PanGEO
INCORPORATED
Geotechnical & Earthquake Engineering Consultants

September 2, 2022
File No. 22-179

Carla and John Monahan
2424 67th Avenue SE
Mercer Island, WA 98040

Subject: **Geotechnical Engineering Report**
Monahan Residence – Proposed Addition
2424 67th Avenue SE, Mercer Island, Washington

Dear Carla and John,

As requested, PanGEO, Inc. has completed a geotechnical engineering study for the proposed addition at the above-referenced property. This study was performed in general accordance with our mutually agreed scope of work outlined in our proposal dated April 6, 2022, and was subsequently approved by you. Our service scope included reviewing readily-available geologic and geotechnical data in the project vicinity, reviewing preliminary design plans, drilling two test borings, conducting a site reconnaissance, and developing the conclusions and recommendations presented in this report.

SITE AND PROJECT DESCRIPTION

The subject site is an approximately 8,856 square foot lot located at 2424 67th Avenue SE in the City of Mercer Island, Washington (see Figure 1, Vicinity Map). The subject lot is rectangular in shape, and is bordered to the west by 67th Avenue SE, and to other three sides by existing single-family residences. A one-story single-family house with a partial basement occupies the approximately middle portion of the site. The site grade generally descends from east to west with a total vertical relief of up to about 14 feet, or an average slope gradient of 13 percent. (see Figure 2, Site and Exploration Plan).

Based on the information provided to us, we understand that you plan to remodel the existing house and add a second story addition onto the existing house (see Plate 1, on the following page). The construction is mainly for the interior remodel and upper floor addition. We expect that the site grading earthwork will be minor.

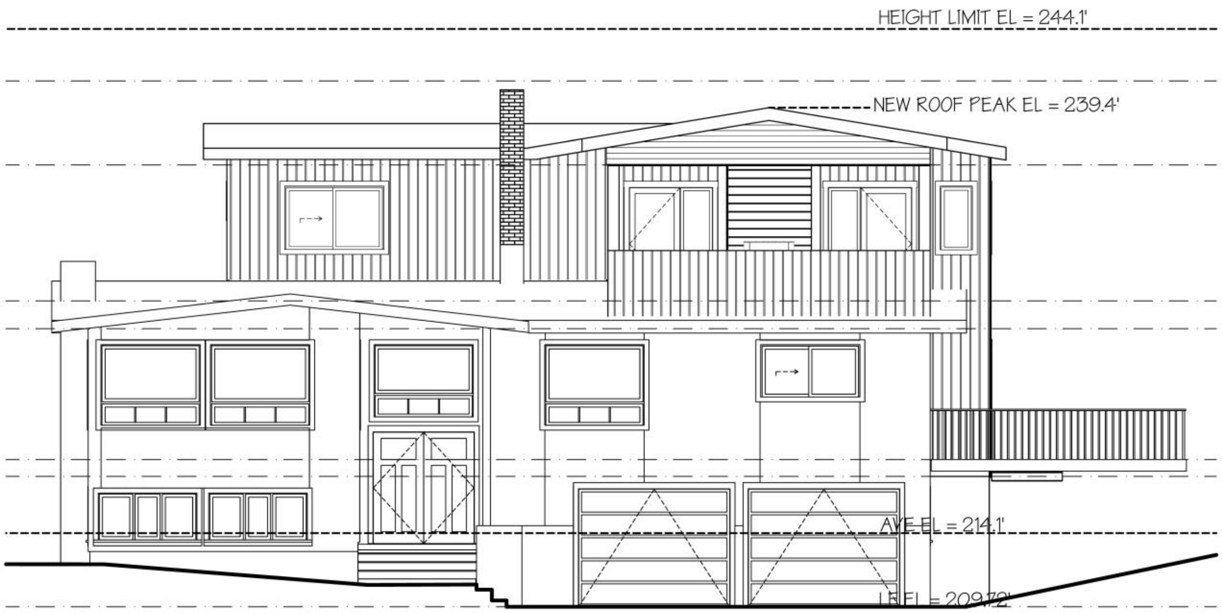


Plate 1. North-south building section, looking east.

