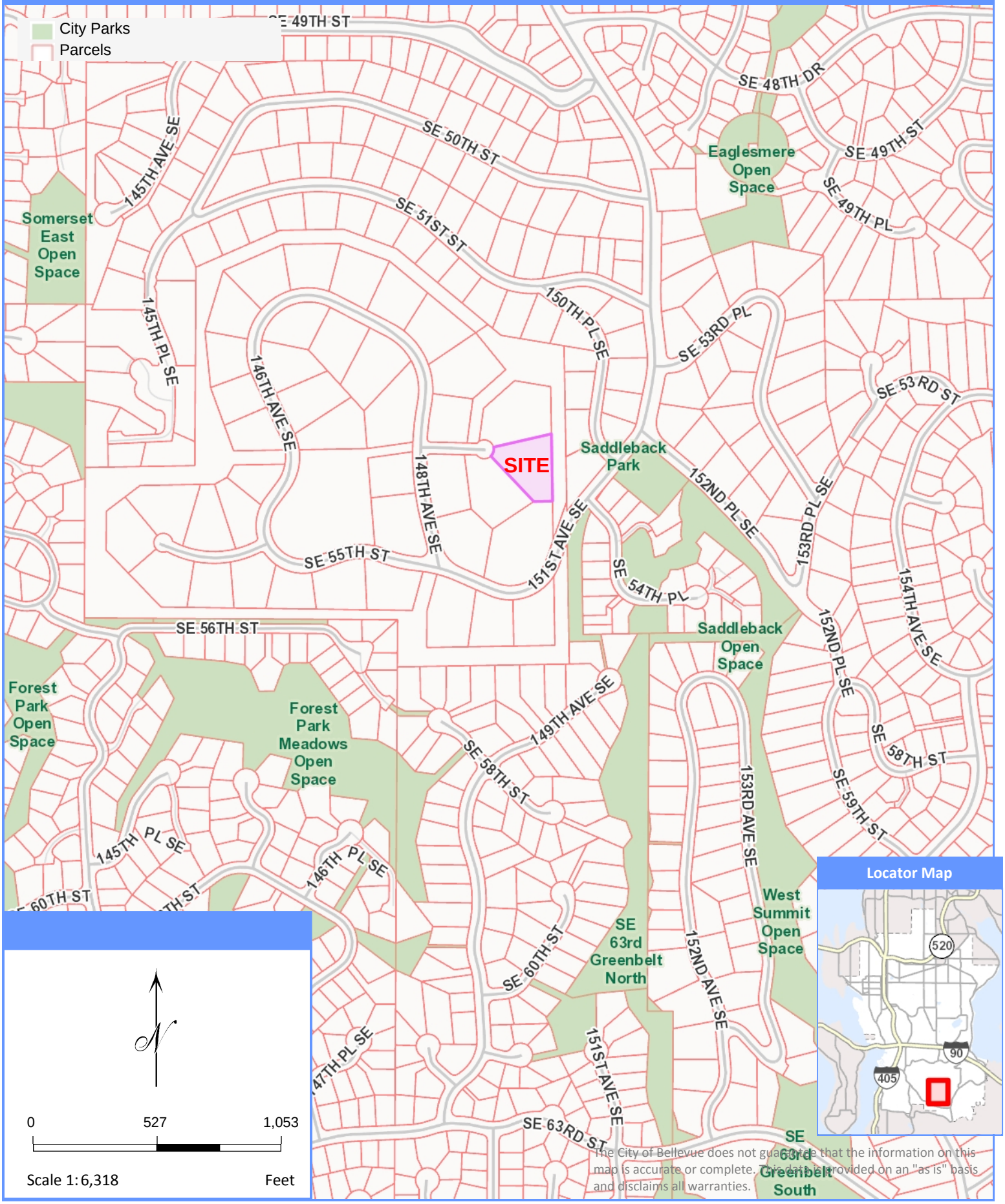
VICINITY MAP



Map Generated on: 09/11/2019

Narrative Description:

