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JN 23326

Gina and Tim O'Neill
8030 Southeast 20th Street
Mercer Island, Washington 98040
*via email: gina.oneill@comcast.net*

Subject: **Transmittal Letter – Geotechnical Engineering Study and Critical Area Study**
Proposed Outdoor Living Spaces and Deck Expansion
8030 Southeast 20th Street
Mercer Island, Washington

Greetings,

Attached to this transmittal letter is our combined geotechnical engineering report and Critical Area Study for your proposed new outdoor living spaces and an expansion of the existing deck area. The scope of our services consisted of exploring site surface and subsurface conditions, and then developing this report to provide recommendations for general earthwork and design considerations for foundations, retaining walls, subsurface drainage, and temporary excavations. This work was authorized by your acceptance of our proposal, dated October 1, 2024.

The attached report contains a discussion of the study and our recommendations. Please contact us if there are any questions regarding this report, or for further assistance during the design and construction phases of this project.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

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**GEOTECHNICAL ENGINEERING STUDY AND CRITICAL AREA STUDY**
**Proposed New Outdoor Living Spaces and Deck Expansion**
**8030 Southeast 20th Street**
**Mercer Island, Washington**

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed new outdoor living space improvements on the subject property in Mercer Island.

We were provided with a set of architectural site plans, prepared by Sturman Architects, dated September 24, 2024. Based on these plans, we understand that new, covered outdoor living spaces are proposed to be constructed north of the existing garage and near the northeastern corner of the residence. These areas, while covered, will be one-story in height, and will have slab elevations similar to the existing concrete pool deck. In addition, a deck expansion is proposed to extend north and west of the existing perimeter of the pool deck. This deck expansion will be elevated above the existing grade, avoiding the need for retaining walls. Cosmetic improvements to the pool and pool deck will likely also occur. Excavations for the new developments are not anticipated to be extensive.

If the scope of the project changes from what we have described above, we should be provided with revised plans in order to determine if modifications to the recommendations and conclusions of this report are warranted.

## ***SITE CONDITIONS***

### ***SURFACE***

The Vicinity Map, Plate 1, illustrates the general location of the site on the northern end of Mercer Island. The irregular-shaped property comprises a total site area of 0.71-acres. The site is bordered on all four sides by residential parcels.

The grade across the developed site slopes downward from east to west, with a total elevation change of up to 50 feet across the property bounds. A moderate to steep slope is located near the eastern property line and leads to the eastern perimeter of the development area, where there is a retaining wall or the foundation wall of the detached garage supporting the toe of the slope. The existing two-story residence is located on the southern portion of the property and contains a basement space that daylights to the west. This basement occupies a majority of the residence footprint, but appears to step upwards to a shallower crawlspace near the eastern mudroom area close to the on-grade garage. A sloped driveway enters the lot from the adjacent street to the southwest of the site and leads to a parking area south of the house and detached garage. A large, elevated pool deck and patio area is present north of the residence and detached garage, and contains an in-ground pool that is 4 to 9 feet deep. The patio and pool deck continue across most of the area north of the residence; brick walls ranging in height from a few feet to around 9.5 feet tall line the downslope edge of a patio area located near the existing residence. The concrete pool deck to the west of the swimming pool is structurally supported above the sloped ground surface on concrete “wing walls” that extend westward from the pool shell. The ground surface west of the brick walls and elevated pool deck slope gently down to a gently-sloped area containing gravel pathways and grass. West of this gently-slope bench area, the grade descends moderately to steeply downward to the west. Areas of this slope appear to be inclined over 40 percent and facilitate elevation changes of around 12 to 16 feet.

The western moderate to steeply-inclined slope is covered with grass and contained a variable height retaining wall at its toe, which is part of the neighboring western property. Our firm previously provided geotechnical services during the redevelopment of the home and garage located below this slope. While no signs of recent deep- seated instability was observed during our recent site visit, some evidence of surficial erosion was visible where some of the grass areas had been disturbed. The eastern steep slope areas are located southeast of the proposed development area, and are covered with underbrush, and large mature trees. No signs of recent instability could be observed in this slope area.

The Mercer Island GIS indicates that the site is mapped as a Potential Landslide Hazard and Erosion Hazard, and a Seismic Hazard. The Mercer Island GIS also maps portions of the western slope as Steep Slope Areas. The *Mercer Island Landslide Hazard Assessment* does not show any mapped potential landslide scarps on, and near, the site.

The adjacent parcels to the north, east, and south are all developed with single-family residences generally located well away from the proposed development areas. The eastern and southern properties contain large residences located upslope of the site and well away from the property lines. The western property contains a one-story residence, and outbuildings located at the toe of the western slope.

## *SUBSURFACE*

The subsurface conditions on the subject site were explored by drilling two test borings and excavating three test holes at the approximate locations shown on the Site Exploration Plan, Plate 2. Our exploration program was based on the proposed construction, anticipated subsurface conditions and those encountered during exploration, and the scope of work outlined in our proposal.

The borings were drilled on October 30, 2024 using a hand carried, portable drill rig and the test holes were excavated with hand tools on the same day. Samples were taken at approximate 2.5 and 5-foot intervals with a standard penetration sampler. This split-spoon sampler, which has a 2-inch outside diameter, is driven into the soil with a 140-pound hammer falling 30 inches. The number of blows required to advance the sampler a given distance is an indication of the soil density or consistency. A geotechnical engineer from our staff observed the drilling process, logged the test borings, and obtained representative samples of the soil encountered. The Test Boring and Test Hole Logs are attached as Plates 3 through 5.

