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CITY OF MUKILTEO

Received by Email

05/14/2021

April 16, 2015
Project No. EE140704A

Tuttle Engineering and Management
275 West Rio Vista Avenue, Suite 1
P.O. Box 1547
Burlington, Washington 98233

Attention: Mr. John R. Tuttle

Subject: Subsurface Exploration and Geotechnical Assessment
61st Place West Culvert Replacement
Mukilteo, Washington

Dear Mr. Tuttle:

Associated Earth Sciences, Inc. (AESI) is pleased to present this report describing our subsurface exploration and geotechnical assessment for the planned 61st Place West culvert replacement. Our services were completed in general accordance with our proposal dated January 6, 2015. Our report has been prepared for the exclusive use of Tuttle Engineering and Management, 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 geotechnical engineering practices in effect at the time our report was prepared. No other warranty, express or implied, is made.

PROJECT DESCRIPTION

The project site is located in the 8900 block of 61st Place West at the point where a small stream passes below the road through a corrugated metal culvert. The approximate location of the site is shown on the "Vicinity Map," Figure 1. It is our understanding that the culvert is undersized and has been prone to flooding and/or plugging. Conceptual plans for mitigation of this problem include replacing some or all of the existing culvert with a new, larger corrugated metal pipe (CMP) or a box culvert.

PURPOSE AND SCOPE

The purpose of our study was to characterize shallow subsurface conditions at the proposed culvert alignment, such that we can derive conclusions and geotechnical recommendations concerning support of the proposed CMP or box culvert. Our scope of work included the following tasks.

- Conducting a visual surface reconnaissance of the proposed culvert site and immediate vicinity.
- Advancing two exploration borings to depths 31½ feet below the existing ground surface near the south side of the culvert.
- Visual classification of all soil samples obtained from our exploration borings.
- Analysis of the field data to derive conclusions and recommendations in context with the proposed culvert.
- Preparation of this report.

Figure 2 illustrates the approximate locations of our exploration borings. Copies of the exploration logs are included in Appendix A.

SURFACE CONDITIONS

The stream corridor above and below the culvert is naturally forested and vegetated with thick brush. An undated topographic survey of the site was reviewed at the time of our study. Based on our field measurements and plan review, the existing culvert is approximately 55 feet long. Given the total fall along the length of the culvert of approximately 8 feet the average inclination of the culvert is approximately 14 percent. The embankment between the road surface and the culvert on the west (downstream) side of the road is approximately 10 feet high with an inclination of approximately 0.8H:1V (Horizontal:Vertical). The face of this embankment is constructed of concrete rubble. The existing culvert is approximately 24 inches in diameter.

SUBSURFACE EXPLORATION

Subsurface exploration for our study was conducted on March 23, 2015. The number, locations, and depths of the 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. The depths shown on the logs 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 report are based, in part, on conditions encountered in the explorations completed for this study. Due to the nature of subsurface exploratory work, is necessary to interpolate and extrapolate soil conditions between and 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 between 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 report.

Exploration Borings

In order to evaluate subsurface conditions for the project, two exploration borings were drilled near the south side of the culvert, approximately where shown on Figure 2. The borings were drilled using a limited access, track-mounted hollow-stem auger drill rig. During drilling, soil samples were collected at depth intervals of approximately 2.5 to 5 feet using the standard penetration test (SPT) procedure in accordance with *American Society for Testing and Materials* (ASTM):D 1586. This test and sampling method 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 is known as the Standard Penetration Resistance ("N-Value"), or blow count. If a total of 50 blows is recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding number of inches of penetration. The Standard Penetration Resistance provides a measure of the relative density of granular soils, or the relative consistency of cohesive soils; these values are plotted on the boring logs in Appendix A.

The exploration borings were continuously observed and logged by an AESI geologist. The samples obtained from the split-barrel, SPT samplers were classified in the field and representative portions placed in water-tight containers. The samples were then transported to our laboratory for further visual classification.

Stratigraphy

Sediments encountered generally consisted of loose/soft to medium stiff, silty fine sand and sandy silt. At the location of boring EB-1, these sediments were underlain at a depth of approximately 30 feet by very stiff to hard, laminated silt. More detailed descriptions of the sediments encountered in our borings, organized from the youngest (shallowest) to oldest (deepest) sediment types are provided below.

Fill

Although no fill soils were encountered in our borings, fill associated with construction of the road and installation of the existing culvert and other underground utilities is known to underlie the project area. Although the composition and quality of the existing fill is unknown, given the elevation of the culvert on the downstream (west) side of the road relative to the road surface, the maximum thickness of the existing fill is anticipated to be approximately 10 feet thick. The fill embankment on the west (downstream) side of the road is faced with concrete rubble.

Slide Debris

Sediments encountered in the upper portions of both borings generally consisted of loose, silty to very silty fine sand with variable gravel content and soft to stiff, sandy silt with chunks of hard silt. These sediments contained variable quantities of wood debris throughout, including what appeared to be a log at a depth of approximately 29 to 30 feet in boring EB-1. We interpret these sediments to be representative of slide debris. At the location of boring EB-1 the slide debris extended to a depth of approximately 31 feet. At the location of boring EB-2, the slide debris extended beyond the maximum depth explored of approximately 31.5 feet.

Pre-Fraser Sediments

Sediments encountered below the slide debris in boring EB-1 generally consisted of very stiff to hard, laminated silt. These sediments were distinguished from the overlying slide debris by their high relative consistency and intact laminations. We interpret these sediments to be representative of sediments deposited prior to the most recent glaciation of the project region. The most recent glaciation of the project region, known as the Fraser Glaciation, ended approximately 12,500 years ago. At the location of boring EB-1, the pre-Fraser sediments extended beyond the maximum depth explored of approximately 31.5 feet.

Ground Water

Ground water was observed at the time of drilling in boring EB-1 at a depth of approximately 4.5 feet. The depth at which seepage was observed at this location appears to lie slightly below the elevation of the culvert invert adjacent to the upstream (east) side of the road. Exploration boring EB-2 was completed as a 1.5-inch-diameter monitoring well (monitoring well MW-1) to allow monitoring of the static ground water level at this location. The monitoring well was developed immediately following its installation using an inertial pump. Approximately 3 gallons of water were purged from the well during development. A static ground water level of approximately 9.9 feet below ground surface was measured in the well on April 3, 2015, 11 days after well installation and development. The static ground water elevation is approximately equal to the invert elevation of the culvert on the downstream (west) side of the road. An electronic data logger was installed in the well subsequent to development to allow long-term monitoring of the ground water level at this location. At both boring locations, the sediments below the depth at which seepage was first observed appeared to remain saturated to the full depth explored.

CONCLUSIONS AND RECOMMENDATIONS

As previously discussed, conceptual plans call for replacing all or some of the existing culvert with either a new CMP culvert or a box culvert. Geotechnical recommendations for both of these options are discussed below.

Removal of the Existing Culvert

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction based on the local conditions encountered at that time. For planning purposes, we anticipate that temporary, unsupported cut slopes in areas of existing fill or loose to medium dense native sediments can be made at a maximum slope of 1.5H:1V (Horizontal:Vertical). Flatter inclinations are recommended in areas of seepage. As is typical with earthwork operations, some sloughing and raveling may occur and cut slopes may have to be adjusted in the field. In addition, temporary slopes should comply with appropriate state and federal regulations concerning maximum inclinations, and the contractor should be made responsible for worker safety as dictated by actual site conditions. Due to site constraints there might not be enough room to lay back the temporary slopes at the recommended inclination. Therefore temporary shoring will be required. Temporary shoring may consist of trench-box shoring or other approved mechanical methods. We do not recommend temporary slopes steeper than recommended above. The existing embankment material is variable and in a loose condition and could be unpredictable if attempts are made to over-steepen temporary cuts.

Embankment Stability

The existing embankment on the west (downstream) side of the road is constructed at an inclination of approximately 0.8H:1V over a height of approximately 10 feet. The face of the embankment is predominantly recycled concrete pieces that are stacked allowing some over steepening. Although in our opinion no fill was encountered in our explorations and its composition is therefore unknown, it is likely that the stability of the embankment is fairly low given its height and inclination. We do not infer an imminent risk of slope failure under the existing conditions; however the embankment could become less stable if there is a significant change in prevailing conditions, such as increased traffic loading, precipitation, snowmelt, or river flow. Recommendations regarding minimum inclination for structural fill slopes are provided in the "Structural Fill" section of this report.

CMP Culvert

To successfully support the overlying road embankment fill, a CMP culvert will transfer the vertical soil overburden stresses to the sides of the pipe (haunches) by slightly flattening from its initial shape. Thus, good compaction of fill soils placed around the haunches of the pipe is critical to prevent excessive lateral movement of the pipe, and a decrease of vertical support. It is difficult to obtain good compaction of fill placed beneath the curved mid line (spring line) of the pipe. Therefore, we recommend that the culvert pipe utilize pea gravel bedding up to the spring line of the pipes. Structural fill should be used for culvert backfill above the spring line of the pipe. The structural fill should be placed and compacted in accordance with the criteria defined below in the "Structural Fill" section of this report.

In order to reduce the potential for surface water from migrating through the backfill around the pipe, potentially resulting in long-term undermining of the pipe and overlying road, we recommend that backfill placed within 4 feet of the inlet or headwall to the culvert consist of a low permeability seepage collar consisting of controlled density fill (CDF).

Structural Fill

After overexcavation/stripping has been completed, the upper 12 inches of exposed ground should be recompacted to a firm and unyielding condition. If the subgrade contains too much moisture, suitable recompaction may be difficult or impossible to attain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below. After recompaction of the exposed ground is tested and approved, or a free-draining rock course is laid, structural fill may be placed to attain desired grades.

Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to at least 95 percent of the modified Proctor maximum dry density using ASTM:D 1557 as the standard. Roadway and utility trench backfill should be placed and compacted in accordance with applicable municipal codes and standards. The top of the compacted fill should extend horizontally a minimum distance of 3 feet beyond pavement edges before sloping down at an angle no steeper than

2H:1V. Fill slopes should either be overbuilt and trimmed back to final grade or surface-compacted to the specified density.

Soils in which the amount of fine-grained material (smaller than No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. The use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions. The natural on-site sediments contain a high percentage of fine-grained material. At the time of our exploration, the moisture contents of these sediments were well above the optimum for achieving suitable compaction. Portions of these sediments also contained abundant wood debris. For this reason, the natural sediments underlying the site are not considered suitable for use as structural fill.

Construction equipment traversing the site when the on-site soils are very moist or wet can cause considerable disturbance. If fill is placed during wet weather or if proper compaction cannot be attained, a select import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction.

All backfill material placed around and over the new culvert should comply with the manufacturer's recommendations. To reduce the need for rigorous backfill compaction, which could potentially distort the culvert, a uniformly graded gravel is generally recommended for culvert backfill.

The contractor should note that any proposed fill soils must be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material at least 3 business days in advance to perform a Proctor test and determine its field compaction standard.

A representative from our firm should inspect the stripped subgrade and be present during placement of structural fill to observe the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses and any problem areas may be corrected at that time.

Box Culvert

Foundation Support

The existing fill and slide debris sediments underlying the site are not suitable for foundation support. Accordingly, we recommend that a deep foundation system consisting of small-diameter, driven pipe piles be used for support of the proposed box culvert. Recommended pipe pile capacities are given below in Table 1.

