedy Implementation,  
Crownhill Elementary School Site  
Prepared for: Bremerton School District

Project No. 100094-004-01 • January 9, 2017



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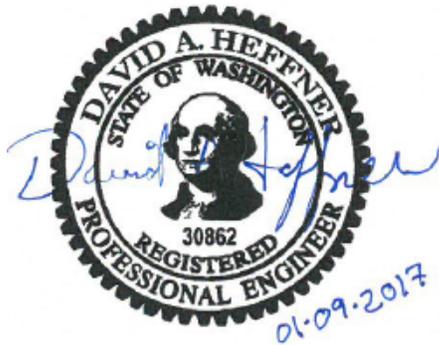




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Aspect Consulting, LLC



**Dave Heffner, PE**  
Associate Remediation Engineer  
dheffner@aspectconsulting.com

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# 1 Introduction

## 1.1 General

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Historical landfill activities at the Bremerton School District (BSD) Crownhill Elementary School site (Site) have resulted in soil and groundwater contamination, including the presence of light non-aqueous-phase liquid (LNAPL) floating on the water table. The Washington State Department of Ecology (Ecology) and BSD entered into two Agreed Orders (AOs) to provide for remedial action at the Site. The first AO (No. DE7916) required BSD to conduct a Remedial Investigation (RI) and Feasibility Study (FS) in accordance with the Washington State Model Toxics Control Act (MTCA) Cleanup Regulation (WAC 173-340). Upon completion of those activities in 2014, Ecology selected a cleanup remedy and prepared a Cleanup Action Plan (CAP) for the Site (Ecology, 2014). As documented in the CAP, requirements of the selected remedy include the following:

- periodic monitoring of groundwater quality and LNAPL layer thickness;
- periodic removal and offsite recycling/disposal of LNAPL from existing wells;
- periodic inspection and maintenance of the existing cover system to prevent direct contact exposures to landfilled materials and impacted soils;
- running the HVAC system in the main school building continuously during the school day (to address the soil vapor intrusion pathway);
- periodic sub-slab soil vapor and/or indoor air sampling to reconfirm that vapor intrusion is not a concern; and
- defining requirements for performing invasive work in soil.

The second AO (No. DE11107) required BSD to develop Site-specific work plans addressing the above requirements, and then to implement the cleanup remedy in accordance with those work plans. The following remedy implementation work plans were prepared by BSD and approved by Ecology in 2015:

- *Groundwater/LNAPL Monitoring and Contingency Plan* (Aspect, 2015a);
- *LNAPL Removal Work Plan* (Aspect, 2015b); and
- *Cover System Inspection and Maintenance Plan* (Aspect, 2015c).

A report documenting remedy implementation activities completed by BSD in 2015 was submitted to Ecology in January 2016 (Aspect, 2016). This report documents activities completed in 2016.

## 1.2 Project Background

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Located in Bremerton, Washington (Figure 1), the Site includes both the Crownhill Elementary School (School) property at 1500 Rocky Point Road and the northern portion of

the Bremerton United Methodist Church (Church) property at 1150 Marine Drive. A Site Plan is provided as Figure 2. The Site was used for sand and gravel mining up to the 1930s, and the mined area was backfilled with municipal and industrial wastes in the 1930s and 1940s. The original school building was constructed in 1956, and partially burned down in 1993. A series of environmental investigations were conducted during the period between that fire and construction of the current school building, which was completed in 1996. Additional investigations were conducted beginning in 2009, culminating in preparation of the *Remedial Investigation Report* (Aspect, 2014a; herein referred to as the RI report).

The purpose of the RI was to collect data necessary to adequately characterize the nature and extent of Site contamination. Using multiple lines of evidence (e.g., historical photographs, site assessment activity, construction observations), the RI identified two generalized areas of landfill accumulation, designated the ‘north’ and ‘south’ landfill areas. Figure 2 shows the interpreted boundaries of these two areas. Landfilled materials were found at up to 40-foot depth in the north landfill area, and at up to 20-foot depth in the south landfill area. Extensive sampling identified the following constituents of potential concern (COPCs) in Site soils:

- total petroleum hydrocarbon (TPH) in the diesel and motor oil ranges;
- trichloroethene (TCE);
- carcinogenic polycyclic aromatic hydrocarbons (cPAHs); and
- the metals/metalloids antimony, arsenic, chromium III, copper, lead, and zinc.

Three monitoring wells (MW-1 through MW-3) were installed at the Site in December 1994/January 1995, and another 13 (MW-4 through MW-16) during the RI (between March 2011 and October 2012). (Refer to Figure 2 for well locations.) This network of 2-inch-diameter wells was used to periodically monitor groundwater, which is encountered beneath the Site at roughly 110-foot depth, for a wide range of contaminants. Monitoring identified TPH in the diesel and motor oil ranges, TCE, arsenic, and lead as COPCs dissolved in groundwater in the northern portion of the Site.

In addition to dissolved contaminants, separate-phase oil was observed floating on the groundwater table (as LNAPL) in well MW-8, installed in the north landfill area. The primary reason for installing the last five RI monitoring wells (MW-12 through MW-16) was to investigate the areal extent and thickness of the LNAPL accumulation. LNAPL was observed in three of these wells (MW-13, MW-14, and MW-16).

Site cleanup alternatives were developed and comparatively evaluated with respect to MTCA-specified criteria in the *Feasibility Study* report (Aspect, 2014b). Based on the information provided in the RI report and on the FS evaluation, the CAP (Ecology, 2014) then established Site-specific cleanup levels for constituents of concern (COCs) in Site soil, groundwater, and air, and selected a cleanup remedy for implementation. Figure 2 shows the estimated TPH, TCE, and arsenic plumes<sup>1</sup> (i.e., areas where concentrations in groundwater exceed the respective groundwater cleanup levels) as depicted in the CAP. Refer to the CAP for a full description of the selected cleanup remedy for the Site.

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<sup>1</sup> Lead is also a COC in groundwater. However, as discussed in the *Groundwater/LNAPL Monitoring and Contingency Plan* (Aspect, 2015a), compliance with the groundwater cleanup level for lead has been demonstrated. Therefore, lead is not included in the groundwater monitoring program.

## 2 Activities Completed in 2016

This section documents cleanup-related activities completed by BSD during the 2016 calendar year. Periodic monitoring of groundwater and LNAPL thickness is documented in Section 2.1, LNAPL removal in Section 2.2, Site inspections in Section 2.3, and other activities in Section 2.4.

### 2.1 Periodic Monitoring Activities

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#### 2.1.1 Groundwater Monitoring

Semiannual groundwater monitoring was conducted on April 5 and October 28, 2016, in general accordance with the requirements of the *Groundwater/LNAPL Monitoring and Contingency Plan* (Aspect, 2015a). Well locations are shown on Figure 2. Table 1 identifies which Site wells are included in the monitoring program, which of those wells contain LNAPL, and the specific COCs analyzed in groundwater samples collected from the wells that do not contain LNAPL. Monitoring results for the non-LNAPL wells are summarized in Table 2. Results going back to December 2013 are included in Table 2; refer to the RI report (Aspect, 2014a) for results prior to December 2013 and for information on Site wells not included in the monitoring program. Laboratory reports for groundwater samples submitted for analysis in 2016 are provided in Appendix C.

