August 25, 2015
Project No. EE150465A

Quadrant Corporation
14725 SE 36th Street, Suite 100
Bellevue, Washington 98006

Attention: Mr. Rob Risinger

Subject: Subsurface Exploration and
Preliminary Geotechnical Assessment
Beta Property
Kirkland, Washington

Dear Mr. Risinger:

Associated Earth Sciences, Inc. (AESI) is pleased to present this report providing a summary of our subsurface exploration and limited geotechnical engineering study at the Beta Property site located at 11801 NE 116th Street in Kirkland, Washington. This report has been prepared for the exclusive use of Quadrant Corporation (Quadrant), and their agents, for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to Quadrant.

INTRODUCTION

The project site consists of a proposed 80-lot residential development located at 11801 NE 116th Street in Kirkland, Washington (Figure 1). We understand the intent is to infiltrate surface water if feasible. The site is currently occupied by a large one-story commercial building within the central portion of the property. The remainder of the site around the structure is mostly paved with asphalt. Portions of the site around the north end of the existing structure contain gravel parking areas and rectangular wood-chip display areas associated with one of the existing business tenants. An access easement extends off the south side of NE 116th Street

through the northern side of the property. The configuration of the proposed lots and roads is shown on the "Site and Exploration Plan," Figure 2, and was prepared by CP|H Consultants.

The existing site topography across the majority of the property around the existing structure is generally flat at an elevation of approximately 210 feet. The topographically highest portion of the property is along the south and south half of the eastern property limits where the elevation ranges to around 230 feet at the top of a 20-foot-high cut slope presumably excavated during construction of the existing development in 1966. These old cuts slope down into the property and show indications of shallow instability since their creation. Ecology blocks have been placed along the toe of the cut presumably to help prevent surface soils on the slope from flowing away from the slope. The cut slope is vegetated with young to mature deciduous and evergreen trees and a moderately dense understory of blackberry brambles and other native shrubs. In the northwestern corner of the property, the topography slopes down to the south from the south side of NE 116th Street to the north side of the access easement. The slope is a maximum of approximately 8 feet high with fairly moderate inclinations.

We understand that Quadrant is considering purchasing the property with the intent of constructing single-family homes as noted above. We anticipate that the homes would be of wood-frame construction. Conventional foundations are expected with relatively light loading conditions. The primary purpose of this study was to evaluate the subsurface soil and ground water conditions and provide preliminary recommendations with respect to the proposed development described above.

This geotechnical engineering assessment was prepared with an understanding of the proposed development based on review of the current site plan prepared by CP|H Consultants, a site reconnaissance of the property, review of published geologic literature for the vicinity of the property, and discussions with the project team.

SUBSURFACE EXPLORATION

Our subsurface exploration completed for this project included advancing four hollow-stem auger soil borings. The conclusions and recommendations presented in this report are based on the explorations completed for this study. The locations and depths of the explorations were completed within site and budget constraints.

The exploration borings were completed by advancing hollow-stem auger tooling with a limited-access trailer-mounted drill rig. During the drilling process, samples were obtained at generally 2.5- to 5-foot-depth intervals. The exploration borings were continuously observed and logged by an engineering geologist from our firm. The exploration logs presented in the Appendix are based on the field logs, drilling action, and inspection of the samples secured.

Disturbed, but representative samples were obtained by using the Standard Penetration Test (SPT) procedure in accordance with *American Society for Testing and Materials* (ASTM):D 1586. This test and sampling method consists of driving a standard 2-inch, outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded, and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance ("N") or blow count. If a total of 50 is recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are plotted on the attached exploration boring logs.

The samples obtained from the split-barrel sampler were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification and testing.

SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, visual reconnaissance of the site, and review of selected applicable geologic literature. Interpreted subsurface sediments encountered at the site generally consist of loose to medium dense fill underlain by dense Vashon lodgement till and Vashon advance outwash. Because of the nature of exploratory work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions may sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations between the field explorations may not become fully evident until construction. The various interpreted geologic units are described below, in order from youngest to oldest.

