November 2, 2020 G-5275

Paul Bosveld
38XX W Mercer Way
Mercer Island, Washington 98040
Email: paulbosveld@gmail.com

Subject: Geotechnical Engineering Study
Proposed New Residence
38XX W Mercer Way
Mercer Island, Washington 98040

Dear Mr. Bosveld,

GEO Group Northwest, Inc. has completed a geotechnical engineering study of the above-subject property for the proposed new residence in Mercer Island, Washington. The scope of our services included a review of the area geologic map, soil boring logging, sample processing, and the completion of this report.

SITE DESCRIPTION

The project site (King County Parcel No. 362350-0037) is located in the northwest area of Mercer Island, Washington, as illustrated in Plate 1 – Site Location Map. The property is 24,138 square feet in size, rectangular in shape, and currently undeveloped. The site is accessible from the intersection of 73rd Avenue SE and SE 38th Street at its north property line, or from W Mercer Way along is south property line. The property gradually slopes from north-to-south with a total inclination of approximately 50 feet over a horizontal distance of 217 feet. The north and southern portions of the property are relatively flat, while the steepest section at the middle of the property has an inclination of about 20 feet over a horizontal distance of over 50 feet (< 40%). The property contains dense brush and mature trees, with the trees along the property's steepest topography showing signs of leaning. Based on our review of the City of Mercer Island GIS Maps, we understand that the property is located within erosion and potential slide environmentally critical areas, and the east portion of the property contains a seismic hazard area. An existing site plan of the property is illustrated in Plate 2 – Site Plan.

PROPOSED NEW RESIDENCE

Based on the information provided, we understand that you are proposing to construct a new single-family residence at the northeast area of the property. The residence will be accessible from the north property line along SE 38th Street and will be constructed in the vicinity of the slope adjacent to the east property line. We understand that the leaning trees along this slope are also proposed to be removed during the development of the property. The main floor of the residence will be constructed at the existing grade adjacent to SE 38th Street, with possible excavations into the slope required for a south-facing daylight basement level. The upper floors may also cantilever to the south to avoid requiring additional excavations into the slope. A preliminary plan for the new residence is illustrated in Plate 3 – Preliminary Site Plan.

GEOLOGIC OVERVIEW

According to published geologic mapping of the area[1], the site soils are identified as Pre-Olympia fine-grained glacial deposits (Q_{POgf}) from the Pleistocene Era. These deposits typically underlie Vashon glacial deposits and typically consist of either hard silt and clay or very dense sandy interbeds. These deposits are mapped throughout the majority of central Seattle's Lake Washington scarped shoreline, where existing steep slopes and historic landslide events are common.

SUBSURFACE INVESTIGATION

On October 16, 2020, Mr. Bryce Frisher, Staff Geotechnical Engineer from our firm, visited the site to perform a visual reconnaissance of the property and investigate the subsurface soil conditions. We drilled two exploratory borings (B-1 and B-2) manually portable hollow-stem auger drilling equipment during our site visit. B-1 was conducted within the sloped area in the central portion of the property, and B-2 was conducted further north, at a higher elevation of the property and within the proposed residence's footprint. The location of our exploratory soil

[1] Geologic Map of Mercer Island, Washington by Kathy G. Troost & Aaron P. Wisher, October 2006.

boring is shown in Plate 2 – Site Plan. Logs of the conditions encountered in the borings are provided in Attachment 1 to this report.

Soils encountered in both borings typically consisted of a surficial layer of gray, fine-grained loose sand with roots and gravel underlain with damp to moist, medium dense, grayish light brown silty sand and sand with silt up to a depth of 5 feet below the ground surface. Soils below 5 feet consisted of medium dense to dense, gray, fine-grained silty sand and these soils remained consistent up to a depth of 6 to 10 feet, where the borings were terminated due to very dense, fine-grained silty sands being encountered. We perceived these dense soils as native pre-Olympia fine-grained glacial (Q_{POgf}) deposits, as noted in the geologic map. We did not encounter groundwater seepage in either of the two borings during our investigation.

GEOLOGIC HAZARDS ASSESSMENT

Based on our review of the City of Mercer Island GIS Maps, the above-subject property is mapped as a geologic hazard area. Critical area designations for the site include potential slide, erosion, and a seismic hazard at the eastern portion of the property. According to the geologic map of Mercer Island, the property does not contain landslide scarps or landslide debris. The mapping of the geologic hazardous areas is illustrated in Plate 4 – Critical Areas Mapping.

We understand that development of the property may require excavations into the naturally sloped topography near the north section of the property. The property is not mapped as containing a steep slope area, and the adjacent properties to the east and west have similar topography and have both been previously developed to include single family residences. The slope located at the above-subject property has inclinations less than 40% and is not part of an adjacent steep slope critical area. During our subsurface investigation, we did not encounter a layer of loose landslide debris beneath the existing ground surface near the sloped portions of the property. We also did not observe any indications of soil tension cracks, slumps, or groundwater seepage at the property. The soils encountered during our subsurface investigation consisted of dense, gray fine-grained silty sand at depths between 5 and 10 feet below the existing ground surface. In our opinion, the property appears stable in its existing condition due to the relatively shallow depths of dense soils encountered and the non-steep inclinations of the property’s topography.

The removal of several small-diameter trees may be required to construct the new residence, and some of these trees along the steeper sections of the property appeared to be leaning. In our opinion, the removal of these trees will not adversely impact the stability of the site. If excavations for the daylight basement are proposed for the new residence, then the removal of these soils may enhance the mitigation of the property's erosion hazard due to the installation of new concrete retaining walls and adequate subsurface drainage.

Provided that our recommendations concerning the earthwork, foundations, retaining walls, and drainage are properly implemented into the design and construction of the new residence, it is our opinion that the proposed new residence will not adversely impact the geologic hazard areas mapped at the above-subject property. Furthermore, it is our opinion that the risk to the above-subject property and the adjacent properties will be minimal such that the project site is determined to be safe in both its existing and developed conditions.