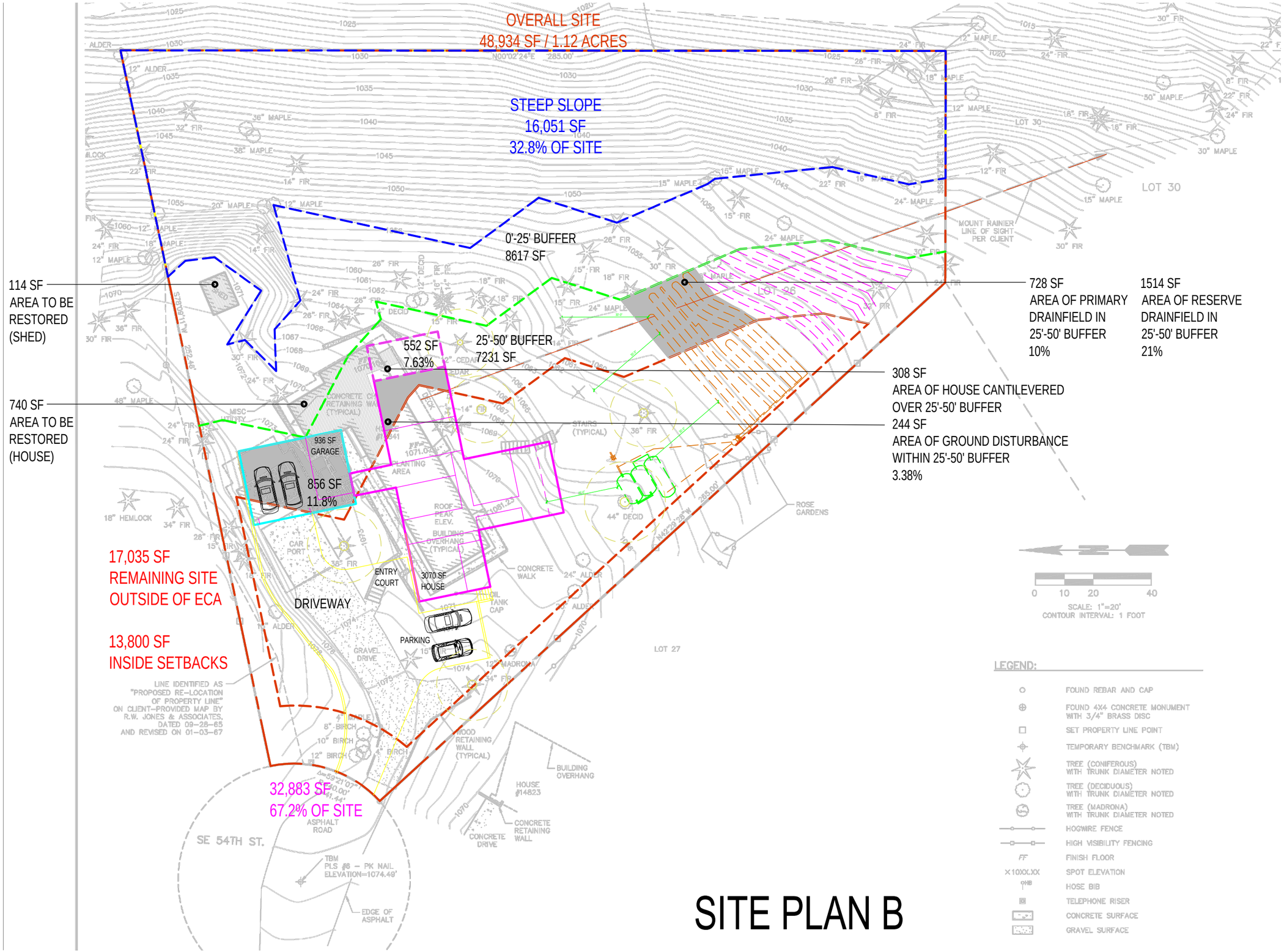
The Project Site address is 14841 SE 54th Street NE in Bellevue, Washington. The Site consists of one King County parcel (Parcel ID 337790-0130), totaling approximately 1-acre in size. The Site is located adjacent to other residential homes in the Hilltop Community neighborhood. The east 1/3 of the property is designated as a steep slope. No wetlands, streams, or other critical areas, including extended buffers, are located on the Site. An existing home is located on site with a small detached garage. A 104 SF shed is also located away from the home, near the top of slope. The Hilltop Community has a sight-line ordinance to protect views of the Cascade Mountain Range and Mount Rainier, however, many significant trees are located throughout the Site. The site plan has gone through several iterations and has been adjusted to preserve as many significant trees as possible while still allowing for a viable project. The footprint of the proposed residence is a similar size as the existing home. The location of the proposed development is further away from the steep slope buffer than the existing residence and associated garage. The location and size of the drain field was determined by a qualified professional and deemed appropriate for a single-family residence of that size.

The steep slope area on the Site constitutes approximately 32.8% of the total area. The remaining buildable area is limited to 17,035 square feet after the 50-foot steep slope buffer and property line setback is applied. It is necessary for the septic drainfield to be located down gradient from the proposed residence to the south, limiting possible configurations of the residence and associated garage. Access to the site is also necessary on the west end of the property, away from the steep slope. After many iterations of the proposed site plan it was determined the current configuration is the best possible approach. The design considers preservation of significant trees and natural vegetation while still maintaining a viable project. The proposed site plan is a more ideal configuration than what is currently in place and is pulled further away from the steep slope. It was determined this is the most feasible approach while still minimizing impacts to the steep slope buffer.

The proposed project will use and follow all best available construction, design, and development techniques to minimize impacts to the steep slope buffer. Performance standards outlined in BLUC 20.25H.125 *Performance Standards – Landslide Hazards and Steep Slopes* will be adhered to. The proposed site plan will be served by adequate public facilities including streets, fire protection, and utilities that are currently utilized by the existing residence.

The project proposes to modify the standard 50-foot buffer width associated with steep slopes. The existing structures on the site already encroach into the steep slope buffer. The proposed design will increase the buffer width slightly from the current condition to construct a new single-family home of similar size. Based on the geotechnical study also provided in this application, it was determined that reducing the buffer to 25-feet is considered safe and stable for the Site while still resulting in no adverse impacts. The proposed design of the residence will preserve as many significant trees and as much native vegetation as possible. The area will then be voluntarily replanted with native vegetation where the existing footprints of structures were located. Impervious surfaces will be reduced from the current condition and will be minimized where possible.

The Critical Areas Report provided in this application determined that no critical areas aside from the steep slope are located on or in the vicinity of the Site. No adverse effect will occur on the Site as a result of the proposed project and a net increase in overall function will be achieved through voluntary mitigation. Significant trees and native vegetation will be preserved to the maximum extent practicable across the entire site. Critical area buffer will be restored where current structures exist, further enhancing the ecological functions.


