MEMORANDUM

Project No. 100094-I-11

November 21, 2022

To: Vance Atkins and Dhroov Shivjiani, Environmental Protection Agency

cc: John Fisher, Bremerton School District

From:

State of Washington
Hydrogeologist
3268
Licensed Geologist
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11/21/2022

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Re: **Crownhill Elementary: Addendum to the Groundwater/LNAPL Monitoring and Contingency Plan**

Historical landfill activities at the Bremerton School District (BSD) Crownhill Elementary School Site (Site) have resulted in groundwater contamination and the presence of light non-aqueous-phase liquid (LNAPL) floating on the water table. The *Groundwater/LNAPL Monitoring and Contingency Plan* (Plan, Aspect 2015) was developed in accordance with Washington State Department of Ecology's (Ecology) Agreed Order No. DE11107 (AO) as part of the Site's Cleanup Action Plan (CAP; Ecology, 2014) to establish monitoring procedures and frequencies and groundwater sampling, analysis, and reporting protocols.

This Plan Addendum adds turbidity to the field parameters, introduces diagnostic analytes to the list of samples submitted for laboratory analysis, and describes procedures for soil gas surveys to measure landfill gas levels in the deep soil at each monitoring well. This Plan Addendum is a component of BSD's response to the arsenic exceedance in groundwater at MW-6 in April 2022 (Aspect, 2022). Well MW-6 provides early warning of potential arsenic migration and exceeded the contingency threshold (40 micrograms per liter [µg/L]) in April 2022. Well MW-10 is located downgradient of MW-6 and is the conditional point of compliance for achieving groundwater cleanup levels (see Figure 1, attached).

The purpose of this Plan Addendum to better understand the potential causes of the rising arsenic concentrations at MW-6. Findings from these additional monitoring and investigation activities may support potential engineered solutions.

Additional Investigation

This section describes new field parameters, new diagnostic analytes, and a new soil gas survey to be completed.

New Field Parameter

In accordance with the Plan, field staff have measured field parameters (including temperature, pH, electrical conductance, dissolved oxygen, and reduction-oxidation potential) while purging the groundwater monitoring wells to ensure collection of a representative groundwater sample. This Plan Addendum adds turbidity as a field parameter that will be measured using a turbidimeter and recorded in nephelometric turbidity units (NTU). Purging will now continue until field parameters stabilize, as defined in the Plan, and when turbidity stabilizes[1] or falls below 25 NTU. Samples will be collected in accordance with procedures provided in the Plan.

Turbidity in groundwater samples can influence the results of total metals analysis due to the use of acid preservative in sample jars. Higher turbidity can result in higher total metals concentrations. To reduce turbidity in a groundwater sample, field staff commonly reduce the purge rate during sampling.

New Diagnostic Analytes

Constituents of concern (COCs) with site-specific cleanup levels include total petroleum hydrocarbons (TPH), total arsenic, and trichloroethene (TCE). Additional diagnostic analytes, including dissolved arsenic, dissolved iron, dissolved manganese, and total alkalinity will be added to the groundwater monitoring program to assess the geochemical conditions that may be mobilizing naturally occurring arsenic. Samples will be submitted for laboratory analysis of diagnostic analytes in coordination with routine sampling for COCs.

Arsenic, iron, and manganese are all naturally occurring compounds in aquifers throughout the Puget Sound lowland basin that are sensitive to changes in groundwater geochemistry. These metals are mobilized in groundwater under increasing acidity and more reducing conditions. A likely potential cause for changes in groundwater geochemistry is a change in soil gas concentrations. Even low levels of landfill gas generated at an old landfill can result in greater acidity (due to carbon dioxide) and more reducing conditions (due to methane).

Table 1 lists the Site groundwater wells and provides information about the presence of LNAPL in those wells. Table 1 also shows sampling frequencies for the existing COCs and the list additional diagnostic analytes. Quarterly groundwater monitoring at MW-6 and MW-10 will be completed in response to the arsenic exceedance at MW-6 in April 2022 (Aspect, 2022). Well MW-10 is the conditional point of compliance for achieving groundwater cleanup levels.

[1] In accordance with EPA low-flow groundwater sampling procedures (EPA, 1996).

Table 1. 2022 Well Monitoring Program Summary

Well Included in Monitoring Program[1]	LNAPL Present in Well[2]	Groundwater Samples Collected for Analysis of COCs[1]			Additional Diagnostic Analytes	
		TPH	Total Arsenic	TCE	Dissolved As, Fe, Mn	Total Alkalinity
MW-5		spring	spring		spring	spring
MW-6			quarterly		quarterly	quarterly
MW-8	X					
MW-9			spring/fall	spring/fall	spring/fall	spring/fall
MW-10		quarterly	quarterly	quarterly	quarterly	quarterly
MW-12		fall	fall		fall	fall
MW-13	X					
MW-14	X					
MW-15		spring/fall	spring/fall		spring/fall	spring/fall
MW-16	X					
EW-17	X					
McKinney				spring/fall		

Notes:
1. The Groundwater/LNAPL Monitoring and Contingency Plan (Aspect, 2015) provides the rationale for including a well in the monitoring program, and for selecting well-specific COC analytes.
2. All wells except McKinney are monitored for LNAPL and only those wells indicated have measurable thicknesses.

Soil Gas Survey

A soil gas survey will be conducted to measure the landfill gas concentrations in the deep vadose zone at nine groundwater monitoring wells including MW-5, MW-6, MW-8, MW-9, MW-12, MW-13, MW-15, MW-16, and MW-17. Landfill gas can influence groundwater geochemistry and result in elevated concentrations of arsenic, iron, and manganese compared to background concentrations. Even low levels of landfill gas generated at an old landfill can affect groundwater geochemistry.

Locations. Monitoring wells at the Site were constructed with a partially saturated screened section, based on the well logs provided as Appendix A and observed water levels. Figure 2 below shows the observed water levels and screen settings for each of the wells selected for the soil gas survey. The partially saturated screen allows for monitoring deep soil gas concentrations in contact with groundwater by conducting a soil gas survey. The soil gas survey will require temporarily replacing the wellhead cap and should not affect groundwater sampling results or other cleanup actions.

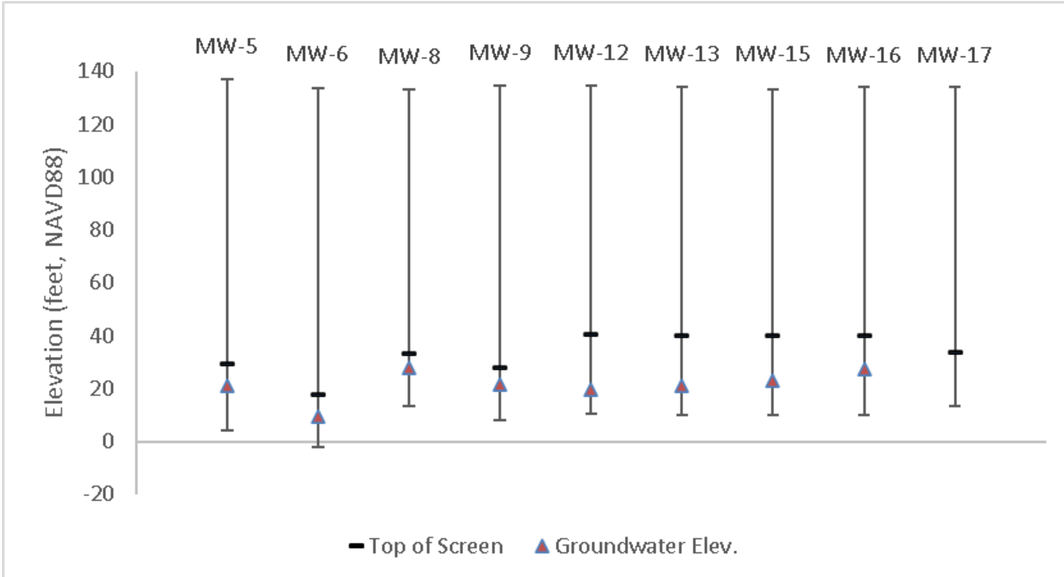


Figure 2. *Schematic of Well Construction, Partially Saturated Screens*

Equipment. Landfill gas concentrations will be measured using a handheld field instrument (GEM-5000). The GEM-5000 will be calibrated each day prior to measuring concentrations of methane, carbon dioxide, oxygen, and balance gas. A supplemental pump (SKC pump) will be used to purge the well at 5 liters per minute (L/min) and connected to the GEM-5000 (pumping at 0.5 L/min) and an excess exhaust port.

Procedure. Location-specific field sheets for the soil gas survey are provided in Appendix B. The field staff representative will conduct the soil gas monitoring procedure as follows:

1. Calibrate the GEM-5000 gas meter for methane, carbon dioxide, and oxygen in accordance with manufacturer's instructions each day prior to sampling. Record calibration results in the field notes.
2. At each monitoring location:
    a. Measure depth to water (DTW) and record on the field sheet.
        i. Determine if the screen is submerged. If the screen is submerged, gas inside the well is not representative of surrounding soils and monitoring is not warranted.
        ii. Examine the tip of the water level indicator for signs of LNAPL.
    b. Install an airtight cap equipped with sampling port to the PVC well casing.
    c. Connect SKC pump to the sampling port set to run at 5 L/min, then connect GEM (0.5 L/min) to SKC pump outlet with excess exhaust port tee between SKC and GEM.
    d. Begin purging gas from well.
        i. If SKC shows "Flow Fail" reduce flow rate, as needed.

e. Record GEM measurements (CH_4, CO_2, O_2, CO, and balance gas) on the field sheet every quarter casing volume for 30 minutes or until gas concentrations stabilize. Stabilization will occur much faster during periods of decreasing barometric pressure.

f. Once the final measurements are recorded, remove the sampling cap and secure the well.

Analysis and Reporting

The collection of additional diagnostic analytes started in April 2022. Turbidity, total arsenic, and dissolved arsenic results will be compared to provide context for historical measurements of total arsenic. Results of dissolved metals will be analyzed to illustrate the range of geochemical conditions observed. The total alkalinity results along with pH field measurements will be analyzed to determine the range of carbon dioxide dissolved in groundwater. This information will help identify the nature and extent of landfill gas impacts to groundwater, and the efficacy of landfill gas collection as a potential mitigation measure.

