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

December 17, 2021
ES-8181

Mr. Kris Mullan
808 – 14th Street Southwest
Puyallup, Washington 98371

Subject: **Geotechnical Evaluation**
Proposed Single-Family Residence
808 – 14th Street Southwest
Puyallup, Washington

Reference: Puyallup Municipal Code (PMC) Chapter 21.06: Critical Areas

J.E. Schuster et al.
Geologic Map of the Tacoma 1:100,000-scale Quadrangle, Washington, 2015

Stephen P. Palmer et al.
Liquefaction Susceptibility Map of Pierce County, Washington, 2004

United States Department of Agriculture (USDA)
Natural Resources Conservation Service (NRCS)
Online Web Soil Survey (WSS) resource

Washington State Department of Ecology
2014 Stormwater Management Manual for Western Washington

Dear Mr. Mullan:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this letter for the proposed project. The letter was prepared in general accordance with the scope of services outlined in the October 2021 Change Order to our original proposal, which was authorized by you. A summary of the subsurface exploration on site and preliminary geotechnical recommendations to aid with the site design are provided in this letter.

Project Description

We understand the subject site will be subdivided (creating a two-lot short plat), and one new single-family residence will be constructed. The proposal will also include construction of a new driveway, utility improvements, and outbuildings. Infiltration and other flow control stormwater Best Management Practices (BMPs) must be utilized to the extent practical. At the time of this letter, the proposal included construction of a porous driveway.

Surface Conditions

The subject site is located on the west side of 14th Street Southwest, about 400 feet south of the intersection with 7th Avenue Southwest, in Puyallup, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The site consists of one tax parcel (Pierce County Parcel No. 5505300831), totaling about 0.93 acres. The site is surrounded to the west, south, and north by residential structures and to the east by 14th Street Southwest.

Subsurface Conditions

An ESNW representative observed, logged, and sampled five test pits on October 7, 2021. Five additional test pits, three of which had piezometers installed for seasonal groundwater monitoring purposes, were completed on November 2, 2021. The test pits were excavated within accessible site areas, using a mini trackhoe and operator retained by ESNW. The test pits were completed to evaluate and classify site soils, characterize groundwater conditions within accessible site areas, and perform in-situ infiltration testing.

The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the attached test pit logs for a more detailed description of subsurface conditions. Representative soil samples collected at the test pit locations were analyzed in general accordance with both Unified Soil Classification System (USCS) and USDA methods and procedures.

Topsoil and Fill

Where encountered at surface grades, the topsoil was about 6 to 12 inches thick. The topsoil was characterized by the observed dark brown hue, the presence of fine organics, and small root intrusions.

Fill was encountered at test pit locations TP-3, TP-6, TP-8, TP-9, and TP-10 to depths of about one-and-one-half to two-and-one-half feet below the existing ground surface (bgs). The fill was characterized as silty sand, in a loose to medium dense and damp to moist condition. Small pieces of asphalt, brick, and plastic were observed in the fill.

Native Soil

Underlying the topsoil and fill, the native soil consisted primarily of silty sand and sandy silt (USCS: SM and ML, respectively). The in-situ density of the native soil was characterized primarily as “medium dense” at each test location, and the in-situ moisture content was characterized as damp to wet condition at the time of exploration depending on the presence of groundwater. The maximum exploration depth was approximately nine-and-one-half feet bgs.

Geologic Setting

The referenced geologic map resource identifies alluvium (Qa) as the primary native soil unit underlying the subject site and proximate areas. As reported on the geologic map resource, alluvium is typified by well-rounded and moderately to well-sorted beds of fluvial silt, sand, and gravel. The referenced WSS resource identifies Sultan silt loam as the primary soil unit underlying the subject development area. The Sultan series was formed in stratified alluvial deposits as a result of the Mount Rainier watershed. Based on our field observations, the on-site native soil is consistent with the local geologic mapping of alluvium.

Groundwater

Groundwater was encountered at the test locations at varying depths during the October and November 2021 fieldwork, ranging from about three to eight-and-one-half feet bgs. As previously mentioned, ESNW installed a series of standpipe piezometers in select test locations and is performing groundwater monitoring over the course of the 2021–2022 wet season. An opinion of the seasonal high groundwater table elevation can be provided at the conclusion of the wet season based on review of groundwater information collected by the in-place dataloggers.

It should be noted that seepage 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.

Geologically Hazardous Areas

We reviewed the referenced PMC chapter to determine the presence of geologically hazardous areas on site. Based on our review, the subject site may be considered within a seismic hazard area. The three remaining geologically hazardous areas recognized by the PMC—erosion hazard area, landslide hazard area, and volcanic hazard area—are not applicable to the subject site.

According to PMC 21.06.1210(3)(c), seismic hazard areas are defined as “areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement or subsidence, soil liquefaction, or tsunamis.” The referenced liquefaction susceptibility map indicates the site and surrounding areas possess high liquefaction susceptibility. Based on our field observations, it is our opinion the risk of liquefaction during a seismic event can generally be considered low. This opinion is based primarily on the significant percentage of fines (material passing the Number 200 sieve) inherent to the native soil; predominantly silty soils are typically not susceptible to liquefaction during a seismic event. On this basis, it is our opinion the site is not at severe risk of damage during a seismic event and does not meet the PMC definition of a seismic hazard area.

Preliminary Geotechnical Recommendations

The primary geotechnical considerations for the proposal are associated with structural fill placement and compaction, earthwork and grading activities, foundation support, and stormwater management. Based on our field observations and our understanding of the proposed development, pertinent geotechnical recommendations and design parameters are provided below.

In-situ and Imported Soil

The native alluvium is moisture sensitive, and successful use of the native alluvium as structural fill will largely be dictated by the moisture content at the time of placement and compaction. If the native alluvium cannot be successfully compacted, the use of an imported soil may be necessary.