According to the City of Mercer Island GIS maps, the subject property contains two mapped geologic hazards: potential landslide and erosion hazards. As such, a geotechnical report is required as part of the permit application for the proposed addition.

The conclusions and recommendations in this report are based on our understanding of the proposed development, which is in turn based on the project information provided. If the above project description is incorrect, or the project information changes, we should be consulted to review the recommendations contained in this study and make modifications, if needed.

SUBSURFACE EXPLORATIONS

Two borings (PG-1 and PG-2) were drilled at the site on May 2, 2022, using a CAT track drill rig owned and operated by Geologic Drill Partners of Fall City, Washington. The approximate boring locations were taped in the field from on-site features and are shown on Figure 2. The borings were drilled to depths of about 11½ and 14 feet below the surface in PG-1 and PG-2, respectively.

The drill rig was equipped with 4-inch outside diameter hollow stem augers. Soil samples were obtained from the borings at 2½-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 freely 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 to observe the drilling, assist in sampling, and to describe and document the soil samples obtained from the borings. The soil samples were described and field classified in general accordance with the symbols and terms outlined in Figure A-1 of Appendix A, and the summary boring logs are included as Figures A-2 and A-3.

SITE GEOLOGY AND SUBSURFACE CONDITIONS

SITE GEOLOGY

According to the Geologic Map of Mercer Island (Troost and Wisher, 2006), the site is underlain by Vashon advance outwash (Qva). Advance outwash deposits are described by Troost, et al. as dense, well-sorted sand and gravel deposited by streams issuing from advancing ice sheets.

SUBSURFACE AND GROUNDWATER CONDITIONS

The soils encountered in the test borings consisted of up to about 4½ feet of loose to medium dense fill overlying medium dense to dense native sandy silt and silty sand with interlayered sand. This soil unit extended to the maximum depths drilled at about 11½ feet and 14 feet below the surface in PG-1 and PG-2, respectively. This soil unit appears to be consistent with the mapped Advance Outwash deposits. Please refer to the boring summary logs in Appendix A for a detailed description of the conditions encountered at each boring location.

Minor perched groundwater seepage was observed between about 9½ and 13½ feet depth at PG-2, but groundwater was not encountered within the depths of PG-1 during drilling. We do not expect the groundwater will be encountered in the planned excavation. 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 and seepage rates are normally highest during the winter and early spring.

GEOLOGIC HAZARDS ASSESSMENT

LANDSLIDE HAZARDS

The southeast portion of the site is mapped as a potential landslide hazard area according to the City of Mercer Island GIS maps. However, the site is not mapped as a steep slope area and the nearest past known slides is at least 450 feet away from the site. A site reconnaissance of the subject property was conducted on May 2, 2022. During our site reconnaissance, we did not observe obvious evidence of past landslides at the site. Based on our field observations, the general topography at the site and vicinity, and the results of our subsurface explorations, it is our opinion that the subject site appears to be globally stable in its current configuration. Furthermore, it is our opinion that the proposed development as currently planned is feasible from a geotechnical engineering standpoint and will not adversely affect the overall stability of the site or adjacent properties, provided the recommendations herein are followed and standard care is implemented during construction.

EROSION HAZARDS

The southeast portion of the site is also mapped as a potential erosion hazard area according to the City of Mercer Island GIS maps. Based on soil conditions encountered in the borings, the near-surface site soils are likely to exhibit low to moderate erosion potential. However, the site grading earthwork is expected to be minor for this project. 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 fence at the construction perimeter, limiting removal of vegetation to the construction area, placing rocks or hay bales at the disturbed/traffic areas and on the downhill side of the project, covering stockpile soil or cut slopes with plastic sheets, constructing a temporary drainage pond to control surface runoff and sediment trap, placing quarry spalls at the construction entrance, etc. 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.