### ***Soil Conditions***

Test Borings 1 and 2 were drilled near the western perimeter of the deck expansion, near the top of the western steep slope. Beneath the ground surface, 5 to 7 feet of loose fill soil was revealed in both borings. Beneath the fill, and a thin layer of wet sand, native, medium-stiff and stiff silt was revealed. This native soil continued with depth, becoming very stiff at a depth of 10 feet, and hard at depths of 15 to 17.5 feet. The test borings were terminated at depths of 18 to 18.5 feet where auger refusal was met.

The test holes were excavated near the proposed covered living spaces north of the existing garage. In general, dense native very silty sand to sandy silt was revealed in the three test holes beneath a mantle of surficial fill 2 to 3 feet in thickness. It should be noted that based on probing, this fill depth increases to the west of these test holes, adjacent to the existing residence's basement wall.

Based on the observed soil conditions, and the recorded SPT blow counts, it is apparent that the native very stiff/hard and dense soils encountered in the borings and test holes have been glacially compressed.

There were no indications of disturbed native soils or landslide deposits encountered in the borings.

***Groundwater Conditions***

Perched groundwater seepage was found during drilling of Test Boring 2 from a depth of 7 to 8.5 feet. Further rusting was observed in samples obtained near the interface of the upper weathered native soils and underlying stiffer/denser soils, indicating at least the potential presence of seasonal elevated moisture levels. The test borings were left open for only a short time period. Therefore, the seepage levels on the logs represent the location of transient water seepage and may not indicate the static groundwater level. Groundwater levels encountered during drilling can be deceptive, because seepage into the boring can be blocked or slowed by the auger itself. It should be noted that groundwater levels vary seasonally with rainfall and other factors.

The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. If a transition in soil type occurred between samples in the borings, the depth of the transition was interpreted. The relative densities and moisture descriptions indicated on the test boring logs are interpretive descriptions based on the conditions observed during drilling.

## ***CRITICAL AREA STUDY (MICC 19.07)***

**Potential Landslide Hazard Area:** The majority of the site is located within a mapped Potential Landslide Hazard area. This is noted on the attached Site Exploration Plan.

The Potential Slide Area mapping covers much of the general vicinity. The core of the subject site consists of very stiff to hard/dense, glacially compressed, native soil that has a low potential for deep-seated landslides. However, this competent soil is overlain by looser fill and medium-stiff native soils that could experience shallow slope movement, particularly during a large earthquake.

All new structures will be fully supported on or into the underlying glacially-compressed soils, protecting them in the event of any future slope movement in the looser, near-surface soils. The recommendations presented in our report are intended to provide protection to the new developments in the event of shallow slope instability, thereby mitigating the Potential Landslide Hazard risk. The western deck expansion will be independently supported from the existing pool deck and residence, and will be supported on deep foundations. The new covered living spaces will be fully supported on the underlying dense soils, either on a conventional foundation system or upon pipe piles driven to refusal through the house's basement wall backfill. These recommendations, which are discussed further in following sections, will prevent the planned development from adversely impacting the stability of the neighboring properties. No buffers are necessary to mitigate the mapped Potential Landslide Hazard.

**Seismic Hazard:** The site is mapped as a Seismic Hazard Area. The Seismic Hazard mapping appears to be related to the proximity of the site to Lake Washington.

The planned development will occur within this mapped Seismic Hazard area. The soils that will support the foundations of the planned developments and associated retaining walls are not liquefiable, due to their glacially-compressed nature. No further measures are needed to mitigate the mapped Seismic Hazard.

**Steep Slope Hazard Areas:** As noted earlier, steeply-inclined slope areas exist along the eastern and western edges of the site; these qualify as a Steep Slope Hazard Area per Mercer Island Code. The slopes are only 40 to 50 percent inclination, so they are not excessively steep, or tall. Also as noted above, no landslides are mapped on or near the site. As noted earlier, the core soil of the site is very stiff to hard silt and dense silty sand to silt, and all loads for the development will be supported on or into these competent native soils. Because of this, it is our opinion that no buffers or setbacks are needed from the Steep Slopes, provided the recommendations presented in this report are followed. Although some movement of the loose surface soil is possible on the western slopes, it is our professional opinion that, if the recommendations presented in the report are followed, any potential shallow slope movement will not impact the proposed development. Additionally, the recommendations presented in this report will prevent the planned development from adversely affecting the stability of the slopes on the site or the neighboring properties.

**Erosion Hazard Area:** The site also meets the City of Mercer Island's criteria for an Erosion Hazard Area. This has also been indicated on the attached Site Exploration Plan.

Excavation and construction of the planned developments will likely be accomplished primarily using manual methods, or small equipment. The planned development can be accomplished without adverse erosion impacts to the site and surrounding properties by exercising care and being proactive with the maintenance and potential upgrading of the erosion control system through the entire construction process. Proper erosion control implementation will be important to prevent adverse impacts to the site and neighboring properties, particularly if grading and construction occurs during the wet season. The temporary erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered during the site work. One of the most important considerations, particularly during wet weather, is to immediately cover any bare soil areas to prevent accumulated water or runoff from the work area from becoming silty in the first place. Existing groundcover, vegetation and pavements should remain undisturbed wherever possible. A wire-backed silt fence bedded in compost, not native soil, or sand, should be erected as close as possible to the perimeter planned work area, and the existing vegetation outside of the perimeter of the silt fence be in place. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Soil stockpiles should be minimized. Silty water accumulating in the excavation must not be allowed to flow off the site. Following rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface.

