PanGEO
INCORPORATED
Geotechnical & Earthquake Engineering Consultants

April 9, 2020
PanGEO Project No. 20-084

Jimmy (InnHsuan) and Shannon Foo
3132 Garret Cord Werner
3132 Western Avenue
Seattle, Washington 98121
Attention: Amir Parnianpour

Subject: **Geotechnical Engineering Report**
Proposed Residence
3453 74th Avenue Southeast
Mercer Island, Washington 98040

Dear Mr. Parnianpour:

As requested, PanGEO has completed a geotechnical study for the proposed single-family residence at 3453 74th Avenue Southeast in Mercer Island, Washington. In summary, our test borings encountered native competent bearing soils (weathered advance outwash deposits) at shallow depths. In our opinion, conventional footings and concrete slab-on-grade are appropriate to support the proposed building. Based on a review of LiDAR image and the results of our slope stability analysis, it is our opinion that the proposed building would not compromise the site stability, provided that the recommendations outlined in this report are properly incorporated into the design and construction of the project.

We appreciate the opportunity to work on this project. Please call if there are any questions.

Sincerely,

Yi-Hsun William Chao, P.E.
Senior Geotechnical Engineer

Encl.: Geotechnical Report

3213 Eastlake Avenue East, Suite B
Seattle, WA 98102
Tel (206) 262-0370
Fax (206) 262-0374

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GEOTECHNICAL ENGINEERING REPORT
PROPOSED RESIDENCE
3453 74TH AVENUE SOUTHEAST
MERCER ISLAND, WASHINGTON

1.0 GENERAL

PanGEO, Inc. is pleased to present this geotechnical report for the proposed residence at 3453 74th Avenue Southeast in Mercer Island, Washington. This study was prepared in general accordance with our mutually agreed scope of services outlined in our proposal dated May 28, 2019, which was approved on February 26, 2020. Our scope of services included reviewing readily available geologic and geotechnical data, conducting a site reconnaissance, advancing four test borings at the site, conducting engineering analyses, and preparing the following geotechnical report.

2.0 SITE AND PROJECT DESCRIPTION

The subject site is located in the Mercer Island Town district of Mercer Island, Washington (see Figure 1, Vicinity Map). The site consists of an approximately 21,618 square-foot (0.5 acres), rectangular shaped parcel that is bordered to the north and west by single-family residences, to the south by Southeast 36th Street, and to the east by Mercerdale Hillside Park. The site is currently occupied by a one-story single-family residence with a detached shed. The existing site conditions are shown in Plates 1 and 2, below.

Plate 1: Existing building (south side), looking west

Plate 2: SE corner of the property, looking NW

Based on the site topographic survey, the overall site grades are practically level. The southeast corner of the subject property slightly descends to the south and east property lines with an elevation relief of about 4 feet. The southeast portion of the property is mapped as a potential landslide area, a potential erosion hazard area, and a seismic hazard area by the City of Mercer Island. As a result, this geotechnical study was performed to evaluate these mapped geologic hazards.

We understand that the existing structures at the site will be removed and a new house will be constructed. The new house will have a basement in the central portion of the proposed building. Within the proposed building footprint, the existing site grades are relatively level.

3.0 SUBSURFACE EXPLORATIONS

3.1 CURRENT EXPLORATIONS

Our study included drilling four test borings (borings PG-1 through PG-4) at the site on March 18, 2020. The approximate locations of the borings are shown on Figure 2. The borings were drilled to depths of about 26½ to 31½ feet below surface grades using a track-mounted mini drill rig owned and operated by Geologic Drill Partners.

The drill rig was equipped with a 6-inch outside diameter hollow stem auger, and soil samples were obtained from the borings at 2½ and 5-foot depth intervals in general accordance with Standard Penetration Test (SPT) sampling methods (ASTM test method D-1586) in which the samples are obtained using a 2-inch outside diameter split-spoon sampler. The sampler was driven into the soil a distance of 18 inches using a 140-pound weight falling a distance of 30 inches. The number of blows required for each 6-inch increment of sampler penetration was recorded. The number of blows required to achieve the last 12 inches of sample penetration is defined as the SPT N-value. The N-value provides an empirical measure of the relative density of cohesionless soil, or the relative consistency of fine-grained soils.

A geologist from PanGEO was present during the field exploration to observe the test borings, to obtain representative samples, and to describe and document the soils encountered in the explorations. The completed borings were backfilled with bentonite chips.

The soil samples retrieved from the borings were described using the system outlined on Figure A-1 of Appendix A and the summary boring logs are included as Figures A-2 through A-5.

3.2 Previous Explorations

In addition to our test borings completed for the current study, we reviewed readily available subsurface data in the nearby property at 7411 Southeast 36th Street (The Galli Group, 2008). Specifically, we reviewed test borings B-1 and B-2 and the records of a previous landslide that occurred in the steep slope located to the east of the property at 7411 Southeast 36th Street. The summary logs for test borings B-1 and B-2 are included in Appendix B.

4.0 SUBSURFACE CONDITIONS

4.1 Site Geology

Generalized subsurface information for the site was obtained from a review of *The Geologic Map of Mercer Island* (Troost and Wisher, 2006). Based on our review, the surficial geologic unit at the site and in the immediate vicinity is Advance Outwash (Geologic Map Unit Qva). Advance outwash consists of sand deposited by meltwater streams emerging from an advancing glacier. Advance outwash has been glacially overridden and as such is typically dense to very dense.

Glacial till (typically dense to very dense unsorted mixture of silty sand and gravel) and Lawton clay (typically very stiff to hard laminated to massive silty clay and clayey silt) are also mapped in the region to the west and east, respectively.

4.2 Soil Conditions

Our test borings generally encountered a sequence of fill, advance outwash deposits, and fine-grained deposits consistent with the Lawton clay deposits mapped in the area. The soils encountered in each test boring are described in the boring logs presented in Appendix A of this report.

A summary of the generalized soil units encountered in our test borings are presented below.

> ***Soil Unit 1: Fill –*** This unit was found immediately below the ground surface in all test borings, and extended to a maximum of about 2 feet below existing grades. The fill generally consisted of loose to medium dense, silty fine sand with trace

amount of gravel. Organics, fine rootlets, and wood debris were also observed in this unit.

***Soil Unit 2: Weathered Advance Outwash Deposits* –** Below the fill, weathered advance outwash deposits were found in all test borings, and extended to about 7 feet below the existing grade (4½ feet deep in PG-4). This unit generally consists of loose to dense (predominately medium dense), silty, fine to medium sand with a varying amount of gravel. Iron-oxide staining was observed in this unit. We interpreted this unit to be weathered advance outwash deposits.

***Soil Unit 3: Advance Outwash Deposits* –** Below Soil Unit 2, Advance outwash sand was encountered at about 7 feet below the existing grade in all test borings (4½ feet deep in PG-4), and extended to about 20 to 22 feet below the existing grade. In PG-1, this unit predominately consist of medium dense, poorly graded relatively clean sand with trace amount of silt. In PG-2 and PG-3, this unit generally consists of about 6 to 10 feet of dense, silty sand overlying about 4 to 9 feet of poorly graded relatively clean sand. In PG-4, this unit generally consists of about 8½ feet of medium dense silty sand and sandy silt that is underlain by about 8½ feet of dense, poorly graded relatively clean sand. We interpreted this unit to be advance outwash deposits.

***Soil Unit 4: Lawton Clay* –** Underlying Advance Outwash deposits, hard, clayey sandy silt and very stiff silt/clay were encountered at about 20 to 22 feet below the existing grade. We interpreted this unit to be Lawton clay deposits. This soil unit extended to the maximum depths of our test borings (i.e. 26½ to 31½ feet).

4.3 Groundwater Conditions

No groundwater was encountered at the boring locations at the time of drilling. However, it should be noted that groundwater elevations and seepage rates are likely to vary depending on the season, local subsurface conditions, and other factors. Groundwater levels are normally highest during the winter and early spring.

5.0 Geologic Hazards Assessment

Based on review of environmental hazard information available on the City of Mercer Island's GIS portal, the geologic hazards mapped at the site include seismic, erosion, and potential landslide hazards (see mapped areas in the attached Figure 3). The following sections discuss each of the mapped hazard areas.

5.1 Seismic Hazards

The City of Mercer Island Code defines seismic hazard areas as those areas subject to risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, soil liquefaction, or surface faulting.

Based on the medium dense to dense glacial soils underlying the proposed building footprint, as well as the lack of groundwater, in our opinion, the potential for soil liquefaction during a design-level earthquake is considered minimal, and special design considerations associated with soil liquefaction are not required.

Based on the results of our global stability analyses (discussed in Section 5.3.3 of this report), it is our opinion that the risk of a large, deep-seated type of slope failure in the proximity of the proposed building is low.

During our site reconnaissance on November 1, 2019, we did not observe evidence of surface faulting or rupture at the site. In our opinion, the risk of damage as a result of earthquake-induced surface faulting at the site is low.

5.2 Erosion Hazards

A small area in the southeast corner of the subject property is mapped within a potential erosion hazard area according to the City of Mercer Island’s Geologic Hazards Map. Based on soil conditions encountered in the borings, the near-surface site soils are likely to exhibit low to moderate erosion potential. In our opinion, the erosion hazards at the site can be effectively mitigated with the best management practice during construction and with properly designed and implemented landscaping for permanent erosion control. During construction, the temporary erosion hazard can be effectively managed with an appropriate erosion and sediment control plan, including but not limited to installing silt fencing at the construction perimeter, limiting removal of vegetation to the construction area, placing gravel or hay bales at the disturbed/traffic areas, covering stockpile soil or cut slopes with plastic sheets, constructing a temporary drainage pond to control surface runoff and sediment trap, and placing quarry spalls at the construction entrance.

Permanent erosion control measures should include establishing vegetation, landscape plants, and hardscape established at the end of project, and reducing surface runoff to the minimum extent possible.

5.3 Potential Landslide Hazards

A small area in the southeast corner of the site and the eastern slope (i.e. Mercerdale Hillside Park) are mapped by the City within a potential landslide hazard area (see attached Figure 3). The City's landslide hazard area map also shows head scarps and a known slide within the eastern slope.

