GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists
& Environmental Specialists

July 21, 2022 G-5571

Eric and Tricia Jaffe
8455 SE 83rd Street
Mercer Island, Washington 98040

Subject: Geotechnical Engineering Investigation
Proposed Residence Remodeling
8455 SE 83rd Street
Mercer Island, Washington

Dear Mr. and Ms. Jaffe:

GEO Group Northwest, Inc. is pleased to present our geotechnical engineering report for a proposed remodeling of the existing residence at the above-subject location on Mercer Island, Washington. Our services were provided per our proposal dated August 19, 2021.

SITE DESCRIPTION

The project site is located in a residential area on Mercer Island, Washington, as illustrated in Plate 1 – Site Location Map. The project site consists of an irregular-shaped lot that has a size of 13,480 square feet and is developed with a single-family residence having a main floor and a finished daylight basement. The site configuration, topography, and existing improvements are illustrated in Plate 2 – Site Plan.

PROPOSED PROJECT

We understand that the proposed remodeling of the residence will include an addition to its north side and an addition joining the south side of the existing garage to the residence. The north addition will have a bottom floor elevation similar to those of the existing basement level, and the addition between the garage and residence will have a floor level similar to the main level of the existing residence. Also, the elevated decking around the north, west, and south sides of the residence is planned to be renovated and extended in select portions. The locations of these proposed modifications are illustrated in Plate 3 – Proposed Project Layout.

GEOLOGIC OVERVIEW

According to published geologic mapping for the area[1], the site is underlain with glacial advance outwash deposits from the Vashon Stade of the Fraser Glaciation (the most recent glacial period in the Seattle region). These soils typically consist of fine to medium grained sand that may contain layers of silty sand or gravelly sand and may be either stratified or unstratified. They typically are dense to very dense where they have not been affected by weathering, groundwater, or by disturbance; and may contain groundwater if underlain by relatively less permeable soils.

The geologic mapping also indicates the presence of surface scarps along the east, south, and west perimeter of the larger upland area in which the project site is located. The mapping shows these scarps being located a minimum of approximately 150 feet east from the site property, approximately 370 feet west from the site property, and approximately 420 feet south from the site property.

SITE INVESTIGATION

Surface Conditions

On November 23, 2021, a geologist from our firm performed a visual reconnaissance of the soil and topographic conditions at the site. We observed no indications of soil instability or of water seepage or springs on the property. We observed that exposed portions of the exterior concrete footings around the perimeter of the existing residence did not exhibit cracks or other signs of structural distress.

[1] Troost, K.G., and A.P. Wisher, Geologic Map of Mercer Island, Washington, December 2006.

Subsurface Exploration

In addition to our site reconnaissance, we oversaw the drilling of two exploratory soil borings (B-1 and B-2) at the site. The borings were completed by a licensed drilling contractor using a manually-portable drilling rig equipped with hollow-stem augers. The borings were drilled to a depth of approximately 20 and 12 feet below ground surface. Both borings were terminated due to drilling refusal in suspected cobbly soils. The boring locations are indicated in Plate 2 – Site Plan.

We recorded the soil conditions encountered in the borings, and checked for the presence of groundwater or seepage in the borings during drilling. Soil density or consistency was evaluated by performing Standard Penetration Tests at multiple depths in the borings during drilling. Samples of the soil encountered were collected for examination and for moisture content testing at our office. Logs of the soil and groundwater conditions encountered in the borings are provided in Attachment A to this report.

Findings

The soils encountered in boring B-1 typically consisted of loose sand and silty sand sandy to a depth of approximately 12 feet, underlain with medium dense interbedded sand, silty sand, and sandy silt to approximately 20 feet, whereupon gravelly to cobbly conditions were encountered and prevented further progress. In boring B-2, loose sand and silty sand soils were encountered to a depth of approximately 7 feet, underlain with dense interbedded sand, silty sand, and sandy silt to approximately 10 feet. Very dense, gravelly soils were encountered from 10 feet to the bottom of the boring at approximately 12 feet, whereupon the conditions prevented further progress. Groundwater was not encountered in the borings during our activities.

GEOLOGIC HAZARD AREAS EVALUATION

We reviewed available geologic hazard areas information on the City of Mercer Island Department of Information and Geographic Services (IGS) website. The information indicates that the project site property contains potential landslide and soil erosion hazard critical areas. According to the IGS information, no steep slope areas are present on the project site, and no documented landslides are identified on the project site or on adjoining properties. The IGS landslide hazard and steep slope areas mapping for the immediate site vicinity is presented in Plate 4 – Geologic Hazard Area Mapping.

Evaluation of Potential Landslide Hazard

During our investigation, we observed no indications of soil instability or erosion on the site property, we observed no springs or water seepage on the site property, and groundwater was not found in the borings completed for our investigation. Additionally, unretained slopes steeper than 40 percent grade and greater than 10 feet in height are not present on the site property. Therefore, it is our opinion that the potential for landslide occurrence on the site is minimal.

Evaluation of Soil Erosion Hazard

In our opinion, the potential risk from soil erosion at the site due to the proposed project is low because of the existing developed and landscaped conditions on the site. However, exposure of the site soils, such as from construction activity, may increase the potential for soil erosion if appropriate controls are not implemented and maintained. The recommended temporary erosion and sediment controls described in the conclusions and recommendations section of this report will reduce the risk of soil erosion at the site to minimal levels if properly implemented and maintained. Post-construction erosion and sediment control should be established by implementing new landscaping and vegetation in areas where soils have been disturbed by the project.

SITE STABILITY EVALUATION

No documented landslide activity on the site property or on adjacent properties is indicated in the IGS mapping information. Also, we observed no indications of soil instability or erosion, landslide deposits, or springs on the site; and groundwater was not found in the borings completed for our investigation. Based on these findings, it is our opinion that the site is stable in its existing condition and that the proposed project presents minimal risk to the stability of the site or to adjacent property provided that the recommendations presented below in this report are properly implemented during project design and construction.

PROPOSED PROJECT RISK STATMENT

Consistent with Mercer Island City Code (MICC) Section 19.07.160(B)(3)), we have reviewed the proposed project with regard to the risk to the project associated with geologically hazardous areas. In our opinion, the landslide hazard area and soil erosion hazard areas will be modified or the development has been designed so that the risk to the site and adjacent property is eliminated or mitigated such that the site is determined to be safe provided that the recommendations presented below in this report are properly implemented during project design and construction.

CONCLUSIONS AND RECOMMENDATIONS

In our opinion, new building footings and new decking should be supported on small-diameter pipe piles that are embedded into the underlying competent soils. The bearing soils found at the soil boring locations are beyond what will be practical for open excavations to reach without extending beyond property lines or potentially disturbing existing footings. We also recommend that existing footings located in proximity to planned excavations that will extend below the footings be underpinned with small-diameter pipe piles before excavation begins, to ensure that support of the footings is maintained during construction. Our recommendations for these and other geotechnical aspects for the proposed project are presented below in the following sections of this report.