**Buffers and Mitigation:** The attached Site Exploration Plan (Plate 2) denotes the extents of the critical areas that cover the site. Under MICC 19.07.160(C), the code-prescriptive buffer of 25 feet is indicated from all sides of a shallow landslide-hazard area. As noted above, the majority of the site lies within a mapped Potential Landslide Hazard area, and the prescriptive buffer would extend far beyond the boundaries of the property and the planned development area.

We recognize that the planned development will occur within the designated critical areas and their applicable prescriptive buffers. The recommendations presented in this geotechnical report are intended to allow the project to be constructed in the proposed configuration without the need for a buffer from the top of the steep slope. Following the recommendations of this report, the planned development will not adversely impact the stability of the neighboring properties or result in a need for increased critical area buffers on those adjacent properties. The geotechnical recommendations associated with foundations, shoring, and erosion control will mitigate any potential hazards to geologic critical areas on the site.

**Statement of Risk:** We can provide the statement of risk required by the City of Mercer Island once we have reviewed the geotechnical aspects of the final plans that have been submitted for permit.

## CONCLUSIONS AND RECOMMENDATIONS

### *GENERAL*

*THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.*

The test borings revealed native, very stiff to hard/dense glacially compressed native soils beneath a mantle of fill and looser weathered soils ranging in thickness from as shallow as 2 to 3 feet near the new covered areas, to 10 feet near the edge of the planned western deck expansion. Based on the conditions encountered in the test borings and test holes, it is apparent that the core of the site and slope consists of this competent glacially-compressed soil. All new foundation loads for the proposed developments will need to fully bear on or into the underlying competent soils and no new foundations should bear on the existing fill or looser native soils as they are prone to post-construction settlement, as well as shallow instability. Considering the variable soil conditions between the two development areas at the site, differing foundation support scenarios exist at this project.

The new foundations for the covered outdoor living space north of the existing detached garage will generally encounter native, dense, glacially-compressed soils within a few feet of the ground surface, and a conventional foundation system could be used in this area. However, any foundations located within a 1:1 (H:V) of the basement of the existing residence will either need to bear on pipe piles, or the footings lowered to bear directly atop the dense, glacially-compressed native soils beneath this 1:1 (H:V) line in order to not surcharge the basement walls. The zone outside of the existing eastern basement wall of the house consists of loose backfill soils unsuitable to support either foundations or settlement-sensitive slabs. Considering this, the use of small-diameter pipe piles may be more practical for the outdoor spaces to be located closer to the existing house.

The planned development will not affect the existing walls located along the east side of the existing pool deck. As a result, the stability of the eastern steep slope will not be impacted by the new construction.

Due to the deeper loose soil deposits adjacent to the western steep slope, the deck addition will need to be fully supported on deep foundations. The fill and loose soils may experience future shallow instability on the steep slopes. The addition will need to be independently supported from the existing pool deck and residence in these areas, so as not to add new loads to these existing features. To vertically support the new elevated deck, we recommend that isolated pile caps supported on a cluster of 2-inch-diameter pipe piles be used. Continuous grade beams or backfilled retaining walls should not interconnect the individual deck supports. The pipe caps supporting both the east and west sides of the deck expansion should contain a minimum of three piles: one driven vertically, and two driven at a 1:5 (Horizontal: Vertical) battered down toward the west. In order to protect the foundations from potential future shallow slope movement within the fill and loose soils, the western line of pile caps should each contain an inclined helical anchor extending down toward the east. These anchors will resist any lateral soil loads acting on the pipe piles from the fill and loose soils. Each anchor should extend into the very stiff to hard silt. Additional information related to the inclined helical anchors is presented in the ***Helical Anchors*** section of this report.

The existing site features, including the western edge of the existing pool deck are likely not pile supported, and may have experienced previous settlement over time. Any existing elements that may be supported on existing fill or looser native soils adjacent to the well-supported new proposed footings may experience visible differential settlement relative to the new foundations in the future, especially if the loading in these areas change. It would be prudent to avoid spanning the new decking material between the existing and new deck areas, as they may behave differently. If needed, areas of the pool deck that may have experienced settlement could be underpinned with pipe piles during this work to help prevent this from occurring.

It is our professional opinion that onsite infiltration or dispersion of stormwater runoff from impervious areas is infeasible for this project. The silty, fine-grained nature of the upper fill and native soils gives them a low permeability, and the underlying glacially-compressed soils are impervious. Introducing additional water into the subsurface soils could increase the chance of flooding on the adjacent lower properties or adversely impact the stability of slopes on and around the site. All collected stormwater, even from paved surfaces, should be discharged to an approved stormwater system. Pervious pavements should not be used for this project.

The drainage and waterproofing recommendations presented in this report are intended only to prevent active seepage from flowing through concrete walls or slabs. Even in the absence of active seepage into and beneath structures, water vapor can migrate through walls, slabs, and floors from the surrounding soil, and can even be transmitted from slabs and foundation walls due to the concrete curing process. Water vapor also results from occupant uses, such as cooking, cleaning, and bathing. Excessive water vapor trapped within structures can result in a variety of undesirable conditions, including, but not limited to, moisture problems with flooring systems, excessively moist air within occupied areas, and the growth of molds, fungi, and other biological organisms that may be harmful to the health of the occupants. The designer or architect must consider the potential vapor sources and likely occupant uses, and provide sufficient ventilation, either passive or mechanical, to prevent a buildup of excessive water vapor within the planned structure.