Table 1
Recommended Pipe Pile Capacities

Nominal Pipe Diameter	Minimum Wall Thickness	Minimum Hammer Size	Allowable Axial Capacity	Driving Time (seconds/inch)
2-inch	Schedule 80	90 lb. jackhammer	4 kips	60
3-inch	Schedule 40	850 foot-lbs.	12 kips	12
4-inch	Schedule 40	1500 foot-lbs.	20 kips	12
6-inch	Schedule 40	1500 foot-lbs.	30 kips	16

In order for the stated pile capacities to apply, the pipe piles should be driven to refusal, which is defined as less than 1 inch of penetration during the specified period of continuous driving. The pipe piles should also completely penetrate the existing fill and slide debris. At the location of boring EB-1, the slide debris extended to a depth of approximately 31 feet. At the location of boring EB-2, the bottom of the slide debris was not encountered within the maximum depth explored of approximately 31.5 feet. No lateral capacity would be provided by vertically installed pipe piles. Lateral capacity could be attained through the use of batter piles. An AESI representative must observe installation of all pipe piling.

Erosion Considerations

As previously discussed, the average inclination of the existing culvert is approximately 14 percent. Given that the existing culvert has been periodically overwhelmed, it is apparent that heavy flows can occur in the stream during peak flow events. The natural sediments underlying the site consist of loose, silty, fine sand and soft to stiff, sandy silt. These sediments are highly sensitive to erosion and down-cutting when exposed to concentrated flows. The anticipated heavy flow and steep inclination of the flow path have the potential to result in accelerated erosion and scour of the exposed stream bed inside the box culvert. Mitigation of stream scour inside the box culvert could be achieved using a system of check dams and/or coarse aggregate, possibly in conjunction with a geotextile. More specific recommendations regarding mitigation of stream scour could be provided by AESI once maximum stream volume and velocity has been determined.

Construction Monitoring

AESI is available to provide field monitoring and consultation during the new culvert installation. Our geotechnical services could include observation of pile installation, evaluation of fill placement, and review of material submittals.

CLOSURE

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

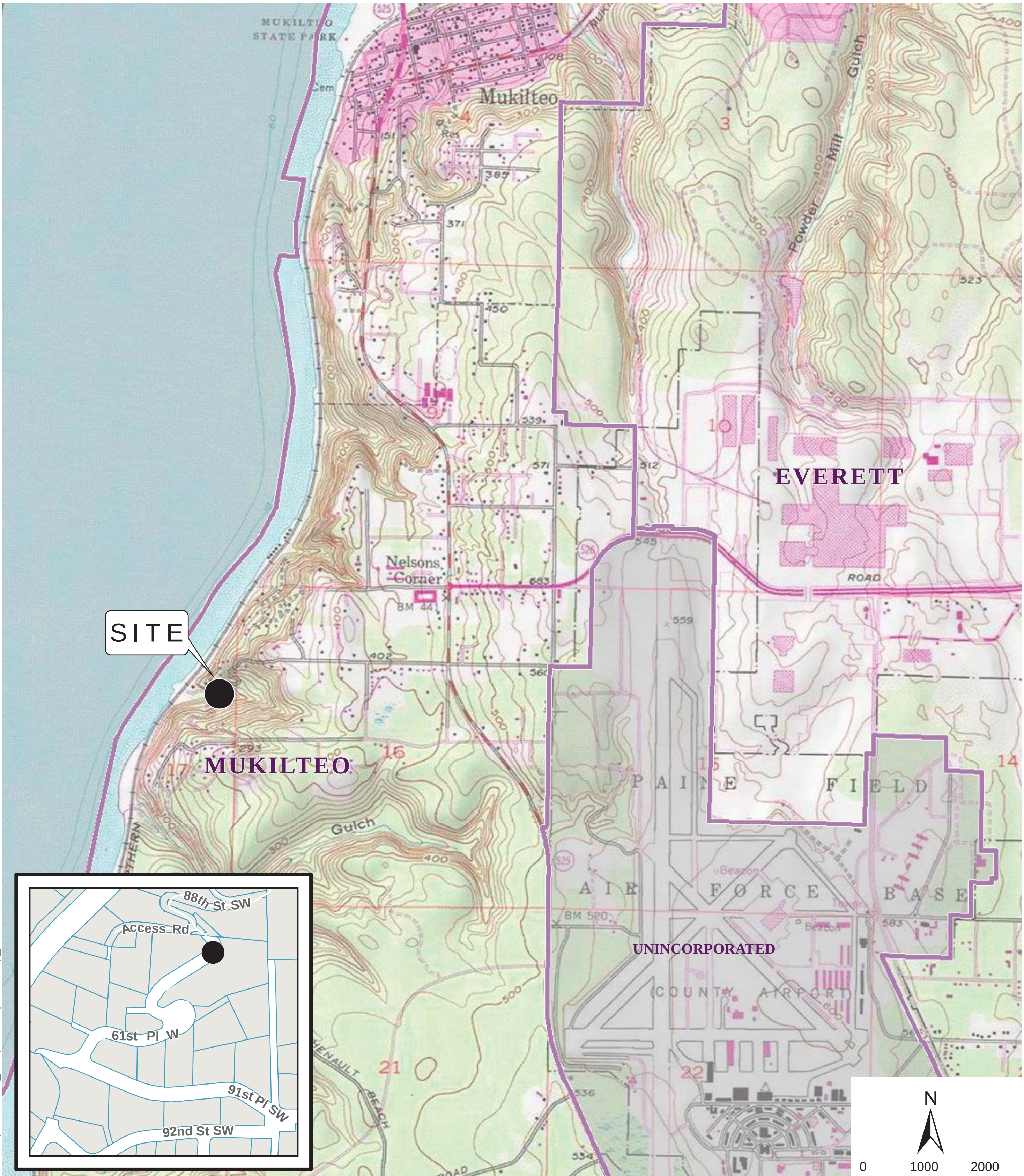
Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Everett, Washington