Fill

Fill soils (those not naturally placed) were encountered in all of our exploration borings. In borings EB-2, EB-3, and EB-4, the fill depth was limited to within approximately 2 feet of the existing ground surface. In boring EB-1, the fill thickness ranged to approximately 19 feet and appeared to have been derived from site source soils. Review of the United States Geological Survey (USGS) topographic maps from 1950 indicates this portion of the property contained a small east-flowing drainage which was likely subsequently filled during initial construction of the property. The fill material generally consisted of loose to medium dense, moist, olive, silty fine- to medium-grained sand with trace to some amounts of gravel and a trace of organics. The organics appear disseminated as thin stringers within the lower portions of the fill, likely derived from organic-rich topsoil that would have been present in the area prior to construction. Fill soils are also likely present elsewhere across the site especially around areas

of the existing structures. The fill is not considered adequate for support of structural loads and should be removed or mitigated during construction to provide support for settlement-sensitive structures as described in the "Foundations" section of this report. These fill soils may be suitable for use as structural fill provided moisture contents are suitable to achieve required compaction and there is minimal presence of organics. Existing moisture contents were estimated to be at or slightly above optimum at the time or our subsurface investigation.

Vashon Lodgement Till

Vashon lodgement till sediments were observed underlying the asphalt paving and limited amounts of fill in exploration borings EB-2, EB-3, and EB-4. Vashon lodgement till is generally a dense, poorly sorted mixture of clay, silt, sand, and gravel. The lodgement till at depth commonly consists of dense to very dense, moist, olive, silty fine- to medium-grained sand with trace to some amounts of gravel and occasional cobbles and boulders. Typically, the lodgement till has a very low permeability, and water tends to perch atop the till and flow laterally as interflow, although some water very slowly infiltrates down into the underlying sediments. The moisture content of the lodgement till throughout much of the year is a few percent over the optimum moisture content for maximum compaction. The lodgement till is suitable for support of building foundations, however will deteriorate rapidly if disturbed while in a wet condition. The lodgement till sediments can be used in structural fills, and the ability to achieve suitable compaction and performance of the fill will depend mostly on the moisture content at the time of placement. Some moisture-conditioning may be required. It should be noted, as mentioned above, that boulders can occur within this unit at the site. Though they may not be abundant, it is likely that more will be encountered.

Vashon Advance Outwash

Vashon advance outwash sediments were observed underlying the fill in exploration boring EB-1, and underlying lodgement till in exploration borings EB-2, EB-3, and EB-4. Vashon advance outwash is generally a dense, suite of sediments deposited in rivers and streams in ahead of the Vashon glacial ice sheet. The advance outwash encountered at depth below the geologic units described above commonly consisted of dense to very dense, moist, olive, fine- to medium-grained sand with some amounts of silt, trace to some amounts of gravel, occasional cobbles, and rare thin interbeds of silt and compressed peat. Typically, the advance outwash has a grain size sorting resulting in a moderate permeability, and water tends to infiltrate through these sediments. However, the majority of the advance outwash sediments encountered in our exploration borings were similar in grain size and sorting to the lodgement till described above. As such, we expect low infiltration rates within these sediments. The advance outwash is suitable for support of building foundations, however will deteriorate rapidly if disturbed while in a wet condition. We do not expect advance outwash sediments to be encountered during excavation for the proposed development. However, if encountered, the advance outwash sediments can be used in structural fills, and the ability to achieve

suitable compaction and performance of the fill will depend mostly on the moisture content at the time of placement. Some moisture-conditioning may be required.

Review of the regional geologic maps titled *Geologic Map of the Renton Quadrangle, King County, Washington*, compiled by D.R. Mullineaux (1965), and the *Geologic Map of King County*, compiled by Derek B. Booth, Kathy A. Troost, and Aaron P. Wisher (2006), indicates that the area of the subject site is underlain by Vashon-age lodgement till with Vashon recessional deposits mapped in the vicinity of the property. Our interpretation of the sediments encountered in our explorations is in general agreement with the regional geologic mapping.

Ground Water

Ground water seepage was not observed in any of our exploration borings to the maximum depth explored. However, very moist soils were observed in EB-1 within interpreted advance outwash sediments at a depth of approximately 25 feet below the existing ground surface. These very moist soils may be localized perched ground water or may be associated with a shallow ground water aquifer that commonly forms within the advance outwash around the Puget Sound region. Additionally, interflow can occur atop lodgement till or other relatively impermeable sediments. Interflow generally occurs during the months of October through June when surface water infiltrates down through a relatively permeable overlying soil layer and becomes trapped atop a very low-permeability, parent sediment (usually lodgement till). Potential interflow would follow the topography across the site. We expect ground water will be present within the limits of the excavations associated with the proposed development depending on the time of the year, due to variations in rainfall and off-site uses, and perched pockets of ground water may occur within porous sections of the fill. During excavation, it is possible that ground water may be encountered at the surface of the contact below the fill. We anticipate that this water can be managed on-site and will not need to be removed.

GEOLOGIC HAZARDS

The following discussion of potential geologic hazards is based on the geologic conditions, as observed and discussed herein.

Seismic Hazards and Mitigations

Earthquakes occur in the Puget Lowland with great regularity. The vast majority of these events are small and are usually not felt by people. However, large earthquakes do occur, as evidenced by the 1949, 7.2-magnitude event; the 1965, 6.5-magnitude event; and the 2001, 6.8-magnitude event. The 1949 earthquake appears to have been the largest in this area during recorded history. Evaluation of return rates indicates that an earthquake of a magnitude between 6.0 and 7.0 is likely every 20 to 40 years in the Puget Sound.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture, 2) seismically induced landslides, 3) liquefaction, and 4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

Surficial Ground Rupture

The project site is not located within the area of any mapped fault zones. The nearest mapped fault zones from the project site are the Southern Whidbey Island-Lake Alice Fault Zone located approximately 5 miles northeast of the property and the Seattle Fault Zone located approximately 10 miles south of the property. The potential for surficial ground rupture is considered to be low during the expected life of new structures due to the distance from the site to these known fault zones and no mitigation efforts beyond complying with the 2012 *International Building Code* (IBC) are recommended.

Liquefaction

The encountered stratigraphy has a low potential for liquefaction due to the high strength and silt content of the glacially consolidated, near-surface site soils. No liquefaction mitigation efforts are recommended.

Ground Motion

It is our opinion that earthquake damage to the proposed structures, when founded on suitable bearing strata in accordance with the recommendations contained herein, will likely be caused by the intensity and acceleration associated with the event. Structural design of the buildings should follow 2012 *International Building Code* (IBC) standards using Site Class "C" as defined in Table 20.3-1 of *American Society of Civil Engineers (ASCE) 7 – Minimum Design Loads for Buildings and Other Structures*. The 2012 IBC seismic design parameters for short period (S_S) and 1-second period (S_1) spectral acceleration values were determined from the latitude and longitude of the project site using the USGS National Seismic Hazard Mapping Project website (http://earthquake.usgs.gov/hazmaps/). These values are based on Site Class "B". Based on USGS 2008 data, the USGS website interpolated ground motions at the project site to be S_{Ms} = 1.251 g and S_{M1} = 0.635 g corrected for Site Class "C".

Steep Slope Hazards

The small slope located in the northwestern corner of the property does not meet the City of Kirkland criteria for steep slopes. The 20-foot-high previously excavated cut slope located along the south and eastern portions of the site noted previously is inclined up to about 41 percent while the 8-foot-high slope in the northwestern corner of the property is inclined at approximately 15 percent. Due to the interpreted dense nature of the soils at depth within the interior of these slopes, it is our opinion that the risk of deep-seated landslides is low for static

and seismic conditions, and no specific mitigation measures beyond the recommendations in this report are required. However, we observed indications of past shallow slope movement (bowed or tilted trees, small-scale slightly bulging surface topography, and partially unvegetated soil exposures), interpreted to be the result of on-going shallow slope movement. The risks of shallow slope instability to the proposed development can be reduced by construction of an engineered wall at the toe of the slope to both help stabilize the loose surface soils in the lower half of the slope and provide a catchment for any debris that may result from future small-scale failures.

Erosion Hazards and Mitigation

The site is not considered a significant erosion hazard area due to the lack of slopes, lack of exposed soils, and likelihood that Best Management Practices (BMPs) will be used in conjunction with an approved Temporary Erosion and Sediment Control (TESC) Plan. To mitigate the erosion hazard potential and off-site sediment transport, we would recommend the following:

1. All TESC measures for a given area to be graded or otherwise worked should be installed prior to any construction activity.

2. Construction access should be provided using existing pavement surfacing or rock-covered, temporary access driveways to limit tracking of sediment onto adjacent streets.

3. During the wetter months of the year, or when large storm events are predicted during the summer months, work areas should be stabilized so that if showers occur, the work area can receive the rainfall without excessive erosion or sediment transport. The required measures for an area to be "buttoned-up" will depend on the time of year and the duration the area will be left unworked. During the winter months, areas that are to be left unworked for more than 2 days should be covered with plastic. During the summer months, stabilization will usually consist of seal-rolling the subgrade.

4. Disturbed areas should be revegetated or paved as soon as possible. Outside of the growing season, the disturbed areas should be covered with mulch or plastic sheeting.

5. Surface runoff should be controlled during and following development. Uncontrolled discharge may promote erosion and sediment transport. Collected water should be directed to a City-approved storm drain system. Catch basins should be fitted with a non-woven filter fabric, such as Mirafi 140N.

6. Soils that are to be reused around the site should be stored in such a manner as to reduce erosion from the stockpile. Protective measures may include, but are not limited to, covering with plastic sheeting.

It is our opinion that with the proper implementation of the TESC plans and by adjusting/field-fitting appropriate mitigation elements during construction, as recommended by the erosion control inspector, the potential adverse impacts from erosion hazards on the project may be mitigated.

CONCLUSIONS AND RECOMMENDATIONS

It is our opinion that, from a geotechnical standpoint, the site is suitable for the proposed development that is planned for this property provided that the recommendations contained herein are properly followed. Our site explorations indicate that medium dense to very dense, unweathered native Vashon sediments suitable for foundation support are present at relatively shallow depths over most of the site. The loose fill and any other loose, weathered Vashon soils are not suitable to support structural loads, but may potentially be utilized as structural fill if appropriately moisture-conditioned. Any fill associated with existing site development is not suitable for foundation support. The following sections provide our recommendations for foundation support and support of slab-on-grade floors.

Foundations

The foundation bearing stratum, consisting of either medium dense to very dense Vashon sediments or structural fill placed over these sediments, is relatively shallow over most of the site and spread footings may be used for foundation support. The depth to foundation bearing soils in the vicinity of exploration borings EB-2 through EB-4 ranged from 1 to 3 feet. However, the depth to suitable foundation bearing sediments in the vicinity of EB-1 ranged to approximately 19 feet as noted above. Depending on the depth to foundation bearing stratum in this area, a foundation system consisting of pipe piles or rock trenches may be necessary for support of the structures as described below. If the depth of foundation bearing soils is less than approximately 10 feet, rock trenches are an appropriate alternative for support of structural loads. Pipe piles are recommended if the depth to foundation bearing sediments is greater than 10 feet. Additional exploration is recommended to further delineate the depth to suitable foundation bearing soils within the area of exploration boring EB-1 in the northeastern portion of the site. Once project plans have been finalized, AESI should be allowed to review the plans and modify our recommendations, as necessary.

If needed, structural fill placed below foundation areas should consist of in-organic soil, free of deleterious materials, placed in maximum loose lift thicknesses of 8 inches with each lift compacted to at least 95 percent of the modified Proctor maximum dry density, as determined by ASTM:D 1557. Structural fill placed below footing areas should extend laterally beyond the footing edges a distance equal to or greater than the thickness of the fill. Sediments exposed in footing excavations should be compacted to a firm and unyielding condition prior to footing placement.

For footings founded either directly on medium dense to very dense Vashon sediments, or on structural fill placed over these materials, we recommend that an allowable bearing pressure of 2,500 pounds per square foot (psf) be used for design purposes, including both dead and live loads. An increase of one-third may be used for short-term wind or seismic loading.

Perimeter footings for the proposed buildings should be buried a minimum of 18 inches into the surrounding soil for frost protection. No minimum burial depth is required for interior footings; however, all footings must penetrate to the prescribed stratum, and no footings should be founded in or above loose, organic, or existing fill soils.

The area bounded by lines extending downward at 1H:1V (Horizontal:Vertical) from any footing must not intersect another footing or intersect a filled area that has not been compacted to at least 95 percent of ASTM:D 1557. In addition, a 1.5H:1V line extending down from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edges of steps or cuts in the bearing soils.

All footing areas should be observed by AESI prior to placing concrete to verify that the exposed soils can support the design foundation bearing capacity and that construction conforms with the recommendations in this report. Foundation bearing verification may also be required by the governing municipality.

Slab-on-Grade Floor Support

Slab-on-grade floors may be constructed either directly on the undisturbed, medium dense to very dense, Vashon sediments, or on structural fill placed over these materials. Areas of the slab subgrade that are disturbed (loosened) during construction should be recompacted to an unyielding condition prior to placing the pea gravel, as described below. Floor support for pipe pile and rock trench foundation systems will need to utilize grade beam support systems and should be designed by a structural engineer.

In order to control moisture vapor transfer through the slab, slab-on-grade floors should be constructed atop a capillary break consisting of a minimum thickness of 4 inches of washed pea gravel. The pea gravel should be overlain by a 10-mil (minimum thickness) plastic vapor retarder.

Storm Water Infiltration

The native Vashon sediments encountered in our borings to the maximum depth explored are not suitable for infiltration due to their high silt contents and dense to very dense condition. Sediments that are more suitable for infiltration may be present at depths greater than that explored and the recommended system for infiltration would be Underground Injection Control (UIC) wells. Additional subsurface exploration would be necessary to determine the presence (or absence) of these receptor soils and the depth of ground water.

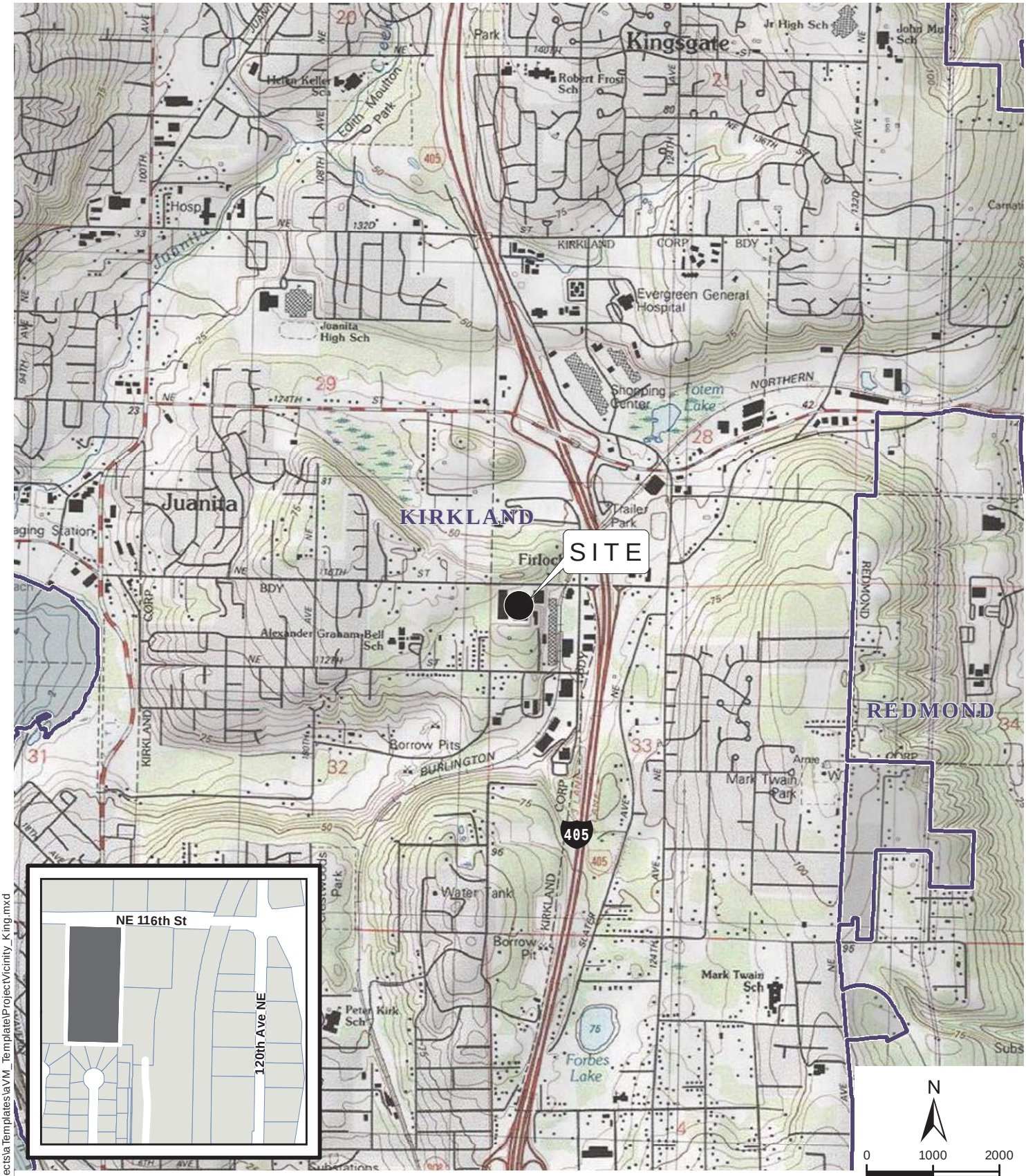
We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this report or other geotechnical aspects of the project, please call us at your earliest convenience.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Everett, Washington

Frank S. Mocker, L.G., L.E.G.
Project Geologist

Matthew A. Miller, P.E.
Principal Engineer

Attachments: Figure 1: Vicinity Map
Figure 2: Site and Exploration Plan
Appendix: Exploration Boring Logs



REFERENCE: USGS, KING CO

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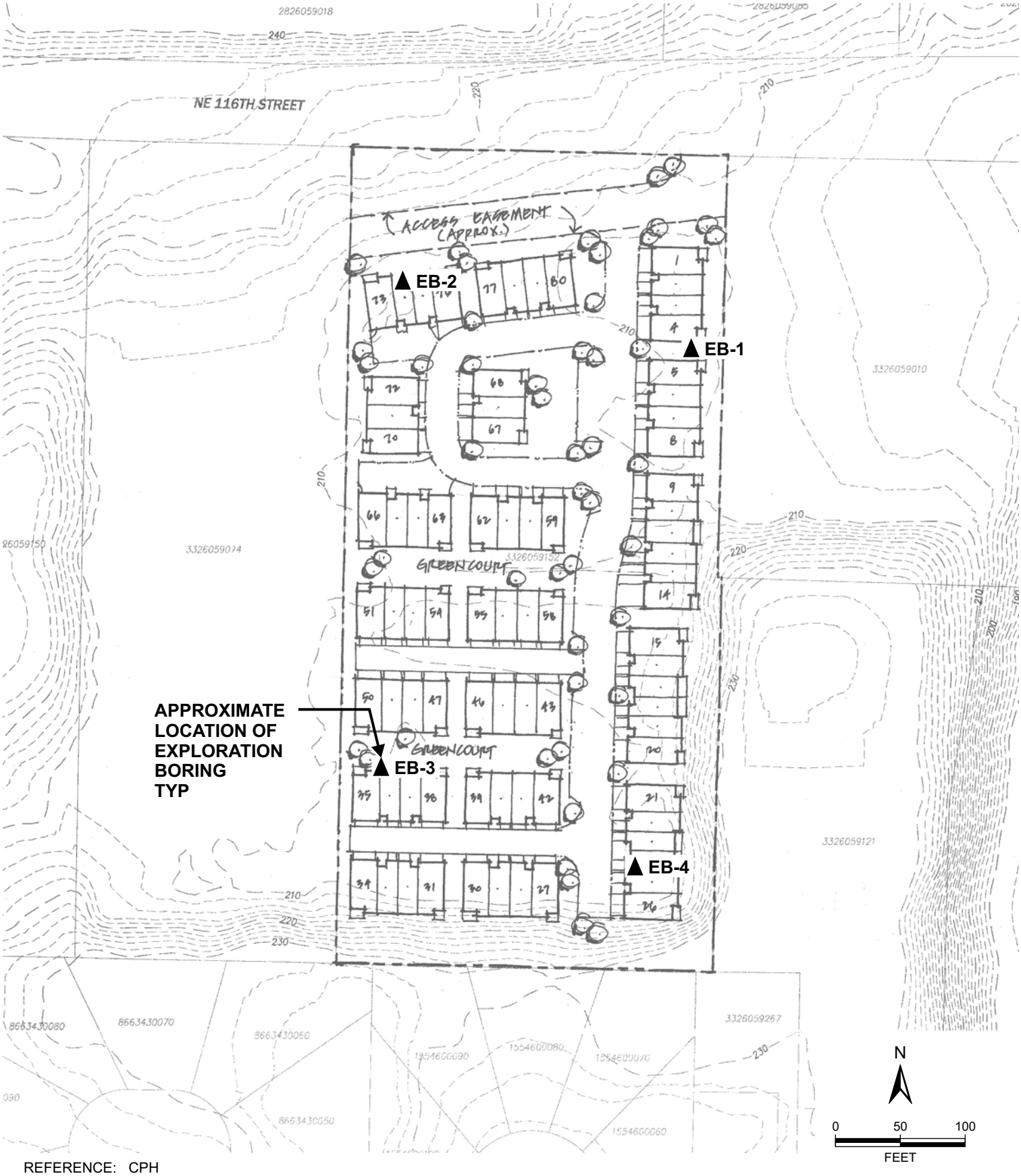
VICINITY MAP

