associated earth sciences incorporated

May 8, 2019
Project No. 190080H001

Underwood Nelson Development
P.O. Box 1301
Seahurst, Washington 98062-1301

Attention: Greg S. Nelson, P.E.

Subject: Infiltration Feasibility
Mukilteo Industrial Development (Nelson 43)
4301 78th Street SW
Mukilteo, Washington

Dear Mr. Nelson:

This letter-report summarizes our subsurface exploration and evaluation of stormwater infiltration feasibility completed for the subject project. Our understanding of the project is based on our discussions with you, and information you previously provided in emails, telephone conversations, and meetings. This letter-report presents the results of our stormwater infiltration feasibility study, as described in our February 20, 2019 scope of work, which included a deep drilling program to evaluate the feasibility for deep infiltration through Underground Injection Control (UIC) wells or deep excavation.

PROJECT AND SITE DESCRIPTION

The project site is an undeveloped, forested property comprised of four Snohomish County parcels, 280410-003-001-00, -004-00, -005-00, and -006-00, totaling approximately 176,141 square feet (4.04 acres). The site is located in the northeast corner of the intersection of 44th Avenue West and 78th Street SW in Mukilteo, Washington, at address 4301 78th Street SW. The property is bounded on the north by undeveloped, forested land, to the east by a church, to the west, across 44th Avenue West, by residential properties, and to the south, across 78th Street SW, by a maintenance shop and Mukilteo Public Works. The site slopes gently from southwest to northeast with elevations ranging from about 572 feet to 534 feet (North American Vertical Datum of 1988 [NAVD88]). Figure 1 shows the location of the site and

Figure 2 shows the site and proposed development, including the explorations completed for this study.

PURPOSE AND SCOPE

Associated Earth Sciences, Inc. (AESI) performed this study to characterize subsurface conditions below the proposed infiltration facility, evaluate the hydrogeologic setting of the site and vicinity, and develop conclusions regarding the feasibility of infiltration using UIC wells or deep excavation trenches under the proposed stormwater vault. Our scope of work included the following tasks:

- Reviewed topographic maps, geologic maps, aerial photos, hydrogeological reports, and other available information pertaining to the site vicinity.
- Completed an exploration pit (EP-1) and an exploration boring (EB-1W) to depths of 10.5 and 55.5 feet, respectively, below existing grade, at the locations shown on Figure 2.
- Installed a groundwater monitoring well in EB-1W, at the locations shown on Figure 2.
- Developed the monitoring well and measured the water level post-development.
- Visually classified all soil samples obtained from our exploration.
- Conducted laboratory grain-size (sieve) tests on two samples of advance outwash sediments from EB-1W.
- Analyzed all research, field, and laboratory data in context with the proposed stormwater infiltration concept.
- Prepared this letter-report summarizing our hydrogeological findings, conclusions, and recommendations.

FIELD EXPLORATION PROCEDURES

We explored subsurface conditions at the site on March 20 (EP-1) and 28 (EB-1W), 2019. Our exploration program consisted of excavating a pit and drilling one exploration boring and completing the boring as a monitoring well. The location and depth of our explorations were completed within site access and budgetary constraints. Our exploration procedures are described below. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the exploration logs presented in Appendix A. Soil contact depths shown on the log should be regarded as only an approximation; the actual changes between sediment types are often gradational and/or undulating.

The conclusions and recommendations presented in this letter-report are based, in part, on conditions encountered by our explorations completed for this study. Due to the nature of subsurface exploratory work, it is necessary to interpolate and extrapolate soil conditions beyond the field explorations. Differing subsurface conditions could be present outside the area of the explorations due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations beyond the field explorations might not become fully evident until construction. If variations are observed at that time, it could be necessary to modify specific conclusions or recommendations in this letter-report.

Exploration Pit

The exploration pit was excavated by Northwest Excavating & Trucking, Inc., under subcontract to AESI, using a Caterpillar 312D track-mounted excavator. The pit permitted direct, visual observation of subsurface conditions. Materials encountered in the exploration pit were studied and classified in the field by a geologist from our firm. The exploration pit was backfilled immediately after examination and logging.

Samples collected from the exploration pit were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification, as necessary.

Exploration Boring

One boring was drilled by Advance Drill Technologies, Inc., working under subcontract to AESI. The boring was completed by advancing an 8-inch outside-diameter, hollow-stem auger with a Diedrich D-50 track-mounted drill rig. During the drilling process, disturbed but representative soil samples were obtained at 5-foot-depth intervals using the Standard Penetration Test (SPT) procedure in accordance with the *American Society for Testing and Materials* (ASTM D-1586).

