Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

June 28, 2022
ES-8413

American Pride Lending, LLC
P.O. Box 1226
Kent, Washington 98035

Attention: Mr. Sikander Sekhon

Subject: Infiltration Evaluation
Proposed Site Improvements
212 Todd Road Northeast
Puyallup, Washington

Reference: Department of Ecology, State of Washington
2014 Stormwater Management Manual for Western Washington (SMMWW)

Schuster, et al.
Geologic Map of Tacoma, November 2015

Dear Mr. Sekhon:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this infiltration evaluation for the subject site.

Project Description

We understand low impact development flow control best management practices (BMPs) are being evaluated to control stormwater. Infiltration of stormwater is being evaluated as part of the overall stormwater design.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to confirm that our geotechnical recommendations have been incorporated into project plans.

Surface

The subject site is located at 212 Todd Road Northeast in Puyallup, Washington, as illustrated on the attached Vicinity Map (Plate 1). The site consists of one tax parcel (Pierce County parcel number 2354300575). The site is currently developed a single-family residence in the northwest corner of the property; the remainder of the property is covered with gravel. The site topography is relatively level.

Subsurface

An ESNW representative observed, logged, and sampled five test pits, excavated at accessible locations within the property boundaries, on March 7, 2022 using a mini-trackhoe and operator provided by our firm. Shallow groundwater monitoring wells were installed within test pits TP-3, TP-4, and TP-5. The approximate locations of the test pits are depicted on the attached Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided as attachments for a more detailed description of subsurface conditions. Representative soil samples collected at the test pit locations were evaluated in general accordance with Unified Soil Classification System (USCS) and USDA methods and procedures.

Fill

Existing gravel fill was encountered at all test pit locations extending to about one foot below the existing ground surface (bgs). The gravel fill was associated with the gravel-surfacing material observed throughout the majority of the site.

Native Soil

Underlying surficial existing fill, native soil was encountered primarily as loose to medium dense silty sand and sandy silt (USCS: SM and ML, respectively). Caving within the test pits was observed, beginning at depths of about three and one-half to seven and one-half feet bgs. The native soil was generally observed to be in a wet condition.

Geologic Setting

The referenced geologic map identifies alluvium deposits throughout the site and surrounding area. According to the geologic map resource, alluvium deposits are loose, stratified to massively bedded fluvial silt, sand, and gravel. Based on our field observations, native soil likely to be exposed on site will be consistent with alluvium deposits.

Groundwater

The local groundwater table was observed beginning at depths of about five to five and one-half feet bgs during the fieldwork on March 7, 2022. It is likely that the local groundwater table rises a foot or two throughout the peak of the wet season; ESNW can complete seasonal groundwater level monitoring upon request. Groundwater flow rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

Infiltration Evaluation

Our evaluation of site infiltration capacity was completed by excavating a series of test pits throughout the site, and completing two small-scale pilot infiltration tests (PITs). As indicated in the *Subsurface* section of this report, native soils encountered during our fieldwork were characterized primarily as silty sand and sandy silt, with the groundwater table encountered beginning at about five to five and one-half feet bgs.

PITs were performed within TP-1 and TP-2 at a depth of roughly four feet bgs; the measured infiltration rates were 4.2 and 1.4 inches per hour, respectively. For preliminary design purposes, we recommend assuming a measured infiltration rate of 1.4 inches per hour. The measured rate must be reduced by the following correction factors:

- Measured infiltration rate 1.4 inches per hour
- Site variability (CF_v) 0.5
- Test method (CF_t) 0.5
- Degree of influent control (CF_m) 0.9

The correction factors, along with the measured infiltration rate, were applied to determine the design infiltration rate. Based on our in-situ test results, it is our opinion the following infiltration rate can be used for preliminary design purposes if pursued:

- Design infiltration rate 0.3 inches per hour

If infiltration is pursued, the facilities will need to maintain proper separation from the local groundwater table. Depending on total impervious area proposed to be directed to infiltration facilities, additional PITs may be necessary.

