CITY OF MERCER ISLAND

COMMUNITY PLANNING & DEVELOPMENT
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Geologic Hazard Areas

Requirements for a Statement of Risk by the Geotechnical Engineer.

Per Section 19.07.060.D.2 of the Mercer Island City Code, development within geologic hazard areas require that a Geotechnical Engineer licensed within the State of Washington provide a statement of risk with supporting documentation indicating that one of the following conditions can be met:

a. The geologic hazard area will be modified, or the development has been designed so that the risk to the lot and adjacent property is eliminated or mitigated such that the site is determined to be safe; or

b. An evaluation of site specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area; or

c. Development practices are proposed for the alteration that would render the development as safe as if it were not located in a geologic hazard area; or

d. The alteration is so minor as not to pose a threat to the public health, safety and welfare.

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March 22, 2021

JN 21122

Shelly and Jamie Johnson
4907 East Mercer Way
Mercer Island, Washington 98040
via email: shellylynnjohnson@gmail.com

Subject: **Geotechnical Engineering Study**
Proposed Garage Addition Project
8456 North Mercer Way
Mercer Island, Washington

Greetings:

We are pleased to present this geotechnical engineering report for the proposed garage addition project on Mercer Island. The scope of our services consisted of exploring site surface and subsurface conditions, reviewing previous explorations done on the site, and then developing this report with regards to the requirements of Mercer Island code.

Based on a site plan provided to us, we understand that an approximate 13-foot by 21-foot addition is proposed onto the western side of an existing garage. This area is relatively flat, and we anticipate that the slab of the garage will be similar to both the existing garage slab grade and the existing ground elevation. The southern side of the garage will be located approximately 16 to 20 feet from a steep slope that exists to the south.

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 site is located in the east-central portion of Mercer Island. A large majority of the property is oddly shaped and bordered to the east by the right-of-way of East Mercer Way. However, there is a long “panhandle” on its northwestern side that allows for driveway access to East Mercer Highlands. The center of the site is relatively flat. A residence, garage, and drive court area are located within this center area. However, the center is essentially on a knoll, as steep slopes decline to the north, south, and east from it. A smaller steep slope rises about 10 feet above the western side.

The proposed garage will be located on the western side of flat center portion of the site, adjacent to the western side of an existing detached garage. The ground to the north and east of the proposed garage area is nearly flat. However, a few feet to the west of the proposed garage is a steep slope, inclined at about 80 percent, that is about 8 to 10 feet tall; it is very apparent to us that this slope was oversteepened by a past excavation. This steep western slope is only lightly vegetated. In addition to this western slope, there is a southern steep slope located about 16 to 20 feet south of the proposed garage. The inclination of this slope is in the range of 45 to 50 percent and its height is in the range of 25 feet. This southern slope is heavily vegetated.

Research conducted on the City of Mercer Island GIS Mapping Portal indicates that the subject site is mapped as having several Critical Areas. They included a Potential Landslide Hazard Area, an Erosion Hazard Area, and a Potential Seismic Hazard Area. No Steep Slope Hazard Areas exist on the site, but are located south of the site near North Mercer Way. These Steep Slope Hazard Areas are about 25 feet tall and located at least 70 feet from the proposed additions; they are located near North Mercer Way.

SUBSURFACE

We obtained the log of the test boring done approximately 45 to 50 feet east/southeast of the proposed garage location. This test boring was done in 2001 for an addition done to the residence in approximately 2002. To supplement the information in the test boring, we observed the soil conditions in a test hole excavated at the southwestern portion of the proposed garage. The locations of both the test boring and recent test hole are shown on the attached Site Exploration Plan. The log of the test boring is also attached with this report.

The test boring, drilled on a sloping area south and downslope of the residence, revealed approximately 4 feet of loose fill soil overlying native silty sand soil. The native soil was initially in a medium-dense condition, but at 7 feet became very dense. The test hole, excavated where it appears a past excavation was made (as noted above), revealed the very dense silty sand soil was revealed within one foot of the ground surface. No groundwater was revealed in either the test boring or test hole.