The SPT procedure consists of driving a standard, 2-inch outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded, and the number of blows required to drive the sampler the final 12 inches represents the Standard Penetration Resistance (also known as the "N-value"). If a total of 50 blows is reached within one 6-inch interval, the N-value is recorded as 50 blows for the corresponding number of inches of penetration. The N-value provides a measure of the relative density of granular soils or the relative consistency of cohesive soils. Blow counts per 6-inch interval are presented on the exploration boring log presented in Appendix A.

The exploration boring was continuously observed and logged by an AESI geologist. All samples obtained from the split-barrel sampler were classified in the field, and representative portions were placed in watertight containers. The samples were then transported to our laboratory for

Regional Geology

Minard, 1982 indicates that the project site is underlain by Vashon lodgement till (Qvt), and shows exposures of Vashon advance outwash (Qva) underlying the Qvt approximately 800 feet east of the site, in Japanese Gulch.

Lodgement till was deposited at the base of an active continental glacier during the Vashon Stade of the Fraser Glaciation approximately 15,000 years ago and was subsequently compacted to a very dense condition by the weight of the overlying glacial ice. Lodgement till typically comprises a very dense, unsorted mixture of silts, sands, gravels, cobbles, and boulders. Thicknesses can range from a few feet to several tens of feet. Lodgement till exhibits a very low permeability, typically about 1 inch per month, and is commonly used in earth berm applications to detain surface water.

The lodgement till is underlain by Vashon advance outwash in the site vicinity. Advance outwash sediments were deposited as outwash from rivers flowing from the base of the southward advancing glacial front during the Vashon Stade of the Fraser Glaciation. The high relative density of the advance outwash is due to its consolidation by the massive weight of glacial ice that overrode the sediments subsequent to their deposition. Advance outwash typically comprises a dense to very dense, well-sorted mixture of fine to coarse sands, gravelly sands, or sandy gravels. Thicknesses can range from several feet to several hundred feet. The advance outwash is generally permeable and where unsaturated, is commonly used for stormwater infiltration. Based on Minard, 1982, the top of the Vashon advance outwash is exposed at the ground surface to the east of the site, immediately beneath the lodgement till beginning at elevations around 500 feet NAD83.

Pre-Fraser deposits of sands, silts, and clays underlie the advance outwash. Based on the regional geologic map, the pre-Fraser deposits are exposed at lower elevations approximately 1,800 feet west of the site adjacent at approximate elevations in the range of 400 to 430 feet NAD83.

Site Stratigraphy

Exploration boring EB-1W encountered approximately 13 feet of lodgement till overlying advance outwash. Sediments interpreted to represent pre-Fraser-aged till were encountered below the advance outwash in EB-1W at a depth of 50 feet bgs (~493 feet NAD83). These findings are generally consistent with the regional geologic maps. The following paragraphs describe our stratigraphic observations. Depths and approximate elevations of the geologic units and groundwater are included in Table 1. The exploration logs contained in Appendix A provide additional subsurface information.

Lodgement Till: Sediments interpreted to be lodgement till were encountered just below a surficial layer of forest duff in EP-1 and EB-1W, and extended beyond the termination depth of

EP-1 (10.5 feet bgs) and to a depth of 13 feet bgs in EB-1W. This deposit consisted of dense to very dense, unsorted, silty, gravelly sands. Lodgement till typically possesses high strength and low compressibility, and has a very low permeability due to its relative high density and high content of fine-grained material.

Advance Outwash: Advance outwash was encountered underlying the glacial till at a depth of about 13 feet bgs at EB-1W and consisted of dense to very dense, fine sand with a variable amount of silt and trace amount of gravel to gravelly. The advance outwash was generally stratified, varying from trace to some silt. The advance outwash deposit extended to around 50 feet bgs in EB-1W. Advance outwash sand is typically relatively permeable and is the proposed receptor for the infiltration of treated stormwater runoff at the site.

Pre-Fraser Till: Sediments comprised of unsorted, grayish brown to dark gray, silty fine sand, trace gravel were encountered in EB-1W, beginning at a depth of 50 feet bgs and extending beyond the termination of the boring (55.5 feet bgs). These sediments were interpreted to represent pre-Fraser till sediments.

Table 1
Exploration Summary
EB-1W

Monitoring Well	Approx. GSE	Depth to GW	Approx. GW Elevation	Depth Below Ground Surface (ft)					Approximate Elevation (ft NAD83)				
				Top of Forest Duff	Top of Qvt	Top of Qva	Top of Qpf	Bottom of Boring	Top of Forest Duff	Top of Qvt	Top of Qva	Top of Qpf	Bottom of Boring
EB-1W	543	42.9	500	0	1	13	50	55.5	543	542	530	493	487.5

Note: Elevations interpolated from site topography
GSE = ground surface elevation
GW = groundwater
Qvt = Vashon lodgement till
Qva = Vashon advance outwash
Qpf = Pre-Fraser sediments
ft = feet
NAD83 = North American Datum of 1983
Depth to groundwater on March 29, 2019, after well development.

