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Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed New Residence
4304 East Mercer Way
Mercer Island, Washington

Greetings.

Attached to this transmittal letter is our geotechnical engineering report for your proposed new residence to be constructed in Mercer Island. 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, slope stability, and temporary excavations and shoring. This work was authorized by your acceptance of our proposal, P-10545 dated October 1, 2020.

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.

Marc R. McGinnis, P.E.
Principal

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GEOTECHNICAL ENGINEERING STUDY
Proposed New Residence
4304 East Mercer Way
Mercer Island, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed new residence to be located in Mercer Island.

Development of the property is in the planning stage, and detailed plans were not available at the time of this study. We were provided with a preliminary site plan, prepared by McClellan Architects, dated December 1, 2020 and a topographic survey prepared by Terrane, dated November 4, 2020. Based on the preliminary plan, we understand that the existing house will be demolished. The site will then be developed with a new, one-story residence underlain by a daylight basement. The new house will be located on the approximate same location as the existing one. The new residence will shift northward several feet and will be skewed slightly from the existing footprint. A new deck will extend off the eastern perimeter of the main floor of the residence. A new driveway extending in from the northern property extent will provide access to the residence. A new retaining wall may be needed along the western side of the driveway near the residence's northern perimeter. Guest parking will be located in the area of the existing western driveway. The new residence will be set greater than 10 feet from the northern, eastern, and western property lines, and will be set as close as approximately 10 feet from the southern property line. Finish floor elevations have not yet been determined yet, but we anticipate that the new basement slab will be close to the finish floor elevation of the existing basement. Based on the preliminary layout, portions of the residence will be located as close as 10 feet from the eastern slope, with the deck extending out to the slope.

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 eastern side of Mercer Island. The irregularly-shaped site is bounded to the north, east, and west by a private access road (Sandy Cove Road), and to the south by a sewer main easement and another single-family property. Much of the site perimeter follows the curvature of the private road alignment.

The site is currently developed with an older, one-story residence underlain by an east-facing daylight basement. An attached, one-car garage is situated on the southern corner of the residence and appears to not contain basement space beneath it and an elevated deck extends off the east edge of the main floor, with a patio located beneath the deck. Based on observations made while onsite, it appears that this deck has settled since it was originally constructed. The property can be accessed via two driveways: one extending into the site from the western roadway, and the second consisting of a small parking area on the northern corner of the property. The remainder of the site is undeveloped, and is covered with grass, underbrush, and scattered landscaping and mature trees.

The grade across the site and surrounding vicinity generally slopes moderately downward from west to east, with a total elevation change of 40 feet across the site bounds. This grade initially drops moderately from the western property line down to the driveway before flattening out to the western perimeter of the one-story residence. The ground surface drops moderately across the residence footprint, facilitating the elevation change between the main and lower floors. This manifests as a sloped area on the southern perimeter of the residence, and a 6- to 8-foot tall rockery extending off the northwestern corner of the residence. The grade carries out gently across the northern portion of the site before sloping moderately down to the private drive that lines the eastern property boundary. This slope becomes steeper and taller near the northeastern corner of the existing house, where the slope is inclined 48 to 59 percent over an elevation change of 14 to 18 feet before flattening out across the private drive located east of the site. The toe of this slope appears to have been oversteepened during previous construction of the lower, eastern road alignment. We saw no indications of recent instability on the steep slope east of the house, which is overgrown with brush and contains several mature trees.

The adjacent property to the south contains a two-story single-family residence located at a higher elevation than the site. This residence is underlain by at least a partial basement and is located greater than 10 feet from the property line. As discussed above, there is a sanitary sewer between the on-site residence and the neighboring house to the south. Residential properties are also located upslope to the west and north of the site, and downslope to the east of the site across the access road.

Research conducted on the City of Mercer Island GIS indicate that the site is mapped within a Potential Slide Area, Seismic Hazard Area, and Erosion Hazard Area. A portion of the eastern slope near the southern property line is mapped as a Steep Slope Area. This is due to the slope being steeper than 40 percent inclination. The *Mercer Island Landslide Hazard Assessment Map (*Troost and Wisher, 2009) indicates that an area of rapid stream incision exists near the approximate site location. This is correct, as a storm structure was observed to be located northwest of the site, west of a small parking area on the private drive. Water was flowing through this location during our time onsite, and likely acts as a collection point for upslope discharge. This may have been a natural feature prior to placement of the man-made features. While no landslides are mapped in the direct vicinity, shallow landslides are a relatively common occurrence on Mercer Island, particularly along the upslope and downslope sides of East Mercer Way, where either cuts were made or loose fill soil was pushed out to create the original road bed. These failures most commonly occur in the upper few feet of this loosely placed fill, typically following extended periods of rainfall. Some shallow and deeper landslides have also been recorded along the upslope side of East Detailed landslide records are difficult to obtain in this area of King County, and we were not able to find any direct documentation regarding recent landslides in the vicinity of the site. In our 34+ years of experience on Mercer Island, we are not aware of any deep-seated landslides in this area of Mercer Island.

SUBSURFACE

The subsurface conditions were explored by drilling four borings 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 November 12, 2020 using a track-mounted, hollow-stem auger drill. 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 Logs are attached as Plates 3 through 6.

Soil Conditions

The test borings were conducted surrounding the existing residence where access and utility conflicts allowed. A 4-foot-thick layer of fill was encountered beneath the ground surface in Boring 3. Beneath the ground surface in the remaining borings, and beneath the fill layer in Boring 3, native very silty sand to sandy silt was encountered. The native soil was initially medium-dense, becoming dense beneath a depth of 5 to 13 feet beneath the ground surface. Dense sand and slightly silty sand were encountered beneath depths of 13 feet in the test borings and became very dense beneath depths of 20 feet. This dense to very dense soil has been glacially compressed, and continued to the base of the borings at a depth of 21.5 to 26.5 feet.

No obstructions were revealed by our explorations. However, debris, buried utilities, and old foundation and slab elements are commonly encountered on sites that have had previous development.

Although our explorations did not encounter cobbles or boulders, they are often found in soils that have been deposited by glaciers or fast-moving water.

Groundwater Conditions

No groundwater seepage was observed during drilling. Mottling was observed in several of the samples, indicating the potential that seasonal perched groundwater seams may develop during the height of the wet season. However, considering our observations in the borings, we do not anticipate that large amounts of near-surface groundwater are present through the wet season.

