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JN 23413

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Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed Residential Project
6520 – 82nd Avenue Southeast
Mercer Island, Washington

Greetings:

Attached to this transmittal letter is our geotechnical engineering report for the residential project to be constructed on Mercer Island, Washington. 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 geotechnical engineering design considerations for the project. This work was authorized by your acceptance of our proposal, P-11518, dated November 20, 2023.

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.

D. Robert Ward, P.E.
Principal

cc: **McClellan Architects** – Joey Pasquinelli
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DRW:kg

GEOTECHNICAL ENGINEERING STUDY
Residential Project
6520 – 82nd Aveue Southeast
Mercer Island, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed residential project to be located at 6520 – 82nd Avenue Southeast on Mercer Island.

We were provided with a site plan and main floor plan of the project prepared by McClellan Architects. We also were provided site plans and a topographic map. A one-story residence and attached garage are located in the flat, central portion of the site. We understand that the garage portion will be removed completely, while the foundation of the residence will likely not be removed. A new one-story residence will be located in the same location as the existing residence, but a new detached garage is proposed further north of the existing garage. In addition, some significant patios are proposed on the western/southwestern sides of the residence. The patios may be raised as much as 3 feet above the existing ground.

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 southeastern portion of Mercer Island. The site has an irregular, but somewhat rectangular shape, being longest in the north-south direction. It is located east/northeast of the northeast portion of a cul-de-sac driveway that extends east of 82nd Avenue Southeast. The site is located in a residential neighborhood and is essentially surrounded by other residential properties.

The overall property slopes down to the west, similar to the surrounding neighborhood. However, the central, majority of the property is nearly flat; the existing one-story residence is located in this flat area. A sloped driveway extends up from the cul-de-sac northeasterly near the western property line that ends in the flat central portion adjacent to the residence; the grade change over this driveway is about 12 vertical feet. Some steep slopes/rockeries mostly line the eastern and western edges of the driveway. The steep slope/rockeries are up to about 8 feet tall at the driveway's northwestern portion and up to about 9 feet at the southeastern portion. In addition to the steep slope/rockery at the southeastern portion of the driveway, there is another small landscape rockery just above it that extends up to the nearly flat central portion of the property. The overall grade change between the flat portion of the property and the base of the driveway slope/rockery is up to approximately 13 feet. We did not observe any instability of these slopes/rockeries during our recent site visits. In addition to the slopes/rockeries on the western portion of the property, there is also an approximate 2- to 4-foot-tall rockery near the eastern property line. It appears there are relatively flat yard/landscape areas of neighboring properties at the top of the rockery. No seeps or springs were observed at the slopes/rockeries, nor anywhere on the site.

The existing residence is a one-story structure that has an attached garage on its northern end. The garage has a slab-on-grade floor, while the living portion of the residence has a crawl space above its main floor. The level of the main floor is one to two feet above the grade around the residence. Using a steel rod, we probed numerous areas around the perimeter of existing residence. Based on these probings, it appears that the residence is supported on a conventional footing foundation. The the top of the footing was found to vary from approximately 18 to 30 inches below the existing ground surface. In addition, the outside “lip” of the footing (outside of the foundation wall) varied from approximately 4 to 9 inches, The location of the probings and other information is shown on Plate 2 as discussed further in the subsequent section of this report.

Based on Mercer Island’s GIS portal, there are two designated Geologic Hazard Areas at the site, both located at/near the slopes/rockeries on the eastern and western portions of the site. The nearly flat central portion of the site is not a Hazard Area.

SUBSURFACE

The subsurface conditions were explored by excavating one test pit and several test holes at the approximate locations shown on the Site Exploration Plan, Plate 2. We also used a steel rod to probe conditions/soils in some areas adjacent to the residence foundation (the depth to the top of existing footings and the approximate width of footings using the probe is described in the previous section of this report); the probing locations are also shown on 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 pit was excavated on December 15, 2023 with a small tracked excavator. 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 Log is attached to this report as Plate 3. The test holes were hand-excavated by the geotechnical engineer, and their logs are attached as Plate 4.

Soil Conditions

Native soils were revealed in the test pit, test hole, and probings. Generally below a top layer of topsoil, native sand was revealed near the ground surface. Initially, the sand was loose but became medium-dense at depths of approximately 2 to 2.5 feet. The sand then became medium-dense to dense at approximately 3 to 4 feet and became dense with depth. The test pit was excavated to a maximum depth of 10 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.