Site Seismic Design Classification

In our opinion, the project site can be assigned Seismic Site Class D (Medium Dense Soil Profile), per the International Building Code 2018 Edition (IBC 2018). Our determination is based upon the findings from our subsurface investigation activities and our knowledge and understanding of the typical deeper subsurface soil conditions in the site vicinity.

The seismic design parameters applicable for the site based on this site class per IBC 2018 are as follows:

$S_s = 1.467g$	$S_{ms} = 1.467g$	$S_{ds} = 0.978g$
$S_1 = 0.505g$	S_{m1} = null	S_{d1} = null

The peak ground acceleration for the site adjusted for site class effects is = 0.69g

In our opinion, the site has low susceptibility to damage from soil liquefaction or lateral spreading because soils found during our subsurface investigation were unsaturated.

Foundations

Small-Diameter Pipe Piles

Driven small-diameter steel pipe piles (also known as pin piles) also can be used to support new or existing foundations for the proposed project where the depth to suitable bearing soils is beyond practical excavation limits, such as in the area of the proposed deck renovation. The piles are driven until the resistance of the subsurface soils sufficiently retards or terminates the advancement of the piles; this condition typically is called "refusal". The depth at which refusal is achieved is dependent upon the specific combination of pipe and driving hammer that are used, and the characteristics of the subsurface soils that the pile encounters.

The following table presents design criteria for commonly-available combinations of driving hammers and pipe sizes. The allowable bearing capacities include a factor of safety of 2.

Pipe Pile Design Criteria

Pipe Diameter	Pipe Wall Thickness	Hammer Weight Class	Hammer Type	Refusal Criteria*	Allowable Capacity
2 inch	Schedule 80	90 pound	jackhammer	60 sec/inch	3 tons
2 inch	Schedule 80	140 pound	Rhino hammer	60 sec/inch	3 tons
3 inch	Schedule 40	650 pound	TB225†	12 sec/inch	6 tons
3 inch	Schedule 40	850 pound	TB325†	10 sec/inch	6 tons
4 inch	Schedule 40	850 pound	TB325†	16 sec/inch	10 tons
4 inch	Schedule 40	1100 pound	TB425†	10 sec/inch	10 tons

* = Maximum penetration rate to be sustained through at least 3 time-cycles of continuous driving.
† = Teledyne hydraulic hammer model number, or equivalent.

The soil conditions encountered in the borings for our investigation are not considered to be corrosive. Therefore, it is our opinion that the piles can consist of non-galvanized pipe.

We estimate that the maximum settlement of the pipe piles should be one-quarter (1/4) inch or less. No reduction in the pile capacities is required if the pile spacing is at least three times the pile diameter. A one-third increase in the above allowable pile capacities can be used when considering short-term transitory wind or seismic loads.

By themselves, pipe piles do not generate lateral capacities. Lateral forces can be resisted by the passive earth pressures developed from friction between grade beams or footings and the subgrade soils, or from using battered pipe piles or helical anchors. An allowable passive soil pressure of 300 pcf equivalent fluid weight, and coefficient of friction of 0.35 for the soil subgrade and the footings or grade beams can be used in design to address lateral resistance.

The performance of pipe piles is dependent on how and to what bearing stratum the piles are installed. Since a completed pile in the ground cannot be observed, it is critical that judgment and experience be used as a basis for determining the driving refusal and acceptability of a pile. Therefore, we recommend that we monitor the pile installation operation, collect and interpret installation data and verify achievement of pile driving refusal. We also suggest that the contractor's equipment and installation procedures be reviewed by us prior to pile installation to help mitigate problems which may delay the progress of the work.

Slab-on-Grade Floors

We recommend that new slab-on-grade floors be supported on small-diameter pipe piles or be structurally reinforced and connected to concrete grade beams. To avoid moisture build-up on the subgrade, floor slabs should be placed on a capillary break, which is in turn placed on the prepared subgrade. The capillary break should consist of a layer, at least 6 inches thick, of free-draining crushed rock or gravel containing no fines and no more than five percent material finer than a No. 4 sieve. A vapor barrier should be placed over the capillary break to reduce upward transmission of water vapor through the slab, if such transmission is undesirable.

Conventional Concrete Basement and Retaining Walls

The following recommendations regarding conventional concrete basement walls and retaining walls are provided below for use in the event of construction of conventional concrete basement or retaining walls up to approximately 10 feet in height. If taller walls are planned, please contact us to review and possibly modify the following recommendations.

Basement walls and conventional retaining walls should be supported on small-diameter pipe piles as discussed in the foundation recommendations presented above in this report and should be designed by a structural engineer. Independent conventional retaining walls (not attached to buildings) that are less than 4 feet in height, however, can be supported on a compacted structural fill pad.

Conventional concrete retaining walls which are free to rotate on top (unrestrained) are considered capable of yielding and should be designed using an active earth pressure. Concrete retaining walls which are restrained horizontally at the top (such as basement walls) are considered unyielding and should be designed using an at-rest earth pressure. Our recommended soil engineering parameters for retaining wall design are as follows:

Active Earth Pressure

- 35 pcf, equivalent fluid pressure, for level ground behind the walls;
- 50 pcf, equivalent fluid pressure, for wall backslope of 2H:1V

At-Rest Earth Pressure

- 45 pcf, equivalent fluid pressure, for level ground behind the walls;
- 60 pcf, equivalent fluid pressure, for wall backslope of 2H:1V

Passive Earth Pressure

- 300 pcf, equivalent fluid pressure, for undisturbed, medium dense native soil or structural fill, and level ground in front of the wall for a distance of two times the wall height;

Base Friction

- 0.35 for competent, native soil or structural fill

Surcharge loads imposed on walls due to driveways and traffic (including that during construction), upward sloping ground, or other conditions that could impose loads against the walls, should be added to the active and at-rest earth pressures stated above. Also, downward sloping ground in proximity to the walls should be evaluated, as it may have the effect of reducing the value of the allowable passive earth pressure stated above.

To prevent the buildup of hydrostatic pressure behind conventional basement or retaining walls, we recommend that a vertical drain mat, such as Miradrain 6000 or similar product, be used to facilitate drainage adjacent to the wall. The drain mat should extend from near the finished surface grade, downward to the bottom of the wall. A drainage collection pipe consisting of rigid 4”-diameter perforated PVC pipe surrounded with gravel and geotextile filter fabric (Mirafi 140NL, or equivalent) can be laid alongside the base of the wall and sloped to an acceptable tightline connection. In addition to the drain mat, we recommend that a zone of free-draining backfill material at least 12 inches wide should be placed against the matted wall. This backfill should extend downward to the drainage collection pipe. A layer of non-woven geotextile filter fabric should separate the free-draining backfill material from the adjacent soils or fills. These recommendations are schematically illustrated in Plate 5 – Typical Retaining Wall Drainage Detail.

