GEOTECH
CONSULTANTS, INC.

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December 27, 2018

JN 18581

Sean and Lori Kell
c/o Stillwell Hanson Architects
46 Etruria Street, #200
Seattle, Washington 98109

Attention: Kerry Fitterer
via email: kerry@stillwellhanson.com

Subject: ***Geotechnical Engineering Considerations***
Proposed Addition and Landscape Project
7450 North Mercer Way
Mercer Island, Washington

Dear Ms. Fitterer:

Our firm prepared a geotechnical engineering study in 2005 for a significant remodel and addition project to the then smaller residence. We subsequently made visits to the project site during the remodel and addition work to observe soil conditions. We understand that a new addition and landscape project is proposed for on the northern portion of the property; this area was generally not developed as part of the 2005 residence remodel and addition project. We recently returned to the site to observe conditions in the new project area and observe soil conditions in several test pit. This report is an update to our 2005 study based on our recent observations and also our past involvement on the property. We have attached our 2005 study with this report.

Based on architectural plans prepared by Stillwell Hanson Architects and landscape plans prepared by Anne James, we understand that the new development for the project includes: 1) a covered porch at the northwestern side of the existing residence, 2) a patio/spa at the northeastern side (both 1 and 2 will have finish floor levels the same as the existing residence basement level), 3) a pool north of the patio/spa, and 4) raising the lawn area north of the porch and spa. A retaining wall is needed at the downslope edges of 3 and 4 to retain the soil needed for these developments.

If the scope of the project noted above 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

The subject property is located between North Mercer Way (to south) and Lake Washington. The existing residence, detached garage, and driveway are located on about the southern half (or somewhat more) of the subject property. The northern portion, where the proposed developments are planned, is mostly a grass lawn. This portion slopes gently downward to the north towards the lake.

Two test pits were excavated on the property in 2005 in approximately the area where the new development is proposed. To supplement those test pits, we visited the site on December 20 and observed the soil conditions in 5 additional test pits. The approximate locations of these seven test pits are shown on the attached Site Exploration Plan. The upper, approximate 2 to 4 feet of soil in these test pits consists of loose soils varying from fill to topsoil to native silty sand/sandy silt. Native, competent soil that consisted of medium-dense or dense silty sand or sandy silt was revealed in the test pit beneath these loose upper soils. The depth to these competent soils is shown on the Plan. Standing groundwater was revealed at depths of about 2 to 3 feet in the recent test pits.

Three test holes were hand excavated on the property in preparation of this report. One of test holes was excavated in the eastern portion of the existing northern basement, while the other two test hole were excavated outside of the existing residence. The location of the three test holes is shown on the attached Site Exploration Plan. In the basement test hole, native, dense sand was revealed below the existing slab. The sand at that location was quite coarsely grained directly under the slab, but at about 1-foot down it became very fine grained. In the outside test holes, below a thin layer of topsoil, the native fine-grained sand was revealed. The sand was mostly loose to medium-dense near the ground surface, but below about 3 to 3.5 feet, the sand became dense.

CONCLUSIONS AND RECOMMENDATIONS

As noted above, competent native soil, medium-dense/dense silty sand and sandy silt soil, was revealed in the seven test pits located in the area of proposed development on the northern side of the site. Recommendations for foundation and retaining walls are provided in the 2005 study, and it is our professional opinion that these recommendations are still valid. The new foundations and retaining walls should bear on the competent native soil or on structural fill placed on the competent native soil. However, due to the groundwater revealed in the recent test pits, we recommend that at least 6 inches of imported, clean, crushed rock be placed on the competent native soil to protect the competent native soil during the excavation process and to raise the foundation subgrade level above the level of the groundwater. All structural fill placed at or below the groundwater level should be this crushed rock, but structural fill placed above the groundwater level can be less clean and of lesser quality, provided it can be compacted to 95 percent.

We appreciate the opportunity to be of service on this project. If you have any questions, or if we may be of further service, please do not hesitate to contact us.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

D. ROBERT WARD
STATE OF WASHINGTON
29740
REGISTERED
PROFESSIONAL ENGINEER

D. Robert Ward, P.E.
Principal

12/27/18

Attachment: 2005 Geotechnical Engineering Study
Site Exploration Plan

DRW:kg

GEOTECH
CONSULTANTS, INC.