Groundwater cleanup levels are 500 micrograms per liter ( $\mu\text{g/L}$ ) for diesel- and motor-oil-range TPH, and 5  $\mu\text{g/L}$  for TCE and total arsenic. Well MW-10 is the conditional point of compliance for achieving these cleanup levels. This well has been sampled on 15 occasions through October 2016, and arsenic is the only COC detected in any of those sampling rounds. Well MW-6, the only well with arsenic cleanup level exceedances since early 2012<sup>2</sup>, is located approximately 130 feet upgradient of MW-10 and serves as a sentinel well for dissolved contaminant plume migration. The *Groundwater/LNAPL Monitoring and Contingency Plan* (Aspect, 2015a) specifies contingency actions that will be taken if arsenic is detected above 40  $\mu\text{g/L}$  at MW-6 or above 4.5  $\mu\text{g/L}$  at MW-10. Figure 3 shows arsenic concentration trends in these two wells since they were installed. Neither of the above concentration limits was exceeded in 2016.

Well MW-9 is the only well with TCE cleanup level exceedances. The TCE concentration detected in this well in April 2016 (11  $\mu\text{g/L}$ ) was consistent with MW-9 detections in recent monitoring rounds, and the December 2016 detection (8.6  $\mu\text{g/L}$ ) was marginally lower.

Well MW-15 is located immediately downgradient of the LNAPL area and serves as a sentinel well for TPH plume migration<sup>3</sup>. Neither diesel-range nor motor-oil-range TPH was detected at MW-15 in 2016, which is consistent with previous monitoring rounds. TPH concentrations detected in wells MW-5 and MW-12 in 2016 are within the range of previous detections in those wells with the exception of the diesel-range TPH concentration detected in MW-12 in October 2016 (1,500  $\mu\text{g/L}$ ), which is marginally lower than previous detections

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<sup>2</sup> As shown on Figure 3, the arsenic cleanup level was also exceeded at MW-10 the first two times it was sampled following its installation in December 2011. Arsenic at MW-10 has been consistently below its cleanup level in the last 13 monitoring rounds.

<sup>3</sup> Well MW-15 is also the conditional point of compliance for LNAPL migration.

in that well. TPH concentrations in these two wells remain above the corresponding groundwater cleanup levels.

Water samples collected from the McKinney domestic well (sampled in both 2016 monitoring rounds) are analyzed for TCE only. As shown in Table 2, TCE has never been detected in any of the water samples collected from the McKinney well.

### 2.1.2 LNAPL Thickness Monitoring

LNAPL thickness monitoring was conducted concurrent with groundwater monitoring in April and October 2016. And, since an LNAPL thickness greater than 4 feet was measured in well MW-13 in October 2015, a follow-up LNAPL removal round (which included LNAPL thickness monitoring) was conducted on January 18, 2016. Consistent with previous monitoring rounds, LNAPL was detected in five wells (MW-8, MW-13, MW-14, MW-16, and EW-17). Table 3 summarizes LNAPL thicknesses measured in these wells since they were installed. Thicknesses measured in 2016 ranged from 0.01 feet in MW-8 (April round) to 1.39 feet in MW-13 (January round).

## 2.2 LNAPL Removal

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Bottom-filling bailers are used to periodically remove LNAPL from Site wells. Table 3 provides a summary of LNAPL volumes removed from each of the five LNAPL-containing wells since they were installed. In 2016, LNAPL removal was conducted concurrent with the three LNAPL thickness monitoring rounds discussed above, in general accordance with the requirements of the *LNAPL Removal Work Plan* (Aspect, 2015b). LNAPL removal was attempted whenever an LNAPL layer thickness of at least 0.3 foot was measured in a well. LNAPL was removed from four wells (all except MW-8) in the January round, from two wells (MW-13 and EW-17) in the April round, and from four wells (all except MW-13) in the October round. The total volume of LNAPL removed in 2016 was 3.27 liters. This compares with a volume of 6.75 liters removed in prior years.

## 2.3 Site Inspections

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Semiannual Site inspections were conducted on June 7 and December 5, 2016, in accordance with the requirements of the *Cover System Inspection and Maintenance Plan* (Aspect, 2015c). The completed inspection records are provided in Appendices A and B, along with photos taken during the inspections. The photos were taken from four specific vantage points, identified on Figure 2, in order to provide photo-documentation of the following cover features:

- Photo Location 1 – Pavement in the parking area along Bertha Avenue NW, where an RI soil sample collected from beneath the pavement (composite sample to 3-foot depth) contained lead at a concentration exceeding the cleanup level.
- Photo Locations 2 and 4 – Soil/sod covers next to the portable classroom building and in the southeast corner of the school property, where lead cleanup level exceedances were identified in soil samples collected from the 1- to 3-foot depth range. In summer 2013, these two areas were covered with a geotextile fabric (placed directly on the undisturbed ground surface) and an additional 1-foot thickness of fill soil was imported and hydroseeded to supplement the pre-existing clean soil cover layer.

- Photo Location 3 – A soil/sod cover in the northwest corner of the church property (and extending approximately 10 feet onto the school property), where an interim action was completed in spring 2012 in which contaminated surface soils were removed to a 1-foot depth, a geotextile fabric was placed on remaining contaminated soils, and a 1-foot thickness of fill soil was imported and hydroseeded.

Potholes and extensive cracks were observed in the pavement in the northern portion of the Bertha Avenue NW parking area. (See close-up photos in Appendices A and B.) However, the pavement continues to provide an effective barrier to direct-contact exposure to the underlying soils (i.e., the paved surface remains intact, with no exposed soil areas).

The soil/sod covers at Photo Locations 2 through 4 appeared to be in good condition, and the 2016 inspections did not identify any cover system deficiencies in other areas of the Site or other action items.

### 3 Statement of Compliance

On behalf of BSD, Aspect certifies that the remedy implementation activities completed at the Site in 2016 complied with the requirements of the CAP, Agreed Order No. DE11107, and the remedy implementation work plans approved by Ecology.

### 4 Plans for 2017

The following remedy implementation activities are planned for 2017:

- Conduct semiannual rounds of groundwater/LNAPL monitoring and LNAPL removal (scheduled for April and October 2017)<sup>4</sup>; and
- Conduct semiannual Site inspections (scheduled for June and December 2017).

Other activities, as specified in the remedy implementation work plans, may also be required based on monitoring and/or inspection results.

### 5 References

Aspect Consulting, LLC (Aspect), 2014a, Remedial Investigation, Crownhill Elementary School, prepared for Bremerton School District, November 2014.

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<sup>4</sup> If an LNAPL thickness greater than 4 feet is measured in the April monitoring round, an LNAPL removal round will also be required in July 2017.

## ASPECT CONSULTING

Aspect Consulting, LLC, 2014b, Feasibility Study, Crownhill Elementary School, prepared for Bremerton School District, October 21, 2014.

Aspect Consulting, LLC, 2015a, Groundwater/LNAPL Monitoring and Contingency Plan, Crownhill Elementary School Site, prepared for Bremerton School District, November 19, 2015.

Aspect Consulting, LLC, 2015b, LNAPL Removal Work Plan, Crownhill Elementary School Site, prepared for Bremerton School District, November 19, 2015.

Aspect Consulting, LLC, 2015c, Cover System Inspection and Maintenance Plan, Crownhill Elementary School Site, prepared for Bremerton School District, December 17, 2015.

Aspect Consulting, LLC, 2016, 2015 Annual Report, Remedy Implementation, Crownhill Elementary School Site, prepared for Bremerton School District, January 14, 2016.

Washington State Department of Ecology (Ecology), 2014, Cleanup Action Plan, Bremerton School District, Crownhill Elementary School Site, Washington State Department of Ecology, December 10, 2014.