OVERALL SITE
48,934 SF / 1.12 ACRES
STEEP SLOPE
16,051 SF
32.8% OF SITE
0'-25' BUFFER
8617 SF
25'-50' BUFFER
7231 SF
114 SF
AREA TO BE
RESTORED
(SHED)
740 SF
AREA TO BE
RESTORED
(HOUSE)
552 SF
7.63%
936 SF
GARAGE
856 SF
11.8%
728 SF
AREA OF PRIMARY
DRAINFIELD IN
25'-50' BUFFER
10%
1514 SF
AREA OF RESERVE
DRAINFIELD IN
25'-50' BUFFER
21%
308 SF
AREA OF HOUSE CANTILEVERED
OVER 25'-50' BUFFER
244 SF
AREA OF GROUND DISTURBANCE
WITHIN 25'-50' BUFFER
3.38%
17,035 SF
REMAINING SITE
OUTSIDE OF ECA
13,800 SF
INSIDE SETBACKS
LINE IDENTIFIED AS
"PROPOSED RE-LOCATION
OF PROPERTY LINE"
ON CLIENT-PROVIDED MAP BY
R.W. JONES & ASSOCIATES,
DATED 09-28-65
AND REVISED ON 01-03-67
32,883 SF
67.2% OF SITE
DRIVEWAY
CAR PORT
ENTRY COURT
3070 SF HOUSE
PARKING
GRAVEL DRIVE
CONCRETE WALK
OIL TANK CAP
WOOD RETAINING WALL (TYPICAL)
BUILDING OVERHANG
HOUSE #14823
CONCRETE RETAINING WALL
CONCRETE DRIVE
ASPHALT ROAD
SE 54TH ST.
TBM
PLS #6 - PK NAIL
ELEVATION=1074.49'
EDGE OF ASPHALT
ROSE GARDENS
LOT 30
LOT 26
LOT 27
MOUNT RAINIER
LINE OF SIGHT
PER CLIENT
STAIRS (TYPICAL)
PLANTING AREA
ROOF PEAK ELEV.
BUILDING OVERHANG (TYPICAL)
0 10 20 40
SCALE: 1"=20'
CONTOUR INTERVAL: 1 FOOT
LEGEND:
FOUND REBAR AND CAP
FOUND 4X4 CONCRETE MONUMENT WITH 3/4" BRASS DISC
SET PROPERTY LINE POINT
TEMPORARY BENCHMARK (TBM)
TREE (CONIFEROUS) WITH TRUNK DIAMETER NOTED
TREE (DECIDUOUS) WITH TRUNK DIAMETER NOTED
TREE (MADRONA) WITH TRUNK DIAMETER NOTED
HOGWIRE FENCE
HIGH VISIBILITY FENCING
FF FINISH FLOOR
×10XX.XX SPOT ELEVATION
HB HOSE BIB
TELEPHONE RISER
CONCRETE SURFACE
GRAVEL SURFACE

SITE PLAN B

GEOTECH
CONSULTANTS, INC.

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

March 2, 2018

JN 18019

Alan and Abby Ismond
14841 Southeast 54th Street
Bellevue, Washington 98006
via email: abby@aqua-terraconsultants.com

Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed New Ismond Residence
14841 Southeast 54th Street
Bellevue, Washington

Dear Mr. and Mrs. Ismond:

We are pleased to present this geotechnical engineering report for the proposed reconstruction of your existing residence in the Hilltop neighborhood of Bellevue, 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, slope setbacks, and design criteria for foundations and retaining walls. This report is also intended to address the geotechnical considerations for the City of Bellevue's Critical Area Land Use Permit (CALUP). This work was authorized by your acceptance of our proposal, P-9972, dated January 15, 2018.

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.

Adam S. Moyer
Geotechnical Engineer

cc: **SkB Architects** – Russell Blazier
via email: rblazier@skbarchitects.com

ASM/MRM:kg

GEOTECHNICAL ENGINEERING STUDY
Proposed New Ismond Residence
14841 Southeast 54th Street
Bellevue, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed new Ismond residence to be located in the Hilltop neighborhood in Bellevue.

Development of the property is in the planning stage, and detailed plans were not available at the time of this report. We were provided a topographic map and a preliminary site plan. PLS, Inc. developed the topographic map which is dated March 14, 2013. SkB Architects provided us with a preliminary proposed house footprint overlaid on the topographic map of the property. Based on this preliminary site plan, we understand that the existing residence and detached carport will be demolished and be replaced with a residence of larger dimensions. The proposed residence will have approximate dimensions of 35 feet by 150 feet with the long dimension rotated 90 degrees from the existing residence, extending in a general north to south direction. We anticipate that the lowest finished floor will be near the existing site grade and that no deep excavations are planned for a basement floor. We also understand that the project will require the installation of a new septic drain field to the south or southwest of the planned house.

A steep slope covers the eastern third of the subject site which is considered a Geologic Hazard Critical Area under the City of Bellevue's Land Use Code. We expect that a Critical Area Land Use Permit (CALUP) will be applied for to reduce the prescriptive minimum required buffer from the top of the steep slope.

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

SITE CONDITIONS

SURFACE

The Vicinity Map, Plate 1, illustrates the general location of the site in the Hilltop neighborhood of Bellevue. The irregular-shaped subject site has a length of 285 feet in the north-south direction along its eastern property line and a length of 252 feet along its northern property line. The western property line borders the cul-de-sac right-of-way for an arc length of 41 feet. A one-story single-family residence is location in the northwestern portion of the property with a detached carport directly north of it. A gravel driveway extends from the carport to Southeast 54th Street to the west. Scattered mature evergreen and maple trees and underbrush cover the remainder of the property.

The western two-thirds of the subject site slopes moderately downwards from northwest to southeast at an approximate average inclination of 11 to 13 percent. However, the eastern third of the property drops steeply downwards to the east 30 to 45 feet at an inclination of approximately 41 to 44 percent. The toe of the steep slope is located on the eastern adjacent, undeveloped, community property. Under the City of Bellevue's Land Use Code, the eastern steep slope is considered a geologic hazard area; specifically, it is defined as a Steep Slope because it has an inclination greater than 40 percent over a vertical height of at least 10 feet. We did not observe any signs of slope instability during our recent site visit.

Residential lots containing single-family residences with large setbacks from their property lines surround the subject site.

SUBSURFACE

The subsurface conditions were explored by drilling three test borings 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 borings were drilled on January 26, 2018 using a limited-access, track-mounted, hollow-stem auger drill. Samples were taken at approximate 2.5- and 5-foot intervals with a standard penetration sampler. This split-spoon sampler, which has a 2-inch outside diameter, is driven into the soil with a 140-pound hammer falling 30 inches. The number of blows required to advance the sampler a given distance is an indication of the soil density or consistency. A geotechnical engineer from our staff observed the drilling process, logged the test borings, and obtained representative samples of the soil encountered. The Test Boring Logs are attached as Plates 3 and 4.

Soil Conditions

The three test borings conducted on the subject site encountered loose native silty sand with gravel, roots, and fragments of weathered sandstone immediately below the ground surface. This loose upper soil appears to be heavily weathered sandstone. Very dense sandstone was encountered below the heavily-weathered material at depths of 4.5 feet in Test Borings 1 and 2, and at 6 feet in Test Boring 3. All three of the borings had to be terminated at 6.5 to 9.9 feet due to auger refusal in the very dense sandstone.

This geologic sequence of heavily-weathered sandstone over dense to very dense, intact sandstone is typical for the area.

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 our subsurface explorations. The test borings were left open for only a short time period. Therefore, the seepage levels 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 isolated zones groundwater could be found in perched between the looser near-surface soil and the underlying very dense sandstone. This is most likely to occur following extended wet weather.

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. If a transition in soil type occurred between samples in the borings, the depth of the transition was interpreted. The relative densities and moisture descriptions indicated

on the test boring logs are interpretive descriptions based on the conditions observed during drilling.

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 borings conducted for this study encountered very dense sandstone at depths of 4.5 to 6 feet below the ground surface. Conventional shallow foundations bearing directly on the very dense bedrock are well-suited to support the proposed residence. Excavation into the sandstone will likely require a toothed excavator bucket, which leaves a layer of loose, disturbed soils. It will be important remove any loose, disturbed soil from the bottom of the footing excavations prior to pouring concrete. Due to the amount of organics in the upper loose silty sand, it should not be used for structural fill. Importing granular structural fill should be anticipated.

As previously discussed, the Bellevue Land Use Code requires a prescriptive minimum 50-foot buffer from the top of a Steep Slope. We understand the proposed residence footprint will encroach into the prescriptive 50-foot buffer. From a geotechnical engineering standpoint, this is acceptable, and the recommendations and conclusions of this report are intended to support a reduction of the buffer. Modifications to the required buffer require an approved Critical Areas Report as part of the process of acquiring a Critical Area Land Use Permit (CALUP). Based on our explorations onsite and our experience with other projects in the Hilltop area of Bellevue, the very dense sandstone encountered underlying the subject site is very resistant to slope instability. It is our professional opinion that the required 50-foot buffer is not necessary from the top of the Steep Slope located on the eastern end of the subject site. However, there is always the possibility of shallow movement in the loose, upper weathered soils that are often several feet thick (as confirmed in our test borings). This type of near-surface movement is typical for any slope in the Puget Sound area. Considering this, we recommend still maintaining a 25-foot buffer from the top of the steep slope. No fill should be placed above the existing grade within this buffer. Additionally, no fill or excavated soil should be placed on the downslope, eastern, side of the proposed residence without being retained by a properly engineered retaining wall bearing directly on the very dense sandstone. Our comments related to a CALUP are presented in a following section of this report.

We anticipate that onsite infiltration of collected stormwater may be considered for the project as well. The sandstone encountered underlying the site is essentially impervious and will not accommodate concentrated stormwater infiltration. Infiltrated water will percolate down to the very dense sandstone and then migrate horizontally. Low volumes of water could be dispersed, provided the system is set back at least 50 feet from the top of the steep slope.

The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. Existing pavements, ground cover, and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Rocked staging areas and construction access roads should be provided to reduce the amount of soil or mud carried off the property by trucks and equipment. Wherever possible, the access roads should follow the alignment of planned pavements. Trucks should not be allowed to drive off of the rock-covered

areas. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Following clearing or rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

The drainage and/or waterproofing recommendations presented in this report are intended only to prevent active seepage from flowing through concrete walls or slabs. Even in the absence of active seepage into and beneath structures, water vapor can migrate through walls, slabs, and floors from the surrounding soil, and can even be transmitted from slabs and foundation walls due to the concrete curing process. Water vapor also results from occupant uses, such as cooking 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 AREA REPORT COMPONENTS

The following are our replies to specific items in the Bellevue Land Use Code (LUC 20.25H.125 and 20.25H.145) that are related to steep slope performance standards and Critical Areas Report (CAR) requirements.

LUC 20.25H.125:

A. As discussed above, the proposed development should be set back at least 25 feet from the top of the Steep Slope. Minimal excavation will be necessary to reach the competent bedrock in the area of the proposed residence. This excavation will not adversely impact stability of the Steep Slope.
B. The proposed building will be located on the western portion of the property, away from the Steep Slope. We recommend that the existing Steep Slope and the recommended buffer remain undisturbed.
C. The recommendations presented in this report are intended to prevent the planned development from adversely impacting the stability of the neighboring properties. This work will not necessitate increased buffers on the surrounding lots.
D. We anticipate minimal grading will be necessary for the project. As previously stated, we recommend no grading within a 25-foot buffer from the top of the Steep Slope.
E. While the proposed development is in the early planning stages and plans have not yet been developed, we recommend no development of any kind on the Steep Slope or within the recommended buffer.

F. We anticipate minimal grading will be necessary outside of the building footprint and no grading should occur with the 25-foot buffer from the Steep Slope.
G. It is our understanding that the proposed residence will be constructed on the moderately-sloped western end of the property and will largely match the existing site topography. Rockeries or landscape walls, if used, are expected to be minimal.
H. No structures are proposed on the Steep Slope or within the recommended buffer.
I. Deck structures are not expected in the Steep Slope area.
J. A restoration plan for the development area will be included as a part of the permit application for this project.

LUC 20.25H.145:

A. With the recommended development buffer from the Steep Slope, it is our opinion that the proposed work will not increase the geologic hazard to either the surrounding properties or the site itself, including the Steep Slope.
B. The proposed work will not adversely impact other critical areas if completed in general accordance with our recommendations and the approved drawings.
C. The recommendations of this report are intended to mitigate the risks posed by the Steep Slope to a level that would exist if the critical area buffer was not modified.
D. The recommendations of this report are intended to prevent the planned development from adversely impacting stability of the critical area, and to make the completed project safe under the anticipated surface and subsurface conditions.
E. This *Geotechnical Engineering Study* follows the guidelines of the City of Bellevue submittal requirements for geotechnical reports.
F. The planned development should comply with our recommendations.
G. To the best of our knowledge, the planned work is not expected to adversely impact habitat associated with species of local importance.

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 C (Very Dense Soil and Soft Rock). 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 1.38g and 0.53g, respectively.

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) 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 is adjusted for site class effects (F_{PGA}) and equals 0.57g. rock beneath the site is not susceptible to seismic liquefaction under the ground motions of the MCE because of its dense nature and the absence of near-surface groundwater.

CONVENTIONAL FOUNDATIONS

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. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on competent native soil, will be about one inch, with differential settlements on the order of one half-inch in a distance of 50 feet along a continuous footing with a uniform load.

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

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.50
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. 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.

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	0.50
Soil Unit Weight	130 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.**

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate

design earth pressures. The surcharge due to traffic loads behind a wall can typically be accounted for by adding a uniform pressure equal to 2 feet multiplied by the above active fluid density. Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment.

The values given above are to be used to design only permanent foundation and retaining walls that are to be backfilled, such as conventional walls constructed of reinforced concrete or masonry. It is not appropriate to use the above earth pressures and soil unit weight to back-calculate soil strength parameters for design of other types of retaining walls, such as soldier pile, reinforced earth, modular or soil nail walls. We can assist with design of these types of walls, if desired. The passive pressure given is appropriate only for a shear key poured directly against undisturbed native soil, or for the depth of level, well-compacted fill placed in front of a retaining or foundation wall. The values for friction and passive resistance are ultimate values and do not include a safety factor. Restrained wall soil parameters should be utilized 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.

Wall Pressures Due to Seismic Forces

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 7**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 free-draining soils are not used for backfill, we recommend a minimum 12-inch width of free-draining gravel be placed against the backfilled retaining walls to allow rapid drainage down to the footing drains.

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 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. 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 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 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. 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.

If the house includes a basement, which would be cut close to or into the hard rock, underslab drainage should be provided. This is intended to collect any shallow subsurface water that could pop up under the slab. Typically, underslab drainage would consist of a minimum 8-inch thick layer of clean gravel, in which perforated 4-inch pipes are buried on approximate 20-foot centers. These pipes would be connected to the foundation drainage system.

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 have been used in the past, but are now recommending a minimum 10-mil thickness for better durability and long term performance. 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

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 upper loose weathered 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. Unless approved by the geotechnical engineer of record, it is important that vertical cuts not be made where the overall depth of the temporary cut slopes is taller than 4 feet.

The above-recommended temporary slope inclination is based on the conditions exposed in our explorations, and on what has been successful at other sites with similar soil conditions. It is possible that variations in soil and groundwater conditions will require modifications to the inclination at which temporary slopes can stand. Temporary cuts are those that will remain unsupported for a relatively short duration to allow for the construction of foundations, retaining walls, or utilities. Temporary cut slopes should be protected with plastic sheeting during wet weather. It is also important that surface runoff be directed away from the top of temporary slope cuts. Cut slopes should also be backfilled or retained as soon as possible to reduce the potential for instability. Please note that loose soil can cave suddenly and without warning. Excavation, foundation, and utility contractors should be made especially aware of this potential danger. These recommendations may need to be modified if the area near the potential cuts has been disturbed in the past by utility installation, or if settlement-sensitive utilities are located nearby.

All permanent cuts into native soil should be inclined no steeper than 2:1 (H:V). Fill slopes should not be constructed with an inclination greater than 2.5:1 (H:V). To reduce the potential for shallow

sloughing, fill must be compacted to the face of these slopes. This can be accomplished by overbuilding the compacted fill and then trimming it back to its final inclination. Adequate compaction of the slope face is important for long-term stability and is necessary to prevent excessive settlement of patios, slabs, foundations, or other improvements that may be placed near the edge of the slope.

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 should be used where: (1) Crawl spaces or basements will be below a structure; (2) A slab is below the outside grade; or, (3) The outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock that is encircled with non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor or the level of a crawl space. The discharge pipe for subsurface drains should be sloped for flow to the outlet point. Roof and surface water drains must not discharge into the foundation drain system. A typical footing drain detail is attached to this report as Plate 5. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains.

The potential need for underslab drainage is discussed above in ***Slabs-On-Grade***.

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 even a few inches of free draining gravel underneath the vapor retarder limits the potential for seepage to build up on top of the vapor retarder.

No groundwater was observed during our field work. If seepage is encountered in an excavation, it should be drained from the site by directing it through drainage ditches, perforated pipe, or French drains, or by pumping it from sumps interconnected by shallow connector trenches at the bottom of the excavation.

The excavation and site should be graded so that surface water is directed 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. 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. 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.

Fills placed on sloping ground should be keyed into the dense sandstone. This is typically accomplished by placing and compacting the structural fill on level benches that are cut into the competent soils. 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 slabs or walkways	95%
Filled slopes and behind retaining walls	90%
Beneath pavements	95% for upper 12 inches of subgrade; 90% below that level

Where: Minimum Relative Compaction is the ratio, expressed in percentages, of the compacted dry density to the maximum dry density, as determined in accordance with ASTM Test Designation D 1557-91 (Modified Proctor).

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 borings 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

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.

The recommendations presented in this report are directed toward the protection of only the proposed residence from damage due to slope movement. Predicting the future behavior of steep slopes and the potential effects of development on their stability is an inexact and imperfect science that is currently based mostly on the past behavior of slopes with similar characteristics. Landslides and soil movement can occur on steep slopes before, during, or after the development of property. The owner of any property containing, or located close to steep slopes must ultimately accept the possibility that some slope movement could occur, resulting in possible loss of ground or damage to the facilities around the proposed residence.

This report has been prepared for the exclusive use of Alan and Abby Ismond 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.

The following plates are attached to complete this report:

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

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

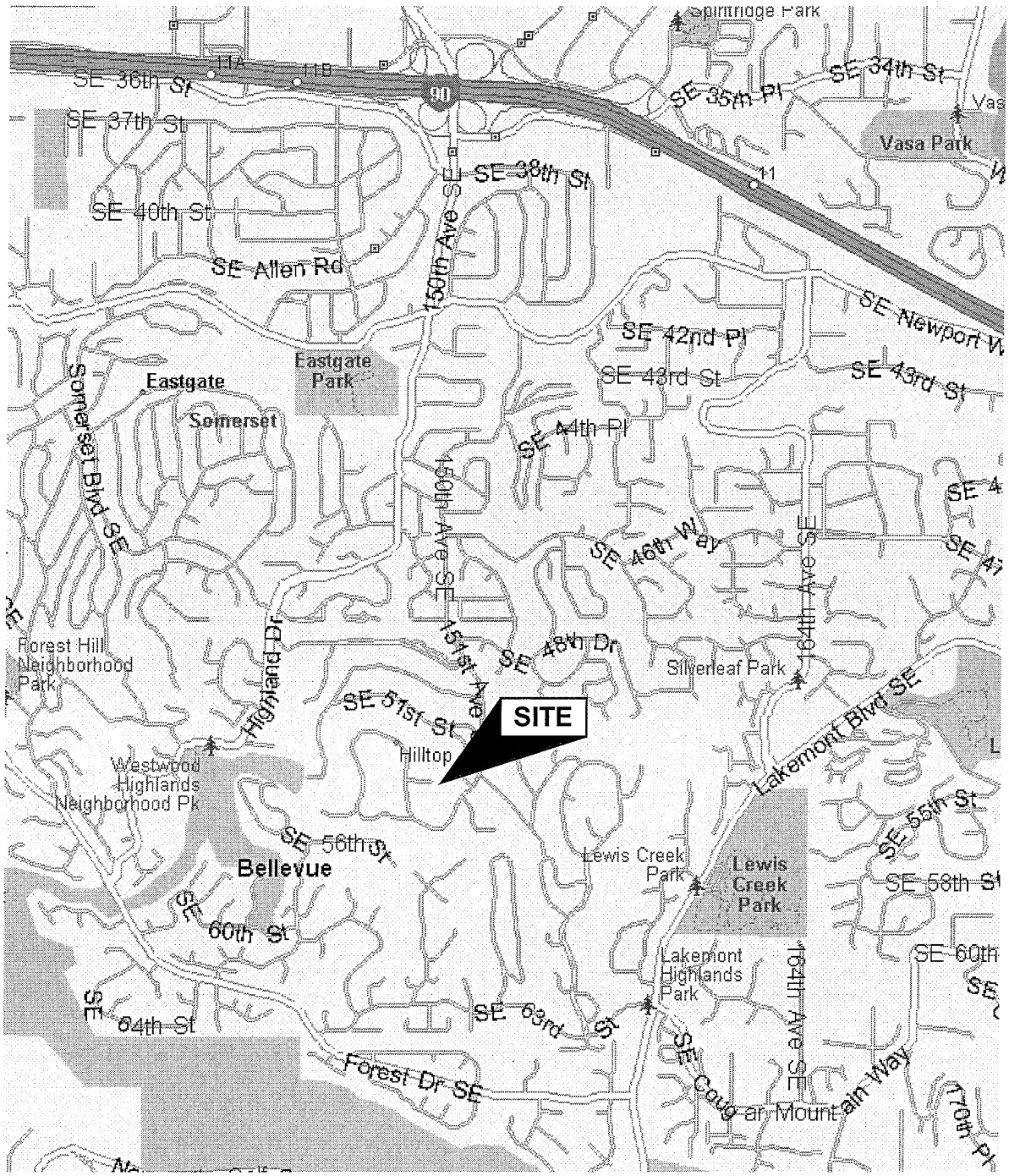
Adam S. Moyer
Geotechnical Engineer

03/02/18

Marc R. McGinnis, P.E.
Principal

ASM/MRM:kg

NORTH



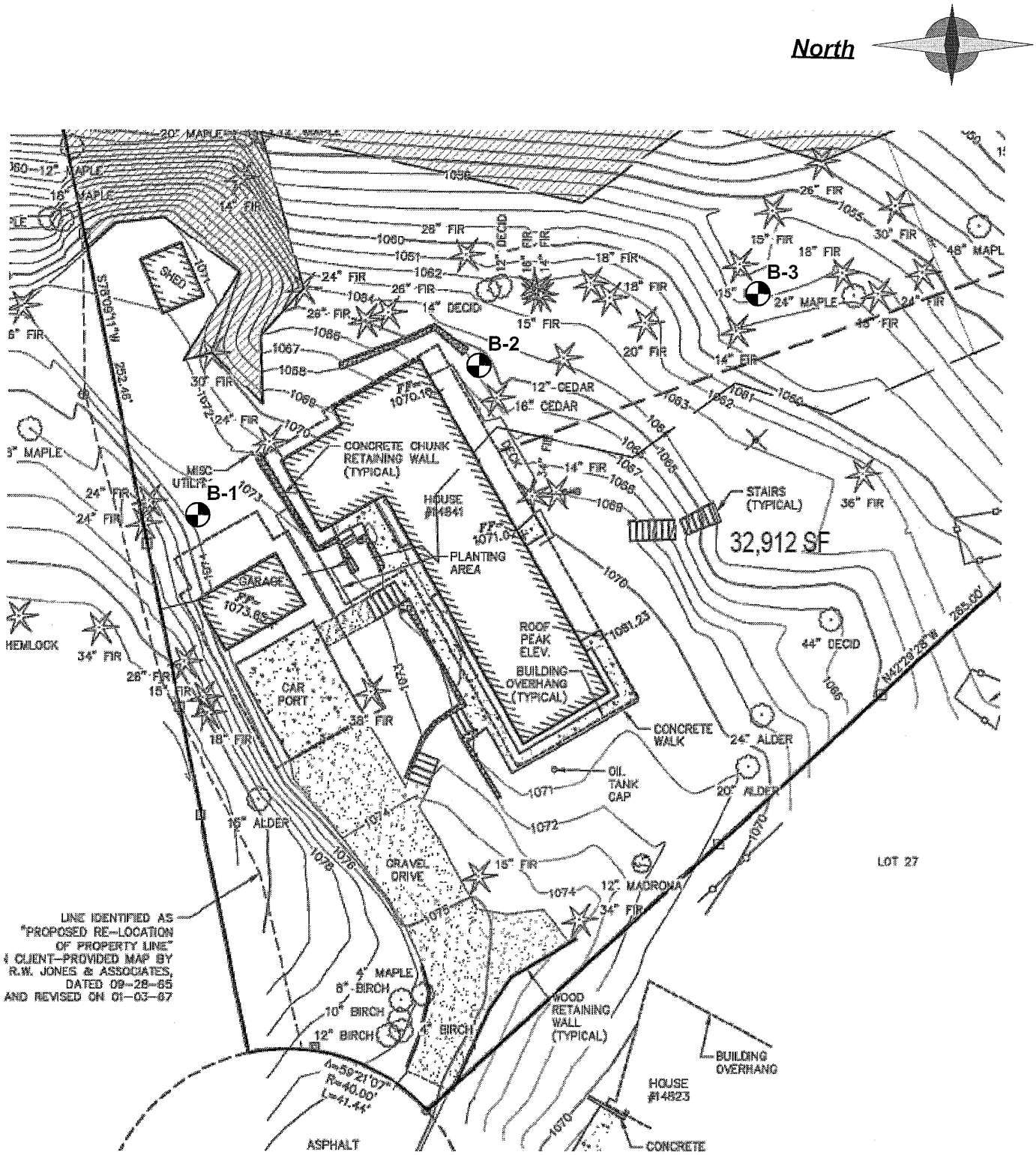
(Source: Microsoft MapPoint, 2013)

GEOTECH CONSULTANTS, INC.

VICINITY MAP

14841 Southeast 54th Street
Bellevue, Washington

Job No:	Date:		Plate:
18019	Mar. 2018		1



Legend:

Test Boring Location

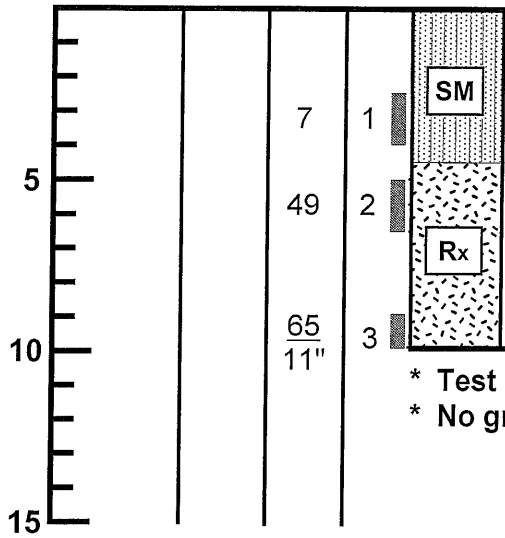
GEOTECH CONSULTANTS, INC.

SITE EXPLORATION PLAN

14841 Southeast 54th Street
Bellevue, Washington

Job No:	Date:		Plate:
18019	Mar. 2018	No Scale	2

BORING 1



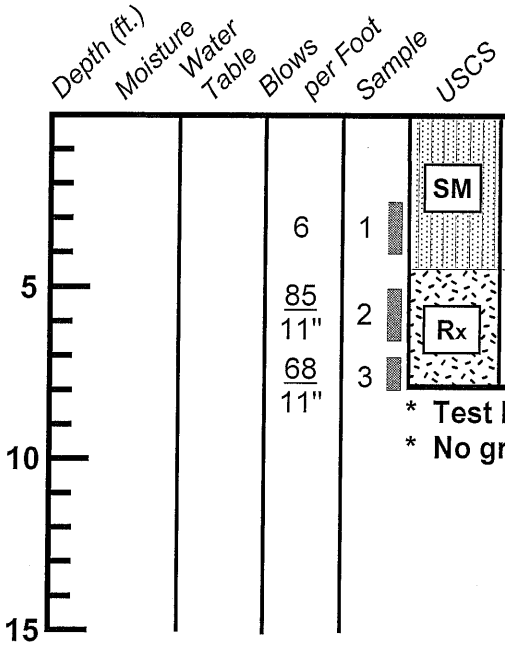
Description

Rust-brown silty SAND with gravel, roots, and pieces of weathered SANDSTONE, fine to medium-grained, moist, loose (heavily weathered SANDSTONE)