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)

Seismic Hazard and Potential Landslide Hazard Areas: The entire subject site is located within a mapped Seismic Hazard Area and a Potential Landslide Hazard area. This is noted on the attached Site Exploration Plan.

Both geologic hazard areas cover much of the general vicinity to the north and south as well. The core of the subject site consists of dense and very dense, glacially compressed, native soil that has a low potential for deep-seated landslides. However, this competent soil is overlain by looser soils that could experience slope movement, particularly during a large earthquake. The recommendations presented in our report are intended to stabilize the development area in the event of foreseeable slope movement, thereby mitigating the Potential Landslide Hazard risk.

The foundations for the new construction will be supported on dense and very dense, non-liquefiable soils, which will mitigate the Seismic Hazard.

Steep Slope Hazard Areas: Based on the provided topographic map of the subject site, and our site observations, the slope east of the proposed house is over 10 feet in height and exceeds an inclination of 40 percent. This slope would meet the definition of a steep slope under the MICC. From our observations, and the findings of our explorations, this slope was likely oversteepened during grading for the private drive servicing the downslope eastern residences. The approximate top and toe of the steep slope is indicated on the attached Site Exploration Plan. The minimum prescriptive buffer equal to the height of the slope, as required by MICC 19.07.160.C.2, is also indicated on the Site Exploration Plan.

It is our opinion that no buffers or setbacks are needed from this Steep Slope, provided the recommendations presented in this report are followed. The new residence will not encroach any further to the top of this slope than the existing footprint. The recommendations presented in the report are intended to allow the alteration of the prescriptive buffer, while: 1)preventing adverse impacts to the stability of the steep slope both on and off the site, and 2) protecting the planned development from foreseeable future shallow soil movement on the steep slope.

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 residence 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. Silty water cannot be discharged off the site, so a temporary holding tank should be planned for wet weather earthwork. A wire-backed silt fence bedded in compost, not native soil, or sand, should be erected as close as possible to the planned work area, and the existing vegetation west of the silt fence be in place. Rocked construction access and staging areas should be established wherever trucks will have to drive off of pavement, in order reduce the amount of soil or mud carried off the property by trucks and equipment. Covering the base of the excavation with a layer of clean gravel or rock is also prudent to reduce the amount of mud and silty water generated. 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 onto the slope or off the site. In wet conditions, this can require the use of temporary holding tanks (aka Baker tanks). 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, a code-prescriptive buffer of 25 feet is required from all sides of a Shallow Landslide Hazard area. However, as noted above, the entire site lies within a mapped Potential Landslide Hazard Area, and the prescriptive buffer for a Potential

Landslide Hazard would extend far beyond the boundaries of the property and the planned development area.

No buffer is required by the MICC for an Erosion Hazard Area.

We recognize that the planned alteration 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 adverse impacts to critical areas on the site or the neighboring 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: In order to satisfy the City of Mercer Island's requirements, a statement of risk is needed. As such, we make the following statement:

> *Provided the recommendations in this report are followed, it is our professional opinion that the recommendations presented in this report for the planned alteration will render the development as safe as if it were not located in a geologically hazardous area, and will not adversely impact critical areas on adjacent properties.*

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 conducted for this study encountered loose and medium-dense fill and native soils to depths of 7.5 to 13 feet beneath the site, with the depth to dense soils increasing to the east. The underlying dense soils will provide suitable foundation support for the proposed residence, and the western perimeter foundation of the new residence could be supported on conventional foundations that bear on these competent soils. However, these bearing soils drop to the east, and it will be impossible to extend excavations downward to reveal the competent soils along the eastern side of the proposed residence. Therefore, we recommend that the eastern approximately one-half of the house be designed to be supported on deep foundations that are embedded into the underlying very dense soils. The piles for the easternmost perimeter foundation should be spaced at no more than 5 feet on-center. At the time of demolition, additional explorations could be conducted to see if some of the pipe piles within the house footprint could be eliminated. Additional recommendations can be found in the ***Conventional Foundations*** and ***Pipe Piles*** sections of this report.

The eastern deck should also be supported on pipe piles, and the pile caps should be tied back to the main house foundation with grade beams.

As previously discussed, the subject site is located within a Potential Landslide Hazard area that encompasses much of the general vicinity. The core of the subject site consists of dense and very dense native silty sand, silt, and slightly silty sand that have a low potential for deep-seated landslides. However, shallow slides within the near-surface fill and weathered native soil can, and have, occurred in this area. The hazard to the residence associated with a potential failure of the onsite steep slope will be mitigated by the utilization of relatively closely-spaced deep foundations for the eastern perimeter foundation, as the looser soil deposits found in our test borings are relatively shallow. The use of deep foundations near the steep slope will transfer the structural loads of the eastern perimeter of the residence through the upper, looser soils to the underlying dense and very dense soils that comprise the core of the site, and are not susceptible to instability. The piles will also give the residence protection in the event of a future, shallow landslide occurring on the eastern slope. Removal of any of the existing fill located in the eastern portion of the site atop the steep slope would also reduce the potential for future instability. No fill should be placed above the existing grade in within 15 feet of the steep slope, unless it is retained by a pile-supported retaining wall.

As discussed above in the ***Critical Area Study*** section, the recommendations presented in this report are intended to prevent adverse impacts to the stability of the slope onsite, protect the planned development from damage in the event of future instability, and prevent the development from adversely affecting the stability of surrounding properties. It should be noted that the proposed development wall will not increase the stability of the slope west of the development area outside of transferring the weight of the new residence down to a competent soil strata.

As previously discussed, the new residence will contain an east-facing daylight basement. We anticipate that excavations of approximately 10 feet will be needed to reach the basement level in areas. Based on the soils encountered in our test borings, a temporary excavation inclination of no steeper than a 1:1 (Horizontal:Vertical) is appropriate for the site soils. Vertical excavations should not be made. Unshored excavations should not extend beneath a 2:1 (H:V) from any neighboring foundations, utilities such as the sewer main to the south of the site, or developed rights-of-way. Based on the preliminary plan, we anticipate that shoring may be needed along the southern side of the basement excavation and may be needed along portions of the western excavation, depending on final excavation configurations and depths. We have provided temporary shoring recommendations later in this report if needed. Driven soldier piles can cause excessive ground vibrations during installation and should not be utilized for this project.

The near-surface excavated soil will generally be unusable as fill for the project and should be hauled off the site. As discussed above, no soil generated from the project excavation or new structural fill should be placed on, or near the steep slope, as the surcharge from the additional soils could reduce the stability of the slope. No water should be directed towards the steep slope along the eastern side of the development. Poorly managed stormwater runoff is a common cause of slope instability that is well documented in the Puget Sound area.

