GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

January 31, 2022

JN 22009

Front Porch Holdings LLC
325 Washington Avenue South, Box #5
Kent, Washington 98032

Attention: Mike Hunsaker
via email: mike@shmrockln.com

Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed Short-Plat
Vacant Lot South of 3782 – 40th Place South
Parcel #0240000065
SeaTac, Washington

Dear Mr. Hunsaker,

Attached to this transmittal letter is our geotechnical engineering report for the new short plat to be constructed in SeaTac. 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, P-11065, dated January 3, 2022.

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.

Matthew K. McGinnis
Geotechnical Engineer

Marc R. McGinnis, P.E.
Principal

cc: **Development Planning & Strategies LLC** – Ross Woods
via email: ross@dev-strat.com

MKM/MRM:kg

GEOTECHNICAL ENGINEERING STUDY
Proposed Short-Plat
Vacant Lot South of 3782 – 40th Place South
Parcel #0240000065
SeaTac, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed short plat to be located in SeaTac.

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 topographic map prepared by 4 Site Surveying & Consulting, dated August 18, 2021, and a preliminary lot layout plan that was undated. Based on this information, we understand that the undeveloped yard area south of the existing residence is proposed to be short platted into two new lots. These new lots will comprise a total site area of approximately 0.17-acres per lot, with approximate dimensions of 120.1 feet in the north south direction, and 60 feet in the east-west direction for each lot. No plans have been developed regarding the site development for each new lot, but they will likely each be developed with a new residence. The new residences will likely be two stories in height, and the northern residence may contain a daylight basement. Decks may extend off the north faces of the new residences. New driveways will extend off 40th Place South into the lots. No finish floor elevations have been provided at this time, but we anticipate that the main levels of the residence will sit close to the existing site grades. Preliminary property line setbacks of 15 feet from the north, 25 feet from the east, 20 feet from the south, and 5 feet from the west are shown on the preliminary lot layout plan. Excavation depths will range depending on the final siting and designs chosen.

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 in SeaTac. The long, narrow property is located near the southern shore of Angle Lake. The site comprises an approximate site area of 0.4-acres and has approximate dimensions of 268.6 feet in the north-south direction, and 60 feet in the east-west direction. The site is bordered on all sides by residential parcels, and a narrow private driveway (40th Place South) runs along the eastern property line.

The site is currently undeveloped and is covered with grass and scattered trees. The grade across the lot slopes downward gently from south to north, with a total elevation change of 28 feet. This sloped lot is generally inclined at 10 percent through the full footprint of the property. No steep slopes were observed on, or in the direct vicinity of the site. Angle Lake is situated to the north of the adjacent northern parcel.

The adjacent parcels are all developed with single family residences and the surrounding vicinity follows a similar south to north trending downgradient continuing to the elevation of Angle Lake. The northern parcel (#3782) is owned by the client and contains a one-story residence with a partial basement set greater than 10 feet from the property lines. A detached garage is set south of the

residence but is still set well away from the property lines. The adjacent eastern parcels also contain one and two-story residences located relatively close to the property lines and the 40th Place South right-of-way. The adjacent southern parcel contains a two-story residence set well away from the property lines and is separated from the subject site by a large yard area; a small stone retaining wall is set near the southern property line.

The adjacent western lots are also developed with single-family residences on similar, narrow lots. The southwestern and central-western lots both contain two story residences with no basements set approximately 5 feet from the property lines. A detached shed and covered porch are set up to the property line on the southwestern property, and a short retaining wall could be observed on the central-western parcel where the grade steps down approximately 3 feet into the adjacent parcel. The northwestern adjacent parcel also contains a two-story residence set 5 feet off the property line; however, this residence contains a partial lower level/basement space which mostly appeared to consist of the attached garage space. All of these residences appear to bear on shallow foundations located close to the ground surface.

SUBSURFACE

The subsurface conditions were explored by excavating four test pits 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 test pits were excavated on January 18, 2022 with a small, tracked excavator provided by the client. A geotechnical engineer from our staff observed the excavation process, logged the test pits, and obtained representative samples of the soil encountered. "Grab" samples of selected subsurface soil were collected from the backhoe bucket. The Test Pit Logs are attached to this report as Plates 3 and 4.