Regional Hydrogeology

The regional hydrogeology of the project area is described in *The Ground-Water System and Ground-Water Quality in Western Snohomish County, Washington* (Thomas et al., 1997). The project area is located in the Intercity Plateau which is underlain by Vashon till, Vashon advance outwash and older sands and silts. Water supply wells in the vicinity of the site appear to

obtain water from the Vashon till, Vashon advance outwash, and undifferentiated sediments lying beneath the Vashon advance outwash. Based on well records and potentiometric surface maps in Thomas et al., 1997, the water levels in the advance outwash aquifer appear to generally follow topography, and decrease to the north and east in the vicinity of the site.

Project Hydrogeology

A thin interval of seepage was encountered in EP-1 at a depth of 3.5 feet. This seepage is interpreted to represent interflow, which commonly accumulates at the base of the weathered Vashon lodgement till, immediately above the low-permeability unweathered till. The monitoring well is completed in the shallowest regional aquifer beneath the site, which is interpreted to be the advance outwash aquifer. The water level in EB-1W after well development was approximately 43 feet bgs, or approximately 500 feet NAVD88. The saturated thickness of the Qva aquifer beneath the site is about 7 feet, based on EB-1W.

Laboratory Testing

Laboratory testing was conducted on two samples of the advance outwash obtained from EB-1W. Testing was performed by AESI's in-house laboratory and included mechanical grain-size distribution (sieve) analyses in accordance with ASTM D-422. As shown on the attached sieve data sheets, the advance outwash samples consisted of gravelly sand with some silt. Laboratory reports are included in Appendix B.

INFILTRATION FEASIBILITY CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to evaluate the feasibility of infiltration as a means of stormwater disposal for the project. In our opinion, the project appears well suited for stormwater infiltration based on the unsaturated Vashon advance outwash encountered in exploration boring EB-1W, completed within the proposed infiltration vault location. Unsaturated advance outwash deposits typically exhibit moderate to high infiltration rates. The unsaturated advance outwash was approximately 30 feet thick in EB-1W.

Based on the grain-size distribution obtained from two samples of advance outwash in EB-1W, we recommend using a preliminary infiltration rate of 2.0 inches per hour for planning purposes. This rate assumes the base of the facility fully penetrates the till, and that pit drains/trenches are excavated 15 to 20 feet below the subgrade.

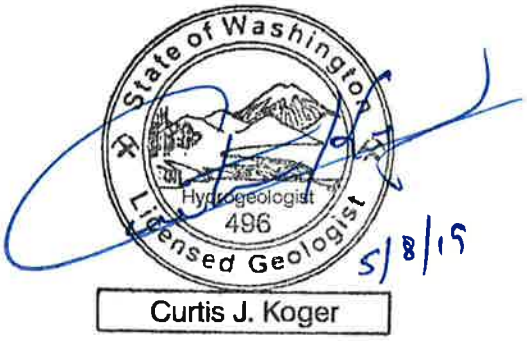
In order to provide design-level infiltration rates, infiltration design details, and respond to the City of Mukilteo's concerns about impacts to off-site wetlands, we recommend groundwater-level monitoring for a full year or until the start of construction, in-situ infiltration testing, and a geologic reconnaissance of the off-site slopes to the east of the property.

CLOSURE

AESI has prepared this letter-report for the exclusive use of our client and their agents, for specific application to this project. Within the limitations of scope and schedule, our services have been performed in accordance with generally accepted local hydrogeological practices in effect at the time our letter-report was prepared. No other warranty, express or implied, is made.

We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this letter-report or other geotechnical aspects of the project, please call us at your earliest convenience.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington



Stanley S. Thompson, L.G., L.Hg.
Senior Project Geologist

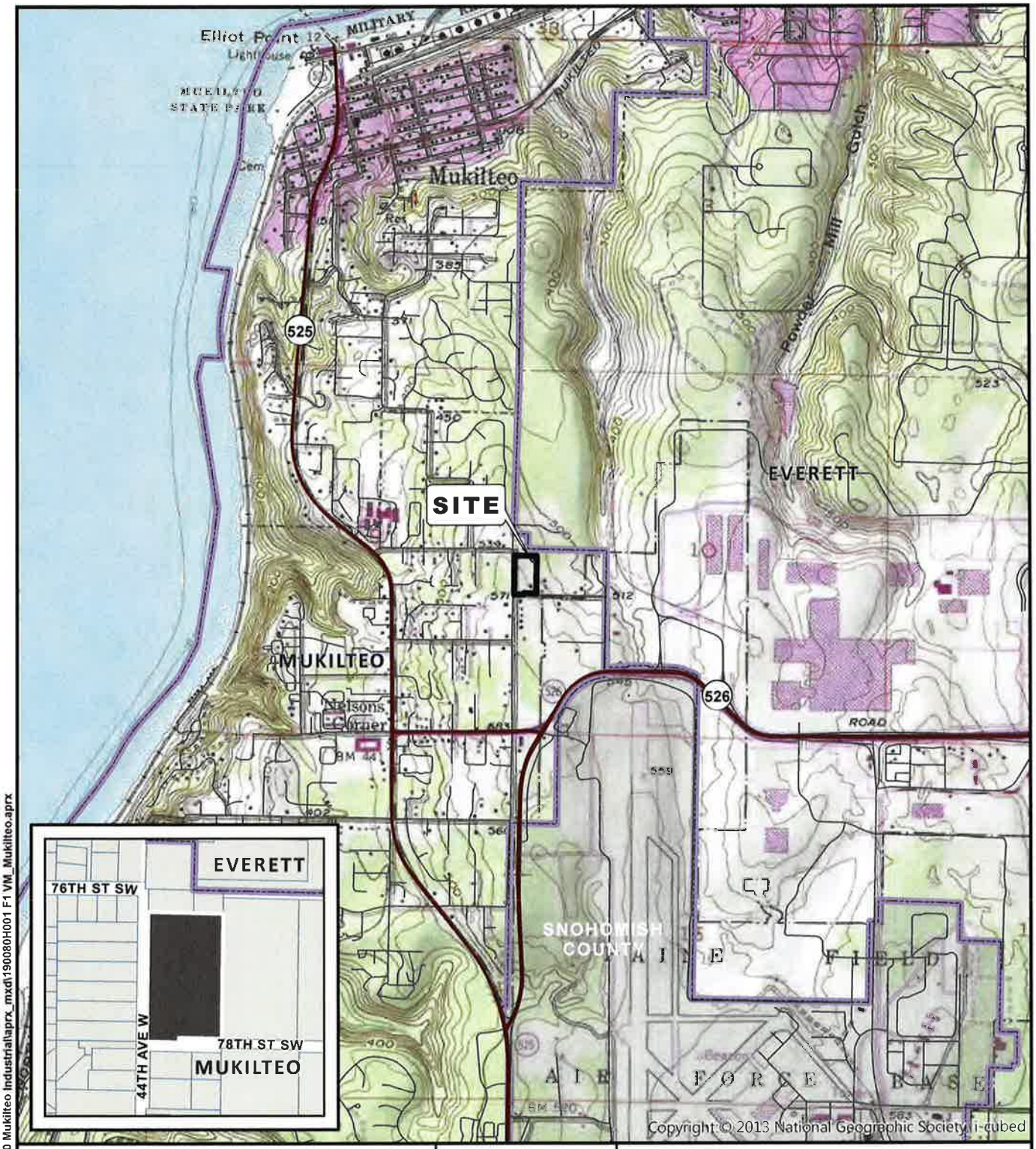
Curtis J. Koger, L.G., L.E.G., L.Hg.
Senior Principal Geologist/Hydrogeologist

Attachments: Figure 1 Vicinity Map
Figure 2 Site and Exploration Plan
Appendix A: Exploration Logs
Appendix B: Laboratory Test Results

REFERENCES

Minard, J.P., 1982, Distribution and description of geologic units in the Mukilteo quadrangle, Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-1438, Scale 1:24,000.

Thomas, B.E., Wilkinson, J.M., and Embrey, S.S., 1997, The ground-water system and ground-water quality in Western Snohomish County, Washington: U.S. Geological Survey Water-Resources Investigations Report 96-4312.



DATA SOURCES / REFERENCES:
USGS: 7.5' SERIES TOPOGRAPHIC MAPS, ESRI/I-CUBED/NATIONAL GEOGRAPHIC SOCIETY 2013
SNOHOMISH CO: STREETS, CITY LIMITS, PARCELS, 2/19
LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