Due to the silty, fine-grained nature of the upper fill and native soils onsite, the steep inclination of the slope to the east of the proposed residence, and the Potential Landslide Hazard designation, it is our professional opinion that onsite infiltration or dispersion of stormwater is not feasible for this project. All collected stormwater, even from paved surfaces, should be discharged to an approved stormwater system. We also recommend against the use of pervious pavements upslope of the planned basement area.

While the site is mapped as an Erosion Hazard Area, the potential for adverse erosion problems can be mitigated by properly implemented erosion control measures. Recommendations for appropriate temporary erosion control measures are discussed above.

The drainage and/or 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 build up of excessive water vapor within the planned structure.

As with any project that involves demolition of existing site buildings and/or extensive excavation and shoring, there is a potential risk of movement on surrounding properties. This can potentially translate into noticeable damage of surrounding on-grade elements, such as foundations and slabs. However, the demolition, shoring, and/or excavation work could just translate into *perceived* damage on adjacent properties. Unfortunately, it is becoming more and more common for adjacent property owners to make unsubstantiated damage claims on new projects that occur close to their developed lots. Therefore, we recommend making an extensive photographic and visual survey of the project vicinity, prior to demolition activities, installing shoring, and/or commencing with the excavation. This documents the condition of buildings, pavements, and utilities in the immediate vicinity of the site in order to avoid, and protect the owner from, unsubstantiated damage claims by surrounding property owners. Additionally, any adjacent structures should be monitored during demolition and construction to detect soil movements. To monitor their performance, we recommend establishing a series of survey reference points to measure any horizontal deflections of the shoring system. Control points should be established at a distance well away from the walls and slopes, and deflections from the reference points should be measured throughout construction by survey methods.

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.

DISCUSSION OF SLOPE STABILITY

To evaluate the potential for a future failure of the sloping ground to the east of the proposed development area, we completed slope stability analyses using the Slope/W computer program. Using the Morgenstern-Price analysis method, we analyzed the eastern slope under static and seismic conditions (1-in-500-year earthquake). In completing our analysis, we have assumed that the eastern foundations will bear on pipe piles embedded into the very dense core of the site.

Using the above-mentioned method, static and seismic safety factors in excess of Mercer Island code minimums were found for a slope failure east of the proposed house. Based on the analyses performed and the recommendations in this report, the proposed new residence will not adversely affect the stability of the adjacent slope during and after construction. Additionally, the residence will be protected from the potential shallow soil movement.

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 1.41g and 0.54g, 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 MCE peak ground acceleration adjusted for site class effects (F_{PGA}) equals 0.58g. The dense to very dense soils that will support the foundations are not susceptible to seismic liquefaction under the ground motions of the MCE.

PIPE PILES

The eastern approximate half of the residence should be supported on deep foundations consisting of small diameter pipe piles driven to refusal in the underlying dense soils. As discussed above, we recommend that the piles not be spaced further than 5 feet on-center along the eastern perimeter footing. Four-, or 6-inch-diameter pipe piles driven with 1,100-, 2,000-pound, or 3,000-pound hydraulic jackhammer to the following final penetration rates may be assigned the following compressive capacities.

INSIDE PILE DIAMETER	FINAL DRIVING RATE (1,100-pound hammer)	FINAL DRIVING RATE (2,000-pound hammer)	FINAL DRIVING RATE (3,000-pound hammer)	ALLOWABLE COMPRESSIVE CAPACITY
4 inches	10 sec/inch	4 sec/inch	n/a	10 tons
6 inches	20 sec/inch	10 sec/inch	6 sec/inch	15 tons

> **Note:** The refusal criteria indicated in the above table are valid only for pipe piles that are installed using a hydraulic impact hammer carried on leads that allow the hammer to sit on the top of the pile during driving. If the piles are installed by alternative methods, such as a vibratory hammer or a hammer that is hard-mounted to the installation machine, numerous load tests to 200 percent of the design capacity would be necessary to substantiate the allowable pile load. The appropriate number of load tests would need to be determined at the time the contractor and installation method are chosen.

As a minimum, Schedule 40 pipe should be used. 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.

Pile caps and grade beams should be used to transmit loads to the piles. Isolated pile caps should include a minimum of two piles to reduce the potential for eccentric loads being applied to the piles. 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 an ultimate (no safety factor included) passive earth pressure of 300 pounds per cubic foot (pcf) for this resistance. If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate.

CONVENTIONAL FOUNDATIONS

The approximate western half of the residence can be supported on conventional continuous and spread footings bearing on undisturbed, dense, native soil, or on structural fill placed above this competent native soil. See the section entitled ***General Earthwork and Structural Fill*** for recommendations regarding the placement and compaction of structural fill beneath structures. Prior to placing structural fill beneath foundations, the excavation should be observed by the geotechnical engineer to document that adequate bearing soils have been exposed.

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. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

An allowable bearing pressure of 2,500 pounds per square foot (psf) is appropriate for footings supported on competent, dense 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 30 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.

FOUNDATION AND RETAINING WALLS

Retaining walls backfilled on only one side should be designed to resist the lateral earth pressures imposed by the soil they retain. The following recommended parameters are for walls that restrain level backfill:

PARAMETER	VALUE
Active Earth Pressure *	35 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.40
Soil Unit Weight	130 pcf

Where: pcf is Pounds per Cubic Foot, and Active and Passive Earth Pressures are computed using the Equivalent Fluid Pressures.

*** For a restrained wall that cannot deflect at least 0.002 times its height, a uniform lateral pressure equal to 10 psf times the height of the wall should be added to the above active equivalent fluid pressure. This applies only to walls with level backfill.**

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate design earth pressures. The surcharge due to traffic loads behind a wall can typically be accounted for by adding a uniform pressure equal to 2 feet multiplied by the above active fluid density. Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment.

The values given above are to be used to design only permanent foundation and retaining walls that are to be backfilled, such as conventional walls constructed of reinforced concrete or masonry. It is not appropriate to use the above earth pressures and soil unit weight to back-calculate soil strength parameters for design of other types of retaining walls, such as soldier pile, reinforced earth, modular or soil nail walls. We can assist with design of these types of walls, if desired.