The soil gas survey will be scheduled after this addendum is finalized and accepted by Ecology. Soil gas survey results will be analyzed to show the range of methane and carbon dioxide concentrations across the Site. These data, in combination with groundwater monitoring data, will be presented to help resolve the potential source of arsenic observed at MW-6.

In accordance with the Plan, all measurements and field observations will be recorded and summarized, along with findings, in the 2022 Annual Monitoring Report, due in early 2023. At that time, Aspect will provide recommendations for additional cleanup actions if necessary.

References

Aspect Consulting, LLC (Aspect), 2015, Groundwater/LNAPL Monitoring and Contingency Plan: Crownhill Elementary School Site, November 19, 2015.

Aspect Consulting, LLC (Aspect), 2022, Crownhill Elementary Arsenic Exceedance Response Memorandum, July 13, 2022.

US Environmental Protection Agency (EPA), 1996, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, April 1996.

Limitations

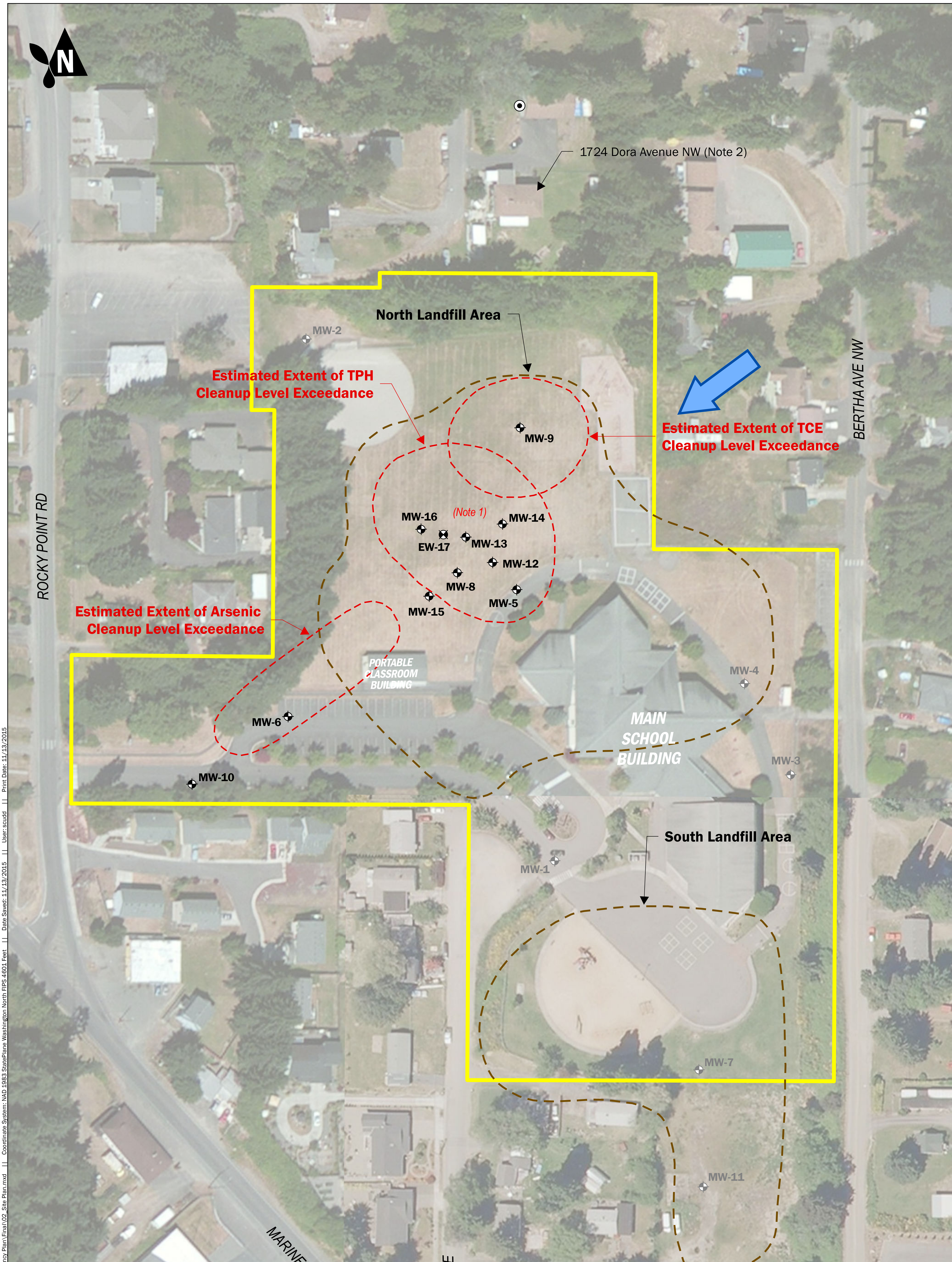
Work for this project was performed for the Bremerton School District (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments: Figure 1 – Site Plan
Appendix A – Well Logs
Appendix B – Soil Gas Data Sheets

V:\100094 BSD Crownhill Elementary RIFS\Deliverables\Sampling and Analysis Plan\SAP Addendum\Final\Sampling Addendum for Arsenic_Ecology Comments_11.21.2022.docx

FIGURE



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)

Note:

(1) LNAPL has been observed in Wells EW-17, MW-8, MW-13, MW-14, and MW-16.
(2) Collect McKinney well water sample 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
- Bremerton School District Property Boundary
- Inferred Direction of Groundwater Flow

Site Plan

Addendum to the Groundwater/LNAPL Monitoring and Contingency Plan
Crownhill Elementary, Bremerton, Washington

Aspect CONSULTING	AUG-2022	BY: DLH / PPW	FIGURE NO.
	PROJECT NO. 100094	REV BY: SCC	1

GIS Path: T:\projects_8\CrownHillElementary\Delivered\GW Monitoring and Contingency Plan Final\02_Site Plan.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 11/13/2015 || User: scudd || Print Date: 11/13/2015

APPENDIX A

Well Logs

Major Divisions		Fines	USCS Symbol	Description
Coarse-Grained Soils - More than 50% [1] Retained on No. 200 Sieve	Gravels - More than 50% [1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines [5]	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥15% Fines [5]	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50% [1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines [5]	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥15% Fines [5]	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% [1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT [2] blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

	Consistency	SPT [2] blows/foot
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

FC = Fines Content
G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Consolidation
DD = Dry Density
K = Permeability
Str = Shear Strength
Env = Environmental
PiD = Photoionization Detector

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

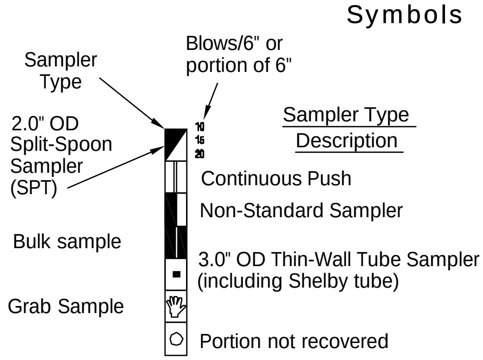
(3) Estimated Percentage

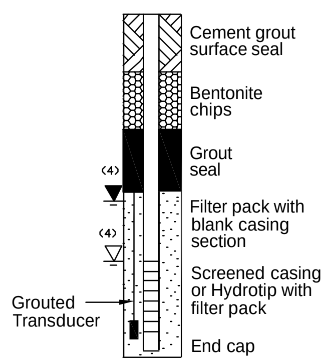
Percentage by Weight	Modifier
<5	Trace
5 to 15	Slightly (sandy, silty, clayey, gravelly)
15 to 30	Sandy, silty, clayey, gravelly)
30 to 49	Very (sandy, silty, clayey, gravelly)

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols





(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of groundwater
▽ ATD = At time of drilling
▼ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 15% as estimated in General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
BGS = below ground surface

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

Aspect CONSULTING

Exploration Log Key

DATE:	PROJECT NO.
DESIGNED BY:	
DRAWN BY:	FIGURE NO.
REVISED BY:	**A**-1

Q:_ACAD Standards\Standard Details\Exploration Log Key B1.dwg

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-5 (NG-F5)	1 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev:
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling- Scott / Hollow Stem Auger
Depth to Water (ft BGS): 115 ATD
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Start/Finish Date: 3/30/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
0	8" Flush mount monument set in concrete						Asphalt.	
							Dense, slightly moist, brown to dark gray, slightly gravelly, silty SAND (SM); fine to medium sand. Landfill material: fabric, charcoal, metal, glass, wire, nails.	
5		NG-F5-5-6.5	TOC		50 20 20			5
10								10
15								15
20	2" Sch. 40 PVC riser	G-F5-20-21.5	TOC		5 5 5		Medium dense, slightly moist, yellow-brown, slightly gravelly, silty SAND (SM); fine to coarse sand. Landfill material: glass, ceramic, nails, wire.	20
25					3 5 10			25
30					7 10 10			30
35					9 10 15		Petroleum-like odor	35
40	3/8" Bentonite chips	G-F5-40-41.5	TOC		10 12 15		Very stiff, slightly moist, yellow-gray, sandy SILT (ML).	40
							Medium dense, slightly moist, gray, silty SAND (SM); fine to medium sand, petroleum-like odor and liquid present.	
45					8 11 15		Very stiff, slightly moist, yellow-brown to gray SILT (ML); petroleum-like odor.	45

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

- Static Water Level
- Water Level (ATD)

Logged by: JSL

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-5 (NG-F5)	2 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev:
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling- Scott / Hollow Stem Auger
Depth to Water (ft BGS): 115 ATD
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Start/Finish Date: 3/30/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
					7 9 10		Medium dense to very dense, moist to very moist, olive brown, silty SAND (SM); fine to medium sand.	
							Petroleum sheen at 50'.	
55					38 50		Trace gravel.	55
60					10 23 28			60
65					18 20 26		Very dense, slightly moist to moist, brown-gray SAND (SW); trace gravel, fine to coarse sand.	65
70					33 50			70
75	3/8" Bentonite chips				38 50			75
80					33 50			80
85					38 50			85
90					42 50		Very gravelly.	90
95					46 50			95

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

- Static Water Level
- Water Level (ATD)

Logged by: JSL

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-5 (NG-F5)	3 of 3

Project Name: Crownhill Elementary School

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Method: Cascade Drilling- Scott / Hollow Stem Auger

Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"

Ground Surface Elev:

Depth to Water (ft BGS): 115 ATD

Start/Finish Date: 3/30/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
	3/8" Bentonite chips				49 50			
105					49 50		Slightly silty, trace gravel.	105
	10-20 Silica sand						Very dense, very moist, brown, silty, sandy GRAVEL (GM); fine to coarse, rounded gravel.	
110					48 50		Very dense, very moist, brown, very sandy GRAVEL (GP); trace silt.	110
115					46 50		Slightly silty.	115
120	2" Sch. 40 prepacked screen 0.020" slot				41 50		Very dense, very moist to wet, gray SAND (SP); trace gravel; fine to coarse sand, predominantly fine.	120
125					50			125
130					41 50			130
	Threaded cap							
135	Slough				38 50			135
							Bottom of Boring at 136' BGS	
140								140
145								145

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

- Static Water Level
- Water Level (ATD)

Logged by: JSL

Approved by: RRH

Figure No.