To evaluate the risk of potential landslide at the subject property, we completed a site reconnaissance, reviewed LiDAR image of the area, reviewed the records of a known slide that occurred in the site vicinity, and performed quantitative slope stability analysis. The results of our evaluations are detailed below.

5.3.1 Site Reconnaissance and Review of LiDAR Image

We conducted a site reconnaissance at the site and within the slope located to the east of the site. During our site reconnaissance on November 1, 2019, we did not observe obvious signs of slope instability such as hummocky ground surface, tension cracks, or leaning mature trees. We also evaluated the existing house and observed no signs of apparent cracks or vertical settlement on the existing foundation walls and no evidence of lateral movement. It appears that the existing development and adjacent slope have been stable. We also reviewed the LiDAR image of the site (see attached Figure 3) and eastern slope. In our opinion, the LiDAR image of the area indicates the surface of the eastern slope appears relatively uniform, indicating no obvious evidence of past or on-going global instability.

5.3.2 Review of Previous Landslide

A previous landslide occurred within the mapped steep slope that is located to the east of a nearby property at 7411 Southeast 36th Street during winter of 2007 (see slide location in the attached Figure 3). The location of the previous slide location is about 180 feet away from the proposed building at 3453 74th Ave SE. Based on the geotechnical report completed by The Galli Group in 2008 for the affected property, the previous slide was described as a shallow, surficial slide landslide (approximately 60 feet long and 20 feet wide) that occurred likely as a result of two seepage zones and stormwater discharge onto the slope.

In our opinion, because the proposed building at 3453 74th Ave SE is at least 70 feet away from the eastern mapped steep slope and the proposed building is anticipated to be supported on footings bearing on competent bearing soils, in our opinion, we do not anticipate the proposed building to adversely affect the stability of the eastern steep slope (see additional discussions in Section 5.3.3 of this report). Also, as discussed in Section 6.5 of this report, we recommended that stormwater of the proposed development at 3453 74th Ave SE be discharged to the appropriate outlets. As such, we do not anticipate the eastern steep slope to be affected by the stormwater discharge from the proposed development at 3453 74th Ave SE.

5.3.3 Quantitative Slope Stability Analysis

We performed quantitative slope stability analyses for the project area and adjacent slope to the south using the program Slide 6.0 by Rocscience Inc. Slide is a two-dimensional limit equilibrium slope stability analysis program. Our analysis used the Spencer Method to estimate the factor of safety for slope failure planes.

We developed a generalized subsurface profile along Section A-A' (see Figure 3 for location of A-A'). The subsurface profiles are shown in Figures 4 and 5. The subsurface profile A-A' consists of three generalized soil units. The uppermost soil unit consisting of about 4½ to 7 feet of loose to medium sand (i.e. fill and weathered advance outwash deposits). The second soil unit consists of medium dense to dense sand (advance outwash deposits). The lowest soil unit consists of very stiff to hard, silt and clay (Lawton clay). The soil strength parameters modeled in the analyses are also shown in Figures 4 and 5.

The following discusses our model and analysis:

<u>Soil Parameters:</u> A summary of the input parameters is provided in Table 1, below. Input parameters were determined based on our experience with soils of similar consistency to the site soils, and published literature and design manuals for similar soils.

Table 1: Slide Slope Stability Input Parameters

Soil Type	Unit Weight (pcf)	Friction Angle (deg)		Cohesion (psf)	
		Static	Seismic	Static	Seismic

Loose/med. dense Fill/Adv. Outwash (sand)	115	30	30	0	0
Medium dense/dense Adv. Outwash (sand)	120	38	38	0	0
Very stiff to hard Lawton Clay (silt/clay)	120	26	0	600	6000

<u>Groundwater:</u> Although groundwater was not encountered in the test borings, our analysis assumed perched groundwater to be present at the interface of advance outwash sand and Lawton clay.

<u>Surface Surcharges:</u> We anticipate that the proposed building loads will be transferred through the footings to the native competent bearing soils. For the proposed slab on grade, we included a surface surcharge of 250 psf in our model.

<u>Seismic Parameters:</u> Seismic design parameters for the site were developed in conformance with the 2015 International Building Code (IBC), a design earthquake having a 2% probability of occurrence in 50 ears (return interval of 2,475 years). Based on the site subsurface conditions, the Seismic Site Class for the site is Site Class D. The Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration was estimated to be 0.576g based on 2015 IBC. Our horizontal PGA used in our Pseudo-static slope analysis was based on one-half of the PGA, or 0.288g.

<u>Potential Failure Planes:</u> We analyzed the most critical failure planes that occur under static and seismic loading. The failure planes were analyzed, and the corresponding factors of safety are shown in Figures 4 and 5.

Estimated Factor of Safety – As shown in Figures 4 and 5, the estimated factors of safety are at least 1.5 under static loading and 1.1 under seismic loading, for potential slide planes that extend to the proposed building location. Based on the results of our slope stability analyses, it is our opinion that the risk of a large, deep-seated type of slope failure in the proximity of the proposed building is low. Shallow, surficial slide may occur near the east property line of the subject property and within the eastern slope. However, we do not anticipate these potential shallow, surficial slide to adversely affect the proposed building.

Conclusion – Based on the site subsurface conditions, our field reconnaissance, a review of LiDAR image and previous landslide in the vicinity, and the results of our slope stability evaluation, it is our opinion that the proposed development would not adversely affect the overall stability of the site or adjacent slope/properties, provided our recommendations herein are followed and the proposed development is properly designed and constructed.

6.0 GEOTECHNICAL RECOMMENDATIONS

6.1 SEISMIC DESIGN CONSIDERATIONS

The seismic design of the residence may be accomplished using the 2015 IBC, which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years). Based on the soil conditions encountered in our test borings, it is our opinion that Site Class D should be assumed for the project design.

6.2 BUILDING FOUNDATION

Based on the results of our test borings PG-2 through PG-4, the soils at the design foundation subgrade (assumed about 2 feet below the existing grade) within the proposed building footprint will likely consist of medium dense, native outwash sand. In our opinion, conventional footings and concrete slab-on-grade are feasible to support the proposed building. If localized unsuitable soils are encountered at the foundation subgrade elevation, they should be over-excavated to reach undisturbed, medium dense native outwash sand.

The following include our recommended foundation design parameters.

Allowable Bearing Pressure – Proposed footings should be founded on undisturbed and medium dense, sand or structural fill placed on undisturbed and medium dense, sand. As such, we recommend that a maximum allowable bearing pressure of 3,000 psf be used to size the footings.

For allowable stress design, the recommended allowable bearing pressure may be increased by 1/3 for transient conditions such as wind and seismic loadings. Spread and continuous footings should have minimum widths of 24 and 18 inches, respectively.

Lateral Resistance – Lateral forces from wind or seismic loading may be resisted by a combination of passive earth pressures acting against the embedded portions of the foundations and walls, and by friction acting on the base of the foundations. Passive resistance values may be determined using an equivalent fluid weight of 350 pounds per cubic foot (pcf). This value includes a factor safety of at least 1.5 assuming that properly compacted structural fill will be placed adjacent to the sides of the footings. A friction coefficient of 0.35 may be used to determine the frictional resistance at the base of the footings. This coefficient includes a factor of safety of approximate 1.5.

Foundation Performance – Total and differential settlements are anticipated to be within tolerable limits for footings designed and constructed as discussed above. Footing settlement under static loading conditions is estimated to be less than approximately ¾ inch, and differential settlement between adjacent columns should be less than about ½ inch. Most settlement will occur during construction as loads are applied.

6.3 Floors Slabs

Floor slabs may be constructed using conventional concrete slab-on-grade floor construction. All loose soils that are present below the slab should be over-excavated. The over-excavation should be backfilled with structural fill. The exposed bottom of the excavation should be compacted to a dense and unyielding condition before placing the new structural fill.

Interior concrete slab-on-grade floors should be underlain by a capillary break consisting of at least of 4 inches of pea gravel or compacted ¾-inch, clean crushed rock (less than 3 percent fines). The capillary break material should meet the gradational requirements provided in Table 2, on the following page.

Table 2 – Capillary Break Gradation

Sieve Size	Percent Passing
¾-inch	100
No. 4	0 – 10
No. 100	0 – 5
No. 200	0 – 3

The capillary break should be placed on subgrade soils that have been compacted to a dense and unyielding condition.

A minimum 10-mil polyethylene vapor barrier should also be placed directly below the slab. Construction joints should be incorporated into the floor slab to control cracking.

6.4 BASEMENT/RETAINING WALL DESIGN PARAMETERS

Basement or retaining walls should be properly designed to resist the lateral earth pressures exerted by the soils behind the wall. Proper drainage provisions should also be provided behind the walls to intercept and remove groundwater from behind the wall. Our geotechnical recommendations for the design and construction of the below-grade walls are presented below.

Lateral Earth Pressures: Basement walls should be designed for an at-rest earth pressure of 50 pcf (assuming level backslope). The recommended lateral pressures assume that the backfill behind the wall consists of a free draining and properly compacted fill with adequate drainage provisions.

A uniform pressure of 8H psf should be added to all basement walls to reflect the increase loading for seismic conditions, where H corresponds to the buried depth of the wall.

If surcharge loads or building foundations will be located within a horizontal distance equal to the height of the backfilled wall, lateral earth pressures will need to be increased based upon the type and magnitude of surcharge.

Wall Backfill: Based on the results of our test borings, the on-site soils largely consist of silty sand. It is our opinion that the onsite soils would not be suitable for use as retaining wall backfill. For budgeting purposes, we recommend that wall backfill consist of imported free draining granular soils such as Gravel Borrow as defined in Section 9-03.14(1) of the WSDOT *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT, 2020). In areas where the space is limited between the wall and the face of excavation, clean crushed 5/8-inch rock may be used as backfill without compaction.

Wall backfill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and systematically compacted to a dense and relatively unyielding condition and to at least 95 percent of the maximum dry density, as determined using test method ASTM D 1557 (Modified Proctor). Within 5 feet of the wall, the backfill should be compacted to at least 90 percent of the maximum dry density.