The passive pressure given is appropriate only for a shear key poured directly against undisturbed native soil, or for the depth of level, well-compacted fill placed in front of a retaining or foundation wall. The values for friction and passive resistance are ultimate values and do not include a safety factor. Restrained wall soil parameters should be utilized the wall and reinforcing design for a distance of 1.5 times the wall height from corners or bends in the walls, or from other points of restraint. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

Wall Pressures Due to Seismic Forces

The surcharge wall loads that could be imposed by the design earthquake can be modeled by adding a uniform lateral pressure to the above-recommended active pressure. The recommended surcharge pressure is 8**H** pounds per square foot (psf), where **H** is the design retention height of the wall. Using this increased pressure, the safety factor against sliding and overturning can be reduced to 1.2 for the seismic analysis.

Retaining Wall Backfill and Waterproofing

Backfill placed behind retaining or foundation walls should be coarse, free-draining structural fill containing no organics. This backfill should contain no more than 5 percent silt or clay particles and have no gravel greater than 4 inches in diameter. The percentage of particles passing the No. 4 sieve should be between 25 and 70 percent. A minimum 12-inch width of free-draining gravel or drainage composite similar to Miradrain 6000 should be placed against the backfilled retaining walls. The gravel or drainage composites should be hydraulically connected to the foundation drain system. Free draining backfill should be used for the entire width of the backfill where seepage is encountered. The later section entitled ***Drainage Considerations*** should also be reviewed for recommendations related to subsurface drainage behind foundation and retaining walls.

The purpose of these backfill requirements is to ensure that the design criteria for a retaining wall are not exceeded because of a build-up of hydrostatic pressure behind the wall. Also, subsurface drainage systems are not intended to handle large volumes of water from surface runoff. The top 12 to 18 inches of the backfill should consist of a compacted, relatively impermeable soil or topsoil, or the surface should be paved. The ground surface must also slope away from backfilled walls at one to 2 percent to reduce the potential for surface water to percolate into the backfill.

Water percolating through pervious surfaces (pavers, gravel, permeable pavement, etc.) must also be prevented from flowing toward walls or into the backfill zone. Foundation drainage and waterproofing systems are not intended to handle large volumes of infiltrated water. The compacted subgrade below pervious surfaces and any associated drainage layer should therefore be sloped away. Alternatively, a membrane and subsurface collection system could be provided below a pervious surface.

It is critical that the wall backfill be placed in lifts and be properly compacted, in order for the above-recommended design earth pressures to be appropriate. The recommended wall design criteria assume that the backfill will be well-compacted in lifts no thicker than 12 inches. The compaction of backfill near the walls should be accomplished with hand-operated equipment to prevent the walls from being overloaded by the higher soil forces that occur during compaction. The section entitled ***General Earthwork and Structural Fill*** contains additional recommendations regarding the placement and compaction of structural fill behind retaining and foundation walls.

The above recommendations are not intended to waterproof below-grade walls, or to prevent the formation of mold, mildew, or fungi in interior spaces. Over time, the performance of subsurface drainage systems can degrade, subsurface groundwater flow patterns can change, and utilities can break or develop leaks. Therefore, waterproofing should be provided where future seepage through the walls is not acceptable. This typically includes limiting cold-joints and wall penetrations and using bentonite panels or membranes on the outside of the walls. There are a variety of different waterproofing materials and systems, which should be installed by an experienced contractor familiar with the anticipated construction and subsurface conditions. Applying a thin coat of asphalt emulsion to the outside face of a wall is not considered waterproofing and will only help to reduce moisture generated from water vapor or capillary action from seeping through the concrete. As with any project, adequate ventilation of basement and crawl space areas is important to prevent a buildup of water vapor that is commonly transmitted through concrete walls from the surrounding soil, even when seepage is not present. This is appropriate even when waterproofing is applied to the outside of foundation and retaining walls. We recommend that you contact an experienced envelope consultant if detailed recommendations or specifications related to waterproofing design or minimizing the potential for infestations of mold and mildew are desired.

FLOOR SLABS

The basement slab in the eastern half of the basement should be structurally supported on the piles, due to the potential for settlement of the loose soils. For the remaining slab-on-grade areas the subgrade soil must be in a firm, non-yielding condition at the time of slab construction or underslab fill placement. Any soft areas encountered should be excavated and replaced with select, imported structural fill.

Even where the exposed soils appear dry, water vapor will tend to naturally migrate upward through the soil to the new 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.

EXCAVATIONS AND SLOPES

Temporary excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Also, temporary cuts should be planned to provide a minimum 2 to 3 feet of space for construction of foundations, walls, and drainage. Temporary cuts to a maximum overall depth of about 4 feet may be attempted vertically in unsaturated soil, if there are no indications of slope instability. However, vertical cuts should not be made near property boundaries, or existing utilities and structures. We do not recommend that vertical cuts be made at the base of sloped cuts. Based upon Washington Administrative Code (WAC) 296, Part N, the soil at the subject site would generally be classified as Type B. Therefore, temporary cut slopes greater than 4 feet in height should not be excavated at an inclination steeper than 1:1 (Horizontal:Vertical), extending continuously between the top and the bottom of a cut. Temporary cut slopes should not extend within 3 feet of the edge of travelled pavements or of settlement-sensitive utilities. Temporary cuts should not extend below a 2:1 (H:V) zone from existing foundations. It appears likely that shoring will be needed along the south and southwestern portions of the excavation, in order to protect the adjacent property and the sewer main to the south.

The above-recommended temporary slope inclination is based on the conditions exposed in our explorations, and on what has been successful at other sites with similar soil conditions. It is possible that variations in soil and groundwater conditions will require modifications to the inclination at which temporary slopes can stand. Temporary cuts are those that will remain unsupported for a relatively short duration to allow for the construction of foundations, retaining walls, or utilities. Temporary cut slopes should be protected with plastic sheeting during wet weather. It is also important that surface runoff be directed away from the top of temporary slope cuts. Cut slopes should also be backfilled or retained as soon as possible to reduce the potential for instability. Please note that loose soil can cave suddenly and without warning. Excavation, foundation, and utility contractors should be made especially aware of this potential danger. These recommendations may need to be modified if the area near the potential cuts has been disturbed in the past by utility installation, or if settlement-sensitive utilities are located nearby.

All permanent cuts into native soil should be inclined no steeper than 2.5:1 (H:V). Water should not be allowed to flow uncontrolled over the top of any temporary or permanent slope. All permanently exposed slopes should be seeded with an appropriate species of vegetation to reduce erosion and improve the stability of the surficial layer of soil.