Performing grading activities during summer months of relatively low rainfall activity is recommended to minimize site degradation. In our opinion, a contingency should be provided in the project budget for the export of soil that cannot be successfully compacted as structural fill, particularly if grading activities take place during periods of extended rainfall activity. In general, soil with an appreciable fines content (greater than 5 percent) typically degrades rapidly when exposed to periods of rainfall.

Imported soil intended for use as structural fill should be evaluated by ESNW during construction. The imported soil must be able to achieve the necessary moisture content, as determined by the Modified Proctor Method (ASTM D1557), at the time of placement and compaction. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, roadway, permanent slope, retaining wall, and utility trench backfill areas. Structural fill placed and compacted during site grading activities should meet the following specifications:

- Structural fill material — Granular soil*****
- Moisture content — At or slightly above optimum†
- Relative compaction (minimum) — 95 percent (Modified Proctor)
- Loose lift thickness (maximum) — 12 inches

* *The existing soil may not be suitable for use as structural fill unless the soil is at (or slightly above) the optimum moisture content at the time of placement and compaction.*

† *Soil shall not be placed dry of optimum and should be evaluated by ESNW during construction.*

Foundations

The proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on either compact structural fill or competent native soil. In general, competent native soil for foundation support should be encountered beginning at a depth of roughly two to three feet bgs. Existing fill intended for reuse as structural fill must be free of debris and should be evaluated by ESNW prior to use. In general, if loose or unsuitable soil conditions are exposed at foundation subgrade elevations, additional mechanical compactive effort or overexcavation and replacement with suitable structural fill will likely be necessary.

Provided foundations will be supported as prescribed, the following parameters may be used for design:

- Allowable soil bearing capacity 2,000 psf
- Passive earth pressure 250 pcf (equivalent fluid)
- Coefficient of friction 0.35

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, about one inch of total static settlement and about one-half inch of differential static settlement is anticipated. Most of the anticipated settlement should occur during construction when dead loads are applied.

Seismic Design

The 2018 International Building Code (2018 IBC) recognizes the most recent edition of the Minimum Design Loads for Buildings and Other Structures manual (ASCE 7-16) for seismic design, specifically with respect to earthquake loads. Based on the soil conditions encountered at the test pit locations, the parameters and values provided below are recommended for seismic design per the 2018 IBC.

Parameter	Value
Site Class	D*
Mapped short period spectral response acceleration, S_S (*g*)	1.278
Mapped 1-second period spectral response acceleration, S_1 (*g*)	0.440
Short period site coefficient, F_a	1.0
Long period site coefficient, F_v	1.860†
Adjusted short period spectral response acceleration, S_{MS} (*g*)	1.278
Adjusted 1-second period spectral response acceleration, S_{M1} (*g*)	0.818†
Design short period spectral response acceleration, S_{DS} (*g*)	0.852
Design 1-second period spectral response acceleration, S_{D1} (*g*)	0.546†

* *Assumes medium dense native soil conditions, encountered to a maximum depth of 9.5 feet bgs during the October and November 2021 field explorations, remain dense to at least 100 feet bgs.*

† *Values assume F_v may be determined using linear interpolation per Table 11.4-2 in ASCE 7-16.*

Please refer to the *Geologically Hazardous Areas* section of this letter for evaluation of site-specific seismic risk and liquefaction susceptibility.

Slab-on-Grade Floors

Slab-on-grade floors for the proposed residential structure should be supported on firm and unyielding subgrades comprised of competent native soil, compacted structural fill, or new structural fill. Unstable or yielding subgrade areas should be recompacted or overexcavated and replaced with suitable structural fill prior to slab construction.

A capillary break, consisting of at least four inches of free-draining crushed rock or gravel, should be placed below each slab. The free-draining material should have a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below each slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for design:

- Active earth pressure (unrestrained condition) — 40 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 60 pcf
- Traffic surcharge* (passenger vehicles) — 70 psf (rectangular distribution)
- Passive earth pressure — 250 pcf (equivalent fluid)
- Coefficient of friction — 0.35
- Seismic surcharge — 8H psf†

* *Where applicable.*
† *Where H equals the retained height (in feet).*

The above design parameters are based on a level backfill condition and level grade at the wall toe under the assumption that native soil will be retained. If a significant zone of imported structural fill will be retained directly behind the wall, less stringent design parameters can be provided. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill may consist of a less permeable soil if desired. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Drainage

Groundwater will likely be encountered in site excavations. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to both identify areas of seepage and provide recommendations to reduce the potential for seepage-related instability.

Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond adjacent to structures. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Infiltration Evaluation

Per the requirements of the referenced 2014 Stormwater Management Manual for Western Washington (2014 SWMMWW), one small-scale Pilot Infiltration Test (PIT) was completed during the November 2021 fieldwork. The PIT was completed at TP-10 and at an approximate depth of two-and-one-half feet bgs. The following test results and correction factors were used to determine the calculated (long-term) infiltration rate:

- K_{sat} initial (measured infiltration rate; TP-10) 1.2 inches per hour (in/hr)
- Site variability and number of tests (CF_v) 0.75
- Test method (CF_t) 0.5 (small-scale PIT)
- Degree of influent control (CF_m) 0.9
- K_{sat} design (calculated infiltration rate; TP-10) 0.4 in/hr

Use of the above infiltration rate is considered acceptable near the location and elevation of the PIT. Should different locations of the site be pursued for infiltration, ESNW should be contacted to review the applicability of the above infiltration rate. Supplementary testing may be warranted as project plans develop. In addition, as mentioned in the *Groundwater* section of this letter, ESNW is currently providing groundwater monitoring services during the 2021–2022 wet season. The seasonal high groundwater table elevation may impact infiltration feasibility and should be discussed further as monitoring data becomes available.

ESNW should be contacted to review stormwater management plans if infiltration is used in the final design. Where infiltration facilities are incorporated into construction, ESNW should be contacted to observe installation of infiltration facilities and provide supplementary recommendations, as necessary.