CONCLUSIONS AND RECOMMENDATIONS

It is our opinion that the proposed new residence as described in this report can be accomplished so that it does not increase the risk of soil instability at the site. The new residence can be supported on medium dense to dense native soils, and these competent soils are anticipated at a depth of approximately 5 feet below the ground surface near the north property line. Therefore, we recommend the use of a shallow conventional concrete foundation system for to provide structural support for the residence. If soft soils are encountered during excavations for the footing elevations, then we recommend excavating these soils and filling these areas with a layer of crushed rock compacted with a jumping jack. Details of these recommendations and other recommendations regarding geotechnical aspects of the project are presented in the following sections of this report.

Grading and Earthwork

Site Clearing and Erosion Control

Grading work for the proposed new residence should be restricted to the minimum needed to achieve proposed final grades. 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) such as silt fences should be installed as part of site clearing activities. The silt fences or other barrier controls should be placed along the property lines and cross-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. We recommend that temporary cuts greater than 4 feet in height should be sloped at inclinations up to 1H:1V (Horizontal: Vertical), or as otherwise discussed below.

Based on the findings from our subsurface investigation, water seepage is not anticipated for excavations up to 10 feet below the ground surface. If water seepage or other adverse conditions are encountered, temporary cuts in these soils may need to be made at shallower inclinations where recommended by the geotechnical engineer. During construction, water should not be allowed to stand in areas where footings, slabs, or pavements are to be constructed. 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.

Subgrade Preparation

Soils in areas to receive structural fill, concrete slabs, or pavements, should be prepared to a firm, unyielding condition. 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. 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

All materials to be 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. All 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 replace the material with an alternative suitable material, in order to be capable of achieving the required compaction. The site soils are likely to be useable as structural fill due to their clean, sandy character and relatively low moisture content.

Compaction Specifications

Structural fill material should be compacted to at least 92 percent of its maximum dry density as determined by ASTM D1557 (Modified Proctor Test), unless otherwise authorized by the geotechnical engineer, and with the following exceptions. 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 as determined by ASTM D1557.

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.

Foundations

Native soils that are anticipated to be acceptable for building support were encountered at a depth of approximately 5 feet below ground surface within the footprint of the proposed new residence at the top of the slope area. Therefore, we recommend that the residence be supported on conventional spread footing foundations that bear directly on medium dense to dense native soils. If soft soils are encountered during excavations, these soils should be removed and replaced with a layer of compacted crushed rock.

Conventional Footing Foundations

Conventional strip and column footings should bear directly on undisturbed, medium dense to dense native soils or on compacted structural fill that has been placed on a medium dense or dense native soil subgrade. Our recommended design criteria for conventional footing foundations constructed on native soils or structural fill are provided below.

- Allowable bearing pressure, including all dead and live loads:
  - Undisturbed, dense native soil = 2,000 psf
  - Structural fill placed on dense native soil = 2,000 psf

- Minimum depth to base of perimeter footing below adjacent exterior grade = 18 inches

- Minimum depth to bottom of interior footings below top of floor slab = 18 inches

- Minimum width of wall footings = 16 inches

- Minimum lateral dimension of column footings = 24 inches

- Estimated post-construction settlement = ½ inch

- Estimated post-construction differential settlement across building width = ½ inch

A one-third increase in the above allowable bearing pressures can be used when considering short-term transitory wind or seismic loads.

Lateral loads against the building foundations can be resisted by friction between the foundation and the supporting compacted fill subgrade or by passive earth pressure acting on the buried portions of the foundations. For the latter case, the foundations must be poured "neat" against the existing undisturbed soil or be backfilled with compacted structural fill. Our recommended parameters are as follows:

- Passive Pressure (Lateral Resistance)
  350 pcf, equivalent fluid weight, for structural fill or competent undisturbed native soil

- Coefficient of Friction (Friction Factor)
  0.35 for structural fill or competent undisturbed native soil

Slab-On-Grade Floors

Slab-on-grade floors should be constructed on a firm, unyielding subgrade. During preparation of the slab subgrade, any areas of the subgrade that have been disturbed by construction activity should be either re-compacted or excavated and replaced with compacted structural fill. We recommend that structural fill placed below slab-on-grade floors conform to the earthwork and grading recommendations provided in this report.

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 and retaining walls are provided below for use for conventional concrete retaining walls up to approximately 10 feet in height. Conventional concrete basement walls at the southern section of the new residence may be supported by the native, dense sandy soils, if encountered during construction.

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

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

Passive Earth Pressure

- 300 pcf equivalent fluid pressure for compacted structural fill and native undisturbed soil

Base Coefficient of Friction

- 0.35 for undisturbed competent native soil or compacted 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 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 140N, or equivalent) can be laid alongside the base of the wall and sloped to an acceptable tight-line 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. Schematic illustrations of these recommendations are illustrated in Plate 5 – Typical Retaining Wall Drainage and Plate 6 – Typical Basement Wall Drainage.

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. In order to prevent surface water from discharging towards the walls near the steep slope, 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 relatively dense condition to mitigate the potential for later ground settlement or excessive saturation. Wall backfill that will support structures or slab, however, 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 use care if machinery such as a vibratory roller or hoe pack is used.

Surface Drainage

We recommend that storm water drainage from impervious areas be collected into one or more tight-line systems which convey the water to an existing stormwater discharge system. Storm water should not be permitted to develop into concentrated flows on the ground surface, because concentrated flows can lead to increased soil erosion and rutting. Final site grades should direct surface water away from the building.

Subsurface Drainage

In order to reduce moisture build-up and strengthen the underlying soils in the landslide hazard area, we recommend that footing drains be installed around the perimeter of the residence foundation footings. The drains should consist of a four-inch minimum diameter, perforated, rigid PVC drain pipe laid at the bottom of the footing 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. Our recommendations for subsurface drainage are illustrated in Plate 7 – Typical Footing Drain.