Any disturbance to the existing slope outside of the building limits may reduce the stability of the slope. Damage to the existing vegetation and ground should be minimized, and any disturbed areas should be revegetated as soon as possible. Soil from the excavation should not be placed on the slope, and this may require the off-site disposal of any surplus soil.

TEMPORARY SHORING

Cantilevered soldier pile systems have proven to be an efficient and economical method for providing excavation shoring. Soldier pile walls would be constructed after making planned cut slopes, and prior to commencing the mass excavation, by setting steel H-beams in a drilled hole and grouting the space between the beam and the soil with concrete for the entire height of the drilled hole. The contractor should be prepared to case the holes or use the slurry method if caving soil is encountered. Excessive ground loss in the drilled holes must be avoided to reduce the potential for settlement on adjacent properties. If water is present in a hole at the time the soldier pile is poured, concrete must be tremied to the bottom of the hole.

As excavation proceeds downward, the space between the piles should be lagged with timber, and any voids behind the timbers should be filled with pea gravel, or a slurry comprised of sand and fly ash. Treated lagging is usually required for permanent walls, while untreated lagging can often be utilized for temporary shoring walls. Temporary vertical cuts will be necessary between the soldier piles for the lagging placement. The prompt and careful installation of lagging is important, particularly in loose or caving soil, to maintain the integrity of the excavation and provide safer working conditions. Additionally, care must be taken by the excavator to remove no more soil between the soldier piles than is necessary to install the lagging. Caving or overexcavation during lagging placement could result in loss of ground on neighboring properties. Timber lagging should be designed for an applied lateral pressure of 30 percent of the design wall pressure if the pile spacing is less than three pile diameters. For larger pile spacings, the lagging should be designed for 50 percent of the design load.

Soldier Pile Wall Design

Temporary soldier pile shoring that is cantilevered, and that has a level backslope, should be designed for an active soil pressure equal to that pressure exerted by an equivalent fluid with a unit weight of 35 pounds per cubic foot (pcf). Traffic surcharges can typically be accounted for by increasing the effective height of the shoring wall by 2 feet. Slopes above the shoring walls will exert additional surcharge pressures. These surcharge pressures will vary, depending on the configuration of the cut slope and shoring wall. We can provide recommendations regarding slope surcharge pressures when the preliminary shoring design is completed.

It is important that the shoring design provides sufficient working room to drill and install the soldier piles, without needing to make unsafe, excessively steep temporary cuts. Cut slopes should be planned to intersect the backside of the drilled holes, not the back of the lagging.

Lateral movement of the soldier piles below the excavation level will be resisted by an ultimate passive soil pressure equal to that pressure exerted by a fluid with a density of 400 pcf. For permanent walls, we recommend a minimum factor of safety of 1.5 be applied to overturning and sliding calculations when using this ultimate value (temporary installations may use a factor of safety of 1.2). This soil pressure is valid only for a level excavation in front of the soldier pile; it acts on two times the grouted pile diameter. Cut slopes made in front of shoring walls significantly decrease the passive resistance. This includes temporary cuts necessary to install internal braces or rakers. The minimum embedment below the floor of the excavation for cantilever soldier piles should be equal to the height of the "stick-up."

EXCAVATION AND SHORING MONITORING

As with any shoring system, there is a potential risk of greater-than-anticipated movement of the shoring and the ground outside of the excavation. This can translate into noticeable damage of surrounding on-grade elements, such as foundations and slabs. Therefore, we recommend making an extensive photographic and visual survey of the project vicinity, prior to demolition activities, installing shoring or commencing excavation. This documents the condition of buildings, pavements, and utilities in the immediate vicinity of the site in order to avoid, and protect the owner from, unsubstantiated damage claims by surrounding property owners.

Additionally, the shoring walls and any adjacent structures should be monitored during construction to detect soil movements. To monitor their performance, we recommend establishing a series of survey reference points to measure any horizontal deflections of the shoring system. Control points should be established at a distance well away from the walls and slopes, and deflections from the reference points should be measured throughout construction by survey methods. At least every other soldier pile should be monitored by taking readings at the top of the pile. Additionally, benchmarks installed on the surrounding buildings should be monitored for at least vertical movement. We suggest taking the readings at least once a week, until it is established that no deflections are occurring. The initial readings for this monitoring should be taken before starting any demolition or excavation on the site.

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 for 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 7. 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.

Underslab drainage should also be provided where (1) a crawl space or slab will slope or be lower than the surrounding ground surface, (2) an excavation encounters significant seepage, or (3) an excavation for a building will be close to the expected high groundwater elevations. We can provide recommendations for interior drains, should they become necessary, during excavation and foundation construction.

As a minimum, a vapor retarder, as defined in the ***Slabs-On-Grade*** 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.

No groundwater was observed during our field work. 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.

GENERAL EARTHWORK AND STRUCTURAL FILL

All building and pavement areas should be stripped of surface vegetation, topsoil, organic soil, and other deleterious material. It is important that existing foundations be removed before site development. The stripped or removed materials should not be mixed with any materials to be used as structural fill, but they could be used in non-structural areas, such as landscape beds.

Structural fill is defined as any fill, including utility backfill, placed under, or close to, a building, or in other areas where the underlying soil needs to support loads. All structural fill should be placed in horizontal lifts with a moisture content at, or near, the optimum moisture content. The optimum moisture content is that moisture content that results in the greatest compacted dry density. The moisture content of fill is very important and must be closely controlled during the filling and compaction process.

The allowable thickness of the fill lift will depend on the material type selected, the compaction equipment used, and the number of passes made to compact the lift. The loose lift thickness should not exceed 12 inches, but should be thinner if small, hand-operated compactors are used. We recommend testing structural fill as it is placed. If the fill is not sufficiently compacted, it should be recompacted before another lift is placed. This eliminates the need to remove the fill to achieve the required compaction. The following table presents recommended levels of relative compaction for compacted fill:

LOCATION OF FILL PLACEMENT	MINIMUM RELATIVE COMPACTION
Beneath slabs or walkways	95%
Filled slopes and behind retaining walls	90%
Beneath pavements	95% for upper 12 inches of subgrade; 90% below that level

Where: Minimum Relative Compaction is the ratio, expressed in percentages, of the compacted dry density to the maximum dry density, as determined in accordance with ASTM Test Designation D 1557-91 (Modified Proctor).

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 residence 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 residence.