Permeable Pavement Considerations

We understand permeable pavement is being considered as part of the project design. Per the 2014 SWMMWW, the native soil underneath the permeable pavement surface must meet minimum cation exchange capacity (CEC) and organic content (OC) values of 5 meq/100 g and 1.0 percent, respectively, for water quality purposes. Based on the laboratory CEC and OC analysis results (attached to this letter for reference), the native underlying soil is generally expected to meet the minimum CEC and OC requirements. The ability of the proposed permeable pavement to meet the required minimum vertical separation from the seasonal high groundwater table elevation is also an important geotechnical consideration, which is being evaluated by ESNW over the course of the 2021–2022 wet season.

Limitations

This letter has been prepared for the exclusive use of Mr. Kris Mullan and his representatives. No warranty, express or implied, is made. 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. Variations in the soil and groundwater conditions encountered at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the contents of this letter if variations are encountered.

We trust this letter meets your current needs. Please call if you have any questions about this letter or if we can be of further assistance.

Sincerely,

EARTH SOLUTIONS NW, LLC

12/17/2021

Steven K. Hartwig, G.I.T.
Staff Geologist

Keven D. Hoffmann, P.E.
Geotechnical Engineering Services Manager

Attachments: Plate 1 – Vicinity Map
Plate 2 – Test Pit Location Plan
Plate 3 – Retaining Wall Drainage Detail
Plate 4 – Footing Drain Detail
Test Pit Logs
Laboratory Data

cc: Barghausen Consulting Engineers, Inc.
Attention: Mr. Vicente Varas (Email only)
Mr. Barry Talkington, P.E. (Email only)

Reference:
Pierce County, Washington
OpenStreetMap.org

NORTH

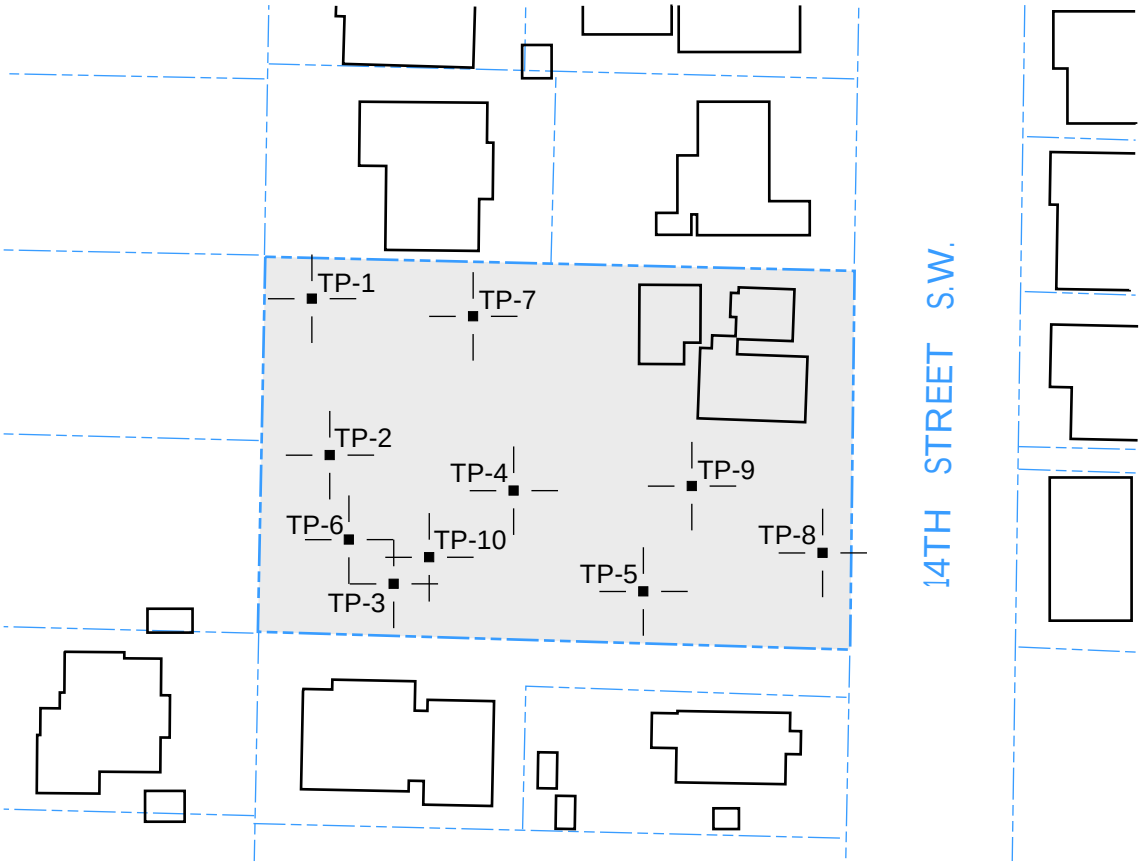
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Mullan Short Plat
Puyallup, Washington

Drwn. MRS	Date 11/04/2021	Proj. No. 8181
Checked SKH	Date Nov. 2021	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-8181, Oct./Nov. 2021

Subject Site

Existing Building

NORTH

1"=80'

0 40 80 160

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.