The top 12 inches of the fill behind the wall can consist of topsoil if desired. This material can be separated from the underlying more granular drainage material by a geotextile fabric, if desired. Alternatively, the surface can be sealed with asphalt or concrete paving. Nearby final grades should be sloped to drain away from the wall, or other measures (such as strip or ribbon drains) should be used to intercept surface water that flows toward the wall.

The backfill for conventional concrete retaining walls should be compacted to a dense condition to mitigate the potential for later ground settlement or excessive saturation. Wall backfill that also will support structures or slab should be placed and compacted as structural fill. We recommend that restrained walls not be backfilled until their restraint has been completed, unless approved by the project structural engineer. The compacting machinery that is used should be compatible with the wall’s resistance capacity against the temporary loading effects produced by operation of the machinery. In this respect, the contractor should exercise care if heavy machinery such as a vibratory roller or hoe pack is used.

Surface Drainage

During construction, water should not be allowed to stand in areas where footings, slabs, or pavements are to be constructed. We recommend that ground surfaces be sealed at the end of the day by tracking over them with a piece of construction equipment or by compacting them, to reduce the potential for moisture infiltration which can degrade soil quality.

We recommend that storm water drainage from building roof areas and driveways be collected into a tightline system that conveys the water to an approved discharge location. Storm water should not be allowed to develop into concentrated flows on the ground surface, because concentrated flow can lead to soil erosion and rutting. Concentrated surface water also should not be allowed to onto the steep slope area on site and should not be directed onto adjacent properties. Final site grades should direct surface water away from buildings.

Subsurface Drainage

We recommend footing drains should be installed alongside new perimeter foundations and basement walls. The drains should consist of a 4-inch minimum diameter, perforated, rigid PVC drain pipe laid at the bottom of the footing or wall with the perforations facing downward. The drain line should be bedded on, surrounded by, and covered with a washed rock or gravel. The drain rock and pipe also should be wrapped with a layer of durable non-woven geotextile fabric. These recommendations are schematically illustrated in Plate 6 – Typical Footing Drain Detail.

The footing drain lines should be sloped at sufficient gradient to generate flow and should be tight-lined to an appropriate stormwater discharge location or collection sump system. The subsurface drainage lines should not be connected to roof downspout or other surface drainage lines.

Grading and Earthwork

Site Clearing and Erosion Control

The area where construction work will be performed should be cleared of vegetation, topsoil, organics, debris, and any other deleterious materials that are found. These materials should be hauled off site or used for landscaping, as appropriate; they should not be used as structural fill or retaining wall backfill for the project.

Temporary erosion and sedimentation controls (TESCs) should be installed as part of site clearing activities. TESCs for the project can include using silt fences, check dams, straw mulch, hay bales, and a stabilized construction entrance. The silt fences or other barrier controls should be placed along the cross-slope and down-slope boundaries of the disturbed areas to prevent sediment-laden runoff from being discharged off site. Exposed soils, including stockpiled soils, should be covered with plastic sheeting when they are not being worked.

Excavations and Slopes

Temporary excavation slopes should not be greater than the limits specified in local, state and federal government safety regulations. Temporary cuts which are greater than 4 feet in height typically can be sloped at inclinations up to 1H:1V (Horizontal: Vertical). In situations where water seepage or other adverse conditions are observed, temporary cuts in these soils may need to be made at shallower inclinations if recommended by the geotechnical engineer. If adequate space is not available to maintain open cuts per the recommendations in this report, engineered support may be required to provide lateral support to such excavations. Permanent unreinforced slopes at the site should be inclined no steeper than 2.5H:1V.

Surface runoff should not be allowed to flow over the top of slopes into excavations. During wet weather, exposed slopes should be covered with plastic sheeting to prevent erosion or softening. We recommend that a GEO Group Northwest representative be on site during excavation of cut slopes to verify anticipated geologic conditions and to evaluate slope stability, particularly if groundwater seepage, caving soils, or debris are encountered.

Subgrade Preparation

After the completion of site clearing and excavation, soils in areas to receive structural fill, concrete slabs, sidewalks, or pavements, should be prepared to a firm, condition free of loose or disturbed soils. The prepared subgrade should be observed and approved by the geotechnical engineer. Any detected soft spots or disturbed areas should be compacted or excavated and replaced with compacted structural fill or crushed rock as directed by the geotechnical engineer.

Structural Fill

Structural fill is typically defined as earthen material that is placed below buildings (including foundations and on-grade slab floors), sidewalks, driveways, or other structures, and provides support to those structures. Soils that meet the material specifications for structural fill as presented below in this report, or are otherwise approved by the geotechnical engineer, can be used for structural fill. Material which is stored on site for later use as structural fill should be covered with plastic sheeting to protect it from moisture if its usability is sensitive to its moisture content. Structural fill material should be placed and compacted in accordance with the recommendations provided below or as otherwise approved by the geotechnical engineer during construction.

Fill Material Specifications

Material used as structural fill should not contain rocks or lumps larger than 3 inches in its greatest dimension. During wet weather, the material should be granular in character, with a fines content (passing a #200 sieve) of less than 5 percent. The material should be placed at or near its optimum moisture content. If the material is too wet to be compacted to the required degree, it will be necessary to dry the material by aeration (which may be difficult), or to replace the material with an alternative suitable material in order to achieve the recommended compaction.

Compaction Specifications

Structural fill material placed under foundation footings and concrete floor slabs should be compacted to at least 92 percent of its maximum dry density as determined by ASTM D1557. Structural fill material under exterior slabs or pavements should be compacted to at least 90 percent of its maximum dry density, except for the top 12 inches of the material, which should be compacted to at least 95 percent of its maximum dry density.

Structural fill material should be spread and compacted in lifts that are 10 inches or less in thickness in an un-compacted state. The compacted fill material should be field tested by using ASTM Designations D2922 and D3017, Nuclear Probe Method, to verify that the required degree of compaction has been achieved.

Wet Weather Season Earthwork Considerations

We recommend that the following measures be implemented in supplement or replacement with the standard erosion and sediment control recommendations for earthwork during the wet weather season.

- Cut and fill slopes exposed during construction should be covered with plastic sheeting when they are not being worked. Soil stockpiles also should be covered when not being worked.

- Structural fill should consist of free-draining material with not more than 5% of the material passing a #4 sieve.

- Earthwork should not be performed during periods of heavy precipitation, in order to minimize rutting and tracking of soils by construction equipment traffic. Equipment that has lower potential to cause rutting or other soil disturbance should be used.