Wall Drainage & Damp Proofing: Drainage provisions for walls should consist of a 4-inch diameter perforated drainpipe placed behind and at the base of the wall footings, embedded in 12 to 18 inches of clean crushed rock or pea gravel wrapped with a layer of filter fabric. A minimum 18-inch wide zone of free draining granular soils (i.e. pea gravel or washed rock) is recommended to be placed adjacent to the wall for the full height of the wall. Alternatively, a composite drainage material, such as Miradrain 6000, may be used in lieu of the clean crushed rock or pea gravel. The drainpipe at the base of the wall should be graded to direct water to a suitable outlet.

Please note that waterproofing considerations are beyond our scope of work. We recommend that a building envelope specialist be consulted to determine appropriate damp-proofing or water-proofing measures.

6.5 Permanent Drainage Considerations

Permanent control of surface water and roof runoff should be incorporated in the final grading design. In addition to these sources, irrigation and rain water infiltrating into the proposed landscaped and planter areas adjacent to paved areas or building foundations should also be controlled. All collected runoff should be directed into conduits that carry the water away from the pavement or structure and into storm drain systems or other appropriate outlets. Adequate surface gradients should be incorporated into the grading design such that surface runoff is directed away from structures.

6.6 On-Site Infiltration Considerations

Based on our review of the City of Mercer Island Low Impact Development (LID) infiltration feasibility map, the project site is in an area were infiltrating LID is not permitted.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Temporary Excavations

The following information is provided solely as a service to our client. Under no circumstances should this information be interpreted to mean that PanGEO is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

For planning purposes, the temporary unsupported excavation may be sloped as steep as 1H:1V (Horizontal:Vertical). Temporary excavations should be evaluated in the field during construction based on actual observed soil conditions. If seepage is encountered, excavation slope inclinations may need to be reduced. During wet weather, the cut slopes may need to be flattened to reduce potential erosion and should be covered with plastic sheeting.

7.2 Groundwater Control

Perched groundwater seepage may be encountered within the foundation excavations. Groundwater seepage, which is expected to be relatively minor, can likely be controlled by sloping the base of the excavation to a low point and removing the water using a sump and pump.

7.3 Material Reuse

Most of the excavated soils are anticipated to consist of silty sand, and will become disturbed and soft when exposed to inclement weather conditions. For planning purposes, we do not recommend reusing the native soils as structural fill. If it is planned to use the native soil in non-structural areas, the excavated soil should be stockpiled and protected with plastic sheeting to prevent it from becoming saturated by precipitation or runoff.

7.4 Structural Fill and Compaction

For planning and budgeting purposes, we recommend that structural fill consist of imported free draining granular soils such as Gravel Borrow as defined in Section 9-03.14(1) of the WSDOT *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT, 2020).

The structural fill should be properly moisture conditioned to near its optimum moisture content, placed in loose, horizontal lifts less than 12 inches in thickness, and systematically compacted to a dense and relatively unyielding condition and to at least 95 percent of the maximum dry density (determined by ASTM D 1557). Within 5 feet of the wall, the backfill should be compacted to 90 percent of the maximum dry density.

Depending on the type of compaction equipment used and depending on the type of fill material, it may be necessary to adjust the thickness of each lift in order to achieve adequate compaction. PanGEO can provide additional recommendations regarding structural fill and compaction during construction.

7.5 EROSION CONSIDERATIONS

Surface runoff can be controlled during construction by careful grading practices. Typically, this includes the construction of shallow, upgrade perimeter ditches or low earthen berms in conjunction with silt fences to collect runoff and prevent water from entering excavations or to prevent runoff from the construction area leaving the immediate work site. Temporary erosion control may require the use of hay bales on the downhill side of the project to prevent water from leaving the site and potential storm water detention to trap sand and silt before the water is discharged to a suitable outlet. All collected water should be directed under control to a positive and permanent discharge system.

Permanent control of surface water should be incorporated in the final grading design. Adequate surface gradients and drainage systems should be incorporated into the design such that surface runoff is collected and directed away from the structure to a suitable outlet. Potential issues associated with erosion may also be reduced by establishing vegetation within disturbed areas immediately following grading operations.

7.6 WET WEATHER CONSTRUCTION

General recommendations relative to earthwork performed in wet weather or in wet conditions are presented below. The following procedures are best management practices recommended for use in wet weather construction:

- All footing surface should be protected against inclement weather, unless the footings can be poured immediately after the subgrade is exposed. It is the contractor’s responsibility to protect the footing subgrade from disturbance. One option is to place 2 to 3 inches of lean-mix concrete or 4 to 6 inches of crushed surfacing base course on the footing subgrade as soon as the subgrade is exposed.
- Earthwork should be performed in small areas to minimize subgrade exposure to wet weather. Excavation or the removal of unsuitable soil should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- During wet weather, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight based on the portion passing ¾-inch sieve. The fines should be non-plastic.

- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water.
- Geotextile silt fences should be strategically located to control erosion and the movement of soil. Erosion control measures should be installed along all the property boundaries.
- Excavation slopes and soils stockpiled on site should also be covered with plastic sheets.

8.0 STATEMENT OF RISK

The site is mapped as a geologic hazard area by the City of Mercer Island, as documented above. Per Mercer Island City Code, development within geologic hazard areas and critical slopes may occur if the geotechnical engineer provides a statement of risk with supporting documentation indicating that one of the following conditions can be met:

a. The geologic hazard area will be modified, or the development has been designed so that the risk to the lot and adjacent property is eliminated or mitigated such that the site is determined to be safe; or

b. Development practices are proposed for the alteration that would render the development as safe as if it were not located in a geologic hazard area; or

c. The alteration is so minor as not to pose a threat to the public health, safety, and welfare; or

d. An evaluation of site-specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area.

It is our opinion that Criterion A and B can be met provided that the development is designed and constructed in accordance with the recommendations in this report. The proposed building will be located at least 70 feet from the eastern steep slope and is anticipated to be supported on footings founded on competent bearing soils. As such, based on the results of our study, it is our opinion that the site can be developed without adversely affecting the overall stability of the site or adjacent slope/properties (Criterion A).

In addition, in our opinion Criterion B can be met through best management practices during construction, including the proper use of a silt fence, minimize earthwork activities during periods heavy precipitation, minimize exposed areas in the wet season, and other appropriate temporary erosion control measures. Permanent erosion control measures, including landscape and hardscape installations, will effectively mitigate the risk of erosion in the long term.

9.0 ADDITIONAL SERVICES

To confirm that our recommendations are properly incorporated into the design and construction of the proposed structure, PanGEO should be retained to conduct a review of the final project plans and specifications, and to monitor the construction of geotechnical elements. The City of Mercer Island, as part of the permitting process, may also require geotechnical construction inspection services. PanGEO can provide you a cost estimate for construction monitoring services at a later date.

10.0 CLOSURE

We have prepared this report for Jimmy (InnHsuan) and Shannon Foo and the project design team. Recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project. The study was performed using a mutually agreed-upon scope of services.

Variations in soil conditions may exist between the locations of the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, we should be notified immediately to review the applicability of our recommendations. Additionally, we should also be notified to review the applicability of our recommendations if there are any changes in the project scope.

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our services specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances. We are not mold consultants nor are our recommendations to be interpreted as being preventative of mold development. A mold specialist should be consulted for all mold-related issues.

This report may be used only by the client and for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 24 months from its issuance. PanGEO should be notified if the project is delayed by more than 24 months from the date of this report so that we may review the applicability of our conclusions considering the time lapse.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use this report.

Within the limitation of scope, schedule and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time the Report or its contents were prepared. No warranty, express or implied, is made.

We appreciate the opportunity to be of service to you on this project. Please feel free to contact our office with any questions you have regarding our study, this report, or any geotechnical engineering related project issues.

Sincerely,

PanGEO, Inc.

Yi-Hsun William Chao, P.E.
Senior Geotechnical Engineer

Siew L. Tan, P.E.
Principal Geotechnical Engineer

11.0 REFERENCES

ASTM D1557-12e1, *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))*, ASTM International, West Conshohocken, PA, 2012, www.astm.org

ASTM D1586-11, *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*, ASTM International, West Conshohocken, PA, 2011, www.astm.org.

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Troost, K.G., and Wisher, A.P, 2006, *Geologic Map of Mercer Island, Washington*, scale 1:24,000.

The Galli Group, 2008, Geotechnical Investigation, Slide and Retaining Wall Remediation, Idiart Residence, 7411 SE 36th Street, Mercer Island, WA 98040, Consultant report prepared for Roger and Debbie Idiart.

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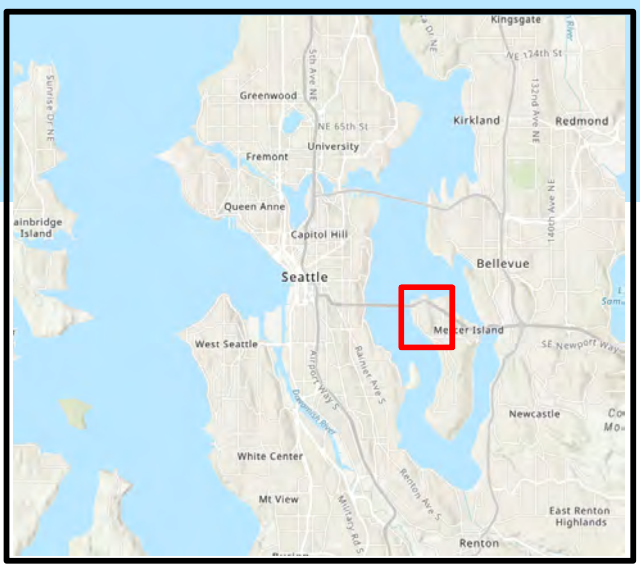
Washington Administrative Code (WAC), 2013, Chapter 296-155 - Safety Standards for Construction Work, Part N - Excavation, Trenching, and Shoring, Olympia, Washington.