13256 Northeast 20th Street, Suite 16
Bellevue, Washington 98005
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May 27, 2005

JN 05205

Scott and Jane Moffitt
7450 Southeast 22nd Street
Mercer Island, Washington 98040

Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed Moffitt Residence
7450 Southeast 22nd Street
Mercer Island, Washington

Dear Mr. and Mrs. Moffitt:

We are pleased to present this geotechnical engineering report for your proposed residence to be constructed in Mercer Island. The scope of our services consisted of exploring site surface and subsurface conditions, and then developing this report to provide recommendations for general earthwork and design criteria for foundations and retaining walls. This work was authorized by your acceptance of our proposal, P-6700, dated March 14, 2005.

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: **Stillwell Architects** – Craig Stillwell

GDB/DRW: esn

GEOTECHNICAL ENGINEERING STUDY
Proposed Moffitt Residence
7450 Southeast 22nd Street
Mercer Island, Washington

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

We were provided with a preliminary site plan showing the general footprint of the proposed residence. Stillwell Architects prepared this plan, which is dated March 1, 2005. Based on this plan, we understand that the existing residence will be demolished and replaced with a new, larger residence. The L-shaped residence will be set back at least 7.5 feet from the eastern and western property lines, respectively. Cuts of up to 8 feet are anticipated to reach the planned excavation bottom on the southern side of the residence. The northern side of the residence will daylight toward Lake Washington. No new development is planned on the northern half of the property adjacent to Lake Washington.

If the scope of the project changes from what we have described above, we should be provided with revised plans in order to determine if modifications to the recommendations and conclusions of this report are warranted.

SITE CONDITIONS

SURFACE

The Vicinity Map, Plate 1, illustrates the general location of the site on the northern tip of Mercer Island. The trapezoidal-shaped site occupies approximately 60 feet of frontage on its southern side along Southeast 22nd Street and is approximately 380 feet long. Lake Washington is located at the northern end of the site. From the high, southern portion of the property, the ground generally slopes at a gentle rate to the north towards Lake Washington, with a maximum topographic relief of 30 feet. Access to the property is by way of a driveway that extends into the property from its southeast corner. The property is currently developed with a one-story, single-family residence that includes a basement. The northern and southern portions of the subject property contain yards or landscaping. Jane Moffitt met us at the subject property during our explorations. Based on conversations with Mrs. Moffitt, we understand that the existing house was built in 1931. In addition, we were informed that some recent foundation repair took place on the northwestern corner of the residence. Numerous vertical and diagonal foundation cracks were observed on the foundation walls during our site visit.

Two-story, single-family residences border the property to the east and west. These houses are generally set back 5 and 10 feet from the eastern and western property lines of the subject property, respectively.

SUBSURFACE

The subsurface conditions were explored by excavating four test pits at the approximate locations shown on the Site Exploration Plan, Plate 2. Our exploration program was based on the proposed construction, anticipated subsurface conditions and those encountered during exploration, and the scope of work outlined in our proposal.

The test pits were excavated on May 19, 2005, with a rubber-tired backhoe. A geotechnical engineer from our staff observed the excavation process, logged the test pits, and obtained representative samples of the soil encountered. "Grab" samples of selected subsurface soil were collected from the backhoe bucket. The Test Pit Logs are attached to this report as Plates 3 and 4.

Soil Conditions

The upper soils encountered in the test pits generally consisted of 1 to 5 feet of topsoil and loose fill soils. Underlying these loose soils was medium-dense, non-plastic silt that became dense from 5 to 6 feet below existing grade. These dense soils were encountered to the maximum explored depth of the test pits of 7 to 7.5 feet below existing grade. All test pits were excavated until the native soils were difficult to excavate using the backhoe.

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

Some perched groundwater seepage was observed at a depth of 4 feet in Test Pit 2, although the test pits were left open for only a short period of time. Therefore, the seepage levels (or lack of seepage) on the logs represent the location of transient water seepage and may not indicate the static groundwater level. It should be noted that groundwater levels vary seasonally with rainfall and other factors. We anticipate that groundwater could be found in perched on the denser silt soil, especially during the wet winter and spring months.

The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. The relative densities and moisture descriptions indicated on the test pit logs are interpretive descriptions based on the conditions observed during excavation.

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

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The test pits conducted for this study encountered medium-dense to dense native silt soil within 1 to 5 feet of existing grade. It is our opinion that the proposed residence can be supported on a conventional foundation bearing on this competent native silt. Some minor overexcavation may be needed to reach the competent silt, especially on the northern side of the proposed residence.