## 6 Limitations

Work for this project was performed and this report prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Bremerton School District for specific application to the referenced property. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

# **TABLES**

## Table 1 - 2016 Well Monitoring Program Summary

Project No. 100094-004-01, Crownhill Elementary, Bremerton, Washington

Well Included in Monitoring Program <sup>1</sup>	LNAPL Present in Well <sup>2</sup>	Groundwater Samples Collected for Analysis of COCs <sup>1</sup>			Additional Notes
		TPH <sup>3</sup>	Total Arsenic <sup>4</sup>	TCE <sup>5</sup>	
MW-5		spring			
MW-6			spring/fall		6
MW-8	X				
MW-9				spring/fall	
MW-10		spring/fall	spring/fall	spring/fall	7
MW-12		fall			
MW-13	X				
MW-14	X				
MW-15		spring/fall			8
MW-16	X				
EW-17	X				
McKinney				spring/fall	9

COC constituent of concern  
 LNAPL light non-aqueous-phase liquid  
 TCE trichloroethene  
 TPH total petroleum hydrocarbon

### Notes

- 1) The *Groundwater/LNAPL Monitoring and Contingency Plan* (Aspect, 2015a) provides the rationale for including a well in the monitoring program, and for selecting well-specific COC analytes. Refer to Table 2 for groundwater monitoring results.
- 2) All wells except McKinney are monitored for LNAPL. If LNAPL is detected, its thickness is measured (refer to Table 3) and groundwater samples are not collected for analysis.
- 3) TPH is analyzed for using Method NWTPH-Dx. Both diesel-range TPH and motor-oil-range TPH are COCs.
- 4) Total arsenic is analyzed for using EPA Method 6010.
- 5) TCE is analyzed for using EPA Method 8260.
- 6) Well MW-6 provides early warning of potential arsenic migration.
- 7) Well MW-10 is the conditional point of compliance for achieving groundwater cleanup levels.
- 8) Well MW-15 is the conditional point of compliance for LNAPL migration.
- 9) The McKinney domestic well water sample is collected from the outdoor faucet on the north side of the residence at 1724 Dora Ave NW.

## Table 2 - Groundwater Monitoring Data Summary

Project No. 100094-004-01, Crownhill Elementary, Bremerton, Washington

Well ID and Top-of-Casing Elevation <sup>1,2</sup>	Date	Depth to Water (feet below top-of-casing)	Groundwater Elevation (feet) <sup>2</sup>	Constituent of Concern/Concentration <sup>3</sup>			
				Diesel-Range TPH	Motor-Oil-Range TPH	TCE	Total Arsenic
MW-5 136.95 ft	12/18/13	117.36	19.59	<b>2,100 x</b>	<b>750 x</b>	1.8	1.0
	04/03/14	117.17	19.78	<b>2,400 x</b>	<b>770 x</b>	na	1.2
	07/01/14	116.23	20.72	<b>2,000 x</b>	490 x	na	1.0
	10/13/14	117.56	19.39	<b>1,300</b>	260 x	na	1.0
	04/07/15	116.49	20.46	<b>2,000</b>	430 x	na	na
	04/05/16	113.41	23.54	<b>1,800</b>	<b>600 x</b>	na	na
MW-6 133.87 ft	12/18/13	124.36	9.51	50 U	250 U	1.0 U	<b>16.6</b>
	04/03/14	124.70	9.17	50 U	250 U	na	<b>20.5</b>
	07/01/14	124.40	9.47	50 U	250 U	na	<b>19.9</b>
	10/13/14	124.54	9.33	50 U	250 U	na	<b>20.4</b>
	04/07/15	124.61	9.26	na	na	na	<b>26.7</b>
	10/28/15	124.84	9.03	na	na	na	<b>22.8</b>
	04/05/16	124.54	9.33	na	na	na	<b>29.1</b>
10/28/16	123.70	10.17	na	na	na	<b>23.3</b>	
MW-9 134.39 ft	12/17/13	114.49	19.90	110 x	250 U	<b>11</b>	1.0 U
	04/03/14	114.35	20.04	210 x	280 x	<b>11</b>	1.0 U
	07/01/14	113.44	20.95	180 x	250 U	<b>12</b>	1.0 U
	10/13/14	114.71	19.68	180 x	250 U	<b>10</b>	1.0 U
	04/07/15	114.50	19.89	na	na	<b>11</b>	na
	10/28/15	115.30	19.09	na	na	<b>10</b>	na
	04/05/16	110.60	23.79	na	na	<b>11</b>	na
10/28/16	112.35	22.04	na	na	<b>8.6</b>	na	
MW-10 132.33 ft	12/18/13	120.87	11.46	50 U	250 U	1.0 U	3.3
	04/03/14	121.21	11.12	50 U	250 U	1.0 U	3.9
	07/01/14	120.55	11.78	50 U	250 U	1.0 U	3.0
	10/13/14	121.48	10.85	50 U	250 U	1.0 U	3.0
	04/07/15	120.60	11.73	50 U	250 U	1.0 U	2.8
	10/28/15	121.30	11.03	80 U	400 U	1.0 U	2.7
	04/05/16	119.33	13.00	50 U	250 U	1.0 U	2.6
10/28/16	120.35	11.98	50 U	250 U	1.0 U	2.6	
MW-12 133.87 ft	12/17/13	114.24	19.63	<b>2,000 x</b>	<b>800 x</b>	1.0 U	1.5
	04/03/14	114.11	19.76	<b>2,800 x</b>	<b>850 x</b>	na	1.4
	07/01/14	113.17	20.70	<b>1,800 x</b>	420 x	na	1.7
	10/13/14	114.45	19.42	<b>1,600</b>	250 U	na	1.7
	10/28/15	115.02	18.85	<b>2,400 x</b>	<b>620 x</b>	na	na
	10/28/16	112.19	21.68	<b>1,500 x</b>	<b>680 x</b>	na	na
MW-15 133.37 ft	12/17/13	nm <sup>4</sup>	--	50 U	250 U	1.0 U	4.6
	04/03/14	nm <sup>4</sup>	--	50 U	250 U	na	1.2
	07/01/14	nm <sup>4</sup>	--	50 U	250 U	na	1.0 U
	10/13/14	nm <sup>4</sup>	--	50 U	250 U	na	1.1
	04/07/15	nm <sup>4</sup>	--	50 U	250 U	na	na
	10/28/15	nm <sup>4</sup>	--	50 U	250 U	na	na
	04/05/16	109.88	23.49	50 U	250 U	na	na
10/28/16	111.65	21.72	50 U	250 U	na	na	
McKinney (domestic well)	10/6/2014 <sup>5</sup>	nm	--	100 U	200 U	0.2 U	0.4
	2/19/2015 <sup>5</sup>	nm	--	100 U	200 U	0.2 U	0.4
	6/1/2015 <sup>5</sup>	nm	--	100 U	200 U	0.2 U	0.3
	10/28/15	nm	--	na	na	1.0 U	na
	04/05/16	nm	--	na	na	1.0 U	na
	10/28/16	nm	--	na	na	1.0 U	na

na not analyzed      TCE trichloroethene      U analyte not detected at or above the reported result  
 nm not measured      TPH total petroleum hydrocarbon      x sample chromatographic pattern does not resemble the fuel standard used for quantitation

### Notes

- 1) Only wells included in the current monitoring program that do not contain LNAPL are shown in this table. Refer to Table 3 for wells containing LNAPL. Refer to the *Remedial Investigation Report* (Aspect, 2014a) for data prior to December 2013 and for information on other wells.
- 2) Elevations are based on NAVD88 vertical datum.
- 3) All concentrations are in micrograms per liter (µg/L). Cleanup levels are 500 µg/L for diesel- and motor-oil-range TPH, and 5 µg/L for TCE and total arsenic. Cleanup level exceedances are bolded.
- 4) Water level was below top of pump and could not be measured.
- 5) Sample was collected for analysis by the Kitsap Public Health District and analyzed by Analytical Resources, Inc.