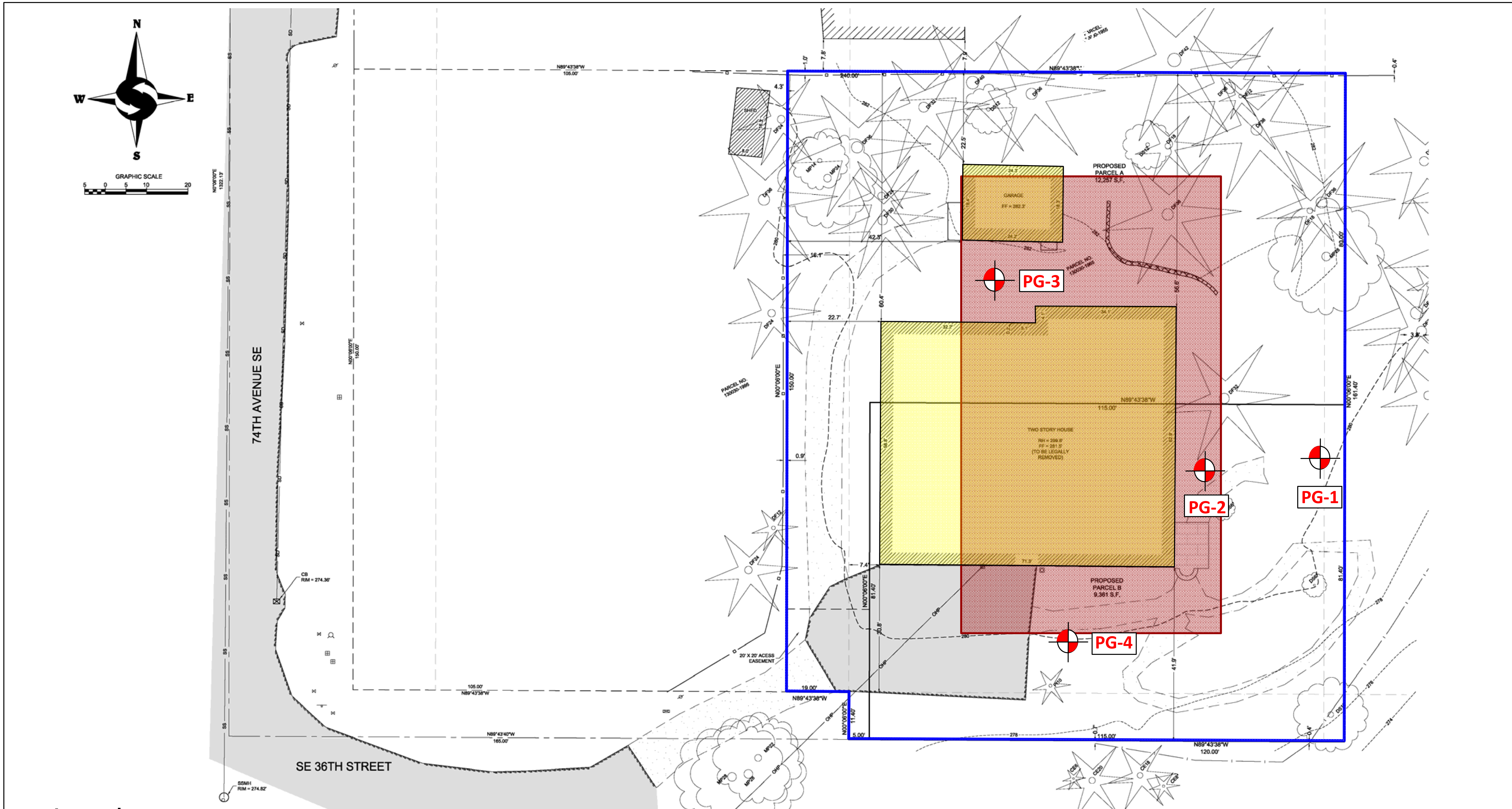


Reference: ESRI ArcGIS Terrain Map

N

Not to Scale

PanGEO INCORPORATED	**Proposed Development** **3453 74th Avenue Southeast** **Mercer Island, Washington**	**VICINITY MAP**	
		20-084	**1**



Legend:

PG-1 Approximate Boring Location (PanGEO, 2020)

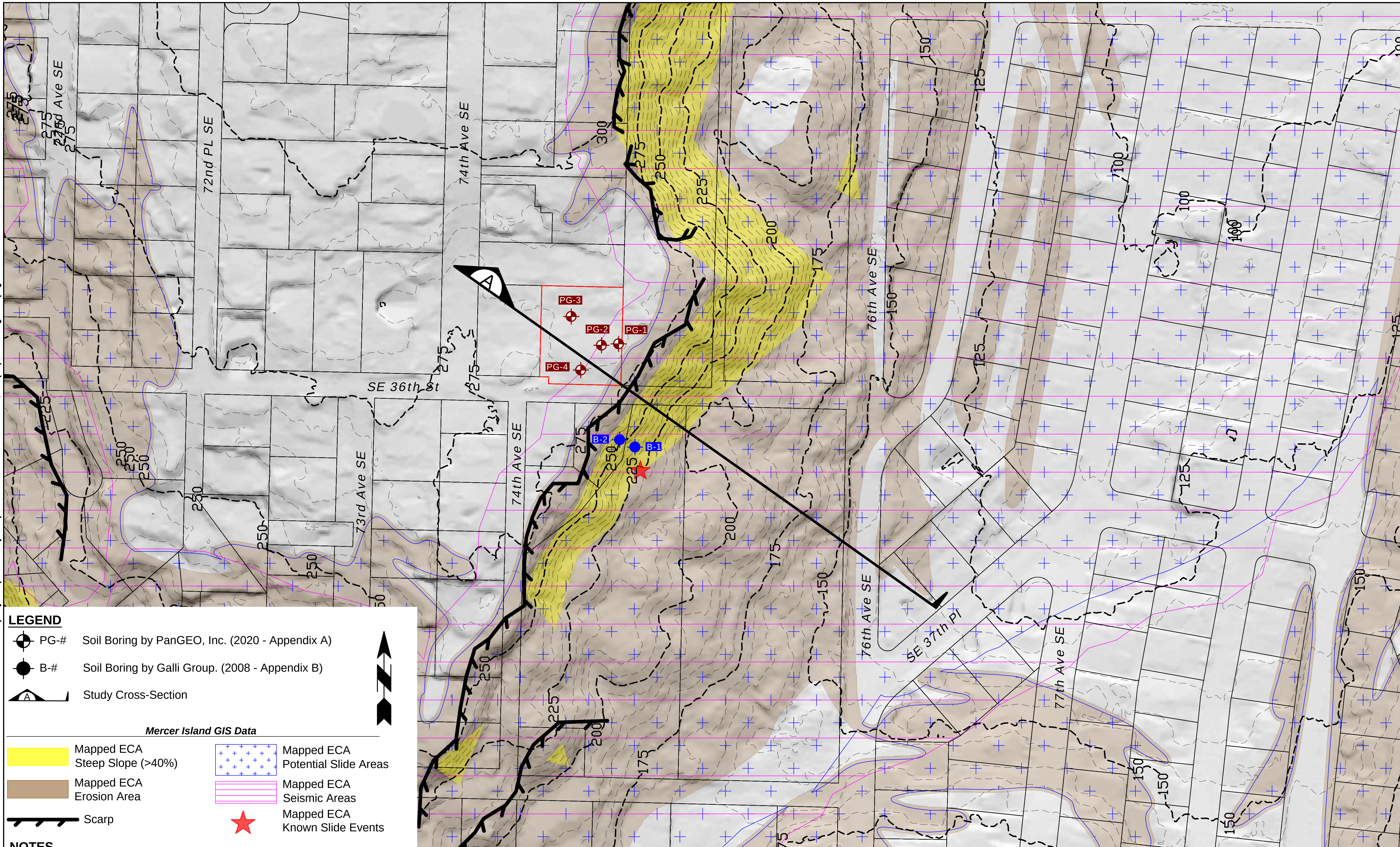
Approximate Site Boundary

Existing Structures

Approximate Location of Proposed Building

Note: Base map modified from Preliminary Short Plat Survey, prepared by Site Surveying, Inc., dated June 14, 2018

PanGEO INCORPORATED	Proposed Development 3453 74th Avenue Southeast Mercer Island, Washington	SITE AND EXPLORATION PLAN
		Project No. 20-084 / Figure No. 2



NOTES

1. Base map and features are based on 2016 King County Lidar and GIS data obtained from Washington DNR and City of Mercer Island websites. Features are provided for relative information only and are not a substitution for field survey.
2. Locations of borings are approximate and based on the relative locations of known site features.
3. Vertical Datum: NAVD 88

100' 0 100' 150'
scale in feet
Scale: 1" =150'

PanGEO INCORPORATED

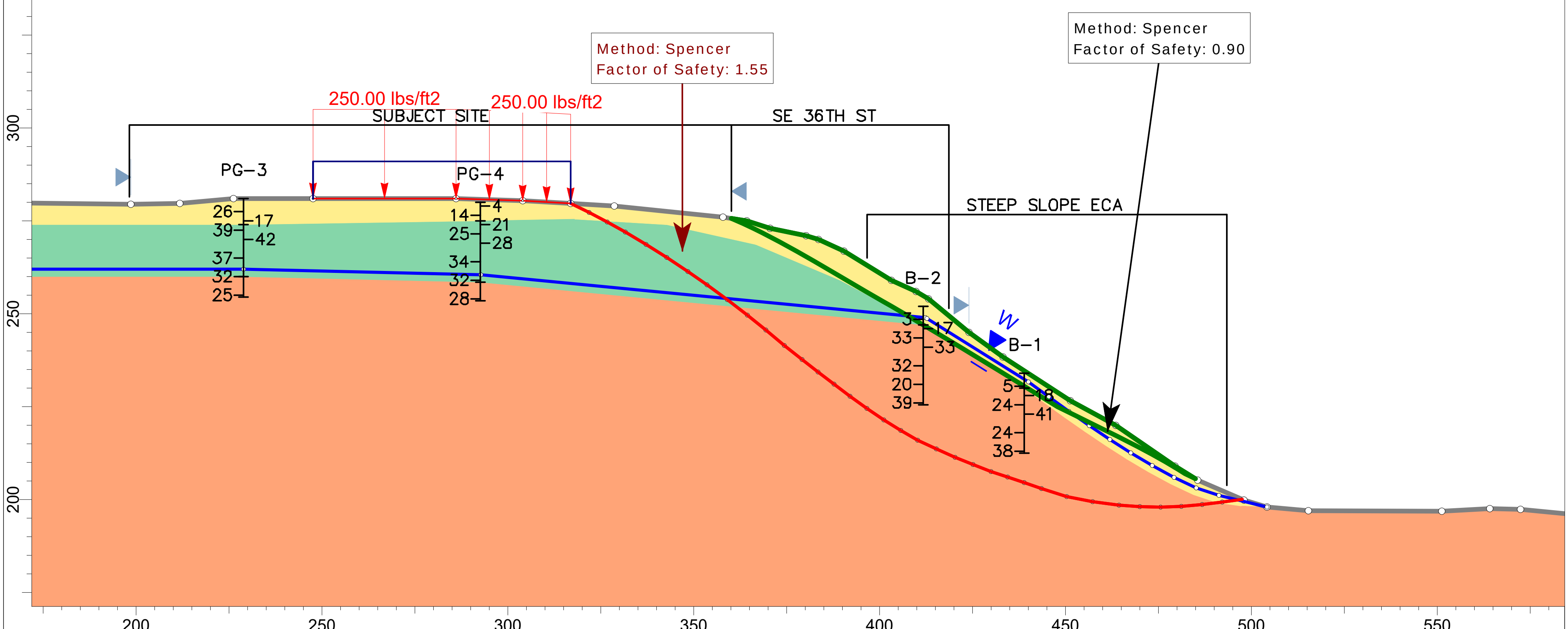
Proposed Development
3453 74th Avenue Southeast
Mercer Island, Washington