The on-site soil is extremely silty, and thus is very moisture sensitive. This soil was above its optimum moisture content during our site explorations. It may be necessary to protect bearing surfaces with a layer of crushed rock to limit disturbance to the subgrades during periods of wet weather or if the soil is wet. The on-site soil will not be reusable as structural fill because of its low compacted strengths and high moisture contents. In addition, this type of soil should not be reused as free-draining wall backfill.

The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. While site clearing will expose a large area of bare soil, the erosion potential on the site is relatively low due to the gentle slope of the ground. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. Rocked construction access roads should be extended into the site to reduce the amount of soil or mud carried off the property by trucks and equipment. Wherever possible, trucks should not be allowed to drive off of the rock-covered areas. Existing catch basins in, and immediately downslope of, the planned work areas should be protected with pre-manufactured silt socks. Cut slopes and soil stockpiles should be covered with plastic during wet weather.

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 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.

Per City of Mercer Island Municipal Code, a statement of risk is required for a site, such as this project site, located in a designated "geologic hazard area". As such, the follow statement is made: If the recommendations presented in this report are adhered to, it is our professional geotechnical engineering opinion that the development has been designed so that the risk to the site and adjacent property is eliminated or mitigated such that the site is determined to be safe.

Geotech Consultants, Inc. should be allowed to review the final development plans to verify that the recommendations presented in this report are adequately addressed in the design. Such a plan review would be additional work beyond the current scope of work for this study, and it may include revisions to our recommendations to accommodate site, development, and geotechnical constraints that become more evident during the review process.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

The site is located within Seismic Zone 3, as illustrated on Figure No. 16-2 of the 1997 Uniform Building Code (UBC). In accordance with Table 16-J of the 1997 UBC, the site soil profile within 100 feet of the ground surface is best represented by Soil Profile Type S_D (Stiff Soil). Under the 2003 International Building Code (IBC), the Soil Class would be D. The site soils are not susceptible to seismic liquefaction because of their dense nature.

CONVENTIONAL FOUNDATIONS

The proposed structure can be supported on conventional continuous and spread footings bearing on undisturbed, medium-dense to dense native soil. We recommend that continuous and individual spread footings have minimum widths of 16 and 24 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

An allowable bearing pressure of 3,000 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. 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.

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 structural fill. We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.40
Passive Earth Pressure	300 pcf

Where: (i) pcf is pounds per cubic foot, and (ii) 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. We recommend maintaining a safety factor of at least 1.5 for the foundation's resistance to lateral loading, when using the above ultimate values.

PERMANENT FOUNDATION AND RETAINING WALLS

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

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

Where: (i) pcf is pounds per cubic foot, and (ii) 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.**

The values given above are to be used to design permanent foundation and retaining walls only. It is not appropriate to back-calculate soil strength parameters from the earth pressures and soil unit weights presented in the table. The passive pressure given is appropriate for the depth of level structural fill placed in front of a retaining or foundation wall only. The values for friction and passive resistance are ultimate values and do not include a safety factor. We recommend a safety factor of at least 1.5 for overturning and sliding, when using the above values to design the walls. Restrained wall soil parameters should be utilized for a distance of 1.5 times the wall height from corners or bends in the walls. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

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 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.

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 on-site soils will not be reusable as free-draining wall backfill. 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. 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 to reduce the potential for surface water to percolate into the backfill. The section entitled ***General Earthwork and Structural Fill*** contains 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 build up 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 a specialty 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 existing non-organic native 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. All interior slabs-on-grade must be underlain by a capillary break or drainage layer consisting of a minimum 4-inch thickness of 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. 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 also notes that vapor *retarders*, such as 6-mil plastic sheeting, are typically used. A vapor retarder is defined as a material with a permeance of less than 0.3 US perms per square foot (psf) per hour, 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 plastic sheeting is used under slabs, joints 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 0.00 perms per square foot per hour when tested in accordance with ASTM E 96. Reinforced membranes having sealed overlaps can meet this requirement.