MATTHEW A. MILLER
STATE OF WASHINGTON
30284
REGISTERED
PROFESSIONAL ENGINEER
4-17-15

Timothy J. Peter, L.G., L.E.G., L.Hg.
Senior Project Geologist

Mathew A. Miller, P.E.
Principal Engineer

Attachments:	Figure 1:	Vicinity Map
	Figure 2:	Site and Exploration Sketch
	Appendix A:	Exploration Boring Logs



REFERENCE: USGS, SNOHOMISH CO

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

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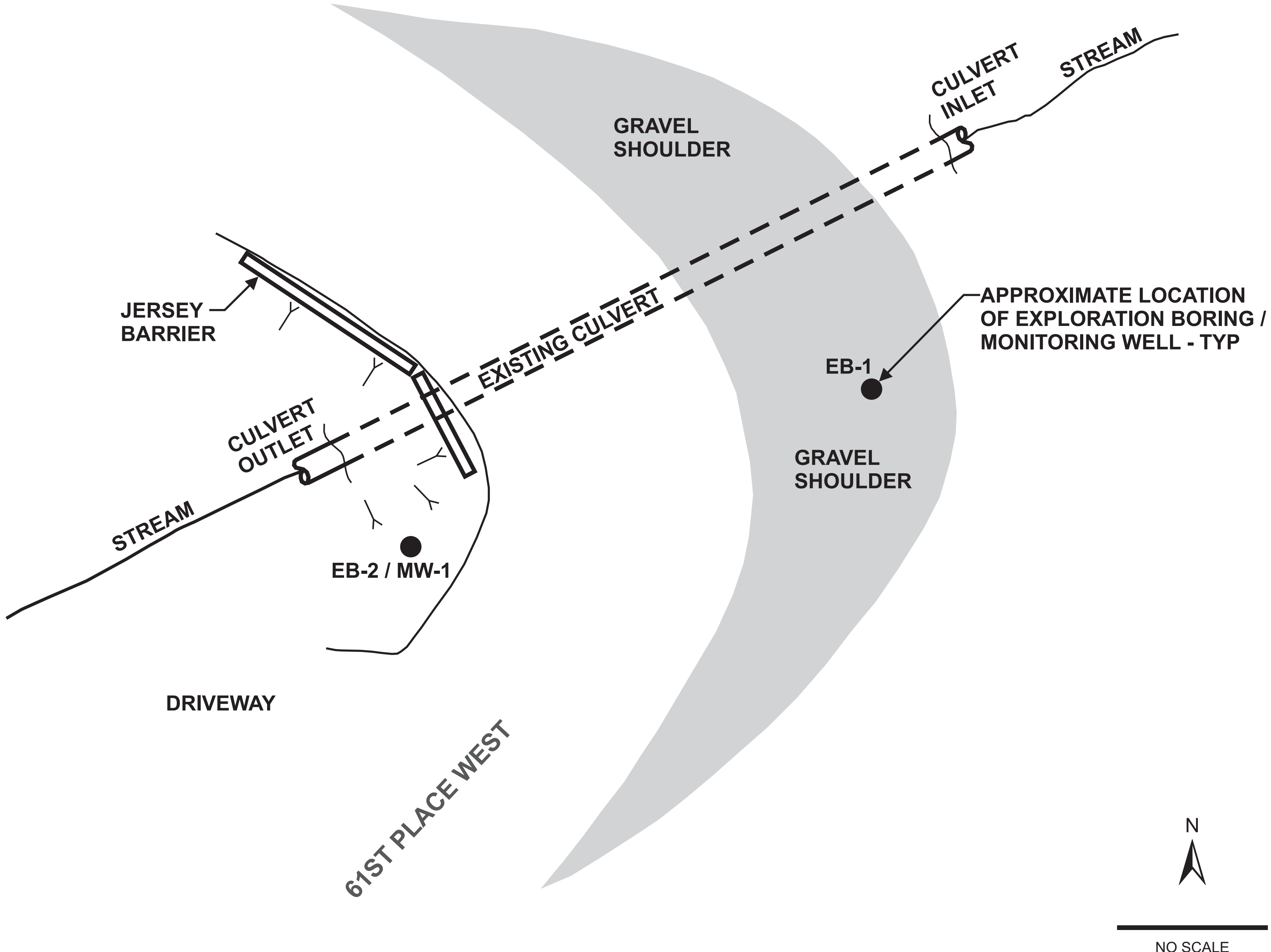
VICINITY MAP

61ST PLACE CULVERT REPLACEMENT