LIDAR AND CRITICAL AREAS

PROJECT NO.	FIGURE NO.
20-084	3

Z:\Projects\2020 Projects\20-084 3453 74th Ave SE, MI\Report & Figures\Figures
DATE: 3/30/2020
CHECKED BY: WC
DRAWN BY: NTW

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
ESU 1: Fill / Colluvium		115	Mohr-Coulomb	0	30	Water Surface
ESU 2: Adv Outwash		120	Mohr-Coulomb	0	38	Water Surface
ESU 3: Lawton Clay		120	Mohr-Coulomb	600	26	None



PanGEO INCORPORATED

SLIDEINTERPRET 8.029

Proposed Development

3453 74th Avenue Southeast

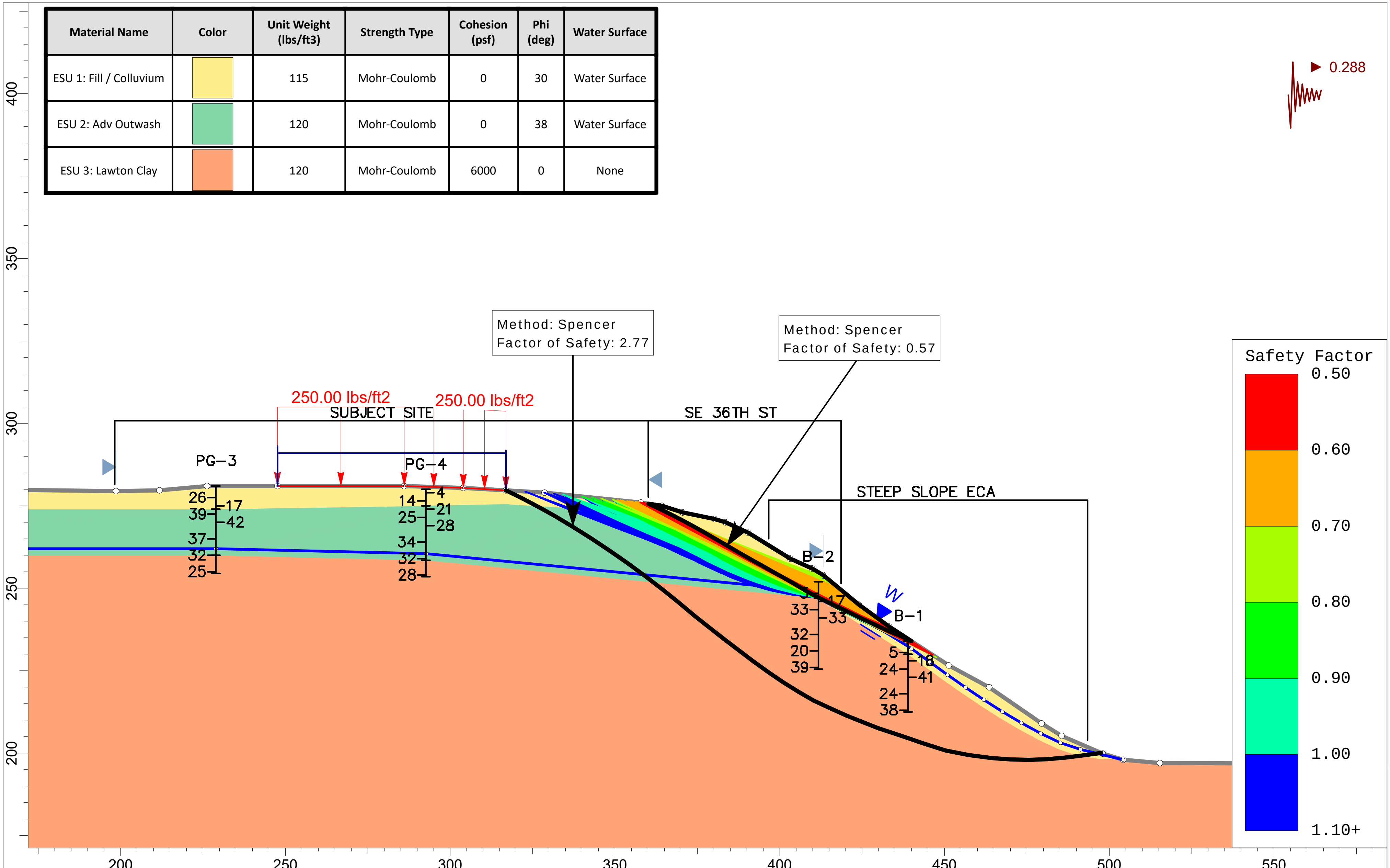
Mercer Island, Washington

Static Global Stability Analysis

Section A - Proposed Condition

Scale:	Project No.	Figure No.
1:480	20-084	X

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
ESU 1: Fill / Colluvium		115	Mohr-Coulomb	0	30	Water Surface
ESU 2: Adv Outwash		120	Mohr-Coulomb	0	38	Water Surface
ESU 3: Lawton Clay		120	Mohr-Coulomb	6000	0	None



SLIDEINTERPRET 8.029

PanGEO INCORPORATED

Proposed Development

3453 74th Avenue Southeast

Mercer Island, Washington

Pseudo-Static (Seismic) Global Stability Analysis

Section A - Proposed Condition (All F.S. < 1.1)

Scale:	Project No.	Figure No.
1:480	20-084	X

APPENDIX A

TEST BORING LOGS

RELATIVE DENSITY / CONSISTENCY

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)	GW	Well-graded GRAVEL
		GP	Poorly-graded GRAVEL
	GRAVEL (>12% fines)	GM	Silty GRAVEL
		GC	Clayey GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)	SW	Well-graded SAND
		SP	Poorly-graded SAND
	SAND (>12% fines)	SM	Silty SAND
		SC	Clayey SAND
Silt and Clay 50%or more passing #200 sieve	Liquid Limit < 50	ML	SILT
		CL	Lean CLAY
		OL	Organic SILT or CLAY
	Liquid Limit > 50	MH	Elastic SILT
		CH	Fat CLAY
		OH	Organic SILT or CLAY
Highly Organic Soils		PT	PEAT

Notes:
1. Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.
2. The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

DESCRIPTIONS OF SOIL STRUCTURES

Layered:	Units of material distinguished by color and/or composition from material units above and below
Laminated:	Layers of soil typically 0.05 to 1mm thick, max. 1 cm
Lens:	Layer of soil that pinches out laterally
Interlayered:	Alternating layers of differing soil material
Pocket:	Erratic, discontinuous deposit of limited extent
Homogeneous:	Soil with uniform color and composition throughout
Fissured:	Breaks along defined planes
Slickensided:	Fracture planes that are polished or glossy
Blocky:	Angular soil lumps that resist breakdown
Disrupted:	Soil that is broken and mixed
Scattered:	Less than one per foot
Numerous:	More than one per foot
BCN:	Angle between bedding plane and a plane normal to core axis

COMPONENT DEFINITIONS

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel		Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
Coarse Gravel:	3 to 3/4 inches	Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Fine Gravel:	3/4 inches to #4 sieve	Silt	0.074 to 0.002 mm
		Clay	<0.002 mm

TEST SYMBOLS

for In Situ and Laboratory Tests listed in "Other Tests" column.

ATT	Atterberg Limit Test
Comp	Compaction Tests
Con	Consolidation
DD	Dry Density
DS	Direct Shear
%F	Fines Content
GS	Grain Size
Perm	Permeability
PP	Pocket Penetrometer
R	R-value
SG	Specific Gravity
TV	Torvane
TXC	Triaxial Compression
UCC	Unconfined Compression

SYMBOLS

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Spilt Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