**Table 3 - LNAPL Thickness Measurements and Removal Summary**

Project No. 100094-004-01, Crownhill Elementary, Bremerton, Washington

Well ID	Date	Initial Thickness in ft <sup>(1)</sup>	LNAPL Removal in Liters	Notes
MW-8	10/26/12	0.20		Well installed on 12/20/11.  (Note 4) (Note 3)  Not bailed because initial thickness was <0.3 feet. (Note 3) Not bailed because initial thickness was <0.3 feet. Not bailed because initial thickness was <0.3 feet. (Note 3)
	11/21/12	nm		
	01/31/13	0.10		
	05/03/13	0.03		
	08/07/13	0.23		
	12/17/13	0.86		
	04/02/14	0.39	0.18	
	05/23/14	0.38	0.11	
	07/01/14	0.23		
	10/13/14	0.28		
	04/07/15	0.27		
	10/28/15	0.90	0.36	
	01/18/16	0.10		
	04/05/16	0.01		
10/28/16	0.40	0.01		
<b>Cumulative LNAPL Removal</b>			0.66	
MW-13	11/01/12	1.46		Well installed on 10/25/12. (Note 3)  Water detected above LNAPL. (Note 3) Water detected above LNAPL. (Note 3)  (Note 3) (Note 3) (Note 3) (Note 3) Not bailed because initial thickness was <0.3 feet.
	11/21/12	0.99	0.90	
	01/31/13	0.10		
	05/03/13	0.31		
	08/07/13	0.49		
	12/17/13	4.90		
	04/02/14	1.35	0.02	
	05/23/14	2.08	0.18	
	07/01/14	0.84		
	10/13/14	3.39		
	04/07/15	1.00	0.17	
	10/28/15	4.15	0.02	
	01/18/16	1.39	0.52	
	04/05/16	1.31	0.26	
10/28/16	0.05			
<b>Cumulative LNAPL Removal</b>			2.06	
MW-14	11/01/12	nd		Well installed on 10/26/12.  Not bailed because initial thickness was <0.1 feet. Not bailed because initial thickness was <0.1 feet.  Not bailed because initial thickness was <0.3 feet. (Note 3) (Note 3) Not bailed because initial thickness was <0.3 feet. (Note 4)
	01/31/13	nd		
	05/03/13	nd		
	08/07/13	0.12		
	12/17/13	0.10		
	04/02/14	0.08		
	05/23/14	0.09		
	07/01/14	0.46		
	10/13/14	0.71		
	04/07/15	0.23		
	10/28/15	1.48	0.35	
	01/18/16	0.32	0.20	
	04/05/16	0.01		
	10/28/16	0.37	0.03	
<b>Cumulative LNAPL Removal</b>			0.57	
MW-16	11/01/12	nd		Well installed on 10/26/12.  (Note 4) (Note 4)  (Note 4) (Note 3) Bailing was stopped after measuring <0.01 foot LNAPL thickness. Four bailing attempts recovered only a trace of LNAPL. Third bailing attempt recovered only 20 ml of LNAPL.
	01/31/13	0.50		
	05/03/13	0.48		
	08/07/13	2.61		
	12/17/13	2.83		
	04/02/14	3.02	0.85	
	05/23/14	4.25	2.06	
	07/01/14	3.79		
	10/13/14	3.25		
	04/07/15	2.64	1.19	
	10/28/15	2.18	0.35	
	01/18/16	0.45	0.17	
	04/05/16	0.39	0.00	
	10/28/16	0.87	0.10	
<b>Cumulative LNAPL Removal</b>			4.72	
EW-17	10/28/15	0.45	0.03	Well installed on 10/13/15. LNAPL observed to be much more viscous (sludge-like) than in other wells. (Note 3) LNAPL appears to be less viscous than in previous rounds. (Note 3) Fourth bailing attempt recovered only 5 ml of LNAPL.
	01/18/16	0.40	0.21	
	04/05/16	0.44	1.66	
	10/28/16	0.47	0.11	
<b>Cumulative LNAPL Removal</b>			2.01	
<b>TOTAL LNAPL REMOVED</b>			<b>10.02</b>	<b>(ALL WELLS)</b>

LNAPL light non-aqueous-phase liquid      nd no detectable LNAPL thickness      nm not measured

**Notes**

- 1) The viscous, sticky nature of the LNAPL results in inconsistent readings of the interface probe (used to measure depth-to-LNAPL and depth-to-water). Therefore, the reported LNAPL thicknesses can only be regarded as estimates.
- 2) Well EW-17 (4-inch ID) has a unit volume of approx. 2.5 liters per vertical foot of well casing. All other wells are 2-inch ID and have unit volumes of approx. 0.62 liter per vertical foot of well casing.
- 3) Bailing was stopped after bailer retrieved a relatively large volume of water with little or no LNAPL.
- 4) Bailing was stopped because bailer would no longer go down well due to LNAPL buildup on inside well casing.

