



**COBALT**  
GEOSCIENCES

**Limited Geotechnical Investigation  
Proposed Subdivision**

4001 W. Mercer Way  
Mercer Island, Washington

December 8, 2020

## Table of Contents

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<b>1.0 INTRODUCTION</b> .....	<b>1</b>
<b>2.0 PROJECT DESCRIPTION</b> .....	<b>1</b>
<b>3.0 SITE DESCRIPTION</b> .....	<b>1</b>
<b>4.0 FIELD INVESTIGATION</b> .....	<b>1</b>
4.1.1 Site Investigation Program .....	1

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<b>5.0 SOIL AND GROUNDWATER CONDITIONS</b> .....	<b>2</b>
5.1.1 Area Geology .....	2
5.1.2 Groundwater .....	2

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<b>6.0 GEOLOGIC HAZARDS</b> .....	<b>3</b>
6.1 Steep Slope/Landslide Hazard .....	3
6.2 Erosion Hazard .....	3
6.3 Seismic Hazard .....	4

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<b>7.0 DISCUSSION</b> .....	<b>4</b>
7.1.1 General.....	4

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<b>8.0 RECOMMENDATIONS</b> .....	<b>4</b>
8.1.1 Site Preparation .....	4
8.1.2 Temporary Excavations.....	5
8.1.3 Erosion and Sediment Control.....	6
8.1.4 Foundation Design .....	6
8.1.5 Reinforced Concrete Retaining Walls .....	7
8.1.6 Stormwater Recommendations .....	8
8.1.7 Slab-on-Grade .....	8
8.1.8 Groundwater Influence on Construction .....	9
8.1.9 Pavements.....	9

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<b>9.0 CONSTRUCTION FIELD REVIEWS</b> .....	<b>11</b>
<b>10.0 CLOSURE</b> .....	<b>11</b>

## LIST OF APPENDICES

Appendix A — Statement of General Conditions  
Appendix B — Figures  
Appendix C — Exploration Logs

December 8, 2020

## **1.0 Introduction**

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In accordance with your authorization, Cobalt Geosciences, LLC (Cobalt) has completed a limited geotechnical investigation for the proposed two lot short plat located at 4001 West Mercer Way in Mercer Island, Washington (Figure 1).

The purpose of the geotechnical investigation was to identify subsurface conditions and to provide geotechnical recommendations for foundation design, earthwork, soil compaction, and suitability of the on-site soils for use as fill.

The scope of work for the geotechnical investigation consisted of a site investigation followed by engineering analyses to prepare this report. Recommendations presented herein pertain to various geotechnical aspects of the proposed development, including foundation design and stormwater management.

## **2.0 Project Description**

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The project includes subdivision of the parcel followed by construction of a new residence west of the existing residence. The existing residence will remain in place. Foundation loads are expected to be relatively light and site grading may include cuts or fills of 10 feet or less if a daylight basement is proposed. We should be provided with the civil and structural plans when they become available.

## **3.0 Site Description**

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The site is located at 4001 West Mercer Way in Mercer Island, Washington (Figure 1). The property consists of one rectangular parcel (No. 3623500365) with a total area of 31,500 square feet.

The southeast portion of the property is developed with a single-family residence. A driveway extends across the property from north to south. There are local accessory structures in the western portion of the property. The remainder of the property is undeveloped and vegetated with grasses, blackberry vines, bushes/shrubs, and sparse trees.

The site slopes downward from east to west at magnitudes of 5 to 30 percent with total relief of about 45 feet. We understand that the site is located within a mapped erosion and potential landslide hazard area.

The site is bordered to the northeast by W. Mercer Way, to the northwest by Freeman Avenue, and to the southeast and southwest by residential properties.

## **4.0 Field Investigation**

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### **4.1.1 Site Investigation Program**

The geotechnical field investigation program was completed on November 19, 2020 and included drilling one boring and two hand borings within the property for subsurface analysis.

December 8, 2020

Disturbed soil samples were obtained during drilling by using the Standard Penetration Test (SPT) as described in ASTM D-1586. The Standard Penetration Test and sampling method consists of driving a standard 2-inch outside-diameter, split barrel sampler into the subsoil with a 140-pound hammer free falling a vertical distance of 30 inches. The summation of hammer-blows required to drive the sampler the final 12-inches of an 18-inch sample interval is defined as the Standard Penetration Resistance, or N-value. The blow count is presented graphically on the boring logs in this appendix. The resistance, or “N” value, provides a measure of the relative density of granular soils or of the relative consistency of cohesive soils.