MONITORING WELL

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

MOISTURE CONTENT

Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

PanGEO INCORPORATED
Phone: 206.262.0370

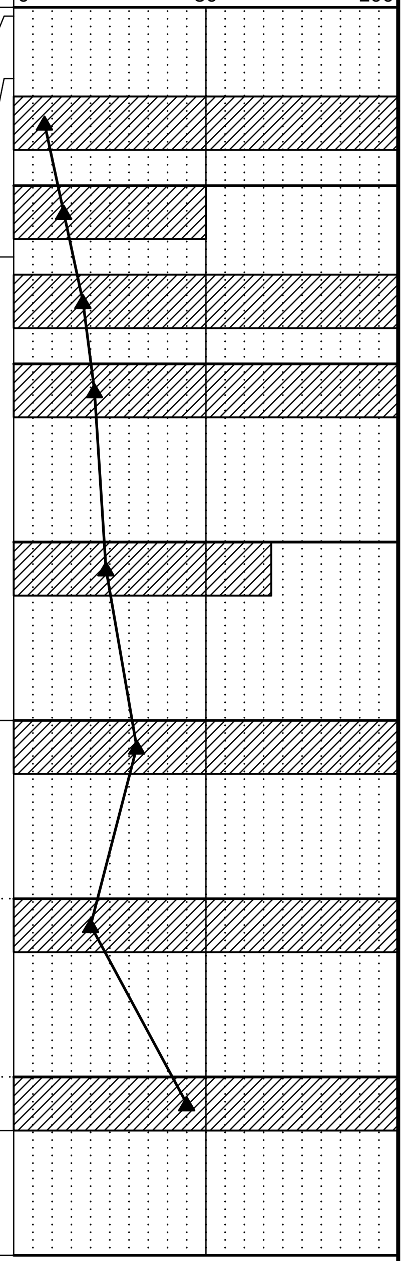
Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	Proposed Development	Surface Elevation:	Approx. 280 feet
Job Number:	20-084	Top of Casing Elev.:	
Location:	3453 74th Avenue SE, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: 47.578374, Easting: -122.239387	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Approximately 3 inches of topsoil.
						[FILL]. Loose, brown to gray, silty fine to medium SAND, trace gravel, trace iron oxide staining, trace organic material (rootlets); moist;.
	S-1	SPT	4 4 4			
						[WEATHERED ADVANCE OUTWASH - Qva]. Loose to medium dense, brown, silty medium SAND, trace gravel, trace iron oxide staining, trace organic material (rootlets); moist..
5	S-2	SPT	4 4 9			
	S-3	SPT	7 7 11			**[ADVANCE OUTWASH - Qva].** Medium dense, brown, fine to medium SAND, trace to some silt, trace iron oxide staining (horizontal layering); moist to very moist.
10	S-4	SPT	6 8 13			Decrease in silt content and iron oxide staining in sample S-4.
15	S-5	SPT	5 11 13			Layer (2-inch) of increased silt content at bottom of sample S-5.
20	S-6	SPT	6 11 21			**[LAWTON CLAY - Qvlc].** Hard, gray, sandy SILT, trace clay, trace iron oxide staining; moist; low-plastic, blocky texture.
25	S-7	SPT	5 8 12			Very stiff, blue gray, silty CLAY to clayey SILT; moist; non- to low-plastic, wavy laminated.
30	S-8	SPT	10 22 23			Hard, gray to blue, clayey SILT, trace sand; moist; non-plastic, wavy laminated.
						Boring terminated approximately 31.5 feet below ground surface. Groundwater was not encountered at the time of drilling.
35						

N-Value ▲ | PL — Moisture ● — LL | RQD | Recovery | 0 50 100



Completion Depth:	31.5ft
Date Borehole Started:	3/18/20
Date Borehole Completed:	3/18/20
Logged By:	C. Venturino
Drilling Company:	Geologic Drill Partners

Remarks: Boring drilled using a Bobcat-mounted mini track drill rig. Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Surface elevation estimated from Preliminary Short Plat Survey provided by Site Surveying, Inc., dated June 14, 2018

PanGEO INCORPORATED

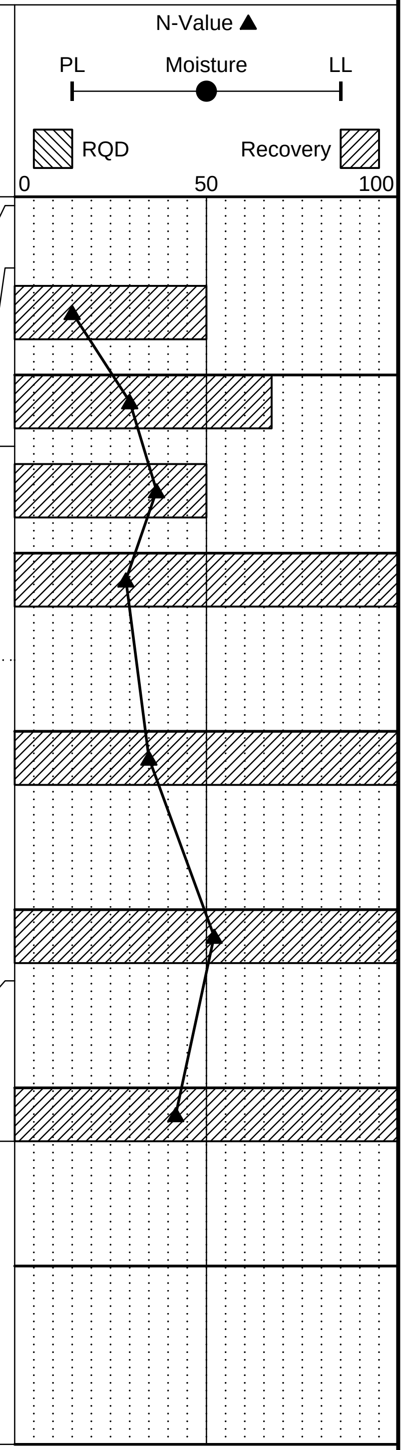
LOG OF TEST BORING PG-1

Figure A-2

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Development	Surface Elevation:	Approx. 281.5 feet
Job Number:	20-084	Top of Casing Elev.:	
Location:	3453 74th Avenue SE, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: 47.57837, Easting: -122.239479	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Approximately 3 inches of topsoil.
						[FILL]. Medium dense, brown to gray, silty fine to medium SAND, trace gravel, trace iron oxide staining, trace organic material (rootlets); moist;.
	S-1		2 6 9			
						[WEATHERED ADVANCE OUTWASH - Qva]. Dense, brown to gray, silty medium SAND with gravel to gravelly SAND with silt, trace iron oxide staining; moist.
5	S-2		7 14 16			
						[ADVANCE OUTWASH - Qva].
	S-3		13 18 19			Slight decrease in gravel content in sample S-3.
10	S-4		9 12 17			Becomes medium dense. Silt layer (3-inch) at bottom of sample.
						Dense, brown to gray, fine to medium SAND, trace silt, trace iron oxide staining; moist.
15	S-5		12 17 18			
20	S-6		12 22 30			Becomes very dense. Small gravel in sampler cap may have inflated blow count value.
						[LAWTON CLAY - Qvlc]. Hard, gray, sandy SILT, trace clay, trace iron oxide staining; moist; non-plastic, wavy lamination.
25	S-7		12 15 27			
						Boring terminated at approximately 26.5 feet below ground surface. Groundwater was not encountered at the time of drilling.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	3/18/20
Date Borehole Completed:	3/18/20
Logged By:	C. Venturino
Drilling Company:	Geologic Drill Partners

Remarks: Boring drilled using a Bobcat-mounted mini track drill rig. Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Surface elevation estimated from Preliminary Short Plat Survey provided by Site Surveying, Inc., dated June 14, 2018

PanGEO INCORPORATED

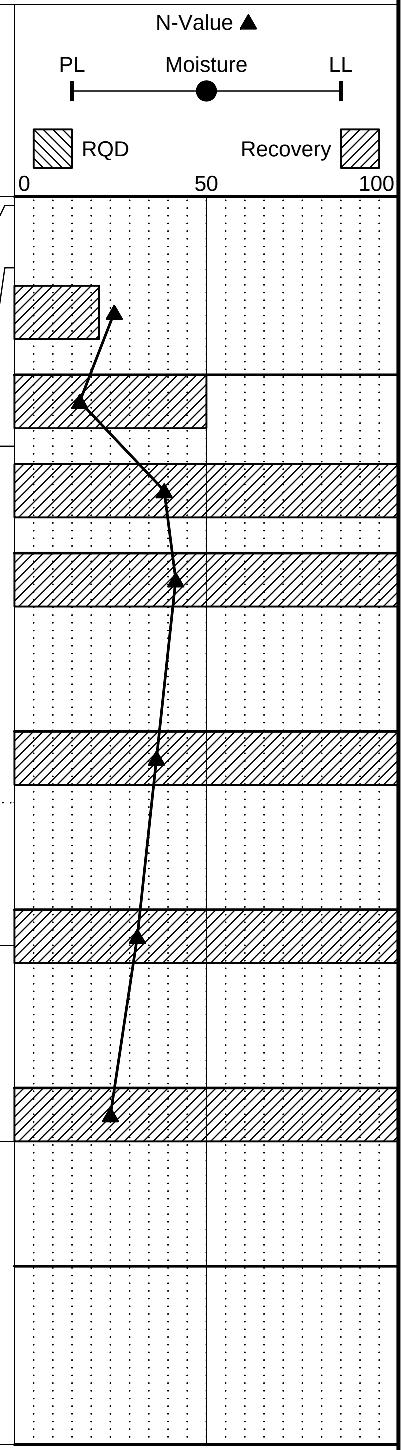
LOG OF TEST BORING PG-2

Figure A-3

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Development
Job Number:	20-084
Location:	3453 74th Avenue SE, Mercer Island, WA
Coordinates:	Northing: 47.578514, Easting: -122.239714
Surface Elevation:	Approx. 281 feet
Top of Casing Elev.:	
Drilling Method:	HSA
Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0						Approximately 3 inches of topsoil.
						[FILL]. Medium dense, dark brown to gray, silty fine to medium SAND, trace gravel, trace organic material (rootlets); moist; slight increase in silt content with depth.
	S-1		9 12 14			
						[WEATHERED ADVANCE OUTWASH - Qva]. Medium dense, brown to gray, silty fine to medium SAND, trace to some gravel, trace iron oxide staining; moist.
5	S-2		7 7 10			
						[ADVANCE OUTWASH - Qva]. Dense, brown to gray, silty fine to medium SAND with gravel to gravelly SAND with silt, trace iron oxide staining; moist.
	S-3		18 19 20			
10	S-4		16 19 23			Slight increase in moisture at top of sample S-4.
15	S-5		15 16 21			
						Dense, brown to gray, fine to medium SAND, trace to some silt, trace gravel, trace iron oxide staining; moist; increase in silt content with depth.
20	S-6		15 17 15			
						[LAWTON CLAY - Qvlc]. Very stiff, gray to blue gray, sandy SILT, trace clay, trace iron oxide staining; moist; non-plastic, blocky texture.
25	S-7		10 10 15			
						Boring terminated at approximately 26.5 feet below ground surface. Groundwater was not encountered at the time of drilling.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	3/18/20
Date Borehole Completed:	3/18/20
Logged By:	C. Venturino
Drilling Company:	Geologic Drill Partners

Remarks: Boring drilled using a Bobcat-mounted mini track drill rig. Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Surface elevation estimated from Preliminary Short Plat Survey provided by Site Surveying, Inc., dated June 14, 2018