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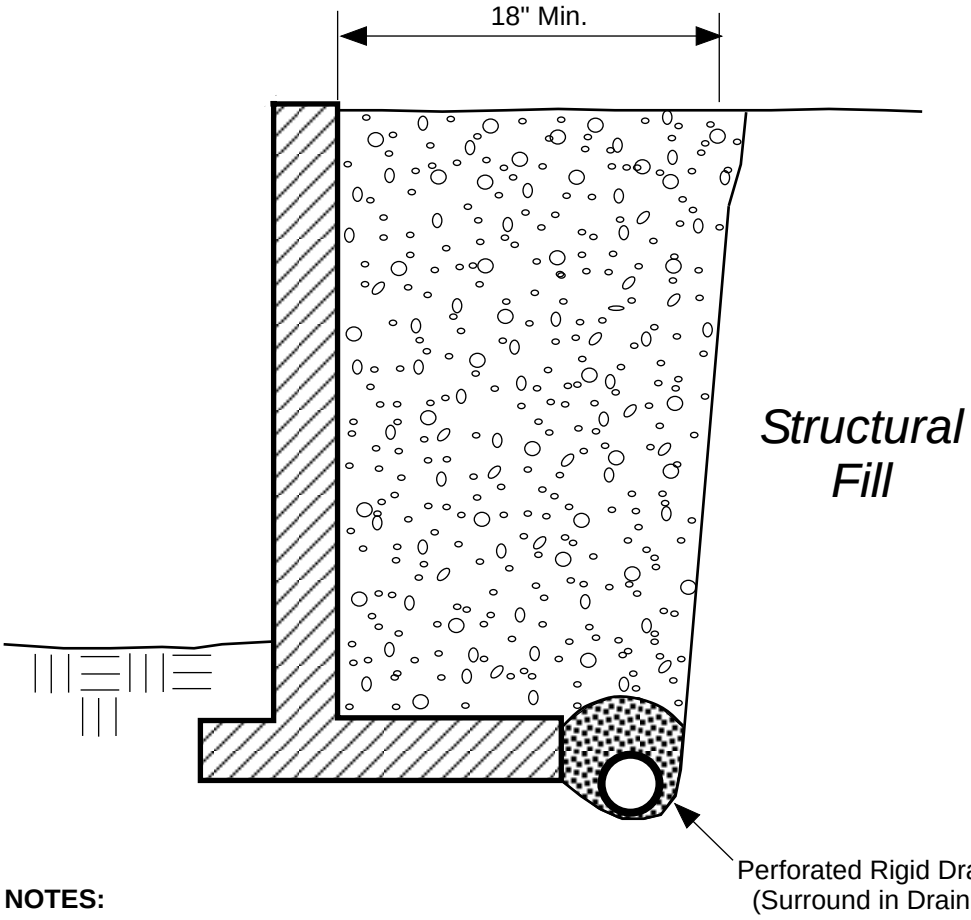
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Test Pit Location Plan
Mullan Short Plat
Puyallup, Washington

Drwn. MRS	Date 12/14/2021	Proj. No. 8181
Checked SKH	Date Dec. 2021	Plate 2



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

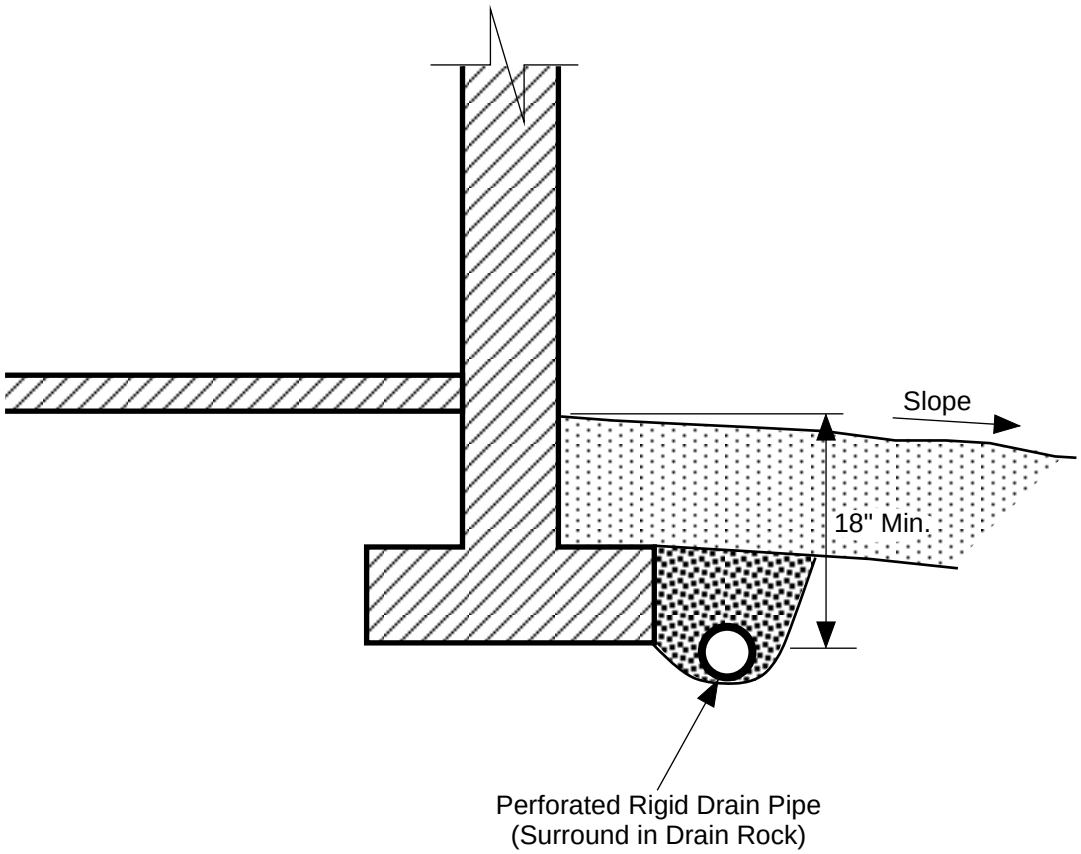
Free-draining Structural Backfill

1-inch Drain Rock

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

Retaining Wall Drainage Detail
Mullan Short Plat
Puyallup, Washington

Drwn. MRS	Date 11/04/2021	Proj. No. 8181
Checked SKH	Date Nov. 2021	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