CONCLUSIONS AND RECOMMENDATIONS, AND CRITICAL AREAS INFORMATION

The recent test hole and the previous test boring drilled on the site clearly indicate that the core soil of the site is very dense, native silty sand soil. This soil was revealed at a very shallow depth in the test hole that was located near the southwestern corner of the proposed garage. It is our opinion that conventional footings can be used as the foundation of the proposed garage provided they bear on the very dense soil.

As noted earlier, an oversteepened slope exists just to the west of the proposed garage. We understand that a concrete wall is proposed against the slope in order to maintain a walkway between the slope and the proposed garage. We recommend that the wall be designed so that a new 2:1 (Horizontal:Vertical) slope can be constructed above the wall.

Discussion of Critical Areas (MICC 19.07)

As noted above, per the Mercer Island GIS, the site is shown to be in an Erosion Hazard Area and potentially located in a Seismic Hazard and Landslide Hazard Area. No Steep Slope Hazard Areas are located on the site, but are located on adjacent properties. A discussion of specific hazard areas is given below.

Erosion Hazard Area: All slopes that are steeper than 15 percent meet the City of Mercer Island's criteria for an Erosion Hazard Area. No buffers are needed per the MICC for Erosion Hazard Areas, nor do we believe any are needed for this project. Excavation and construction of the project can readily be accomplished without adverse to the site and surrounding properties by exercising care and being proactive with the maintenance and potential upgrading of the erosion control system through the entire construction process. Proper erosion control implementation will be important to prevent adverse impacts to the site and neighboring properties. The temporary erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered during the site work. One of the most important considerations, particularly during wet weather, is to immediately cover any bare soil areas to prevent accumulated water or runoff from the work area from becoming silty in the first place. Any cut slopes and soil stockpiles should be covered with plastic during wet weather. Soil stockpiles should be minimized. The southern steep slope is well away from the proposed garage area and will not be disturbed, thus no erosion control measures are needed there; however, a silt fence should be placed upslope of the top of the southern slope to protect it.

Landslide Hazard Areas: There area several criteria for being a Landslide Hazard Area based on the MICC. The first of several criteria are as follow:

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.

In our professional opinion, none of these criteria in the area of the proposed garage project are met.

There is a fifth criteria with regards to Landslide Hazard areas: Any slope that is 40 percent or greater measured over a 30-foot horizontal run (Steep Slope). As noted earlier, there is an approximate 10-foot-tall Steep Slope on the western side of the proposed garage, while about 16 to 20 to the south of the garage is another Steep Slope that is approximately 25 feet tall and inclined between 45 to 55 percent. Because the core of the site is very dense soil, the only potential type of landslide that could occur is shallow (involving on the out 2 to 24 inches of site slopes). Based on MICC 19.07.160, For Steep Slope Landslide Hazard Areas whose only potential is shallow landslide, this default buffer 25 feet. However, an “alteration” to this default buffer so that less than 25 feet can be used. For the steep southern slope, the garage is proposed about 16 to 20 feet from the top of the slope, while for the steep western slope, a new retaining wall is proposed right at the toe of the slope. We strongly believe that if the recommendations contained in this letter are followed, the project and surrounding areas will be very stable. However, the MICC requires further discussion about alterations. The specific notation from the MICC for an alteration is given below (bolded), followed by our responses in italics.

An alteration of a landslide hazard area and associate buffers may occur if the proposed alteration:

a. **Will not adversely impact other critical areas.** *Other nearby critical areas are steep slopes located at least 50 feet east and north of the garage area (the other two sides of the flat center portion of the site). This project will in no way impact those because of the very dense soil in the new garage area and site, and the distance they are located from the new garage area.*

b. **Will not adversely impact the subject property or adjacent properties.** *Because the footings for the new garage will be founded on the very dense, core soil, and/or a retaining wall is proposed at the base of the western slope, it is our professional opinion that the project will definitely not adversely impact the subject site or any adjacent sites.*

c. **Will mitigate impacts to the geologically hazard area consistent with best available science to the maximum extent reasonably possible such that the site is determined to be safe.** *Based on the soils revealed in the onsite explorations (core soils are very dense) and our professional geotechnical engineering evaluation of the project, we strongly believe the project is very safe.*

d. **Includes the landscaping of all disturbed areas outside of building footprints and installation of hardscape prior to final inspection.** *The only real disturbance for this project will be on the western side of the garage where a retaining wall is proposed. We understand that landscaping and hardscaping are proposed there to satisfy this requirement.*