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100094	MW-6 (NG-A2)	1 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev:
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling-Scott / Hollow Stem Auger
Depth to Water (ft BGS): 126.8 ATD
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Start/Finish Date: 3/28/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Description	Depth (ft)
0	8" Flush mount monument set in concrete					Asphalt	
						Very dense, slightly moist, gray brown, slightly gravelly SAND (SP); trace silt, fine to medium sand, predominantly medium.	
5		NG-A2-5-6.5	TOC		19 20 23		5
10					19 25 27	Very dense, slightly moist, gray brown SAND (SW); fine to coarse sand; trace gravel.	10
15					12 15 18		15
20	2" Sch. 40 PVC riser	NG-A2-20-21	TOC		36 50		20
25					28 36 40	Very dense, slightly moist, gray brown SAND (SP); trace gravel; fine to medium sand.	25
30					31 50	Very dense, slightly moist, brown, very sandy GRAVEL (GW); trace silt, fine to coarse gravel; fine to coarse sand.	30
35					16 18 28	Very dense, slightly moist, gray brown, gravelly SAND (SP); trace silt, fine to medium sand.	35
40	3/8" Bentonite chips	NG-A2-40-41.5	TOC		18 23 30		40
45					20 23 35		45

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

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Figure No.

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Boring Log

Project Number	Boring Number	Sheet
100094	MW-6 (NG-A2)	2 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev:
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling-Scott / Hollow Stem Auger
Depth to Water (ft BGS): 126.8 ATD
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Start/Finish Date: 3/28/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
					27 35 38		Very dense, slightly moist, brown, silty SAND (SM); fine sand.	
55					31 50		Trace silt.	55
60					38 50			60
65					42 50			65
70					34 50			70
75	3/8" Bentonite chips				28 38 45		Very dense, slightly moist, gray brown, slightly silty SAND (SP-SM); fine to medium sand.	75
80					32 38 40			80
85					37 50			85
90					34 50			90
95					39 50		Very dense, moist, dark brown, very silty SAND (SM); fine sand.	95

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

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Approved by: RRH
Figure No.

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Boring Log

Project Number	Boring Number	Sheet
100094	MW-6 (NG-A2)	3 of 3

Project Name: Crownhill Elementary School

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Method: Cascade Drilling-Scott / Hollow Stem Auger

Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"

Ground Surface Elev

Depth to Water (ft BGS): 126.8 ATD

Start/Finish Date: 3/28/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
	3/8" Bentonite chips				39 50		Very dense, slightly moist, gray brown SAND (SP); trace silt; fine to medium sand.	
105					42 50			105
110					39 50		Hard, slightly moist, dark gray SILT and CLAY (ML/CL); thinly laminated; highly fractured and slickensided to brecciated texture.	110
115	10-20 Silica sand				44 50			115
120					41 50		Very dense, slightly moist, brown with iron-oxide staining, slightly silty SAND (SP-SM); fine to medium sand; trace organic fragments.	120
125	2" Sch. 40 prepacked screen 0.020" slot				41 50		Very dense, wet, dark brown, silty SAND (SM); fine to coarse sand.	125
130					48 50		Hard, wet, gray, slightly sandy SILT (ML); fine sand; trace fine organic fragments.	130
135	Threaded cap				48 50		Very dense, wet, gray, silty SAND (SM); fine sand.	135
							Bottom of Boring at 136.7' BGS	
140								140
145								145

Sampler Type:

- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

- Static Water Level
- Water Level (ATD)

Logged by: JSL

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-8	1 of 3

Project Name: Crownhill Elementary School
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling-Dave / Hollow Stem Auger
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Ground Surface Elev:
Depth to Water (ft BGS): 109 ATD
Start/Finish Date: 12/20/2011-12/21/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
	8" Flush mount monument set in concrete				7, 10, 8, 10, 12, 12, 9, 13, 15, 5, 3, 3, 4, 4, 4, 3, 2, 2, 3, 4, 5, 4, 4, 4, 2, 4, 4		Light brown TOPSOIL.	
							Very stiff, moist, brown with iron stain mottling, gravelly, very sandy SILT (ML) FILL.	
5							Loose, moist, dark brown, gravelly, silty SAND (SM) FILL; with LANDFILL DEBRIS; including glass, brick, plastic, charcoal, cermaic, organics, wood.	5
10								10
	Bentonite chips (NSF/ANSI 60)						Very moist, very silty.	
15							Very dense, moist, gravelly SAND (SW); fine to coarse sand; gravel up to 2" diameter.	15
20		MW-8-20	NWTPH-Dx, total As, total Pb		50, 12, 12, 16		Medium dense, moist, gray brown, gravelly, very silty SAND (SM).	20
25					7, 8, 9		Medium dense, moist, brown, gravelly SAND (SW); fine to coarse sand; subrounded gravel.	25
30					8, 8, 8		Medium dense, moist, brown SAND (SP); iron stained strata.	30
35	2" Sch. 40 PVC casing				6, 7, 7		Faint stratification.	35
40					9, 10, 11		Gravelly; rounded gravel up to 2" in diameter.	40
45					16, 50		Very dense, moist, gray SAND (SP); iron stained stratification; fine to medium sand; trace silt.	45

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: MV/AET
Approved by: RRH
Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-8	2 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Method: Cascade Drilling-Dave / Hollow Stem Auger
Depth to Water (ft BGS) 109 ATD

Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Start/Finish Date 12/20/2011-12/21/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
					50		Pockets of light gray, silty sand; trace gravel.	
55	Bentonite grout				50			55
60					50		Basaltic gravel.	60
65					50		Faint stratification delineated by brown stained sand.	65
70					50		Stratification may be non-horizontal.	70
75					50			75
80		MW-8-80	NWTPH-Dx, total As, total Pb		50		Faint non-horizontal stratification.	80
85					50		1"silty sand layer.	85
90					50			90
	Bentonite chips (NSF/ANSI 60)						Very dense, moist, light gray, gravelly SAND (SW); fine to coarse sand; fine gravel; mixed granitic and basaltic lithology.	
95					50		Very dense, moist, gray, SAND (SP); fine to medium sand.	95

Sampler Type:

No Recovery

3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

Static Water Level

Water Level (ATD)

Logged by: MV/AET

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-8	3 of 3

Project Name: Crownhill Elementary School
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling-Dave / Hollow Stem Auger
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Ground Surface Elev:
Depth to Water (ft BGS): 109 ATD
Start/Finish Date: 12/20/2011-12/21/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
					50		Light gray, trace gravel.	
	#2/12 sand filter pack							
105		No Recovery			50			105
110	2" Sch. 40 prepacked screen 0.020" slot	MW-8-110	NWTPH-Dx, total As, total Pb		50 18 21		Separate phase black viscous petroleum-like liquid.	110
115					13 18 21			115
							Dense, wet, gray, sandy GRAVEL (GP); fine gravel; medium to course sand; separate phase black viscous petroleum-like liquid.	
120	Threaded PVC endcap				50		Very dense, wet, gray, SAND (SW); fine to coarse sand.	120
							Bottom of Boring at 120.5' BGS	
125								125
130								130
135								135
140								140
145								145

Sampler Type:
No Recovery
3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
Static Water Level
Water Level (ATD)

Logged by: MV/AET
Approved by: RRH
Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-9	1 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev:
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling-Dave / Hollow Stem Auger
Depth to Water (ft BGS): 116 ATD
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Start/Finish Date: 12/19/2011-12/20/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Description	Depth (ft)
0–8	8" Flush mount monument set in concrete				5 5 5 5 3 3 3 5 7 4 5 2	Light brown TOPSOIL. Loose, moist, brown to dark brown, silty, gravelly SAND (SM) FILL; brown at 0.5'; subrounded gravel up to 1"; fine to medium sand. Reddish brown silt pockets. Gray sandy pockets. Loose, brown and gray mottled, sandy SILT (ML) FILL; trace gravel. Loose, moist, brown-gray, very silty, gravelly SAND (SM) FILL; rare organics; petroleum-like droplets; gravel up to 2"; subrounded; fine to medium sand.	5
8–10	Bentonite chips (NSF/ANSI 60)	No Recovery			1 2		10
10–16.5		MW-9-15	NWTPH-Dx, total As, total Pb		3 8 16 20 6 5 6 4	Medium dense LANDFILL DEBRIS; including wood, glass, brick and plastic in a sandy gravelly silt matrix. Loose, moist, light gray, silty SAND (SM). Gray and brown mottled, gravelly. 2" pocket of gray silt. Very stiff, moist, gray and brown mottled SILT (ML); mm to cm scale blocky fractures; oxidized fracture surfaces and slickensides stops.	15
16.5–25					4 4 3 3 3 3 8 8 5 6 7	Medium dense, moist, slightly sitly, gravelly SAND (SP-SM); strong petroleum-like odor; fine subrounded gravel; fine to medium sand. Trace gravel.	20
25–30					10 9 10 10 10 10	Medium dense, moist, gray SAND (SP); fine to medium sand; mild petroleum-like odor.	25
30					11 12 16		30
35	2" Sch. 40 PVC casing				4 17 20	Dense, trace silt; pocket of gravelly silty sand; granitic gravel.	35
40					12 24 27	Very dense, gray brown. 1 cm oxidized brown layer at 40.3' bgs	40
45					22 50	faint stratification; thin vertical dark brown laminae.	45