The soils encountered were logged in the field and are described in accordance with the Unified Soil Classification System (USCS).

A Cobalt Geosciences field representative conducted the explorations, collected disturbed soil samples, classified the encountered soils, kept a detailed log of the explorations, and observed and recorded pertinent site features.

The results of the sampling are presented on the exploration logs enclosed in Appendix C.

## 5.0 Soil and Groundwater Conditions

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### 5.1.1 Area Geology

The site lies within the Puget Lowland. The lowland is part of a regional north-south trending trough that extends from southwestern British Columbia to near Eugene, Oregon. North of Olympia, Washington, this lowland is glacially carved, with a depositional and erosional history including at least four separate glacial advances/retreats. The Puget Lowland is bounded to the west by the Olympic Mountains and to the east by the Cascade Range. The lowland is filled with glacial and non-glacial sediments consisting of interbedded gravel, sand, silt, till, and peat lenses.

The Geologic Map of Mercer Island, indicates that the site is underlain by Pre-Olympia Glacial and Non-Glacial Deposits.

These materials generally include areas and layers of till-like drift, outwash gravels, and local mixtures of silt, clay, sand and gravel. These materials are typically dense to very dense below a weathered zone.

#### Explorations

The explorations encountered a thin layer of topsoil and vegetation underlain by loose to medium dense, silty-fine to medium grained sand with gravel. These materials were underlain by very dense gravels in B-1 at about 6.25 feet below grade.

We also reviewed three boring logs that were drilled for the library just west of the site. These borings and test pits encountered soils consistent with the findings of our site investigation.

### 5.1.2 Groundwater

Groundwater was encountered in B-1 at 2 feet below grade. The groundwater appears to be perched on denser silty-sands.

December 8, 2020

Water table elevations often fluctuate over time. The groundwater level will depend on a variety of factors that may include seasonal precipitation, irrigation, land use, climatic conditions and soil permeability. Water levels at the time of the field investigation may be different from those encountered during the construction phase of the project.

## **6.0 Geologic Hazards**

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### **6.1 Steep Slope/Landslide Hazards**

Critical area ordinances designate slopes with magnitudes greater than about 40 percent and vertical relief of at least 10 feet as potentially geologically hazardous (steep slope/landslide hazards). Additional criteria include areas where landslide activity has taken place historically or where there is evidence of slope movements. Slope areas underlain by permeable soils overlying impermeable soils often exhibit landslide activity.

There are mapped potential landslide and erosion hazards within and/or adjacent to the subject property. Based on our review of numerous nearby explorations (historic geotechnical investigations) as well as the results of our site investigation, there do not appear to be significant geologic hazards at this site. The near surface soils become denser with depth and not highly susceptible to landslide activity.

Provided earthwork and grading are performed in accordance with typical engineering standards and permit requirements, the risk to any geologic hazards and adjacent properties will be minimal. Typical erosion control measures should adequately protect the property and downslope properties if implemented correctly and maintained until permanent landscaping is in place.

No specific buffer or setback is required since the site consists of a continuous moderate slope. We recommend a minimum effective setback of 5 feet or all foundation elements. This is the lateral distance (measured horizontally) from the outside edge of the footing to the adjacent slope face. Essentially, this recommendation reduces the generally low risk of erosion potential around foundations when located in sloped areas.

### **6.2 Erosion Hazard**

The Natural Resources Conservation Services (NRCS) maps for King County indicate that the site is underlain by Kitsap silt loam (2 to 8 and 15 to 30 percent slopes). These soils have a slight to severe erosion potential in a disturbed state depending on slope magnitude.

It is our opinion that soil erosion potential at this project site can be reduced through landscaping and surface water runoff control. Typically, erosion of exposed soils will be most noticeable during periods of rainfall and may be controlled by the use of normal temporary erosion control measures, such as silt fences, hay bales, mulching, control ditches and diversion trenches. The typical wet weather season, with regard to site grading, is from October 31<sup>st</sup> to April 1<sup>st</sup>. Erosion control measures should be in place before the onset of wet weather.

December 8, 2020

### 6.3 Seismic Hazard

The overall subsurface profile corresponds to a Site Class *D* as defined by Table 1613.5.2 of the 2015 International Building Code (2015 IBC). A Site Class *D* applies to an overall stiff soil profile within the upper 100 feet.