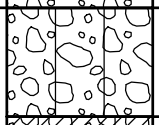
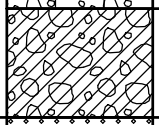
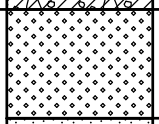
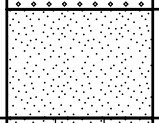
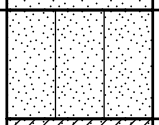
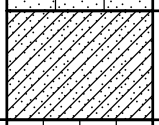
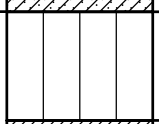
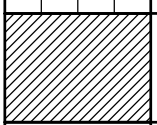
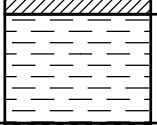
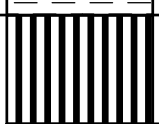
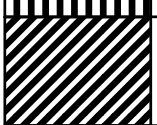
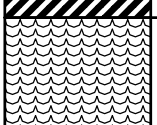
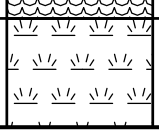
Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Footing Drain Detail
Mullan Short Plat
Puyallup, Washington

Drwn. MRS	Date 11/04/2021	Proj. No. 8181
Checked SKH	Date Nov. 2021	Plate 4

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-8181 **PROJECT NAME** Mullan Short Plat
DATE STARTED 10/7/21 **COMPLETED** 10/7/21 **GROUND ELEVATION** 35 ft
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18528 **LONGITUDE** -122.31428
EXCAVATION METHOD **GROUND WATER LEVEL:**
LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**
NOTES Depth of Topsoil & Sod 10": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, minor root intrusions to 1'
					1.0 — 34.0
		MC = 12.5%	SM		Brown silty SAND, loose to medium dense, damp -becomes gray, trace iron oxide staining
5		MC = 24.8% Fines = 22.9%			-becomes blue-gray [USDA Classification: fine sandy LOAM] -becomes moist
					7.0 — 28.0
		MC = 44.9%	ML		Gray silty SAND, medium dense, wet -light groundwater seepage -organic debris
					8.0 — 27.0
					Test pit terminated at 8.0 feet below existing grade. Groundwater encountered at 7.5 feet during excavation. No caving observed.

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Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat

DATE STARTED 10/7/21 **COMPLETED** 10/7/21 **GROUND ELEVATION** 35 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.1851 **LONGITUDE** -122.31418

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**

NOTES Depth of Topsoil & Sod 6": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL	
				0.5		34.5
		MC = 12.2%	SM		Brown silty SAND, loose to medium dense, damp -becomes gray, light iron oxide staining	
				3.5		31.5
5		MC = 33.9% Fines = 98.4%	ML		Gray SILT, medium dense, moist [USDA Classification: LOAM] -organic debris -becomes wet -light groundwater seepage	
		MC = 55.6%		8.0		27.0

Test pit terminated at 8.0 feet below existing grade. Groundwater encountered at 7.5 feet during excavation. No caving observed.

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TEST PIT NUMBER TP-3

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat
DATE STARTED 10/7/21 **COMPLETED** 10/7/21 **GROUND ELEVATION** 35 ft
EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18495 **LONGITUDE** -122.31412
EXCAVATION METHOD **GROUND WATER LEVEL:**
LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**
NOTES Depth of Topsoil & Sod 6": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL	
				0.5		34.5
			SM		Brown silty SAND with gravel, medium dense, damp (Fill)	
					-asphalt debris	
				2.0		33.0
		MC = 50.0% Fines = 93.2%			Gray SILT, medium dense, wet	
					[USDA Classification: LOAM]	
					-organic debris, light iron oxide staining	
5						
			ML			
		MC = 41.6%			-light groundwater seepage, moderate organics	
					-light groundwater seepage	
		MC = 52.4%		9.5		25.5

Test pit terminated at 9.5 feet below existing grade. Groundwater encountered at 6.5 and 8.0 feet during excavation. No caving observed.

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TEST PIT NUMBER TP-4

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat

DATE STARTED 10/7/21 **COMPLETED** 10/7/21 **GROUND ELEVATION** 35 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18508 **LONGITUDE** -122.31391

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**

NOTES Depth of Topsoil & Sod 10": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, minor roots to 12"
					1.0 34.0
		MC = 12.8% Fines = 32.9%	SM		Brown silty SAND, loose to medium dense, damp [USDA Classification: sandy LOAM] -becomes gray, light iron oxide staining
					4.0 31.0
5		MC = 52.3%	ML		Gray SILT, medium dense, moist to wet -trace organics debris -light groundwater seepage
		MC = 35.2%			-light groundwater seepage
		MC = 32.7%			9.5 25.5

Test pit terminated at 9.5 feet below existing grade. Groundwater encountered at 6.5 and 8.5 feet during excavation. No caving observed.

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TEST PIT NUMBER TP-5

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat

DATE STARTED 10/7/21 **COMPLETED** 10/7/21 **GROUND ELEVATION** 35 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18493 **LONGITUDE** -122.31369

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**

NOTES Depth of Topsoil & Sod 8": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL	
0.5						34.5
		MC = 10.2%	SM		Brown silty SAND, loose to medium dense, damp to moist	
2.5						32.5
		MC = 35.0% LL = 44 PL = 35 Fines = 81.1%			Gray SILT with sand, medium dense, moist to wet	
5						
			ML		-light groundwater seepage, slight caving at seepage point	
		MC = 43.7%			-light groundwater seepage	
9.0		MC = 36.9%				26.0

Test pit terminated at 9.0 feet below existing grade. Groundwater encountered at 5.0 and 7.5 feet during excavation. Caving observed at 5.0 feet.