PanGEO INCORPORATED

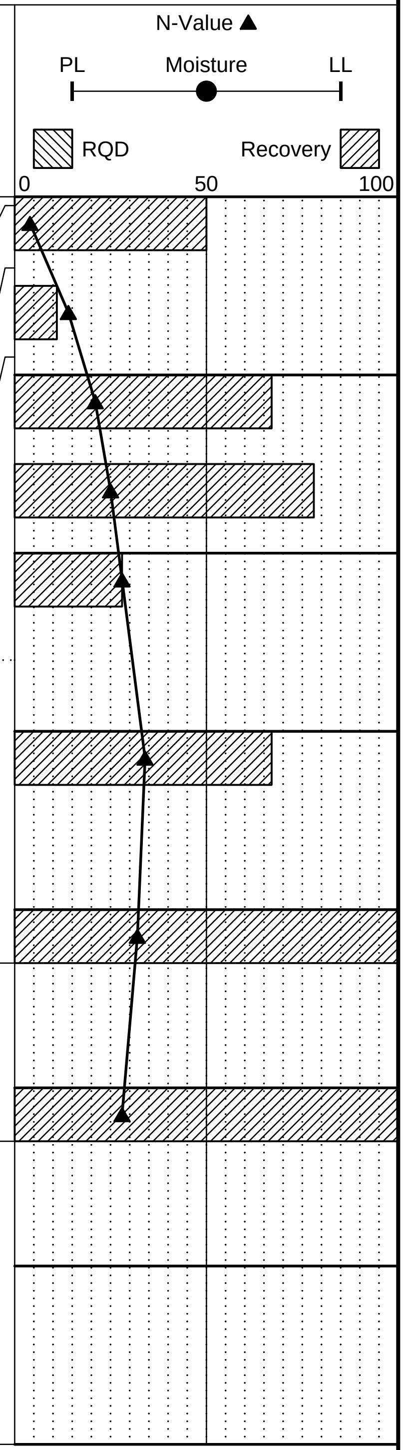
LOG OF TEST BORING PG-3

Figure A-4

The stratification lines represent approximate boundaries. The transition may be gradual.

Project:	Proposed Development	Surface Elevation:	Approx. 280 feet
Job Number:	20-084	Top of Casing Elev.:	
Location:	3453 74th Avenue SE, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: 47.578282, Easting: -122.239597	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1	SPT	2, 2, 2			Approximately 3 inches of topsoil. **[FILL].** Loose, dark brown, silty fine SAND, trace gravel, trace organic material (rootlets and wood debris); moist.
	S-2	SPT	2, 4, 10			**[WEATHERED ADVANCE OUTWASH - Qva].** Medium dense, gray, silty fine to medium SAND, trace to some gravel, trace organic material; moist..
5	S-3	SPT	9, 10, 11			**[ADVANCE OUTWASH - Qva].** Medium dense to stiff, gray, silty fine SAND to sandy SILT, trace gravel, trace organic material, trace iron oxide staining; moist.
	S-4	SPT	10, 11, 14			
10	S-5	SPT	13, 17, 11			
						Dense, gray to brown, fine to medium SAND, trace silt, trace gravel; moist.
15	S-6	SPT	11, 14, 20			
20	S-7	SPT	7, 14, 18			Slight increase in iron oxide staining and gravel in sample S-7.
						[LAWTON CLAY - Qvlc]. Very stiff, blue gray, silty CLAY to clayey SILT, trace sand; moist; low-plastic, wavy lamination.
25	S-8	SPT	7, 12, 16			
						Boring terminated at approximately 26.5 feet below ground surface. Groundwater was not encountered at the time of drilling.
30						
35						



Completion Depth:	26.5ft
Date Borehole Started:	3/18/20
Date Borehole Completed:	3/18/20
Logged By:	C. Venturino
Drilling Company:	Geologic Drill Partners

Remarks: Boring drilled using a Bobcat-mounted mini track drill rig. Standard Penetration Test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Surface elevation estimated from Preliminary Short Plat Survey provided by Site Surveying, Inc., dated June 14, 2018

PanGEO INCORPORATED

LOG OF TEST BORING PG-4

Figure A-5

The stratification lines represent approximate boundaries. The transition may be gradual.

APPENDIX B

PREVIOUS TEST BORING LOGS

Project 1509 - 01

Boring Log B-1

4-2-08

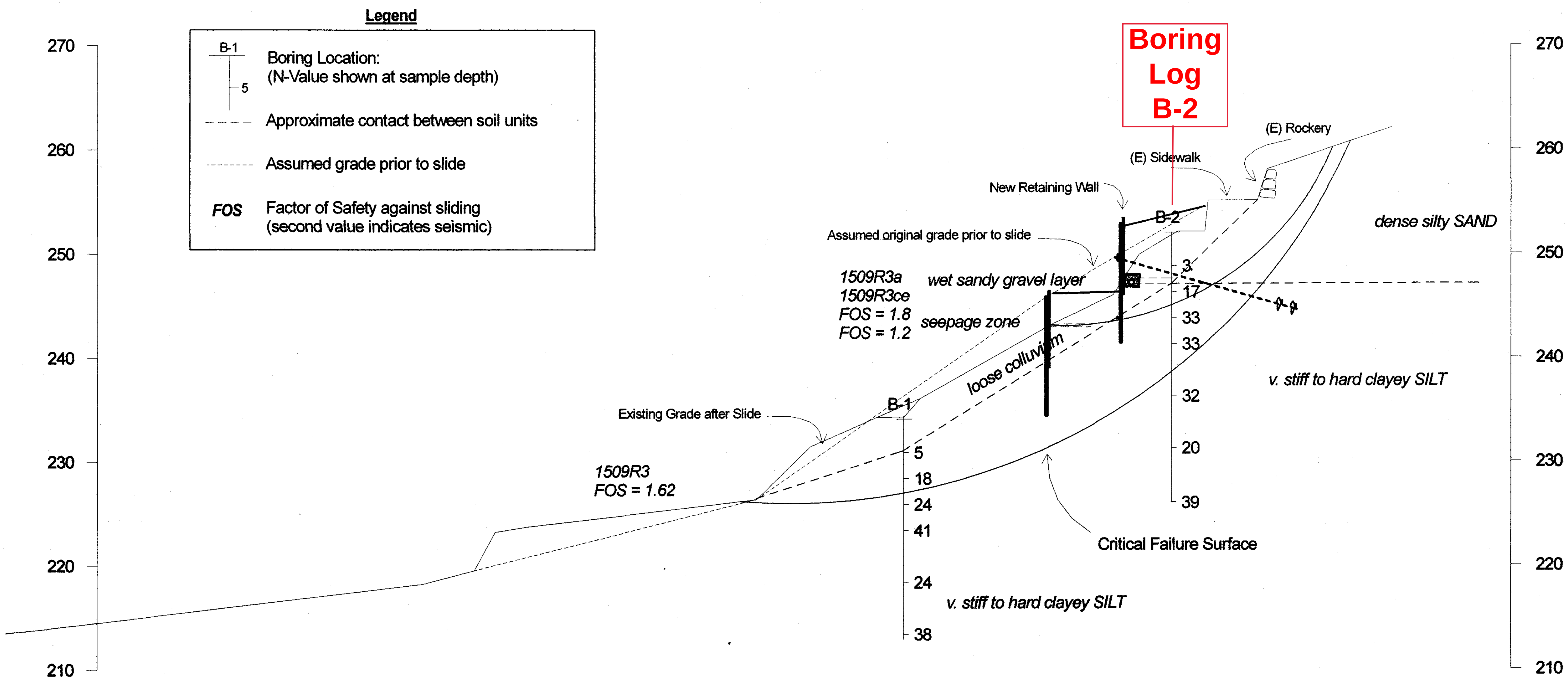
Elevation = ± 234 feet

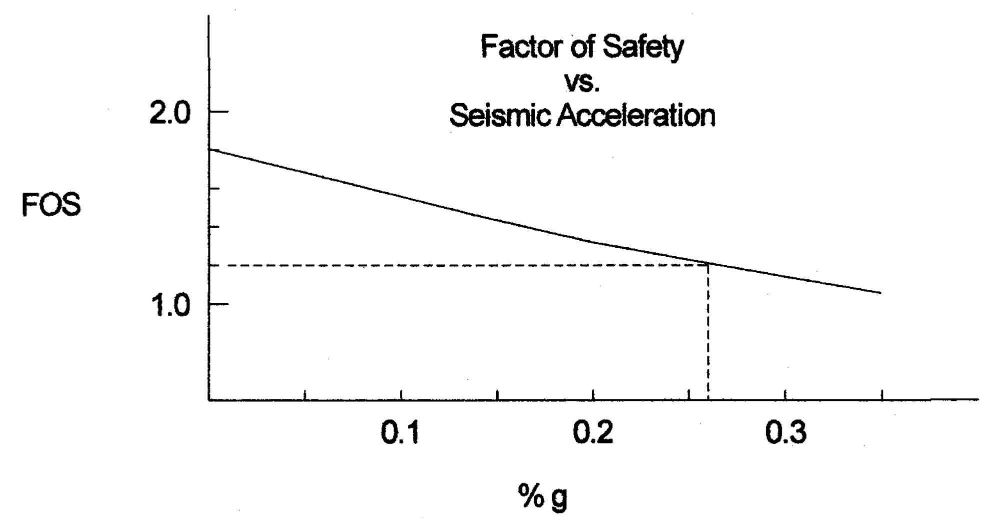
Log	Soil Description	Depth	Sample	SPT
	Brown, loose, v. silty SAND with clay; wet (Colluvium)		S-1	2-2-3
	Brown, v. stiff clayey SILT with trace fine sand, Wet. (TRANSITIONAL BEDS).	5'	S-2	5-7-11
	-gray-brown, clayey Silt; oxidized surfaces; moist		S-3	4-9-15
	-brown, clayey SILT	10'	S-4	9-16-25
	-gray-brown clayey SILT; weathered seams	15'	S-5	8-11-13
	Gray, hard, clayey SILT	20'	S-6	10-15-23
	Bottom of boring at 21.5 feet No water in boring	25'		
	Bottom of boring at 26.5', no water table encountered --Boring located 3' below sidewalk	30'		
		35'		
		40'		
		45'		

The Galli Group
Geotechnical Consulting
5034 - 18th Avenue NE
Seattle, WA 98105

7411 32nd Ave.
Mercer Island, Washington

Figure A-2





Date:
5-28-08

Roger Idiart Residence
7411 SE 36th Street
Mercer Island, WA 98040

Generalized Soil Stratigraphy

The Galli Group
5034 18th Avenue NE
Seattle, WA 98105
206-525-5097

FIGURE
3

April 26, 2020

Jimmy and Shannon Foo
2820 29th Avenue W
Seattle, WA 98199

Re: Bald eagle nest guidelines, permits, and regulations for property located at 3453 74th Avenue SE in Mercer Island, Washington.