Groundwater Conditions

No groundwater seepage was observed in the explorations, nor emanating from the ground at the property. We do not believe that groundwater will be a consideration for this project.

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/hole 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.

Based on the explorations done in the existing and proposed residence areas of the site, it appears that native, medium-dense sand soil exists at approximately 2 to 2.5 feet below the ground, and the sand becomes medium-dense to dense at approximately 3 to 4 feet. From our several probings around the perimeter of the existing residence, it appears that the top of the footing of the residence varies from approximately 18 to 30 inches below the existing ground surface. Based on this information, and assuming the footings are 6 inches deep (thus 24 to 36 inches below the ground surface), it appears that the existing footings bear on or very near the medium-dense sand soil. The footings, which generally appear to be about 14 inches wide based on the probings and an assumption that the existing foundation wall is 6 inches wide, can be reused if desired provided a relatively low bearing capacity (provided in the ***Conventional Footing Foundation*** section of this report) is used in the structural design of these existing footings. New footings are also suitable for new structures of the project, although they should bear on the slightly deeper, medium-dense to dense sand. New footings can be designed for a higher bearing capacity, also as noted in the ***Conventional Footing Foundation*** section of this report.

As noted earlier, based on Mercer Island's GIS portal, there are two designated Geologic Hazard Areas at property; these are located at/near the slopes/rockeries on the eastern and western portions of the site. The nearly flat central portion of the site is not a Hazard Area. A Critical Areas discussion of these areas is given in the subsequent section of this report.

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.

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.

CRITICAL AREAS STUDY (MICC 19.07)

As noted in the ***General*** section above, there are two mapped Geologic Hazard Areas at the site. A discussion of each Area is given below:

Potential Landslide Hazard Area:

Under 19.16.010 of the Mercer Island City Code, a Landslide Hazard is defined as:

Those areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors, including:

1. *Areas of historic failures;*
2. *Areas with all three of the following characteristics:*
   a. *Slopes steeper than 15 percent; and*
   b. *Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and*
   c. *Springs or ground water seepage;*
3. *Areas that have shown evidence of past movement or that are underlain or covered by mass wastage debris from past movements;*
4. *Areas potentially unstable because of rapid stream incision and stream bank erosion; or*
5. *Steep slope. Any slope of 40 percent or greater calculated by measuring the vertical rise over any 30-foot horizontal run.*

Of the above criteria, the only one that applies to the site is 5.; this is at the slope/rockery on the southwestern side of the site. None of the other criteria apply to the site; there is no evidence of historic or past landslide movements, no springs or groundwater seepage, and no rapid stream incision or stream bank erosion.

With regard to the steep slope/rockeries area at the southwestern corner of the property (5.), we strongly believe that the lower rockery was placed in an excavated location and is adjacent to the native, medium-dense and denser sand soil. The small upper rockery is likely supporting fill soil. The residence is founded on the medium-dense sand (no fill) that is at least 2 feet below the ground, and all new building loads (including the proposed patio) will be founded on medium-dense to dense soil as recommended in this report, thus the foundations do/will bear on competent sand soil below the base of the small rockery; thus the small rockery does not provide any stability for the residence and patio structures, and these structures will have no effect on the stability of the small rockery. The residence is set back about 25 feet from the top of the 9-foot-tall base rockery that is adjacent to competent sand soil, while the patio will be set back about 15 feet. As noted earlier, this rockery appears to be in a stable condition and supports competent sand. The only significant potential of instability would potentially be during an MCE seismic event. However, based on the setback distances, it is our professional opinion that this potential rockery failure would not affect stability of the existing and new structures on the property. Therefore, it is our opinion that no buffers or setbacks are required for the project other than what is currently proposed, provided the recommendations presented in this report are followed. In addition, no adverse conditions will be made on the property or on adjacent properties if the recommendations in this report are followed.