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AET/MV
Approved by: RRH
Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-9	2 of 3

Project Name: Crownhill Elementary School
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling-Dave / Hollow Stem Auger
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Ground Surface Elev:
Depth to Water (ft BGS): 116 ATD
Start/Finish Date: 12/19/2011-12/20/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Description	Depth (ft)
					50		
55	Bentonite grout				26 50	1" layer of fine sand. Gray.	55
60					20 22 50/5	1" pockets of gray silt	60
65					27 50	faint stratification	65
70					20 50		70
75		MW-9-75	NWTPH-Dx, total As, total Pb		50	Diagonal, light gray, 1cm bed.	75
80					50	Brown, trace to slightly gravelly, isolated beds of silty sand.	80
85					50/4	Very dense, moist, brown, trace to slightly gravelly, slightly silty SAND (SP-SM); metamorphic gravel up to 1", subrounded to subangular; diamict structure.	85
90					10 14 22	Dense, moist, gray-brown, slightly gravelly SAND (SW); fine to coarse sand.	90
95					10 14 14	Medium dense, moist, gray-brown SAND (SP); trace gravel; fine to medium sand. Medium dense, moist, gray-brown SAND (SW); fine to coarse sand. Medium dense, moist, gray-brown SAND (SP); fine to medium sand.	95

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

- Static Water Level
- Water Level (ATD)

Logged by: AET/MV

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-9	3 of 3

Project Name:	Crownhill Elementary School	Ground Surface Elev	
Location:	1500 Rocky Point Road, Bremerton WA 98312		
Driller/Method:	Cascade Drilling-Dave / Hollow Stem Auger	Depth to Water (ft BGS)	116 ATD
Sampling Method:	D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"	Start/Finish Date	12/19/2011-12/20/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Description	Depth (ft)
	Bentonite chips (NSF/ANSI 60)				7 7 8	Medium dense, moist, brown, gravelly SAND (SW); fine to coarse sand; fine, subrounded to subangular gravel, metamorphic clasts.	
105					50	Very dense.	105
110	#2/12 sand filter pack				50		110
115					2 4 6	Loose, wet, brown, very silty fine SAND (SM).	115
	0.020" slot 2" Sch. 40					Medium dense, wet, brown, SAND (SP); fine to medium sand, trace silt.	
120		MW-9-120	NWTPH-Dx, total As, total Pb		50	Very dense.	120
125					50		125
	Threaded PVC endcap				50	Bottom of Boring at 127.5' BGS	
130							130
135							135
140							140
145							145

Sampler Type:

- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)

- Static Water Level
- Water Level (ATD)

Logged by: AET/MV

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-10	1 of 3

Project Name: Crownhill Elementary School — Ground Surface Elev:

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Method: Cascade Drilling-Dave / Hollow Stem Auger — Depth to Water (ft BGS): 135 ATD

Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30" — Start/Finish Date: 12/21/2011-12/29/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Description	Depth (ft)
0	8" Flush mount monument set in concrete					Asphalt.	
						Medium dense, dry, brown, slightly gravelly, silty SAND (SM) FILL; fine to medium sand.	
5		MW-10-5	NWTPH-Dx, total As, total Pb		7 7 8 7 5 6	Medium dense, dry, brown, slightly gravelly SAND (SP) FILL; trace silt, trace organics.	5
10	Bentonite chips (NSF/ANSI 60)				8 3 6 50 50 50 50/5 50	Very dense, dry, brown, slightly silty, slightly gravelly SAND (SP-SM); wood, fine to medium sand, medium fine subrounded gravel.	10
15							15
20					50	Very dense, slightly moist, brown, trace to slightly gravelly SAND (SP); fine to medium sand; predominately fine subrounded gravel.	20
25					50	Very dense, moist, brown, slightly gravelly SAND (SW); fine to coarse sand; fine subrounded gravel.	25
30					50		30
35	2" Sch. 40 PVC casing				22 50	Trace to slightly gravelly; fine subrounded gravel.	35
40					50		40
45					50	Gravelly.	45

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AET/MV

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-10	2 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev:
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling-Dave / Hollow Stem Auger
Depth to Water (ft BGS): 135 ATD
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Start/Finish Date: 12/21/2011-12/29/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Material Type	Description	Depth (ft)
					50	SP	Very dense, moist, brown SAND (SP); trace gravel, fine to medium sand.	
55					50		Gravelly.	55
60	Bentonite grout				50		Trace gravel.	60
65					50			65
70		MW-10-70	NWTPH-Dx, total As, total Pb		50		Gray-brown, faint stratification.	70
75					50			75
80					50			80
85					50			85
90					50			90
95					50	SM	Very dense, moist, brown, silty sand (SM); fine sand.	95

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AET/MV
Approved by: RRH
Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-10	3 of 3

Project Name: Crownhill Elementary School
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Cascade Drilling-Dave / Hollow Stem Auger
Sampling Method: D & M / Hammer Weight: 300 lb jars / Hammer Drop: 30"
Ground Surface Elev:
Depth to Water (ft BGS): 135 ATD
Start/Finish Date: 12/21/2011-12/29/2011

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Drive/ Recovery	Description	Depth (ft)
					50	Very dense, very moist, gray-brown, very sandy SILT (ML); fine sand, faint iron stain stratification.	
105					50	1" thick dark brown fine sand layer Very dense, moist, gray-brown SAND (SP); fine to medium sand.	105
110					50	Very dense, very moist, gray-brown, sandy SILT (ML); fine sand. Very Dense, moist, gray-brown SAND (SP); fine to medium sand.	110
115	Bentonite chips (NSF/ANSI 60)				50		115
120					50	Very dense, moist, gray-brown, SAND (SW); fine to coarse sand; trace gravel. Hard, slightly moist, gray-purple CLAY (CL).	120
125					50		125
130	#2/12 sand filter pack 0.010" slot 2" Sch. 40				50	Very dense, moist, gray-purple and brown mottled, silty SAND (SM); fine to medium sand; trace gravel; pocket of brown fine sandy silt and trace organics; charcoal.	130
135		MW-10-135	NWTPH-Dx, total As, total Pb		50	Very dense, wet, gray-purple, SAND (SW); fine to coarse sand (predominately fine to medium); trace silt.	135
140					50	Very dense, very moist, gray-blue, SAND (SP); fine to medium sand, predominately fine. could not tag water level, too much heave	140
145	Threaded PVC endcap				50	Wet, trace gravel. Bottom of Boring at 145.5' BGS	145

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

PID - Photoionization Detector (Headspace Measurement)
- Static Water Level
- Water Level (ATD)

Logged by: AET/MV
Approved by: RRH
Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-12	1 of 3

Project Name: Crownhill Elementary School

Ground Surface Elev: 134.72

Location: 1500 Rocky Point Road, Bremerton WA 98312

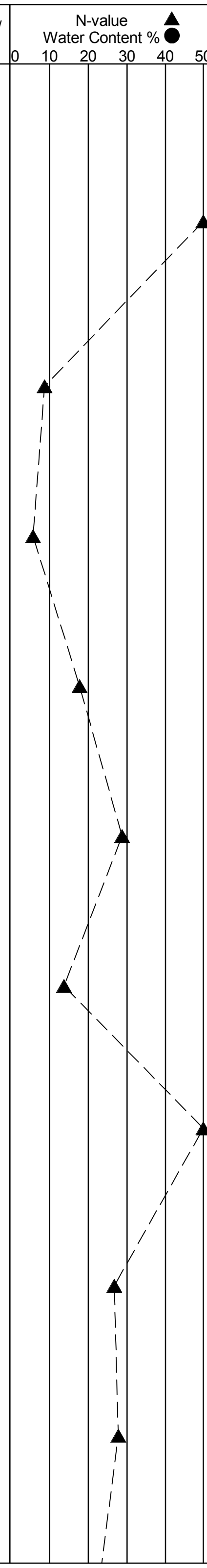
Driller/Equipment: Cascade Drilling-Dave / CME 75

Depth to Water (ft BGS): 115

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"

Start/Finish Date: 10/25/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/ 6"	Description	Depth (ft)
0 / 134.72	8" Flush mount monument set in concrete				Grass over topsoil	
5 / 130			PID = 0	50	**LANDFILL** Moist, dark brown LANDFILL DEBRIS in a sandy SILT (ML) matrix; debris includes plastic, metal, white powdery debris. (Blow count not representative of soil density)	5
10 / 125			PID = 1.3	6 5 4	Loose, with PVC debris.	10
15 / 120			PID = 0.0 PID = 0.8 PID = 0.0	3 3 3	Becomes gravelly, debris includes glass, rope, white powder, fabric, screws, charred material.	15
20 / 115			PID = 1.0 PID = 0.0	7 9 9	Becomes red; debris includes plastic, metal wire, charred material, fabric, glass, nails. (Blow count not representative of soil density)	20
25 / 110	Bentonite chips (NSF/ANSI 60)		PID = 0.0 PID = 0.0 PID = 0.0	7 9 20	Becomes red, dark brown, black, and white mottled; debris includes glass, drywall, charred material, nails, yellow plastic pieces. (Blow count not representative of soil density)	25
30 / 105			PID = 4.3 PID = 1.7	7 7 7	Moist, gray, sandy GRAVEL (GW) to very gravelly SAND (SW); fine to coarse sand, fine to coarse gravel, with cobbles up to 3", landfill debris includes wire. (Blow count not representative of soil density)	30
35 / 100	2" Sch. 40 PVC casing		PID = 1.8 PID = 13.1	10 50		35
40 / 95		MW-12-41	PID = 130. NWTPH-Dx	12 13 14	**VASHON ADVANCE OUTWASH** Medium dense, moist, dark gray SAND (SW); fine to coarse sand, trace silt, petroleum-like odor and sheen, blebs.	40
45 / 90			PID = 191 PID = 30.1	12 13 15	Medium dense, moist, dark gray SAND (SP); with cobbles, fine to medium sand, petroleum-like odor and sheen, blebs.	45
85						



