Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

August 25, 2022
ES-8694

Ms. Deb Alexander
6010 East Mercer Way
Mercer Island, Washington 98040

Subject: **Geotechnical and Geologically Hazardous Areas Evaluation**
Proposed Residential Addition
6010 East Mercer Way
Mercer Island, Washington

Reference: C.O. Davidson Architects and CT Engineering Inc.
Architectural and Structural Plans
Project Nos. 2022-4 and 22055 (respectively), dated May 2022

Troost, K.G. and Wisher, A.P.
Geologic Map of Mercer Island, Washington, dated October 2006

Snyder, D.E., Gale, P.S., and Pringle, R.F.
United States Department of Agriculture, Soil Conservation Service
Soil Survey of King County Area, Washington, November 1973

Web Soil Survey (WSS) Online Resource

City of Mercer Island
Landslide, Erosion, and Seismic Hazard Assessment Maps, dated April 2009
Low Impact Development Infiltration Feasibility Map (Figure 3), dated 2009
Mercer Island City Code

Tetra Tech, Inc.
Liquefaction Susceptibility Map of King County, Map 11-5, dated May 2010

Dear Ms. Alexander:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this geotechnical and geologically hazardous areas evaluation letter to support the proposed residential addition. We performed our work in general accordance with the scope of services outlined in our proposal dated June 17, 2022 and authorized on June 20, 2022. A summary of our subsurface exploration, laboratory analyses, geologically hazardous areas evaluation, and recommendations with respect to the proposed residential addition are provided in this letter report.

Project & Site Description

The subject site is a waterfront property located on the east side of Mercer Island, east of East Mercer Way, in Mercer Island, Washington. Access to the property is provided via Glenhome Road and private access lanes. The site consists of one tax parcel (King County Parcel No. 1924059206) and totals roughly 0.42 acres of land area. The approximate site location is depicted on Plate 1 (Vicinity Map).

Currently, the property is developed with a single-family residence and associated improvements. Site topography descends at moderate gradients to the east, and we estimate roughly 55 feet of topographic relief occurs within the property boundaries. The site is bordered to the east by Lake Washington, and to the north, south, and west by a driveway and existing single-family residential development.

We understand the proposed project includes a roughly 250-square foot addition to the existing home. The addition will be located between the existing home and the detached garage, generally in the northwestern portion of the property. Significant earthwork and land disturbance are not anticipated to be necessary, given the limited size and scope of the addition.

At the time of report submission, specific building load values were not available for review; however, we anticipate the proposed residential addition will consist of relatively lightly loaded wood framing supported on conventional foundations. Based on our experience with similar projects, we estimate wall loads of about 0.75 to 1.5 kips per linear foot and slab-on-grade and slab-on-grade loading of 150 pounds per square foot (psf) will be incorporated into the final design.

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

Subsurface Conditions

An ESNW representative observed, logged, and sampled three hand-auger borings advanced at accessible locations within the property boundaries on June 24, 2022, using hand tools. The borings were completed to assess and classify the site soils and to characterize the groundwater conditions within areas proposed for new construction. The maximum exploration depth was approximately four feet below the existing ground surface (bgs).

The approximate locations of the borings are depicted on Plate 2 (Hand-Auger Boring Location Plan). Please refer to the attached boring logs for a more detailed description of subsurface conditions. Representative soil samples collected at our exploration sites were analyzed in general accordance with Unified Soil Classification System (USCS) and USDA methods and procedures.

Topsoil and Fill

Topsoil was generally encountered within the upper 3 to 10 inches of existing grades at the boring locations, but was completely missing at one boring location (HA-3). Given the limited development area, wide variations in topsoil thickness are not anticipated. The topsoil was characterized by its dark brown color, the presence of fine organic material, and small root intrusions.

Fill was encountered at test locations HA-1 and HA-2 extending to a maximum observed depth of about four feet bgs (maximum reach of hand-auger tool). The fill was characterized as a gray silty sand with gravel in a medium dense to dense and moist condition. Based on the existing developed condition, we assume the observed fill was placed as part of the lot grading and landscaping activities during initial site development.

Native Soil

Underlying the topsoil and fill and within the proposed development envelope, native soils consisted primarily of well-graded sand with silt and gravel (USCS: SW-SM). At test location HA-3, native soils were encountered throughout the borehole and consisted of silt with sand (USCS: ML) in a medium dense to dense condition.