Geotech Consultants, Inc. should be allowed to review the final development plans to verify that the recommendations presented in this report are adequately addressed in the design. Such a plan review would be additional work beyond the current scope of work for this study, and it may include revisions to our recommendations to accommodate site, development, and geotechnical constraints that become more evident during the review process.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

***SEISMIC CONSIDERATIONS***

In accordance with the International Building Code (IBC), the site class within 100 feet of the ground surface is best represented by Site Class Type D (Stiff Soil). As noted in the USGS website, the mapped spectral acceleration value for a 0.2 second ($S_s$) and 1.0 second period ($S_1$) equals 1.37g and 0.48g, respectively.

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The glacially-compressed soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of their dense nature.

***CONVENTIONAL FOUNDATIONS***

The footings for the new covered outdoor living area can generally be supported on conventional continuous and spread footings bearing on undisturbed, glacial compressed native soils, or on structural fill (quarry spalls or railroad ballast rock) placed above these competent soils. All fill, topsoil, and loose, weathered soil must be removed beneath the footings. Please refer to the ***General*** section of this report for additional discussions about the use of conventional foundations in this area.

We recommend that continuous and individual spread footings have minimum widths of 16 and 24 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required.

An allowable bearing pressure of 2,000 pounds per square foot (psf) is appropriate for footings supported on competent native soil. A one-third increase in this design bearing pressure may be used when considering short-term wind or seismic loads. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on competent native soil, will be about one-half-inch, with differential settlements on the order of one-half-inch in a distance of 25 feet along a continuous footing with a uniform load.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing soil, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level, well-compacted fill. We recommend using the following ultimate values for the foundation's resistance to lateral loading:

| PARAMETER | ULTIMATE VALUE |
|---|---|
| Coefficient of Friction | 0.40 |
| Passive Earth Pressure | 300 pcf |

**Where: pcf is Pounds per Cubic Foot, and Passive Earth Pressure is computed using the Equivalent Fluid Density.**

If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. The above ultimate values for passive earth pressure and coefficient of friction do not include a safety factor.

## *PIPE PILES*

Pipe piles should be used to support isolated foundations of the new deck expansion, and could be used to carry the outdoor improvements located behind the east basement wall of the house. Please refer to the ***General*** section for additional discussions and recommendations regarding the western perimeter foundation, as well as the transition area between the two foundation types.

A 2-inch-diameter pipe pile driven with a minimum 90-pound jackhammer or a 140-pound Rhino hammer to a final penetration rate of 1-inch or less for one minute of continuous driving may be assigned an allowable compressive load of 3 tons.

Extra-strong, Schedule 80 steel pipe should be used for 2-inch-diameter piles. The site soils are not highly organic and are not located near salt water. As a result, they do not have an elevated corrosion potential. Considering this, it is our opinion that standard "black" pipe can be used, and corrosion protection, such as galvanizing, is not necessary for the pipe piles.

Isolated pile caps for the outdoor improvements should include a minimum of two piles to reduce the potential for eccentric loads being applied to the piles. As recommended above in the ***General*** section, pile caps for the deck expansion should include a minimum of three piles. Of these, one should be vertical, and the other two battered down toward the west at a 1:5 (H:V) inclination. Subsequent sections of pipe can be connected with slip or threaded couplers, or they can be welded together. If slip couplers are used, they should fit snugly into the pipe sections. This may require that shims be used or that beads of welding flux be applied to the outside of the coupler.

Lateral loads due to wind or seismic forces may be resisted by passive earth pressure acting on the vertical, embedded portions of the foundation. For this condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level compacted fill. We recommend using a passive earth pressure of 250 pounds per cubic foot (pcf) for this resistance. This is an ultimate value that does not include a safety factor. If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate.

## *HELICAL ANCHORS*

Helical anchors will be needed to laterally support the western deck foundations located close to the top of the steep slope. Helical anchors could also be used to vertically support foundations where needed as well instead of pipe piles.

Helical anchors consist of single or multiple helixes that are rotated into the ground on the end of round or square metal shafts. These anchors can be used to support both compression and tension loads, but their lateral capacity is negligible due to the relatively small diameter of the metal shafts. The design capacity of single helix anchors is the allowable soil bearing capacity on the helix area. Multiple-helix anchors are typically assumed to have a design capacity equal to the sum of the allowable bearing capacity on each helix if they are separated more than three helix diameters.

The anchors needed along the western perimeter of the deck addition will need to restrain lateral pressures in the event of potential movement of the looser upper soils. The lateral pressure can be calculated by applying an active earth pressure of 40 pounds per cubic foot (pcf) over a depth of 10 feet measured from the existing grade. Based on our calculations, the helical anchor for each of the western pile caps should be installed to have an allowable capacity of 10 kips.

A 10 to 15-kip allowable capacity should be possible for an 8/10-inch helix configuration, with the anchor installed to a torque of 2,000 to 3,000 ft-pounds. The ultimate capacity of the anchor in tension or compression can be estimated roughly by multiplying the installation torque by 10. The anchors should be installed by a specialty contractor familiar with the design and installation of helical anchor systems. The contractor can assist with refining the anchor design and details and estimating capacities for different soil and anchor conditions.

## *BUILDING FLOORS*

Where conventional foundations are to be used, the building floors can be constructed as slabs-on-grade atop competent native soil, or on structural fill placed atop competent native soil. This will require that the existing fill within the building footprint be excavated to expose suitable native soil. Alternately, the floor could be constructed as a framed floor atop a crawlspace if the client desires. Where deep foundations are needed, we recommend that the floors be designed to be supported on the pile supported foundations.