In the recent past, ACI (Section 4.1.5) recommended that a minimum of 4 inches of well-graded compactable granular material, such as a 5/8 inch minus crushed rock pavement base, should be placed over the vapor retarder or barrier for protection of the retarder or barrier and as a "blotter" to aid in the curing of the concrete slab. Sand was not recommended by ACI for this purpose. However, the use of material over the vapor retarder is controversial as noted in current ACI literature because of the potential that the protection/blotter material can become wet between the time of its placement and the installation of the slab. If the material is wet prior to slab placement, which is always possible in the Puget Sound area, it could cause vapor transmission to occur up through the slab in the future, essentially destroying the purpose of the vapor barrier/retarder. Therefore, if there is a potential that the protection/blotter material will become wet before the slab is installed, ACI now recommends that no protection/blotter material be used. However, ACI then recommends that, because there is a potential for slab cure due to the loss of the blotter material, joint spacing in the slab be reduced, a low shrinkage concrete mixture be used, and "other measures" (steel reinforcing, etc.) be used. ASTM E-1643-98 "Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs" generally agrees with the recent ACI literature.

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. Our opinion is that with impervious surfaces that all means should be undertaken to reduce water vapor transmission.

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

Excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Temporary cuts to a 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 water be directed away from temporary slope cuts. The 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 and structural fill slopes 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

We recommend that foundation drains be used at the base of all foundation and earth-retaining walls, including interior walls where unbalanced floors exist. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock and then wrapped in 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, and it should be sloped for drainage. All roof and surface water drains must be kept separate from the foundation drain system. A typical drain detail is attached to this report as Plate 5. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains.

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. Also, an outlet drain is recommended for all crawl spaces to prevent a build up of any water that may bypass the footing drains.

Groundwater was observed during our field work. If seepage is encountered in an excavation, it should be drained from the site by directing it through drainage ditches, perforated pipe, or French drains, or by pumping it from sumps interconnected by shallow connector trenches at the bottom of the excavation.

The excavation and site should be graded so that surface water is directed off the site and away from the tops of slopes. Water should not be allowed to stand in any area where foundations, slabs, or pavements are to be constructed. Final site grading in areas adjacent to a building should slope away at least 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.

GENERAL EARTHWORK AND STRUCTURAL FILL

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

Structural fill is defined as any fill, including utility backfill, placed under, or close to, a building, behind permanent retaining or foundation walls, 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. As discussed in the ***General*** section, the on-site soils are not suitable for reuse as structural fill, due to their high silt and moisture contents.

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. We recommend testing the fill as it is placed. If the fill is not sufficiently compacted, it can 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 relative compactions for structural fill:

LOCATION OF FILL PLACEMENT	MINIMUM RELATIVE COMPACTION
Beneath footings, slabs or walkways	95%
Filled slopes and behind retaining walls	90%

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).

Structural fill that will be placed in wet weather should consist of a coarse, granular soil with a silt or clay content of no more than 5 percent. The percentage of particles passing the No. 200 sieve should be measured from that portion of soil passing the three-quarter-inch sieve.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test pits are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated soil conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking soil samples in test pits. Subsurface conditions can also vary between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

This report has been prepared for the exclusive use of Scott and Jane Moffitt, and their representatives, for specific application to this project and site. Our recommendations and conclusions are based on observed site materials and selective laboratory testing. Our conclusions and recommendations are professional opinions derived in accordance with current standards of practice within the scope of our services and within budget and time constraints. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

The following plates are attached to complete this report:

Plate 1	Vicinity Map
Plate 2	Site Exploration Plan
Plates 3 - 4	Test Pit Logs
Plate 5	Typical Footing Drain Detail

We appreciate the opportunity to be of service on this project. If you have any questions, or if we may be of further service, please do not hesitate to contact us.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