Geologic Setting

Geologic mapping of the area identifies Pre-Olympia coarse grained glacial deposits (Qpogc) as the primary geologic unit underlying the subject site, with Pre-Olympia glacial till (Qpogt) and lake deposits (Ql) in sequence downhill to the east, and Pre-Olympia nonglacial deposits (Qpon) uphill to the west.

As described on the geologic map resource, Pre-Olympia coarse grained glacial deposits consist of sand and gravel with variable silt content and layering in a moderately to heavily oxidized condition. Glacial till is typically described as a non-sorted mixture of clay, silt, sand, and gravel in variable amounts, deposited directly beneath the glacier as it advanced over bedrock and older deposits. Lake deposits are comprised of silt and clay with local sand layers, peat, and other organic sediments that were deposited in slow-flowing water. Some areas mapped as lake deposits are lake-bottom sediments exposed by the lowering of Lake Washington in 1916, and are locally gradational with recessional lacustrine (Qvrl), alluvium (Qal), and peat (Qp) deposits. Pre-Olympia nonglacial deposits consist of sand, gravel, silt, clay, and organic deposits of inferred nonglacial origin, primarily based on the presence of paleosols and tephra layers.

The online WSS resource identifies Kitsap silt loam (Map Unit Symbol: KpD) as the primary soil unit underlying the site. Kitsap series soils formed atop glacial lake deposits under a cover of conifer trees and shrubs. Per the referenced soil survey report, runoff over this soil unit is characterized as rapid, with severe erosion hazard and slippage potential.

In our opinion, the native soils observed at our test locations are glacial in origin, generally consistent with the typical makeup of both coarse- and fine-grained outwash deposits.

Groundwater

Groundwater was not observed during our June 2022 subsurface exploration – it should be noted, however, that the maximum exploration depth was limited to about four feet below existing grades. In our experience, groundwater seepage is typical of glacially derived deposits and should be expected within site excavations, particularly during the wet season.

Groundwater seepage rates and elevations may 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 Review

As part of our evaluation, we reviewed City of Mercer Island City Code (MICC) Chapter 19.07.160 – Geologically Hazardous Areas to evaluate the presence of geologically hazardous areas at the subject site. Per the Mercer Island Municipal Code, geologically hazardous areas within the City of Mercer Island include areas susceptible to erosion, sliding, earthquake, or other geological events based on a combination of slope (gradient or aspect), soils, geologic material, hydrology, vegetation, or alterations, including landslide hazard areas, erosion hazard areas, and seismic hazard areas.

Based on our review of the City of Mercer Island GIS Portal, the site contains mapped areas of steep slope, erosion, and seismic hazard areas. Detailed evaluations of each hazard type are provided below:

Landslide Hazard Areas

Landslide hazard areas are those areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors. Review of Mercer Island's GIS Portal indicates the site is located entirely within a "potential slide" area. The detail provided on the referenced Mercer Island Landslide Hazard Assessment map confirms the project is located within a known or suspected landslide hazard area.

The proposed development envelope consists of a relatively level area which then breaks and descends to the east-northeast at gradients at or exceeding 40 percent along the northern property line, meeting the definition criteria for landslide hazard areas. However, based on our review, there are no known landslide deposits at the subject site or within the immediate vicinity, nor is there any evidence of past movement or mass wastage debris on site. The site is not subject to rapid stream incision nor stream bank erosion. No evidence of relatively permeable sediments atop relatively impermeable sediments was observed during our subsurface exploration. Groundwater seepage was also not observed at any of the exploration locations.

Per the MICC, "alteration of landslide hazard areas […] may occur" pending the results of a critical area study. Given the size of the proposed residential addition (i.e., roughly 250 square feet) and the existing, developed condition of the site, it is our professional opinion that the project proposal will not increase the risk of landsliding at the site. In our opinion, the proposal will not adversely impact other critical areas, will not adversely impact the subject property or adjacent properties, and will mitigate impacts to the landslide hazard area to the maximum extent reasonably possible - the development is so minor as not to pose a threat to the public health, safety and welfare.

Erosion Hazard Areas

The referenced Mercer Island Erosion Hazard Assessment map indicates the site is located entirely within an erosion hazard area. As described in the *Geologic Setting* section of this letter report, the native Kitsap series soils are characterized by the USDA with severe erosion potential. As such, to mitigate the potential for soil erosion, Best Management Practices (BMPs) in accordance with both accepted practice and the requirements of the approved stormwater management plans (MICC Chapter 15.09) should be adhered to during the design and construction phases of the project. Typical erosion control practices are considered adequate for mitigating soil erosion during construction activities, and final landscaping including re-establishment of vegetative groundcover is generally sufficient in stabilizing the post-construction land surface.