Even where the exposed soils appear dry, water vapor will tend to naturally migrate upward through the soil to the newly constructed space above it. This can affect moisture-sensitive flooring, cause imperfections or damage to the slab, or simply allow excessive water vapor into the space above the slab. All interior slabs-on-grade should be underlain by a capillary break drainage layer consisting of a minimum 4-inch thickness of clean gravel or crushed rock that has a fines content (percent passing the No. 200 sieve) of less than 3 percent and a sand content (percent passing the No. 4 sieve) of no more than 10 percent. Pea gravel or crushed rock are typically used for this layer.

As noted by the American Concrete Institute (ACI) in the *Guides for Concrete Floor and Slab Structures*, proper moisture protection is desirable immediately below any on-grade slab that will be covered by tile, wood, carpet, impermeable floor coverings, or any moisture-sensitive equipment or products. ACI recommends a minimum 10-mil thickness vapor retarder for better durability and long-term performance than is provided by 6-mil plastic sheeting that has historically been used. A vapor retarder is defined as a material with a permeance of less than 0.3 perms, as determined by ASTM E 96. It is possible that concrete admixtures may meet this specification, although the manufacturers of the admixtures should be consulted. Where vapor retarders are used under slabs, their edges should overlap by at least 6 inches and be sealed with adhesive tape. The sheeting should extend to the foundation walls for maximum vapor protection.

If no potential for vapor passage through the slab is desired, a vapor *barrier* should be used. A vapor barrier, as defined by ACI, is a product with a water transmission rate of 0.01 perms when tested in accordance with ASTM E 96. Reinforced membranes having sealed overlaps can meet this requirement.

We recommend that the contractor, the project materials engineer, and the owner discuss these issues and review recent ACI literature and ASTM E-1643 for installation guidelines and guidance on the use of the protection/blotter material.

***DRAINAGE CONSIDERATIONS***

Footing drains should be used where: (1) crawl spaces or basements will be below a structure; (2) a slab is below the outside grade; or (3) the outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock that is encircled with non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor or the level of a crawl space. The discharge pipe for subsurface drains should be sloped to flow to the outlet point. Roof and surface water drains must not discharge into the foundation drain system. A typical footing drain detail is attached to this report as Plate 6. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains. Clean-outs should be provided for potential future flushing or cleaning of footing drains.

As a minimum, a vapor retarder, as defined in the ***Building Floors*** section, should be provided in any crawl space area to limit the transmission of water vapor from the underlying soils. Crawl space grades are sometimes left near the elevation of the bottom of the footings. As a result, an outlet drain is recommended for all crawl spaces to prevent an accumulation of any water that may bypass the footing drains. Providing a few inches of free draining gravel underneath the vapor retarder is also prudent to limit the potential for seepage to build up on top of the vapor retarder.

If seepage is encountered in an excavation, it should be drained from the site by directing it through drainage ditches, perforated pipe, or French drains, or by pumping it from sumps interconnected by shallow connector trenches at the bottom of the excavation.

The excavation and site should be graded so that surface water is directed off the site and away from the tops of slopes. Water should not be allowed to stand in any area where foundations, slabs, or pavements are to be constructed. Final site grading in areas adjacent to the residence should slope away at least one to 2 percent, except where the area is paved. Surface drains should be provided where necessary to prevent ponding of water behind foundation or retaining walls. A discussion of grading and drainage related to pervious surfaces near walls and structures is contained in the ***Foundation and Retaining Walls*** section.

## ***LIMITATIONS***

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test borings are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking samples in test borings. Subsurface conditions can also vary between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

The recommendations presented in this report are directed toward the protection of only the proposed development from damage due to slope movement. Predicting the future behavior of steep slopes and the potential effects of development on their stability is an inexact and imperfect science that is currently based mostly on the past behavior of slopes with similar characteristics. Landslides and soil movement can occur on steep slopes before, during, or after the development of property. The owner of any property containing or located close to steep slopes must ultimately accept the possibility that some slope movement could occur, resulting in possible loss of ground or damage to the facilities around the proposed new construction.

This report has been prepared for the exclusive use of Gina and Tim O'Neill and their representatives, for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew, and fungi in either the existing or proposed site development.

## ***ADDITIONAL SERVICES***

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document sitework we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

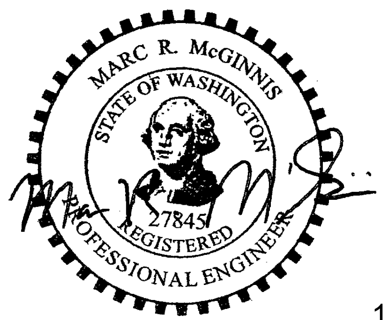
The following plates are attached to complete this report:

| | |
|---|---|
| Plate 1 | Vicinity Map |
| Plate 2 | Site Exploration Plan |
| Plates 3 - 5 | Test Boring and Test Hole Logs |
| Plate 6 | Typical Footing Drain Detail |