We referenced the U.S. Geological Survey (USGS) Earthquake Hazards Program Website to obtain values for  $S_s$ ,  $S_i$ ,  $F_a$ , and  $F_v$ . The USGS website includes the most updated published data on seismic conditions. These parameters are from ASCE 7-10. The site-specific seismic design parameters and adjusted maximum spectral response acceleration parameters are as follows:

PGA	(Peak Ground Acceleration, in percent of g)
$S_s$	140.80% of g
$S_i$	54.20% of g
$F_A$	1.00
$F_V$	1.50

Additional seismic considerations include liquefaction potential and amplification of ground motions by soft/loose soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table. The very fine grained soil materials that underlie the site have a low potential for liquefaction.

## 7.0 DISCUSSION

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### 7.1.1 General

It is our opinion that the proposed residence may be supported on a shallow foundation system bearing on medium dense or firmer native soils. These soils are anticipated to be encountered within 3 feet of the ground surface. Local overexcavation and replacement may be necessary if loose soils are encountered during footing excavation work.

Stormwater infiltration is not feasible at this site. The site is underlain by silty-sand with gravel, which is nearly impermeable. Additionally, we encountered groundwater at 2 feet below grade in B-1. We recommend direct connection to City infrastructure if possible. We can provide additional recommendations upon request.

## 8.0 Recommendations

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### 8.1.1 Site Preparation

Trees, shrubs and other vegetation should be removed prior to stripping of surficial organic-rich soil. Based on observations from the site investigation program, it is anticipated that the stripping depth will range from 6 to 12 inches. Deeper excavations should be expected below larger vegetation and where undocumented fill is present.

December 8, 2020

The near-surface soils consist of silty-sand with gravel. These soils are suitable for use as structural fill provided it is within 3 percent of the optimum moisture. These soils are moisture sensitive and may not be suitable during the winter months. We do not recommend using the native soils as fill below foundation elements of the structure.

Imported structural fill should consist of a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill should be placed in maximum lift thicknesses of 12 inches and should be compacted to a minimum of 95 percent of the modified proctor maximum dry density, as determined by the ASTM D 1557 test method.

### **8.1.2 Temporary Excavations**

Based on our understanding of the project, we anticipate that the grading could include local cuts on the order of approximately 10 feet or less for foundation placement if a basement is proposed. Excavations should be sloped no steeper than 1H:1V (Horizontal:Vertical) in medium dense native soils. If an excavation is subject to heavy vibration or surcharge loads, we recommend that the excavations be sloped no steeper than 1.5H: 1V, where room permits.

Temporary cuts should be in accordance with the Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. Temporary slopes should be visually inspected daily by a qualified person during construction activities and the inspections should be documented in daily reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and reducing slope erosion during construction.

Temporary cut slopes should be covered with visqueen to help reduce erosion during wet weather, and the slopes should be closely monitored until the permanent retaining systems or slope configurations are complete. Materials should not be stored or equipment operated within 10 feet of the top of any temporary cut slope.

Soil conditions may not be completely known from the geotechnical investigation. In the case of temporary cuts, the existing soil conditions may not be completely revealed until the excavation work exposes the soil. Typically, as excavation work progresses the maximum inclination of temporary slopes will need to be re-evaluated by the geotechnical engineer so that supplemental recommendations can be made. Soil and groundwater conditions can be highly variable. Scheduling for soil work will need to be adjustable, to deal with unanticipated conditions, so that the project can proceed and required deadlines can be met.

If any variations or undesirable conditions are encountered during construction, we should be notified so that supplemental recommendations can be made. If room constraints or groundwater conditions do not permit temporary slopes to be cut to the maximum angles allowed by the WAC, temporary shoring systems may be required. The contractor should be responsible for developing temporary shoring systems, if needed. We recommend that Cobalt Geosciences and the project structural engineer review temporary shoring designs prior to installation, to verify the suitability of the proposed systems.

December 8, 2020

### **8.1.3 Erosion and Sediment Control**

Erosion and sediment control (ESC) is used to reduce the transportation of eroded sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features for the site:

- Schedule the soil, foundation, utility, and other work requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be completed during the wet season (generally October through April).
- All site work should be completed and stabilized as quickly as possible.
- Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.
- Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

### **8.1.4 Foundation Design**

The proposed residences may be supported on shallow spread footing foundation systems bearing on undisturbed medium dense or firmer native soils or on properly compacted structural fill placed on the suitable native soils. If structural fill is used to support foundations, then the zone of structural fill should extend beyond the faces of the footing a lateral distance at least equal to the thickness of the structural fill.