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

LIMITATIONS

The findings and recommendations stated herein are based on field observations, our experience on similar projects and our professional judgment. The recommendations presented herein are our professional opinions 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 reevaluated and modified if appropriate.

CLOSING

We appreciate the opportunity to provide you with geotechnical engineering services for this project. Please do not hesitate to contact us if you have any questions regarding this report.

Sincerely,

GEO Group Northwest, Inc.

Bryce Frisher, E.I.T.
Staff Geotechnical Engineer

William Chang, P.E.
Principal Engineer

Plates and Attachments:

Plate 1 – Site Location Map
Plate 2 – Site Plan
Plate 3 – Preliminary Site Plan
Plate 4 – Critical Areas Mapping
Plate 5 – Typical Retaining Wall Drainage
Plate 6 – Typical Basement Wall Drainage
Plate 7 – Typical Footing Drain

Attachment 1 – Boring Logs

Source: King County GIS, 2017.

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

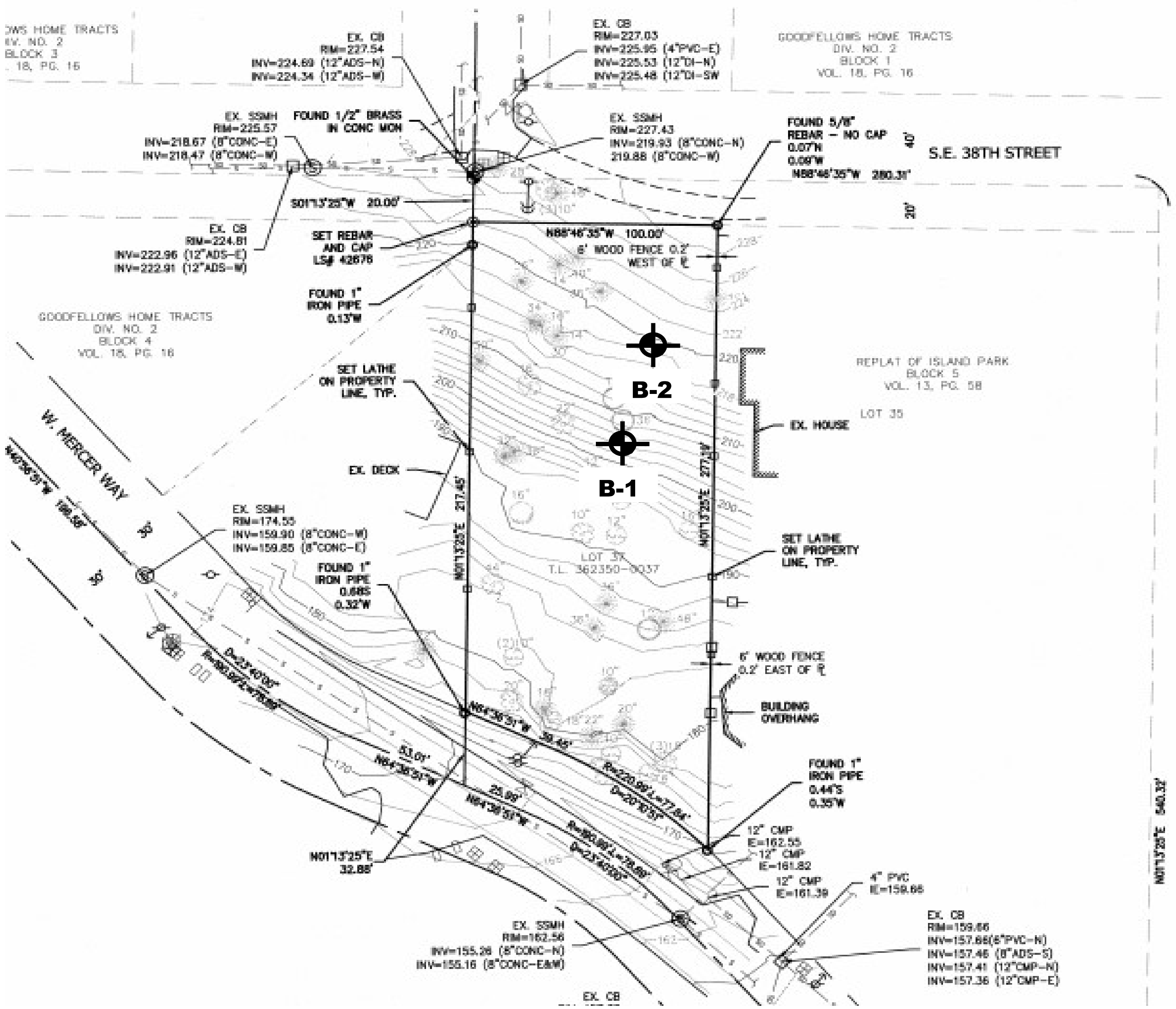
SITE LOCATION MAP

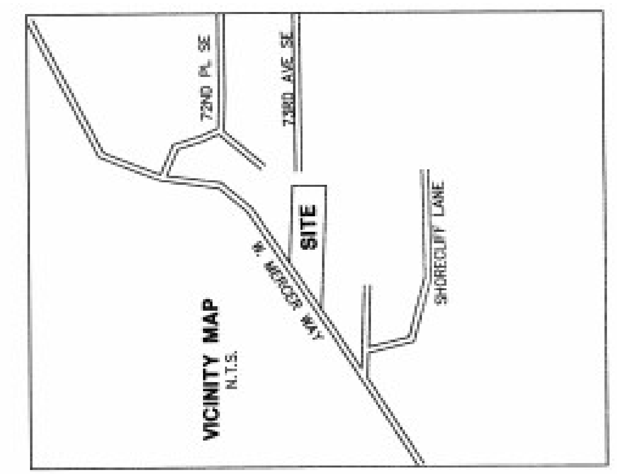
PROPOSED NEW RESIDENCE
38XX W MERCER WAY
MERCER ISLAND, WASHINGTON

SCALE:	NO SCALE	**DATE:**	10/21/2020	**MADE:**	BF	**CHKD:**	WC	**JOB NO:**	G-5275	**PLATE**	1

HA-1

PORTION OF THE S.E. 1/4 OF THE S.W. 1/4 OF SECTION 12, T.24N., R.04E., W.M. MERCER ISLAND, STATE OF WASHINGTON





LEGAL DESCRIPTION

THE WEST ONE-HUNDRED (100) FEET OF TRACT FIVE (5) (MEASURED ON THE NORTH LINE THEREOF), REPLAT OF ISLAND PARK ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 13 OF PLATS, PAGE 58, RECORDS OF KING COUNTY, WASHINGTON;