Soil Conditions

The test pits generally encountered similar subsurface soil conditions. Beneath the ground surface, a layer of loose fill soil was revealed to depths of 2 to 2.5 feet. A layer of old topsoil was revealed beneath the fill in Test Pit 2, extending to a depth of 3 feet. Beneath the fill and topsoil, native, loose, weathered silty sand was revealed. This weathered layer contained some roots, exhibited rust staining and mottling, and was in an elevated moisture state. This weathered layer continued to depths of 4 to 4.5 feet, where the soils became cemented and dense. This native soil is glacially compressed and is geologically referred to as glacial till. The dense glacial till continued to the base of the excavations at depths of 5 feet.

Published geologic maps indicate that the near-surface geologic unit in this area consists of glacial drift, a glacially-compressed, silty, fine-grained sand. Glacial till is similar in composition and strength to glacial drift. Our firm has also completed previous projects in the site vicinity that found similar glacial till soils.

An old drainpipe was revealed within the fill soils in Test Pit 4 during excavation. 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

Perched groundwater seepage was observed at a depth of 2 to 3 to 3 feet in all but Test Pit 1, which was excavated near the southern property extent, near the highest point of the site. These test pits were excavated in the middle of the wet season, and this perched groundwater is typical for a near-surface water table that perches on top of the impervious glacial till soils.

It should be noted that groundwater levels vary seasonally with rainfall and other factors. We anticipate that groundwater could be found in more permeable soil layers, sand seams within the till, and between the looser near-surface soil and the underlying glacial till.

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. The relative densities and moisture descriptions indicated on the test pit logs are interpretive descriptions based on the conditions observed during excavation.

The compaction of test pit backfill was not in the scope of our services. The test pits were backfilled with excavated soil that was lightly tamped into place. Loose soil will therefore be found in the area of the test pits. If this presents a problem, the backfill will need to be removed and replaced with structural fill during construction.

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 pits conducted for this study encountered dense to very dense, glacially-compressed glacial till soil at depths ranging from about 4 to 4.5 feet beneath the ground surface. These soils are suitable for supporting new structural loads, and a conventional foundation system can be used, provided they bear either directly atop the glacial till, or on structural fill placed atop the glacial till. It will be important for all fill, topsoil, and loose soil to be removed from beneath foundations. Depending on final site and foundation elevations, some overexcavations may be needed in areas to reach this suitable bearing soil. Excavations into glacially compressed soils are typically conducted using toothed buckets due to the soil's density. This creates several inches of loose, disturbed soils at the base of the excavations. It will be important that the base of the excavations be scraped clean of any loose debris or soil that may become disturbed during excavation. This can be accomplished by using a cleanout bucket, smooth grade bar, or flat blade shovel. In addition, it may be necessary to protect the soil subgrade in footing areas with a mat of imported, clean, granular fill if the native soils are wet at the time of foundation construction; this is because the soil is moisture sensitive and prone to being disturbed if wet or by foot and machine traffic. This will likely be the scenario in the winter and spring months. This rock layer would both help to protect the

prepared bearing surfaces from disturbance and would facilitate any pumping of standing water from the foundation excavations if needed. Additional recommendations can be found in the ***Conventional Foundations*** section of this report.

Existing fill and topsoil should be removed from beneath settlement floor slabs. The on-site soils are silty and fine grained. Reuse of the excavated soils as compacted fill beneath lightly-loaded elements, such as slabs, would be possible in hot, dry weather, but will not be possible in wet conditions, if the soils are overly moist when excavated, or if the excavated soils are allowed to become overly moist before they are placed and compacted. The on-site soils will not have good drainage properties, even when well compacted. Imported, clean, angular rock or gravel such as ballast rock or quarry spalls should be used beneath the foundations where structural fill is needed, and free-draining, granular fill should be placed behind backfilled walls.