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TEST PIT NUMBER TP-6

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat

DATE STARTED 11/2/21 **COMPLETED** 11/2/21 **GROUND ELEVATION** 35 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18498 **LONGITUDE** -122.31417

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**

NOTES Depth of Topsoil & Sod 6": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION	
0			TPSL		0.5	Dark brown TOPSOIL, root to 1.5'	34.5
			SM		2.0	Brown silty SAND, loose to medium dense, damp (Fill) -asphalt debris	33.0
		MC = 42.8%	SP-SM		3.5	Brown poorly graded SAND with silt, medium dense, wet -becomes gray, groundwater seepage, moderate iron oxide staining	31.5

Test pit terminated at 3.5 feet below existing grade. Groundwater encountered at 3.0 feet during excavation. No caving observed.

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TEST PIT NUMBER TP-7

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat

DATE STARTED 11/2/21 **COMPLETED** 11/2/21 **GROUND ELEVATION** 35 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18518 **LONGITUDE** -122.31399

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**

NOTES Depth of Topsoil & Sod 12": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL, roots to 1.5'	
					1.0	34.0
		MC = 16.6% Fines = 26.2%	SM		Brown silty SAND, loose to medium dense, moist [USDA Classification: slightly gravelly loamy SAND] -moderate caving to BOH -groundwater	
					4.5	30.5
5			ML		Gray SILT, medium dense, wet -becomes saturated	
		MC = 40.4%				
		MC = 50.1%			9.0	26.0

Test pit terminated at 9.0 feet below existing grade. Groundwater encountered at 4.0 feet during excavation. Caving observed from 4.0 feet to BOH.

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TEST PIT NUMBER TP-8

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat

DATE STARTED 11/2/21 **COMPLETED** 11/2/21 **GROUND ELEVATION** 35 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18494 **LONGITUDE** -122.31338

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**

NOTES Depth of Topsoil & Sod 6": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL	0.5	Dark brown TOPSOIL, roots	34.5
		MC = 39.6%	SM	2.5	Brown silty SAND, loose to medium dense, damp (Fill) -asphalt debris, plastic debris	32.5
		MC = 37.5% CEC = 14.0 meq/100g OC = 2.7%	ML		Gray SILT, medium dense, wet -moderate iron oxide staining at contact	
		MC = 43.8%		4.5	-groundwater	30.5

Test pit terminated at 4.5 feet below existing grade. Groundwater encountered at 4.0 feet during excavation. No caving observed.

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TEST PIT NUMBER TP-9

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat

DATE STARTED 11/2/21 **COMPLETED** 11/2/21 **GROUND ELEVATION** 35 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18506 **LONGITUDE** -122.31362

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**

NOTES Depth of Topsoil & Sod 6": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL, roots to 6"	34.5
		MC = 6.7%	SM		Brown silty SAND with gravel, loose to medium dense, damp to moist (Fill)	
2.0					-asphalt debris, brick debris	33.0
		MC = 60.7% CEC = 15.0 meq/100g OC = 4.7% MC = 63.2%	ML		Brown SILT with sand, medium dense, saturated -becomes gray, moderate to severe iron oxide staining	
4.0					-groundwater	31.0

Test pit terminated at 4.0 feet below existing grade. Groundwater encountered at 3.5 feet during excavation. No caving observed.

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TEST PIT NUMBER TP-10

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat

DATE STARTED 11/2/21 **COMPLETED** 11/2/21 **GROUND ELEVATION** 35 ft

EXCAVATION CONTRACTOR NW Excavating **LATITUDE** 47.18493 **LONGITUDE** -122.31403

EXCAVATION METHOD **GROUND WATER LEVEL:**

LOGGED BY SKH **CHECKED BY** KDH ▽ **AT TIME OF EXCAVATION**

NOTES Depth of Topsoil & Sod 6": grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION	
0			TPSL		0.5	Dark brown TOPSOIL, roots to 8"	34.5
			SM		1.5	Brown silty SAND, loose to medium dense, moist (Fill) -asphalt debris	33.5
			GM		2.5	Brown silty GRAVEL with sand, medium dense, moist -becomes gray, infiltration test [USDA Classification: very gravelly LOAM]	32.5
		MC = 20.9% Fines = 38.6%					