Dear Jimmy and Shannon:

Ecological Land Services, Inc. (ELS) was contracted to conduct a reconnaissance of bald eagle nests at the above-referenced property in order to determine presence and/or current usage. Three bald eagle nests are mapped by the City of Mercer Island Information and Geographic Services (IGS) website within and in the vicinity of Mercerdale Hillside Park. The buffers from the eagle nests are 330 feet and 660 feet as required by the U.S. Fish and Wildlife Services (USFWS), which are also shown on the IGS map (Attachment 1). The reconnaissance involved a 1.5 to 2 hour visit to the property and the park to look for the nests and make observations regarding eagle presence. The site visit was conducted on Friday, March 1, 2019, between 11:30 and 1:30 p.m. and the weather was sunny with temperatures to 45 degrees.

Bald Eagle Breeding Season

Bald eagle nests in western Washington are typically found near the top of the tallest conifer trees that include Douglas fir and grand fir. The nests are constructed of large sticks and lined with moss, grass, plant stalks, lichen, seaweed, or sod. They are usually about 4 to 6 feet in diameter and roughly 3 feet deep. They often weigh up to 1,000 pounds so the upper branches of the trees must be strong enough to support the nests. Mated pairs often have alternate nests, which are built or maintained by the eagles, and are not used on a yearly basis.

Nesting usually begins several months before eggs are laid, which typically occurs from late April to early May in Washington State. The incubation period is 33 to 35 days and eaglets start to fly around 10 to 12 weeks after hatching and fledge within a few days of their first flight. Young birds remain close to their natal nest for several weeks after fledging because they are dependent on their parents for up to an additional 6 weeks. Bald eagle nest occupation begins in January with the building or repair of nests and ends near the end of August when the young have fully fledged.

Reconnaissance Results

The reconnaissance involved observations from the property at 3453 74th Avenue SE to determine if the nest closest to the property was present and whether there were eagles on the nest. Research of the Mercer Island IGS indicated that the last time the nest was identified in the mapped location was July 22, 2005, and at that time, it was in a leaning grand fir tree with a flagged top. Onsite observations of the area did not reveal a tree containing a bald eagle nest and the leaning grand fir was not seen. Since it was last identified in July of 2005, it is possible that the tree fell especially since it was leaning at that time. Additional reconnaissance from the Mercerdale Park trails did not result in identification of eagle nests in any of the trees on the hillside or within proximity of the property. The Mercerdale Hillside Park Trail is east and along the hillside below the subject property. The closest trail to the subject property is about 35 feet below the elevation of the property and within about 100 feet so the property and the potential nest trees could be seen from the trail. The trail winds up to the end of 74th Avenue, which provided an additional vantage point to view the mapped nest location.

The second closest nest is mapped next to the existing home at 3635 74th Avenue SE and according to the Mercer Island ICS mapping website, it is situated about 30 feet from the top of a Douglas fir tree near the southeast corner of that property. The information did not include the date of the last sighting within the nest so there is no recent information regarding use of the nest. However, no eagles were heard or seen within the vicinity of this property or the subject property. The mapped nest is roughly 550 feet from the subject property and there is no direct line of sight between it and the nest location due to the number of native and ornamental trees and homes between the two areas.

The third nest is mapped about 750 feet southwest of the subject property. The nest tree is a Douglas fir that is about 15 feet south of SE 38th Street on a currently undeveloped property according to the information in the Mercer Island ICS mapping website. The use of the nest was noted last in November 2015 and there is no recent information regarding its use. This mapped nest tree is greater than 660 feet from subject property and there is no direct line of sight again because of homes and trees but also because it is slightly downslope of this property.

There is no recent information available because bald eagles were removed from the Endangered Species list and both the U.S. Fish and Wildlife Service (USFWS) and the Washington Department of Fish and Wildlife (WDFW) no longer actively monitor the use of eagle nests. WDFW does not require buffers from eagle nests or permits for construction within proximity to nests but the USFWS as well as the City of Mercer Island, require 660 feet of buffer around identified nest trees. The USFWS will issue a disturbance permit for activities in proximity to eagle nests, which serves as legal authorization that protects the landowner from prosecution for potential nest disturbances.

The nest that is mapped closest to the property was not found during the site reconnaissance on March 1, 2019. The next closest nest could not be accessed because it is mapped on private property so its presence and/or use could not be definitively verified. Based on the observations made by ELS, there does not appear to be an active eagle nest within 330 feet of this property. The next closest nest is mapped about 550 feet from the property and there is no line of sight because of existing development and vegetation. The furthest nest was not examined for usage because it is outside the buffer distances required by the USFWS.

Development Feasibility

Bald eagle nests are generally in use yearly between January and August and construction activities are not allowed when they are within 660 feet of the nest. The *National Bald Eagle Guidelines* document prepared by the USFWS in May of 2007 provides additional guidance regarding development within proximity to an active eagle nest. The Activity-Specific Guidelines section of the referenced document considers building construction of a 1 or 2 story building having a footprint of less than one-half acre a Category A activity. Construction on this property will have a less than one-half acre footprint and will likely consist of a 1 or 2 story building so would meet the criteria for a Category A activity. The category of the activity is important because for Category A activities where there is no line of sight between the activity and the nest tree, a buffer of 330 feet is recommended. It further states that clearing, external construction, and landscaping between 330 and 660 feet should be conducted outside the breeding season.

The bald eagle nests around the Mercerdale Park are located within residentially developed areas with the two mapped nests on or adjacent to developed properties. Based on the locations of these nests, the eagles are likely accustomed to the activities within the residential area and would likely not be negatively impacted by construction activities on this property. Despite the mapped location of the nest trees within 330 and 660 feet of the property, guidance states that onsite activities should be conducted outside the breeding season or between September 1st and December 31st so that breeding of the bald eagles is not negatively impacted. ELS contacted Katherine Watts with the USFWS via email on March 4, 2019 regarding our findings and they suggest that an additional reconnaissance be conducted on or around

April 1st to determine if the nest about 550 feet away is occupied for the year. In addition, ELS completed the online *Do I Need a Permit* questionnaire on the USFWS website to determine when a permit would be needed. The results of the questionnaire for construction activities between January and August was a permit is needed if the nest is within 660 feet and a permit would not be required if the work was conducted after August 31st and the nest is within 330 feet.

ELS observations revealed that no nest was observed in the area mapped just offsite from the subject property from both the property itself and the Mercerdale Park Trail. The mapped nest that is about 550 feet from the subject property is located on private property so we couldn't get close enough to verify the presence/use of the nest. Because use of this nest could not be definitively verified, ELS recommends avoiding work during the breeding season to avoid needing the permit from USFWS. To avoid the breeding season restrictions, additional visits to the area are recommended to determine definitively that the eagle nest is either not present or not in use. According to Ms. Watts of the USFWS, the best time to conduct another visit would be on or around April 1st. Based on the locations of the mapped eagle nests and after review of the current regulations and guidelines, construction on this property is allowed even if it is within the designated eagle nest tree buffers.

Potential Impacts to Bald Eagle Nesting Activities

The MIC requires project proceed through the mitigation sequencing section (19.07.107.B.1.f) when projects are proposed within FWHCA buffers to demonstrate that the project avoids and minimizes potential impacts to bald eagle nests and their use. The project proposes to replace the existing home, which will require demolition and construction activities, with a new home in the same basic location. The home is surrounded by maintained grounds including lawn and ornamental landscaping, which extend to the top of the steep east facing slope, which lies about 40 feet east of the home.

This project is proposed in a high intensity residential area of Mercer Island where the main impact to eagle nesting activities will be the noise generated during demolition and construction. There will be heavy equipment noise during demolition and other early construction activities. Noise generated by construction workers and specialty contractors will replace the heavy equipment noise and while there will be occasional large delivery trucks, the noise level will be lower during the late stages of construction. Once construction is completed and the house is occupied, the noise levels will return to current residential levels. Overall, there will be temporary and short-term noise impacts that will rectify once the house is occupied.

The closest eagle nest on the Mercer Island map was not observed during the March 2019 field visit and is presumed abandoned or destroyed. There is a somewhat obscured line of sight from the property to the closest mapped eagle nest, but the onsite vegetation will remain to provide screening of noise generated during construction should the nest become active again. There is no direct line of sight from the property to the nests within the residential area to the south because of the multiple residences (5 to 7), 36th Street, and existing landscape between the property and the closest nest. The noise generated onsite will be screened by the existing residential noises and native/ornamental vegetation on the private lots. The furthest south nest is about 750 feet from the project so is not within the eagle management boundaries established from this property. There is no line of sight to this nest and the noise generated onsite will not influence the use of this nest.

This project will generate temporary noise that may impact the use of the closest nests but only during construction activities. The noise impacts cannot be avoided but the project is a residential project and will replace an existing home so avoids creating new, long-term sources of noise that would affect use of the mapped eagle nests. The noise impacts will be minimized by maintaining as much of the existing onsite vegetation in order to diminish the distance that the construction noises extend. In addition, the demolition and early construction activities will be completed after the bald eagle nesting season ends in August. Because the project's noise impacts are unavoidable yet temporary, mitigation is not needed to aid in protection of the closest nest. The project will also have little to no impact to the unverified eagle nests offsite to the south because of the distances (550 to 750 feet), the residential development, and large tree/residential landscaping. The project will be conducted entirely onsite and does not propose to remove any native vegetation that might be used by the local eagle population so avoids impacts to habitat conditions in this area of Mercer Island.

If you have any additional questions regarding construction on the property and the eagle nests, please contact me at (360) 674-7186 or joanne@eco-land.com.

Sincerely,

Joanne Bartlett

Joanne Bartlett
Senior Biologist

Attachment