MUKILTEO, WASHINGTON

FIGURE 1

DATE 4/15

PROJ. NO. EE140704A



REFERENCE: SKETCH

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SITE AND EXPLORATION SKETCH

61ST PLACE WEST CULVERT
MUKILTEO, WASHINGTON

FIGURE 2
DATE 4/15
PROJ. NO. EE140704A

140704 61st Place West Culvert \ 140704 F2 Site and Exploration Plan.cdr

APPENDIX A

Exploration Boring 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

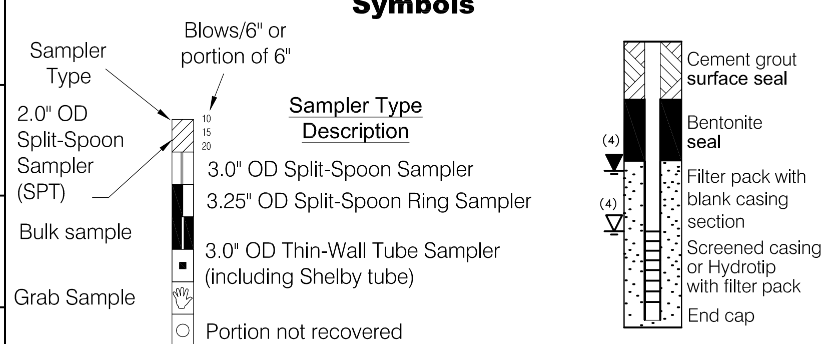
Slightly Moist - Perceptible moisture

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.

