Cobalt Geosciences, LLC
P.O. Box 82243
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April 7, 2022
Updated December 1, 2022

John Sullivan
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RE: Geotechnical Evaluation
Proposed Residence
3024 69th Avenue SE
Mercer Island, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to discuss the results of our geotechnical evaluation at the referenced site.

The purpose of our evaluation was to provide recommendations for foundation design, grading, and earthwork.

Site Description

The site is located at 3024 69th Avenue SE in Mercer Island, Washington. The site consists of one rectangular parcel (No. 2175100315) with a total area of 9,000 square feet.

The site is mostly undeveloped except for local short walls in the eastern third. This area has local lawn and patio areas associated with the residence to the east. The remainder of the site is undeveloped and vegetated with grasses, blackberry vines, understory, and sparse small diameter trees.

The site slopes downward from east to west at magnitudes of 5 to 100 percent and total relief of about 30 feet. The steepest slope is near the west property line along 69th Avenue SE. This slope is about 20 feet tall with magnitudes of 80 to 100 percent. There is a local short slope near the walls and lawn areas that is about 6 to 8 feet tall and was likely created through prior grading.

The site contains seismic, erosion, and potential landslide hazard areas per City mapping.

The site is bordered to the north by undeveloped land, to the south and east by residences, and to the west by 69th Avenue SE.

The proposed development includes a new residence with basement areas and driveway in the west-central portion of the property.

Stormwater will be routed to City infrastructure since the site is within an infiltration infeasibility area. Site grading may include cuts and fills of about 12 feet or less for driveway and basement construction and foundation loads are expected to be light. We should be provided with the final plans to verify that our recommendations remain valid and do not require updating.

We note that we have reviewed provided architectural drawings in October 2022.

Area Geology

The Geologic Map of Mercer Island, indicates that the site is near the contacts between Vashon Advance Outwash and Lawton Clay.

Vashon Advance Outwash includes fine to medium grained sand with gravel. These deposits are typically permeable and become denser with depth.

These deposits are locally underlain by Lawton Clay. These materials are a subfacies of the outwash sands and include silt and clay deposited in lake environments. These materials are typically stiff to hard below a weathered zone. Many Puget Sound landslides occur at or near this contact when coupled with groundwater and steep topography.

Soil & Groundwater Conditions

As part of our evaluation, we drilled a hollow stem auger boring where accessible. We also reviewed numerous boring, hand auger, and test pit logs from geotechnical investigations conducted on nearby properties. Some of these logs are attached.

Disturbed soil samples were obtained during drilling by using the Standard Penetration Test (SPT) as described in ASTM D-1586. The Standard Penetration Test and sampling method consists of driving a standard 2-inch outside-diameter, split barrel sampler into the subsoil with a 140-pound hammer free falling a vertical distance of 30 inches. The summation of hammer-blows required to drive the sampler the final 12-inches of an 18-inch sample interval is defined as the Standard Penetration Resistance, or N-value. The blow count is presented graphically on the boring logs in this appendix. The resistance, or "N" value, provides a measure of the relative density of granular soils or of the relative consistency of cohesive soils.

The soils encountered were logged in the field and are described in accordance with the Unified Soil Classification System (USCS).

The boring encountered approximately 6 inches of grass and topsoil underlain by approximately 10 feet of very loose to loose, silty-fine to medium grained sand with gravel (Colluvium). These materials were underlain by very stiff to hard, silt with fine grained sand (Lawton Clay), which continued to the termination depth of the exploration.

Groundwater was not observed or encountered in the boring. Light volumes of groundwater could be present on or within the Lawton Clay at variable depths below grade.

Water table elevations often fluctuate over time. The groundwater level will depend on a variety of factors that may include seasonal precipitation, irrigation, land use, climatic conditions and soil permeability. Water levels at the time of the field investigation may be different from those encountered during the construction phase of the project. It would be necessary to install a piezometer to determine groundwater depths over a typical year.

City of Mercer Island GIS Mapped Hazards

The City of Mercer Island GIS maps indicate that the site is within a potential slide, seismic, and erosion hazard area. These designations are likely present due to a combination of historic mass wastage/landslide activity in steeper slope areas west of the site, close proximity of the property to the contact between outwash and underlying silts, and presence of outwash soils (erosion hazards).

The site slopes downward from east to west at magnitudes of 5 to 100 percent and total relief of about 30 feet. The steepest slope is near the west property line along 69th Avenue SE. This slope is about 20 feet tall with magnitudes of 80 to 100 percent. This slope may have been in part created through prior excavation work related to construction of 69th Avenue SE. There is a local

short slope near the walls and lawn areas that is about 6 to 8 feet tall and was likely created through prior grading.

Available geologic mapping for the area indicates the presence of older landslide scarps and features west and north of the site area. Some of these features are noted in Figure 2. We note that the upper loose soils at the site could consist of colluvium associated with historic mass wasting. It appears likely that the soil movements that created the current landforms likely occurred shortly after deglaciation about 11,000 years ago. Local reactivation of landslide areas may have occurred on downslope properties. We did not observe evidence of landslide activity or severe erosion on the subject parcel.

Overall, the site areas appear stable at this time with no evidence of recent or ongoing erosion or landslide activity. It is our opinion that the risk of landslide activity and erosion can be decreased through proper development, including excavation of loose soils, retaining walls, drainage systems, and grading to decrease slope magnitudes near the west property line. We can provide additional input once a site plan has been prepared. It is our opinion that the seismic hazard risks are low.

Mitigation of Impact to Geologic Hazard Areas

We have reviewed the proposed project with respect to the mitigation sequencing approach described in MICC 19.07.110. The project incorporates the following measures which mitigate the potential impact to the geologic hazards at the site and adjacent areas (landslide and erosion):

- The proposed residence is located in the 'least' critical area of the site (more level areas and areas away from former landslide features) and utilizes temporary shoring to limit disturbance and improve local stability.
- Ground disturbance required to construct the development will be minimized by using soldier piles east of the residence and temporary excavations where grading is not as extensive (deep).
- Temporary erosion control systems will be in place during construction and permanent landscaping will be implemented following grading.
- Work should take place during the dry season (April 1 through October 1) only to further minimize erosion risks.

A minimum 25 foot buffer from the known landslide features is suitable. This should be measured from the approximated scarp locations in Figure 2. The proposed building location is well away from these areas (at least 40 feet).

Statement of Risk

Per Section 19.07.160B2 of the Mercer Island City Code, development within geologic hazard areas require that a Geotechnical Engineer licensed within the State of Washington provide 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.

The project meets the criteria of c from above. Evidence and discussion of this item can be provided once we have a site plan with building elevations. Development practices that would help render the development safe as if it were not within a hazard area could include drainage improvements, retaining walls, loose soil removal, soldier pile walls, soil compaction, and overall landscaping as part of a new home.

Areas with higher risk of soil movements are situated west of the site, in areas where historic landslides appear to have occurred. This proposed development can be completed without adversely affecting geologic hazards near or within the site.

Erosion Hazard

The Natural Resources Conservation Services (NRCS) maps for King County indicate that the site is underlain by Arents, Alderwood material (6 to 15 percent slopes). These soils would have a slight to moderate erosion potential in a disturbed state depending on the slope magnitude.

It is our opinion that soil erosion potential at this project site can be reduced through landscaping and surface water runoff control. Typically, erosion of exposed soils will be most noticeable during periods of rainfall and may be controlled by the use of normal temporary erosion control measures, such as silt fences, hay bales, mulching, control ditches and diversion trenches. The typical wet weather season, with regard to site grading, is from October 31st to April 1st. Erosion control measures should be in place before the onset of wet weather.

Seismic Parameters

The overall subsurface profile corresponds to a Site Class *D* as defined by Table 1613.5.2 of the International Building Code (IBC). A Site Class *D* applies to an overall profile consisting of stiff/medium dense soils within the upper 100 feet.

We referenced the U.S. Geological Survey (USGS) Earthquake Hazards Program Website to obtain values for S_S, S_1, F_a, and F_v. The USGS website includes the most updated published data on seismic conditions. The following tables provide seismic parameters from the USGS web site with referenced parameters from ASCE 7-16.

Seismic Design Parameters (ASCE 7-16)

Site Class	Spectral Acceleration at 0.2 sec. (g)	Spectral Acceleration at 1.0 sec. (g)	Site Coefficients		Design Spectral Response Parameters		Design PGA
			F_a	F_v	S_{DS}	S_{D1}	
D	1.415	0.492	1.0	Null	0.943	Null	0.606

Additional seismic considerations include liquefaction potential and amplification of ground motions by soft/loose soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table. The site has a relatively low likelihood of liquefaction. We provide recommendations for foundation support that will eliminate the presence of loose, potentially liquefiable sands. For items listed as "Null" see Section 11.4.8 of the ASCE.

Conclusions and Recommendations

General

The site is underlain by a zone of loose soils underlain by relatively dense silts and sandy silts. The property is feasible for development with a new residence and driveway. This construction will require significant grading, retaining walls, and other systems to increase stability and decrease the risk of soil erosion and landslide activity.

The new residence will likely include a basement level with new concrete walls and at least one shoring wall to facilitate construction and excavation work. The new residence can be supported on medium dense/stiff or denser native soils that underlies the likely colluvium. Pipe piles could also be utilized to support the building if basements are not proposed.

Site Preparation

Trees, shrubs and other vegetation should be removed prior to stripping of surficial organic-rich soil and fill. Based on observations from the site investigation program, it is anticipated that the stripping depth will be 6 to 18 inches. Deeper excavations will be necessary in areas of loose soils, if they remain once building and grading elevations are achieved.

The native soils consist of silty-sand with gravel and sandy silt. Some of the native soils may be used as structural fill provided they achieve compaction requirements and are within 3 percent of the optimum moisture. Some of these soils may only be suitable for use as fill during the summer months, as they will be above the optimum moisture levels in their current state. These soils are variably moisture sensitive and may degrade during periods of wet weather and under equipment traffic.

Imported structural fill should consist of a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill should be placed in maximum lift thicknesses of 12 inches and should be compacted to a minimum of 95 percent of the modified proctor maximum dry density, as determined by the ASTM D 1557 test method.

Temporary Excavations

Based on our understanding of the project, we anticipate that the grading could include local cuts on the order of approximately 12 feet or less for foundation and most of the utility placement. Temporary excavations should be sloped no steeper than 1.5H:1V (Horizontal:Vertical) in loose native soils and fill and 1H:1V in medium dense native soils. If an excavation is subject to heavy vibration or surcharge loads, we recommend that the excavations be sloped no steeper than 2H:1V, where room permits.

We recommend locating the residence and any basement areas at least 10 feet from the south property line and/or north property line if a residence is built on that lot between now and the time of construction on this parcel. Temporary shoring consisting of soldier piles is suitable and would be required if basements are proposed and there is inadequate space for temporary excavations. We can provide more specific recommendations once a site plan with elevations has been prepared.

Temporary cuts should be in accordance with the Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. Temporary slopes should be visually inspected daily by a qualified person during construction activities and the inspections should be documented in daily reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and reducing slope erosion during construction.

Temporary cut slopes should be covered with visqueen to help reduce erosion during wet weather, and the slopes should be closely monitored until the permanent retaining systems or slope configurations are complete. Materials should not be stored or equipment operated within 10 feet of the top of any temporary cut slope.

Soil conditions may not be completely known from the geotechnical investigation. In the case of temporary cuts, the existing soil conditions may not be completely revealed until the excavation work exposes the soil. Typically, as excavation work progresses the maximum inclination of temporary slopes will need to be re-evaluated by the geotechnical engineer so that supplemental recommendations can be made. Soil and groundwater conditions can be highly variable. Scheduling for soil work will need to be adjustable, to deal with unanticipated conditions, so that the project can proceed and required deadlines can be met.

If any variations or undesirable conditions are encountered during construction, we should be notified so that supplemental recommendations can be made. If room constraints or groundwater conditions do not permit temporary slopes to be cut to the maximum angles allowed by the WAC, temporary shoring systems may be required. The contractor should be responsible for developing temporary shoring systems, if needed. We recommend that Cobalt Geosciences and the project structural engineer review temporary shoring designs prior to installation, to verify the suitability of the proposed systems.

Soldier Pile Walls

One or more temporary or permanent soldier pile walls with pressure treated timber (wood) or concrete lagging would be suitable to support the proposed excavations where and if required.

Soldier piles typically consist of steel W or H-beams inserted into oversized drilled shafts, which are backfilled with structural concrete, lean mix {Controlled Density Fill (CDF)}, or a combination of lean mix to the base of the excavation and structural concrete below the excavation to anchor the soldier piles.

Due to the potential for local caving during drilling operations for the soldier pile holes due to soft soil conditions and shallow groundwater, consideration should be given to using slurry or drilling fluid to reduce the risk of caving of the pile holes during installation. If water is present within the pile hole at the time of soldier pile concrete placement, the concrete should be placed starting at the bottom of the hole with a tremie pipe and the column of concrete should be raised slowly to displace the water. Note that groundwater may be present near the toe of the pile along with fine grained soils at depth. Groundwater could cause local sloughing.

We recommend that soldier piles have a maximum spacing of eight feet on center. To account for arching effects, lateral loading on the lagging can be reduced by 50 percent. Unlagged excavation heights should not exceed three feet. No portion of the excavation should remain unsupported overnight. Lagging sections may be up to 6 feet in height depending on stability. Note that the soils are sandy and shorter vertical cuts may be required for lagging placement.

Cantilever soldier pile walls for this site may be designed based on an active lateral earth pressure of 35 pcf for level backslope conditions, provided the wall is unrestrained (not fixed; permitted to move at least 0.2 percent of the wall height). If the wall is restrained, we recommend a lateral earth pressure of 55 pcf. The pressure will act on the soldier pile width below the base of the excavation as well. All applicable surcharge pressures should be included, where anticipated or shown (buildings, construction traffic). An increase in the above pressures is necessary if sloping backslope conditions will be present. This increase can be calculated using an increase of 0.75 pcf per degree of slope.

A lateral uniform seismic pressure of 7H is recommended for seismic conditions (active). An at-rest pressure of 14H may be used if the wall is restrained. Note that seismic conditions may not be required for a temporary system.

In front of the soldier piles, resistive pressure can be estimated using an allowable passive earth pressure of 150 pcf acting over 2 times the soldier pile diameter, neglecting the upper 2 feet below the base of the excavation (upper 10 feet), and a pressure of 250 pcf below 10 feet. A factor of safety of 1.5 has been incorporated into the passive pressure value. We can provide updated pressures once a site plan with elevations has been prepared.

A lateral pressure reduction of 50 percent may be used for design of the lagging for a pile spacing of three diameters. Lagging should be backfilled with 5/8 inch clean angular rock to minimize void spaces.

The shoring system and any nearby existing structures, including roadways, should be monitored for movement during construction (if present). A system of survey points should be established prior to commencing with the excavation activities. Readings should be taken periodically (weekly) until the permanent wall is in place and these readings should be compared to the original baseline measurements.

Permanent pile walls will also require special and specific modifications to increase their design life. This can include pile upsizing, various coatings, and use of concrete lagging in lieu of pressure treated timbers.

Foundation Design

The proposed structure may be supported on a shallow spread footing foundation system bearing on undisturbed medium dense or firmer native soils or on properly compacted structural fill placed on the suitable native soils. Any undocumented fill and/or loose native soils should be removed and replaced with structural fill below foundation elements. Structural fill below footings should consist of clean angular rock 5/8 to 4 inches in size. We should verify soil conditions during foundation excavation work.

Note that all loose soils will require removal. If a basement is not proposed, it may be more cost effective to support the structure on pin piles. We can provide recommendations for pin piles upon request and once a more detailed site plan has been prepared. Even with a basement excavation, overexcavation of several feet may be required.

For shallow foundation support, we recommend widths of at least 16 and 24 inches, respectively, for continuous wall and isolated column footings supporting the proposed structure. Provided that the footings are supported as recommended above, a net allowable bearing pressure of 2,500 pounds per square foot (psf) may be used for design.

A 1/3 increase in the above value may be used for short duration loads, such as those imposed by wind and seismic events. Structural fill placed on bearing, native subgrade should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Footing excavations should be inspected to verify that the foundations will bear on suitable material.

Exterior footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower.

If constructed as recommended, the total foundation settlement is not expected to exceed 1 inch. Differential settlement, along a 25-foot exterior wall footing, or between adjoining column footings, should be less than ½ inch. This translates to an angular distortion of 0.002. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. All footing excavations should be observed by a qualified geotechnical consultant.

Resistance to lateral footing displacement can be determined using an allowable friction factor of 0.30 acting between the base of foundations and the supporting subgrades. Lateral resistance for footings can also be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglect the upper 12 inches below grade in exterior areas). The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Any extremely wet or dry materials, or any loose or disturbed materials at the bottom of the footing excavations, should be removed prior to placing concrete. The potential for wetting or drying of the bearing materials can be reduced by pouring concrete as soon as possible after completing the footing excavation and evaluating the bearing surface by the geotechnical engineer or his representative.

Concrete Retaining Walls

The following table, titled **Wall Design Criteria**, presents the recommended soil related design parameters for retaining walls with a level backslope. Contact Cobalt if an alternate retaining wall system is used. This has been included for new cast in place walls, if any are proposed.

Wall Design Criteria	
"At-rest" Conditions (Lateral Earth Pressure – EFD^{+})	55 pcf (Equivalent Fluid Density)
"Active" Conditions (Lateral Earth Pressure – EFD^{+})	35 pcf (Equivalent Fluid Density)
Seismic Increase for "At-rest" Conditions (Lateral Earth Pressure)	21H* (Uniform Distribution) 1 in 2,500 year event
Seismic Increase for "At-rest" Conditions (Lateral Earth Pressure)	14H* (Uniform Distribution) 1 in 500 year event

Seismic Increase for "Active" Conditions (Lateral Earth Pressure)	7H* (Uniform Distribution)
Passive Earth Pressure on Low Side of Wall (Allowable, includes F.S. = 1.5)	Neglect upper 2 feet, then 250 pcf EFD+
Soil-Footing Coefficient of Sliding Friction (Allowable; includes F.S. = 1.5)	0.30

*H is the height of the wall; Increase based on one in 500 year seismic event (10 percent probability of being exceeded in 50 years),
+EFD – Equivalent Fluid Density. Assumes excavation into stiff to hard soils for passive pressures.

The stated lateral earth pressures do not include the effects of hydrostatic pressure generated by water accumulation behind the retaining walls. Uniform horizontal lateral active and at-rest pressures on the retaining walls from vertical surcharges behind the wall may be calculated using active and at-rest lateral earth pressure coefficients of 0.3 and 0.5, respectively. A soil unit weight of 125 pcf may be used to calculate vertical earth surcharges.

To reduce the potential for the buildup of water pressure against the walls, continuous footing drains (with cleanouts) should be provided at the bases of the walls. The footing drains should consist of a minimum 4-inch diameter perforated pipe, sloped to drain, with perforations placed down and enveloped by a minimum 6 inches of pea gravel in all directions.

The backfill adjacent to and extending a lateral distance behind the walls at least 2 feet should consist of free-draining granular material. All free draining backfill should contain less than 3 percent fines (passing the U.S. Standard No. 200 Sieve) based upon the fraction passing the U.S. Standard No. 4 Sieve with at least 30 percent of the material being retained on the U.S. Standard No. 4 Sieve. The primary purpose of the free-draining material is the reduction of hydrostatic pressure. Some potential for the moisture to contact the back face of the wall may exist, even with treatment, which may require that more extensive waterproofing be specified for walls, which require interior moisture sensitive finishes.

We recommend that the backfill be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. In place density tests should be performed to verify adequate compaction. Soil compactors place transient surcharges on the backfill. Consequently, only light hand operated equipment is recommended within 3 feet of walls so that excessive stress is not imposed on the walls.

Stormwater Management Feasibility

All stormwater should be collected and routed via tightline into City infrastructure. We can provide additional input if other systems are under consideration.

Slab-on-Grade

We recommend that the upper 18 inches of the existing native soils within slab areas be re-compacted to at least 95 percent of the modified proctor (ASTM D1557 Test Method).

Often, a vapor barrier is considered below concrete slab areas. However, the usage of a vapor barrier could result in curling of the concrete slab at joints. Floor covers sensitive to moisture typically requires the usage of a vapor barrier. A materials or structural engineer should be consulted regarding the detailing of the vapor barrier below concrete slabs. Exterior slabs typically do not utilize vapor barriers.

The American Concrete Institutes ACI 360R-06 Design of Slabs on Grade and ACI 302.1R-04 Guide for Concrete Floor and Slab Construction are recommended references for vapor barrier selection and floor slab detailing.

Slabs on grade may be designed using a coefficient of subgrade reaction of 210 pounds per cubic inch (pci) assuming the slab-on-grade base course is underlain by structural fill placed and compacted as outlined above. A 4- to 6-inch-thick capillary break layer should be placed over the prepared subgrade. This material should consist of pea gravel or 5/8 inch clean angular rock.

A perimeter drainage system is recommended unless interior slab areas are elevated a minimum of 12 inches above adjacent exterior grades. If installed, a perimeter drainage system should consist of a 4-inch diameter perforated drain pipe surrounded by a minimum 6 inches of drain rock wrapped in a non-woven geosynthetic filter fabric to reduce migration of soil particles into the drainage system. The perimeter drainage system should discharge by gravity flow to a suitable stormwater system.

Exterior grades surrounding buildings should be sloped at a minimum of one percent to facilitate surface water flow away from the building and preferably with a relatively impermeable surface cover immediately adjacent to the building.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented, and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.
- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

Utilities

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards, by a contractor experienced in such work. The contractor is responsible for the safety of open trenches. Traffic and vibration adjacent to trench walls should be reduced; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced, especially during or shortly following periods of precipitation.

In general, silty and sandy soils were encountered at shallow depths in the explorations at this site. These soils have low cohesion and density and will have a tendency to cave or slough in excavations. Shoring or sloping back trench sidewalls is required within these soils in excavations greater than 4 feet deep.

All utility trench backfill should consist of imported structural fill or suitable on site soils. Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. The upper 5 feet of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Below 5 feet, utility trench backfill in pavement areas should be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

The contractor is responsible for removing all water-sensitive soils from the trenches regardless of the backfill location and compaction requirements. Depending on the depth and location of the proposed utilities, we anticipate the need to re-compact existing fill soils below the utility structures and pipes. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction procedures.

CONSTRUCTION FIELD REVIEWS

Cobalt Geosciences should be retained to provide part time field review during construction in order to verify that the soil conditions encountered are consistent with our design assumptions and that the intent of our recommendations is being met. This will require field and engineering review to:

- Monitor and test structural fill placement and soil compaction
- Observe bearing capacity at foundation locations
- Observe slab-on-grade preparation
- Verify shoring installation if performed
- Monitor foundation drainage placement
- Observe excavation stability

Geotechnical design services should also be anticipated during the subsequent final design phase to support the structural design and address specific issues arising during this phase. Field and engineering review services will also be required during the construction phase in order to provide a Final Letter for the project.

CLOSURE

This report was prepared for the exclusive use of John Sullivan and his appointed consultants. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Cobalt Geosciences, LLC.

The recommendations contained in this report are based on assumed continuity of soils with those of our test holes and assumed structural loads. Cobalt Geosciences should be provided with final architectural and civil drawings when they become available in order that we may review our design recommendations and advise of any revisions, if necessary.

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of John Sullivan who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Cobalt Geosciences should any of these not be satisfied.

Sincerely,

Cobalt Geosciences, LLC

12/1/2022
Phil Haberman, PE, LG, LEG
Principal

Statement of General Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Cobalt Geosciences and the Client. Any use which a third party makes of this report is the responsibility of such third party.

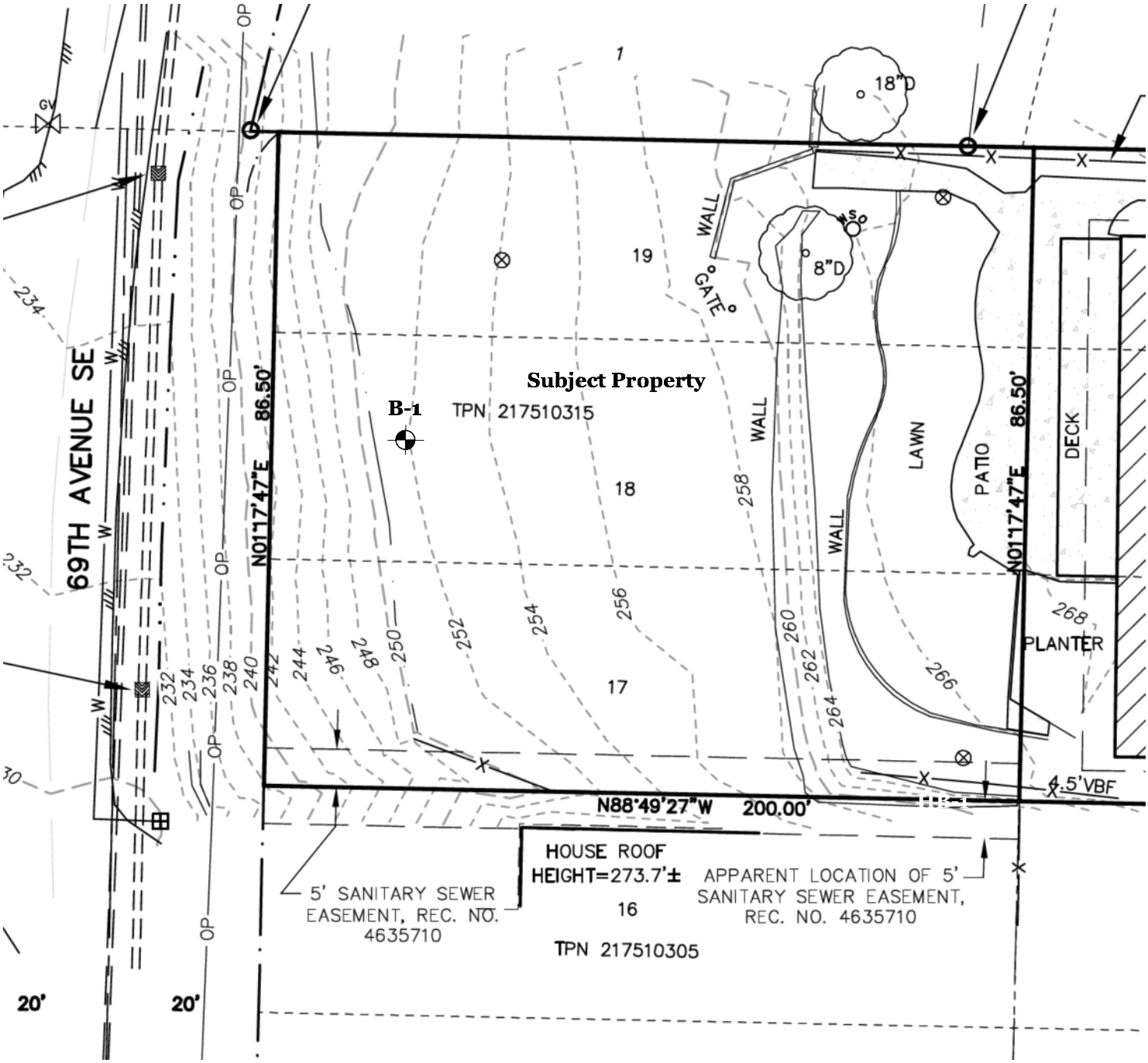
BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Cobalt Geosciences present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Cobalt Geosciences is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Cobalt Geosciences at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Cobalt Geosciences must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Cobalt Geosciences will not be responsible to any party for damages incurred as a result of failing to notify Cobalt Geosciences that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Cobalt Geosciences, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Cobalt Geosciences cannot be responsible for site work carried out without being present.



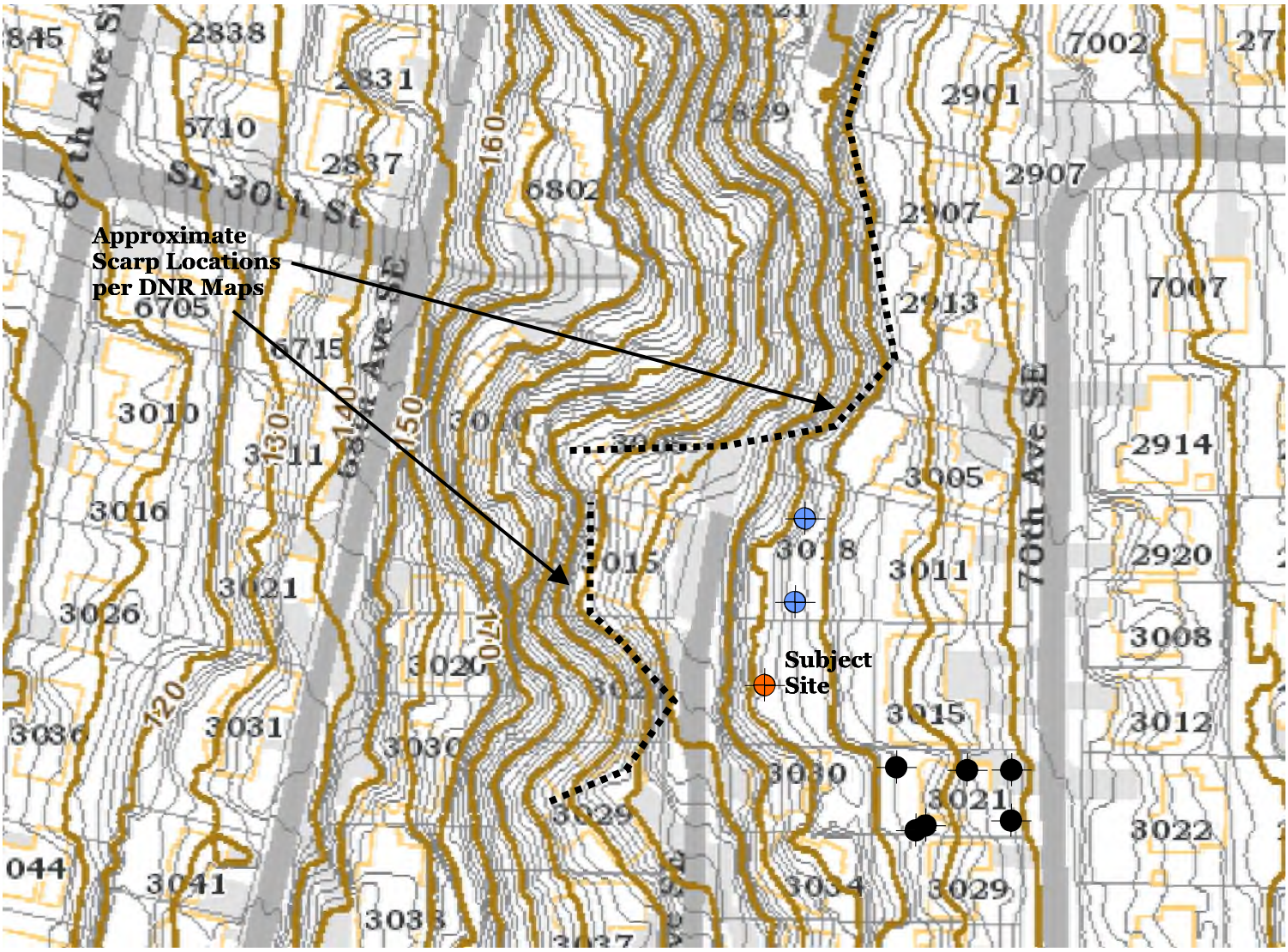
Provided topo survey

B-1 **Approximate Boring Location**

N

Not to Scale

COBALT GEOSCIENCES	Proposed Residence 3024 69th Avenue SE Mercer Island, Washington	**SITE MAP** **FIGURE 1**	Cobalt Geosciences, LLC P.O. Box 82243 Kenmore, WA 98028 (206) 331-1097 www.cobaltgeo.com cobaltgeo@gmail.com



- Cobalt Boring 2022
- Nelson Geotechnical Boring 2020
- Adapt Hand Borings 2003

COBALT GEOSCIENCES

Proposed Residence
3024 69th Avenue SE
Mercer Island, Washington

GIS MAP FIGURE 2

Cobalt Geosciences, LLC
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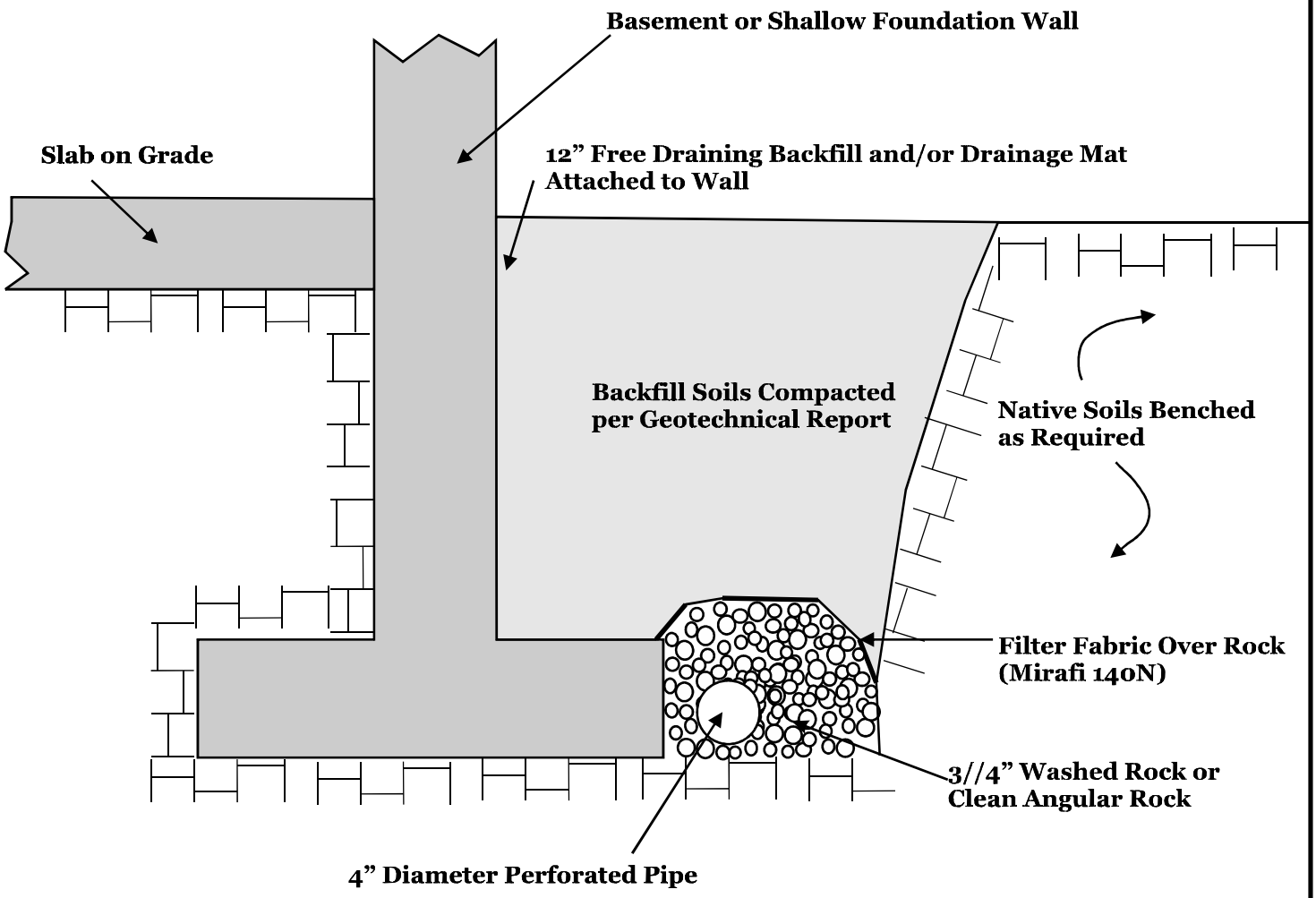
(206) 331-1097
www.cobaltgeo.com
cobaltgeo@gmail.com



Not to Scale

COBALT GEOSCIENCES	**Typical Foundation Drain Detail**	**Attachment**	Cobalt Geosciences, LLC PO Box 1792 North Bend, WA 98045 (206) 331-1097 www.cobaltgeo.com phil@cobaltgeo.com

Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		Gravels with Fines (more than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
			SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (50% or more passes the No. 200 sieve)	Silts and Clays (liquid limit less than 50)	Inorganic	ML	Inorganic silts of low to medium plasticity, sandy silts, gravelly silts, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays silty clays, lean clays
		Organic	OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays (liquid limit 50 or more)	Inorganic	MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt
			CH	Inorganic clays of medium to high plasticity, sandy fat clay, or gravelly fat clay
		Organic	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT	Peat, humus, swamp soils with high organic content (ASTM D4427)

Classification of Soil Constituents

MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).

Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).

Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).

Grain Size Definitions

Description	Sieve Number and/or Size
Fines	<#200 (0.08 mm)
Sand	
-Fine	#200 to #40 (0.08 to 0.4 mm)
-Medium	#40 to #10 (0.4 to 2 mm)
-Coarse	#10 to #4 (2 to 5 mm)
Gravel	
-Fine	#4 to 3/4 inch (5 to 19 mm)
-Coarse	3/4 to 3 inches (19 to 76 mm)
Cobbles	3 to 12 inches (75 to 305 mm)
Boulders	>12 inches (305 mm)

Relative Density (Coarse Grained Soils)

N, SPT, Blows/FT	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

Consistency (Fine Grained Soils)

N, SPT, Blows/FT	Relative Consistency
Under 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
15 - 30	Very stiff
Over 30	Hard

Moisture Content Definitions

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

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Soil Classification Chart

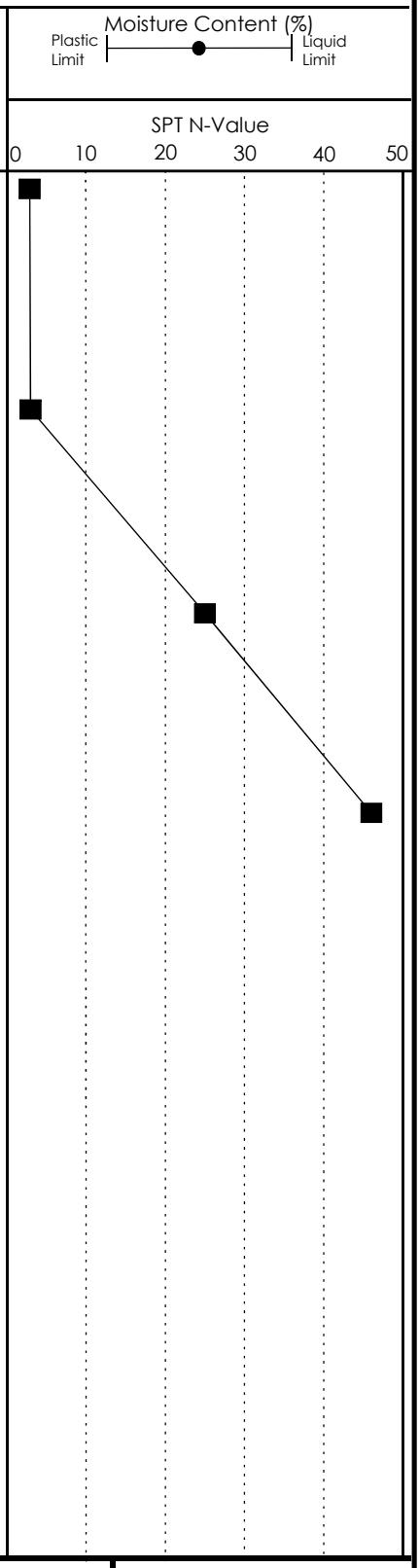
Figure C1

Log of Boring B-1

Date: April 5, 2022	Depth: 16.5'	Initial Groundwater: None
Contractor: CN	Elevation:	Sample Type: Split Spoon
Method: Hollow Stem Auger	Logged By: PH Checked By: SC	Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description
0			1			Vegetation/Topsoil
2			1 1		SM	Very loose to loose, silty-fine to medium grained sand, mottled yellowish brown to grayish brown, moist. (Colluvium)
4						
6			1 1 1			
8						
10			3			
12			9 16		ML	Very stiff to hard, silt with fine grained sand, mottled olive gray, moist. (Lawton Clay)
14						
16			10 16 19			
18						End of Boring 16.5'
20						
22						
24						
26						
28						
30						
32						
34						

Groundwater



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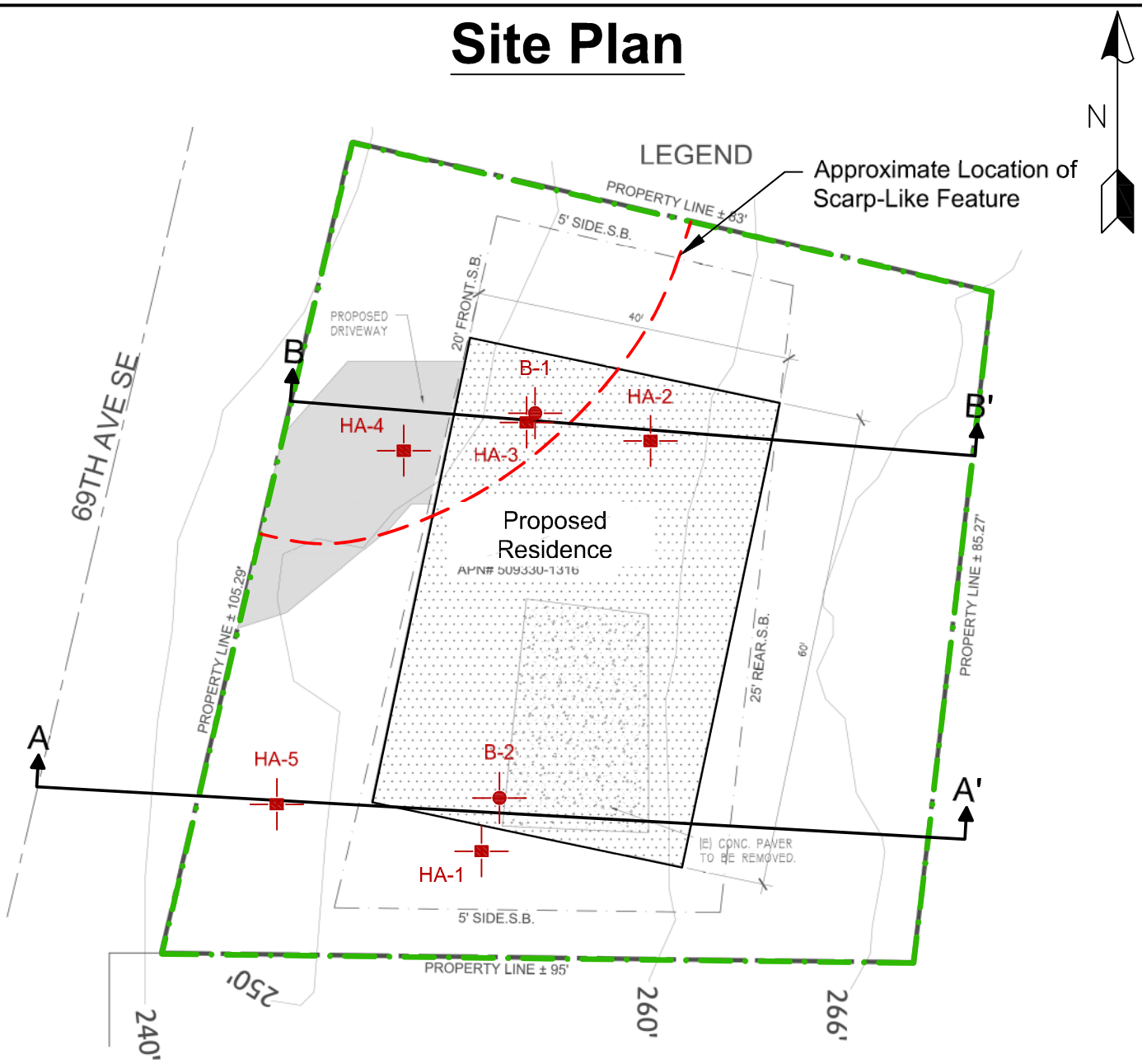
Proposed Residence
3024 69th Avenue SE
Mercer Island, Washington

Boring Log

Site Plan



LEGEND

- Property line
- B-1 — Number and approximate location of boring
- HA-1 — Number and approximate location of hand auger
- A — A' — Approximate location of cross-section

0 20 40

Scale: 1 inch = 20 feet

Reference: Site Plan based on a plan dated June 24, 2018 titled " Site Plan."

Project Number 11448B20	Hu Residence Development Additional Explorations Site Plan	Nelson Geotechnical Associates, Inc. NGA Geotechnical Engineers & Geologists	
Figure 2		Woodinville Office: 17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax: 481-2510	East Wenatchee Office: 5526 Industry Lane, #2, East Wenatchee, WA 98802, (509) 665-7696 / Fax: 665-7692
		www.nelsongeotech.com	

No.	Date	Revision	By	CK
1	11448B20	Original	DPN	KSB
2	6/19/20	Revision	DPN	KSB

\\HILL\company\2020 NGA Project Folders\11448B-20 Hu Res Dev Mercer Island Additional Explorations\Drafting\SP.dwg

BORING LOG

B-1

Approximate Ground Surface Elevation: ??

Soil Profile: Description	Graphic Log	Group Symbol	Sample Data: Blow Count	Sample Location (Depth in feet)
Brown to gray, silty fine to medium sand with trace gravel (very loose, moist) (**FILL**)			3	5
Brown-gray, mottled sandy silt with iron-oxide staining (stiff, dry to moist)		ML	28	10
Blue-gray, silty fine sand (very dense, moist)		SM	55	15
Blue-gray silt with fine sand (hard, dry to moist)		ML	36	20
Blue-gray, silty fine sand interbedded with blue-gray silt (medium dense, dry to moist)		SM-ML	45	
Boring terminated below existing grade at 24.0 feet on 6/9/20. Groundwater seepage was not encountered during drilling.				25

Penetration Resistance (Blows/foot - ●): 10 20 30 40 50 50+

Moisture Content (Percent - ■): 10 20 30 40 50 50+

Laboratory Testing

Piezometer Installation - Ground Water Data (Depth in Feet)

5 10 15 20 25

LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- ✱ Liquid Limit
- \+ Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M	Moisture Content
A	Atterberg Limits
G	Grain-size Analysis
DS	Direct Shear
PP	Pocket Penetrometer Readings, tons/ft
P	Sample Pushed
T	Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Hu Residence Development Additional Explorations Boring Log	Nelson Geotechnical Associates, Inc.
11448B20		Geotechnical Engineers & Geologists
Figure 6		Woodinville Office: 17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax: 481-2510
Page 1 of 1		www.nelsongeotech.com
		East Wenatchee Office: 5526 Industry Lane, #2, East Wenatchee, WA 98802, (509) 665-7696 / Fax: 665-7692