Sampler Type:

- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:

HSA: Hollow Stem Auger

MR: Mud Rotary

Logged by: AET

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-12	2 of 3

Project Name: Crownhill Elementary School — Ground Surface Elev: 134.72

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75 — Depth to Water (ft BGS): 115

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30" — Start/Finish Date: 10/25/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	Description
				PID = 16.2 PID = 182 PID = 32.1	8 11 12	Very stiff, moist, gray and tan-mottled SILT (ML) interbedded with medium dense, moist, dark gray and dark brown SAND (SP); fine to medium sand, stratification at approximately 45 degrees from horizontal, petroleum-like odor.
55	80			PID = 1.7	12 14 15	
60	75		MW-12-61.5	PID = 15.7 PID = 6.8 PID = 13.5, NWTPH-Dx	10 12 18	Medium dense, moist, gray, brown, slightly silty, gravelly SAND (SW-SM); fine to coarse sand, fine gravel, slight petroleum-like odor.
65	70			PID = 2.9	15 15 15	Hard, moist, brown, gravelly, sandy SILT (ML) interbedded with very thin beds gray SAND (SP); medium to coarse sand, beds at approximately 45 degrees from horizontal, blocky fractures in silt, slight petroleum-like odor.
70	65	Bentonite chips (NSF/ANSI 60)		PID = 0.0	13 50	
75	60			PID = 4.9	21 50	Very dense, moist, gray, brown, slightly gravelly SAND (SP); medium to coarse sand, slight petroleum-like odor
80	55		MW-12-81	PID = 7.7 NWTPH-Dx	18 50	
85	50			PID = 20.7	50	
90	45	#2/12 sand filter pack		PID = 12.8	50	Very dense, moist, brown to gray, very sandy GRAVEL (GW); fine sand, subangular fine to coarse gravel, slight petroleum-like odor. Thin bed brown, gray, slightly gravelly, slightly silty SAND (SP-SM); fine to medium sand, slight petroleum-like odor.
95	40	0.020" slot 2" Sch. 40		PID = 28.7	50/3	
	35					

N-value ▲ / Water Content % ● (scale 0 10 20 30 40 50)

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
- HSA: Hollow Stem Auger
- MR: Mud Rotary

Logged by: AET

Approved by: RRH

Figure No.

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100094	MW-12	3 of 3

Project Name: Crownhill Elementary School — Ground Surface Elev: 134.72

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75 — Depth to Water (ft BGS): 115

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30" — Start/Finish Date: 10/25/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	Description	Depth (ft)
				PID = 2.7	50	Very dense, moist, gray, very gravelly SAND to very sandy GRAVEL (SW-GW); fine to coarse sand, fine to coarse gravel.	
105	30		MW-12-105.5	PID = 8.0, NWTPH-Dx	50	Very dense, moist, gray, very gravelly SAND (SW); fine to coarse sand, fine to coarse gravel, slight petroleum-like odor at 105'.	105
110	25	0.020" slot 2" Sch. 40		PID = 1.8	50		110
115	20	▽ 10/25/2012	MW-12-115.5	PID = 10.3, NWTPH-Dx	50	Very dense, wet, gray, gravelly SAND (SP); fine to medium sand, coarse gravel	115
120	15			PID = 2.0 PID = 1.4	12 16 18	Dense, wet GRAVEL (GP); coarse gravel.	120
125	10	Threaded PVC endcap		PID = 0.2	20 50/5	Very dense, wet, gravelly SAND (SW); trace silt, fine to coarse sand, fine, subangular gravel. Bottom of boring at 125' BGS.	125
130	5						130
135	0						135
140	-5						140
145	-10						145
	-15						

N-value ▲ / Water Content % ● (scale 0 10 20 30 40 50)

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
HSA: Hollow Stem Auger
MR: Mud Rotary

Logged by: AET

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-13	1 of 3

Project Name: Crownhill Elementary School

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"

Ground Surface Elev: 134.22

Depth to Water (ft BGS): 114.5

Start/Finish Date: 10/25/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	Description
0		8" Flush mount monument set in concrete				Grass over topsoil
5	130			PID = 0	10, 19, 16	**LANDFILL** Dense, dark brown, slightly silty, very gravelly SAND (SP-SM).
10	125			PID = 0	8, 6, 5	Medium dense, moist, dark brown to brown-yellow, slightly silty, gravelly SAND (SP-SM); abundant landfill debris including brick, paper, glass, copper, steel.
15	120			PID = 0.5	6, 5, 6	Abundant landfill debris including brick, glass, steel.
20	115			PID = 0	6, 5, 6	Medium dense, very moist, dark brown, gravelly, very silty SAND (SM); abundant landfill debris including wood, brick, nails, paper.
25	110	Bentonite chips (NSF/ANSI 60)		PID = 0	7, 6, 5	Trace gravel, trace landfill debris includes brick, glass.
30	105			PID = 0	7, 16, 15	**VASHON ADVANCE OUTWASH** Dense, moist, brown, very sandy GRAVEL (GP); subrounded gravel, fine to coarse sand.
35	100	2" Sch. 40 PVC casing		PID = 0	17, 10, 12	Medium dense, moist, brown, gravelly SAND (SW); fine to coarse sand, trace silt.
40	95			PID = 0	16, 15, 15	Dense, medium to coarse sand.
45	90		MW-13-45	PID = 84.4, NWTPH-Dx	10, 16, 17	Strong petroleum-like odor, saturated in product, heavy sheen.
	85					

Sampler Type:

- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:

HSA: Hollow Stem Auger

MR: Mud Rotary

Logged by: RRH/AET

Approved by: RRH

Figure No.

Project Name: Crownhill Elementary School

Ground Surface Elev: 134.22

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75

Depth to Water (ft BGS): 114.5

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"

Start/Finish Date: 10/25/2012

Depth (ft)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	N-value	Material Type	Description
50–55	80			PID = 150	14 14 19		GP-GM	Dense, very moist to wet, dark gray, silty, sandy GRAVEL (GP-GM); saturated in product.
55	75			PID = 31.5	19 19 15			Becomes wet, gray; strong odor, heavy sheen with blebs.
60	70			PID = 91.5	25 26 20			Becomes moist, dark brown to brown, thin beds brown fine sand, strong petroleum-like odor, visible product.
65	65		MW-13-65	PID = 162, NWTPH-Dx	25 25 20			
70	60	Bentonite chips (NSF/ANSI 60)		PID = 43	25 26 20			Becomes blue-gray; strong petroleum-like odor, heavy sheen with blebs.
75	55			PID = 82	20 20 20			
80	50				>50	50+	GP	Very dense, wet, gray, slightly silty, sandy GRAVEL (GP); with cobbles, strong petroleum-like odor, heavy sheen with blebs down to 115'.
85	45		MW-13-85	NWTPH-Dx	>50	50+		
90	40	#2/12 sand filter pack		PID = 56.5	>50	50+		
95	35	0.020" slot 2" Sch. 40		PID = 83.5	>50	50+		

N-value ▲ / Water Content % ● scale: 0 10 20 30 40 50

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
- HSA: Hollow Stem Auger
- MR: Mud Rotary

Logged by: RRH/AET

Approved by: RRH

Figure No.

Aspect CONSULTING	Boring Log		
	Project Number: 100094	Boring Number: MW-13	Sheet: 3 of 3

Project Name: Crownhill Elementary School — Ground Surface Elev: 134.22

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75 — Depth to Water (ft BGS): 114.5

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30" — Start/Finish Date: 10/25/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	N-value	Material Type	Description
100			Split-spoon	PID = 75	>50	50+	GP	Very dense, wet, gray, slightly silty, sandy GRAVEL (GP); with cobbles, strong petroleum-like odor, heavy sheen with blebs down to 115'.
105	30		Split-spoon, MW-13-105	PID = 84, NWTPH-Dx	>50	50+	GP	Thin beds fine sand.
110	25	0.020" slot 2" Sch. 40	Split-spoon	PID = 65	>50	50+	GP	Thin beds fine sand.
115	20	▽ 10/25/2012	Split-spoon	PID = 0.0	>50	50+	SM	Very dense, wet, gray-brown, silty, gravelly SAND (SM); fine to coarse sand, slight petroleum-like odor, no visible sheen.
120	15		No Recovery		>50	50+		No recovery.
125	10	Threaded PVC endcap	No Recovery		>50	50+		Bottom of boring at 125' BGS.
130	5							
135	0							
140	-5							
145	-10							
	-15							

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
- HSA: Hollow Stem Auger
- MR: Mud Rotary

Logged by: RRH/AET

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-14	1 of 3

Project Name: Crownhill Elementary School

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"