For shallow foundation support, we recommend widths of at least 16 and 24 inches, respectively, for continuous wall and isolated column footings supporting the proposed structure. Provided that the footings are supported as recommended above, a net allowable bearing pressure of 2,500 pounds per square foot (psf) may be used for design. If a detention vault is used and is at least 5 feet below grade, an allowable bearing pressure of 5,000 psf may be used for design.

A 1/3 increase in the above value may be used for short duration loads, such as those imposed by wind and seismic events. Structural fill placed on bearing, native subgrade should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Footing excavations should be inspected to verify that the foundations will bear on suitable material.

Exterior footings should have a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower.

If constructed as recommended, the total foundation settlement is not expected to exceed 1 inch. Differential settlement, along a 25-foot exterior wall footing, or between adjoining column footings, should be less than 1/2 inch. This translates to an angular distortion of 0.002. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction



December 8, 2020

settlement may occur if the foundation soils are flooded or saturated. All footing excavations should be observed by a qualified geotechnical consultant.

Resistance to lateral footing displacement can be determined using an allowable friction factor of 0.35 acting between the base of foundations and the supporting subgrades. Lateral resistance for footings can also be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglect the upper 12 inches below grade in exterior areas). The allowable friction factor and allowable equivalent fluid passive pressure values include a factor of safety of 1.5. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance.

Care should be taken to prevent wetting or drying of the bearing materials during construction. Any extremely wet or dry materials, or any loose or disturbed materials at the bottom of the footing excavations, should be removed prior to placing concrete. The potential for wetting or drying of the bearing materials can be reduced by pouring concrete as soon as possible after completing the footing excavation and evaluating the bearing surface by the geotechnical engineer or his representative.

### 8.1.5 Reinforced Concrete Retaining Walls

The following table, titled **Wall Design Criteria**, presents the recommended soil related design parameters for retaining walls with a level backslope, if this information is required. Contact Cobalt if an alternate retaining wall system is used.

<b>Wall Design Criteria</b>	
“At-rest” Conditions (Lateral Earth Pressure – EFD <sup>+</sup> )	55 pcf (Equivalent Fluid Density)
“Active” Conditions (Lateral Earth Pressure – EFD <sup>+</sup> )	35 pcf (Equivalent Fluid Density)
Seismic Increase for “At-rest” Conditions (Lateral Earth Pressure)	21H* (Uniform Distribution) 1 in 2,500 year event
Seismic Increase for “At-rest” Conditions (Lateral Earth Pressure)	14H* (Uniform Distribution) 1 in 500 year event
Seismic Increase for “Active” Conditions (Lateral Earth Pressure)	7H* (Uniform Distribution)
Passive Earth Pressure on Low Side of Wall (Allowable, includes F.S. = 1.5)	Neglect upper 2 feet, then 250 pcf EFD <sup>+</sup>
Soil-Footing Coefficient of Sliding Friction (Allowable; includes F.S. = 1.5)	0.35

\*H is the height of the wall; Increase based on one in 500 year seismic event (10 percent probability of being exceeded in 50 years),  
+ EFD – Equivalent Fluid Density

December 8, 2020

The stated lateral earth pressures do not include the effects of hydrostatic pressure generated by water accumulation behind the retaining walls. Uniform horizontal lateral active and at-rest pressures on the retaining walls from vertical surcharges behind the wall may be calculated using active and at-rest lateral earth pressure coefficients of 0.3 and 0.5, respectively. The soil unit weight of 125 pcf may be used to calculate vertical earth surcharges.

To reduce the potential for the buildup of water pressure against the walls, continuous footing drains (with cleanouts) should be provided at the bases of the walls. The footing drains should consist of a minimum 4-inch diameter perforated pipe, sloped to drain, with perforations placed down and enveloped by a minimum 6 inches of pea gravel in all directions.

The backfill adjacent to and extending a lateral distance behind the walls at least 2 feet should consist of free-draining granular material. All free draining backfill should contain less than 3 percent fines (passing the U.S. Standard No. 200 Sieve) based upon the fraction passing the U.S. Standard No. 4 Sieve with at least 30 percent of the material being retained on the U.S. Standard No. 4 Sieve. The primary purpose of the free-draining material is the reduction of hydrostatic pressure. Some potential for the moisture to contact the back face of the wall may exist, even with treatment, which may require that more extensive waterproofing be specified for walls, which require interior moisture sensitive finishes.

We recommend that the backfill be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. In place density tests should be performed to verify adequate compaction. Soil compactors place transient surcharges on the backfill. Consequently, only light hand operated equipment is recommended within 3 feet of walls so that excessive stress is not imposed on the walls.