The excavations for the proposed residences will range depending on the final design and siting locations. Based on the soils encountered in our test pits, a temporary excavation inclination of no steeper than a 1:1 (Horizontal:Vertical) is appropriate for this project. Vertical excavations should not be made on, or near the shared property lines, or near any settlement sensitive structure. Some caving was observed in the loose weathered soils, particularly in the zones of perched groundwater seepage. Based on the preliminary lot layout plan, sufficient setbacks from the north, east, and south property lines are being proposed to maintain the excavations within the property boundaries. However, a setback of only 5 feet is shown from the western property line, and the adjacent western residences and accessory site features are located close to the common property line. Depending on the final foundation elevations, excavations in this area may either require that temporary excavation easements be obtained from the adjacent property owners, or some form of excavation shoring be utilized to facilitate the excavations, especially if the excavation requires several feet of room for the concrete subcontractor to work on the perimeter forms, and if the outside edge of the footing extends past the building setback line. We can comment further on this once preliminary residence designs have been completed, however, it should be noted that excavations will likely need to extend at least 4 to 4.5 feet below the existing grade to reach the suitable bearing soils encountered in the test pits. Further recommendations can be found in the ***Excavations and Slopes*** section of this report.

A layer of perched groundwater was revealed in the test pits approximately 2 to 3 feet below the ground surface A similar amount of onsite water is possible to exist within the site bounds in the winter and spring months in any year and could affect earthwork during these months. The earthwork and utility contractor(s) for the project should be aware of this. A sufficient subsurface drainage system and waterproofing should be included beneath the proposed structure locations, especially if below-grade spaces are included in the residence designs. This is true even for crawl spaces. More detailed recommendations can be found in the ***Drainage Considerations*** section of this report.

The underlying Glacial Till is essentially impervious and will stop downward percolation of large volumes of water infiltrated above it. A 1997 study published by U.S. Geologic Survey (USGS) in cooperation with the Washington Department of Ecology (WDOE) determined the infiltration capacity of Glacial Till soils to vary between 0.0005 and 0.005 inches/hour. We have found similar extremely low infiltration rates in Pilot Infiltration Tests our firm has conducted in glacial till soils. This is because Glacial Till is very dense, cemented, is often comprised of fine-grained sand, and can have high silt (fines) content. As a result, there are no large or continuous pore spaces in the soil that can transmit water. Often, the impermeable nature of the Glacial Till causes a shallow seasonal perched water table to form where the ground surface is not covered by an impervious layer. This is a common problem in the wet season throughout the Puget Sound area and was

observed in the shallow perched groundwater layers during our field work. Considering all this, and that perched groundwater was encountered, it is our professional opinion that onsite infiltration or dispersion of stormwater is not feasible for the subject site. Attempting on-site infiltration or dispersion would likely increase the potential for surface and subsurface drainage problems in both the proposed homes, and on the adjacent properties. All collected stormwater runoff should be tightlined offsite to the appropriate facilities.

The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. Existing pavements, ground cover, and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Rocked staging areas and construction access roads should be provided to reduce the amount of soil or mud carried off the property by trucks and equipment. Trucks should not be allowed to drive off of the rock-covered areas. Cut slopes and soil stockpiles should be covered with plastic during wet weather. It will be important that no silty runoff is allowed to travel downhill to the north, and reach Angle Lake. Currently, another residential parcel exists between the development area and the lake, which should provide sufficient runout to prevent any runoff from reaching the lake's edge. However, if uncapped drainage lines or ditches exist within the influence of the development area, it will be important that any silty water be diverted from these conveyance locations, as these lines typically directly discharge into Angle Lake. Following clearing or rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

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 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 1.43g 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 MCE peak ground acceleration adjusted for site class effects (F_{PGA}) equals 0.66g. The glacial till soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of their dense, glacially-compressed nature.

CONVENTIONAL FOUNDATIONS

The proposed structures can be supported on conventional continuous and spread footings bearing on undisturbed, dense glacial till, or on imported crushed rock 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.

Depending on the final site grades, overexcavation may be required below the footings to expose competent native soil. Unless lean concrete is used to fill an overexcavated hole, the overexcavation must be at least as wide at the bottom as the sum of the depth of the overexcavation and the footing width. For example, an overexcavation extending 2 feet below the bottom of a 2-foot-wide footing must be at least 4 feet wide at the base of the excavation. If lean concrete is used, the overexcavation need only extend 6 inches beyond the edges of the footing.