BETA PROPERTY
KIRKLAND, WASHINGTON

FIGURE 1

DATE 8/15

PROJ. NO. EE150465A



REFERENCE: CPH

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SITE AND EXPLORATION PLAN

BETA PROPERTY
KIRKLAND, WASHINGTON

FIGURE 2

DATE 5/15

PROJ. NO. EE150465A

APPENDIX

Coarse-Grained Soils - More than 50% (1) Retained on No. 200 Sieve	Gravels - More than 50% (1) of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines (5)	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥12% Fines (5)	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50% (1) or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines (5)	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥12% Fines (5)	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% (1) or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

Coarse-Grained Soils

Density	SPT(2) blows/foot
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	>50

Fine-Grained Soils

Consistency	SPT(2) blows/foot
Very Soft	0 to 2
Soft	2 to 4
Medium Stiff	4 to 8
Stiff	8 to 15
Very Stiff	15 to 30
Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

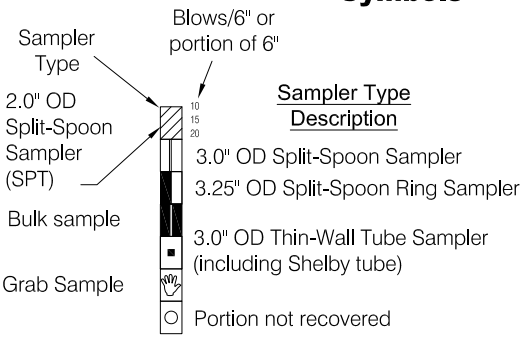
(3) Estimated Percentage

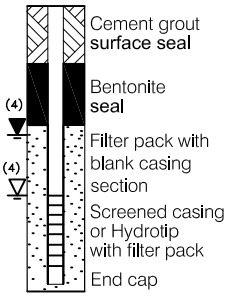
Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols





(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of ground water
▼ ATD = At time of drilling
▽ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 12%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

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Exploration Log

Project Number	Exploration Number	Sheet
EE150465A	EB-1	1 of 1

Project Name	Beta Property	Ground Surface Elevation (ft)	~210
Location	Kirkland, WA	Datum	Unknown
Driller/Equipment	Geologic Drill / HSA with XL Drill	Date Start/Finish	8/19/15,8/19/15
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	8 inches

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Asphalt - 2 inches					
				Fill					
		S-1		Medium dense, moist, olive, fine to coarse SAND, some silt ranging to silty, trace gravel; nonstratified; upper 3 inches is weathered; iron-oxide stained (SW-SM).			6 9 12	▲21	
5		S-2		Medium dense, moist, olive, fine to medium SAND, some silt, trace gravel; crudely layered (SP-SM).			5 13 15	▲28	
10		S-3		Loose, moist, olive and brown, fine to coarse SAND, some silt, some gravel; dark brown layer (≤ 1 inch thick) and iron-oxide staining at approximately 11 feet (old topsoil horizon?) SP-SM).			5 3 5	▲8	
15		S-4		As above; still contains dark brown topsoil-like layers (SP-SM).			5 4 4	▲8	
				Driller noted harder, rocky drill action at approximately 19 feet.					
				Vashon Advance Outwash ?					
20		S-5		Dense, moist, olive, fine to medium SAND, some silt, some gravel; occasional thin silt interbeds (< 1 inch thick); stratified (SP-SM/ML).			14 17 18	▲35	
25		S-6		As above, very moist (SP-SM/ML). Pounded rock.			8 8 12	▲20	
				Bottom of exploration boring at 26.5 feet Wet soils at ~25 feet.					

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture

Water Level ()

Water Level at time of drilling (ATD)

Logged by: FSM

Approved by: CJK

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Exploration Log

Project Number	Exploration Number	Sheet
EE150465A	EB-2	1 of 1

Project Name	Beta Property	Ground Surface Elevation (ft)	~208
Location	Kirkland, WA	Datum	Unknown
Driller/Equipment	Geologic Drill / HSA with XL Drill	Date Start/Finish	8/19/15,8/19/15
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	8 inches