Erosion Hazard: The site also meets the City of Mercer Island's criteria for an Erosion Hazard Area. However, the work areas for the proposed work are located where only flat to gently sloped areas and excavations for the project will not be substantial. Thus, typical erosion control measures will be very suitable to suitably control the potential of erosion. 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. A wire-backed silt fence should be erected on the downslope, western side of the property, and the existing vegetation should be left in-place where possible. Straw wattles may also be used in tandem with the silt fence as needed. Also, any soil stockpiles should be covered with plastic during wet weather. Soil stockpiles should be minimized. 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. The existing driveway can be used as a construction entrance, but any loose soil that reaches the driveway needs to be cleared ASAP.

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:

It is our professional opinion that the recommendations presented in this report for the proposed project will render the development as safe as if it were not located in a Geologically Hazardous Area and will not adversely impact adjacent properties.

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 1.46g and 0.51g, 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 0.69g. The soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE because of their dense nature and/or the absence of near-surface groundwater.

Sections 1803.5 of the IBC and 11.8 of ASCE 7 require that other seismic-related geotechnical design parameters (seismic surcharge for retaining wall design and slope stability) include the potential effects of the Design Earthquake. The peak ground acceleration for the Design

Earthquake is defined in Section 11.2 of ASCE 7 as two-thirds (2/3) of the MCE peak ground acceleration, or 0.46g.

CONVENTIONAL FOOTING FOUNDATIONS

As noted earlier in this report, the existing footings can be used to support loads of the proposed residence project. However, a low bearing capacity of 2,000 psf should be used in the design of these footings. Where new footings are needed, they should bear on undisturbed, medium-dense to dens, native sand. An allowable bearing pressure of 3,000 pounds per square foot (psf) is appropriate for the new footings. A one-third increase in this design bearing pressure may be used when considering short-term wind or seismic loads. 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.

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	0.50
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 *	35 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.50
Soil Unit Weight	120 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. 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, 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 lateral pressure. The recommended seismic surcharge pressure for this project 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. If the native sand is used as backfill, drainage composite similar to Miradrain 6000 should be placed against the backfilled retaining walls. The drainage composites 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 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.

The ***General***, ***Slabs-On-Grade***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

SLABS-ON-GRADE

The building floors can be constructed as slabs-on-grade atop firm native sand or on structural fill. 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.

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.

The ***General***, ***Permanent Foundation and Retaining Walls***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

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. 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.

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 sand 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.

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 are only needed 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. 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.

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 and garage 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 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	92%
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 pit 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 pit. 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 Izabela Tekiela and her 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.

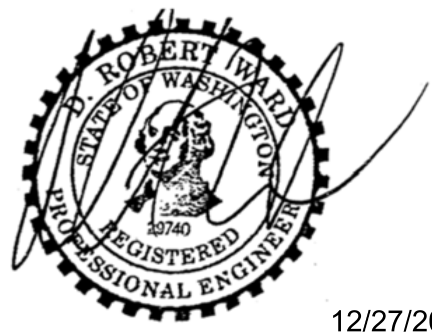
The following plates are attached to complete this report:

Plate 1	Vicinity Map
Plate 2	Site Exploration Plan
Plates 3 - 4	Test Pit and Test Hole Logs

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.