- Soil subgrades in areas where footings or slabs are to be built should be protected from softening due to standing water or to disturbance.

- Erosion control measures, such as silt fences, straw bales and wattle, etc., should be arranged to control soil erosion and sediment travel as appropriate within the project limits as well as along its downslope and cross-slope perimeter.

- Earthwork should be performed in a sequence of limited areas, where feasible, to limit the extent of exposed soil during the project.

- We recommend that we visit the project site upon completion of the installation of the perimeter erosion controls to verify their suitability. During earthwork to prepare the residence location for construction, we recommend that we visit the site if precipitation greater than 0.5 inches in a 24-hour period occurs, in order to monitor the performance of the TESC measures and monitor excavation stability. We also recommend that we visit the site during backfilling work to verify that the materials being used are appropriate for wet weather conditions and are being properly placed and compacted.

LIMITATIONS

This report has been prepared for the specific application to this site for the exclusive use of Eric and Tricia Jaffe and their authorized assignees or agents. Any other use of this report is solely at the user's own risk. We recommend that this report be included in its entirety in the project contract documents for reference during construction.

Our findings and recommendations stated herein are based on field observations, our experience with similar projects, and our professional judgment. The recommendations presented in this letter are our professional opinion derived in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area and within the project schedule and budget constraints. No warranty is expressed or implied. In the event that site conditions are found to differ from those described in this report, we should be notified so that the relevant recommendations in this report can be re-evaluated and modified if appropriate.

CLOSING

We appreciate this opportunity to provide you with geotechnical engineering services. Please feel free to contact us if you have any questions.

Sincerely,

GEO Group Northwest, Inc.

7/21/2022 7/21/2022

Keith Johnson
Project Geologist

William Chang, PE
Principal Engineer

Plates and Attachments:

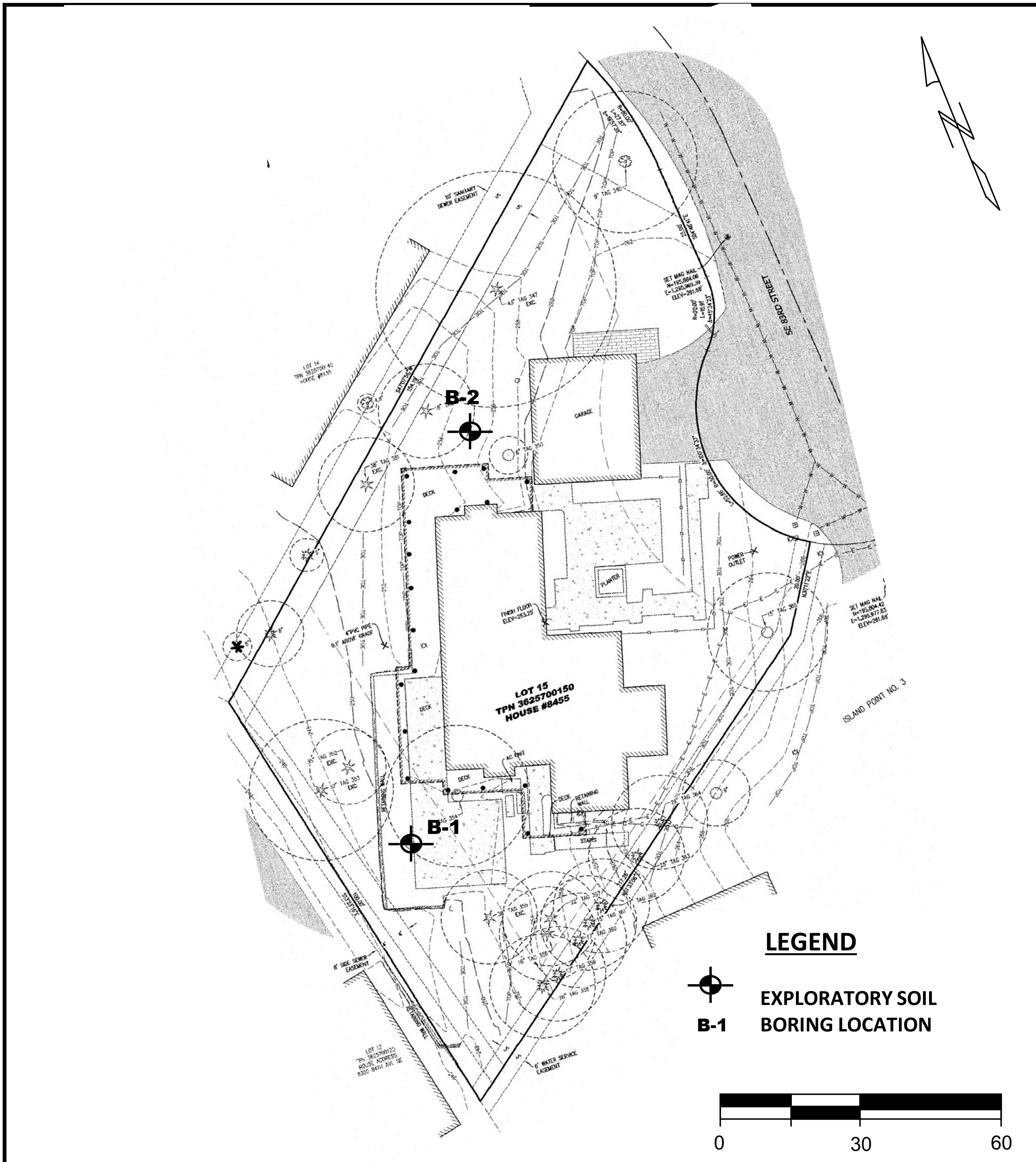
Plate 1 – Site Location Map
Plate 2 – Site Plan
Plate 3 – Proposed Project Layout
Plate 4 – Geologic Hazard Areas Mapping
Plate 5 – Typical Retaining Wall Drainage Detail
Plate 6 – Typical Footing Drain Detail

Attachment A – Boring Logs

Source: King County GIS, 2019.

GEO Group Northwest, Inc. Geotechnical Engineers, Geologists, & Environmental Scientists	**SITE LOCATION MAP** **PROPOSED RESIDENCE ADDITION** **8455 SE 83RD STREET** **MERCER ISLAND, WASHINGTON**

SCALE:	1" = 2000'	**DATE:**	7/21/2022	**MADE:**	KJ	**CHKD:**	WC	**JOB NO:**	G-5571	**PLATE**	1



Source: Topographic Survey by Apex Engine...ing, dated 12/21/21.