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Exploration Log

Project Number	Exploration Number	Sheet
EE140704A	EB-1	1 of 1

Project Name	61st Place West Culvert	Ground Surface Elevation (ft)	Unknown
Location	Mukilteo, WA	Datum	N/A
Driller/Equipment	Geologic Drill / Mini Track	Date Start/Finish	3/23/15,3/23/15
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	6 inches

Depth (ft)	Samples	DESCRIPTION	Water Level	Blows/6"	Blows/Foot
		Slide Debris			
	S-1	Very moist, brownish gray, gravelly, silty to very silty SAND; stratified (SM).	▼	6 5 5	10
5	S-2	Wet, brown to gray, sandy to very sandy SILT, moderately abundant organics (ML).		1 1 1	2
	S-3	Wet, gray, silty to very silty SAND (SM).		1 3 3	6
10	S-4	Wet, greenish gray, fine sandy SILT (SM). Wet, gray, gravelly, silty SAND (SM).		1 3 7	10
15	S-5	Contains lenses of silt and gravel; scattered pieces of wood.		4 21 19	40
20	S-6	Wet, gray, SILT, some fine sand, scattered pieces of wood (ML).		4 5 8	13
25	S-7	Contains pieces of hard silt. Wood in tip of sampler. (Smooth drilling action to 30 feet.) (Difficult drilling 29 to 30 feet - wood?)		5 7 10	17
30	S-8	Wet, gray, gravelly, silty SAND (SM). Abundant shredded wood debris in upper portion of sampler. **Pre-Fraser Sediments** Wet, gray, coarse SILT; laminated (ML). Bottom of exploration boring at 31.5 feet		4 9 15	24

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 ()
- ▼ Water Level at time of drilling (ATD)

Logged by: TJP
Approved by: JNS

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Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
EE140704A	EB-2 / MW-1	1 of 1

Project Name: 61st Place West Culvert
Elevation (Top of Well Casing): Unknown
Water Level Elevation: Unknown
Drilling/Equipment: Geologic Drill / Mini Track
Hammer Weight/Drop: 140# / 30"

Location: Mukilteo, WA
Surface Elevation (ft): Unknown
Date Start/Finish: 3/23/15,3/23/15
Hole Diameter (in): 7 inches

Depth (ft)	Water Level	WELL CONSTRUCTION	S T	Blows/ 6"	Graphic Symbol	DESCRIPTION
		Flush mount monument J-Plug Concrete seal 0 to 1.5 feet				**Slide Debris**
		Bentonite chips 1.5 to 4 feet		2 2 2		Very moist, brown, fine sandy SILT, abundant roots (ML).
5		1.5-inch I.D. PVC casing: 0 to 5 feet		2 2 2		Very moist, brown, silty to very silty fine SAND, some gravel, trace organics (SM).
		10/20 Silica sand 4 to 16 feet		9 10 9		Becomes gray. Abundant wood debris (most of sample is wood debris).
10	∇			2 1 2		Becomes wet, uniformly very silty, trace wood. (Gravelly drilling action.)
15		Slip cap 1.5-inch I.D. PVC well screen: 0.010-inch slot width, 5 to 15 feet Bentonite chips 16 to 25 feet		5 3 4		Contains gravelly lenses.
20				5 6 5		Becomes gravelly throughout. Becomes brown (fine organics) from 20.5 to 21 feet
25		Caved material		2 4 7		Wet, gray, fine sandy SILT, some gravel (fractured), trace organics; contains pieces of hard silt (ML).
30				1 3 3		Becomes greenish gray; contains wood and other fine organic; contains pieces of hard silt.
		Well tag #BAH-914				Boring terminated at 31.5 feet. Well completed at 15 feet on 3/23/15.

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 (4/3/15)
▼ Water Level at time of drilling (ATD)

Logged by: TJP
Approved by: JNS