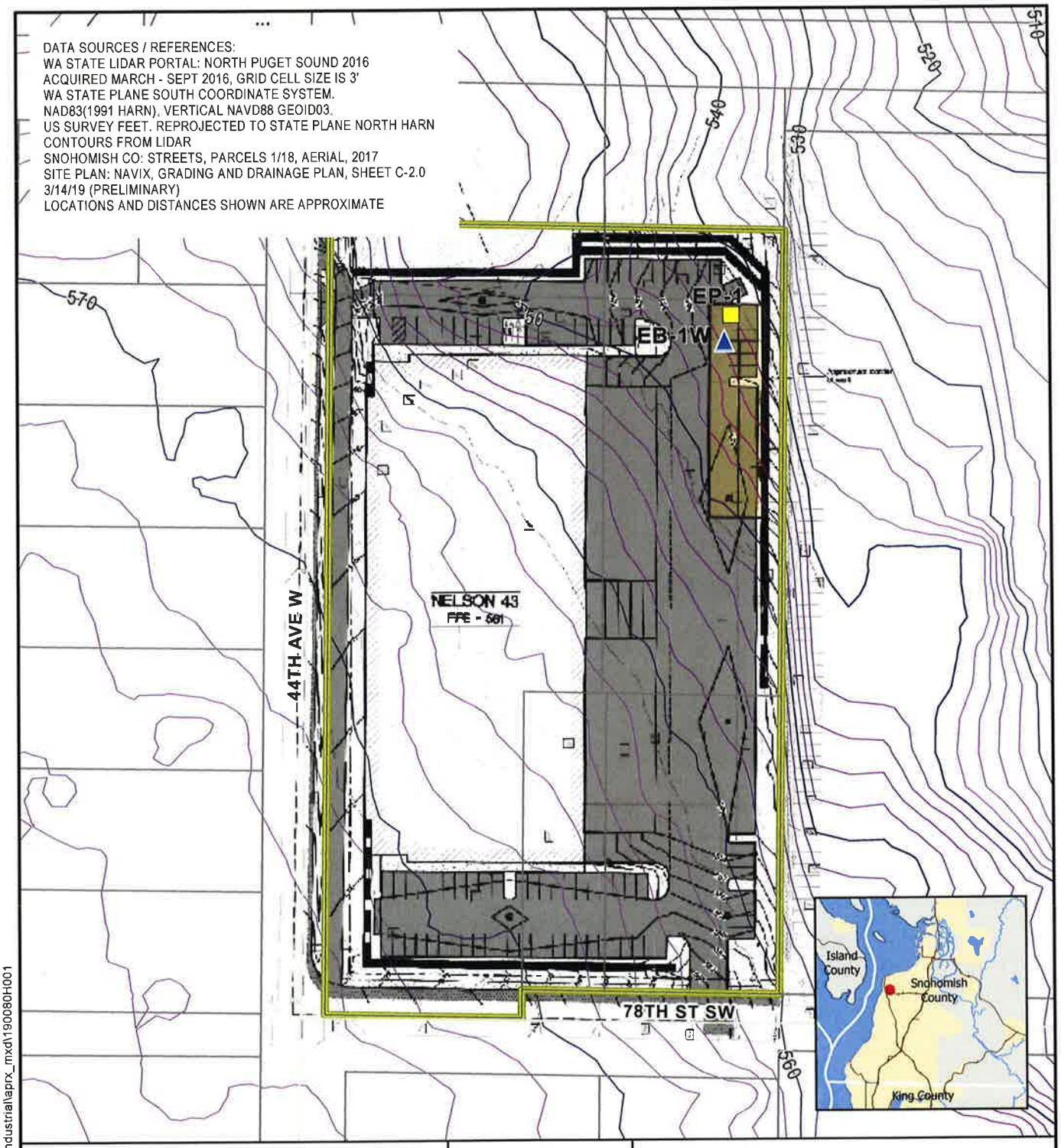
associated earth sciences incorporated

VICINITY MAP

MUKILTEO INDUSTRIAL DEVELOPMENT
MUKILTEO, WASHINGTON

PROJ NO.	DATE:	FIGURE:
190080H001	5/19	1

Document Path: G:\GIS_Projects\aaY2019\190080 Mukilteo Industrial\aprx_mxd\190080H001 F1 VM_Mukilteo.aprx



MONITORING WELL
EXPLORATION PIT
SITE
PROPOSED VAULT
CONTOUR 2 FT
CONTOUR 10 FT
PARCEL

N

0 100
Feet

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

associated earth sciences incorporated

EXISTING SITE AND EXPLORATION PLAN

MUKILTEO INDUSTRIAL DEVELOPMENT
MUKILTEO, WASHINGTON

PROJ NO.	DATE:	FIGURE:
190080H001	5/19	2

Path: G:\GIS_Projects\aaY2019\190080 Mukilteo Industrial\aprx_mxd\190080H001

APPENDIX A

Exploration Logs

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
		≥12% 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
		≥12% 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