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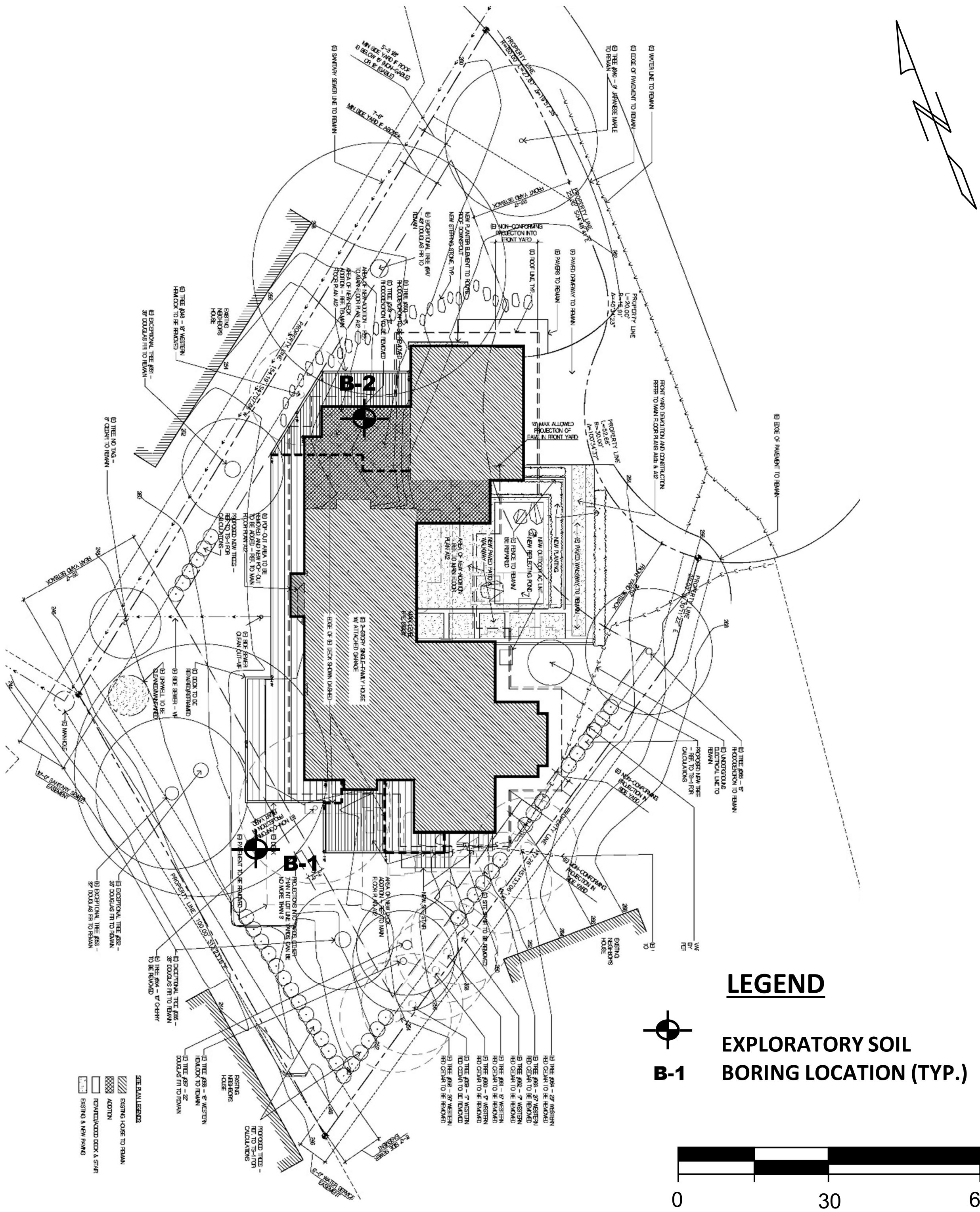
Geotechnical Engineers, Geologists, & Environmental Scientists

SITE PLAN

PROPOSED RESIDENCE ADDITION
8455 SE 83RD STREET
MERCER ISLAND, WASHINGTON

SCALE:	1" = 30'	**DATE:**	7/21/2022	**MADE:**	KJ	**CHKD:**	WC	**JOB NO:**	G-5571	**PLATE**	2



Source: Progress Site Plan by Suyama Peterson Deguchi, dated 7/18/22.

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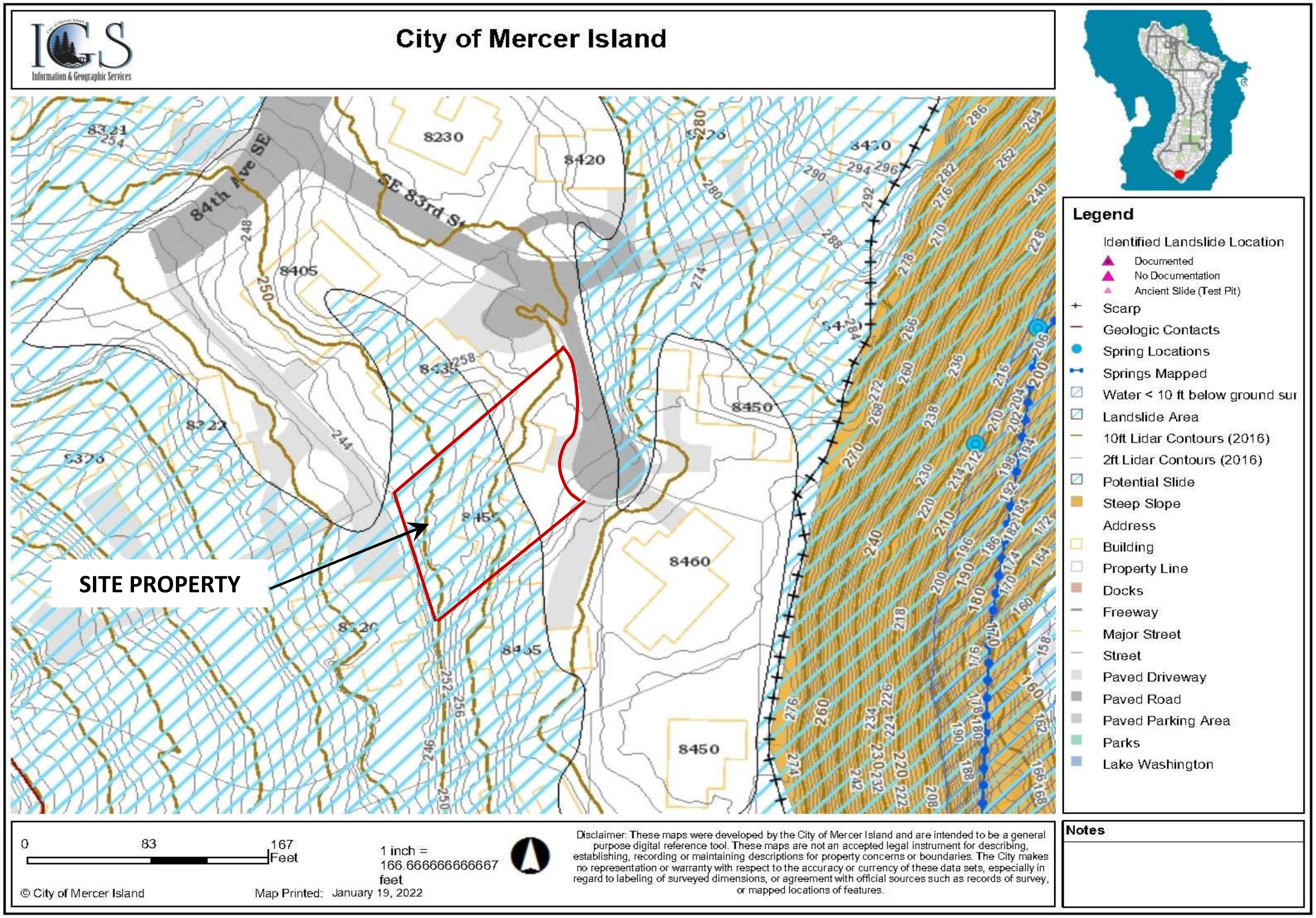
PROPOSED PROJECT LAYOUT

