

October 14, 2025

JN 25304

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Subject: **Geotechnical Engineering Report**
Proposed New Residence
3246 – 72nd Place S.E.
Mercer Island, Washington

Greetings:

This report presents our geotechnical engineering report related to the planned residence to be constructed on the subject property. The scope of our services consisted of assessing the site surface and subsurface conditions, and then developing this geotechnical report.

Based on the information provided by Sturman Architects, the site will be redeveloped with a new two-story residence that will likely be underlain by a basement. The existing house will be demolished as a part of this development. We expect that the main floor elevation will be close to the existing site grades.

SITE CONDITIONS

We visited the subject property on October 7, 2025 to observe the existing conditions and to monitor excavation of exploratory test pits on the property. The subject lot is a rectangular-shaped property situated on the east side of 72nd Place S.E. A two-story residence occupies the western portion of the lot. This structure is two stories in height and does not include a basement. A detached garage is located to the south of the southeastern corner of the house. A paved driveway extends east to this garage from 72nd Place S.E. A patio extends east from the house. The remainder of the property is covered with grass, landscaping, and scattered trees. The eastern portion of the lot appears to once have been used as a garden.

The ground surface on the site and the surrounding lots is relatively flat, with a very slight grade down toward the west. Our review of the City of Mercer Island's GIS confirms that there are no mapped geologically critical areas on, or near, the subject property. This area is not known for historic or recent episodes of slope instability. According to the *Mercer Island Landslide Hazard Assessment*, the nearest documented landslides are over 500 feet east and west of the site.

The property line to the north contains a single-story residence located approximately 7 feet from the common property line. According to King County Assessor records, this house does not have a basement. The home to the south is approximately 5 feet from the property line and contains a basement located approximately 7 feet below grade. Storm as-builts found on the Mercer Island GIS indicate that both the adjacent southern residence (#3256) and the next house to the south (#3400) discharge their storm and subsurface drainage water to the storm sewer located in 72nd Place S.E. Residence #3256 has a pump to discharge collected water.

During our visit to the property, we monitored the excavation of two test pits at the locations shown on the attached Site Exploration Plan. Logs for the test pits are also attached. Test Pit 1, located to the east of the rear patio, found loose, silty sand below a thin layer of sod and topsoil. At a depth of 1.5 feet, this exploration exposed medium-dense, gravelly, silty sand. Below 3 feet, we observed medium-dense, gravelly sand that extended to the 6.5-foot depth of the test pit. Slight caving occurred in the gravelly sand below a depth of 3 feet in this test pit. Test Pit 2 was excavated to the west of the existing residence, and encountered an approximate one-foot thickness of sod and topsoil below the ground surface. The topsoil was underlain by loose, slightly gravelly, silty sand that became medium-dense below a depth of 3 feet. From 4 to 6 feet in depth was medium-dense, slightly gravelly, slightly silty sand, with medium-dense gravelly sand below 6 feet. Slight caving was also observed in the gravelly sand found in the lower portion of this test pit. No groundwater seepage was encountered in the test pits. It is not uncommon to find shallow localized groundwater perched on top of the silty sand following extended wet weather.

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 holes conducted on the site found competent, medium-dense native soils suitable to support the new house using conventional foundations. It will be important that all foundations be excavated through the topsoil and loose soils. Any soil loosened by the excavation process should be removed from the foundation areas prior to pouring concrete. Where footing subgrades consist of the gravelly sand, we recommend that the subgrade soils be recompact with at least a walk-behind plate compactor to re-densify them.

All floor slabs and other settlement-sensitive on-grade elements should be excavated through the topsoil.

The adjacent house to the south contains a basement and a pumped drainage system. Additionally, the proposed new residence will likely contain a basement. Attempting to use on-site infiltration of storm water for this project would increase the risk of drainage problems for both the proposed and neighboring existing homes. In our professional opinion, the use of onsite infiltration for disposal of storm runoff from impervious surfaces is infeasible for this site.