Test pit terminated at 2.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

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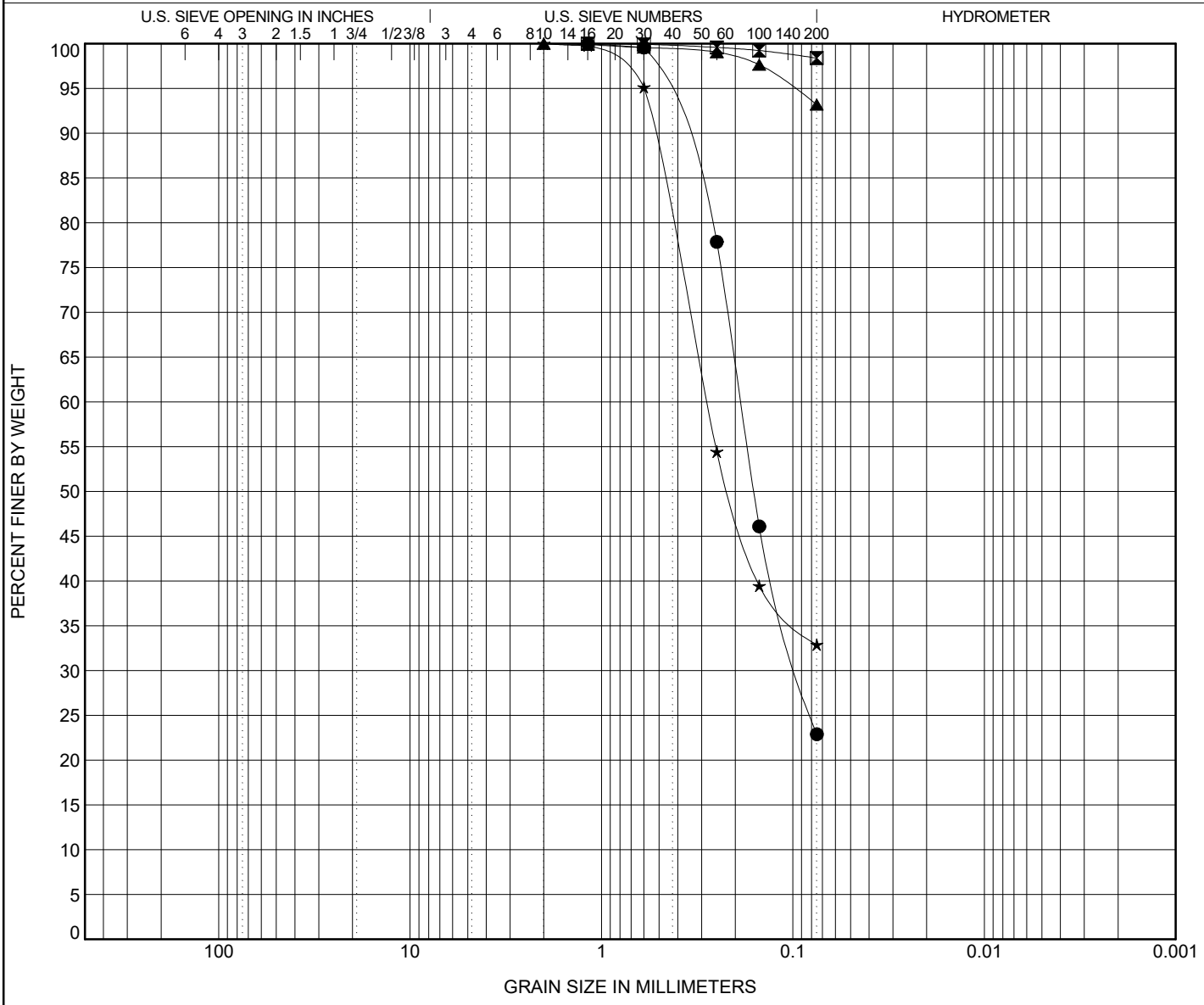
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	**TP-01**	**5.00ft.**	**USDA: Blue-Gray Fine Sandy Loam. USCS: SM.**		
⧓	**TP-02**	**4.00ft.**	**USDA: Gray Loam. USCS: ML.**		
▲	**TP-03**	**2.50ft.**	**USDA: Gray Loam. USCS: ML.**		
★	**TP-04**	**1.50ft.**	**USDA: Brown Sandy Loam. USCS: SM.**		

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**TP-01**	**5.0ft.**	**1.18**	**0.188**	**0.093**					**22.9**	
⧓	**TP-02**	**4.0ft.**	**1.18**							**98.4**	
▲	**TP-03**	**2.5ft.**	**2**							**93.2**	
★	**TP-04**	**1.5ft.**	**2**	**0.282**						**32.9**	

GRAIN SIZE USDA ES-8181 MULLAN SHORT PLAT.GPJ GINT US LAB.GDT 10/22/21

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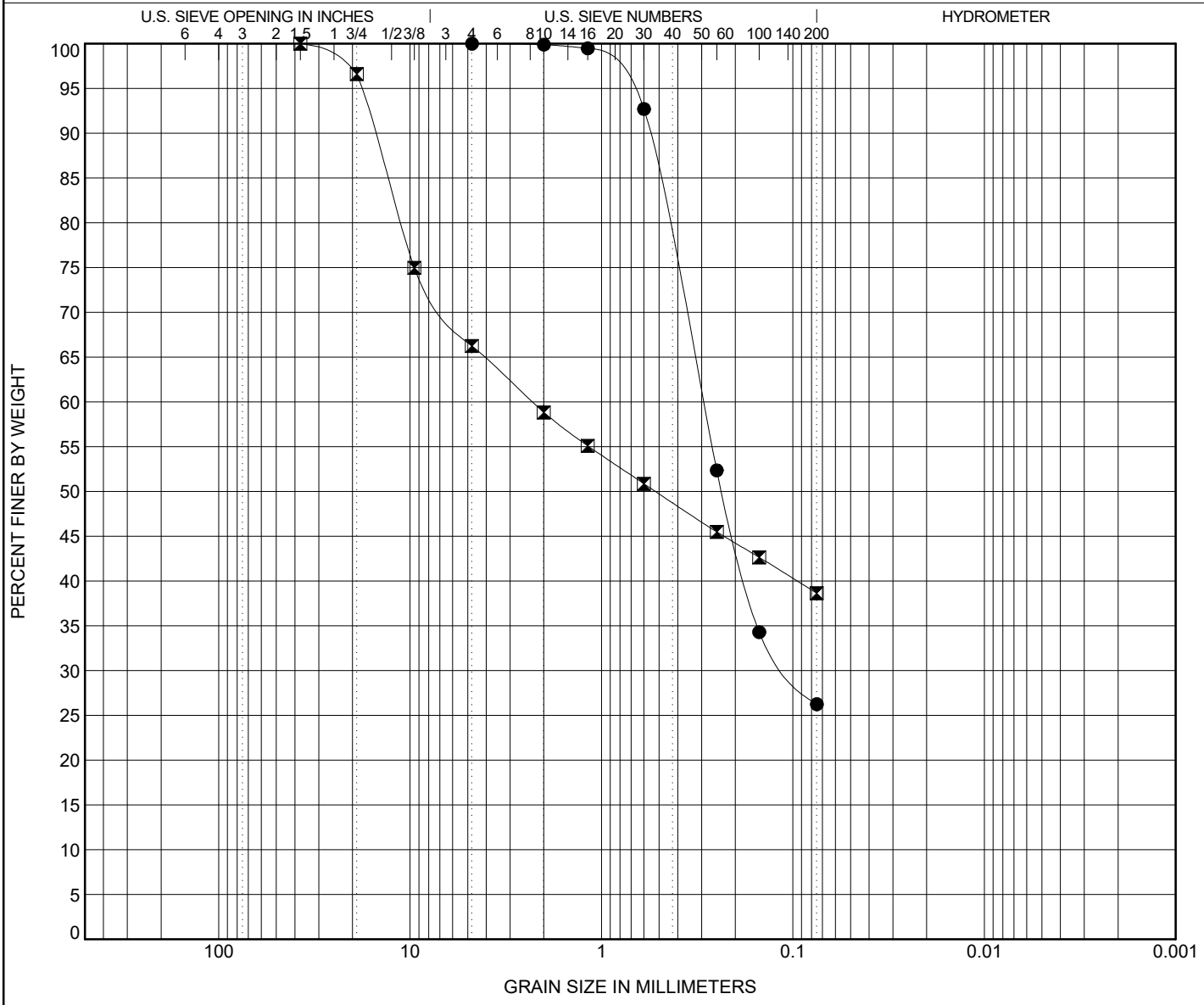
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	**TP-07**	**2.00ft.**	**USDA: Brown Slightly Gravelly Loamy Sand. USCS: SM.**		
⊠	**TP-10**	**2.50ft.**	**USDA: Gray Very Gravelly Loam. USCS: GM with Sand.**		