PROPOSED RESIDENCE ADDITION
8455 SE 83RD STREET
MERCER ISLAND, WASHINGTON

SCALE:	1" = 30'	DATE:	7/21/2022	MADE:	KJ	CHKD:	WC	JOB NO:	G-5571	PLATE	3



Source: City of Mercer Island Information & Geographic Services.

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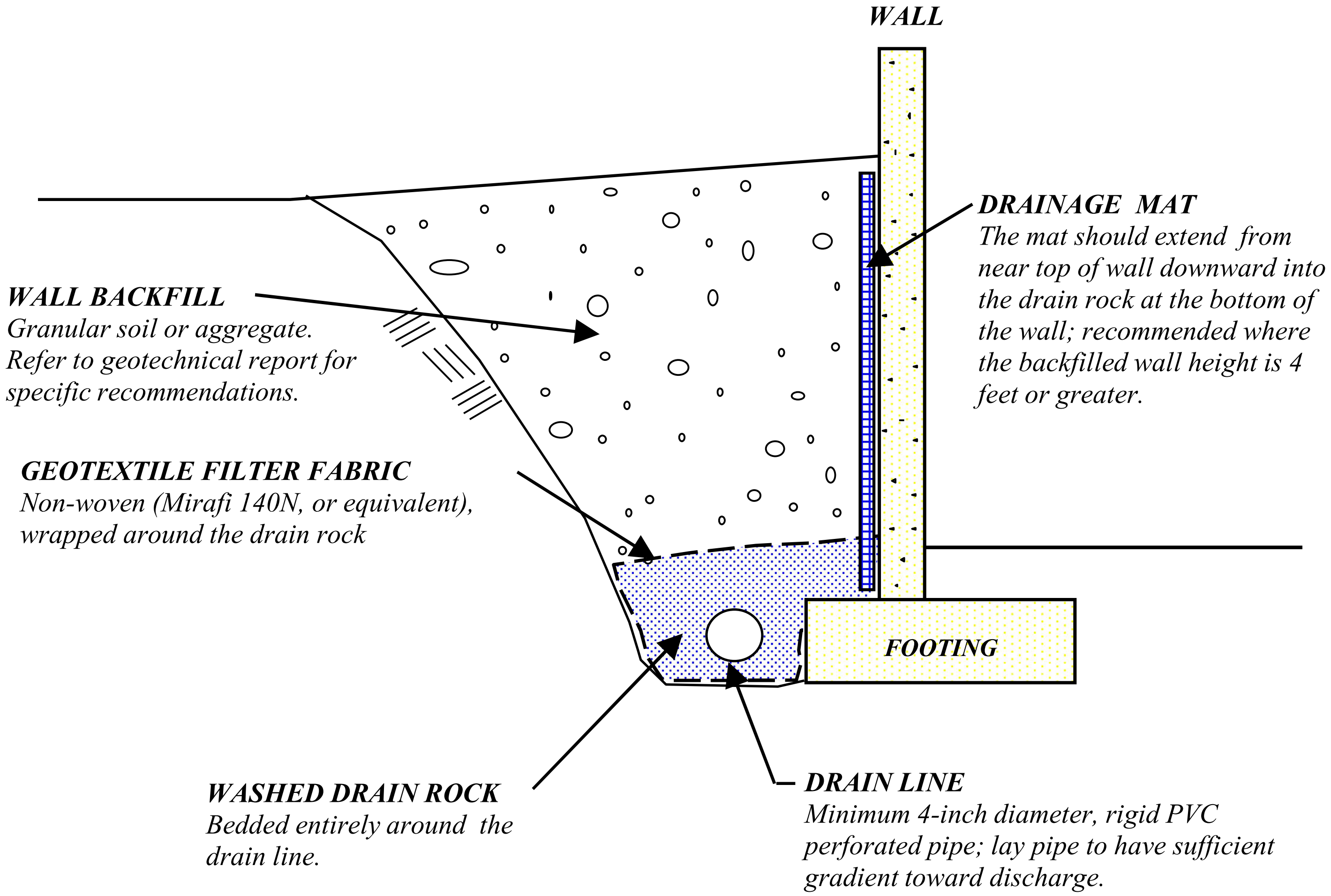
GEOLOGIC HAZARD AREA MAPPING

PROPOSED RESIDENCE ADDITION
8455 SE 83RD STREET
MERCER ISLAND, WASHINGTON

SCALE:	As Shown	DRAWN:	KJ	CHECKED:	WC	DATE:	7/21/2022	PROJECT NO.:	G-5571	PLATE	4

TYPICAL RETAINING WALL DRAINAGE DETAIL



NOT TO SCALE

NOTES:

1.) Do not substitute rigid PVC pipe with flexible corrugated pipe.

2.) Perforated PVC pipe should be tight jointed and laid with perforations oriented downward. The pipe should be gently sloped to provide flow toward the tightline or discharge location.

3.) Do not connect other drainage lines into the wall drainage system.

4.) Backfill should meet structural fill specifications if it will support driveways, sidewalks, patios, or other structures. Refer to the geotechnical engineering report for structural fill recommendations.