An alteration of landslide hazard areas and associated buffers may occur if statement of risk is provided. *A statement of risk is provided in a subsequent section at the bottom of this page.*

Potential Seismic Hazard: The soils beneath the site are not susceptible to seismic liquefaction under the ground motions of a potential large earthquake because of their dense nature and/or the absence of near-surface groundwater. Because of this, because of the inclusion of the new western retaining wall where there is up-to-a-10-foot-high slope, and because there is only the potential for a shallow landslide of the southern slope, it is our professional opinion that the project does not meet the criterial for a Seismic Hazard as noted in the MICC. We believe the project is very suitable from a geotechnical engineering standpoint provided our recommendations are followed.

Statement of Risk: As noted above, the City of Mercer Island's requirements to obtain an alteration is for a geotechnical statement of risk. As such, we make the following statement:

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

The drainage 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.

CONVENTIONAL FOUNDATIONS

The proposed garage and western retaining wall can be supported on conventional continuous and spread footings bearing on undisturbed, competent, very dense, native sand soil. We recommend that continuous and individual spread footings have minimum widths of 12 and 16 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

An allowable bearing pressure of 4,000 pounds per square foot (psf) is appropriate for footings supported on competent native soil. A one-third increase in this design bearing pressure may be used when considering short-term wind or seismic loads.

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 backfill sloped at a 2:1 (H:V) inclination:

PARAMETER	VALUE
Active Earth Pressure *	45 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.5
Soil Unit Weight	125 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, 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.

<u>Wall Pressures Due to Seismic Forces</u>

The surcharge wall loads that could be imposed by the design earthquake can be modeled by adding a uniform lateral pressure to the above-recommended active pressure. The recommended surcharge pressure is 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.

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

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

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

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

EXCAVATIONS AND SLOPES

Temporary excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Also, temporary cuts should be planned to provide a minimum 2 to 3 feet of space for construction of foundations, walls, and drainage. Temporary cuts to a maximum overall depth of about 4 feet may be attempted vertically in unsaturated soil, if there are no indications of slope instability. However, vertical cuts should not be made near property boundaries, or existing utilities and structures. It is important that vertical cuts not be made at the base of sloped cuts. Based upon Washington Administrative Code (WAC) 296, Part N, the soil at the subject site would generally be classified as Type A. Therefore, temporary cut slopes greater than 4 feet in height should not be excavated at an inclination steeper than 0.75:1 (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 slopes in the development area should be inclined no steeper than 2.5:1 (H:V). Water should not be allowed to flow uncontrolled over the top of any temporary or permanent slope. All permanently exposed slopes should be seeded with an appropriate species of vegetation to reduce erosion and improve the stability of the surficial layer of soil.

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

DRAINAGE CONSIDERATIONS

Footing drains or weep holes should be used for the subsurface drainage of the western retaining wall. The drains, consisting a rigid, perforated, 4-inch-diameter pipe, 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). If weep holes are used, they should be 2 inches in diameter and spaced at 6-foot centers.

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 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. A discussion of grading and drainage related to pervious surfaces near walls and structures is contained in the ***Foundation and Retaining Walls*** section.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our recent exploration and assume that the soil and groundwater conditions encountered in the explorations 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 borings. Subsurface conditions can also vary between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

This report has been prepared for the exclusive use of Shelly and Jamie Johnson, 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.