At a minimum, silt fencing should be placed along the downslope site margins, and soil stockpiles should be covered with plastic sheeting when not in use. If construction occurs during periods of wet weather, methods to control surface water runoff will be necessary. Construction stormwater should be collected and diverted away from the steepest slope gradients to an appropriate discharge location. Construction entrances should be prepared to minimize off-site tracking of silt and soil generated during site construction.

Seismic Hazard Areas

A seismic hazard area is identified along the eastern-most portion of the property within about 50 feet of the shoreline. While we do not dispute the presence of this seismic hazard (likely associated with the geologic mapping of lake deposits), in our opinion, it is not relevant to the project as the proposed development envelope is at least 100 feet west of the identified hazard area. Furthermore, dense, glacially consolidated soils were observed at the exploration locations within the development envelope.

The referenced liquefaction hazard map indicates the site maintains a low to moderate hazard of liquefaction. In our opinion, site susceptibility to liquefaction may be considered very low to negligible based on the relatively dense soil conditions and lack of groundwater observed during our fieldwork.

<u>Geotechnical Recommendations</u>

In our opinion, construction of the proposed residential addition is feasible from a geotechnical standpoint. The geotechnical recommendations, conclusions, and considerations provided in the following sections are intended to support the proposed construction.

In-situ and Imported Soil

The in-situ soils encountered at the subject site have a high sensitivity to moisture and were generally in a moist condition at the time of exploration. Soils anticipated to be exposed on site will degrade if exposed to wet weather and construction traffic. Compaction of the soils to the levels necessary for use as structural fill may be difficult or impossible during wet weather conditions. Soils encountered during site excavations that are excessively over the optimum moisture content will likely require aeration or treatment prior to placement and compaction. Conversely, soils that are substantially below the optimum moisture content will require moisture conditioning through the addition of water prior to use as structural fill. An ESNW representative should determine the suitability of in-situ soils for use as structural fill at the time of construction.

Imported soil intended for use as structural fill should be evaluated by ESNW during construction. The imported soil must be workable to the optimum 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. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D1557). For soil placed in utility trenches underlying structural areas, compaction requirements are dictated by the local city, county, or utility district, and are typically specified to a relative compaction of at least 95 percent.

Subgrade Preparation

Following stripping within the proposed development envelope, ESNW should observe the subgrade to confirm soil conditions are as anticipated and to provide supplementary recommendations for subgrade preparation, as necessary. In general, foundation subgrades on native cut surfaces should be compacted in-situ to a minimum depth of one foot below the design subgrade elevation. Uniform compaction of structural fill and the foundation and slab subgrade areas will establish a relatively consistent subgrade condition below the foundation and slab elements. Supplementary recommendations for subgrade improvement may be provided at the time of construction and would likely include further mechanical compaction or overexcavation and replacement with suitable structural fill.

Foundations

The proposed residential addition can be supported on conventional spread and continuous footings bearing on undisturbed, competent native soil, recompacted native soil, or new structural fill bearing directly upon competent native soil. Based on our subsurface observations, at least three to four feet of existing fill soil is expected to be exposed within the development envelope, underlain by dense native soils. Where exposed, existing fill will likely need to be reworked and recompacted in place prior to foundation support.

Due to the relatively high moisture sensitivity of the site soils, foundation subgrade areas should be protected from wet weather or areas of remediation should be anticipated; a layer of crushed rock can be considered to protect foundation subgrade areas. If structural building pads are disturbed during wet weather, remediation measures such as overexcavation and replacement with rock may be necessary in some areas. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soil to the specifications of structural fill, or overexcavation and replacement with suitable structural fill will be necessary.

The geotechnical engineer should confirm suitability of foundation subgrades at the time of construction. Provided the structure will be supported upon dense native soil or reworked structural fill as described above, the following parameters may be used for design of the new foundations:

- Allowable soil bearing capacity 2,000 psf
- Passive earth pressure 250 pcf
- Coefficient of friction 0.40

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

Slab-on-Grade Floors

Slab-on-grade floors should be supported on competent, firm, and unyielding subgrades comprised of competent native soil or compacted 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 (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 the 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 retaining wall design:

- Active earth pressure (unrestrained condition) 35 pcf
- At-rest earth pressure (restrained condition) 55 pcf
- Traffic surcharge* (passenger vehicles) 70 psf (rectangular distribution)
- Passive earth pressure 300 pcf
- Coefficient of friction 0.40
- Seismic surcharge 8H psf†

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

The above passive earth pressure and coefficient of friction values include a safety factor of 1.5. Additional surcharge loading from adjacent foundations, sloped backfill, or other 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.

Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design. 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.

Drainage

Groundwater seepage may be encountered within site excavations depending on the time of year grading operations take place; however, given the limited amount of ground disturbance anticipated to occur on this site, groundwater that might be exposed would most likely be limited to minor interflow seepage. Temporary measures to control surface water runoff and groundwater during construction would likely involve passive elements such as interceptor trenches, interceptor swales, and sumps. ESNW should be consulted during preliminary grading to 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 or slopes. In our opinion, a foundation drain should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Infiltration Feasibility

Review of the referenced infiltration potential map indicates that infiltrating LID facilities are not permitted at the subject site. In general, given the relatively steep slope gradients and glacially consolidated soils observed at the site, infiltration is not recommended from a geotechnical standpoint.

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*)	1.448
Mapped 1-second period spectral response acceleration, S_1 (*g*)	0.502
Short period site coefficient, F_a	1
Long period site coefficient, F_v	1.798†
Adjusted short period spectral response acceleration, S_{MS} (*g*)	1.448
Adjusted 1-second period spectral response acceleration, S_{M1} (*g*)	0.903†
Design short period spectral response acceleration, S_{DS} (*g*)	0.966
Design 1-second period spectral response acceleration, S_{D1} (*g*)	0.602†

* *Assumes dense native soil conditions, encountered to a maximum depth of four feet bgs during the June 2022 field exploration, 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.*

As indicated in the table footnote, several of the seismic design values provided above are dependent on the assumption that site-specific ground motion analysis (per Section 11.4.8 of ASCE 7-16) will not be required for the subject project. ESNW recommends the validity of this assumption be confirmed at the earliest available opportunity during the planning and early design stages of the project. Further discussion between the project structural engineer, the project owner, and ESNW may be prudent to determine the possible impacts to the structural design due to increased earthquake load requirements under the 2018 IBC. ESNW can provide additional consulting services to aid with design efforts, including supplementary geotechnical and geophysical investigation, upon request.

Liquefaction is a phenomenon where saturated or loose soil suddenly loses internal strength and behaves as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or other source of intense ground shaking. In our opinion, site susceptibility to liquefaction may be considered very low to negligible. The relative density of the native soils and the absence of a uniformly established, shallow groundwater table were the primary bases for this opinion.

Limitations & Additional Services

This letter has been prepared for the exclusive use of Ms. Deborah Alexander and her representatives. The recommendations and conclusions provided in this letter report 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 neither expressed nor implied. If the design assumptions outlined herein either change or are incorrect, ESNW should be contacted to review the recommendations provided in this letter report. ESNW should be contacted to review the final design to confirm that our geotechnical recommendations have been incorporated into the plans.

ESNW should be retained to provide earthwork observations and testing services during construction. Variations in the soil and groundwater conditions observed at the exploration locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this letter report if variations are encountered.

We appreciate the opportunity to be of service to you and trust this letter meets your current needs. Should you have any questions, or require additional information, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

State of Washington
Engineering Geologist
2561
Licensed Geologist
08/25/2022
Scott S. Riegel

Brian C. Snow, G.I.T.
Senior Staff Geologist

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

Attachments: Plate 1 – Vicinity Map
Plate 2 – Hang Auger Boring Location Plan
Plate 3 – Retaining Wall Drainage Detail
Plate 4 – Footing Drain Detail
Hand Auger Boring Logs
Grain Size Distribution

cc: Davidson Architects
Attention: Mr. Chris Davidson (Email only)

Reference:
King 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.