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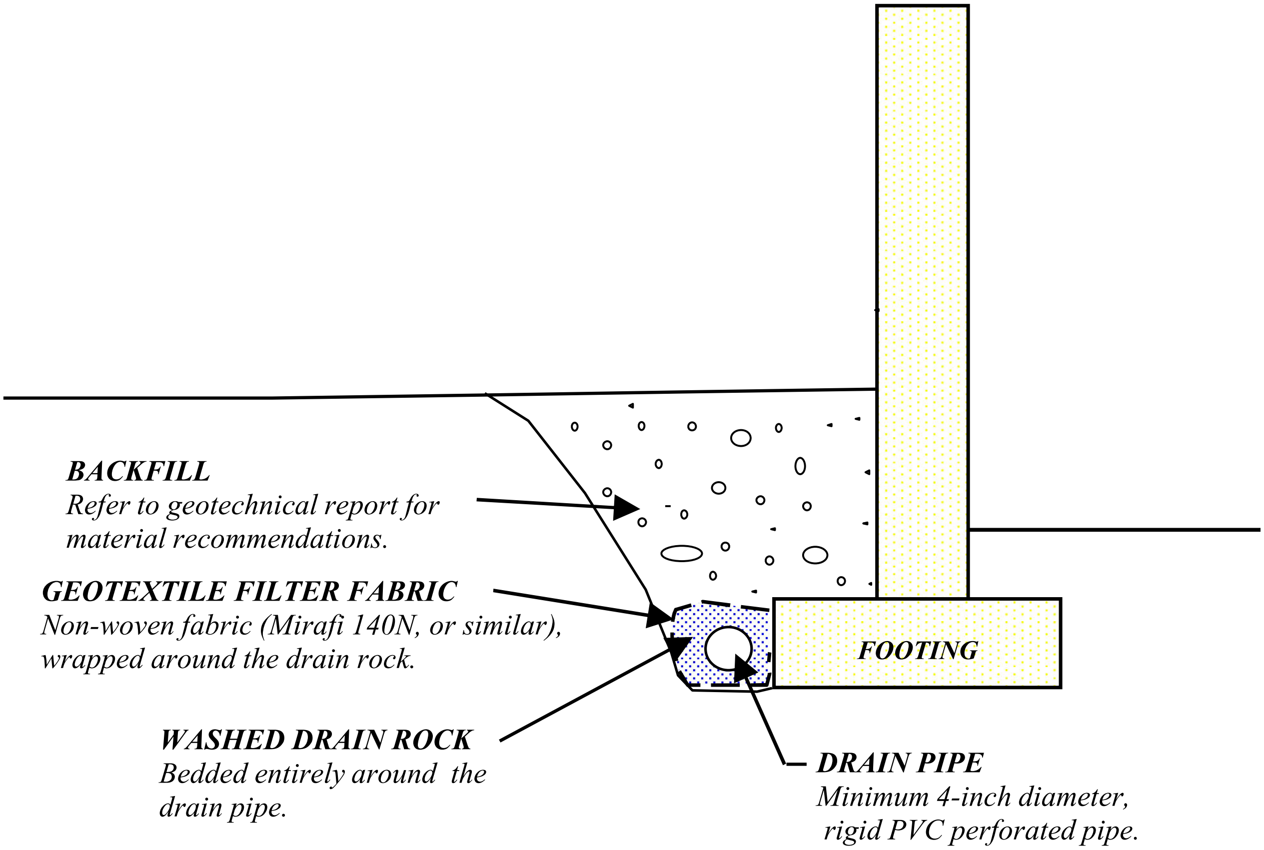
TYPICAL RETAINING WALL DRAINAGE DETAIL

PROPOSED RESIDENCE ADDITION
8455 SE 83RD STREET
MERCER ISLAND, WASHINGTON

SCALE NONE	**DATE** 7/21/2022	**MADE** KJ	**CHKD** WC	**JOB NO.** G-5571	**PLATE** 5

TYPICAL FOOTING DRAIN DETAIL



NOT TO SCALE

NOTES:

1.) Do not substitute rigid PVC pipe with flexible corrugated pipe.

2.) Perforated PVC pipe should be tight jointed and laid with perforations oriented downward. The pipe should be gently sloped to provide flow toward the tightline or discharge location.

3.) Do not connect other drainage lines into the footing drainage system.

4.) Backfill should meet structural fill specifications if it will support driveways, sidewalks, patios, or other structures. Refer to the geotechnical engineering report for structural fill recommendations.

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Environmental Scientists

TYPICAL FOOTING DRAIN DETAIL

PROPOSED RESIDENCE ADDITION
8455 SE 83RD STREET
MERCER ISLAND, WASHINGTON

SCALE	DATE	MADE	CHKD	JOB NO.	PLATE
NONE	7/21/2022	KJ	WC	G-5571	6

ATTACHMENT A

G-5571

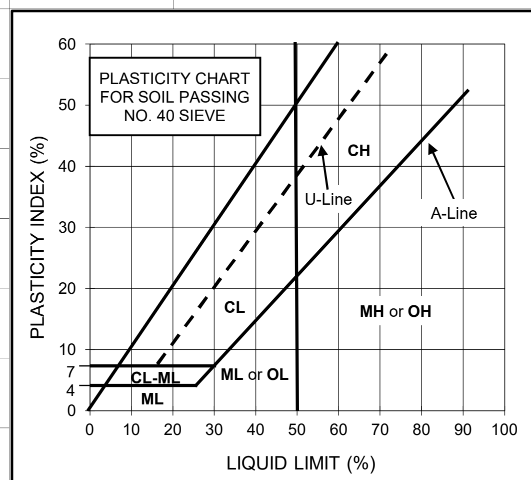
BORING LOGS

GEO Group Northwest, Inc.

SOIL CLASSIFICATION & PENETRATION TEST DATA EXPLANATION

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS More Than Half by Weight Larger Than No. 200 Sieve	**GRAVELS** (More Than Half Coarse Fraction is Larger Than No. 4 Sieve)	**CLEAN GRAVELS** (little or no fines)	**GW**	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURE, LITTLE OR NO FINES	CONTENT OF FINES BELOW 5%	Cu = (D60 / D10) greater than 4 Cc = $(D30)^2$ / (D10 * D60) between 1 and 3
			GP	POORLY GRADED GRAVELS, AND GRAVEL-SAND MIXTURES LITTLE OR NO FINES		CLEAN GRAVELS NOT MEETING ABOVE REQUIREMENTS
		DIRTY GRAVELS (with some fines)	**GM**	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	GM: ATTERBERG LIMITS BELOW "A" LINE. or P.I. LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		GC: ATTERBERG LIMITS ABOVE "A" LINE. or P.I. MORE THAN 7
	SANDS (More Than Half Coarse Fraction is Smaller Than No. 4 Sieve)	**CLEAN SANDS** (little or no fines)	**SW**	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	CONTENT OF FINES BELOW 5%	Cu = (D60 / D10) greater than 6 Cc = $(D30)^2$ / (D10 * D60) between 1 and 3
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES		CLEAN SANDS NOT MEETING ABOVE REQUIREMENTS
		DIRTY SANDS (with some fines)	**SM**	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW "A" LINE with P.I. LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE "A" LINE with P.I. MORE THAN 7
FINE-GRAINED SOILS Less Than Half by Weight Larger Than No. 200 Sieve (i.e., fines)	**SILTS** (Below A-Line on Plasticity Chart, Negligible Organics)	Liquid Limit < 50%	**ML**	INORGANIC SILTS, ROCK FLOUR, SANDY SILTS OF SLIGHT PLASTICITY		
		Liquid Limit > 50%	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOIL		
	CLAYS (Above A-Line on Plasticity Chart, Negligible Organics)	Liquid Limit < 50%	**CL**	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS		
		Liquid Limit > 50%	**CH**	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS (Below A-Line on Plasticity Chart)	Liquid Limit < 50%	**OL**	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		Liquid Limit > 50%	**OH**	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			**Pt**	PEAT AND OTHER HIGHLY ORGANIC SOILS		