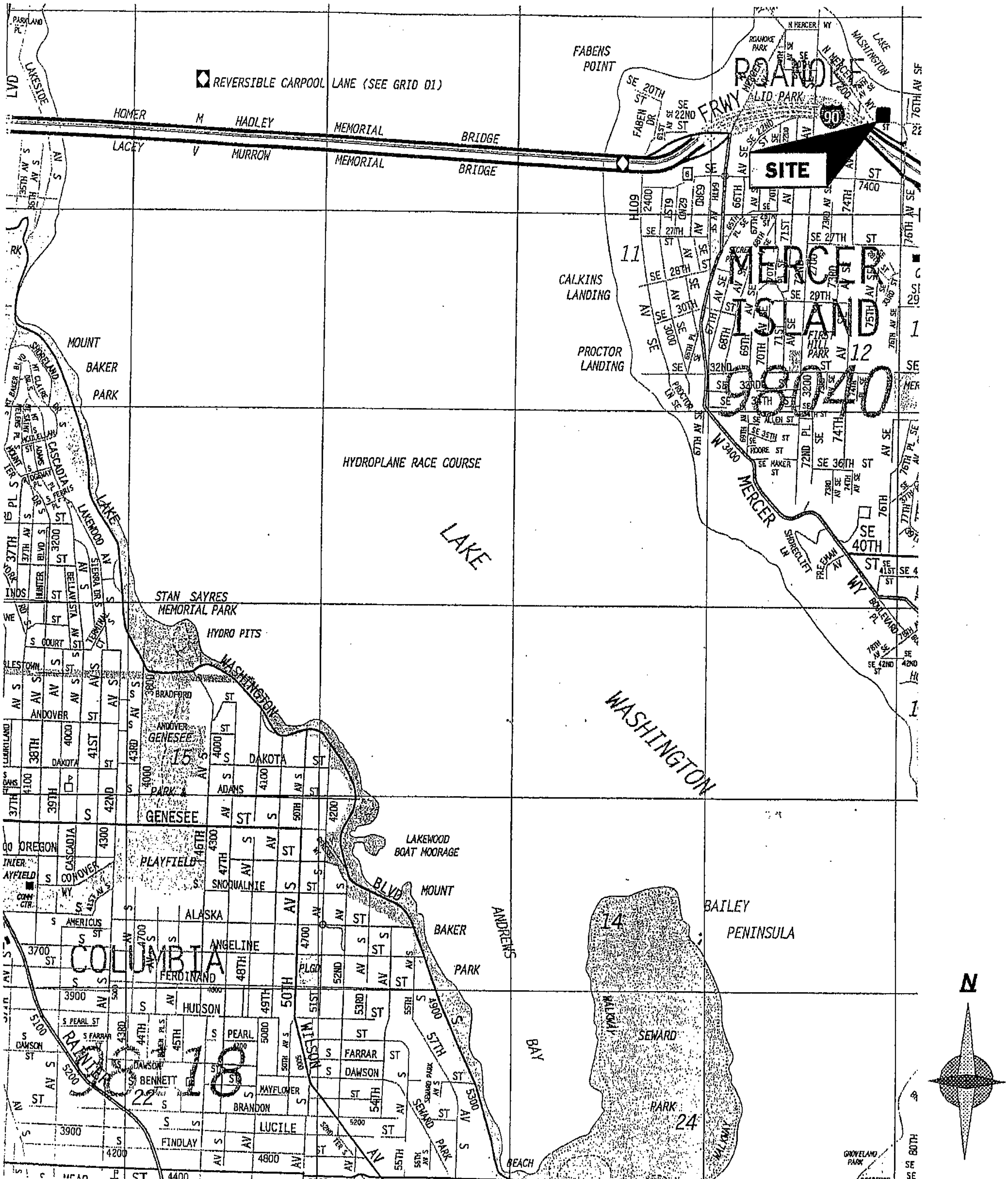
Gerry D. Bautista, Jr.
Geotechnical Engineer