ESNW can provide further evaluation and recommendations for site BMPs as plans develop. ESNW should review final stormwater management plans to provide supplementary recommendations, as needed.

Limitations

The recommendations and conclusions provided in this letter are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions observed at the test sites may exist and may not become evident until construction. ESNW should reevaluate the conclusions in this letter if variations are encountered.

Additional Services

ESNW can complete additional PITs and seasonal groundwater level monitoring upon request. ESNW should have an opportunity to review the final design with respect to the geotechnical recommendations provided in this letter. ESNW should also be retained to provide testing and consultation services during the earthwork phase of construction.

We trust this letter meets your current needs. Should you have questions regarding the content herein, or require additional information, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

06/28/2022

Henry T. Wright, P.E.
Associate Principal Engineer

Attachments: Plate 1 – Vicinity Map
Plate 2 – Test Pit Location Plan
Test Pit Logs
Grain Size Distribution

Reference:
Pierce County, Washington
OpenStreetMap.org

NORTH

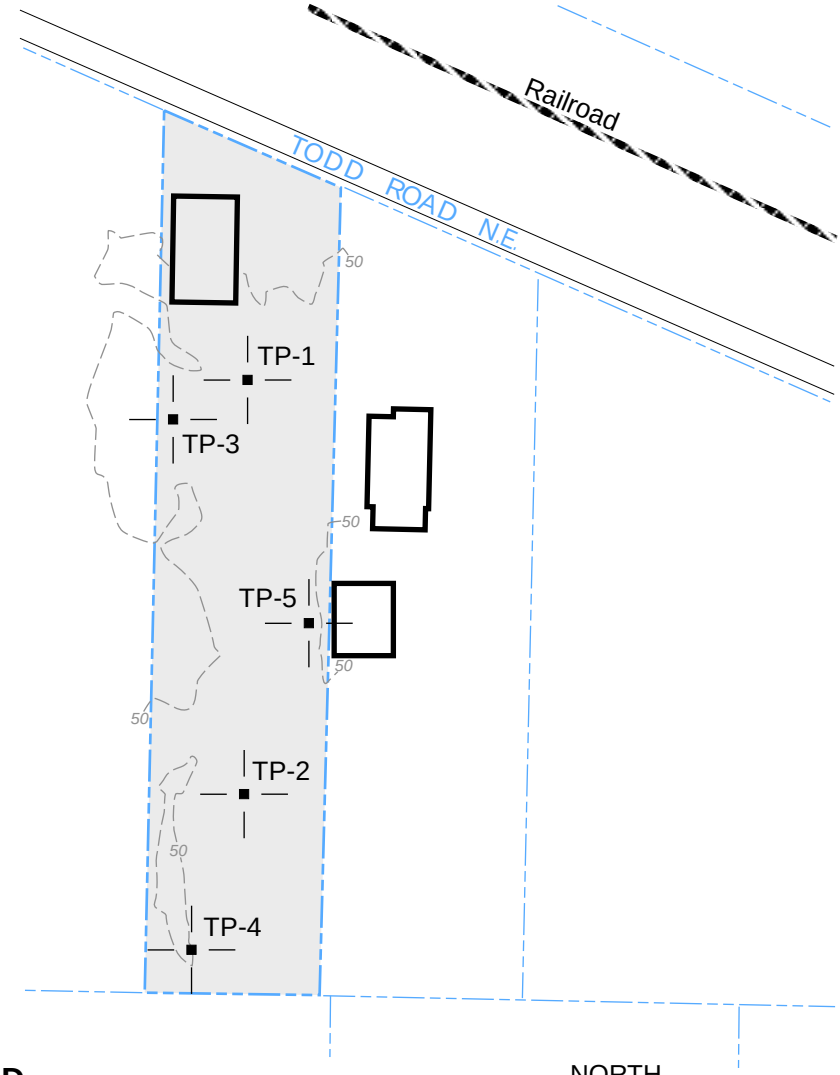
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
212 Todd Road N.E.
Puyallup, Washington

Drwn. CAM	Date 05/24/2022	Proj. No. 8413
Checked SES	Date May 2022	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-8413, March 2022

Subject Site

Existing Building

NORTH

0 50 100 200

1"=100' Scale in Feet

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

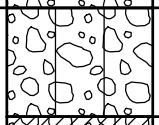
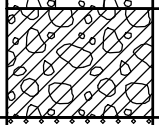
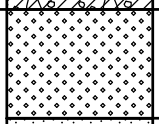
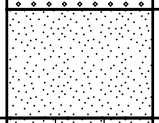
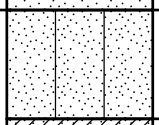
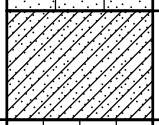
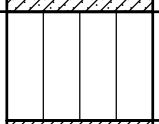
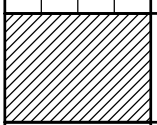
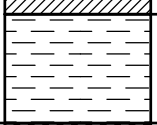
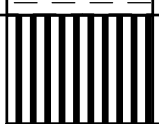
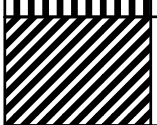
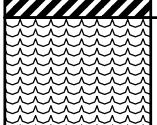
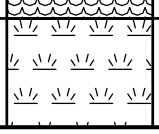
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Test Pit Location Plan
212 Todd Road N.E.
Puyallup, Washington

Drwn. CAM	Date 05/24/2022	Proj. No. 8413
Checked SES	Date May 2022	Plate 2

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-8413 **PROJECT NAME** 212 Todd Road N.E.

DATE STARTED 3/7/22 **COMPLETED** 3/7/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SES **CHECKED BY** HTW ▽ **AT TIME OF EXCAVATION** 5.0 ft

NOTES Surface Conditions: gravel pad

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			GP		Gray poorly graded GRAVEL, loose, damp (Fill)
					-fabric at contact
				1.0	Dark brown silty SAND, loose to medium dense, wet
		MC = 27.0% OC = 4.4%			
2.5					
		MC = 27.2% Fines = 48.6%			-infiltration test at 4' [USDA Classification: slightly gravelly very fine sandy LOAM]
					-becomes wet
5.0					▽ -groundwater table
			SM		
7.5					-slight caving to BOH
10.0		MC = 32.6% Fines = 30.5%		10.0	[USDA Classification: fine sandy LOAM]
					Test pit terminated at 10.0 feet below existing grade. Groundwater table encountered at 5.0 feet during excavation. Caving observed from 7.5 feet to BOH.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

PROJECT NUMBER ES-8413 **PROJECT NAME** 212 Todd Road N.E.

DATE STARTED 3/7/22 **COMPLETED** 3/7/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SES **CHECKED BY** HTW ▽ **AT TIME OF EXCAVATION** 5.0 ft

NOTES Surface Conditions: gravel pad

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			GP		Gray poorly graded GRAVEL, loose, damp (Fill)
				1.0	
			SM		Dark brown silty SAND, loose to medium dense, wet
		MC = 35.6% OC = 6.2%			
2.5					
		MC = 28.4% Fines = 42.9%			-infiltration test at 4', becomes wet [USDA Classification: slightly gravelly very fine sandy LOAM]
5.0					▽ -groundwater table
				5.5	
			ML		Dark brown sandy SILT, loose to medium dense, wet
7.5					-slight caving to BOH
10.0		MC = 44.4% Fines = 98.4%		10.0	[USDA Classification: slightly gravelly LOAM]
					Test pit terminated at 10.0 feet below existing grade. Groundwater table encountered at 5.0 feet during excavation. Caving observed from 7.0 feet to BOH.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

PROJECT NUMBER ES-8413 **PROJECT NAME** 212 Todd Road N.E.

DATE STARTED 3/7/22 **COMPLETED** 3/7/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SES **CHECKED BY** HTW ▽ **AT TIME OF EXCAVATION** 5.5 ft

NOTES Surface Conditions: gravel pad

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			GP		Gray poorly graded GRAVEL, loose, damp (Fill)
				1.0	
			SM		Dark brown silty SAND, loose to medium dense, wet
		MC = 18.9%			
2.5					
5.0				5.0	
			ML		Dark brown sandy SILT, loose to medium dense, wet
					▽ -groundwater table, moderate caving to BOH
					-mottled texture
		MC = 37.9%			
7.5					
		MC = 34.6%		9.5	
					Test pit terminated at 9.5 feet below existing grade. Groundwater table encountered at 5.5 feet during excavation. Caving observed from 5.5 feet to BOH.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

PROJECT NUMBER ES-8413 **PROJECT NAME** 212 Todd Road N.E.

DATE STARTED 3/7/22 **COMPLETED** 3/7/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SES **CHECKED BY** HTW ▽ **AT TIME OF EXCAVATION** 5.0 ft

NOTES Surface Conditions: gravel pad

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
			GP		Gray poorly graded GRAVEL, loose, damp (Fill)
					1.0
		MC = 24.6%			Brown silty SAND, loose to medium dense, wet
2.5			SM		
					4.0
					Dark brown sandy SILT, loose to medium dense, wet
					-mottled texture
5.0		MC = 41.1%			▽ -groundwater table
					-slight caving to BOH
			ML		
7.5					
10.0		MC = 33.6%			10.0
					Test pit terminated at 10.0 feet below existing grade. Groundwater table encountered at 5.0 feet during excavation. Caving observed from 6.5 feet to BOH.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

PROJECT NUMBER ES-8413 **PROJECT NAME** 212 Todd Road N.E.

DATE STARTED 3/7/22 **COMPLETED** 3/7/22 **GROUND ELEVATION**

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** **LONGITUDE**

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SES **CHECKED BY** HTW ▽ **AT TIME OF EXCAVATION** 5.0 ft

NOTES Surface Conditions: gravel pad

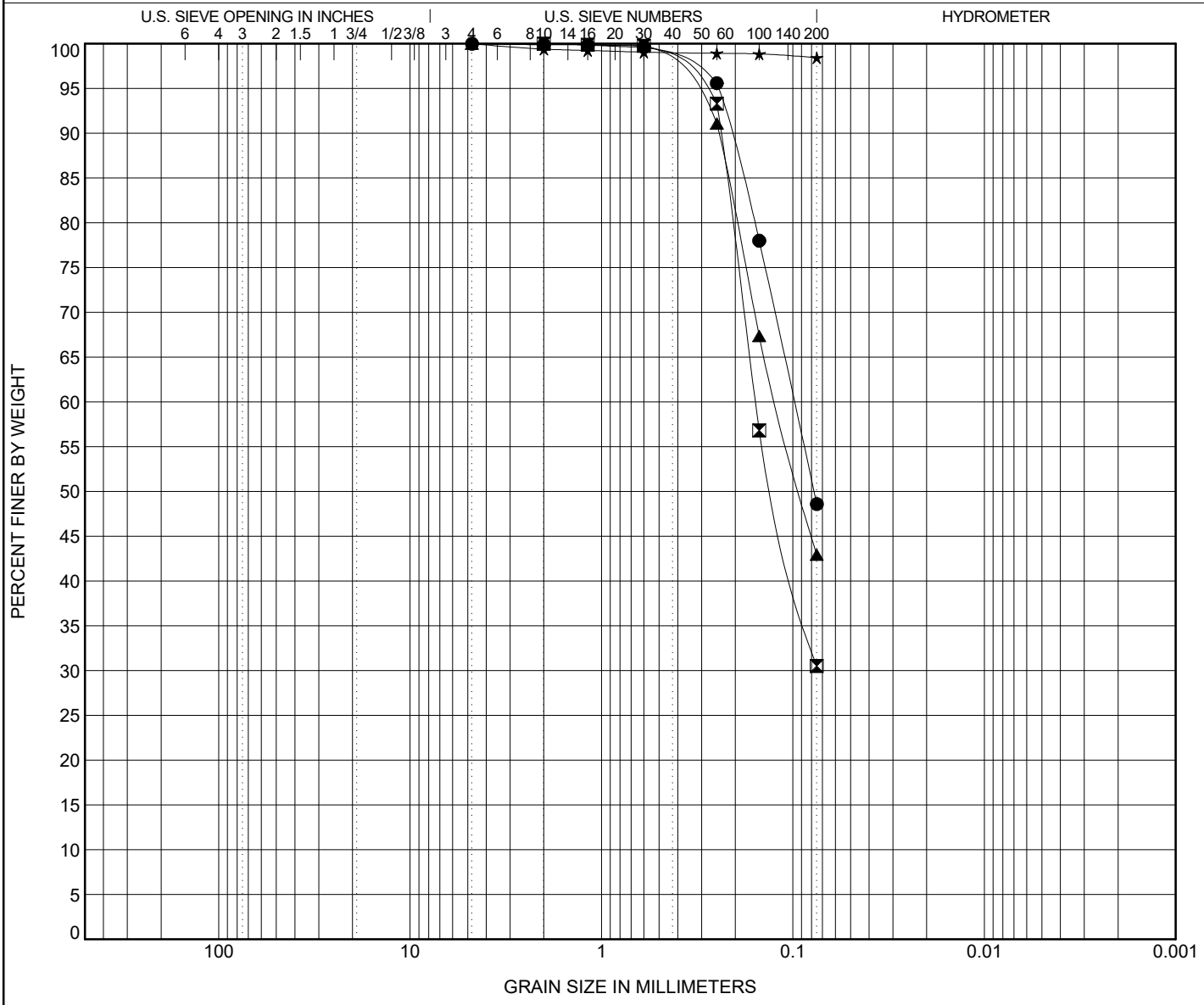
DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			GP		Gray poorly graded GRAVEL, loose, damp (Fill)
				1.0	
					Brown silty SAND, loose to medium dense, wet
		MC = 23.8%			
2.5			SM		-slight caving to BOH
5.0				▽	-groundwater table
				5.5	
					Dark brown sandy SILT, loose to medium dense, wet
		MC = 37.2%			
7.5			ML		
10.0		MC = 34.2%		10.0	

Test pit terminated at 10.0 feet below existing grade. Groundwater table encountered at 5.0 feet during excavation. Caving observed from 3.0 feet to BOH.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-8413 **PROJECT NAME** 212 Todd Road N.E



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	TP-01	4.00ft.	USDA: Dk Brown Slightly Gravelly Very Fine Sandy Loam. USCS: SM.		
⊠	TP-01	10.00ft.	USDA: Dk Brown Fine Sandy Loam. USCS: SM.		
▲	TP-02	4.00ft.	USDA: Dk Brown Slightly Gravelly Very Fine Sandy Loam. USCS: SM.		
★	TP-02	10.00ft.	USDA: Dk Brown Slightly Gravelly Loam. USCS: ML.		

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-01	4.0ft.	4.75	0.098						48.6	
⊠	TP-01	10.0ft.	2	0.157						30.5	
▲	TP-02	4.0ft.	4.75	0.122						42.9	
★	TP-02	10.0ft.	4.75							98.4	

GRAIN SIZE USDA ES-8413 212 TODD ROAD N.E.GPJ GINT US LAB.GDT 3/10/22