An allowable bearing pressure of 2,500 pounds per square foot (psf) is appropriate for footings supported on competent, dense native soil, or on adequately compacted structural fill placed atop the competent native soils. 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, dense native soil, or on structural fill up to 5 feet in thickness, 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 *	40 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.40
Soil Unit Weight	135 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

Per IBC Section 1803.5.12, a seismic surcharge load need only be considered in the design of walls over 6 feet in height. A seismic surcharge load would be imposed by adding a uniform lateral pressure to the above-recommended active pressure. The recommended seismic surcharge pressure for this project is 9**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. If the on-site soils can be properly compacted, and are used as wall backfill, a minimum 12-inch width of free-draining gravel should be placed against the backfilled retaining walls. The gravel 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.

SLABS-ON-GRADE

The building floors can be constructed as slabs-on-grade atop competent native soil, or on structural fill placed following removal of the existing fill and topsoil. 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. Alternately, the floors could be constructed as framed floors atop a crawlspace if the client desires.

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.

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 5. 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.

Drainage inside the building's footprint 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. It is common for crawl spaces that extend close to, or into, glacial till soils to develop standing water from groundwater that bypasses the perimeter footing drains. 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 several 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.

Perched 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 buildings 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. 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 fills 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. As discussed in the ***General*** section, the on-site soils are generally unsuitable for not suitable for reuse as structural fill, especially underneath foundations, due to their fine-grained, silty nature, elevated moisture content, and poor drainage qualities.

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 pits 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 pits. 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.

This report has been prepared for the exclusive use of Front Porch Holdings LLC and its 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 - 4	Test Pit Logs
Plate 5	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,

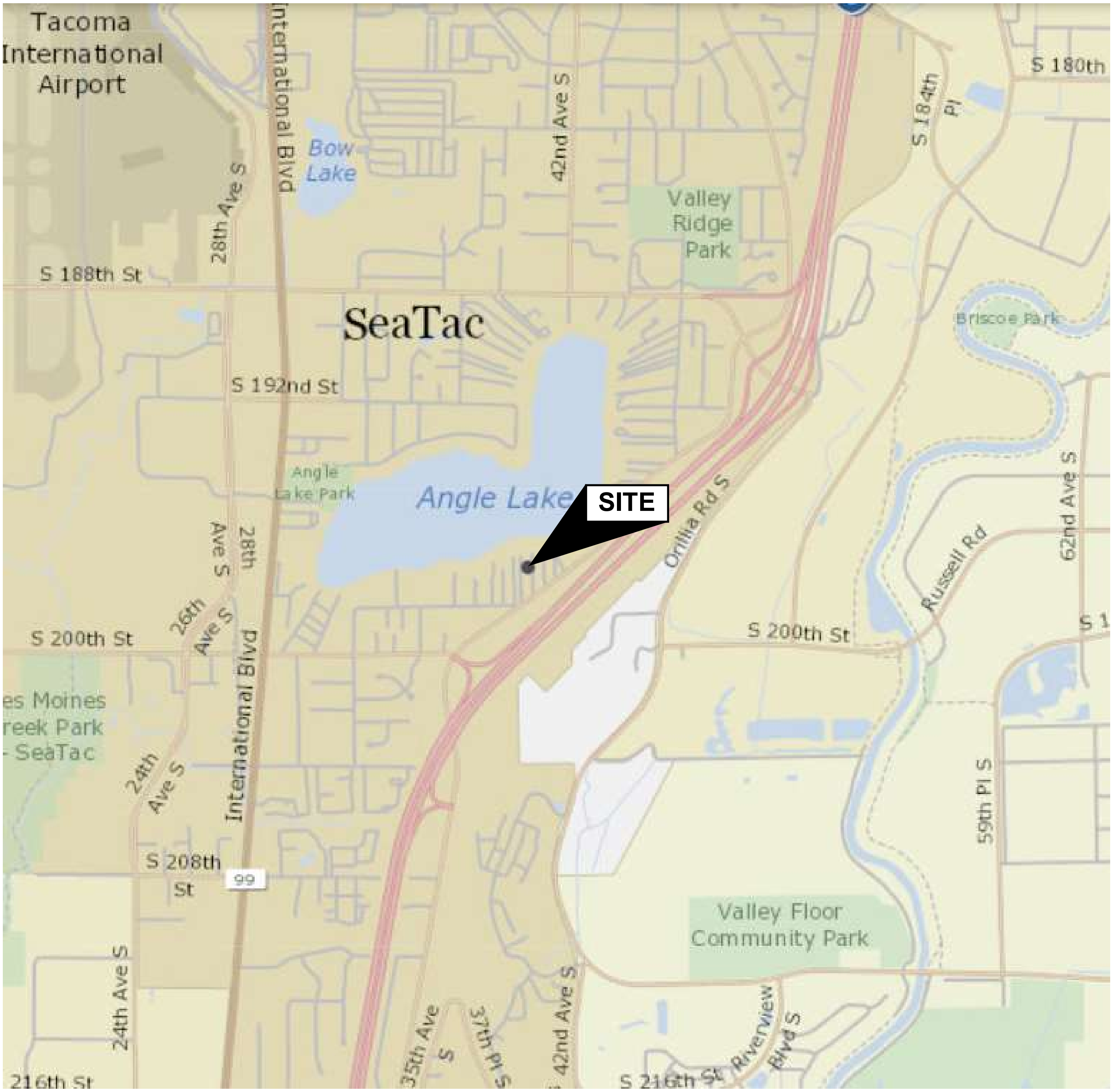
GEOTECH CONSULTANTS, INC.