TOGETHER WITH THAT PORTION OF ISLAND AVENUE VACATED BY KING COUNTY COMMISSIONER'S ADJOINING.

DATUM

NAVD 88

BENCHMARK

WGS DESIGNATION 8003
3/8" COPPER PIN IN 4" SQUARE CONCRETE MONUMENT, DOWN 1.1', LOCATED ON MERCER WAY 182 FEET NORTHWEST OF THE INTERSECTION WITH S.E. 40TH STREET
ELEVATION=143.51

HORIZONTAL DATUM

NAD 1983/91

HORIZONTAL CONTROL

HELD LINE BETWEEN WGS SURVEY DATA POINT 8003 AND WGS DATA POINT 7999
IE=N40°56'51"W

INSTRUMENTATION

INSTRUMENT USED: 5 SECOND TOTAL STATION,

FIELD SURVEY WAS BY CLOSED TRAVERSE LOOPS, MINIMUM CLOSURE OF LOOPS WAS 1:22,000, IN ACCORDANCE WITH WAC 332-130-090.

NORTH

0 10 20 40
SCALE 1" = 40'

LEGEND

B-1 — EXPLORATORY SOIL BORING LOCATION

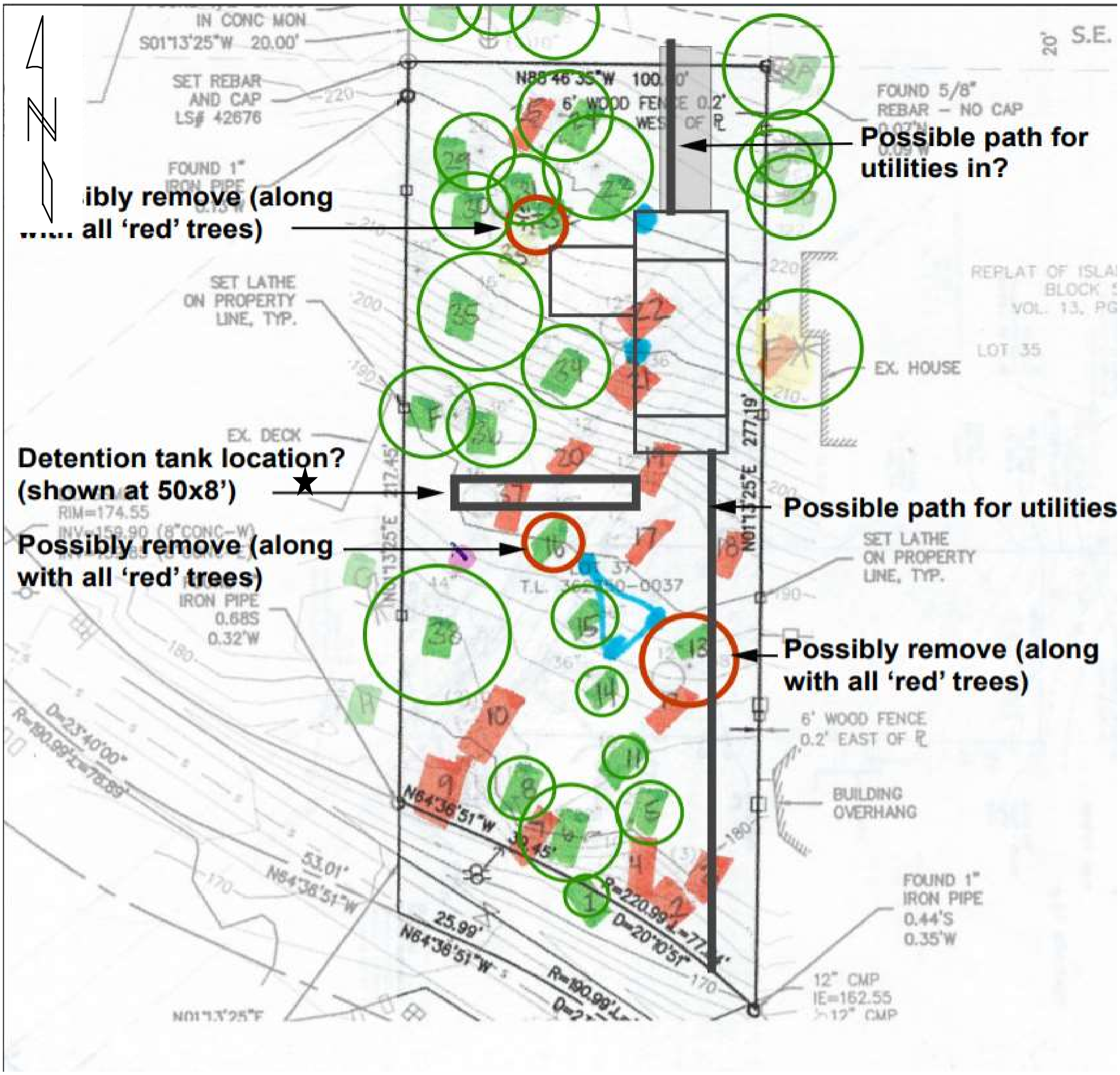
GEO Group Northwest, Inc.
Geotechnical Engineers, Geologists, & Environmental Scientists

SITE PLAN

PROPOSED NEW RESIDENCE
38XX W MERCER WAY
MERCER ISLAND, WASHINGTON

Source: Jane Burns Boundary/Topographic Plan by Encompass Engineering & Surveying, Dated 10/6/2015.