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

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

Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch

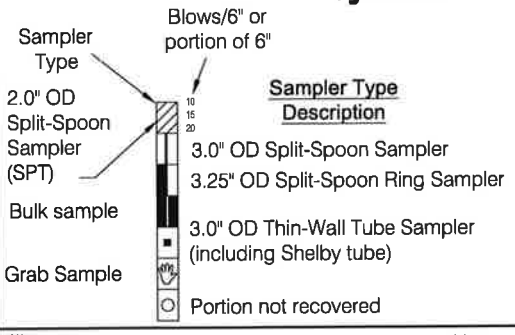
Slightly Moist - Perceptible moisture

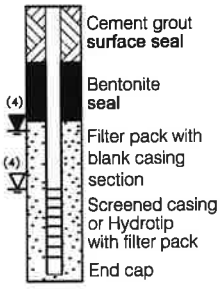
Moist - Damp but no visible water

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 ground water
▼ ATD = At time of drilling
▽ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 12%

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.

associated earth sciences incorporated

EXPLORATION LOG KEY

FIGURE A1

associated earth sciences incorporated

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
190080H001	EB-1W	1 of 2

Project Name: Mukilteo Industrial
Elevation (Top of Well Casing): ~546
Water Level Elevation: 500
Drilling/Equipment: ADT
Hammer Weight/Drop: 140# / 30"

Location: Mukilteo, WA
Surface Elevation (ft): 543 (LiDAR Contours)
Date Start/Finish: 3/28/19,3/28/19
Hole Diameter (in): 8 inches

Depth (ft)	Water Level	WELL CONSTRUCTION	ST	Blows/ 6"	Graphic Symbol	DESCRIPTION
		Above ground steel locking monument Concrete 0 to 2 feet				**Forest Duff**
						Vashon Lodgment Till Loose to medium dense, moist, brown, silty, fine SAND, some fine to coarse gravel, trace cobbles, trace organics (rootlets); weathered (SM).
						Becomes dense, brownish gray.
5		3/8-inch Bentonite chips 2 to 6 feet		8 26 41		Moist, brownish gray grading to gray, silty, fine SAND, trace gravel; unsorted (SM).
10				20 36 50/4"		Dark gray, moist, silty, fine SAND, trace gravel (SM).
						Vashon Advance Outwash Driller notes increased drill rate.
15				50 50/2"		Moist, gray, gravelly, well graded SAND, trace silt; unsorted (SW).
		Bentonite grout 6 to 30 feet				
20		2-inch I.D. Sch 40 PVC casing -3 to 40 feet		17 34 37		Moist, brownish gray, gravelly, medium SAND, some silt; increased gravel in lower 4 inches to gravelly, SAND; stratified (SP/SM).
						Driller notes drills more gravelly.
25				35 50/5"		Upper 2 inches: very moist, brownish gray, gravelly, medium to coarse SAND, trace silt (SP). Mid 3 inches: moist, tan, fine to coarse SAND, some silt, trace gravel (SP). Lower 4 inches: slightly moist, tannish gray, fine to coarse SAND, some gravel, trace to some silt; stratified (SW/SM). Driller notes increased larger gravel; stratified.
30				8 32 37		Upper 8 inches: moist, brownish gray, gravelly, fine to medium SAND, some silt (SP). Lower 6 inches: moist, tannish gray, fine SAND, trace silt, trace gravel (SP).
		3/8-inch Bentonite chips 30 to 37 feet				
35				37 41 50/5"		Moist, brownish gray, sandy, GRAVEL, trace to some silt; multiple broken larger pieces of gravel in sampler (GP).
		10/20 filter sand 37 to 50 feet				

Sampler Type (ST):
- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture
Water Level (3/29/19)
Water Level at time of drilling (ATD)

Logged by: SST
Approved by: CJK

NWWELL- B 190080.GPJ BORING.GDT 5/3/19

associated earth sciences incorporated

Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
190080H001	EB-1W	2 of 2

Project Name: Mukilteo Industrial
Elevation (Top of Well Casing): ~546
Water Level Elevation: 500
Drilling/Equipment: ADT
Hammer Weight/Drop: 140# / 30"

Location: Mukilteo, WA
Surface Elevation (ft): 543 (LiDAR Contours)
Date Start/Finish: 3/28/19,3/28/19
Hole Diameter (in): 8 inches

Depth (ft)	Water Level	WELL CONSTRUCTION	ST	Blows/ 6"	Graphic Symbol	DESCRIPTION
				20 50/3"		Moist to very moist, brown, sandy, GRAVEL, some silt; cuttings and broken gravel in sampler suggest fine to coarse gravel (GM/GW).
45		2-inch I.D. Sch 40 PVC well screen 0.020-inch slot width 40 to 50 feet		21 24 37		Wet, grayish brown, medium to coarse sandy, GRAVEL, some silt; grades siltier in lower 4 inches of sampler (SP/SM).
50				30 50/2"		**Pre-Fraser Till** Driller notes change in drilling action, more dense, less coarse gravel at 50 feet. Moist, grayish brown with slight orange mottling, silty, fine SAND, some gravel; unsorted (SM).
55		Native slough and 10/20 filter sand 50 to 55 feet Well tag # BKU 938		50/5"		Moist, dark gray, silty, fine SAND, trace gravel; unsorted (SM). Boring terminated at 55.4 feet Well completed at 50 feet on 3/28/19. Groundwater encountered at 43 feet ATD and at 42.9 on 3/29/19.
60						
65						
70						
75						