1/31/2022

Marc R. McGinnis, P.E.
Principal

MKM/MRM:kg

NORTH



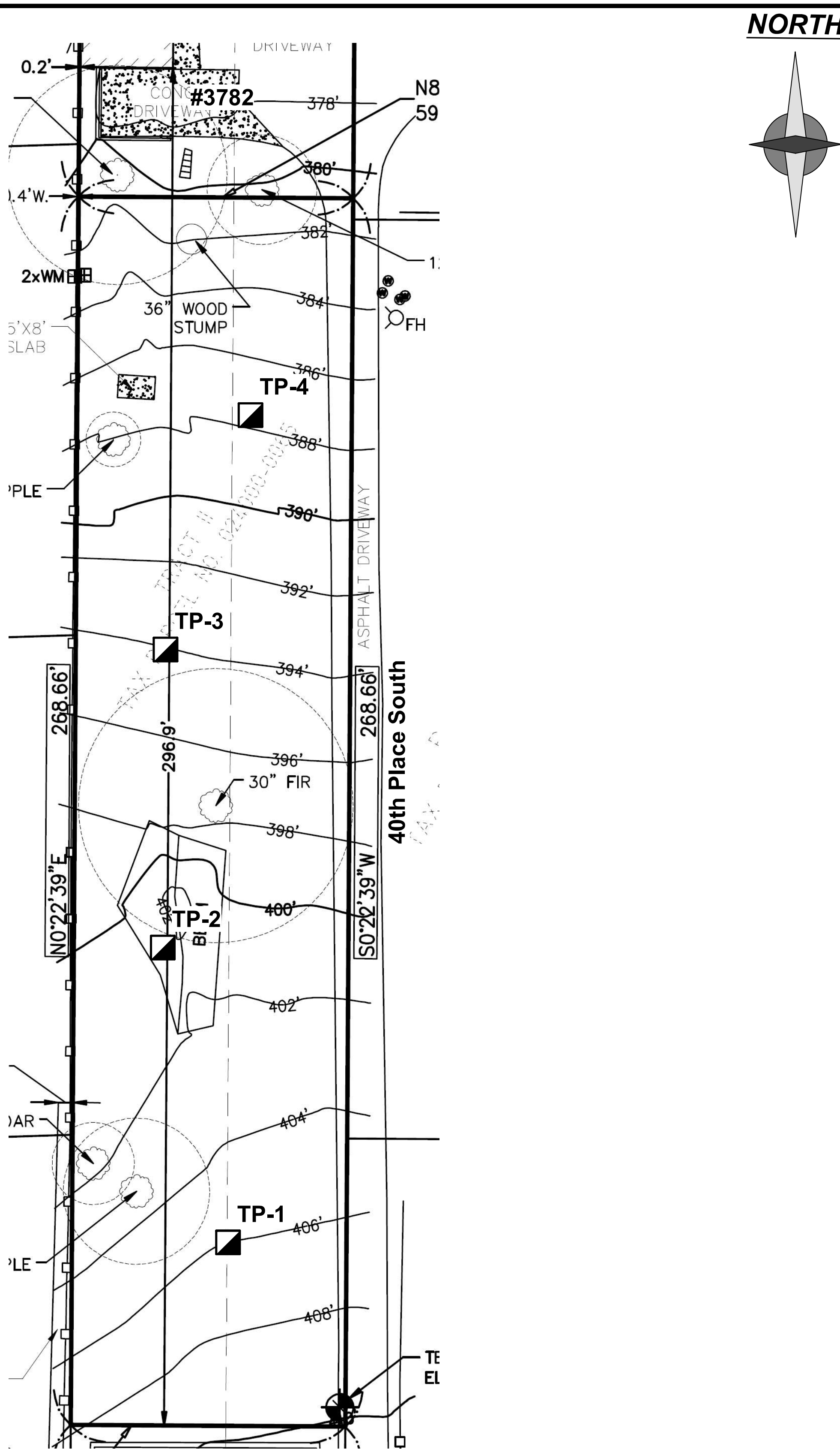
(Source: King County iMap)