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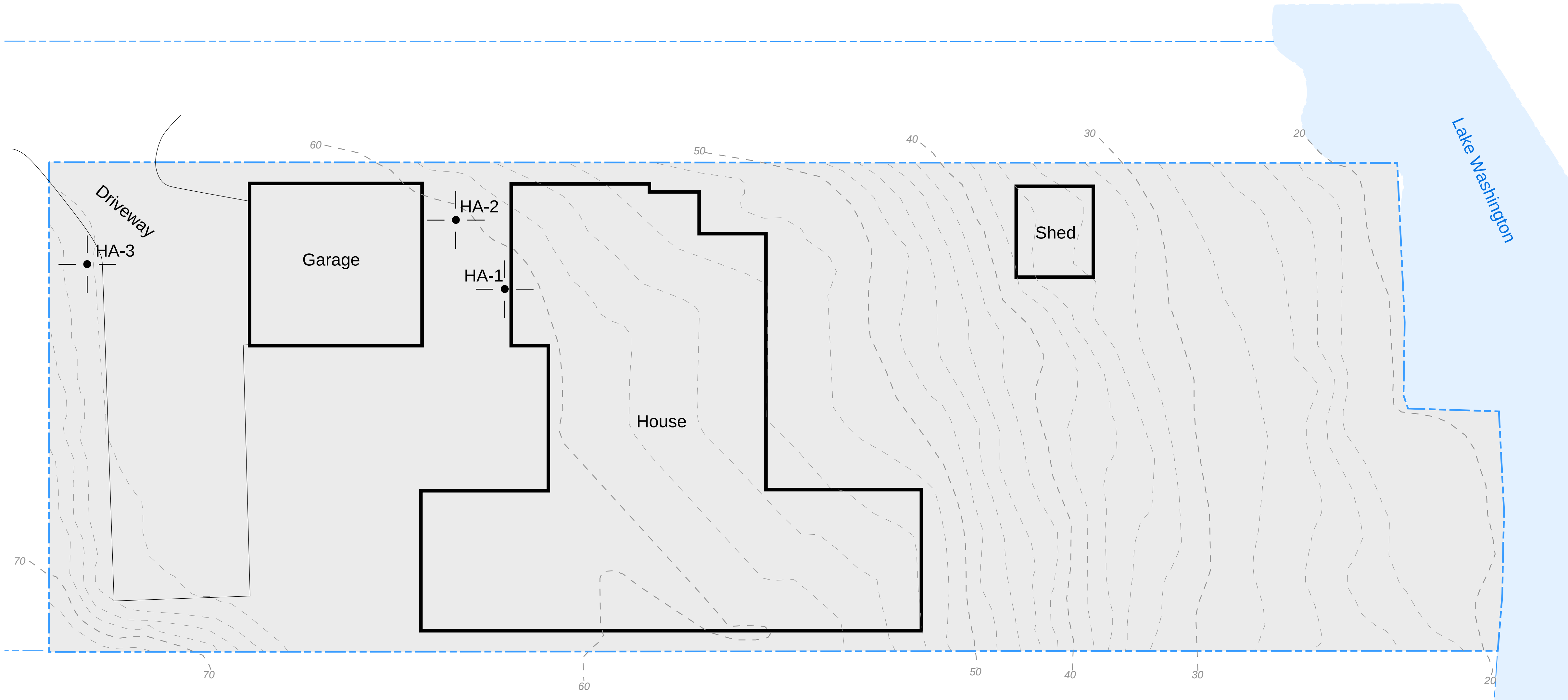
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Alexander Residence
Mercer Island, Washington

Drwn. MRS	Date 07/28/2022	Proj. No. 8694
Checked SSR	Date July 2022	Plate 1

Hand Auger Boring Location Plan
Alexander Residence
Mercer Island, Washington



LEGEND

HA-1 — Approximate Location of ESNW Hand Auger Boring, Proj. No. ES-8694, June 2022