GEOTECHNICAL DESIGN RECOMMENDATIONS

SEISMIC SITE CLASS

We anticipate that the seismic design of the structures will be accomplished using the 2018 edition of the International Building Code (IBC), which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years). Based on the subsurface conditions at the site, it is our opinion that Site Class D should be used for the seismic design.

BUILDING FOUNDATIONS

Based on the subsurface conditions encountered at the site and our understanding of the current building design, it is our opinion that the proposed addition may be supported on conventional footings. New footings should bear on competent native soils or on newly placed structural fill placed on undisturbed native soils. In summary, the competent bearing soils are estimated at about four feet below the existing grade at boring PG-1, and at about one foot below grade at boring PG-2.

Exterior foundation elements should be placed at a minimum depth of 18 inches below final exterior grade. Interior spread foundations should be placed at a minimum depth of 12 inches below the top of slab. Where space may be limited, the use of L-shaped footings may be required to conserve space for the temporary cuts.

We recommend that a maximum allowable bearing pressure of 2,000 pounds per square feet (psf) be used for sizing the. The recommended allowable bearing pressures are for dead plus live loads. For allowable stress design, the recommended bearing pressure may be increased by one-third for transient loads, such as wind or seismic forces. Continuous and individual spread footings should have minimum widths of 18 and 24 inches, respectively.

Settlements of footings designed and constructed as described above should have a total settlement of less than one inch, and differential settlement of less than ½ inch. Most of the anticipated settlement should occur during construction as dead loads are applied.

Lateral Resistance

Lateral loads on the structure may be resisted by passive earth pressure developed against the embedded portion of the foundation system and by frictional resistance between the bottom of the foundation and the supporting subgrade soils. For footings bearing on the medium dense native soils or compacted structural fill, a frictional coefficient of 0.35 may be used to evaluate sliding resistance at the bottom of footings. Passive soil resistance may be calculated using an equivalent fluid weight of 320 pcf, assuming properly compacted structural fill will be placed against the footings. The above values include a factor of safety of 1.5. Unless covered by pavements or slabs, the passive resistance in the upper 12 inches of soil should be neglected.

Footing Subgrade Preparation

All footing subgrades should be carefully prepared. Loose or softened soil exposed at the construction subgrade elevation should be removed prior to pouring concrete. The adequacy of footing subgrade should be verified by a representative of PanGEO, prior to placing forms or rebar.

FLOORS SLABS

It is our opinion that concrete slab-on-grade floors are appropriate for this project. Concrete slab-on-grade floors may be supported on the competent native soil or on compacted structural fill placed on the native soil. If loose or soft soils are encountered at the slab subgrade elevation that cannot be adequately compacted, the loose or soft soil should be over-excavated to competent native soil and replaced with compacted structural fill.

Slab-on-grade floors should be underlain by a capillary break consisting of at least of 4 inches of ¾-inch, clean crushed rock (less than 3 percent fines) compacted to a firm and unyielding condition. The capillary break should be placed on subgrade that has been compacted to a dense and unyielding condition. The capillary break should be placed on a suitable subgrade as confirmed by PanGEO. A minimum 10-mil polyethylene vapor barrier should also be placed directly below the slab. We also recommend that control joints be incorporated into the floor slab to control cracking.

RETAINING WALL DESIGN PARAMETERS

Retaining wall, if needed, 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 that may be present behind the wall. Our geotechnical recommendations for the design and construction of the retaining wall are presented below.

Lateral Earth Pressures

Concrete cantilever walls should be designed for an equivalent fluid pressure of 35 pcf for level backfills behind the walls assuming the walls are free to rotate. If walls are to be restrained at the top from free movement, such as basement walls, equivalent fluid pressures of 45 pcf should be used for level backfills behind the walls. Walls with a maximum 2H:1V backslope should be designed for an active and at rest earth pressure of 45 and 55 pcf, respectively.