The erosion hazard for this property is low, due to its relatively flat condition. Even so, proper temporary erosion control measures should be implemented, depending largely on the weather conditions encountered during the site work. If the excavation or areas of bare soil are not below the level of the surrounding properties, a silt fence or straw wattle should be installed around the downslope sides of any work areas. Existing ground cover and landscaping should be left in place wherever possible to minimize the amount of exposed soil. It is prudent to avoid clearing of ground cover until permanent landscaping is to be accomplished. Any soil stockpiles should be covered with plastic during wet weather. Soil and mud should not be tracked onto the adjoining streets, and silty water must be prevented from traveling off the site. As with any construction project, it can be necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

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).

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 soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of their compact nature and the lack of a near-surface water table.

CONVENTIONAL FOUNDATIONS

An allowable bearing pressure of 2,000 pounds per square foot (psf) is appropriate for new footings supported on dense, native soils. A one-third increase in this design bearing pressure can 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 less than one inch, with differential settlements on the order of one-quarter-inch in a distance of 25 feet along a continuous footing with a uniform load.

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

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.45
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
Lateral Earth Pressure *	40 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.44
Soil Unit Weight	130 pcf

Where: pcf is Pounds per Cubic Foot, and Lateral 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 lateral 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. 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 the 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 for the wall and reinforcing design for a distance of 1.5 times the wall's 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 needs only to be considered in the design of backfilled walls over 6 feet in height. A seismic surcharge load would be imposed by adding a uniform lateral pressure to the above-recommended lateral pressure. The recommended seismic surcharge pressure for this project is $8H$ 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 native soils are used as 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. 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 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 non-organic native soils, or on structural fill placed above this competent soil. 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 newly constructed space above it. This can affect moisture-sensitive flooring, cause imperfections or damage to the slab, or simply allow excessive water vapor into the space above the slab. All interior slabs-on-grade should be underlain by a capillary break drainage layer consisting of a minimum 4-inch thickness of clean gravel or crushed rock that has a fines content (percent passing the No. 200 sieve) of less than 3 percent and a sand content (percent passing the No. 4 sieve) of no more than 10 percent. Pea gravel or crushed rock are typically used for this layer.

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

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

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 of 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 the uppermost silty soil, if it is not wet, and if there are no indications of slope instability. However, vertical cuts should not be made near property boundaries, or existing utilities and structures. Considering the slight caving observed in the lower portions of the test pits, vertical cuts should not be attempted below a depth of 3 to 4 feet below the existing grade.

Based upon Washington Administrative Code (WAC) 296, Part N, the near-surface, looser, 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.

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 2:1 (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.

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 4. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains. Clean-outs should be provided for potential future flushing or cleaning of footing drains.

As a minimum, a vapor retarder, as defined in the **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 away from foundations and walls. 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 a building 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.

LIMITATIONS

This report has been prepared for the exclusive use of the Yusens 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.

Please contact us if you have any questions regarding this report, or if we can be of further assistance.

Respectfully submitted,
GEOTECH CONSULTANTS, INC.

Marc R. McGinnis, P.E.
Principal



10/14/2025

Attachments:

- Vicinity Map
- Site Exploration Plan
- Test Pit Logs
- Footing Drain Detail

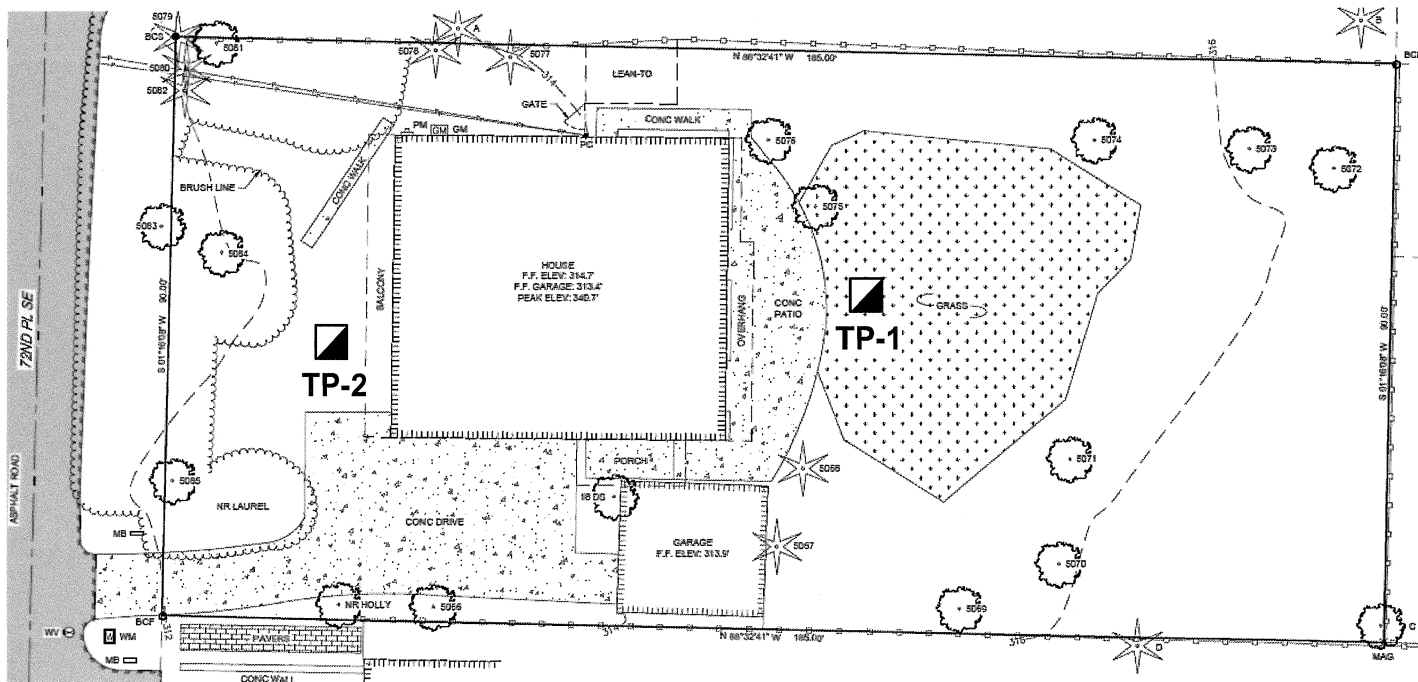
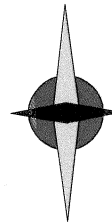
cc: **Sturman Architects** – Kati Eitzman
via email: kati@sturmanarchitects.com
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VICINITY MAP
 3246 - 72nd Place S.E.
 Mercer Island, Washington

Job No: 25304	Date: Oct. 2025		Plate: 1
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North



Legend:

■ TP-1 Test Pit Location



SITE EXPLORATION PLAN
 3246 - 72nd Place S.E.
 Mercer Island, Washington

Job No: 25304	Date: Oct. 2025	No Scale	Plate: 2
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TEST PIT 1

Depth (feet)	Soil Description
0 – 1.0	Sod over Topsoil
1.0 – 1.5	Orangish-brown, silty SAND, fine-grained, damp, loose
1.5 – 3.0	Brown, gravelly, silty SAND, fine-grained, damp, medium-dense
3.0 – 6.5	Brown, gravelly SAND with cobbles, medium- to coarse-grained, damp, medium-dense

Test Pit was terminated at a depth of 6.5 feet on October 7, 2025.

No groundwater seepage was observed.

Slight caving occurred below 3 feet.

TEST PIT 2

Depth (feet)	Soil Description
0 – 1.0	Sod and Topsoil
1.0 – 4.0	Brown, slightly gravelly, silty SAND with roots, fine-grained, damp, loose -becomes medium-dense with no roots below 3 feet
4.0 – 6.0	Brown, slightly gravelly, slightly silty SAND, fine-grained, damp, medium-dense
6.0 – 7.0	Brown, gravelly SAND with cobbles, damp, medium-dense

Test Pit was terminated at a depth of 7.0 feet on October 7, 2025.

No groundwater seepage was observed.

Slight caving occurred below 6 feet.