This report has been prepared for the exclusive use of the Vogel Family 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 site work 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 - 6	Test Boring Logs
Plate 7	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,

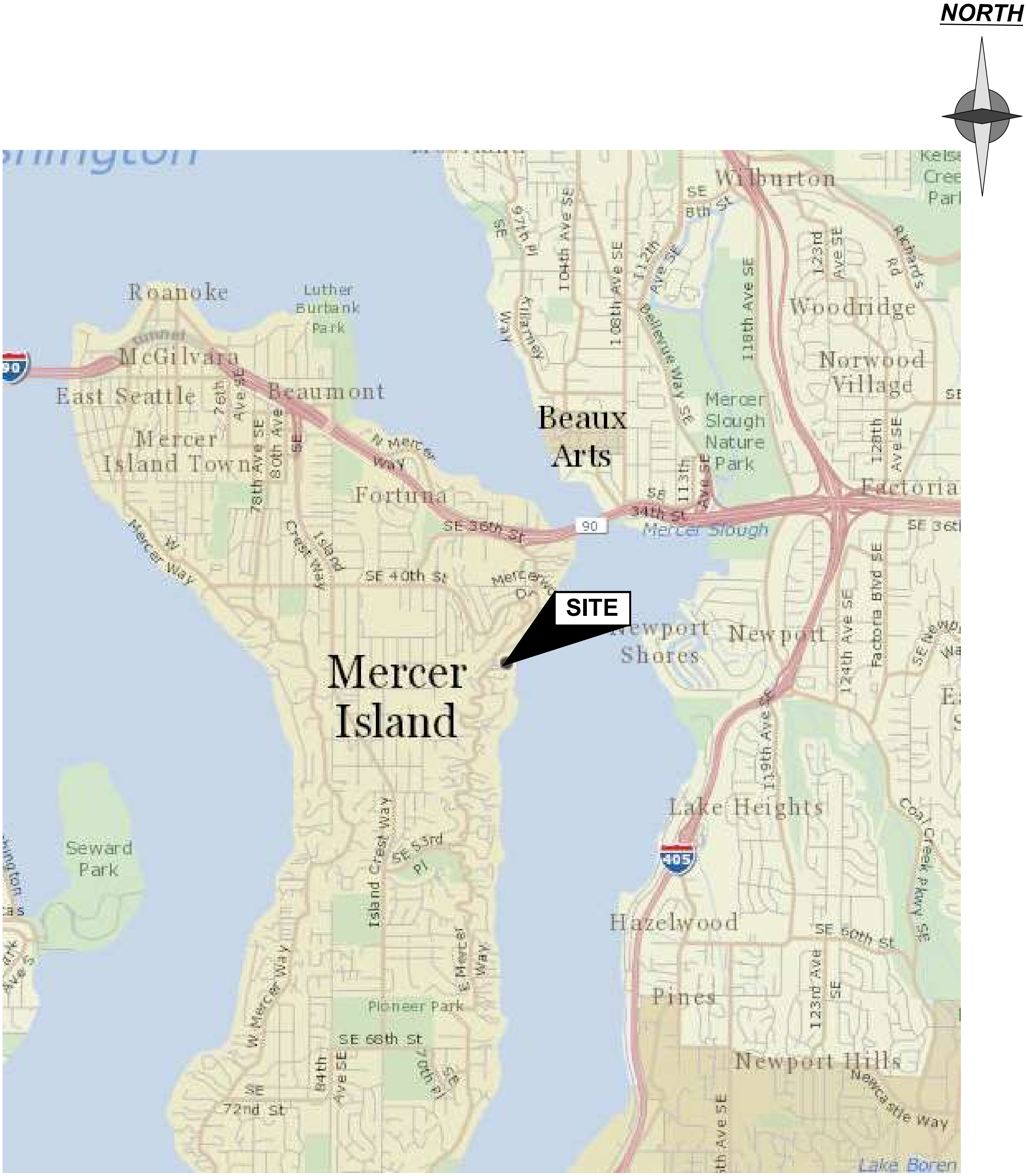
GEOTECH CONSULTANTS, INC.

MARC R. McGINNIS
27845

12/11/2020

Marc R. McGinnis, P.E.
Principal

MKM/MRM:kg



(Source: King County iMap)

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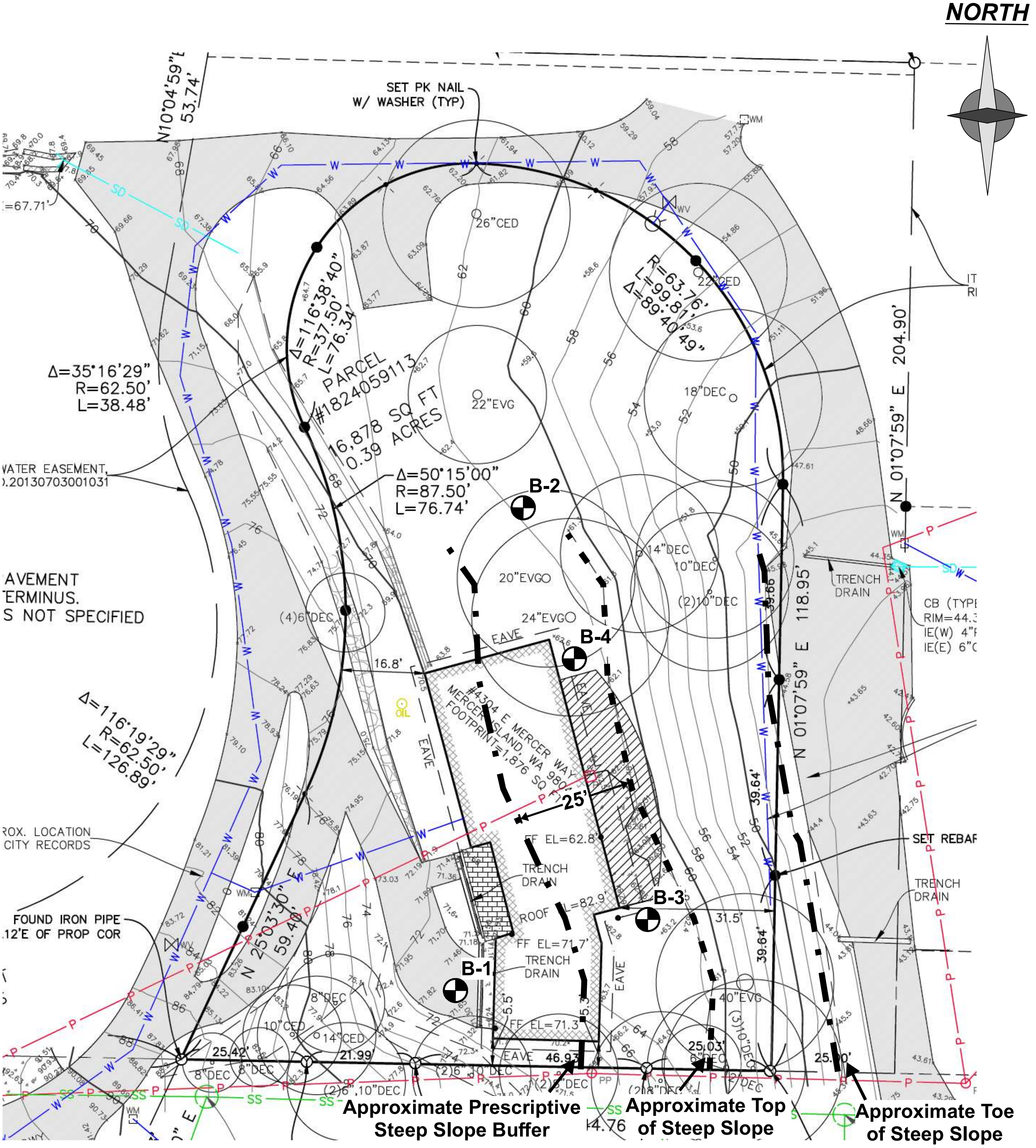
VICINITY MAP