Gray SANDSTONE with iron stains, fine-grained, moist, dense to very dense

* **Test boring was terminated due to refusal at 9.9 feet on January 26, 2018.**
* **No groundwater was encountered during drilling.**

BORING 2



Description

Rust-brown silty SAND with gravel, roots, and occasional pieces of sandstone, fine to medium-grained, moist, loose (heavily weathered SANDSTONE)

Gray SANDSTONE with iron stains, fine-grained, moist, very dense

-becomes dark-gray

* **Test boring was terminated due to refusal at 7.9 feet on January 26, 2018.**
* **No groundwater was encountered during drilling.**

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TEST BORING LOG

14841 Southeast 54th Street
Bellevue, Washington

Job	Date:	Logged by:	Plate:
18019	Mar. 2018	ASM	3

BORING 3

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
			7	1	SM	Rust-brown silty SAND with gravel and roots, fine to medium-grained, moist, loose (heavily weathered SANDSTONE)
5			53	2	Rx	Gray SANDSTONE, fine-grained, moist, very dense
10						
15						

* **Test boring was terminated due to refusal at 6.5 feet on January 26, 2018.**

* **No groundwater was encountered during drilling.**

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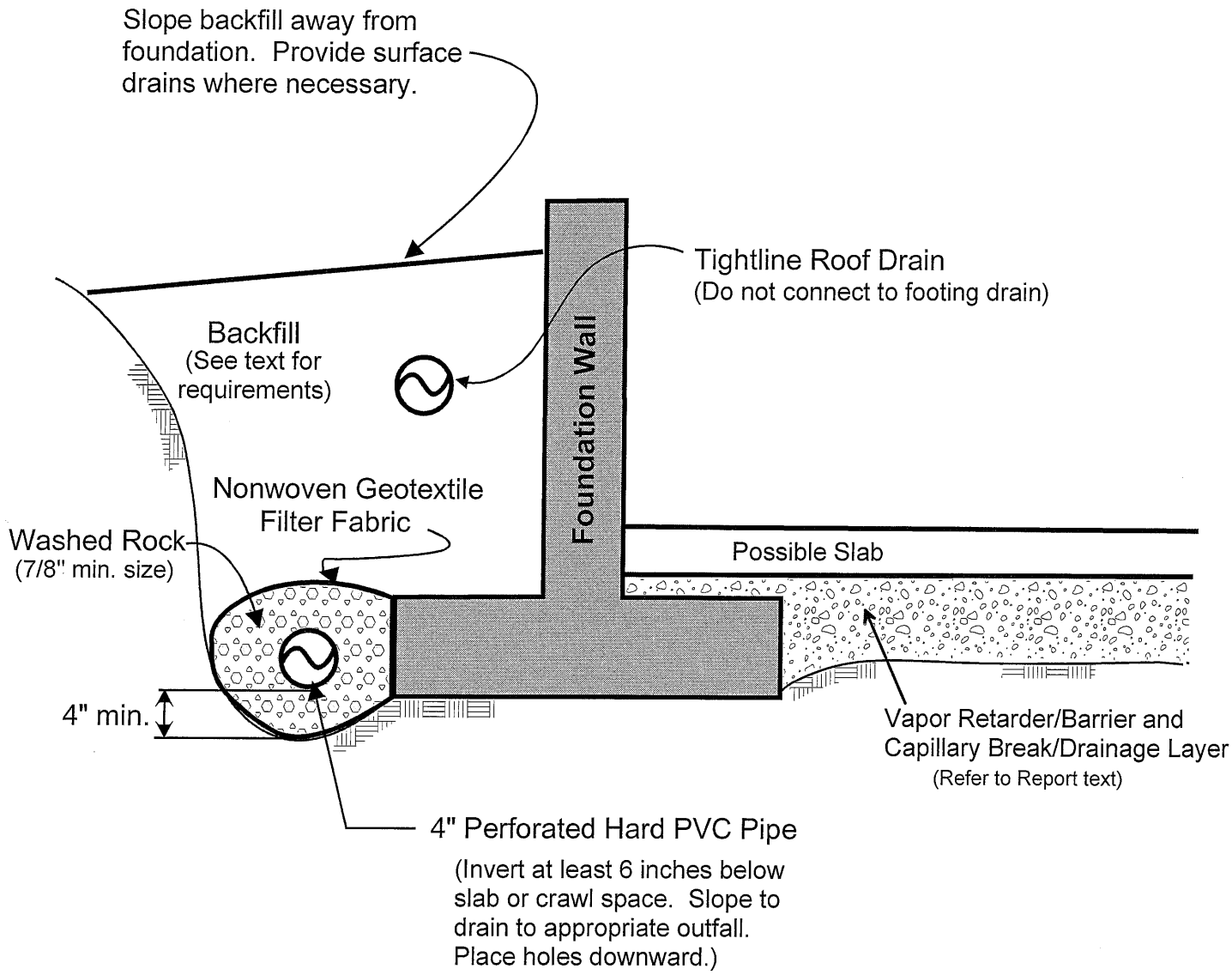
TEST BORING LOG

14841 Southeast 54th Street
Bellevue, Washington

Job	Date:	Logged by:	Plate:
18019	Mar. 2018	ASM	4



NOTES:

(1) In crawl spaces, provide an outlet drain to prevent buildup of water that bypasses the perimeter footing drains.

(2) Refer to report text for additional drainage, waterproofing, and slab considerations.

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FOOTING DRAIN DETAIL

14841 Southeast 54th Street
Bellevue, Washington

Job No:	Date:		Plate:
18019	Mar. 2018		5