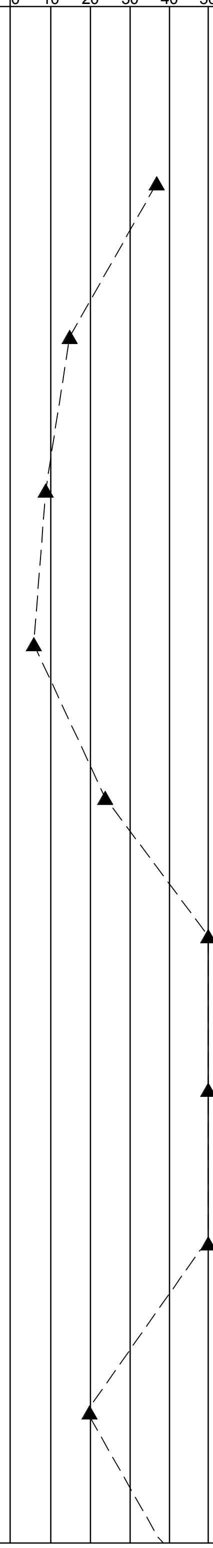
Ground Surface Elev: 134.53

Depth to Water (ft BGS): 115

Start/Finish Date: 10/26/2012

Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/ 6"	Description	Depth (ft)
0 / 134.53	8" Flush mount monument set in concrete				Grass over topsoil	
5 / 130		Split-spoon	PID = 1.7	9 16 21	**LANDFILL** Moist, brown, slightly silty, gravelly SAND (SP-SM). (Blow count not representative of soil density.) Moist, gray, gravelly SAND (SW); trace silt, fine to coarse sand. (Blow count not representative of soil density.)	5
10 / 125		Split-spoon / No Recovery	PID = 0.0	7 8 7	Moist, dark brown LANDFILL DEBRIS in a gravelly SAND (SW) matrix; debris includes nails, metal, plastic, and glass.	10
15 / 120		Split-spoon / No Recovery	PID = 0.0	3 4 5	Sandy SILT matrix; debris includes nails, brick, white powder, plastic, glass, large screws.	15
20 / 115		Split-spoon	PID = 0.0	3 3 3	Silty SAND matrix; Landfill debris includes kiln firing, metal, plastic, nails.	20
25 / 110	Bentonite chips (NSF/ANSI 60)	Split-spoon / No Recovery	PID = 0.0	11 12 12	Landfill debris includes rebar, glass, nails, plastic, metal. (Blow count not representative of soil density.)	25
30 / 105		Split-spoon	PID = 1.5	50	Dark brown, sheen present. (Blow count not representative of soil density.)	30
35 / 100	2" Sch. 40 PVC casing	Split-spoon	PID = 11.2	50	Wet, silty, sandy GRAVEL matrix; debris includes metal, wire. Free-phase petroleum product present in sample, sheen, strong odor, blebs. (Blow count not representative of soil density.)	35
40 / 95		Split-spoon MW-14-40	PID = 51.2, NWTPH-Dx	50	**VASHON ADVANCE OUTWASH** Medium dense, moist, black, slightly gravelly, silty SAND (SM); fine sand, fine to coarse gravel, strong petroleum-like odor.	40
45 / 90		Split-spoon	PID = 223	20 10 10	Medium dense, moist, black, lightly silty SAND SP-SM); fine to coarse sand, fine gravel, strong petroleum-like odor and staining	45
85						

N-value ▲ / Water Content % ●



Sampler Type:

- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:

HSA: Hollow Stem Auger

MR: Mud Rotary

Logged by: AET

Approved by: RRH

Figure No.

Aspect CONSULTING

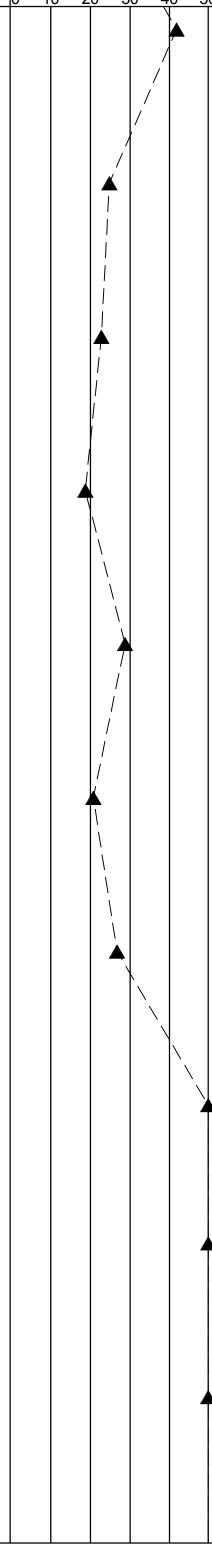
Boring Log

Project Number	Boring Number	Sheet
100094	MW-14	2 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev: 134.53
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Equipment: Cascade Drilling-Dave / CME 75
Depth to Water (ft BGS): 115
Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"
Start/Finish Date: 10/26/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	Description	Depth (ft)
				PID = 176 PID = 201	20 21 21	Dense, moist, gray to black, veriy silty, sandy GRAVEL (GM); fine to coarse sand, strong petroleum-like odor, blebs, heavy sheen	
55	80			PID = 213	10 10 15	Medium dense, moist, black to tan with brown mottling, slightly silty, slightly gravelly SAND (SP); fine sand, strong petroleum-like odor, heavy sheen, blebs.	55
60	75		MW-14-60	PID = 410, NWTPH-Dx	10 15 18	Medium dense, very moist, gray and brown mottled, gravelly, silty SAND (SM); gravel to 3", fine sand, petroleum-like odor, heavy sheen, blebs.	60
65	70			PID = 293	10 8 11	Medium dense, moist, gray and brown, mottled, slightly silty SAND (SP); trace coarse gravel, fine to medium sand, predominately fine, petroleum-like odor, sheen.	65
70	65	Bentonite chips (NSF/ANSI 60)		PID = 285	10 18 11	Gray and dark brown alternating layers of SAND (SP); fine sand.	70
75	60			PID = 389	8 10 11	Thin, gray crossbeds.	75
80	55		MW-14-80	PID = 67.1, NWTPH-Dx	10 11 16	Petroleum-like odor, sheen present.	80
85	50			PID = 85.9	11 24 50	Becomes trace silt, petroleum-like odor, sheen present.	85
90	45			PID = 37	50	Very dense, moist, gravelly SAND (SW); fine to coarse sand, fine to coarse gravel, trace silt, petroleum-like odor, sheen present.	90
		#2/12 sand filter pack					
95	40	0.020" slot 2" Sch. 40		PID = 59.7	50	Very dense, very moist, gray sandy GRAVEL (GP); coarse sand, fine to coarse gravel, predominately coarse, trace silt, petroleum-like odor, sheen, blebs.	95
	35						

N-value ▲ / Water Content % ●



Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
- HSA: Hollow Stem Auger
- MR: Mud Rotary

Logged by: AET

Approved by: RRH

Figure No.

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100094	MW-14	3 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev: 134.53
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Equipment: Cascade Drilling-Dave / CME 75
Depth to Water (ft BGS): 115
Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"
Start/Finish Date: 10/26/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	N-value	Description
~101			MW-14-100	PID = 14.0, NWTPH-Dx	50	50	Very dense, very moist, gray sandy GRAVEL (GP); coarse sand, fine to coarse gravel, predominately coarse, trace silt, petroleum-like odor, sheen, blebs.
105	30			PID = 33.1	50	50	Slight petroleum-like odor.
110	25	0.020" slot 2" Sch. 40		PID = 13.0	50	50	
115	20	▽ 10/26/2011		PID = 1.3	50	50	
120	15			PID = 0.0	50	50	Very dense, wet, gray, brown, gravelly SAND (SW); fine gravel, fine to coarse sand.
124.5	10	Threaded PVC endcap		PID = 0.0	50	50	Very dense, wet, gray-brown SAND (SP); trace gravel, medium to coarse sand.
							Bottom of boring at 124.5' BGS.

Depth scale: 105, 110, 115, 120, 125, 130, 135, 140, 145. Elevation scale: 30, 25, 20, 15, 10, 5, 0, -5, -10, -15.

N-value ▲ / Water Content % ● (0 10 20 30 40 50)

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
HSA: Hollow Stem Auger
MR: Mud Rotary

Logged by: AET
Approved by: RRH
Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-15	1 of 3

Project Name: Crownhill Elementary School

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"

Ground Surface Elev: 134.18

Depth to Water (ft BGS): 115

Start/Finish Date: 10/26/2012

Borehole Completion:
- 8" Flush mount monument set in concrete
- Bentonite chips (NSF/ANSI 60)
- 2" Sch. 40 PVC casing

Depth (ft)	Elevation (feet)	Sample Type/ID	Tests	Blows/6"	N-value
5	129	3.25" OD D&M Split-Spoon Ring Sampler; No Recovery	PID = 5.7	50	50
10	124	3.25" OD D&M Split-Spoon Ring Sampler; No Recovery	PID = 1.8	5 5 6	11
15	119	3.25" OD D&M Split-Spoon Ring Sampler	PID = 0	50	50
20	114	3.25" OD D&M Split-Spoon Ring Sampler	PID = 0	50	50
25	109	3.25" OD D&M Split-Spoon Ring Sampler	PID = 0	50	50
30	104	3.25" OD D&M Split-Spoon Ring Sampler	PID = 0	50/4	50
35	99	3.25" OD D&M Split-Spoon Ring Sampler	PID = 0	50	50
40	94	3.25" OD D&M Split-Spoon Ring Sampler	PID = 0	50	50
45	89	3.25" OD D&M Split-Spoon Ring Sampler; MW-15-45	PID = 0, NWTPH-Dx	50	50

Description:

0 ft: Grass over topsoil.

5 ft: **LANDFILL**
Moist, brown, silty, gravelly SAND (SM); fine to coarse sand, landfill debris includes: wood, glass, metal. (Blow count not representative of soil density)

10 ft: Medium dense.

15 ft: Moist, gray, slightly silty, gravelly SAND (SW-SM); fine to coarse sand, landfill debris includes metal. (Blow count not representative of soil density)

20 ft: Brown to gray, moist, slightly silty, sandy GRAVEL (GM-GW); coarse gravel, fine to coarse sand, landfill debris includes wood, concrete rubble. (Blow count not representative of soil density)

25 ft: **VASHON ADVANCE OUTWASH**
Very dense, moist, gray to brown, slightly silty, sandy GRAVEL (GM-GP); fine to coarse sand, fine gravel.

40 ft: Very dense, moist, gray, slightly silty SAND (SP-SM); fine to coarse sand, predominately medium to coarse sand.

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
- HSA: Hollow Stem Auger
- MR: Mud Rotary

Logged by: MV

Approved by: RRH

Figure No.