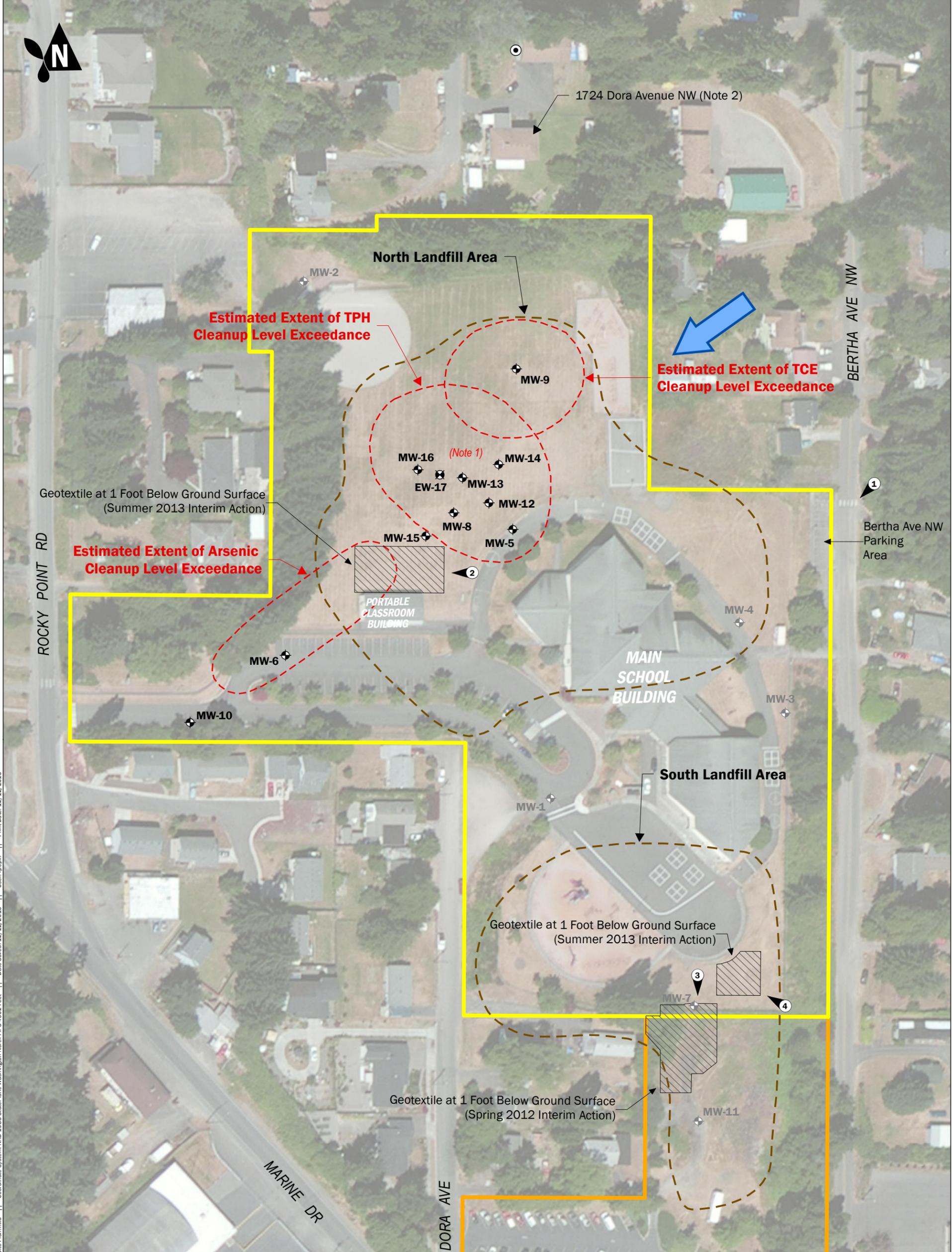
# FIGURES



## Vicinity Map

2016 Annual Report  
Crownhill Elementary, Bremerton, Washington

	<p><b>JAN-2017</b></p> <p>PROJECT NO. 100094</p>	<p>BY: PPW</p> <p>REV BY: RMB</p>
		<p>FIGURE NO.</p> <h1 style="font-size: 2em;">1</h1>



**Well Locations:**

- Extraction Well Included in Monitoring Program
- Monitoring Well Included in Monitoring Program
- Monitoring Well Not Included in Monitoring Program
- McKinney Domestic Well (Note 2)
- Approximate photo location & orientation for semiannual cover system inspections

**Note:**

(1) LNAPL has been observed in Wells EW-17, MW-8, MW-13, MW-14, and MW-16.  
 (2) The McKinney well water sample is collected from the outdoor faucet on the north side of the residence at 1724 Dora Avenue NW.

**Other Site Features and Interpretation:**

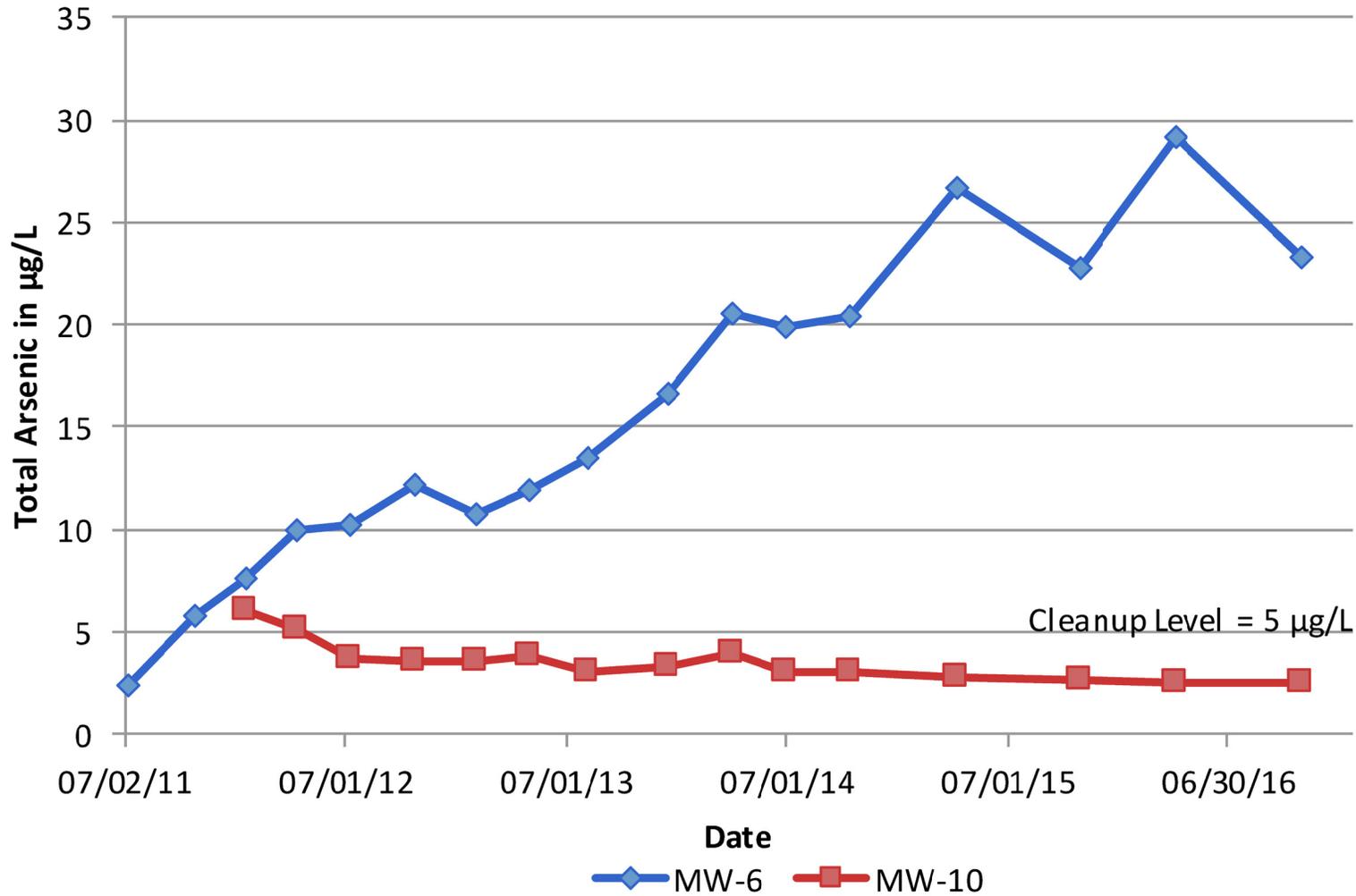
- Interpreted Extent of Landfill Activity
- Estimated Extent of Groundwater Cleanup Level Exceedances in 2014 (Ecology, 2014)
- Bremerton School District Property Boundary
- Bremerton United Methodist Church Property Boundary
- Inferred Direction of Groundwater Flow

0 100 200  
Feet

**Site Plan**  
2016 Annual Report  
Crownhill Elementary, Bremerton, Washington

	JAN-2017	BY: DLH / PPW	FIGURE NO. <b>2</b>
	PROJECT NO. 100094	REVISED BY: SCC	

GIS Path: T:\projects\_8\CrownhillElementary\Delivered\Annual Report\_2016\02\_Site Plan.mxd || Coordinate System: NAD\_1983\_StatePlane\_Washington\_North\_FIPS\_4601\_Feet || Date Saved: 12/12/2016 || User: rpepin || Print Date: 12/12/2016



**Notes:**

1. Well MW-6 provides early warning of potential arsenic migration.
2. Well MW-10 is the conditional point of compliance for achieving groundwater cleanup levels.

**Arsenic Concentration Trends  
 in Wells MW-6 and MW-10**

2016 Annual Report  
 Crownhill Elementary, Bremerton, Washington



Dec-2016  
 PROJECT NO.  
 100094

BY:  
 DAH/SCC  
 REVISED BY:  
 -

FIGURE NO.  
**3**

## **APPENDIX A**

### **June 2016 Inspection Record and Photos**



Project Name: **Crownhill Elementary School**

Date: 6/7/16

Project No.: 100094

Inspector's Name: Matthew M. Lewis

Weather Conditions: Sunny, 70°F

Inspector's Signature: Matthew M. Lewis

Inspector's Title/Affiliation: Sr Staff Hydrogeologist, Aspect Consulting

**FORM 1 - INSPECTION RECORD**

INSPECTION ITEM	YES	NO	COMMENTS/NOTES
<b>1. North Environmental Covenant Area</b>			
a. Building or pavement modifications since last inspection?		X	None are planned before next inspection either some depressions in pavement (~2-3" deep) cracked & broken inside
b. Pavement deterioration/damage along Bertha Ave NW? <sup>1</sup>	X		
c. Evidence of soil disturbance?		X	
d. Geotextile fabric visible in interim action area?		X	
<b>2. South Environmental Covenant Area</b>			
a. Building or pavement modifications since last inspection?		X	
b. Evidence of soil disturbance?		X	
c. Geotextile fabric visible in interim action areas?		X	
<b>3. Other Inspection Items</b>			
a. Are all wells (MW-1 through EW-17) accessible?	X		
b. Evidence of well monument damage/tampering?		X	
c. HVAC system operates continuously during school day? <sup>2</sup>	X		The system is on all days: runs <sup>heating/cooling</sup> intermittently <sup>temp.</sup> based on settings -D. Reffner

**Deficient Action Items & Other Comments:**  
See photos from locations 1-4.

- Notes**
- Item 1b refers to the paved parking area described in Section 1.3.
  - The inspector should describe under COMMENTS/NOTES how the determination is made regarding HVAC system operation.

Revision: December 2015

A-1



Photo Location 1, 6/7/16 site inspection



Photo Location 1 showing pavement deterioration, 6/7/16 site inspection



Photo Location 2, 6/7/16 site inspection



Photo Location 3, 6/7/16 site inspection



Photo Location 4, 6/7/16 site inspection

## **APPENDIX B**

### **December 2016 Inspection Record and Photos**



Project Name: **Crownhill Elementary School**

Date: 12/5/16

Project No.: 100094

Inspector's Name: Matthew Lewis

Inspector's Signature: [Signature]

Weather Conditions: Rain/sleet 40s-45

Inspector's Title/Affiliation: Sr. Staff Hydrogeologist

**FORM 1 - INSPECTION RECORD**

INSPECTION ITEM	YES	NO	COMMENTS/NOTES
<b>1. North Environmental Covenant Area</b>			
a. Building or pavement modifications since last inspection?		X	
b. Pavement deterioration/damage along Bertha Ave NW? <sup>1</sup>	X		Same as last inspection. No new deterioration.
c. Evidence of soil disturbance?		X	
d. Geotextile fabric visible in interim action area?		X	
<b>2. South Environmental Covenant Area</b>			
a. Building or pavement modifications since last inspection?		X	
b. Evidence of soil disturbance?		X	
c. Geotextile fabric visible in interim action areas?		X	
<b>3. Other Inspection Items</b>			
a. Are all wells (MW-1 through EW-17) accessible?		X	
b. Evidence of well monument damage/tampering?		X	
c. HVAC system operates continuously during school day? <sup>2</sup>	X		HVAC on all day, but engages as needed - David Herrington → i.e., Air is circulated continuously during school hours; heating and cooling cycle on and off to maintain desired temperature. -12/6/16 communication with Dave Herrington. D. Haffner

**Deficient Action Items & Other Comments:**

See photos from locations 1-4.

**Notes**

- Item 1b refers to the paved parking area described in Section 1.3.
- The inspector should describe under COMMENTS/NOTES how the determination is made regarding HVAC system operation.

Revision: December 2015

B-1



Photo Location 1, 12/5/16 site inspection



Photo Location 1 showing pavement deterioration (1<sup>st</sup> view), 12/5/16 site inspection



Photo Location 1 showing pavement deterioration (2nd view), 12/5/16 site inspection



Photo Location 2, 12/5/16 site inspection



Photo Location 3, 12/5/16 site inspection



Photo Location 4, 12/5/16 site inspection

## **APPENDIX C**

### **Laboratory Reports, April and October 2016 Groundwater Monitoring Rounds**

FRIEDMAN & BRUYA, INC.

---

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.  
Yelena Aravkina, M.S.  
Michael Erdahl, B.S.  
Arina Podnozova, B.S.  
Eric Young, B.S.

3012 16th Avenue West  
Seattle, WA 98119-2029  
(206) 285-8282  
fbi@isomedia.com  
www.friedmanandbruya.com

April 12, 2016

Dave Heffner, Project Manager  
Aspect Consulting, LLC  
401 2<sup>nd</sup> Ave S, Suite 201  
Seattle, WA 98104

Dear Mr. Heffner:

Included are the results from the testing of material submitted on April 6, 2016 from the Crown Hill Elem. 100094, F&BI 604100 project. There are 13 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.



Michael Erdahl  
Project Manager

Enclosures

c: data@aspectconsulting.com

ASP0412R.DOC

FRIEDMAN & BRUYA, INC.

---

ENVIRONMENTAL CHEMISTS

CASE NARRATIVE

This case narrative encompasses samples received on April 6, 2016 by Friedman & Bruya, Inc. from the Aspect Consulting, LLC Crown Hill Elem. 100094, F&BI 604100 project. Samples were logged in under the laboratory ID's listed below.

<u>Laboratory ID</u>	<u>Aspect Consulting, LLC</u>
604100 -01	MW-6-040516
604100 -02	MW-10-040516
604100 -03	MW-15-040516
604100 -04	MW-9-040516
604100 -05	McKinney-040516
604100 -06	MW-5-040516

All quality control requirements were acceptable.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 04/12/16  
Date Received: 04/06/16  
Project: Crown Hill Elem. 100094, F&BI 604100  
Date Extracted: 04/07/16  
Date Analyzed: 04/07/16

**RESULTS FROM THE ANALYSIS OF WATER SAMPLES  
FOR TOTAL PETROLEUM HYDROCARBONS AS  
DIESEL AND MOTOR OIL  
USING METHOD NWTPH-Dx**  
Results Reported as ug/L (ppb)

<u>Sample ID</u> Laboratory ID	<u>Diesel Range</u> (C <sub>10</sub> -C <sub>25</sub> )	<u>Motor Oil Range</u> (C <sub>25</sub> -C <sub>36</sub> )	<u>Surrogate</u> <u>(% Recovery)</u> (Limit 41-152)
MW-10-040516 604100-02	<50	<250	95
MW-15-040516 604100-03	<50	<250	98
MW-5-040516 604100-06	1,800	600 x	122
Method Blank 06-687 MB	<50	<250	86

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Analysis For Total Metals By EPA Method 200.8

Client ID:	MW-6-040516	Client:	Aspect Consulting, LLC
Date Received:	04/06/16	Project:	Crown Hill Elem. 100094
Date Extracted:	04/07/16	Lab ID:	604100-01
Date Analyzed:	04/07/16	Data File:	604100-01.042
Matrix:	Water	Instrument:	ICPMS1
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Arsenic	29.1

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Analysis For Total Metals By EPA Method 200.8

Client ID:	MW-10-040516	Client:	Aspect Consulting, LLC
Date Received:	04/06/16	Project:	Crown Hill Elem. 100094
Date Extracted:	04/07/16	Lab ID:	604100-02
Date Analyzed:	04/07/16	Data File:	604100-02.043
Matrix:	Water	Instrument:	ICPMS1
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Arsenic	2.60

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Analysis For Total Metals By EPA Method 200.8

Client ID:	Method Blank	Client:	Aspect Consulting, LLC
Date Received:	NA	Project:	Crown Hill Elem. 100094
Date Extracted:	04/07/16	Lab ID:	I6-192 mb2
Date Analyzed:	04/07/16	Data File:	I6-192 mb2.024
Matrix:	Water	Instrument:	ICPMS1
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Arsenic	<1

# FRIEDMAN & BRUYA, INC.

## ENVIRONMENTAL CHEMISTS

### Analysis For Volatile Compounds By EPA Method 8260C

Client Sample ID:	MW-10-040516	Client:	Aspect Consulting, LLC
Date Received:	04/06/16	Project:	Crown Hill Elem. 100094
Date Extracted:	04/06/16	Lab ID:	604100-02
Date Analyzed:	04/06/16	Data File:	040625.D
Matrix:	Water	Instrument:	GCMS4
Units:	ug/L (ppb)	Operator:	JS

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	97	57	121
Toluene-d8	101	63	127
4-Bromofluorobenzene	101	60	133

Compounds:	Concentration ug/L (ppb)
Trichloroethene	<1

# FRIEDMAN & BRUYA, INC.

## ENVIRONMENTAL CHEMISTS

### Analysis For Volatile Compounds By EPA Method 8260C

Client Sample ID:	MW-9-040516	Client:	Aspect Consulting, LLC
Date Received:	04/06/16	Project:	Crown Hill Elem. 100094
Date Extracted:	04/06/16	Lab ID:	604100-04
Date Analyzed:	04/06/16	Data File:	040626.D
Matrix:	Water	Instrument:	GCMS4
Units:	ug/L (ppb)	Operator:	JS

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	101	57	121
Toluene-d8	102	63	127
4-Bromofluorobenzene	99	60	133

Compounds:	Concentration ug/L (ppb)
Trichloroethene	11

# FRIEDMAN & BRUYA, INC.

## ENVIRONMENTAL CHEMISTS

### Analysis For Volatile Compounds By EPA Method 8260C

Client Sample ID:	McKinney-040516	Client:	Aspect Consulting, LLC
Date Received:	04/06/16	Project:	Crown Hill Elem. 100094
Date Extracted:	04/06/16	Lab ID:	604100-05
Date Analyzed:	04/06/16	Data File:	040627.D
Matrix:	Water	Instrument:	GCMS4
Units:	ug/L (ppb)	Operator:	JS

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	98	57	121
Toluene-d8	102	63	127
4-Bromofluorobenzene	101	60	133

Compounds:	Concentration ug/L (ppb)
Trichloroethene	<1

# FRIEDMAN & BRUYA, INC.

## ENVIRONMENTAL CHEMISTS

### Analysis For Volatile Compounds By EPA Method 8260C

Client Sample ID:	Method Blank	Client:	Aspect Consulting, LLC
Date Received:	Not Applicable	Project:	Crown Hill Elem. 100094
Date Extracted:	04/06/16	Lab ID:	06-0630 mb
Date Analyzed:	04/06/16	Data File:	040607.D
Matrix:	Water	Instrument:	GCMS4
Units:	ug/L (ppb)	Operator:	JS

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	101	57	121
Toluene-d8	102	63	127
4-Bromofluorobenzene	99	60	133

Compounds:	Concentration ug/L (ppb)
Trichloroethene	<1

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 04/12/16

Date Received: 04/06/16

Project: Crown Hill Elem. 100094, F&BI 604100

**QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER  
SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS  
DIESEL EXTENDED USING METHOD NWTPH-Dx**

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Diesel Extended	ug/L (ppb)	2,500	108	105	63-142	3

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 04/12/16

Date Received: 04/06/16

Project: Crown Hill Elem. 100094, F&BI 604100

**QUALITY ASSURANCE RESULTS  
FOR THE ANALYSIS OF WATER SAMPLES  
FOR TOTAL METALS USING EPA METHOD 200.8**

Laboratory Code: 604073-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	ug/L (ppb)	10	4.17	113	113	70-130	0

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	ug/L (ppb)	10	100	85-115

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 04/12/16

Date Received: 04/06/16

Project: Crown Hill Elem. 100094, F&BI 604100

**QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER  
SAMPLES FOR VOLATILES BY EPA METHOD 8260C**

Laboratory Code: 604100-02 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Acceptance Criteria
Trichloroethene	ug/L (ppb)	50	<1	96	66-135

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Trichloroethene	ug/L (ppb)	50	103	102	80-120	1

# FRIEDMAN & BRUYA, INC.

## ENVIRONMENTAL CHEMISTS

### **Data Qualifiers & Definitions**

- a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.
- b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.
- ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.
- c - The presence of the analyte may be due to carryover from previous sample injections.
- cf - The sample was centrifuged prior to analysis.
- d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.
- dv - Insufficient sample volume was available to achieve normal reporting limits.
- f - The sample was laboratory filtered prior to analysis.
- fb - The analyte was detected in the method blank.
- fc - The compound is a common laboratory and field contaminant.
- hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.
- hs - Headspace was present in the container used for analysis.
- ht - The analysis was performed outside the method or client-specified holding time requirement.
- ip - Recovery fell outside of control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.
- j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.
- J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.
- jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.
- js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.
- lc - The presence of the analyte is likely due to laboratory contamination.
- L - The reported concentration was generated from a library search.
- nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.
- pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.
- ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.
- vo - The value reported fell outside the control limits established for this analyte.
- x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.



FRIEDMAN & BRUYA, INC.

---

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.  
Yelena Aravkina, M.S.  
Michael Erdahl, B.S.  
Arina Podnozova, B.S.  
Eric Young, B.S.

3012 16th Avenue West  
Seattle, WA 98119-2029  
(206) 285-8282  
fbi@isomedia.com  
www.friedmanandbruya.com

November 7, 2016

Dave Heffner, Project Manager  
Aspect Consulting, LLC  
401 2<sup>nd</sup> Ave S, Suite 201  
Seattle, WA 98104

Dear Mr Heffner:

Included are the results from the testing of material submitted on October 31, 2016 from the Crown Hill Elem. 100094, F&BI 610461 project. There are 13 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.



Michael Erdahl  
Project Manager

Enclosures

c: data@aspectconsulting.com  
ASP1107R.DOC

FRIEDMAN & BRUYA, INC.

---

ENVIRONMENTAL CHEMISTS

CASE NARRATIVE

This case narrative encompasses samples received on October 31, 2016 by Friedman & Bruya, Inc. from the Aspect Consulting, LLC Crown Hill Elem. 100094, F&BI 610461 project. Samples were logged in under the laboratory ID's listed below.

<u>Laboratory ID</u>	<u>Aspect Consulting, LLC</u>
610461 -01	MW-6-102816
610461 -02	MW-10-102816
610461 -03	MW-12-102816
610461 -04	MW-15-102816
610461 -05	MW-9-102816
610461 -06	McKinney-102816

All quality control requirements were acceptable.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 11/07/16  
Date Received: 10/31/16  
Project: Crown Hill Elem. 100094, F&BI 610461  
Date Extracted: 11/01/16  
Date Analyzed: 11/01/16

**RESULTS FROM THE ANALYSIS OF WATER SAMPLES  
FOR TOTAL PETROLEUM HYDROCARBONS AS  
DIESEL AND MOTOR OIL  
USING METHOD NWTPH-Dx**  
Results Reported as ug/L (ppb)

<u>Sample ID</u> Laboratory ID	<u>Diesel Range</u> (C <sub>10</sub> -C <sub>25</sub> )	<u>Motor Oil Range</u> (C <sub>25</sub> -C <sub>36</sub> )	<u>Surrogate</u> (% Recovery) (Limit 47-140)
MW-10-102816 610461-02	<50	<250	105
MW-12-102816 610461-03	1,500 x	680 x	108
MW-15-102816 610461-04	<50	<250	109
Method Blank 06-2255 MB2	<50	<250	108

FRIEDMAN & BRUYA, INC.