D. ROBERT WARD
STATE OF WASHINGTON
29710
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 10/21/05

5/27/2005

D. Robert Ward, P.E.
Principal

GDB/DRW: esn



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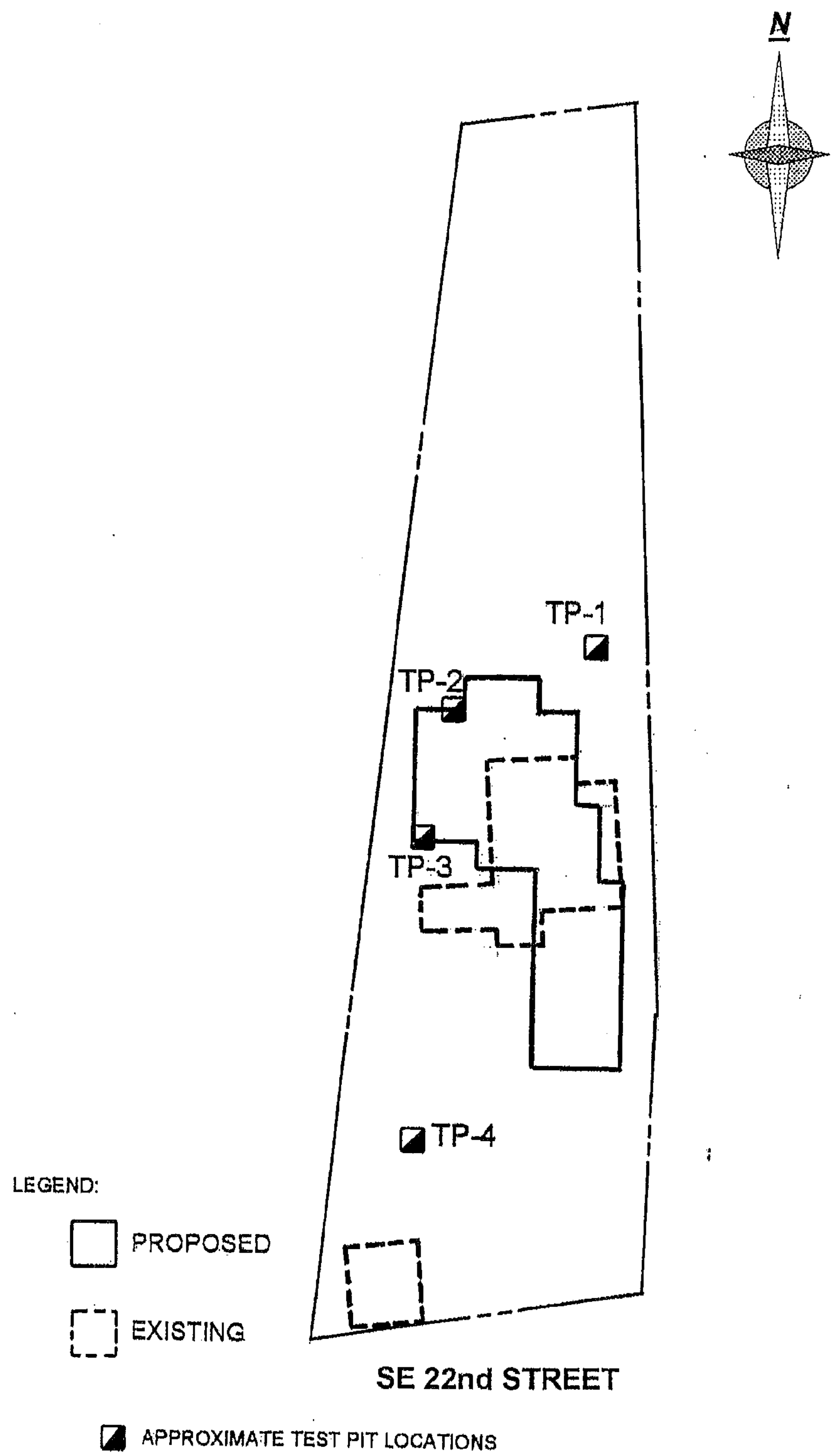
VICINITY MAP

7450 SE 22nd Street
Mercer Island, Washington

Job	Date:	Scale:	Plate:
05205	May 2005	Not to Scale	1



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SITE EXPLORATION PLAN

7450 SE 22nd Street
Mercer Island, Washington

Job	Date:	Scale:	Plate:
05205	May 2005	Not to Scale	2

TEST PIT 1

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				TOPSOIL
			FILL	Gray, silty SAND, fine- to medium-grained, moist, loose (*fill*)
5			ML	Brown SILT, non-plastic, very moist, medium-dense to dense - becomes dense
10				
15				

*** Test Pit was terminated at 7.5 feet on May 19, 2005.**
*** No groundwater seepage was observed during excavation.**
*** No caving was observed during excavation.**

TEST PIT 2

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				TOPSOIL
				Brown, silty SAND, fine- to medium-grained, moist, loose (*fill*)
				Old topsoil
		▼	SP	Brown SAND, fine-grained, very moist, medium-dense
5			ML	Brown, sandy SILT, non-plastic, very moist to wet, medium-dense to dense -becomes gray, dense
10				
15				

*** Test Pit was terminated at 7 feet on May 19, 2005.**
*** Groundwater seepage was observed at 4 feet during excavation.**
*** No caving was observed feet during excavation.**

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TEST PIT LOGS

7450 SE 2nd Street
Mercer Island, Washington

Job No:	Date:	Logged by:	Plate:
05205	May 2005	GDB	3

TEST PIT 3

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Black, silty SAND, fine- to medium-grained, moist, loose (*fill*)
				-Drain rock
			ML	Orange/gray, sandy SILT, non-plastic, very moist, loose to medium-dense
5				-becomes gray, medium-dense
				-becomes dense with fine-grained sand lenses
10				
15				

* Test Pit was terminated at 7.5 feet on May 19, 2005.
* No groundwater seepage was observed during excavation.
* No caving was observed feet during excavation.