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

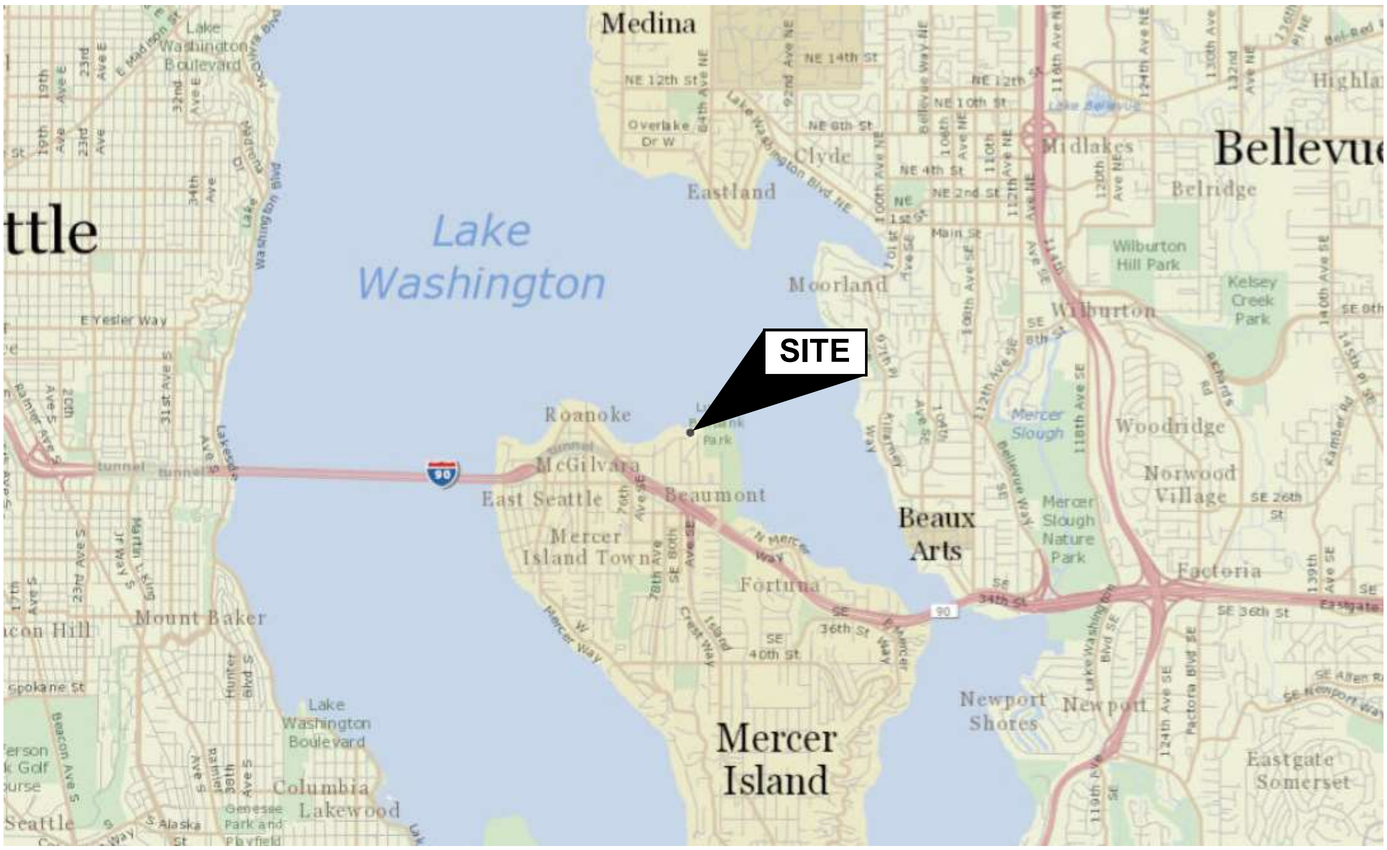



11/18/2024

Marc R. McGinnis, P.E.
Principal

MKM/MRM:kg

**NORTH**




(Source: King County iMap)