GEOTECH CONSULTANTS, INC.

VICINITY MAP

Vacant Lot South of 3782 - 40th Place South
Parcel #0240000065
SeaTac, Washington

Job No:	Date:		Plate:
22009	Jan. 2022		1



Legend:

Test Pit Location

GEOTECH CONSULTANTS, INC.

SITE EXPLORATION PLAN

Vacant Lot South of 3782 - 40th Place South
Parcel #0240000065
SeaTac, Washington

Job No:	Date:		Plate:
22009	Jan. 2022	No Scale	2

TEST PIT 1

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Brown silty SAND with roots, fine-grained, moist, loose **(FILL)**
				Topsoil
			SM	Gray mottled brown and orange, silty SAND with rusting and trace roots, fine-grained, moist, loose to medium-dense -becomes gray mottled orange, cemented, dense **(Glacial Till)**
5				
10				

* **Test Pit terminated at 5 feet on January 18, 2022.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

TEST PIT 2

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Brown silty SAND with roots, fine-grained, moist, loose **(FILL)**
		▼	SM	Brown mottled orange, silty SAND with roots and gravel, fine-grained, wet, loose -becomes gray-brown mottled orange and rust, very moist, loose to medium-dense -becomes gray, cemented, dense **(Glacial Till)**
5				
10				

* **Test Pit terminated at 5 feet on January 18, 2022.**
* **Perched groundwater seepage was observed at 3 feet during excavation.**
* **No caving was observed during excavation.**

GEOTECH
CONSULTANTS, INC.

TEST PIT LOG

Vacant Lot South of 3782 - 40th Place South
Parcel #0240000065
SeaTac, Washington

Job	Date:	Logged by:	Plate:
22009	Jan. 2022	MKM	3

TEST PIT 3

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Brown silty SAND with roots, fine-grained, very moist, loose **(FILL)**
		▼	SM	Brown mottled orange, silty SAND with roots, fine-grained, wet, loose
				-becomes gray-brown mottled orange, very moist, medium-dense
5				-becomes gray with rusting, cemented, dense **(Glacial Till)**
10				

*** Test Pit terminated at 5 feet on January 18, 2022.**
*** Perched groundwater seepage was observed from 2 to 3 feet during excavation.**
*** No caving observed during excavation.**

TEST PIT 4

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Brown silty SAND with roots, fine-grained, moist to very moist, loose **(FILL)**
				Old AC drainpipe
		▼	SM	Brown mottled orange, gravelly, silty SAND with roots, fine-grained, wet, loose
5				-becomes gray with rusting, cemented, dense **(Glacial Till)**
10				