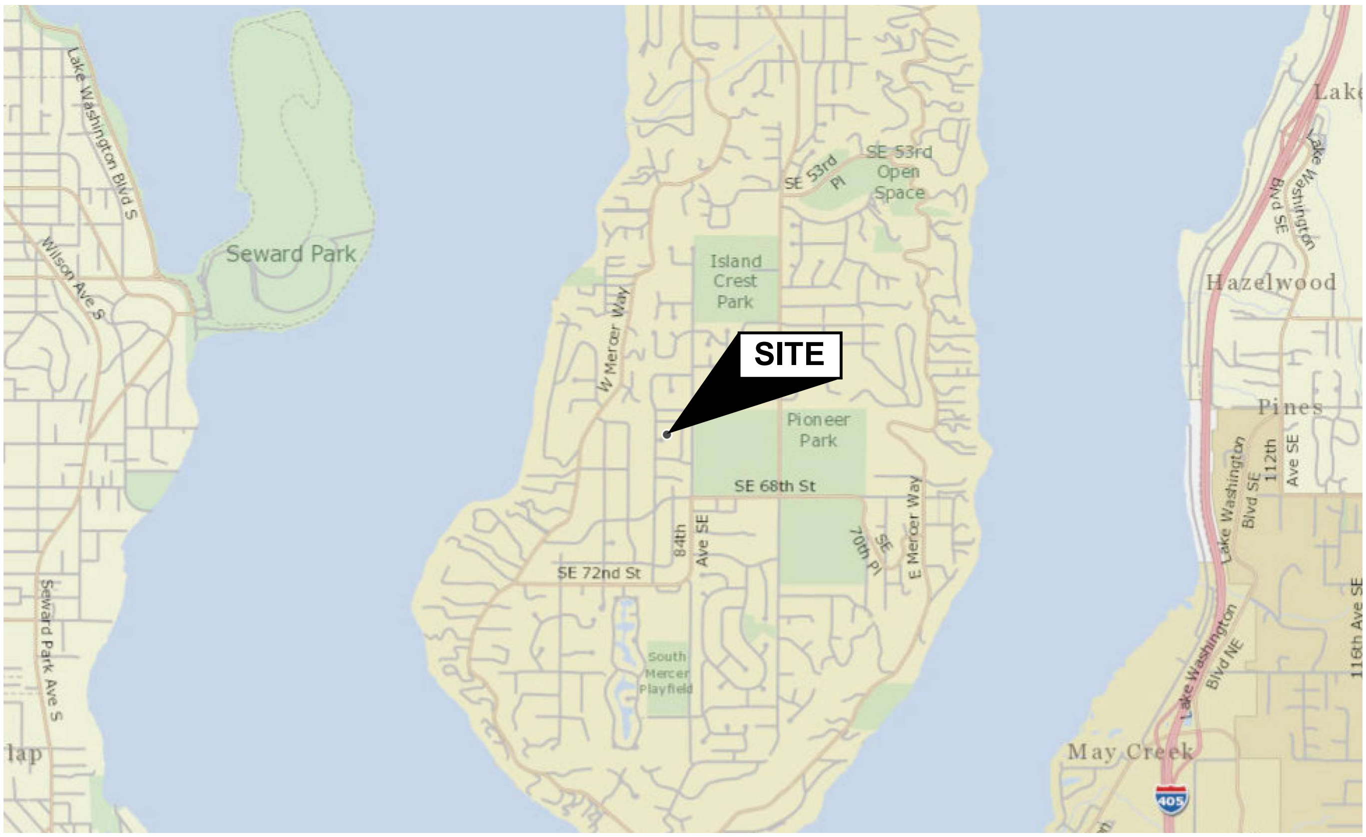


12/27/2023

D. Robert Ward, P.E.
Principal

DRW:kg

NORTH



(Source: King County iMap)