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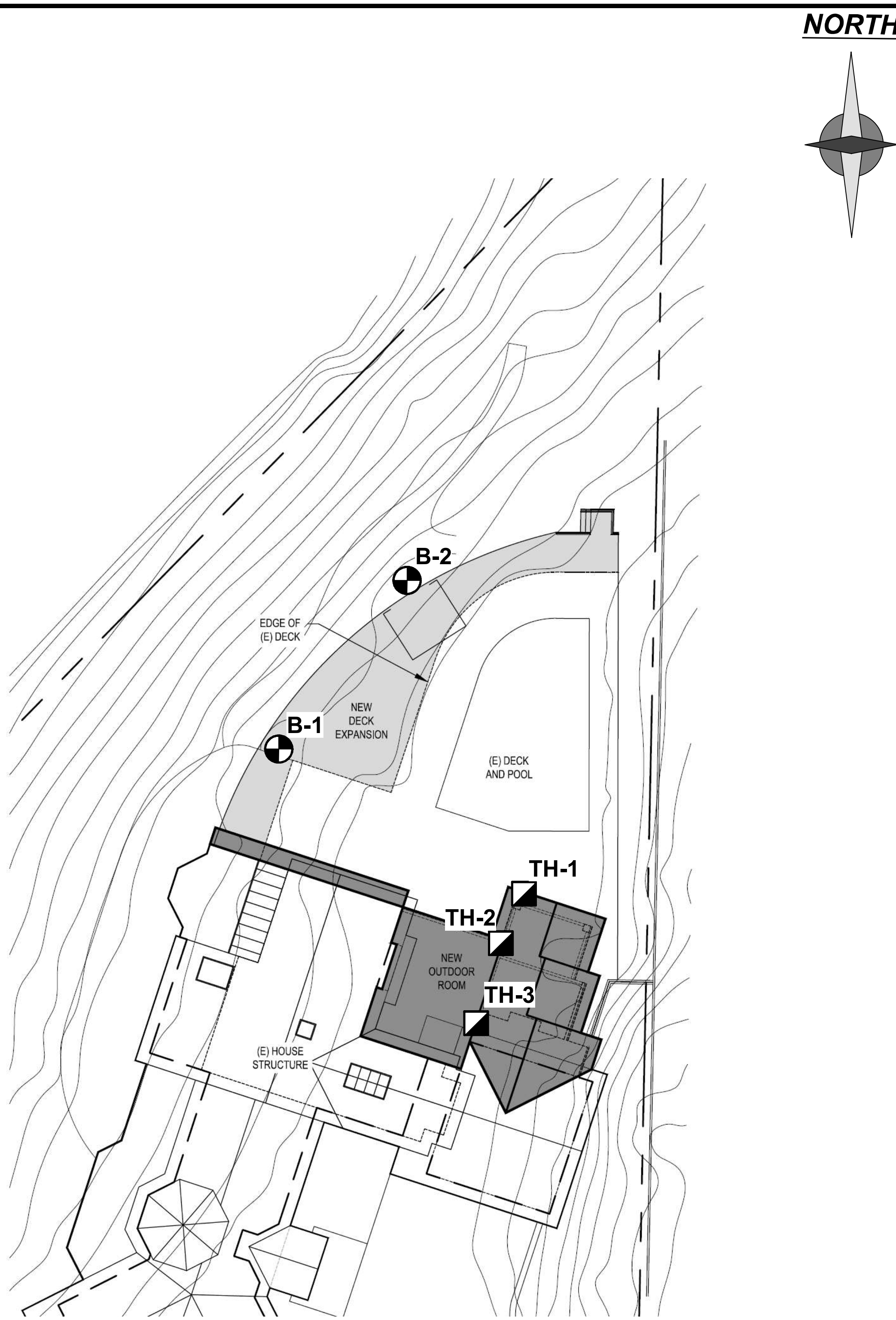
# VICINITY MAP

8030 Southeast 20th Street
Mercer Island, Washington

| Job No: | Date: | | Plate: |
|---|---|---|---|
| 23326 | Nov. 2024 | | 1 |




**Legend:**

- Test Boring Location
- Test Hole Location

* The City of Mercer Island GIS Tool maps the subject site as a Potential Landslide Hazard Area, Erosion Hazard Area and Seismic Hazard Area. The prescriptive buffers for shallow Potential Landslide Hazard Areas under MICC 19.07 extend beyond the property lines.

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# SITE EXPLORATION PLAN

8030 Southeast 20th Street
Mercer Island, Washington

| Job No: | Date: | | Plate: |
|---|---|---|---|
| 23326 | Nov. 2024 | No Scale | 2 |

# BORING 1

| Depth (ft.) | Moisture | Water Table | Blows per Foot | Sample | USCS | Description |
|---|---|---|---|---|---|---|
| | | | 13 | 1 | FILL | Dark-brown silty SAND with decayed organics, fine-grained, moist, jumbled, loose **(FILL)** |
| 5 | | | 13 | 2 | ML | Brown slightly sandy SILT, low plasticity, moist, medium-stiff |
| | | | 9 | 3 | | |
| 10 | | | 16 | 4 | | |
| | | | 25 | 5 | | -becomes very stiff |
| 15 | | | 42 | 6 | | -becomes gray, very moist, hard |
| | | | 47 | 7 | | |
| 20 | | | | | | |

*** Test boring was terminated at 18.5 feet on October 30, 2024 due to auger refusal.**
*** No groundwater was encountered during drilling.**

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# TEST BORING LOG

8030 Southeast 20th Street
Mercer Island, Washington

| Job No: | Date: | Logged by: | Plate: |
|---|---|---|---|
| 23326 | Nov. 2024 | MKM | 3 |

# BORING 2

| Depth (ft.) | Moisture | Water Table | Blows per Foot | Sample | USCS | Description |
|---|---|---|---|---|---|---|
| | | | 15 | 1 | FILL | Brown and gray silty SAND with decayed organics, fine-grained, moist, jumbled, loose **(FILL)** |
| 5 | | | 6 | 2 | | |
| | | ▽ | 15 | 3 | SP | Brown gravelly SAND, fine to medium-grained, wet, medium-dense |
| | | | | | ML | Brown mottled orange, SILT with trace organics and rootlets, low plasticity, moist, stiff |
| 10 | | | 24 | 4 | | -becomes gray-brown with rusting, trace gravel and rootlets, very stiff |
| | | | 29 | 5 | ML | |
| 15 | | | 19 | 6 | | |
| | | | 50/6" | 7 | | -becomes hard |
| 20 | | | | | | |

*** Test boring was terminated at 18 feet on October 30, 2024 due to auger refusal.**

*** Perched groundwater was encountered at 7 to 8.5 feet during drilling.**

**GEOTECH**
**CONSULTANTS, INC.**

# TEST BORING LOG

8030 Southeast 20th Street
Mercer Island, Washington

| Job No: | Date: | Logged by: | Plate: |
|---|---|---|---|
| 23326 | Nov. 2024 | MKM | 4 |

## TEST HOLE 1

| Depth (feet) | Soil Description |
|---|---|
| 0 – 3.0 | Brown and gray gravelly silty sand with organics, fine-grained, moist, loose **[FILL]** |
| 3.0 – 3.5 | Gray mottled orange, gravelly, very silty SAND to sandy SILT, fine-grained, moist, dense **[SM/ML]** |

Test Hole was terminated at a depth of 3.5 feet on October 30, 2024 due to auger refusal.
No groundwater seepage was observed.