SOIL PARTICLE SIZE

FRACTION	U.S. STANDARD SIEVE			
	Passing		Retained	
	Sieve	Size (mm)	Sieve	Size (mm)
SILT / CLAY	#200	0.075		
SAND				
FINE	#40	0.425	#200	0.075
MEDIUM	#10	2.00	#40	0.425
COARSE	#4	4.75	#10	2.00
GRAVEL				
FINE	0.75"	19	#4	4.75
COARSE	3"	76	0.75"	19
COBBLES	76 mm to 203 mm			
BOULDERS	> 203 mm			
ROCK FRAGMENTS	> 76 mm			
ROCK	>0.76 cubic meter in volume			

GENERAL GUIDANCE FOR ENGINEERING PROPERTIES OF SOILS, BASED ON STANDARD PENETRATION TEST (SPT) DATA

SANDY SOILS				SILTY & CLAYEY SOILS		
Blow Counts N	Relative Density, %	Friction Angle φ, degrees	Description	Blow Counts N	Unconfined Strength q_u, tsf	Description
0 - 4	0 -15		Very Loose	< 2	< 0.25	Very soft
4 - 10	15 - 35	26 - 30	Loose	2 - 4	0.25 - 0.50	Soft
10 - 30	35 - 65	28 - 35	Medium Dense	4 - 8	0.50 - 1.00	Medium Stiff
30 - 50	65 - 85	35 - 42	Dense	8 - 15	1.00 - 2.00	Stiff
> 50	85 - 100	38 - 46	Very Dense	15 - 30	2.00 - 4.00	Very Stiff
				> 30	> 4.00	Hard

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PLATE A1

BORING NO. B - 1

Logged By: KJ
Drilled By: CN Drilling
Date Drilled: 11/23/2021
Surface Elev.

Depth ft.	Elevation	USCS Code	Description	Sample Loc.	Sample No.	SPT Blow Counts	Water Content %	Other Tests/ Comments
			Planter bed behind top of railroad tie wall.					
		SM	Dark brown SILTY SAND, very loose, moist, sand is fine to medium grained, mottled with oxide stain, occas. minor fine organics, 20% fines.			1,1,2 (N=3)	13.3	
5		SP	Brown SAND, moist, loose, medium grained, no fines.			2,2,3 (N=5)	13.1	
		SP	SAND, grayish brown, medium dense, moist, fine and medium grained, no fines.			3,7,8 (N=15)	4.8	
10		SM/ML	Olive brown SILTY SAND and SANDY SILT, moist, medium dense, mostly fine grained, mottled with minor oxide staining.			2,5,7 (N=12)	18.8	
		SP	Olive gray SAND, moist, medium dense, fine to medium grained, no oxide staining, no fines.			3,5,7 (N=12)	10.9	
15		SM	Olive gray SILTY SAND, medium dense, moist, sand is fine grained, 15% fines, no oxide stain, gravel in sampler shoe.			2,10,12 (N=22)	22.1	
		SW-GW						Driller added water to borehole.
20			No sample recovery.			50/0" (N=50+)		Drilling and sampling refusal at 20'. Boring terminated.
25			Depth of boring: 20 feet. Drilling Method: Hollow-stem auger. Sampling Method: 2"-O.D. standard penetration test sampler driven with 140 lb. hammer and cathead. Groundwater not encountered during drilling.					

LEGEND:
- 2" O.D. SPT Sampler
- 3" O.D. California Sampler
- Water Level noted during drilling
- Water Level measured at later time, as noted

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BORING LOG

PROPOSED RESIDENCE REMODEL
8455 SE 83RD STREET
MERCER ISLAND, WASHINGTON

JOB NO. G-5571 **DATE** 1/20/2022 **PLATE** A2

BORING NO. B - 2

Logged By: KJ   Date Drilled: 11/23/2021   Surface Elev. ______
Drilled By: CN Drilling

Depth ft.	Elevation	USCS Code	Description	Sample Loc.	Sample No.	SPT Blow Counts	Water Content %	Other Tests/ Comments
			Bare ground surface.					
		SM	Brown SILTY SAND, moist, loose, sand is fine to medium grained, 15% fines.	I		2,3,4 (N=7)	16.7	
		SP-SM	Brown SILTY SAND, very loose, moist, sand is fine to medium grained, 10% fines.	I		1,1,1 (N=2)	7.1	
5		SP	Grayish brown SAND, moist, medium dense, 5-10% fines, fine to medium grained, occas. rootlets.	I		3,5,7 (N=12)	7.0	
		SM/ML	Grayish brown SILTY SAND to SANDY SILT, dry to damp, medium dense, fining downward gradation, silt at bottom of sample is dry.	I		6,7,9 (N=16)	13.5	
10		SM-GM	Gray SILTY SAND and GRAVEL, damp, very dense, well graded sand to gravel, 10-15% fines, occas. fine clean sand lenses.	I		13,27,50 (N=77)	5.7	Driller added water to borehole.
		SM-GM	Gray SILTY SAND with GRAVEL, dense, moist sand is well graded, very gravelly.	I		14,17,28 (N=45)	12.2	Drilling refusal at 13'. Boring terminated.
15			Depth of boring: 13 feet. Drilling Method: Hollow-stem auger. Sampling Method: 2"-O.D. standard penetration test sampler driven with 140 lb. hammer and cathead. Groundwater not encountered during drilling.					
20								
25								

LEGEND:
- 2" O.D. SPT Sampler
- 3" O.D. California Sampler
- ▽ Water Level noted during drilling
- ▼ Water Level measured at later time, as noted

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BORING LOG

PROPOSED RESIDENCE REMODEL
8455 SE 83RD STREET
MERCER ISLAND, WASHINGTON

JOB NO. G-5571 **DATE** 1/20/2022 **PLATE** A3