No.	Date	Revision	By	CK
1	6/18/20	Original	DPN	KSB

Logged by: KSB on 6/9/20

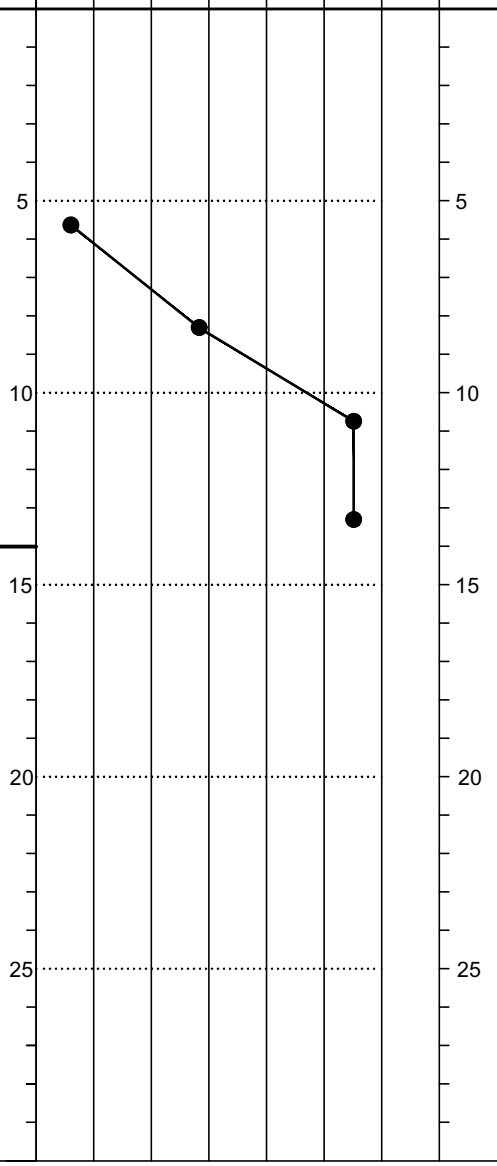
\\HILL\company\2020 NGA Project Folders\11448B-20 Hu Res Dev Mercer Island Additional Explorations\Drafting\Borings.dwg

BORING LOG

B-2

Approximate Ground Surface Elevation: ??

Soil Profile			Sample Data		Penetration Resistance (Blows/foot - ●) 10 20 30 40 50 50+ / Moisture Content (Percent - ■) 10 20 30 40 50 50+	Laboratory Testing	Piezometer Installation - Ground Water Data (Depth in Feet)
Description	Graphic Log	Group Symbol	Blow Count	Sample Location (Depth in feet)			
Brown, medium to coarse sand with silty, fine to medium sand with gravel (loose, moist) (**FILL**)			7				
Gray silt with trace fine sand (stiff, dry to moist)			25				
-becomes hard		ML	59				
-with iron-oxide staining			59				
Boring terminated below existing grade at 14.0 feet on 6/9/20. Groundwater seepage was not encountered during drilling.							



LEGEND

- Depth Driven and Amount Recovered with 2-inch O.D. Split-Spoon Sampler
- Depth Driven and Amount Recovered with 3-inch Shelby Tube Sampler
- Solid PVC Pipe
- Slotted PVC Pipe
- Monument/ Cap to Piezometer
- * Liquid Limit
- + Plastic Limit
- Concrete
- Bentonite
- Native Soil
- Silica Sand
- Water Level

M Moisture Content
A Atterberg Limits
G Grain-size Analysis
DS Direct Shear
PP Pocket Penetrometer Readings, tons/ft
P Sample Pushed
T Triaxial

NOTE: Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgement. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Project Number	Hu Residence Development Additional Explorations Boring Log	Nelson Geotechnical Associates, Inc.
11448B20		Geotechnical Engineers & Geologists
Figure 7		Woodinville Office: 17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax: 481-2510
Page 1 of 1		www.nelsongeotech.com
		East Wenatchee Office: 5526 Industry Lane, #2, East Wenatchee, WA 98802, (509) 665-7696 / Fax: 665-7692

No.	Date	Revision	By	CK
1	6/18/20	Original	DPN	KSB

Logged by: KSB on 6/9/20

\\HILL\company\2020 NGA Project Folders\11448B-20 Hu Res Dev Mercer Island Additional Explorations\Drafting\Borings.dwg

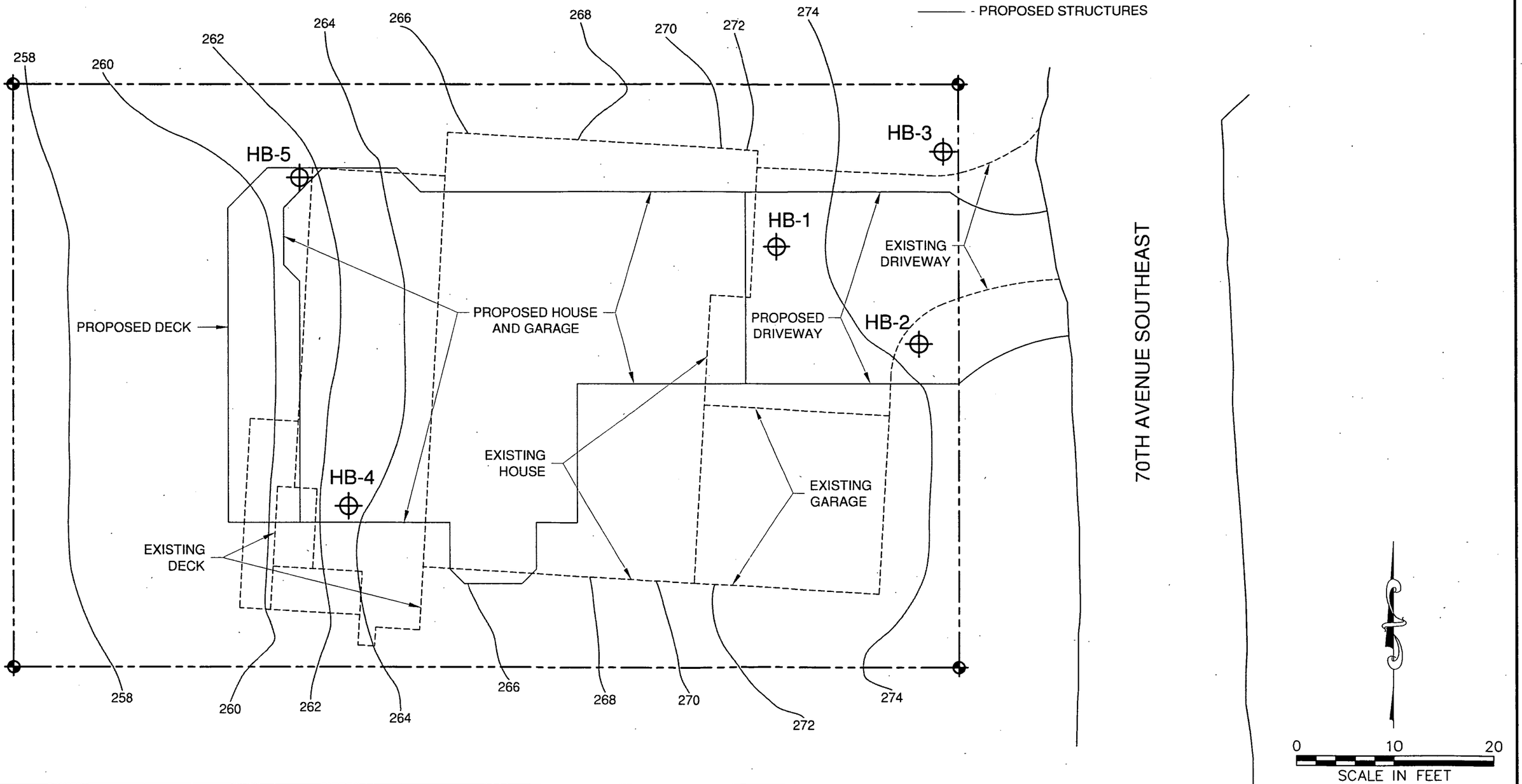
NOTE: SITE PLAN BASED ON SHEET NUMBER "A" BY ARMSTRONG BUILDING COMPONENTS (UNDATED, RECIEVED OCTOBER 2003)

LEGEND:

HB-1 ⊕ - HAND BORING NUMBER AND APPROXIMATE LOCATION

------ - EXISTING STRUCTURES

——— - PROPOSED STRUCTURES



LSI ADAPT

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Seattle, Washington 98104
Ph : 206.654.7045 Fax : 206.654.7048

FIGURE 2 - Site & Exploration Plan

Project : Volk Residence
Location : 3021 70th Avenue Southeast
Mercer Island, Washington 98040
Client : Patty Volk
Date : 10/31/03 **Job #** :S-WA-03-10238-GEO

HAND BORING LOG

LSI ADAPT
615 8th Avenue South
Seattle, Washington 98104
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : Volk Residence
LOCATION : 3021 70th Avenue Southeast
Mercer Island, Washington 98040 Patty Volk

Job Number : WA03-10238-GEO

Boring No. : **HB-1**

Ground Surface Elevation : 273.0 feet

Elevation Reference : Drawing "A" by Armstrong

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	PID READING	GROUND WATER	NOTES	LABORATORY TESTING
0	6-inches of topsoil, sod and roots							
	Loose, moist to wet, tan-gray, silty fine to coarse SAND (Fill)							
	Medium dense, moist, tan-gray, gravelly, silty fine to medium SAND with some coarse sand and brick fragments (Fill)							
	Loose, moist, gray, fine to coarse SAND with some gravel			5				
	Increasing gravel content							
	Terminated at 4.0 feet due to refusal on gravel. No groundwater observed. No caving observed.							
5	Note: Glacial Till fragments encountered within fill soils at about 2.5 feet depth.							
10								
15								

LEGEND

- Dynamic Cone Penetrometer Test (Equivalent SPT Blowcount shown)
- Shelby Tube Sample
- Sample not Recovered
- DATE — Static Water Level at Drilling
- DATE — Static Water Level
- DATE — Perched Groundwater
- 100 to 1000 g — Bag Sample
- WTPH-D Ext. 8010 — Type of Analytical Testing Performed
- NR — No Recovery
- ATD — At Time of Drilling
- XX — Grain Size Analysis (% fines shown)
- XX — 200 Wash (% fines shown)

File Name : Hand Boring Log.dwg

Start Date : 10/13/03 Completion Date : 10/13/03 Logged By : R.B.H.

HAND BORING LOG

LSI ADAPT
615 8th Avenue South
Seattle, Washington 98104
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : Volk Residence
LOCATION : 3021 70th Avenue Southeast
Mercer Island, Washington 98040 Patty Volk

Job Number : WA03-10238-GEO

Boring No. : **HB-2**

Ground Surface Elevation : 274.0 feet

Elevation Reference : Drawing "A" by Armstrong

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	PID READING	GROUND WATER	NOTES	LABORATORY TESTING
0	3-inches of topsoil over relic AC pavement							
	Terminated due to refusal on AC pavement.							
	No groundwater observed.							
	No caving observed.							
5								
10								
15								

LEGEND

- Dynamic Cone Penetrometer Test (Equivalent SPT Blowcount shown)
- Shelby Tube Sample
- Sample not Recovered
- DATE ▽ — Static Water Level at Drilling
- DATE ▽ — Static Water Level
- Perched Groundwater
- 100 to 1000 g — Bag Sample
- WTPH-D Ext. 8015 — Type of Analytical Testing Performed
- NR — No Recovery
- ATD — At Time of Drilling
- XX — Grain Size Analysis (% fines shown)
- XX — 200 Wash (% fines shown)

File Name : Hand Boring Log.dwg

Start Date : 10/13/03 Completion Date : 10/13/03 Logged By : R.B.H.

HAND BORING LOG

LSI ADAPT
615 8th Avenue South
Seattle, Washington 98104
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : Volk Residence
LOCATION : 3021 70th Avenue Southeast
Mercer Island, Washington 98040 Patty Volk

Job Number : WA03-10238-GEO

Boring No. : **HB-3**

Ground Surface Elevation : 275.0 feet

Elevation Reference : Drawing "A" by Armstrong

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	PID READING	GROUND WATER	NOTES	LABORATORY TESTING
0	3-inches of topsoil, sod and roots							
	Medium dense to dense, damp to moist, light gray-brown, silty, gravelly, fine to coarse SAND (Fill)							
	Dense to very dense, moist, gray-brown, silty fine to coarse SAND with some gravel (Weathered Glacial Till)			>>15				
	Terminated at 2.25 feet due to refusal on very dense soils. No groundwater observed. No caving observed.							
5								
10								
15								

LEGEND

- Dynamic Cone Penetrometer Test (Equivalent SPT Blowcount shown)
- Shelby Tube Sample
- Sample not Recovered
- DATE ▽ Static Water Level at Drilling
- DATE ▽ Static Water Level
- DATE ▽ Perched Groundwater
- 100 to 1000 g — Bag Sample
- WTPH-D Ext. 8010 — Type of Analytical Testing Performed
- NR — No Recovery
- ATD — At Time of Drilling
- XX — Grain Size Analysis (% fines shown)
- XX — 200 Wash (% fines shown)

File Name : Hand Boring Log.dwg

Start Date : 10/13/03 Completion Date : 10/13/03 Logged By : R.B.H.

HAND BORING LOG

LSI ADAPT
615 8th Avenue South
Seattle, Washington 98104
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : Volk Residence
LOCATION : 3021 70th Avenue Southeast
Mercer Island, Washington 98040 Patty Volk

Job Number : WA03-10238-GEO

Boring No. : **HB-4**

Ground Surface Elevation : 263.0 feet

Elevation Reference : Drawing "A" by Armstrong

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	PID READING	GROUND WATER	NOTES	LABORATORY TESTING
0	2-inches topsoil, sod and roots							
	Loose, moist to wet, tan-gray, silty fine to medium SAND with some gravel (Fill)			4				
	Loose, wet to saturated, tan-gray with rusty mottling, silty fine to coarse SAND with gravel (Fill)							
	Medium dense to dense, moist to wet, gray with rusty mottling, silty fine to coarse SAND with gravel and trace clay (Weathered Glacial Till)			12 >15 >>15				
5	Terminated at 5.0 feet due to refusal. No groundwater observed. No caving observed.							
10								
15								

LEGEND

- Dynamic Cone Penetrometer Test (Equivalent SPT Blowcount shown)
- Shelby Tube Sample
- Sample not Recovered
- DATE — Static Water Level at Drilling
- DATE — Static Water Level
- Perched Groundwater
- 100 to 1000 g — Bag Sample
- WTPH-D Ext. 8010 — Type of Analytical Testing Performed
- NR — No Recovery
- ATD — At Time of Drilling
- XX — Grain Size Analysis (% fines shown)
- XX — 200 Wash (% fines shown)

File Name : Hand Boring Log.dwg

Start Date : 10/14/03 Completion Date : 10/14/03 Logged By : R.B.H.

HAND BORING LOG

LSI ADAPT
615 8th Avenue South
Seattle, Washington 98104
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : Volk Residence
LOCATION : 3021 70th Avenue Southeast
Mercer Island, Washington 98040 Patty Volk

Job Number : WA03-10238-GEO

Boring No. : **HB-5**

Ground Surface Elevation : 262.0 feet

Elevation Reference : Drawing "A" by Armstrong

DEPTH (feet)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	PID READING	GROUND WATER	NOTES	LABORATORY TESTING
0	6-inches grass, sod and topsoil							
	Loose to medium dense, moist, tan-gray, gravelly, silty fine to coarse SAND (Fill)							
	Medium dense to dense, moist to wet, gray with rusty mottling, silty fine to coarse SAND with gravel (Weathered Glacial Till)			15 8 >15			Blowcount possibly overstated on rock	
5	Terminated at 4.5 feet due to refusal. No groundwater observed. No caving observed.							
10								
15								

LEGEND

- Dynamic Cone Penetrometer Test (Equivalent SPT Blowcount shown)
- Shelby Tube Sample
- Sample not Recovered
- DATE ▼ Static Water Level at Drilling
- DATE ▽ Static Water Level
- Perched Groundwater
- 100 to 1000 g — Bag Sample
- WTPH-D Ext. 8010 — Type of Analytical Testing Performed
- NR — No Recovery
- ATD — At Time of Drilling
- XX — Grain Size Analysis (% fines shown)
- XX — 200 Wash (% fines shown)

File Name : Hand Boring Log.dwg

Start Date : 10/14/03 Completion Date : 10/14/03 Logged By : R.B.H.