4304 East Mercer Way
Mercer Island, Washington

Job No:	Date:		Plate:
20069	Dec. 2020		1



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

Legend:

◓ Test Boring Location

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SITE EXPLORATION PLAN

4304 East Mercer Way
Mercer Island, Washington

Job No:	Date:		Plate:
20069	Dec. 2020	No Scale	2

BORING 1

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description (Elevation ±72 feet)
						2-inches of asphalt over;
			24	1	SM/ML	Gray very silty SAND to sandy SILT, very fine-grained, moist, medium-dense
5			31	2		-becomes slightly gravelly with angular sand seams, dense
			39	3		-becomes mottled orange with pockets of clean sand -grades to sandy silt
10			40	4	ML	Gray mottled orange, very sandy SILT with thin silty sand seams, non-plastic, moist, dense
15			44	5	SP	Gray SAND trace silt, very fine-grained, moist, dense
20			51	6		-with thin rusted bedding planes, becomes very dense
25			58	7		-becomes slightly silty
30						

*** Test boring was terminated at 26.5 feet on November 12, 2020.**

*** No groundwater was encountered during drilling.**

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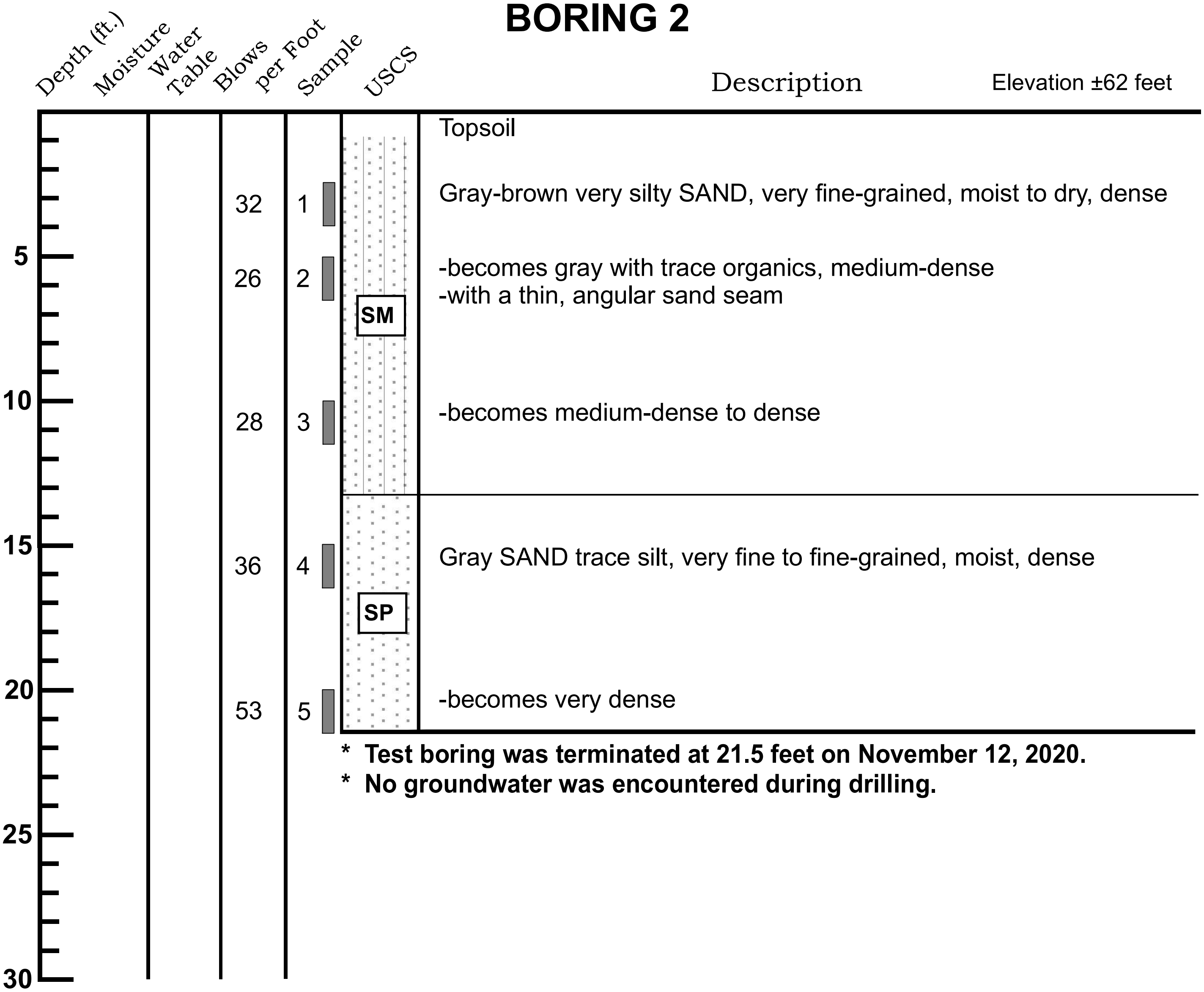
TEST BORING LOG