TEST PIT LOGS

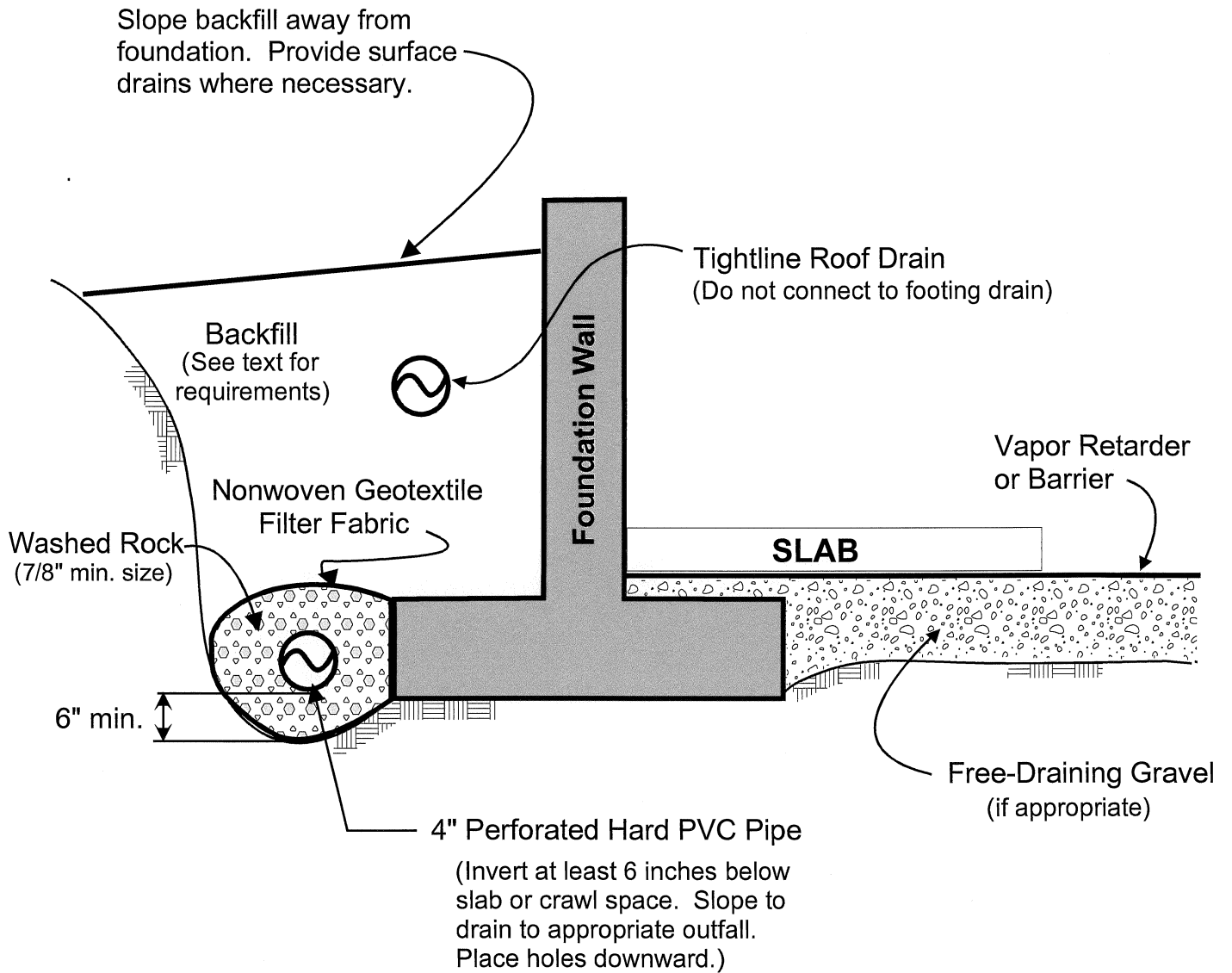
3246 - 72nd Place S.E.
Mercer Island, Washington

Job No:
25304

Date:
Oct. 2025

Plate:

3



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 and waterproofing considerations.



FOOTING DRAIN DETAIL
3246 - 72nd Place S.E.
Mercer Island, Washington

Job No: 25304	Date: Oct. 2025	Plate: 4
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