Boring Log

Project Number	Boring Number	Sheet
100094	MW-15	2 of 3

Project Name: Crownhill Elementary School

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"

Ground Surface Elev: 134.18

Depth to Water (ft BGS): 115

Start/Finish Date: 10/26/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Tests	Blows/6"	Description
			PID = 0	32 50	Very dense, moist, gray, slightly silty SAND (SP-SM); fine to coarse sand, predominately medium to coarse sand.
55	80		PID = 0	50	Becomes brown
60	75		PID = 0	50	
65	70		PID = 0	50	3" interbeds of fine sand, grades to grey-brown.
70	65	Bentonite chips (NSF/ANSI 60)	PID = 0	50	
75	60		PID = 0	27 50	
80	55		PID = 0	50	Predominately fine sand.
85	50		PID = 0	50	Very dense, moist, gray SAND (SP); trace silt, fine to medium sand.
90	45		PID = 0	50	Trace coarse sand, trace fine gravel
		#2/12 sand filter pack			
95	40	0.020" slot 2" Sch. 40	PID = 0	50	Very dense, moist, grey-brown, slightly silty SAND (SP-SM); fine to medium sand
	35				

N-value ▲ / Water Content % ● (scale 0 10 20 30 40 50)

Sampler Type:

- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:

HSA: Hollow Stem Auger

MR: Mud Rotary

Logged by: MV

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-15	3 of 3

Project Name: Crownhill Elementary School
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Equipment: Cascade Drilling-Dave / CME 75
Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"

Ground Surface Elev: 134.18
Depth to Water (ft BGS): 115
Start/Finish Date: 10/26/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	N-value	Description
101	33		Split-Spoon	PID = 0	50	50	Very dense, moist, grey-brown, slightly silty SAND (SP-SM); fine to medium sand
106	28		Split-Spoon	PID = 0	50	50	
111	23	0.020" slot 2" Sch. 40	Split-Spoon MW-15-110	PID = 0, NWTPH-Dx	50	50	
116	18	▽ 10/26/2012	Split-Spoon	PID = 0	50	50	Wet at 115' BGS.
121	13		Split-Spoon	PID = 0	50	50	
124.5	9.7	Threaded PVC endcap					
125	9.18						Bottom of boring at 125' BGS.

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon
- Ring Sampler

Drilling Method:
HSA: Hollow Stem Auger
MR: Mud Rotary

Logged by: MV
Approved by: RRH
Figure No.

Boring Log

Aspect CONSULTING

Project Number	Boring Number	Sheet
100094	MW-16	1 of 3

Project Name: Crownhill Elementary School

Location: 1500 Rocky Point Road, Bremerton WA 98312

Driller/Equipment: Cascade Drilling-Dave / CME 75

Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"

Ground Surface Elev: 134.07

Depth to Water (ft BGS): 115

Start/Finish Date: 10/26/2012

Depth (ft)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	Description
0	8" Flush mount monument set in concrete				Grass over topsoil.
5			PID = 0	15, 13, 12	**LANDFILL** Medium dense, moist, dark gray, slightly gravelly, silty SAND (SM); fine to coarse sand.
10			PID = 0	11, 13, 16	Dark brown, gravelly, woody debris.
15			PID = 0	50	Very dense, moist, brown to gray, silty, sandy GRAVEL (GM); fine to coarse gravel, fine to coarse sand, landfill debris including metal and wood.
20		MW-16-20-20.5	PID = 0, NWTPH-Dx	19, 20, 20	**VASHON ADVANCE OUTWASH** Dense, moist, brown, sandy GRAVEL (GW); trace silt, fine to coarse gravel, fine to coarse sand.
25	Bentonite chips (NSF/ANSI 60)		PID = 0	50	Very dense.
30			PID = 0	50	
35	2" Sch. 40 PVC casing		PID = 0	50	Very dense, moist, gray SAND (SW); trace silt, fine to medium sand.
40			PID = 0	50	
45			PID = 0	21, 21, 20	Dense, light brown, faint stratification.

Elevation (feet): 130, 125, 120, 115, 110, 105, 100, 95, 90, 85

N-value ▲ / Water Content % ●: 0 10 20 30 40 50

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
- HSA: Hollow Stem Auger
- MR: Mud Rotary

Logged by: MV

Approved by: RRH

Figure No.

Aspect CONSULTING

Boring Log

Project Number	Boring Number	Sheet
100094	MW-16	2 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev: 134.07
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Equipment: Cascade Drilling-Dave / CME 75
Depth to Water (ft BGS): 115
Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"
Start/Finish Date: 10/26/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	N-value ▲ / Water Content % ● (0 10 20 30 40 50)	Description	Depth (ft)
			▮	PID = 0	50	▲ 50	Very dense, moist, gray SAND (SW); trace silt, fine to medium sand.	
	80							
55			▮	PID = 0	50	▲ 50		55
	75							
60			▮	PID = 0	50	▲ 50	Very dense, moist, gray, sandy GRAVEL (GW); trace silt, fine to coarse gravel, fine to coarse sand.	60
	70							
65			▮	PID = 0	50	▲ 50	Very dense, moist, light gray-brown, slightly silty. slightly gravelly SAND (SP-SM); fine to medium sand, fine gravel.	65
	65							
70		Bentonite chips (NSF/ANSI 60)	▮	PID = 0	50	▲ 50		70
	60							
75			▮	PID = 0	50	▲ 50	Faint stratification. Strata dip at 45 degrees	75
	55							
80			▮	PID = 0	50	▲ 50	Trace gravel.	80
	50							
85			▮	PID = 0	50	▲ 50	Very dense, moist, dark gray-brown SAND (SP); trace silt, fine to medium sand.	85
	45							
90			▮	PID = 0	50	▲ 50		90
	40	#2/12 sand filter pack						
95		0.020" slot 2" Sch. 40	▮	PID = 0	50	▲ 50		95
	35							

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
- HSA: Hollow Stem Auger
- MR: Mud Rotary

Logged by: MV

Approved by: RRH

Figure No.

Boring Log

Project Number	Boring Number	Sheet
100094	MW-16	3 of 3

Project Name: Crownhill Elementary School
Ground Surface Elev: 134.07
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Equipment: Cascade Drilling-Dave / CME 75
Depth to Water (ft BGS): 115
Drilling Method/Hammer: HSA / D & M / 300 lb jars / 30"
Start/Finish Date: 10/26/2012

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	Blows/6"	N-value	Material Type	Description
101			Split-spoon	PID = 0	50	50	SP	Very dense, moist, dark gray-brown SAND (SP); trace silt, fine to medium sand. Trace fine gravel
104	30							
105			Split-spoon	PID = 0	50	50		
109	25							
110		0.020" slot 2" Sch. 40	Split-spoon, MW-16-110-110.5	PID = 0, NWTPH-Dx	50	50	SP-SM	Very dense, moist, gray, dark brown to black, slightly silty SAND (SP-SM); fine to medium sand, strong petroleum-like odor, sheen present.
114	20							
115		▽ 10/26/2012	Split-spoon	PID = 0	50	50		Wet, stratified, trace gravel, strong petroleum-like odor.
119	15							
120			Split-spoon	PID = 0	50	50		Gray, trace silt, faint petroleum-like odor.
124	10	Threaded PVC endcap						
125								Bottom of boring at 125' BGS.
129	5							
130								
134	0							
135								
139	-5							
140								
144	-10							
145								
149	-15							

N-value ▲ / Water Content % ● scale: 0 10 20 30 40 50

Sampler Type:
- No Recovery
- 3.25" OD D&M Split-Spoon Ring Sampler

Drilling Method:
HSA: Hollow Stem Auger
MR: Mud Rotary

Logged by: MV
Approved by: RRH
Figure No.

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
100094	EW-17	1 of 3

Project Name:	Crownhill Elementary School	Ground Surface Elev	134.1
Location:	1500 Rocky Point Road, Bremerton WA 98312	Top of Casing Elev.	133.68
Driller/Method:	Holt / Sonic	Depth to Water (ft BGS)	114.6 - 10/13/2015
Sampling Method:	8" Continuous Core	Start/Finish Date	10/12/2015-10/13/2015

Columns: Depth / Elevation (feet) | Borehole Completion | Sample Type/ID | Laboratory Tests | PID (ppm) | Density | Material Type | Description | Depth (ft)

Depth marks: 5, 10, 15, 20, 25, 30, 35, 40, 45. Elevation marks: 130, 125, 120, 115, 110, 105, 100, 95, 90, 85.

Borehole Completion:
- 12" Flush mount monument set in concrete
- Bentonite chips (NSF/ANSI 60)
- 4" Sch. 40 PVC casing

PID (ppm) readings: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0

Description:

Grass over moist, brown, silty, sandy TOPSOIL; trace fine gravel

Moist, brown, silty, sandy, FILL; trace fine gravel

Gray, moist, silty, sandy GRAVEL (GM); fine to coarse sand, fine to coarse subrounded gravel, abundant debris: metal, wire, glass

Gray, moist, sandy, very gravelly SILT (ML); fine to coarse subrounded gravel, predominantly fine sand, abundant debris: metal, glass

Brown, moist, silty, very gravelly SAND to very sandy GRAVEL (SM-GM); fine to coarse rounded to subrounded gravel, predominantly fine to medium sand, glass and metal debris
Becomes dark brown with woody debris at 11'
Becomes very moist at 14'

Very moist, dark brown, silty, sandy, GRAVEL (GM); fine to medium sand, fine to coarse subrounded gravel, glass and metal debris

VASHON ADVANCE OUTWASH

Moist, brown, sandy GRAVEL(GW); trace silt, predominantly medium to coarse sand, fine to coarse rounded to subrounded gravel with cobbles, no visible debris

Moist, brown, gravelly SAND (SW); trace silt, fine to coarse sand, fine rounded to subrounded gravel, no odor

Becomes slightly gravelly with finer sand overall at 41'

Moist, brown SAND (SP); predominantly medium sand, scattered very thinly bedded slightly silty fine sand, no odor

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector
- Static Water Level
- Water Level (ATD)

Logged by: MML

Approved by: RRH

Figure No.