4304 East Mercer Way
Mercer Island, Washington

Job	***Date:***	***Logged by:***	***Plate:***
20069	Dec. 2020	MKM	3

BORING 2

Description Elevation ±62 feet



Topsoil

Gray-brown very silty SAND, very fine-grained, moist to dry, dense

-becomes gray with trace organics, medium-dense
-with a thin, angular sand seam

-becomes medium-dense to dense

Gray SAND trace silt, very fine to fine-grained, moist, dense

-becomes very dense

*** Test boring was terminated at 21.5 feet on November 12, 2020.**
*** No groundwater was encountered during drilling.**

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TEST BORING LOG

4304 East Mercer Way
Mercer Island, Washington

Job	*Date:*	*Logged by:*	*Plate:*
20069	Dec. 2020	MKM	4

BORING 3

Elevation ±63 feet

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
					FILL	Dark-brown silty SAND with organics, fine-grained, moist, jumbled, loose **(FILL)**
5			13	1	ML	Gray-brown SILT with organics, low plasticity, moist, stiff -with thin, layered silty sand seams
		**	51	2	SM/ML	Gray very silty SAND, fine-grained, moist, dense (**blow counts overstated - driving on a rock)
10		**	57	3		-becomes mottled orange, grades to sandy silt at tip of sampler
15			37	4	SP/SM	Gray slightly silty SAND, very fine-grained, moist, dense
20			63	5		-grades to silty sand in part, becomes very dense
25			83	6		-with thin seams of silt
30						

*** Test boring was terminated at 26.5 feet on November 12, 2020.**

*** No groundwater was encountered during drilling.**

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TEST BORING LOG

4304 East Mercer Way
Mercer Island, Washington

Job	***Date:***	***Logged by:***	***Plate:***
20069	Dec. 2020	MKM	5

BORING 4

Elevation ±62 feet

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
						Topsoil
			16	1	SP SM	Brown slightly gravelly SAND with silt, fine-grained, dry, medium-dense
5			23	2		-becomes gray and gray-brown mottled orange, slightly silty to silty with thin silt lenses, moist
			34	3		-becomes gray, dense
10			29	4		-becomes medium-dense to dense

*** Test boring was terminated at 11.5 feet on November 12, 2020.**
*** No groundwater was encountered during drilling.**

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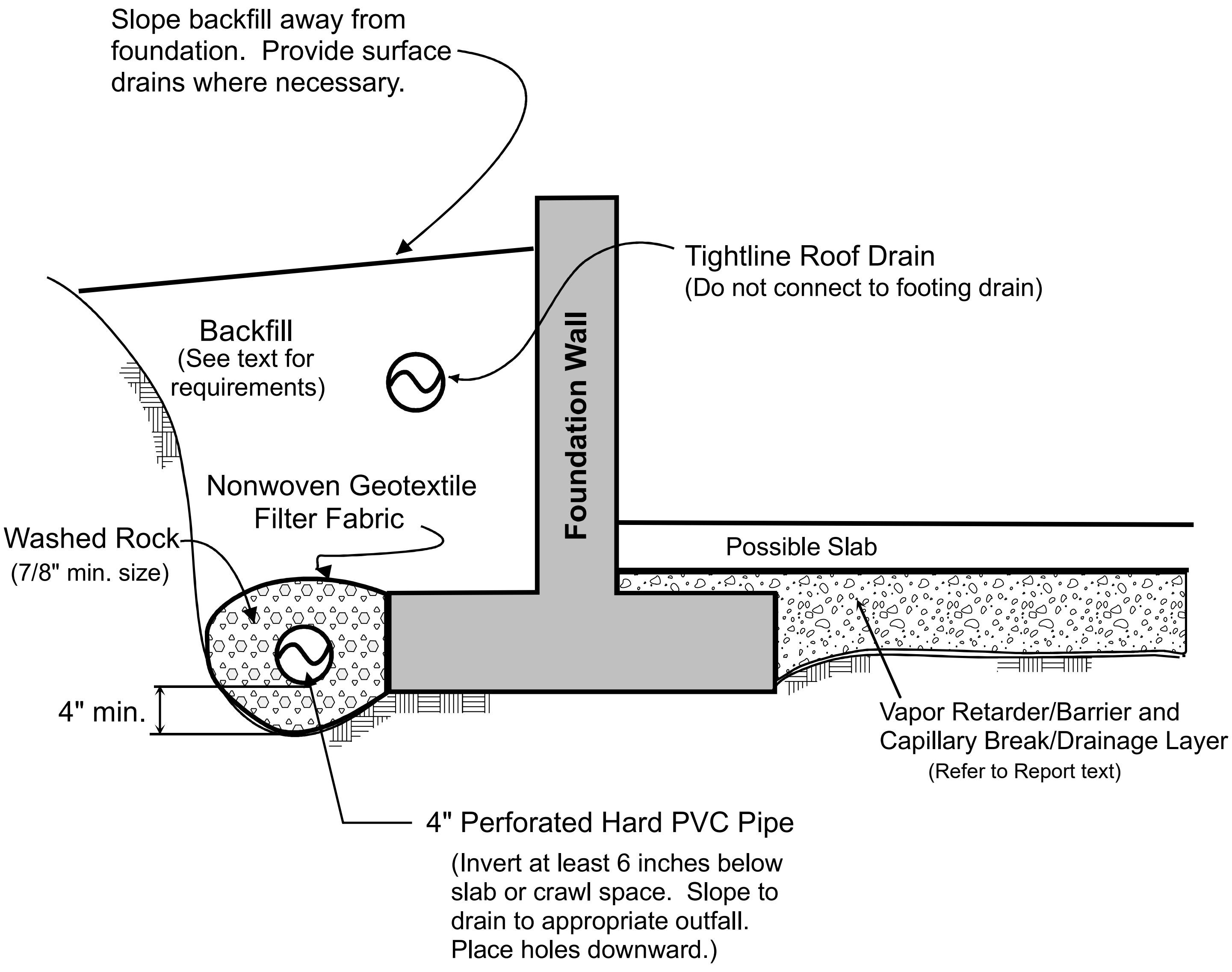
TEST BORING LOG

4304 East Mercer Way
Mercer Island, Washington

Job	***Date:***	***Logged by:***	***Plate:***
20069	Dec. 2020	MKM	6



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

4304 East Mercer Way
Mercer Island, Washington

Job No: 20069	**Date:** Dec. 2020		**Plate:** 7