Subject Site

Existing Building

NORTH

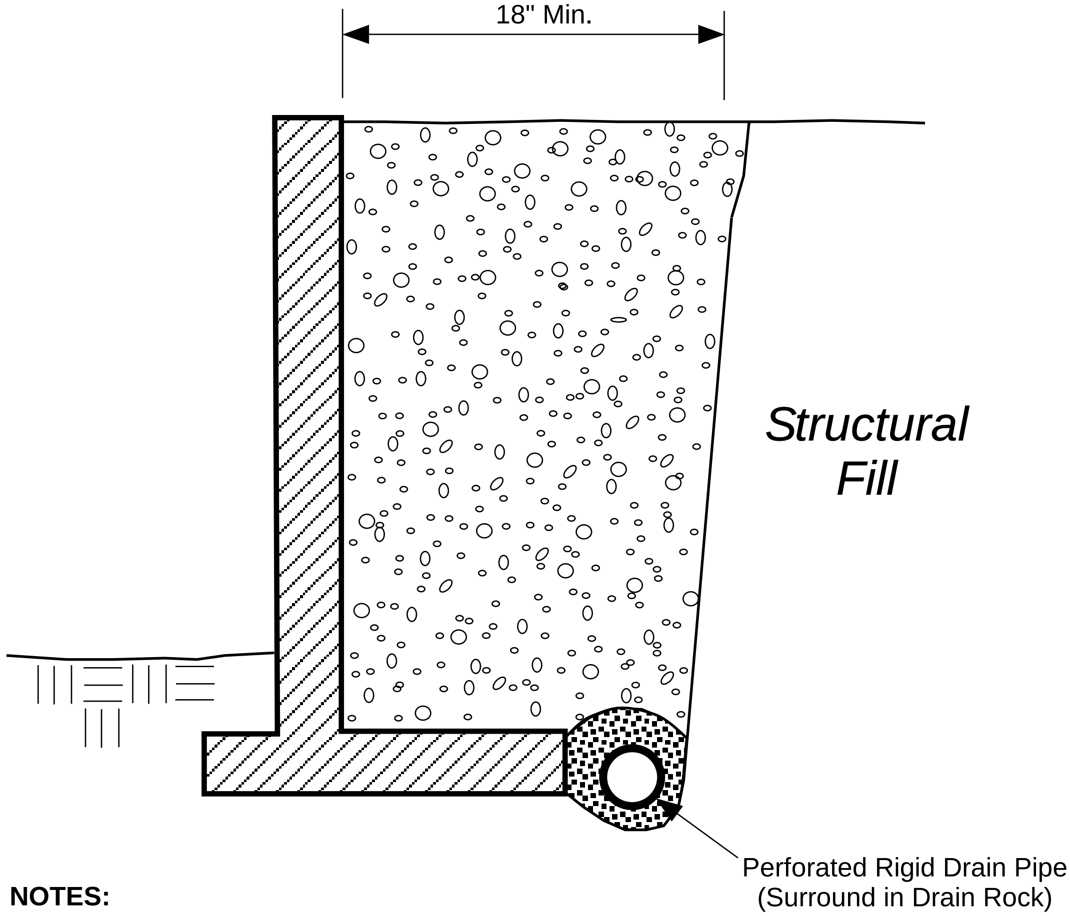
NOT - TO - SCALE

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

Drwn. By	MRS
Checked By	SSR
Date	07/28/2022
Proj. No.	8694
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

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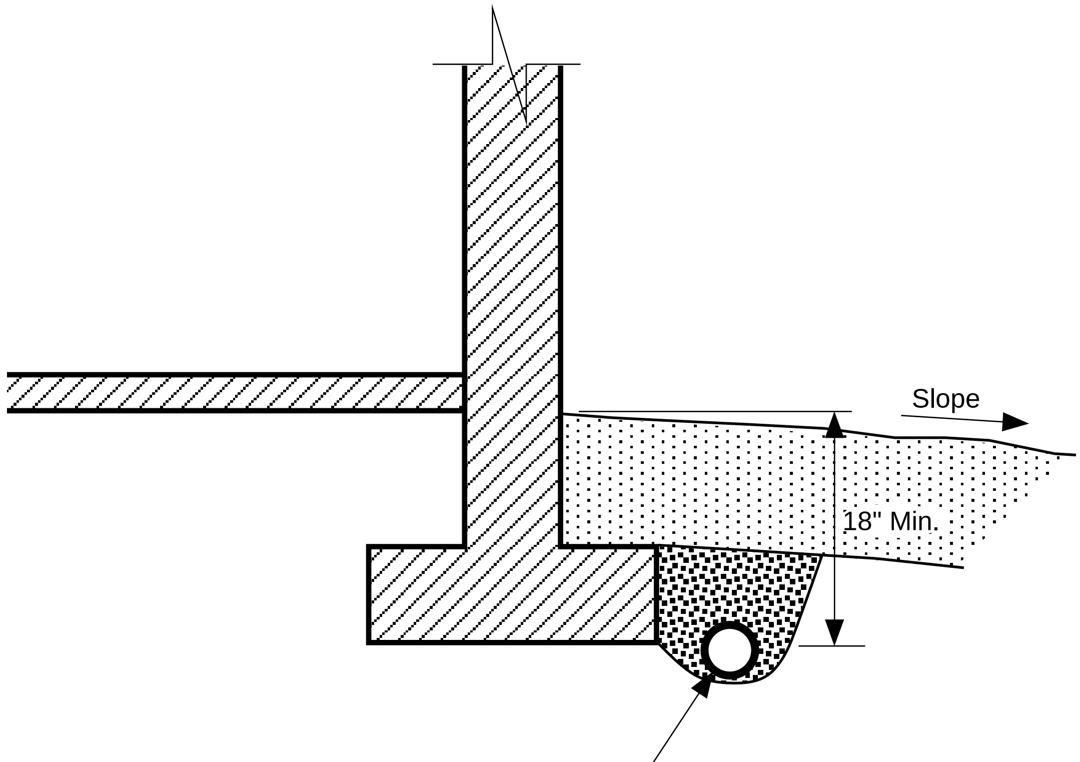
Retaining Wall Drainage Detail
Alexander Residence
Mercer Island, Washington

Drwn. CAM	Date 08/25/2022	Proj. No. 8694
Checked SSR	Date Aug. 2022	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 NWLLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Footing Drain Detail
Alexander Residence
Mercer Island, Washington

Drwn. MRS	Date 08/25/2022	Proj. No. 8694
Checked SSR	Date Aug. 2022	Plate 4

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
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

BORING NUMBER HA-1

PROJECT NUMBER ES-8694 **PROJECT NAME** Alexander Residence
DATE STARTED 6/24/22 **COMPLETED** 6/24/22 **GROUND ELEVATION**
DRILLING CONTRACTOR ESNW Rep **LATITUDE** 47.54917 **LONGITUDE** -122.21018
LOGGED BY BCS **CHECKED BY** SSR **GROUND WATER LEVEL:**
NOTES ▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Landscaping/Flower beds **AFTER DRILLING**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			TPSL	0.6	Dark brown TOPSOIL
		MC = 12.6%	SM		Gray silty SAND, medium dense, moist (Fill)
		MC = 13.8% Fines = 34.6%			[USDA Classification: slightly gravelly sandy LOAM]
2.5					-increasing density
		MC = 12.4%			-scattered plant roots, gravel
		MC = 10.7%		4.0	

Hand auger boring terminated at 4.0 below existing grade due to maximum hand auger reach. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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

BORING NUMBER HA-2

PROJECT NUMBER ES-8694
PROJECT NAME Alexander Residence
DATE STARTED 6/24/22 **COMPLETED** 6/24/22
GROUND ELEVATION
DRILLING CONTRACTOR ESNW Rep
LATITUDE 47.54921 **LONGITUDE** -122.2102
LOGGED BY BCS **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES
AT TIME OF DRILLING
SURFACE CONDITIONS Landscaping/Flower beds
AFTER DRILLING

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		MC = 13.4% MC = 13.7% MC = 14.6%	SM		Gray silty SAND with gravel, dense, moist (Fill)
2.5					
3.0		MC = 11.7% MC = 7.1% Fines = 8.9%	SW-SM		Brown well-graded SAND with silt and gravel, dense, damp -becomes gray [USDA Classification: gravelly SAND]
4.0					

Test pit terminated at 4.0 feet below existing grade due to maximum hand auger reach. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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

BORING NUMBER HA-3

PROJECT NUMBER ES-8694
PROJECT NAME Alexander Residence
DATE STARTED 6/24/22 **COMPLETED** 6/24/22
GROUND ELEVATION
DRILLING CONTRACTOR ESNW Rep
LATITUDE 47.54918 **LONGITUDE** -122.21045
LOGGED BY BCS **CHECKED BY** SSR
GROUND WATER LEVEL:
NOTES
▽ **AT TIME OF DRILLING**
SURFACE CONDITIONS Bare Soil, toe of cut rockery
AFTER DRILLING

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			ML		Gray SILT with sand, medium dense, moist to wet
		MC = 19.0%			-becomes dense
		MC = 21.8% Fines = 83.8%			-little to no gravel
2.5					[USDA Classification: slightly gravelly LOAM]
		MC = 23.0%			
		MC = 21.0%		4.0	

Hand auger boring terminated at 4.0 feet below existing grade due to maximum hand auger reach. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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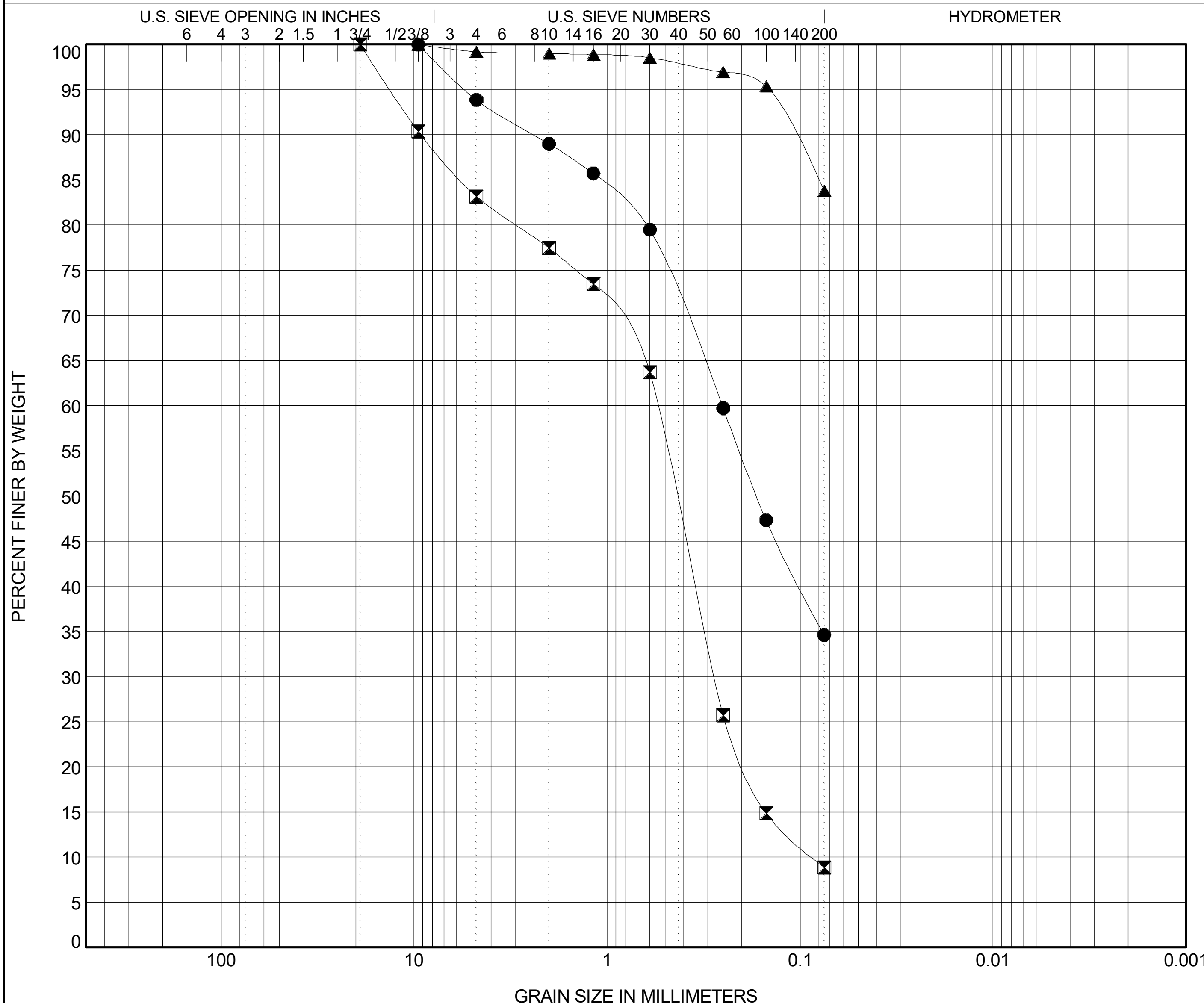
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-8694 **PROJECT NAME** Alexander Residence



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	**HA-01**	**2.00ft.**	**USDA: Gray Slightly Gravelly Sandy Loam. USCS: SM.**		
⧗	**HA-02**	**4.00ft.**	**USDA: Gray Gravelly Sand. USCS: SW-SM with Gravel.**	**1.62**	**6.47**
▲	**HA-03**	**2.00ft.**	**USDA: Gray Slightly Gravelly Loam. USCS: ML with Sand.**		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**HA-01**	**2.0ft.**	**9.5**	**0.253**						**34.6**	
⧗	**HA-02**	**4.0ft.**	**19**	**0.551**	**0.276**	**0.085**				**8.9**	
▲	**HA-03**	**2.0ft.**	**9.5**							**83.8**	