_MONITORING WELL_SONIC CROWNHILL.GPJ October 29, 2015

Monitoring Well Construction Log

Aspect Consulting

Project Number	Well Number	Sheet
100094	EW-17	2 of 3

Project Name:	Crownhill Elementary School	Ground Surface Elev	134.1
Location:	1500 Rocky Point Road, Bremerton WA 98312	Top of Casing Elev.	133.68
Driller/Method:	Holt / Sonic	Depth to Water (ft BGS)	114.6 - 10/13/2015
Sampling Method:	8" Continuous Core	Start/Finish Date	10/12/2015-10/13/2015

Depth (feet)	Elevation (feet)	Borehole Completion	Laboratory Tests	PID (ppm)	Description
50			Soil: EW-17-50		
	80			0.0	
55		Bentonite chips (NSF/ANSI 60)			
				0.0	
	75				
60					
				0.0	
	70			0.0	
65		4" Sch. 40 PVC casing			
				0.0	
	65				
70			Soil: EW-17-70		
					Grades to very gravelly at 70.5
	60			0.0	
75					Moist, gray, sandy GRAVEL (GW); fine to coarse rounded gravel, predominantly medium sand, strong petroleum odor, visible product
				0.0	
	55				
80					
				60.1	
	50		Soil: EW-17-84	145	
85					Moist, gray SAND (SP); fine to medium sand, strong petroleum odor, medium sheen, no visible product
				61.6	
	45				
90					Petroleum odor becomes faint at 90'
	40				
95					Product visible below 95.25'
		#8/12 sand filter pack			
	35			319	

Sampler Type:

- No Recovery
- Continuous Core

PID - Photoionization Detector

- Static Water Level
- Water Level (ATD)

Logged by: MML

Approved by: RRH

Figure No.

Monitoring Well Construction Log

Aspect CONSULTING

Project Number	Well Number	Sheet
100094	EW-17	3 of 3

Project Name: Crownhill Elementary School
Location: 1500 Rocky Point Road, Bremerton WA 98312
Driller/Method: Holt / Sonic
Sampling Method: 8" Continuous Core

Ground Surface Elev: 134.1
Top of Casing Elev.: 133.68
Depth to Water (ft BGS): 114.6 - 10/13/2015
Start/Finish Date: 10/12/2015-10/13/2015

Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Laboratory Tests	PID (ppm)	Density	Material Type	Description
100								Trace fine to coarse rounded gravel below 100'
105	30				0.0			Becomes slightly gravelly at 105'
110	25		Soil: EW-17-110					
					0.0			
115	20	▼ 10/13/2015						Product no longer visible below 115'
		0.040" slot Vee Wrap/Sch. 40 PVC			0.0			Silty fine sand in scattered, very thin beds below 117.5'
120	15	Bentonite chips and sand						Moderate to weak petroleum odor at 120'
					0.0			Becomes wet at approximately 122'
125	10							Bottom of boring at 125', groundwater encountered at 122'
130	5							
135	0							
140	-5							
145	-10							
	-15							

Sampler Type:
- No Recovery
- Continuous Core

PID - Photoionization Detector
▼ Static Water Level
▽ Water Level (ATD)

Logged by: MML
Approved by: RRH
Figure No.

APPENDIX B

Soil Gas Data Sheets

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-5

Date & Time:

Field Personnel:

Top of Screen (ft TOC): 108

Depth to Water (ft TOC):

Screen submerged?

Total Depth (ft TOC): 133

Baro. Pressure (in Hg):

Rising or falling?

Probe Pressure (" wc):

Total Casing Volume (L): 67

Probe Diameter (in): 2

1 CV Purge Time (min) 13

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	16.7	5	200						
0.50	33.4	5	400						
0.75	50.0	5	600						
1.00	66.7	5	801						
1.25	83.4	5	1001						
1.50	100.1	5	1201						
1.75	116.8	5	1401						
2.00	133.4	5	1601						
2.25	150.1	5	1801						
2.50	166.8	5	2002						
2.75	183.5	5	2202						
3.00	200.2	5	2402						

Comments:

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-6

Date & Time:

Field Personnel:

Top of Screen (ft TOC): 116
Depth to Water (ft TOC):
Total Depth (ft TOC): 136.17
Baro. Pressure (in Hg):
Probe Pressure (" wc):
Total Casing Volume (L): 72
Probe Diameter (in): 2
1 CV Purge Time (min) 14

Screen submerged?

Rising or falling?

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	17.9	5	215						
0.50	35.9	5	431						
0.75	53.8	5	646						
1.00	71.8	5	861						
1.25	89.7	5	1077						
1.50	107.7	5	1292						
1.75	125.6	5	1507						
2.00	143.5	5	1722						
2.25	161.5	5	1938						
2.50	179.4	5	2153						
2.75	197.4	5	2368						
3.00	215.3	5	2584						

Comments:

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-8

Date & Time:

Field Personnel:

Top of Screen (ft TOC): 100
Depth to Water (ft TOC):
Total Depth (ft TOC): 120
Baro. Pressure (in Hg):
Probe Pressure (" wc):
Total Casing Volume (L): 62
Probe Diameter (in): 2
1 CV Purge Time (min) 12

Screen submerged?

Rising or falling?

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	15.4	5	185						
0.50	30.9	5	371						
0.75	46.3	5	556						
1.00	61.8	5	741						
1.25	77.2	5	927						
1.50	92.7	5	1112						
1.75	108.1	5	1297						
2.00	123.6	5	1483						
2.25	139.0	5	1668						
2.50	154.4	5	1853						
2.75	169.9	5	2039						
3.00	185.3	5	2224						

Comments:

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-9

Date & Time:

Field Personnel:

Top of Screen (ft TOC):	107
Depth to Water (ft TOC):	
Total Depth (ft TOC):	126.6
Baro. Pressure (in Hg):	
Probe Pressure (" wc):	
Total Casing Volume (L):	66
Probe Diameter (in):	2
1 CV Purge Time (min)	13

Screen submerged?

Rising or falling?

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	16.5	5	198						
0.50	32.9	5	395						
0.75	49.4	5	593						
1.00	65.9	5	790						
1.25	82.3	5	988						
1.50	98.8	5	1185						
1.75	115.2	5	1383						
2.00	131.7	5	1581						
2.25	148.2	5	1778						
2.50	164.6	5	1976						
2.75	181.1	5	2173						
3.00	197.6	5	2371						

Comments:

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-12

Date & Time:

Field Personnel:

Top of Screen (ft TOC):	94
Depth to Water (ft TOC):	
Total Depth (ft TOC):	124
Baro. Pressure (in Hg):	
Probe Pressure (" wc):	
Total Casing Volume (L):	58
Probe Diameter (in):	2
1 CV Purge Time (min)	12

Screen submerged?

Rising or falling?

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	14.5	5	174						
0.50	29.0	5	348						
0.75	43.6	5	523						
1.00	58.1	5	697						
1.25	72.6	5	871						
1.50	87.1	5	1045						
1.75	101.6	5	1219						
2.00	116.1	5	1394						
2.25	130.7	5	1568						
2.50	145.2	5	1742						
2.75	159.7	5	1916						
3.00	174.2	5	2091						

Comments:

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-13

Date & Time:

Field Personnel:

Top of Screen (ft TOC): 94

Depth to Water (ft TOC):

Screen submerged?

Total Depth (ft TOC): 124

Baro. Pressure (in Hg):

Rising or falling?

Probe Pressure (" wc):

Total Casing Volume (L): 58

Probe Diameter (in): 2

1 CV Purge Time (min) 12

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	14.5	5	174						
0.50	29.0	5	348						
0.75	43.6	5	523						
1.00	58.1	5	697						
1.25	72.6	5	871						
1.50	87.1	5	1045						
1.75	101.6	5	1219						
2.00	116.1	5	1394						
2.25	130.7	5	1568						
2.50	145.2	5	1742						
2.75	159.7	5	1916						
3.00	174.2	5	2091						

Comments:

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-15

Date & Time:

Field Personnel:

Top of Screen (ft TOC): 93

Depth to Water (ft TOC):

Screen submerged?

Total Depth (ft TOC): 123.19

Baro. Pressure (in Hg):

Rising or falling?

Probe Pressure (" wc):

Total Casing Volume (L): 58

Probe Diameter (in): 2

1 CV Purge Time (min) 12

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	14.4	5	173						
0.50	28.8	5	345						
0.75	43.2	5	518						
1.00	57.6	5	691						
1.25	72.0	5	864						
1.50	86.4	5	1036						
1.75	100.7	5	1209						
2.00	115.1	5	1382						
2.25	129.5	5	1554						
2.50	143.9	5	1727						
2.75	158.3	5	1900						
3.00	172.7	5	2073						

Comments:

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-16

Date & Time:

Field Personnel:

Top of Screen (ft TOC): 94

Depth to Water (ft TOC):

Screen submerged?

Total Depth (ft TOC): 124

Baro. Pressure (in Hg):

Rising or falling?

Probe Pressure (" wc):

Total Casing Volume (L): 58

Probe Diameter (in): 2

1 CV Purge Time (min) 12

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	14.5	5	174						
0.50	29.0	5	348						
0.75	43.6	5	523						
1.00	58.1	5	697						
1.25	72.6	5	871						
1.50	87.1	5	1045						
1.75	101.6	5	1219						
2.00	116.1	5	1394						
2.25	130.7	5	1568						
2.50	145.2	5	1742						
2.75	159.7	5	1916						
3.00	174.2	5	2091						

Comments:

Crownhill Elementary Cleanup
Soil Gas Data Sheet

Aspect CONSULTING

Well ID: MW-17

Date & Time:

Field Personnel:

Top of Screen (ft TOC):	101		
Depth to Water (ft TOC):		Screen submerged?	
Total Depth (ft TOC):	120.5		
Baro. Pressure (in Hg):		Rising or falling?	
Probe Pressure (" wc):			
Total Casing Volume (L):	62		
Probe Diameter (in):	2		
1 CV Purge Time (min)	12		

Casing Volume Purged	Volume Purged (L)	Purge Rate (L/min)	Purge Time (s)	CH_4 (%volume)	CO_2 (%volume)	O_2 (%volume)	CO (ppm)	H_2S (ppm)	Bal (%volume)
0	0	0	0						
0.25	15.5	5	186						
0.50	31.0	5	373						
0.75	46.6	5	559						
1.00	62.1	5	745						
1.25	77.6	5	931						
1.50	93.1	5	1118						
1.75	108.7	5	1304						
2.00	124.2	5	1490						
2.25	139.7	5	1676						
2.50	155.2	5	1863						
2.75	170.7	5	2049						
3.00	186.3	5	2235						

Comments: