GEOTECHNICAL REPORT

PROPOSED REMODEL AND ADDITION
7649 WEST MERCER WAY
MERCER ISLAND, WASHINGTON

Project No. 23-392
January 2024

Prepared for:

David and Robin Shipper

PanGEO INCORPORATED

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PanGEO INCORPORATED
Geotechnical & Earthquake Engineering Consultants

January 25, 2024
File No. 23-392

David and Robin Shipper
7649 West Mercer Way
Mercer Island, WA 98040

Subject: **Geotechnical Report**
Proposed Remodel and Addition
7649 West Mercer Way, Mercer Island, WA

Dear David and Robin,

Attached please find our geotechnical report for the proposed remodel and addition project at the above referenced site in Mercer Island, Washington. This report documents the subsurface conditions at the site and presents our geotechnical design recommendations for the proposed project.

In general, our borings drilled at the site encountered about 3 feet to 7 feet of fill/loose soil overlying native, medium dense to very dense sand//silty sand (Pre-Olympian Non-Glacial Deposits). Based on soil conditions and our understanding of the project design, in our opinion, conventional shallow footings may be used to support the one-story additions on the east side of the existing house. The existing foundations for the west cantilevered portion supporting the living room should be underpinned with 2-inch diameter pipe piles (pin piles) to minimize the potential future foundation settlement at this location. In our opinion, the enlarged, elevated deck on the west side of the house can be supported by either shallow footings or pin piles. Temporary unsupported excavations may be sloped as steep as 1H:1V (Horizontal: Vertical).

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

Sincerely,

H. Michael Xue, P.E.
Principal Geotechnical Engineer

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1.0 INTRODUCTION

This report presents the results of a geotechnical engineering study that was undertaken to support the design of the proposed remodel and addition project in Mercer Island, Washington. Our study was performed in general accordance with our mutually agreed-upon scope of work as outlined in our proposal dated December 19, 2023 and was subsequently approved on December 21, 2023. Our service scope included reviewing readily available geologic and geotechnical data in the site vicinity, conducting a site reconnaissance, advancing three test borings, and developing the geotechnical design recommendations presented in this report.

2.0 PROJECT AND SITE DESCRIPTION

The project site is an approximately 0.4 acre lot located at 7649 West Mercer Way in Mercer Island, Washington. (See Figure 1 – Vicinity Map). The site is roughly trapezoidal in shape, and is bordered by Lake Washington to the west, by a single-family residence and West Shuck Park Drive to the north, and existing single-family residences to the south and east. The subject site is currently occupied by a one-story single-family house with a daylight basement and a detached garage (see Figure 2). Based on a review of the GIS maps, the existing site grade generally slopes down from the east to the west with an average gradient of about 27 percent with a total vertical relief of about 50 feet between the east and west property lines.

Based on the information provided to us, we understand that the current project will consist of constructing small additions to the east of the existing house, reconstructing/expanding an elevated deck on the west side of the house, reconstructing an elevated walkway between the garage and house in the southeastern portion of the site, and an interior remodel. In addition, the center showcase gable above the living room is splitting apart in the interior and signs of foundations settlement supporting this portion of the structure were observed. As such, the foundation soils at this portion of the structure should be evaluated to assess the need for foundation underpinning.

According to the City of Mercer Island, the property is mapped with potential landslide, erosion, and seismic hazards. As such, a geotechnical engineering study will be required as part of the building permit process. The objective of our geotechnical study is to explore subsurface

conditions, to evaluate the potential geologic, and to provide geotechnical design recommendations pertinent to the proposed development.

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. In any case, PanGEO should be retained to provide a review of the final design to confirm that our geotechnical recommendations have been correctly interpreted and adequately implemented in the construction documents.

3.0 SUBSURFACE EXPLORATIONS

Three test borings (PG-1 through PG-3) were advanced at the site on December 28, 2023 using a limited-access hand-operated portable Acker drill rig owned and operated by CN Drilling, subcontracted to PanGEO. Test borings PG-1, PG-2 and PG-3 were drilled to depths of about 16½ feet, 16½ feet, and 11½ feet below the existing grade, respectively. The approximate boring locations were taped from existing features at the site and are indicated on the attached Figure 2.

The drill rig was equipped with 5-inch outside diameter hollow stem augers. Soil samples were obtained from the borings at 2½- and 5-foot 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. The completed borings were backfilled with drill cuttings and bentonite chips.

An engineer from PanGEO was present during the field exploration to observe the drilling, to assist in sampling, and to describe and document the soil samples obtained from the borings. The summary boring logs are included in Appendix A, Figures A-2 through A-4. The soil samples were described using the Modified Unified Soil Classification System outlined on Figure A-1 in Appendix A.

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 SITE GEOLOGY

The Geologic Map of Mercer Island, Washington (Troost, et al., 2006) mapped the surficial geologic unit at the subject site as Pre-Olympia non-glacial deposits (Mapped as Qpon). Pre-Olympia non-glacial deposits (Qpon) are described as sand, gravel, silt, clay, and organic deposits of inferred non-glacial origin, based on the presence of paleosols and tephra layers or southern Cascade provenance. This unit is typically dense and hard in its unweathered and undisturbed state.

4.2 SOIL CONDITIONS

Our borings generally encountered a layer of very loose to loose fill overlying loose to very dense native sand/silty sand and silt, which we interpret as Weathered Olympia non-glacial deposits underlain by dense to very dense silty sands. The following is a generalized description of the soils encountered in the borings. For a detailed description of the subsurface conditions encountered at each exploration location, please refer to the boring logs provided in Appendix A.

> ***UNIT 1: Fill*** – Very loose to loose sand and silty sand with varying amounts of organics and gravel were encountered from ½ foot to about 6 feet deep in the borings. We interpret this soil unit as undocumented fill based on the loose condition, disturbed texture, and presence of organics.
>
> ***UNIT 2: Weathered Pre-Olympian non-glacial (Qpon)*** – Below Unit 1, all borings encountered loose to dense, silty sand to poorly-graded sand with occasional silt layers to between 8½ feet to 12 feet below the existing ground surface. We interpret this soil unit as the weathered Pre-Olympian non-glacial deposits.
>
> ***UNIT 3***: ***Pre-Olympian non-glacial (Qpon)*** – Below Unit 2, the borings encountered dense to very dense silty sand with occasional silt layers to the maximum drilling depths which was interpreted as mapped Pre-Olympia non-glacial deposits.

The stratigraphic contacts indicated on the boring logs represent the approximate depth to boundaries between soil units. Actual transitions between soil units may be more gradual or occur at different elevations. The descriptions of groundwater conditions and depths are likewise approximate.

4.3 GROUNDWATER CONDITIONS

Perched groundwater was encountered in PG-1 and PG-2 between approximately 4½ feet and 6 feet below ground surface. No groundwater was observed within the drilling depth of PG-3 during drilling. It should be noted that groundwater elevations and seepage rates may 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 (typically October through May).

5.0 GEOLOGY HAZARDS ASSESSMENT

5.1 LANDSLIDE HAZARDS AND STEEP SLOPES

The site only contains a steep slope (40% or greater) area in the north side of the property located alongside the house and the southeast corner of the property. Additionally, the entire site is mapped within a potential landslide hazard area according to the City of Mercer Island's Geologic Hazards Map. A site reconnaissance of the subject property was conducted on December 28, 2023. During our site reconnaissance, we did not observe obvious evidence of past slope instability or ground movement at the subject site. Based on our field observations, the topography at the site and vicinity, and the subsurface conditions encountered in the borings, in our opinion, the subject site appears to be globally stable in its current configuration. It is our further opinion that the proposed remodel/addition project as currently planned will not adversely affect the overall stability of the site or adjacent properties, provided the recommendations outlined herein are followed and the proposed development is properly design and constructed.

5.2 EROSION HAZARDS

The site is mapped within a potential erosion hazard area in accordance with the City of Mercer Island's Geologic Hazards Map. Based on the results of our borings, the sandy site soils at the site are anticipated to exhibit moderate erosion potential. The current remodel and additions project will have limited ground disturbance for the proposed construction. In our opinion, the potential 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 if needed, placing rocks at the construction entrance, etc. Permanent erosion control measures should include establishing vegetation, landscape plants, and hardscape established at the end of project.

5.3 SEISMIC HAZARDS

Based on review of the City of Mercer Island Parcel Map, the site is mapped within a seismic/soil liquefaction hazard area.

Liquefaction is a process that can occur when soils lose shear strength for short periods of time during a seismic event. Ground shaking of sufficient strength and duration can result in the loss of grain-to-grain contact and an increase in pore water pressure, causing the soil to behave as a fluid. Soils with a potential for liquefaction are typically cohesionless, with a predominately silt and sand grain size, must be loose, and be below the groundwater table.

Based on our subsurface explorations, the site is mainly underlain by medium dense to very dense silty sand at shallow depths. In addition, borings PG-1 and PG-2 only encountered a thin layer of perched groundwater, and all borings did not encounter unconfined groundwater. Based on this and results of our analyses, it is our opinion that the liquefaction potential of the site soils is considered low, and design considerations related to soil liquefaction are not necessary for this project

6.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

6.1 SEISMIC DESIGN CONSIDERATIONS

We anticipate that the seismic design of the structures will be accomplished using the 2018/2021 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 results of our subsurface explorations, a Site Class D (stiff Soil) would be appropriate for the project.

6.2 FOUNDATIONS

6.2.1 East Addition Foundations

Based on the subsurface conditions encountered, it is our opinion that conventional shallow footings may be used to support the east additions. The new footings should bear on the competent undisturbed native soils (Pre-Olympian Non-glacial deposits) or on properly compacted structural fill placed on undisturbed native soils.

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 concrete slabs.

We recommend a maximum allowable soil bearing pressure of 2,000 pounds per square foot (psf) be used to size the foundation elements bearing on the undisturbed medium dense native soils and properly compacted structural fill. The recommended allowable bearing pressure is for dead plus live loads. For allowable stress design, the recommended bearing pressure may be increased by one-third for transient loading, such as wind or seismic forces. Continuous and individual spread footings should have minimum widths of 18 and 24 inches, respectively.

Footings designed and constructed in accordance with the above recommendations should experience total settlements on the order of about one inch, and differential settlements on the order of ½ inch or less. Most of the anticipated settlement should occur during construction as dead loads are applied.

Lateral Resistance - Lateral loads on the structures 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 sand or compacted structural fill, a frictional coefficient of 0.35 may be used to evaluate sliding resistance developed between the concrete and the subgrade soil.

Passive soil resistance may be calculated using an equivalent fluid weight of 250 pcf, assuming foundations are backfilled with properly compacted structural fill, and level ground surface. Unless covered by pavements or slabs, the passive resistance in the upper 12 inches of soil should be neglected. The above values include a factor of safety of 1.5.

Footing Subgrade Preparation **-** All footing subgrades should be carefully prepared. The adequacy of footing subgrade should be verified by a representative of PanGEO, prior to placing forms or rebar. The footing subgrade at the foundation level should be in a firm/dense condition prior to concrete pour. Any loose soils at the foundation subgrade level should be over-excavated and backfilled with compacted structural fill or lean-mix concrete/CDF. Footing excavations should be observed by PanGEO to confirm that the exposed footing subgrade is consistent with the expected conditions and adequate to support the design bearing pressure.

The native soil at the site contains high fines content and is poorly graded. As such, the foundation subgrade will need to be protected from equipment disturbance or moisture-related disturbance during wet weather. It is the contactor's responsibility to protect the exposed footing subgrade.

6.2.2 Foundation Underpinning

In our opinion, the existing foundations supporting the west cantilevered portion of the house below the living room should be underpinned with 2-inch diameter pipe piles (pin piles) to minimize the potential future foundation settlement at this location. The following sections present our recommendations for the pin pile design:

Two-inch diameter pin piles should consist of schedule-80, galvanized pipe piles. The piles should be driven to refusal, which is defined as less than one inch of penetration during one minute of continuous driving, with either a 90-lb jackhammer or a 140-lb pneumatic hammer. Piles driven to refusal are considered adequate for supporting an axial compression load of 3 tons per pile, with a factor of safety of at least 2.0. We estimate that potential future pile-supported foundation settlement is anticipated to be less than ½ inch under anticipated loading conditions.

The number of pin piles needed, and pile layout should be determined by your structural engineer. Piles shall be driven in nominal sections and connected with compression fitted sleeve couplers. We discourage welding of pipe joints as we have frequently observed welds broken during driving.

The geotechnical engineer of record or their representative shall provide full time observation of pile installation and testing.

Lateral Forces – The capacity of pin pipes to resist lateral loads is very limited and should not be used in design. Therefore, lateral forces should be resisted by the passive earth pressures acting against the pile caps and below-grade walls or from battered piles (batter no steeper than 3(H):12(V)). ***Friction at the base of pile-supported concrete grade beam should be ignored in the design calculations.*** Passive resistance values may be determined using an equivalent fluid weight of 200 pounds per cubic foot (pcf). This value includes a safety factor of about 1.5 assuming that properly compacted granular fill will be placed adjacent to and surrounding the pile caps and grade beams.

Estimated Pile Length – The required pile length in order to develop the recommended pile capacity may vary depending on the actual subsurface and driving conditions encountered. For planning and cost estimating purposes, we estimate that pile lengths will likely be on the order of 15 to 20 feet below surface.

6.2.3 Elevated Deck Foundations

Based on the boring PG-1 drilled near the elevated deck location, the bearing soil is located approximately 4 feet below the patio surface. In our opinion, the new elevated deck can be supported by shallow footings if excavations to the bearing is feasible. The design recommendations in Section 6.2.1 may be used for the shallow footing design. Alternatively, the deck may also be supported by 2-inch diameter pin piles to reduce the excavation requirements. The design recommendations in Section 6.2.2 may be used for the pin pile design.

6.3 CONCRETE SLAB-ON-GRADE

The floor slabs for the proposed east additions may be constructed using conventional concrete slab-on-grade floor construction. The floor slabs should be supported on competent native soil or compacted structural fill. Any loose sand at the slab subgrade should be either recompacted to a dense condition or over-excavated to expose dense native soils. Over-excavation should be replaced with compacted structural fill.