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Vashon Lodgement Till					
		S-1		Dense, moist, olive, fine to coarse SAND, some silt to silty, some fine to coarse gravel; nonstratified (SW-SM).			11 14 17	▲31	
5		S-2		Medium dense, moist, olive, fine to coarse SAND, some silt, trace to some gravel; nonstratified to crudely bedded; more sandy than above (SW-SM).			9 8 8	▲16	
10		S-3		Very dense, moist, olive, silty fine to medium SAND, trace coarse sand, trace to some gravel; faintly stratified? to nonstratified (SP-SM).			11 27 50/6"	▲77	
				Vashon Advance Outwash ?					
15		S-4		Very dense, moist, olive, silty, gravelly, fine to medium SAND, trace coarse sand; contains one organic PEAT layer (~1/2 inch thick); stratified (SP-SM).			27 50/5.5"	▲50	
20		S-5		Very dense, moist, olive, fine to medium SAND, trace coarse sand, trace to some gravel; faintly stratified to massive (SP-SM).			42 50/4"	▲50	
25				Bottom of exploration boring at 20.8 feet No ground water encountered.					

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture

Water Level ()

Water Level at time of drilling (ATD)

Logged by: FSM

Approved by: CJK

associated earth sciences incorporated

Exploration Log

Project Number	Exploration Number	Sheet
EE150465A	EB-3	1 of 1

Project Name	Beta Property	Ground Surface Elevation (ft)	~209
Location	Kirkland, WA	Datum	Unknown
Driller/Equipment	Geologic Drill / HSA with XL Drill	Date Start/Finish	8/19/15,8/19/15
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	8 inches

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Asphalt - 2 inches					
				Vashon Lodgement Till					
		S-1		Very dense, moist, olive, fine to medium SAND, trace coarse sand, some silt, trace fine to coarse rounded gravel; faintly stratified ? (SP-SM).			18 48 50/5"	▲50	
5		S-2		As above (SP-SM). Bouncing on rock.			50/3"	▲50	
10		S-3		Very dense, moist, olive, fine to medium SAND, some silt, trace coarse sand, trace gravel; massive to faintly stratified (SP-SM). Extra sample acquired drilling down from 10 to 15 feet.			50/5.5"	▲50	
15		S-4		Very dense, moist, olive, fine to medium SAND, some silt, trace coarse sand, trace to some gravel; massive to faintly stratified (SP-SM). Bouncing on rock. Extra sample acquired drilling down from 15 to 20 feet.			50/3"	▲50	
				Vashon Advance Outwash ?					
20		S-5		Very dense, moist, olive, fine to medium SAND, some silt, trace coarse sand, trace to some fine to coarse gravel; faintly stratified (SP-SM).			50/4"	▲50	
				Bottom of exploration boring at 20.3 feet No ground water encountered.					
25									

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture
Water Level ()
Water Level at time of drilling (ATD)

Logged by: FSM
Approved by: CJK

associated earth sciences incorporated

Exploration Log

Project Number	Exploration Number	Sheet
EE150465A	EB-4	1 of 1

Project Name	Beta Property	Ground Surface Elevation (ft)	~209
Location	Kirkland, WA	Datum	Unknown
Driller/Equipment	Geologic Drill / HSA with XL Drill	Date Start/Finish	8/19/15,8/19/15
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	8 inches

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Asphalt - 4 inches					
				Vashon Lodgement Till					
				At approximately 2 feet encountered large boulder, moved approximately 1.5 feet west, started another boring.					
		S-1		Very dense, moist, olive, silty fine to coarse SAND, some fine to coarse gravel; nonstratified (SM).			32 50/4"	▲50	
5		S-2		Very dense, moist, olive, fine to medium SAND, some silt, trace coarse sand, trace fine to coarse gravel (SP-SM). At approximately 6 feet encountered another boulder, used spike to try to break.			13 50/4"	▲50	
10		S-3		Very dense, moist, olive, fine to medium SAND, some silt to silty, trace to some coarse sand, trace gravel; nonstratified to faintly bedded (SP-SM). (SP-SM).			23 50/5"	▲50	
15		S-4		Very dense, moist, olive, silty fine to medium SAND, trace coarse sand, trace ranging to some fine to coarse gravel; occasional thin interbed (<1.5 inches thick) of fine to coarse SAND, trace to some silt; stratified to massive (SP-SM/SW).			50/5"	▲50	
20		S-5		Very dense, moist, olive, fine to medium SAND, some silt to silty, trace coarse sand, trace fine to coarse gravel; nonstratified to faintly stratified (SP-SM).			50/6"	▲50	
25				Bottom of exploration boring at 20.5 feet No ground water encountered.					

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture

Water Level ()

Water Level at time of drilling (ATD)

Logged by: FSM

Approved by: CJK