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**TP-07**	**2.0ft.**	**4.75**	**0.295**	**0.104**					**26.2**	
⊠	**TP-10**	**2.5ft.**	**37.5**	**2.294**						**38.6**	

GRAIN SIZE USDA ES-8181 MULLAN SHORT PLAT.GPJ GINT US LAB.GDT 11/19/21

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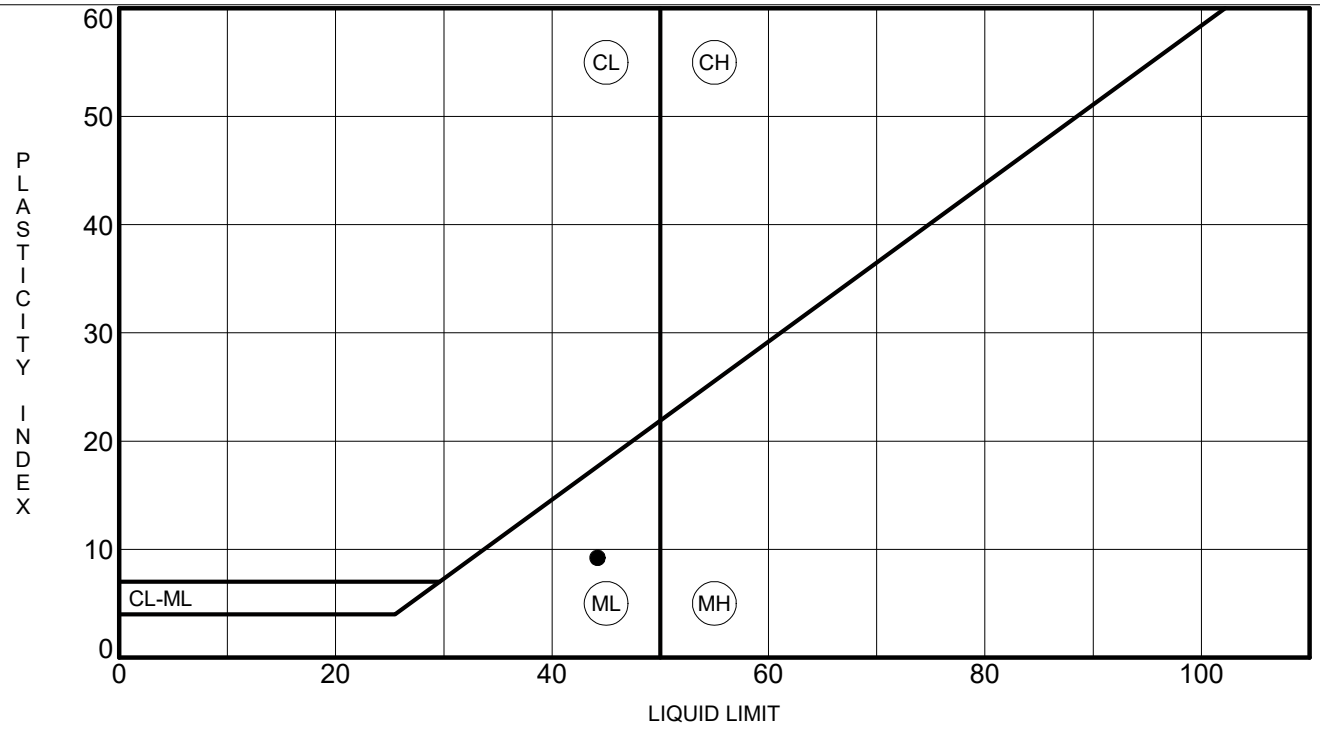
ATTERBERG LIMITS' RESULTS

PROJECT NUMBER ES-8181 **PROJECT NAME** Mullan Short Plat



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**TP-05**	**3.0**	**44**	**35**	**9**	**81.1**	**Gray SILT with Sand, ML**

Am Test Inc.
13600 NE 126TH PL
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Professional Analytical Services

ANALYSIS REPORT

EARTH SOLUTIONS NW
1805 136TH PL NE
BELLEVUE, WA 98005
Attention: KEVEN HOFFMAN
Project Name: MULLAN SHORT PLAT
All results reported on an as received basis.

Date Received: 11/08/21
Date Reported: 11/23/21

AMTEST Identification Number **21-A017058**
Client Identification **TP-8, 3.5'**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	14.	meq/100g		0.5	SW-846 9081	JDR	11/18/21

AMTEST Identification Number **21-A017059**
Client Identification **TP-9, 3'**
Sampling Date

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	15.	meq/100g		0.5	SW-846 9081	JDR	11/18/21

Kathy Fugiel
President