Sampler Type (ST):
- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture
Water Level (3/29/19)
Water Level at time of drilling (ATD)

Logged by: SST
Approved by: CJK

NWWELL-B 190080.GPJ BORING.GDT 5/3/19

LOG OF EXPLORATION PIT NO. EP-1

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered. **DESCRIPTION**
	Forest Duff / Topsoil - 8 inches
	Vashon Lodgment Till
1	Loose to medium dense, very moist, brown to reddish brown, silty, fine SAND, some fine to coarse gravel, trace cobbles, trace organics; unsorted; weathered; (SM).
2	
3	
	Very dense, moist, gray, silty, fine SAND, trace gravel, trace cobbles; unsorted; unweathered (SM).
4	
5	
6	
7	
8	
9	
10	
11	Bottom of exploration pit at depth 10.5 feet Minor seepage at 3.5 feet (interflow). No caving. Terminated due to difficult digging conditions.
12	

Mukilteo Industrial
Mukilteo, WA

Logged by: SST
Approved by: CJK

associated earth sciences incorporated

Project No. 190080H001

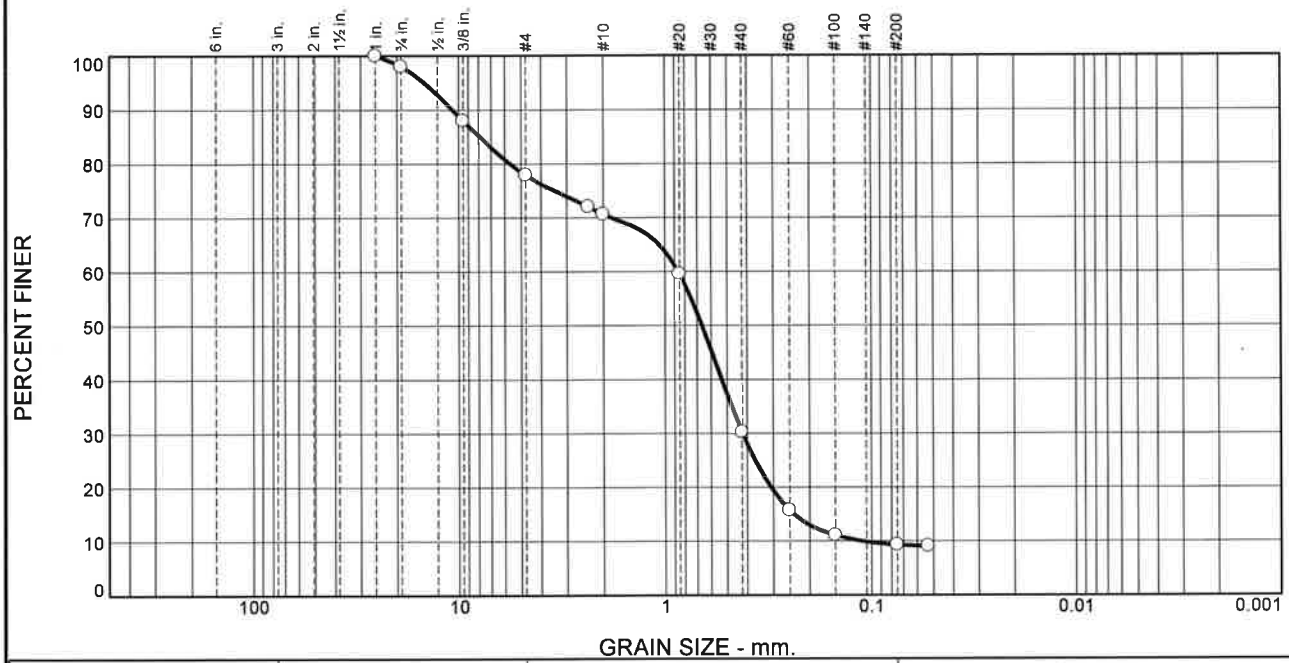
3/20/19

KCTP3 190080.GPJ May 3, 2019

APPENDIX B

Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.0	20.1	7.3	40.3	21.0	9.3	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
.75	98.0		
.375	88.0		
#4	77.9		
#8	72.0		
#10	70.6		
#20	59.6		
#40	30.3		
#60	15.7		
#100	11.1		
#200	9.3		
#270	9.0		

* (no specification provided)

Material Description

Gravelly sand some silt

Atterberg Limits (ASTM D 4318)

PL= LL= NV PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 10.7390 D_{85}= 7.9377 D_{60}= 0.8623
D_{50}= 0.6622 D_{30}= 0.4220 D_{15}= 0.2385
D_{10}= 0.1118 C_u= 7.71 C_c= 1.85

Remarks

Date Received: 4/1/19 **Date Tested:** 4/1/19

Tested By: BP

Checked By: MM

Title:

Location: On site **Date Sampled:** 3/28/19

Sample Number: EB-1W **Depth:** 20'

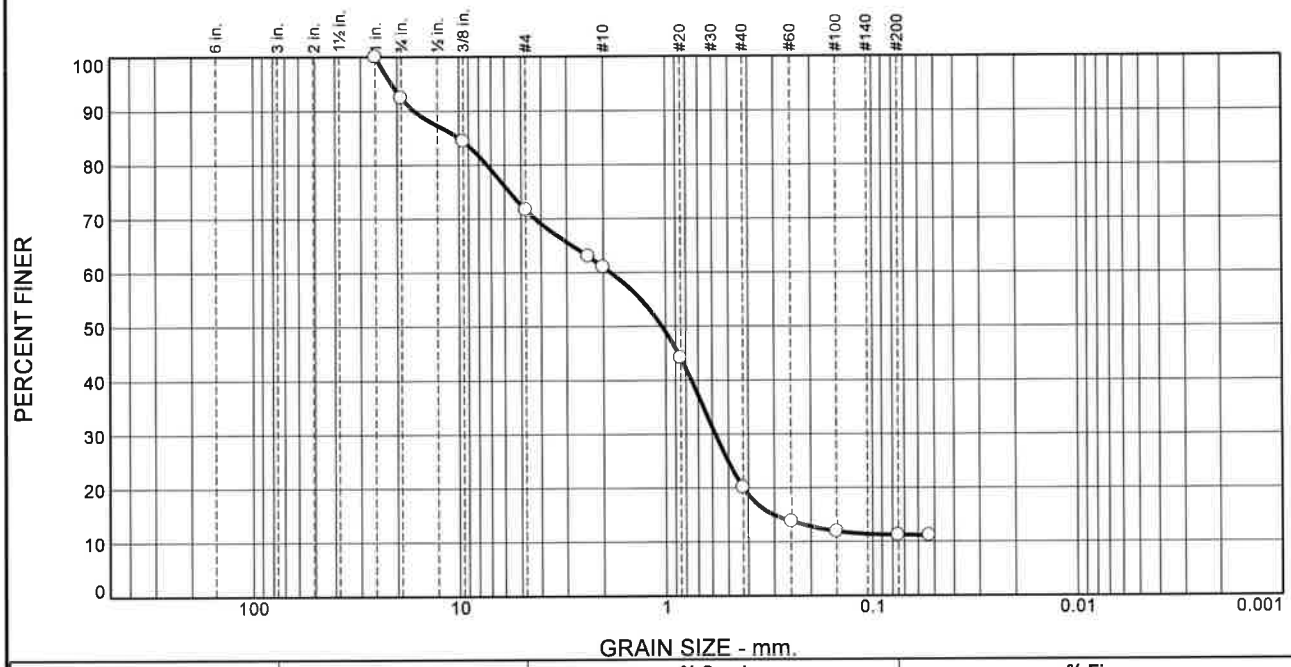
associated earth sciences incorporated

Client: Underwood Nelson Development

Project: Mukilteo Industrial

Project No: 190080 H001 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.6	20.7	10.7	40.9	8.9	11.2	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
.75	92.4		
.375	84.4		
#4	71.7		
#8	63.0		
#10	61.0		
#20	44.2		
#40	20.1		
#60	13.8		
#100	11.9		
#200	11.2		
#270	11.1		

* (no specification provided)

Material Description

Gravelly sand some silt

Atterberg Limits (ASTM D 4318)

PL= LL= NV PI=

Classification

USCS (D 2487)= AASHTO (M 145)=

Coefficients

D_{90}= 16.5263 D_{85}= 10.0164 D_{60}= 1.8448
D_{50}= 1.0426 D_{30}= 0.5784 D_{15}= 0.3029
D_{10}= C_u= C_c=

Remarks

Date Received: 4/1/19 **Date Tested:** 4/1/19

Tested By: BP

Checked By: MM

Title:

Location: On site **Date Sampled:** 3/28/19

Sample Number: EB-1W **Depth:** 30'

associated earth sciences incorporated

Client: Underwood Nelson Development

Project: Mukilteo Industrial

Project No: 190080 H001 **Figure**