TEST PIT 4

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				TOPSOIL
			ML	Orange/gray, sandy SILT, non-plastic, very moist, medium-dense
5				-becomes brown/gray, dense
				-becomes very dense
10				
15				

* Test Pit was terminated at 7 feet on May 19, 2005.
* No groundwater seepage was observed during excavation.
* No caving was observed feet during excavation.

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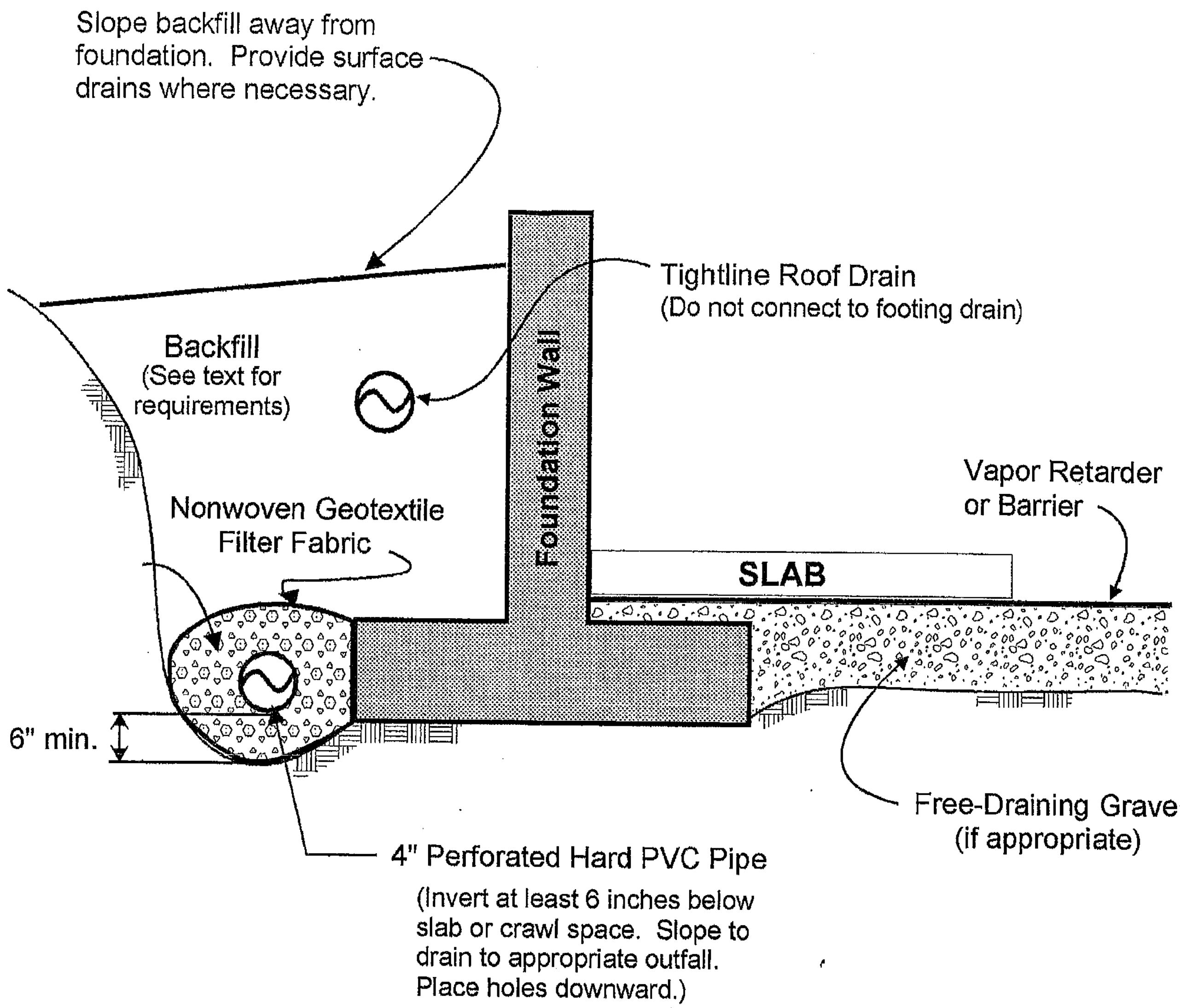
TEST PIT LOGS

7450 SE 22nd Street
Mercer Island, Washington

4

Job No:	Date:	Logged by:	Plate:
05205	May 2005	GDB	



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.