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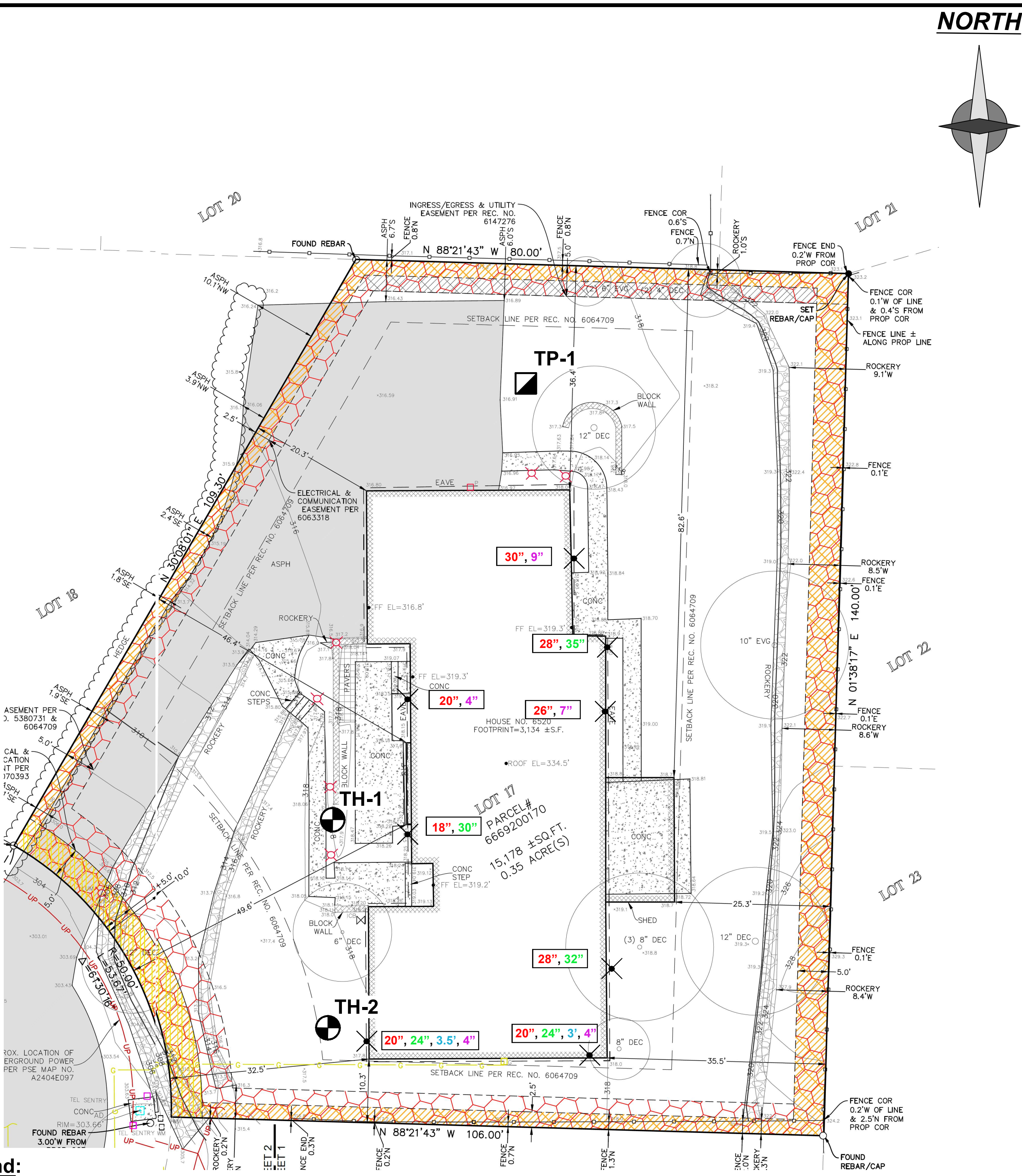
VICINITY MAP

6520 - 82nd Avenue Southeast
Mercer Island, Washington

Job No:	Date:		Plate:
23413	Dec. 2023		1



Legend:

- Test Pit Location
- Test Hole Location
- Probe Location

- XX Depth to Top of Footing
- XX Approx. Depth to Medium-Dense Soils
- XX Approx. Depth to Medium-Dense to Dense Soils
- XX Approx. Footing Width Outside of Foundation Wall

GEOTECH CONSULTANTS, INC.

SITE EXPLORATION PLAN

6520 - 82nd Avenue Southeast
Mercer Island, Washington

Job No:	Date:		Plate:
23413	Dec. 2023	No Scale	2

TEST PIT 1

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				Topsoil
				Brown SAND with roots, fine-grained, moist, loose
				-becomes gray-brown to brown mottled orange, with slightly silty seams, medium-dense
				-becomes gray, medium-dense to dense
5			SP	-with thin, fine to coarse-grained gravelly lenses, becomes dense
10				

*** Test Pit terminated at 10 feet on December 15, 2023.**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

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TEST PIT LOG

6520 - 82nd Avenue Southeast
Mercer Island, Washington

Job No:	Date:		Plate:
23413	Dec. 2023		3

TEST HOLE 1

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				Topsoil
			SP	Brown mottled orange, SAND with roots, fine-grained, moist, loose
				-becomes gray-brown to brown, medium-dense
				-becomes gray, medium-dense to dense
5				
10				

* **Test Hole terminated at 4.5 feet on December 15, 2023.**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

TEST HOLE 2

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				Topsoil
				Brown to gray-brown SAND with roots, fine-grained, moist, loose to medium-dense
			SP	-becomes gray, medium-dense
				-becomes medium-dense to dense
5				
10				

* **Test Hole terminated at 5 feet on December 15, 2023.**
* **No groundwater seepage was observed during excavation.**
* **No caving was observed during excavation.**

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TEST HOLE LOGS

6520 - 82nd Avenue Southeast
Mercer Island, Washington

Job No:	Date:		Plate:
23413	Dec. 2023		4