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,

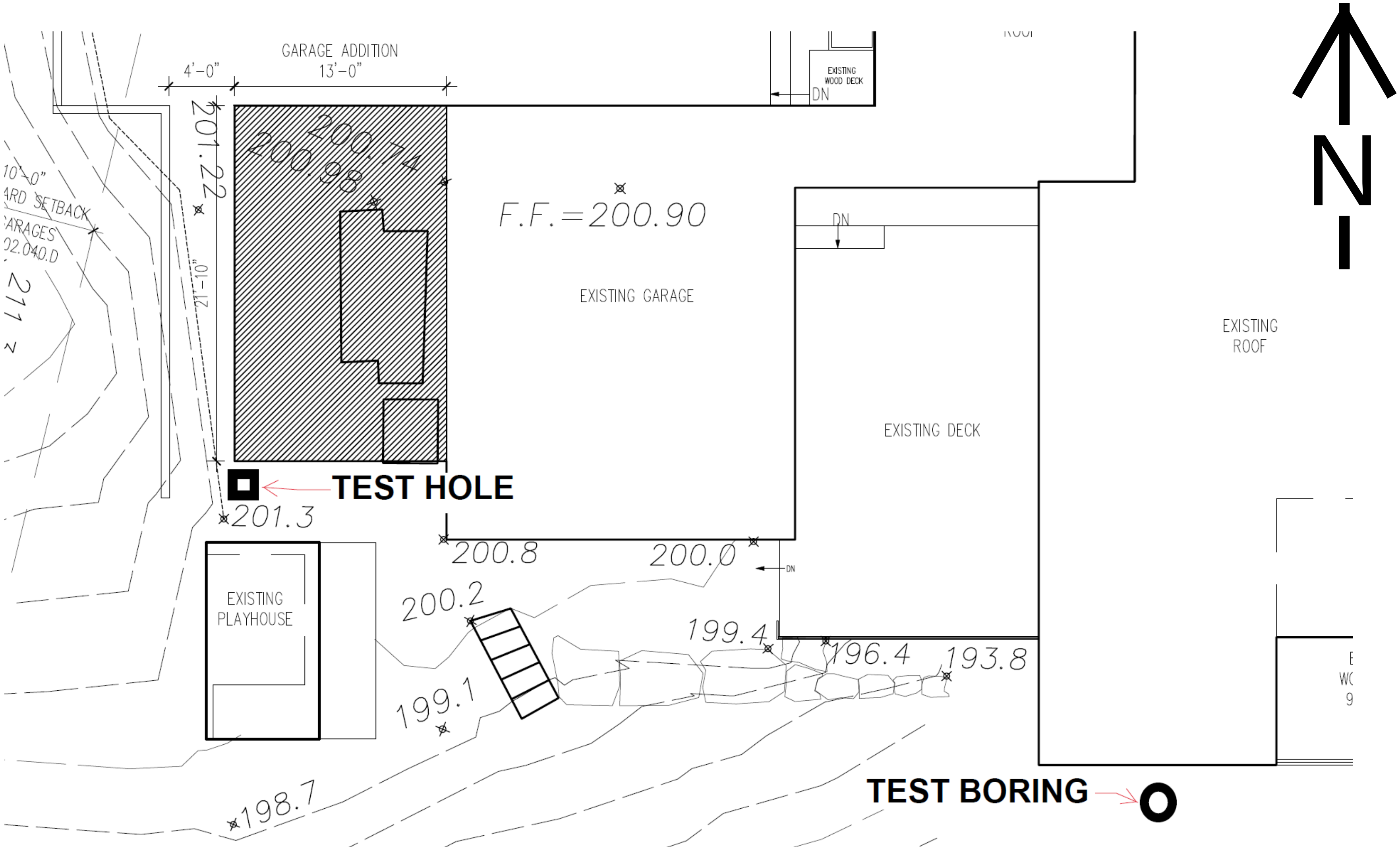
GEOTECH CONSULTANTS, INC.

03/21/21

D. Robert Ward, P.E.
Principal

Attachment: Site Exploration Plan, Test Boring Log

DRW:kg



SITE EXPLORATION PLAN – Test Hole and Test Boring Locations Shown

Boring No. B-1

Logged by: TA

Date: 12/19/01

Approximate Elev. 190

Soil Description	Consistency/ Relative Density	Depth (ft.)	Sample	(N) Blows/ ft.	Moisture Content (%)
Dark brown to brown silty SAND with organics, wet. (SM) (maybe fill) Oxidized stain at 2.5 feet.	Loose			4	22
				7	21
Brown silty SAND, wet. (SM) Occasional gray sand pockets below 5 feet.	Medium Dense	5		25	22
Brown silty SAND with gravel, occasional oxidized stain, moist. (SM)	Very Dense			50	20
		10		50/5"	9
				50/5"	20

Boring terminated at 13 feet.
No groundwater encountered.

Terra Associates, Inc.
Geotechnical Consultants

BORING LOG
PATTERSON RESIDENCE ADDITION
MERCER ISLAND, WASHINGTON

Proj. No. T-5060	Date JAN 2002	Figure 4