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ENVIRONMENTAL CHEMISTS

Analysis For Total Metals By EPA Method 200.8

Client ID:	MW-6-102816	Client:	Aspect Consulting, LLC
Date Received:	10/31/16	Project:	Crown Hill Elem. 100094, F&BI 610461
Date Extracted:	11/01/16	Lab ID:	610461-01
Date Analyzed:	11/02/16	Data File:	610461-01.134
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Arsenic	23.3

FRIEDMAN & BRUYA, INC.

---

ENVIRONMENTAL CHEMISTS

Analysis For Total Metals By EPA Method 200.8

Client ID:	MW-10-102816	Client:	Aspect Consulting, LLC
Date Received:	10/31/16	Project:	Crown Hill Elem. 100094, F&BI 610461
Date Extracted:	11/01/16	Lab ID:	610461-02
Date Analyzed:	11/02/16	Data File:	610461-02.135
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Arsenic	2.59

FRIEDMAN & BRUYA, INC.

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ENVIRONMENTAL CHEMISTS

Analysis For Total Metals By EPA Method 200.8

Client ID:	Method Blank	Client:	Aspect Consulting, LLC
Date Received:	NA	Project:	Crown Hill Elem. 100094, F&BI 610461
Date Extracted:	11/01/16	Lab ID:	I6-719 mb
Date Analyzed:	11/01/16	Data File:	I6-719 mb.063
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Arsenic	<1

# FRIEDMAN & BRUYA, INC.

## ENVIRONMENTAL CHEMISTS

### Analysis For Volatile Compounds By EPA Method 8260C

Client Sample ID:	MW-10-102816	Client:	Aspect Consulting, LLC
Date Received:	10/31/16	Project:	Crown Hill Elem. 100094, F&BI 610461
Date Extracted:	11/01/16	Lab ID:	610461-02
Date Analyzed:	11/01/16	Data File:	110111.D
Matrix:	Water	Instrument:	GCMS9
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	100	85	117
Toluene-d8	100	91	108
4-Bromofluorobenzene	99	76	126

Compounds:	Concentration ug/L (ppb)
Trichloroethene	<1

# FRIEDMAN & BRUYA, INC.

## ENVIRONMENTAL CHEMISTS

### Analysis For Volatile Compounds By EPA Method 8260C

Client Sample ID:	MW-9-102816	Client:	Aspect Consulting, LLC
Date Received:	10/31/16	Project:	Crown Hill Elem. 100094, F&BI 610461
Date Extracted:	11/01/16	Lab ID:	610461-05
Date Analyzed:	11/01/16	Data File:	110109.D
Matrix:	Water	Instrument:	GCMS9
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	102	85	117
Toluene-d8	101	91	108
4-Bromofluorobenzene	96	76	126

Compounds:	Concentration ug/L (ppb)
Trichloroethene	8.6

# FRIEDMAN & BRUYA, INC.

## ENVIRONMENTAL CHEMISTS

### Analysis For Volatile Compounds By EPA Method 8260C

Client Sample ID:	McKinney-102816	Client:	Aspect Consulting, LLC
Date Received:	10/31/16	Project:	Crown Hill Elem. 100094, F&BI 610461
Date Extracted:	11/01/16	Lab ID:	610461-06
Date Analyzed:	11/01/16	Data File:	110110.D
Matrix:	Water	Instrument:	GCMS9
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	101	85	117
Toluene-d8	100	91	108
4-Bromofluorobenzene	96	76	126

Compounds:	Concentration ug/L (ppb)
Trichloroethene	<1

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Analysis For Volatile Compounds By EPA Method 8260C

Client Sample ID:	Method Blank	Client:	Aspect Consulting, LLC
Date Received:	Not Applicable	Project:	Crown Hill Elem. 100094, F&BI 610461
Date Extracted:	11/01/16	Lab ID:	06-2239 mb
Date Analyzed:	11/01/16	Data File:	110107.D
Matrix:	Water	Instrument:	GCMS9
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	100	85	117
Toluene-d8	101	91	108
4-Bromofluorobenzene	100	76	126

Compounds:	Concentration ug/L (ppb)
Trichloroethene	<1

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 11/07/16

Date Received: 10/31/16

Project: Crown Hill Elem. 100094, F&BI 610461

**QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER  
SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS  
DIESEL EXTENDED USING METHOD NWTPH-Dx**

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Diesel Extended	ug/L (ppb)	2,500	95	91	61-133	4

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 11/07/16

Date Received: 10/31/16

Project: Crown Hill Elem. 100094, F&BI 610461

**QUALITY ASSURANCE RESULTS  
FOR THE ANALYSIS OF WATER SAMPLES  
FOR TOTAL METALS USING EPA METHOD 200.8**

Laboratory Code: 611002-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Arsenic	ug/L (ppb)	10	2.19	114	110	70-130	4

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Arsenic	ug/L (ppb)	10	107	85-115

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 11/07/16

Date Received: 10/31/16

Project: Crown Hill Elem. 100094, F&BI 610461

**QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER  
SAMPLES FOR VOLATILES BY EPA METHOD 8260C**

Laboratory Code: 610461-06 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Acceptance Criteria
Trichloroethene	ug/L (ppb)	50	<1	100	75-109

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Trichloroethene	ug/L (ppb)	50	103	104	77-108	1

**Data Qualifiers & Definitions**

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The compound is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht - The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits. Compounds in the sample matrix interfered with the quantitation of the analyte.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

610461

SAMPLE CHAIN OF CUSTODY

ME 10/31/16

VW 2/ATY/EOY

Report To DAVE HEFFNER

Company ASPECT CONSULTANTS

Address 461 2nd Ave S, Ste 201

City, State, ZIP SEATTLE, WA 98104

Phone \_\_\_\_\_ Email \_\_\_\_\_

SAMPLERS (signature)	PROJECT NAME	PO #
<u>[Signature]</u>	<u>Groundwater Elev. 100094</u>	
REMARKS	INVOICE TO	
<u>TCE - TRICHLOROETHYLENE</u>		

Page # \_\_\_\_\_ of \_\_\_\_\_

TURNAROUND TIME

Standard Turnaround

RUSH

Rush charges authorized by: \_\_\_\_\_

SAMPLE DISPOSAL

Dispose after 30 days

Archive Samples

Other \_\_\_\_\_

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	ANALYSES REQUESTED										Notes		
						TPH-HCID	TPH-Diesel	TPH-Gasoline	BTEX by 8021B	VOCs by 8260C	SVOCs by 8270D	PAHs 8270D SIM	TOTAL As	TCE				
MW-6-102816	01	10/28/16	0940	Water	1								X					
MW-10-102816	02 A-F		1040		6		X						X	X				
MW-12-102816	03		1210		1		X											
MW-15-102816	04		1315		1		X											
MW-9-102816	05 A-D		1420		4									X				
McKinney - 102816	06 A-D		1210		4									X				← added per ECR 10/31/16

Samples received at 3 °C

Samples received at 3 °C

Friedman & Bruya, Inc.

3012 16th Avenue West

Seattle, WA 98119-2029

Ph. (206) 285-8282

Relinquished by:	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	<u>[Signature]</u>	<u>Eric Knudsen</u>	<u>Aspect</u>	<u>10/31/16</u>	
Received by:	<u>[Signature]</u>	<u>Camel Patterson</u>	<u>Federal SD</u>	<u>10/31/16</u>	<u>8:50</u>
Received by:	<u>[Signature]</u>	<u>Nhan Phan</u>	<u>F&amp;B</u>	<u>10/31/16</u>	<u>0853</u>

UP