SCALE	AS SHOWN	DRAWN BY	BF	CHECKED BY	WC	DATE	10/28/2020	PROJECT NO.	G-5275	PLATE	2



Source: Tree Removal Plan, Paul Bosveld, Property Owner, Dated 9/23/2020.

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Geotechnical Engineers, Geologists, & Environmental Scientists

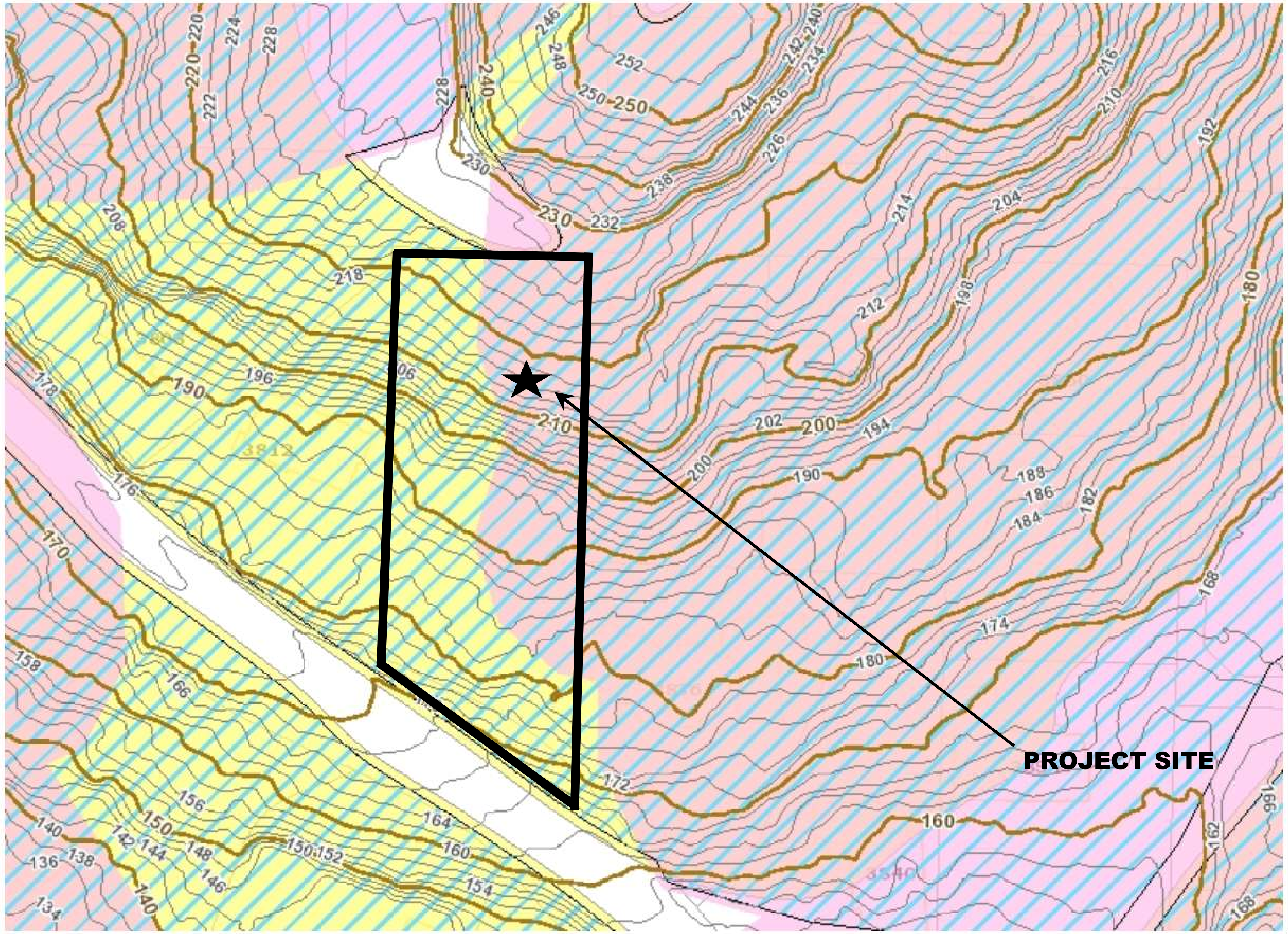
PRELIMINARY SITE PLAN

PROPOSED NEW RESIDENCE
38XX W MERCER WAY
MERCER ISLAND, WASHINGTON

SCALE: NONE	**DATE:** 10/28/2020	**MADE:** BF	**CHKD:** WC	**JOB NO:** G-5275	**PLATE** 3

IGS
Information & Geographic Services

City of Mercer Island



Legend

- 10ft Lidar Contours (2016)
- 2ft Lidar Contours (2016)
- Potential Slide
- Seismic
- Erosion
- Address
- Building
- Property Line
- Docks

0 78 157 Feet

1 inch = 156.992463833333 feet

Map Printed: November 3, 2020

Disclaimer: These maps were developed by the City of Mercer Island and are intended to be a general purpose digital reference tool. These maps are not an accepted legal instrument for describing, establishing, recording or maintaining descriptions for property concerns or boundaries. The City makes no representation or warranty with respect to the accuracy or currency of these data sets, especially in regard to labeling of surveyed dimensions, or agreement with official sources such as records of survey, or mapped locations of features.