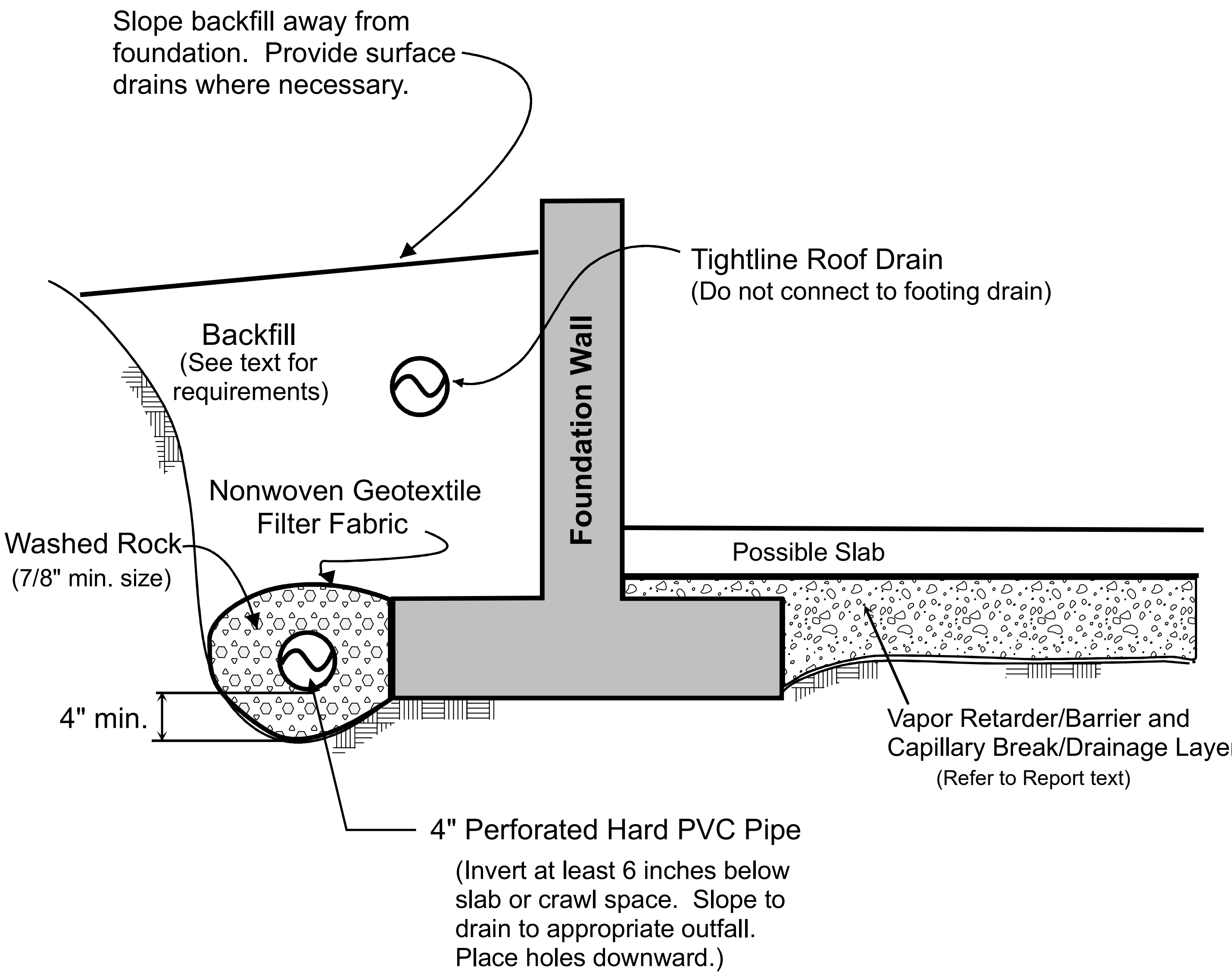
*** Test Pit terminated at 5 feet on January 18, 2022.**
*** Perched groundwater seepage was observed from 2.5 to 3 feet during excavation.**
*** Slight caving was observed from 2 to 3 feet during excavation.**

GEOTECH
CONSULTANTS, INC.

TEST PIT LOG

Vacant Lot South of 3782 - 40th Place South
Parcel #0240000065
SeaTac, Washington

Job	Date:	Logged by:	Plate:
22009	Jan. 2022	MKM	4



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.

GEOTECH CONSULTANTS, INC.

FOOTING DRAIN DETAIL

Vacant Lot South of 3782 - 40th Place South
Parcel #0240000065
SeaTac, Washington

Job No:	Date:		Plate:
22009	Jan. 2022		5