Permanent walls should be designed for an additional uniform lateral pressure of 8H psf for seismic loading, where H corresponds to the buried depth of the wall. The recommended lateral pressures assume that the backfill behind the wall consists of a free draining and properly compacted fill with adequate drainage provisions.

Surcharge

Surcharge loads, where present, should also be included in the design of retaining walls. We recommend that a lateral load coefficient of 0.3 be used to compute the lateral pressure on the wall face resulting from surcharge loads located within a horizontal distance of one-half wall height.

Lateral Resistance

Lateral forces from seismic loading and unbalanced lateral earth pressures may be resisted by a combination of passive earth pressures acting against the embedded portions of the foundations and by friction acting on the base of the foundations. Passive resistance values may be determined using an equivalent fluid weight of 320 pcf. This value includes a factor of safety of 1.5, assuming the footing is poured against dense native sand, re-compacted on-site sandy soil or properly compacted structural fill adjacent to the sides of footing. A friction coefficient of 0.35 may be used to determine the frictional resistance at the base of the footings. The coefficient includes a factor safety of 1.5.

Wall Drainage

Provisions for wall drainage should consist of a 4-inch diameter perforated drainpipe 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.

Wall Backfill

Retaining wall backfill should consist of free draining granular material. The site soils within the planned excavation depth are relatively silty and would not meet the requirements for wall backfill. We recommend importing a free draining granular material, such as Seattle Type 17 or a soil meeting the requirements of Gravel Borrow as defined in Section 9-03.14(1) of the WSDOT *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT, 2022). In areas where space is limited between the wall and the face of excavation, pea gravel may be used as backfill without compaction.

Wall backfill should be properly moisture conditioned, placed in loose, horizontal lifts less than 12 inches in thickness, and compacted to a dense and unyielding condition. If density tests will be performed, the test results should show 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 with hand-operated equipment to at least 90 percent of the maximum dry density.

STATEMENT OF MINIMUM RISK

We understand that the portion of the site is mapped as geologic hazard areas, specifically as potential landslide and erosion hazard areas. Per Mercer Island City Code Section 19.07.060.D.2, 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. An evaluation of site specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area; or

c. 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

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

Based on the surface conditions at the site and results of our geotechnical study, it is also our opinion that the proposed development meets the criteria (c) above. Best management practices should be implemented during construction, including the proper use of silt fence, minimize earthwork activities during periods heavy precipitations, minimized exposed areas in wet season, etc. Permanent erosion control measures including landscape and hardscape installations will effectively mitigate the risk of erosion in the long term.

CONSTRUCTION CONSIDERATIONS

TEMPORARY EXCAVATIONS

As currently planned, the proposed development may require excavations up to about three feet deep for the foundation construction. We anticipate the excavations to encounter loose to medium dense/very stiff soils. All temporary excavations should be performed in accordance with Part N of WAC (Washington Administrative Code) 296-155. The contractor is responsible for maintaining safe excavation slopes and/or shoring.

Based on the soil conditions at the site, for planning purposes, it is our opinion that temporary excavations for the proposed construction may be sloped 1H:1V or flatter. Based on our current understanding of the anticipated building layout and finished floor elevations, it appears that sufficient space is available for unsupported open cuts for the proposed construction. Where space may be limited, the use of L-shaped footings may be required to conserve space for the temporary cuts.

The temporary excavations and cut slopes should be re-evaluated in the field during construction based on actual observed soil conditions, and may need to be modified in the wet reasons. The cut slopes should be covered with plastic sheets in the raining season. We also recommend that heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within a distance equal to 1/3 the slope height from the top of any excavation.

MATERIAL REUSE

The soils underlying the site primarily consist of silty sand and sandy silt, are moisture sensitive, and will become disturbed and soft when exposed to inclement weather conditions. 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.

STRUCTURAL FILL PLACEMENT AND COMPACTION

In the context of this report, structural fill is defined as compacted fill placed under footings, concrete stairs and landings, slabs, pavement, or other load-bearing areas. Structural fill, if needed, should consist of City of Seattle Type 17, WSDOT Section 9-03.9(3) Crushed Surfacing Base Course (WSDOT 2022), or an approved equivalent.

Structural fill should be properly moisture conditioned, placed in loose, horizontal lifts less than 12 inches in thickness, and compacted to a dense and unyielding condition. The adequacy of compaction should be verified by a PanGEO representative. Alternatively, if density tests will be performed, the test results should indicate a minimum 95 percent relative compaction level as determined using ASTM D-1557 (Modified Proctor).

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

WET WEATHER EARTHWORK

In our opinion, the proposed site construction may be accomplished during wet weather (such as in winter) without adversely affecting the site stability. However, earthwork construction performed during the drier summer months likely will be more economical. Winter construction will require the implementation of best management erosion and sedimentation control practices to reduce the risk of off-site sediment transport. Most of the site soils within the anticipated depth of excavation contain a high percentage of fines and are moisture sensitive. Any footing subgrade soils that become softened either by disturbance or rainfall should be removed and replaced with structural fill, Controlled Density Fill (CDF), or lean-mix concrete. General recommendations relative to earthwork performed in wet conditions are presented below:

- Site stripping, excavation and subgrade preparation should be followed promptly by the placement and compaction of clean structural fill or CDF;
- The size and type of construction equipment used may have to be limited to prevent soil disturbance;
- 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;
- Structural fill should consist of less than 5% fines; and
- Excavation slopes should be covered with plastic sheets.

SURFACE DRAINAGE 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 from leaving the immediate work site.

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 directed away from slopes and structures. Water from roof drains and other impervious areas should be properly collected and discharged into a storm drain system, and should not be discharged on to the slope areas.

ADDITIONAL SERVICES

To confirm that our recommendations are properly incorporated into the design and construction of the proposed residence, 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, will also require geotechnical construction inspection services. PanGEO can provide you a cost estimate for construction monitoring services at a later date.

We anticipate that the following additional services will be required:

- Review final project plans and specifications
- Verify implementation of erosion control measures;
- Verify adequacy of footing subgrade;
- Monitor temporary excavation;
- Confirm the adequacy of the compaction of structural backfill; and

- Other consultation as may be required during construction

Modifications to our recommendations presented in this report may be necessary, based on the actual conditions encountered during construction.

CLOSURE

We have prepared this report for Carla and John Monahan 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 work.

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 work 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 has been prepared for planning and design purposes for specific application to the proposed project in accordance with the generally accepted standards of local practice at the time this report was written. No warranty, express or implied, is made.

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.

We appreciate the opportunity to be of service.

Sincerely,

PanGEO, Inc.

09/02/2022

Chien-Lin (Johnny) Chen, P.E.
Senior Geotechnical Engineer

Enclosures:

Figure 1 Vicinity Map
Figure 2 Site and Exploration Plan

Appendix A

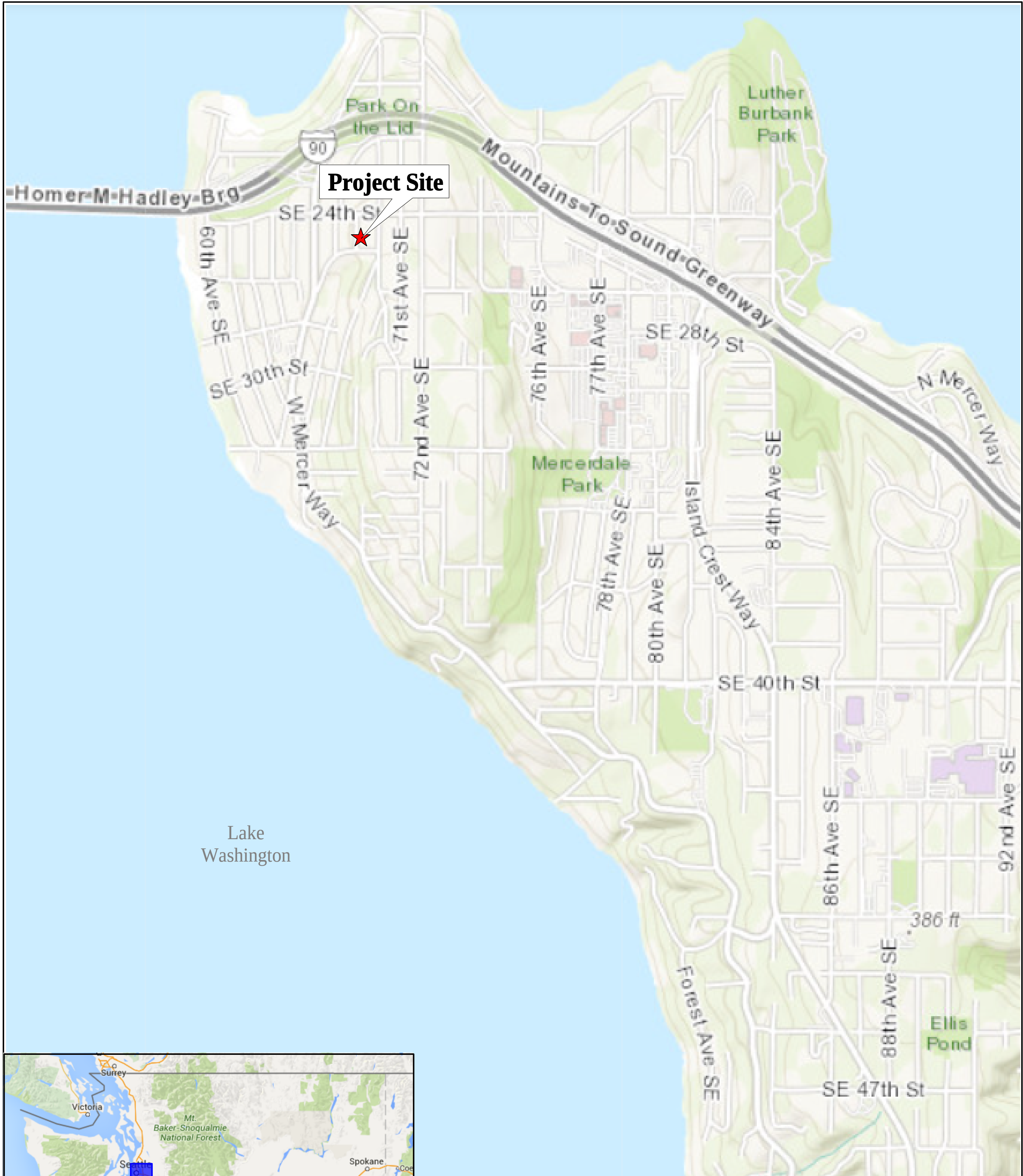
Figure A-1 Terms and Symbols for Boring and Test Pit Logs
Figure A-2 Log of Test Boring PG-1
Figure A-3 Log of Test Boring PG-2

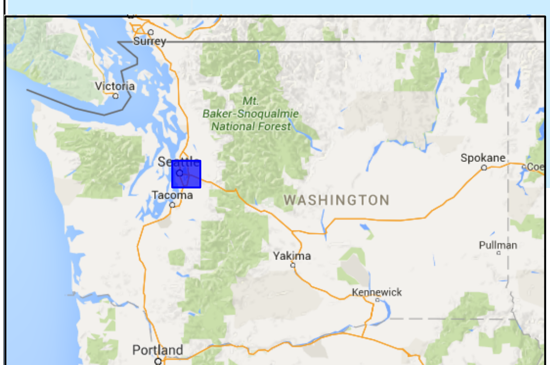
REFERENCES

International Code Council, 2018, *International Building Code (IBC).*

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

WSDOT, 2022, *Standard Specifications for Road, Bridge and Municipal Construction, M 41-10.*





Base Map: ESRI Topographic

NORTH

Approx. Scale:
Not to Scale

PanGEO INCORPORATED

Proposed Addition
2424 67th Avenue SE
Mercer Island, Washington

VICINITY MAP

Project No.	22-179	Figure No.	1

Approx. Scale
1" = 25'

Base map modified from City of Mercer Island Online Mapping Portal

Legend:

Approx. Test Boring Location

PanGEO INCORPORATED

Proposed Addition
2424 67th Avenue SE
Mercer Island, Washington

SITE AND EXPLORATION PLAN

Project No.	22-179	Figure No.	2

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

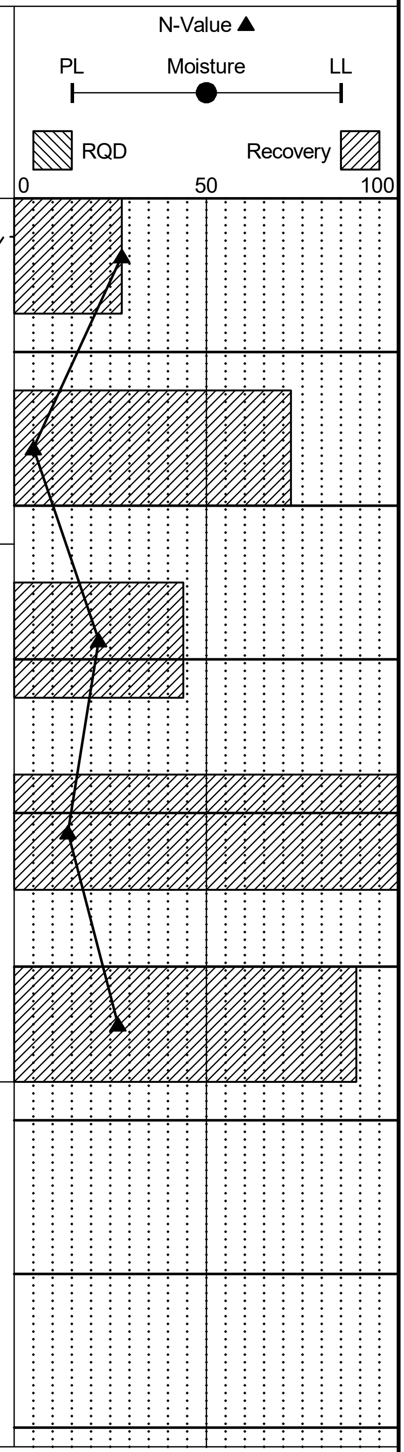
PanGEO INCORPORATED
Phone: 206.262.0370

Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	Proposed Addition	Surface Elevation:	212.0ft
Job Number:	22-179	Top of Casing Elev.:	N/A
Location:	2424 67th Ave SE, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: 47.5885, Easting: -122.246	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		3, 11, 17			Grass and sod over loose, dark brown, silty SAND; moist; poorly graded, rootlets [Topsoil].
						Medium dense to loose, mixed gray and brown, slightly gravelly, silty SAND; moist; poorly graded, organics, disturbed appearance [Fill].
2	S-2		1, 2, 3			
4						Medium dense, gray and gray-brown, silty fine SAND interlayered with fine SAND; moist; poorly graded, trace iron oxide staining [Qva - Vashon Advance Outwash].
6	S-3		6, 13, 9			
8	S-4		3, 5, 9			~3" gray silt interlayer.
10	S-5		6, 11, 16			
12						Boring terminated at about 11.5 feet below ground surface. Groundwater was not observed during drilling.
14						
16						



Completion Depth:	11.5ft
Date Borehole Started:	5/2/22
Date Borehole Completed:	5/2/22
Logged By:	B. Weitering
Drilling Company:	CN Drilling

Remarks: Boring drilled using an acker portable 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 City of Mercer Island Online Mapping Portal.

PanGEO INCORPORATED

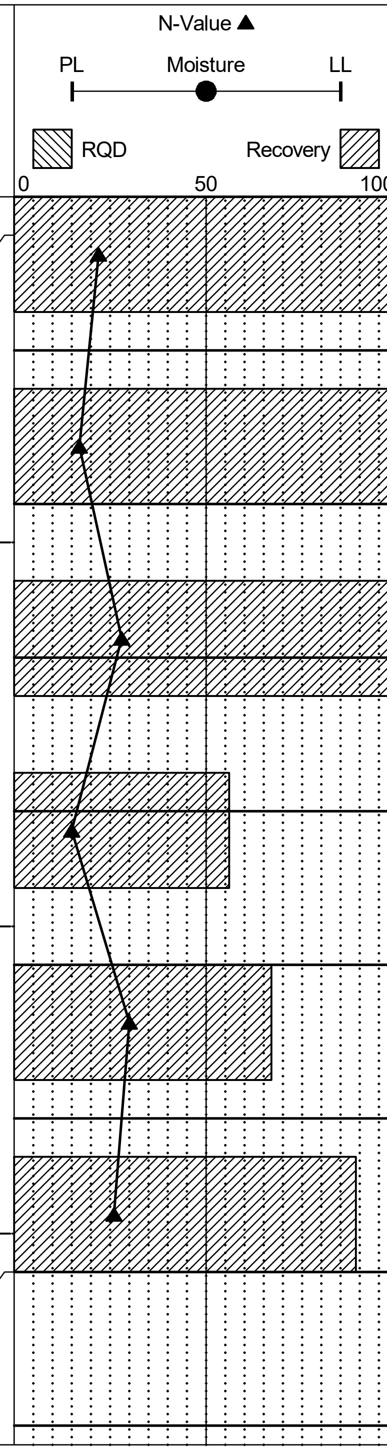
LOG OF TEST BORING PG-1

Figure A-2

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

Project:	Proposed Addition	Surface Elevation:	217.0ft
Job Number:	22-179	Top of Casing Elev.:	N/A
Location:	2424 67th Ave SE, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: 47.58835, Easting: -122.2457	Sampling Method:	SPT

Depth, (ft)	Sample No.	Sample Type	Blows / 6 in.	Other Tests	Symbol	MATERIAL DESCRIPTION
0	S-1		5, 7, 15			Grass and sod over loose, dark brown, silty SAND; moist; poorly graded, rootlets [Topsoil].
						Very stiff, brown, sandy SILT trace gravel; moist; non-plastic, trace iron oxide banding [Qva - Vashon Advance Outwash].
2	S-2		3, 8, 9			
4						Medium dense, gray-brown, silty fine SAND interlayered with fine SAND trace gravel; moist; poorly graded, trace iron oxide staining [Qva - Vashon Advance Outwash].
6	S-3		8, 13, 15			
8	S-4		7, 7, 8			
10	S-5		8, 11, 19			Medium dense to dense, gray-brown, slightly silty fine SAND; wet; poorly graded, few silty laminations [Qva - Vashon Advance Outwash].
12	S-6		7, 11, 15			
14						Medium dense, gray-brown and orange, silty SAND; moist; poorly graded, trace iron oxide staining [Qva - Vashon Advance Outwash].
						Boring terminated at about 14 feet below ground surface. Minor perched groundwater seepage was observed between about 9.5 and 13.5 feet depth during drilling.
16						



Completion Depth:	14.0ft
Date Borehole Started:	5/2/22
Date Borehole Completed:	5/2/22
Logged By:	B. Weitering
Drilling Company:	CN Drilling

Remarks: Boring drilled using an acker portable 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 City of Mercer Island Online Mapping Portal.

PanGEO INCORPORATED

LOG OF TEST BORING PG-2

Figure A-3

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