## TEST HOLE 2

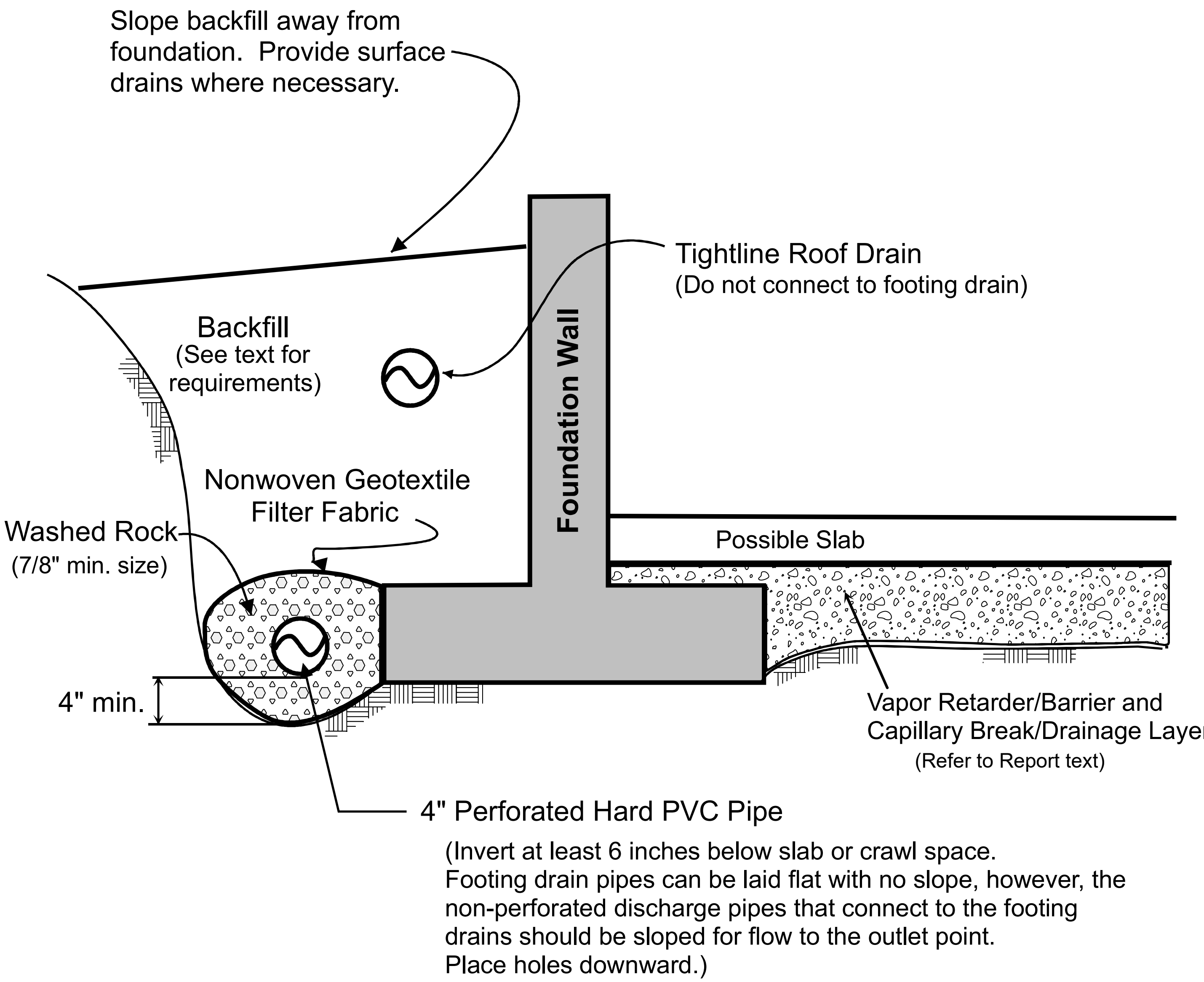
| Depth (feet) | Soil Description |
|---|---|
| 0 – 2.0 | Brown and gray gravelly silty sand with organics, fine-grained, moist, loose **[FILL]** |
| 2.0 – 2.5 | Gray mottled orange, gravelly, very silty SAND to sandy SILT, fine-grained, moist, dense **[SM/ML]** |

Test Hole was terminated at a depth of 2.5 feet on October 25, 2024 due to auger refusal.
No groundwater seepage was observed.

## TEST HOLE 3

| Depth (feet) | Soil Description |
|---|---|
| 0 – 2.0 | Brown and gray gravelly silty sand with organics, fine-grained, moist, loose **[FILL]** |
| 2.0 – 2.5 | Gray mottled orange, gravelly, very silty SAND to sandy SILT, fine-grained, moist, dense **[SM/ML]** |

Test Hole was terminated at a depth of 2.5 feet on October 25, 2024 due to auger refusal.
No groundwater seepage was observed.




**NOTES:**

(1) In crawl spaces, provide an outlet drain to prevent buildup of water that bypasses the perimeter footing drains.

(2) Refer to report text for additional drainage, waterproofing, and slab considerations.

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# FOOTING DRAIN DETAIL

8030 Southeast 20th Street
Mercer Island, Washington

| Job No: | Date: | | Plate: |
|---|---|---|---|
| 23326 | Nov. 2024 | | 6 |