Interior concrete slab-on-grade floors should be underlain by a capillary break consisting of at least of 4 inches of compacted ¾-inch, clean crushed rock (less than 3 percent fines). The capillary break material should also have no more than 10 percent passing the No. 4 sieve and less than 5 percent by weight of the material passing the U.S. Standard No. 100 sieve. The capillary break should be placed on the subgrade that has been compacted to a dense and

unyielding condition. A 10-mil polyethylene vapor barrier should also be placed directly below the slab. We also recommend that construction joints be incorporated into the floor slab to control cracking.

6.4 STATEMENT OF MINIMUM RISKS

We understand that the site is mapped as a geologic hazard area. Per Mercer Island City Code Section 19.07.160.B.3, 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. An evaluation of site specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area;

b. 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

c. Construction practices are proposed for the alteration that would render the development as safe as if it were not located in a geologic hazard area and do not adversely impact adjacent properties; or

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

It is our opinion that Criterion (c) and (d) can be met through best management practices 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.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 SITE PREPARATION

Site preparation for the proposed project includes removing of a tree, stripping and clearing of surface vegetation, and excavations to the design subgrade for the addition. All stripped surface

materials should be properly disposed off-site or be "wasted" on site in non-structural landscaping areas.

Following site clearing and excavations, the adequacy of the subgrade where structural fill, foundations, slabs, or pavements are to be placed should be verified by a representative of PanGEO. The subgrade soil in the improvement areas, if recompacted and still yielding, should also be over-excavated and replaced with compacted structural fill or CDF/lean-mix concrete.

7.2 TEMPORARY EXCAVATION

Based on our understanding of the project, we anticipate that temporary excavations on the order of about 2 to 4 feet will be needed for the new addition and deck foundation construction. As such, it is our opinion that unsupported slope cut excavations are feasible at the site. Based on the soil conditions at the site, for planning purposes, it is our opinion that temporary excavations may be sloped as steep as 1H:1V.

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. In general, temporary excavations deeper than a total of 4 feet should be sloped or shored. However, excavations less than 4 feet deep, if located along or near property lines, will also need to be sloped or supported if sufficient space is not available to lay back the excavations without encroaching into neighboring properties.

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 flattened in the wet seasons and should be covered with plastic sheets. 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.

7.3 MATERIAL REUSE

In the context of this report, structural fill is defined as compacted fill placed under footings, concrete stairs and landings, and slabs, or other load-bearing areas. The contractor should be aware that the site soils contain high fines content and are poorly graded, and may be difficult to compact to the requirements of structural fill. As a result, for planning purposes, we do not recommend the on-site soils be re-used as structural backfill for the project. Structural fill should

consist of a well-graded granular material, such as WSDOT Gravel Borrow or CSBC, or approved equivalent.

7.4 Structural Fill Placement and Compaction

Structural fill 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.

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.

7.5 Erosion and 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. 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 directed away from structures. Potential problems associated with erosion may also be reduced by establishing vegetation within disturbed areas immediately following grading operations.

7.6 Wet Earthwork Recommendations

It is our opinion that construction of the project can be accomplished during the wet season. However, performing earthwork activities during wet season is anticipated to be more costly than during dry weather conditions. Based on the anticipated soil conditions and topography in the proposed construction area, it is our opinion that potential for erosion at the site can be

adequately mitigated by employing sediment control best management practices (BMPs). Additional information and details of the BMPs discussed in this section can be found in the Washington State Department of Ecology's *Stormwater Management Manual for Western Washington, Volume II* (http://www.ecy.wa.gov/programs/wq/stormwater/manual.html). Sediment control BMPs should be installed/constructed and functional prior to land disturbing activities.

General recommendations relative to earthwork performed in wet weather or in wet conditions are presented below:

- All footing surfaces 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. If needed, one option is to place 2 to 3 inches of lean-mix concrete or 4 to 6 inches of crushed surfacing base course (CSBC) on the exposed foundation 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.

- Where practical, maintain vegetation buffers around cleared areas (BMP C101).

- 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 ADDITIONAL SERVICES

To confirm that our recommendations are properly incorporated into the design and construction of the proposed addition, PanGEO should be retained to conduct a review of the final project plans and specifications, and to monitor the construction of geotechnical elements. Modifications to our recommendations presented in this report may be necessary, based on the actual conditions encountered during construction.

9.0 LIMITATIONS

We have prepared this report for use by David and Robin Shipper and the project design team. Recommendations contained in this report are based on a site reconnaissance, 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 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 of this report.

We appreciate the opportunity to be of service.

Sincerely,

1/25/2024

Lisa A. Dunham, P.E.
Project Geotechnical Engineer

1/25/2024

H. Michael Xue, P.E.
Principal Geotechnical Engineer

10.0 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.

International Building Code (IBC), 2018/21, *International Code Council.*

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

Washington Administrative Code (WAC), 2019, Chapter 296-155 - *Safety Standards for Construction Work, Part N - Excavation, Trenching, and Shoring*, Olympia, Washington.

WSDOT, 2024, *Standard Specifications for Road, Bridge and Municipal Construction, M 41-10, Washington State Department of Transportation.*

Not to Scale

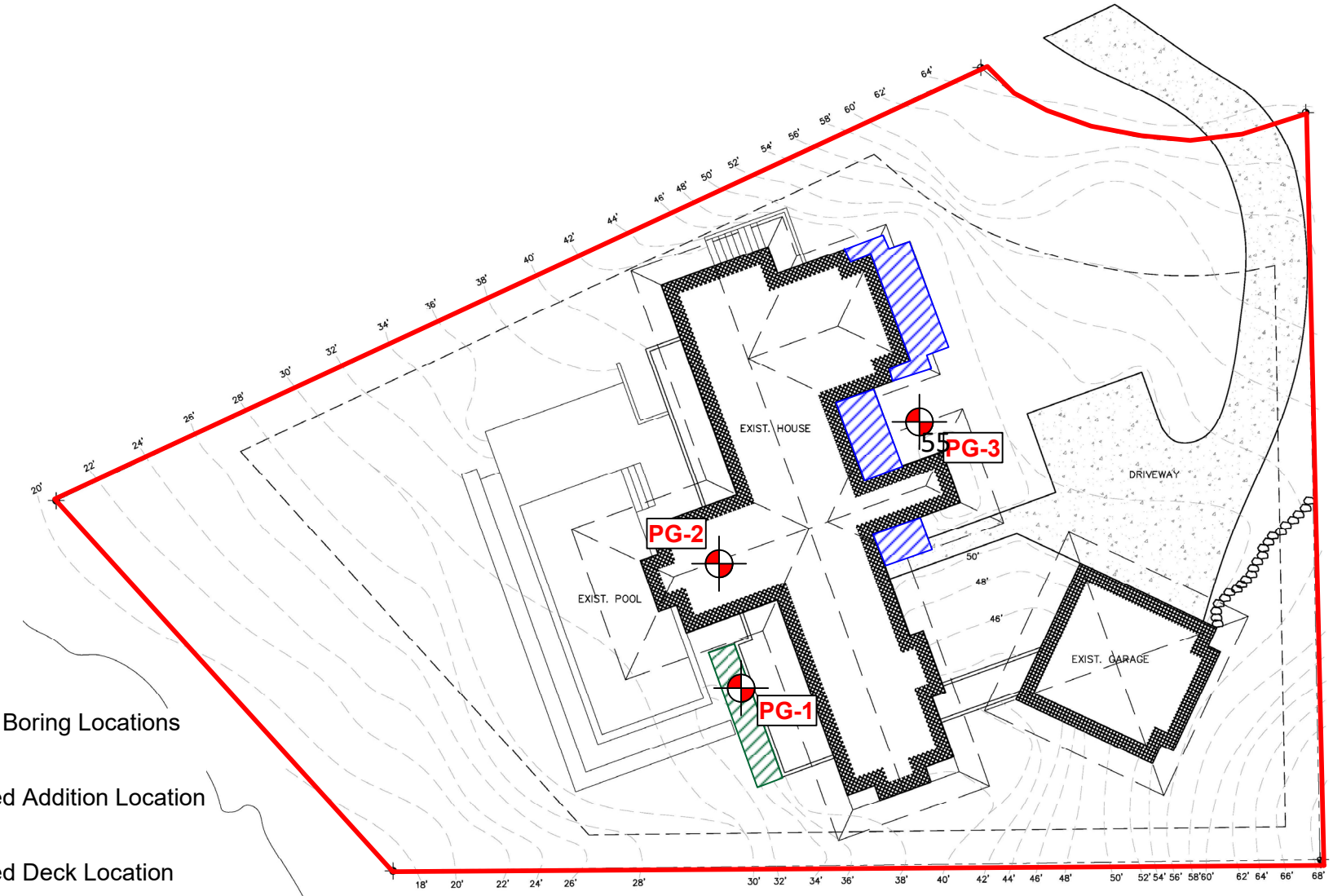
Base Map: ArcGIS

PanGEO INCORPORATED

Proposed Remodel and Addition
7649 West Mercer Way
Mercer Island, Washington

VICINITY MAP

Project No.	Figure No.
23-392	1



Legend:

- Approx. Boring Locations
- Proposed Addition Location
- Proposed Deck Location
- Propery Line

Note: Base map from Site Plan provided by Graham Baba Architects

PanGEO INCORPORATED

Proposed Remodel and Addition
7649 West Mercer Way
Mercer Island, Washington

SITE AND EXPLORATION PLAN

Project No.	Figure No.
23-392	**2**

APPENDIX A

SUMMARY 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

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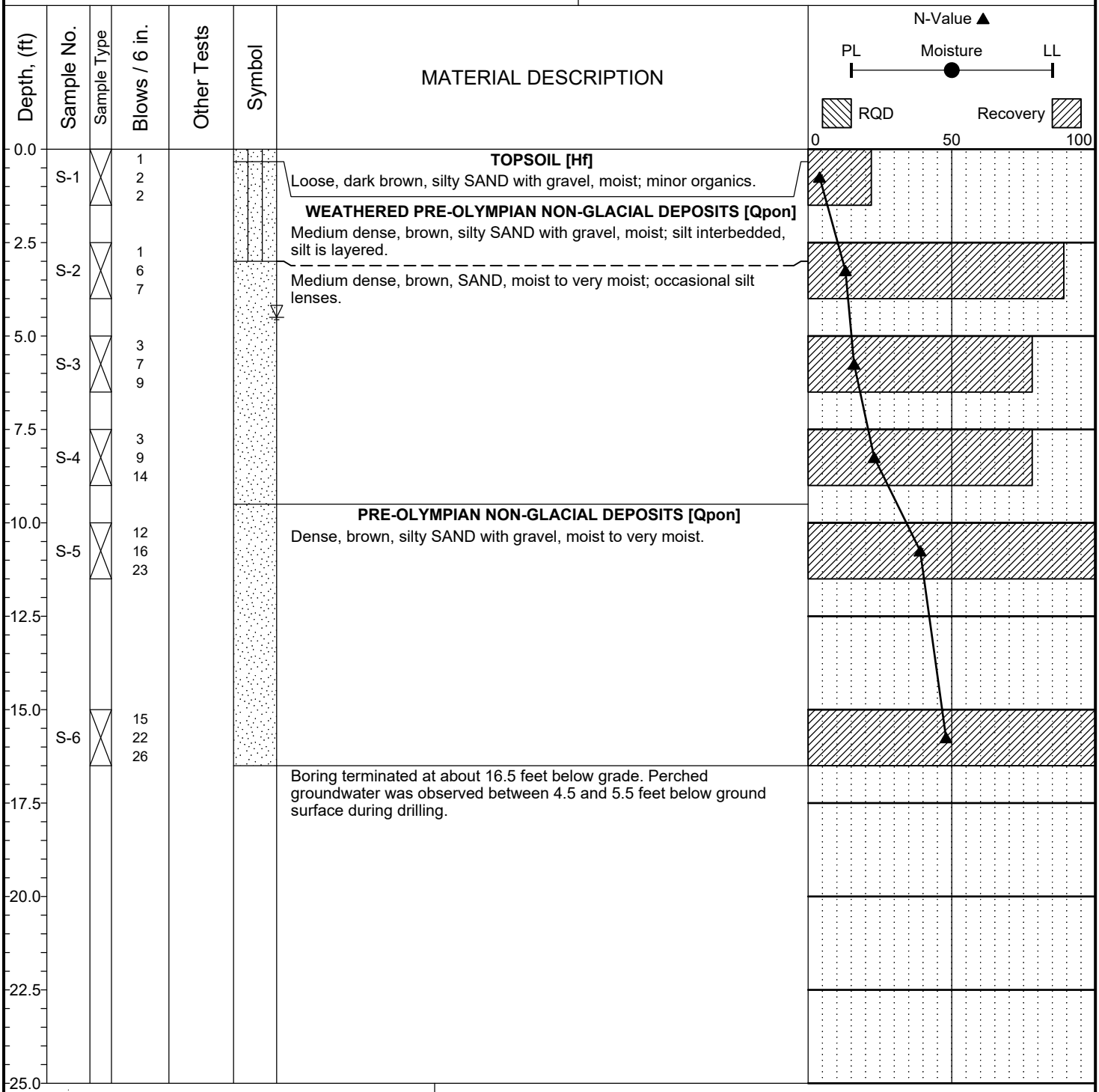
Terms and Symbols for Boring and Test Pit Logs

Figure A-1

Project:	Proposed Remodel and Addition	Surface Elevation:	42.0ft
Job Number:	23-392	Top of Casing Elev.:	N/A
Location:	7649 West Mercer Way	Drilling Method:	Portable Acker, hollow stem auger
Coordinates:	Northing: 47.533249, Easting: -122.240659	Sampling Method:	SPT



Completion Depth:	16.5ft
Date Borehole Started:	12/28/23
Date Borehole Completed:	12/28/23
Logged By:	L. Dunham
Drilling Company:	CN Drilling

Remarks: Standard penetration test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Coordinates and elevation are approximate and based on their relative location to known site features. This information is provided for relative information only and is not a substitution for field survey. **Datum: WGS84/NAVD88**

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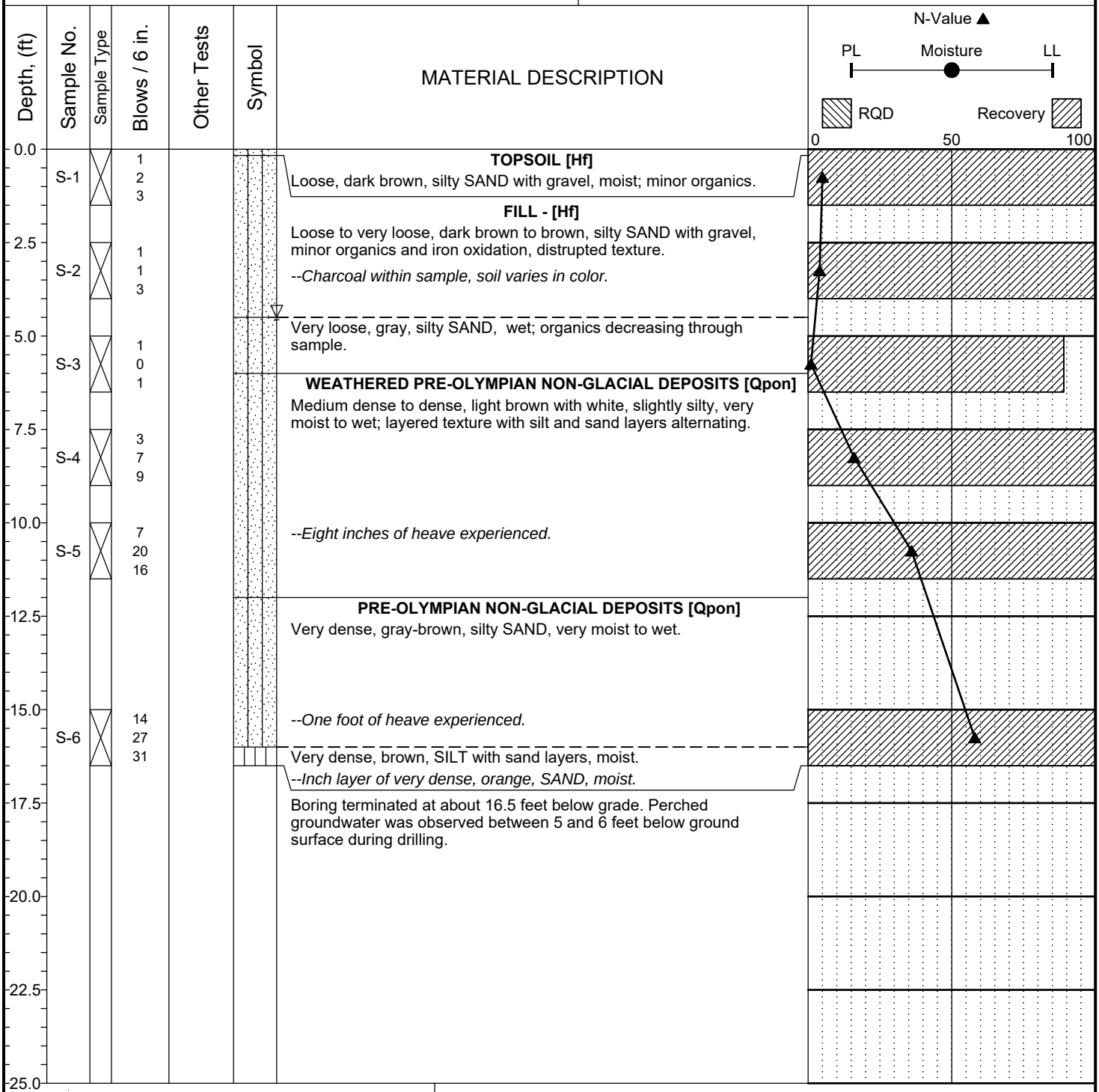
LOG OF TEST BORING PG-1

Figure A-2

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

Project:	Proposed Remodel and Addition	Surface Elevation:	40.0ft
Job Number:	23-392	Top of Casing Elev.:	N/A
Location:	7649 West Mercer Way	Drilling Method:	Portable Acker, hollow stem auger
Coordinates:	Northing: 47.533287, Easting: -122.240688	Sampling Method:	SPT



Completion Depth:	16.5ft
Date Borehole Started:	12/28/23
Date Borehole Completed:	12/28/23
Logged By:	L. Dunham
Drilling Company:	CN Drilling

Remarks: Standard penetration test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Coordinates and elevation are approximate and based on their relative location to known site features. This information is provided for relative information only and is not a substitution for field survey. **Datum: WGS84/NAVD88**

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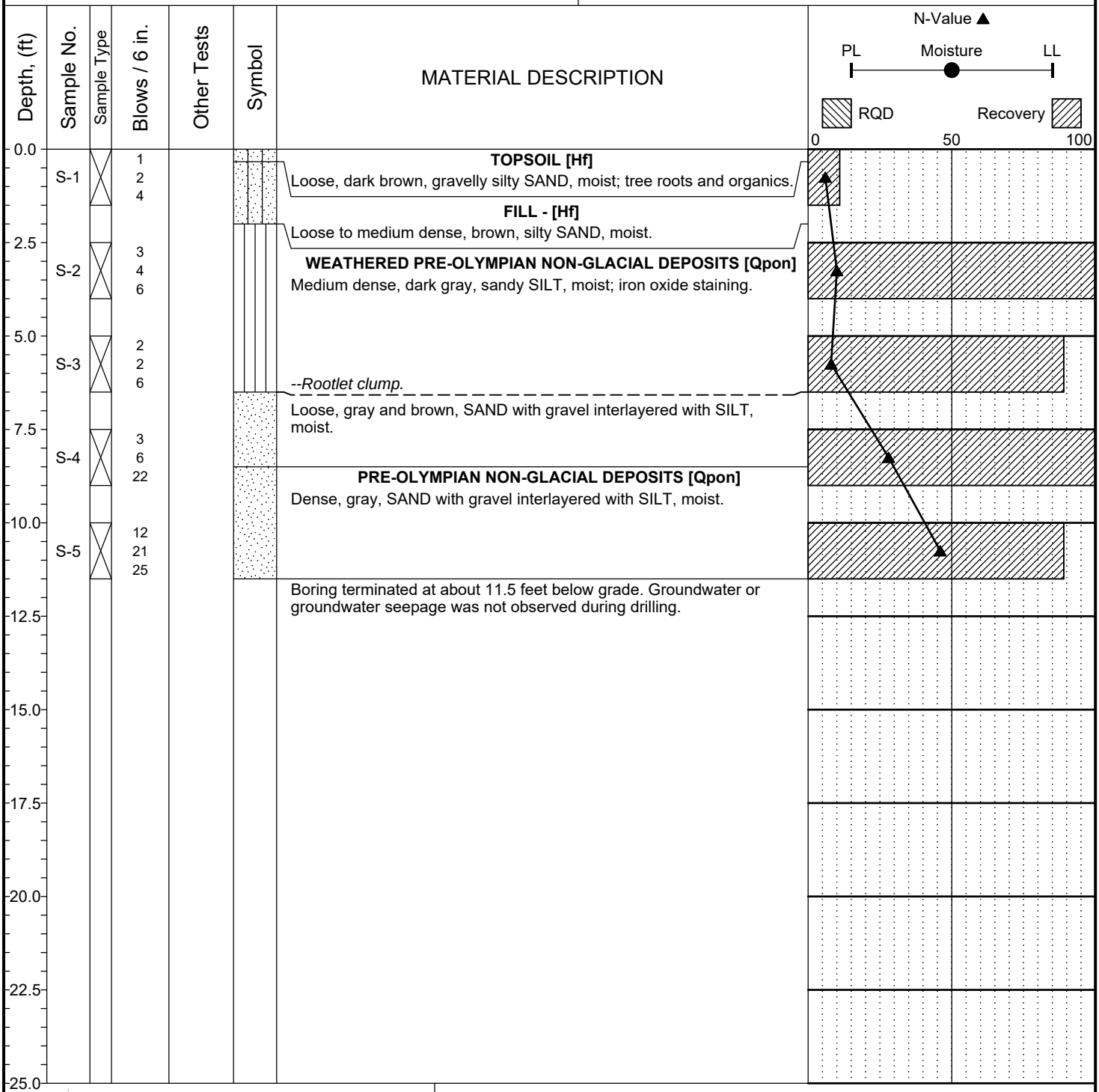
LOG OF TEST BORING PG-2

Figure A-3

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

Project:	Proposed Remodel and Addition	Surface Elevation:	55.0ft
Job Number:	23-392	Top of Casing Elev.:	N/A
Location:	7649 West Mercer Way	Drilling Method:	Portable Acker, hollow stem auger
Coordinates:	Northing: 47.533364, Easting: -122.240513	Sampling Method:	SPT



Completion Depth:	11.5ft
Date Borehole Started:	12/28/23
Date Borehole Completed:	12/28/23
Logged By:	L. Dunham
Drilling Company:	CN Drilling

Remarks: Standard penetration test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Coordinates and elevation are approximate and based on their relative location to known site features. This information is provided for relative information only and is not a substitution for field survey. **Datum: WGS84/NAVD88**

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LOG OF TEST BORING PG-3

Figure A-4

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