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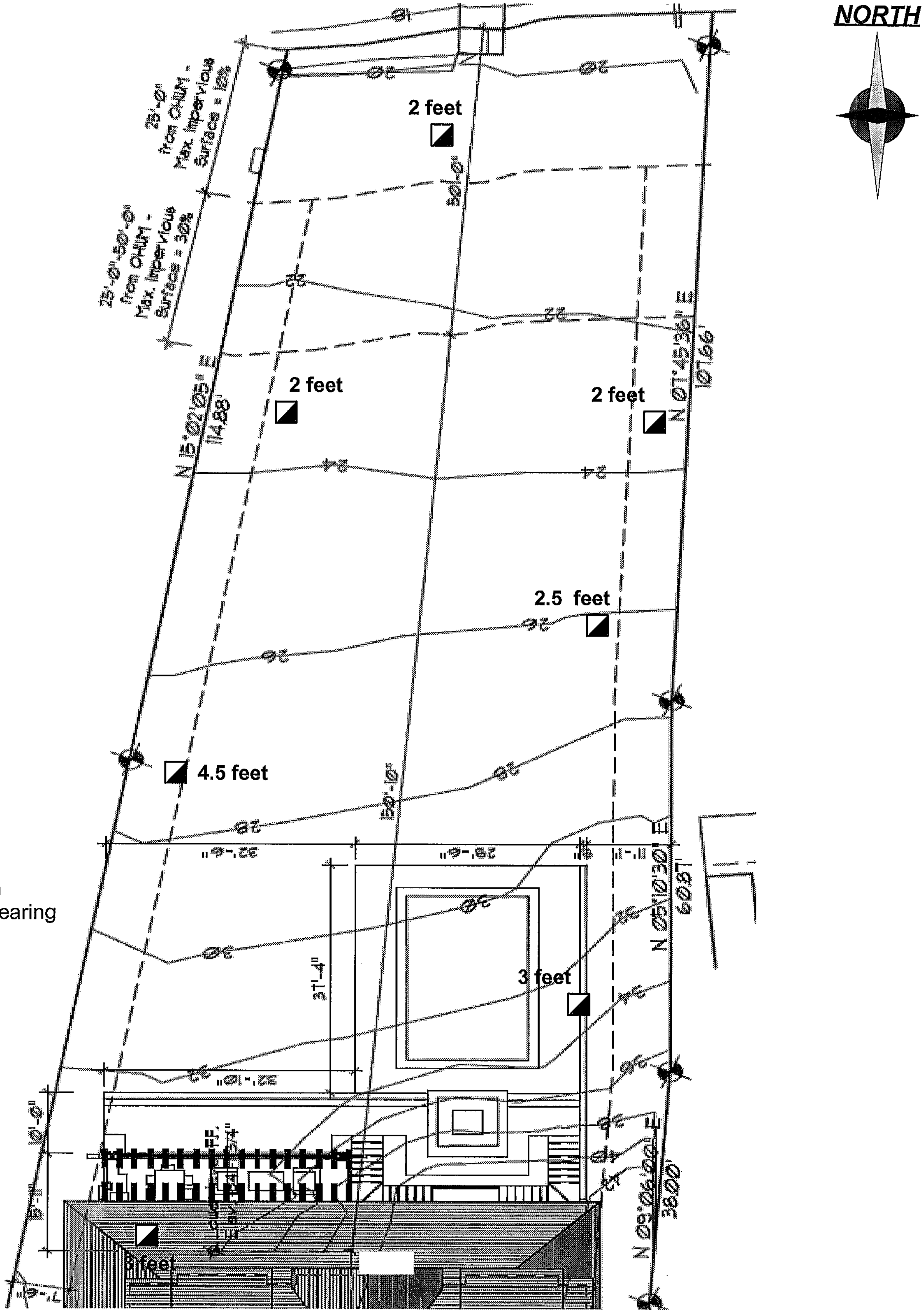
FOOTING DRAIN DETAIL

7450 SE 22nd Street
Mercer Island, Washington

Job	Date:	Scale:	Plate:
05205	May 2005	Not to Scale	5



Legend:

Test Pit Location
3 feet (depth to bearing soil - typ)

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SITE EXPLORATION PLAN

7450 North Mercer Way
Seattle, Washington

Job No:	Date:		Plate:
18581	Dec. 2018	No Scale	2