Notes

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

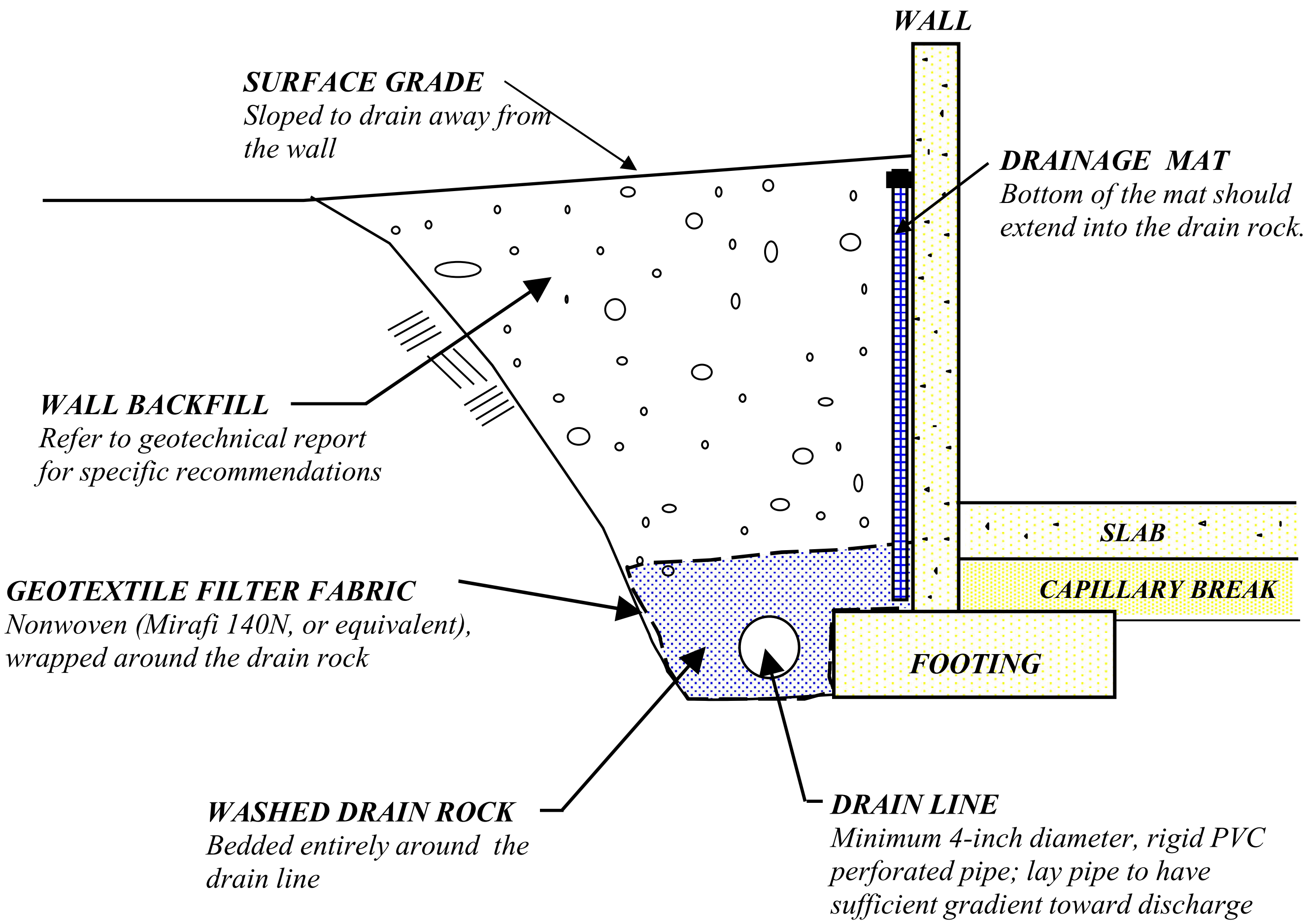
CRITICAL AREAS MAPPING

PROPOSED NEW RESIDENCE
38XX W MERCER WAY
MERCER ISLAND, WASHINGTON

SCALE	AS SHOWN	DRAWN BY	BF	CHECKED BY	WC	DATE	11/3/2020	PROJECT NO.	G-5275	PLATE	4

Source: City of Mercer Island GIS Portal

TYPICAL BASEMENT WALL DRAINAGE



NOT TO SCALE

NOTES:

1.) Do not replace rigid PVC pipe with flexible corrugated plastic pipe.

2.) Perforated PVC pipe should be tight jointed, laid with perforations facing downward, and sloped toward discharge location(s).

3.) The geotextile filter fabric should be wrapped around the drain rock that surrounds the pipe, not wrapped directly around the pipe.

4.) Wall backfill should be compacted to structural fill specifications if it will support pavements, slabs, or structures. Refer to the geotechnical report for structural fill recommendations and specifications.

5.) Surface grade above the backfill can be covered with a layer of relatively impermeable topsoil or pavement or slab to reduce infiltration of surface water into the backfill and drainage system.

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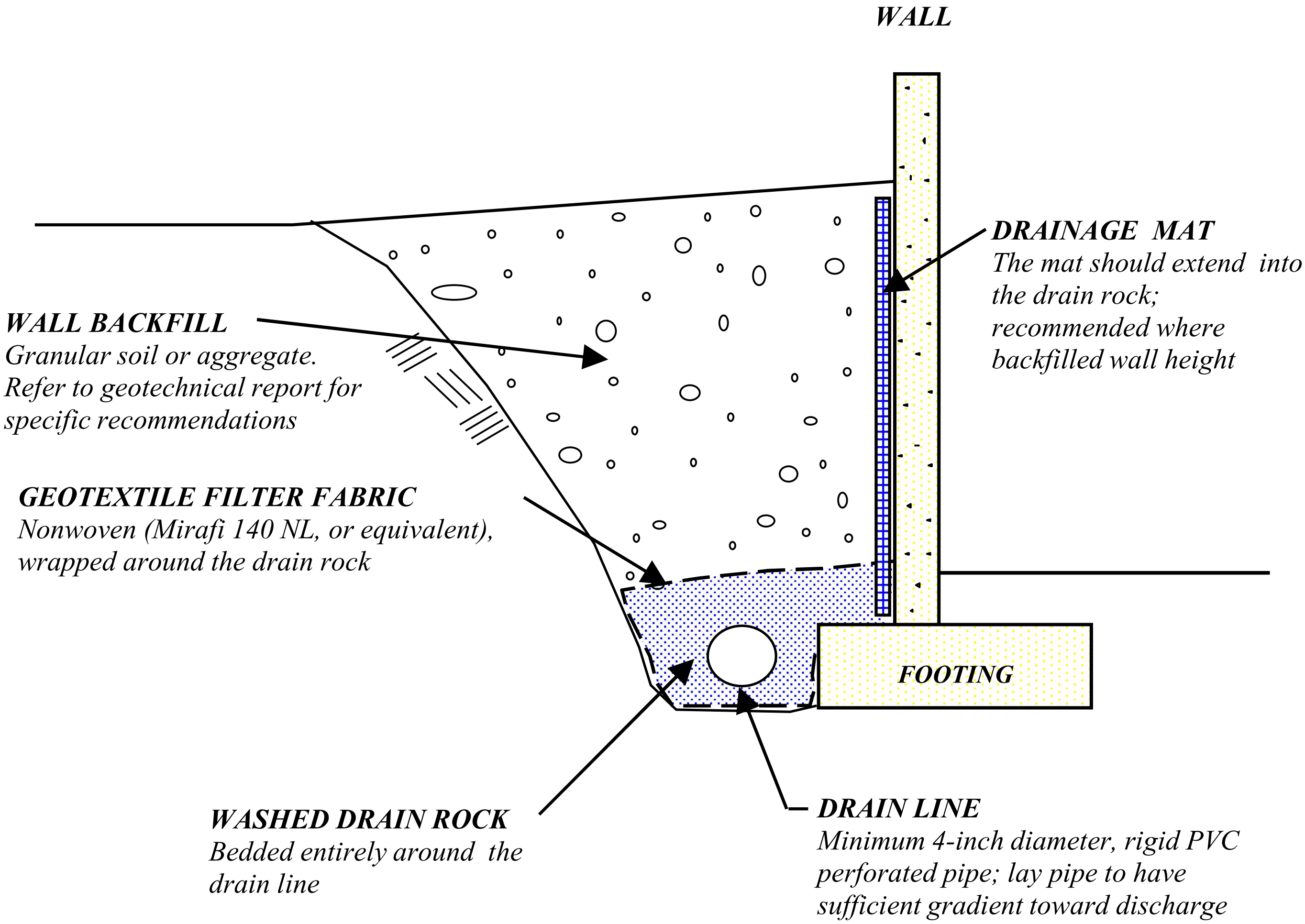
TYPICAL BASEMENT WALL DRAINAGE

PROPOSED NEW RESIDENCE
38XX W MERCER WAY
MERCER ISLAND, WASHINGTON

SCALE: NONE	DATE: 10/29/2020	MADE: BF	CHKD WC	JOB NO. G-5275	PLATE 5

TYPICAL RETAINING WALL DRAINAGE



NOT TO SCALE

NOTES:

1.) Do not replace rigid PVC pipe with flexible corrugated plastic 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.

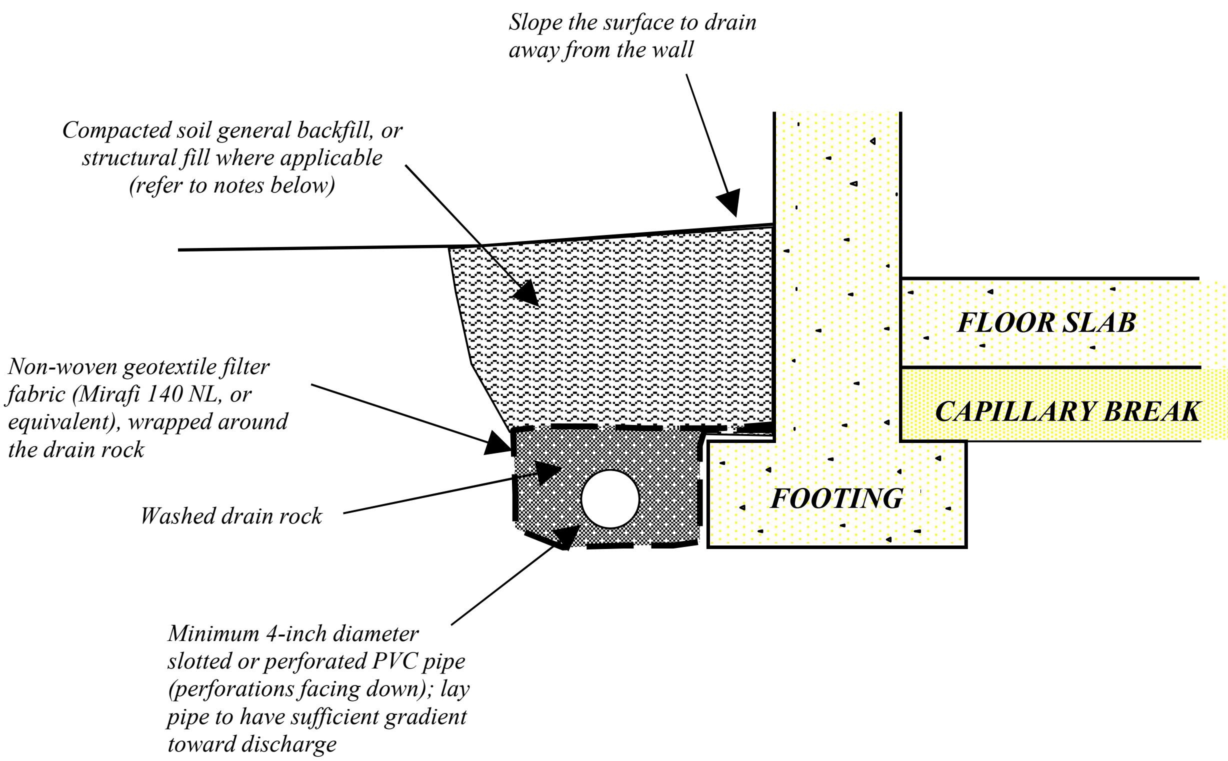
3.) Do not connect other drain lines into the footing drain system.

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.

GEO Group Northwest, Inc. Geotechnical Engineers, Geologists, & Environmental Scientists	**TYPICAL RETAINING WALL DRAINAGE** **PROPOSED NEW RESIDENCE** **38XX W MERCER WAY** **MERCER ISLAND, WASHINGTON**

SCALE NONE	**DATE** 10/29/2020	**MADE** BF	**CHKD** WC	**JOB NO.** G-5275	**PLATE** 6

TYPICAL FOOTING DRAIN



NOT TO SCALE

NOTES:

1.) Perforated or slotted rigid PVC pipe should be tight jointed and laid with perforations or slots down, and with positive gradient toward discharge location(s). The pipe should be placed at or slightly above the elevation of the bottom of the footing. Do not replace rigid PVC pipe with flexible corrugated plastic pipe.

2.) Do not connect other drainage lines to the footing drain lines. Drain line cleanouts should be installed at appropriate locations to allow inspection and maintenance of the lines after construction.

3.) If the backfill will support sidewalks, driveways, patios, or other structures, it should be compacted to at least 90% of its maximum dry density based on the Modified Proctor test method, except that the top 12 inches of the backfill should be compacted to at least 95% of the maximum dry density.

4.) The geotextile filter fabric should be placed around the drain rock as shown, and not wrapped directly around the pipe.

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Geotechnical Engineers, Geologists, & Environmental Scientists

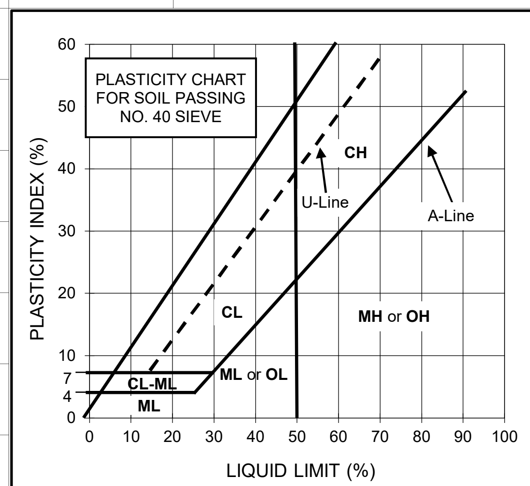
TYPICAL FOOTING DRAIN
PROPOSED NEW RESIDENCE
38XX W MERCER WAY
MERCER ISLAND, WASHINGTON

SCALE: NONE	DATE: 10/29/2020	MADE: BF	CHKD: WC	JOB NO. G-5275	PLATE 7

SOIL CLASSIFICATION & PENETRATION TEST DATA EXPLANATION

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS	**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
More Than Half by Weight Larger Than No. 200 Sieve	**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	**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, CLEAN CLAYS		
		Liquid Limit > 50%	**CH**	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
Less Than Half by Weight Larger Than No. 200 Sieve	**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: BF
Drilled by: CN Drilling
Date Drilled: 10/16/2020
Surface Elev. 210'

Depth ft.	Elevation	USCS Code	Description	Sample Loc.	Sample No.	SPT Blow Counts.	Water Content %	Other Tests/ Comments
		SP	SAND, gray, fine-grained, moist, loose.					
2.5		**SM**	SILTY SAND, grayish light brown, medium dense, fine-grained, rare GRAVEL, moist.			2, 5, 10 (N = 15)	17.5	Water added during sample retrieval.
5		**SP - GP**	SAND and GRAVEL, light brown to grayish brown, fine-grained SAND, damp, dense.			50/5"	8.1	**Little sample recovery, rock** encountered.
		SM	SILTY SAND, gray, fine-grained, very dense, moist.			18, 20, 31 (N = 51)	24.4	
7.5			Depth of boring: 6 feet. Drilling Method: Hollow-Stem Auger Sampling Method: 2"-O.D. standard penetration test sampler Groundwater not encountered.					
10								

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 NEW RESIDENCE
38XX W MERCER WAY
MERCER ISLAND, WASHINGTON

JOB NO. G-5275 **DATE** 10/20/2020 **PLATE** A2

BORING NO. B-2

Logged By: BF
Drilled by: CN Drilling
Date Drilled: 10/16/2020
Surface Elev. 222'

Depth ft.	Elevation	USCS Code	Description	Sample Loc.	Sample No.	SPT Blow Counts.	Water Content %	Other Tests/ Comments
		SP	SAND, loose, brown to light brown, damp, fine-grained with some GRAVEL.			3, 5, 6 (N = 11)	10.4	
2.5		**SP- SM**	SAND with SILT, medium dense, grayish light brown, fine-grained, rare GRAVEL, damp.			5, 7, 9 (N = 16)	11.5	
5		**SM**	SILTY SAND, medium dense, gray, fine-grained, damp to moist.			3, 6, 12 (N = 18)	19.6	
7.5		**SM**	As above, SILTY SAND, damp to moist, medium dense to dense, fine-grained, gray.			7, 11, 14 (N = 25)	14.3	
10		**SM**	SILTY SAND, dense, gray, damp to moist, fine-grained.			9, 14, 18 (N = 32)	13.2	
			Depth of boring: 10 feet. Refusal. Drilling Method: Hollow-Stem Auger Sampling Method: 2"-O.D. standard penetration test sampler Groundwater not encountered.					

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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Geotechnical Engineers, Geologists, & Environmental Scientists

BORING LOG

PROPOSED NEW RESIDENCE
38XX W MERCER WAY
MERCER ISLAND, WASHINGTON

JOB NO. G-5275 **DATE** 10/20/2020 **PLATE** A3