#### **8.1.6 Stormwater Recommendations**

The site is underlain by very fine-grained deposits which become very dense within a few feet of the ground surface. These materials are nearly impermeable and we encountered groundwater at shallow depths.

Due to moderately steep slope conditions in the area of the property as well as the presence of shallow groundwater, infiltration and dispersion devices do not appear to be feasible. We recommend direction connection of runoff devices to City infrastructure. We can provide additional recommendations once a civil plan has been prepared.

#### **8.1.7 Slab-on-Grade**

We recommend that the upper 12 inches of the native soils within any proposed slab areas be compacted to at least 95 percent of the modified proctor (ASTM D1557 Test Method). Any remaining loose or unstable soils should be removed prior to fill placement and compaction.

Often, a vapor barrier is considered below concrete slab areas. However, the usage of a vapor barrier could result in curling of the concrete slab at joints. Floor covers sensitive to moisture typically requires the usage of a vapor barrier. A materials or structural engineer should be consulted regarding the detailing of the vapor barrier below concrete slabs. Exterior slabs typically do not utilize vapor barriers.

December 8, 2020

The American Concrete Institutes ACI 360R-06 Design of Slabs on Grade and ACI 302.1R-04 Guide for Concrete Floor and Slab Construction are recommended references for vapor barrier selection and floor slab detailing.

Slabs on grade may be designed using a coefficient of subgrade reaction of 200 pounds per cubic inch (pci) assuming the slab-on-grade base course is underlain by structural fill placed and compacted as outlined in Section 8.1. A 4 to 6-inch-thick capillary break consisting of 5/8 inch clean angular rock or pea gravel should be placed over the prepared subgrade.

A perimeter drainage system is recommended unless interior slab areas are elevated a minimum of 12 inches above adjacent exterior grades. If installed, a perimeter drainage system should consist of a 4-inch diameter perforated drain pipe surrounded by a minimum 6 inches of drain rock wrapped in a non-woven geosynthetic filter fabric to reduce migration of soil particles into the drainage system. The perimeter drainage system should discharge by gravity flow to a suitable stormwater system.

Exterior grades surrounding buildings should be sloped at a minimum of one percent to facilitate surface water flow away from these buildings and preferably with a relatively impermeable surface cover immediately adjacent to the buildings.

### **8.1.8 Groundwater Influence on Construction**

Groundwater was encountered in B-1 at 2 feet below grade during drilling. We do not expect significant volumes of groundwater if the earthwork takes place during the dry season. There will likely be shallow perched groundwater during late winter and spring months.

If groundwater is encountered during construction, we anticipate that sump excavations and small pumps will adequately de-water short-term excavations. We can provide additional recommendations if necessary.

### **8.1.9 Pavement Recommendations**

The near surface subgrade soils generally consist of silty sand with gravel. These soils are rated as good for pavement subgrade material (depending on silt content and moisture conditions). We estimate that the subgrade will have a California Bearing Ratio (CBR) value of 10 and a modulus of subgrade reaction value of  $k = 200$  pci, provided the subgrade is prepared in general accordance with our recommendations.

We recommend that, at a minimum, 18 inches of the existing subgrade material be moisture conditioned (as necessary) and re-compacted to prepare for the construction of pavement sections. Deeper levels of recompaction or overexcavation and replacement may be necessary in areas where fill and/or very poor (soft/loose) soils are present. Any soils that cannot be compacted to required levels and soils that have more than 40 percent fines by weight should be removed and replaced with imported structural fill.

The subgrade should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Test Method D1557. In place density tests should be performed to verify proper moisture content and adequate compaction.

The recommended flexible and rigid pavement sections are based on design CBR and modulus of subgrade reaction ( $k$ ) values that are achieved, only following proper subgrade preparation. It should be noted that subgrade soils that have relatively high silt contents will likely be highly sensitive to moisture

December 8, 2020

conditions. The subgrade strength and performance characteristics of a silty subgrade material may be dramatically reduced if this material becomes wet.

Based on our knowledge of the proposed project, we expect the traffic to range from light duty (passenger automobiles) to heavy duty (delivery trucks). The following tables show the recommended pavement sections for light duty and heavy duty use. For areas where firetrucks may travel, we recommend using the heavy duty section.

**ASPHALTIC CONCRETE (FLEXIBLE) PAVEMENT**

**LIGHT DUTY**

<b>Asphaltic Concrete</b>	<b>Aggregate Base*</b>	<b>Compacted Subgrade* **</b>
2.5 in.	6.0 in.	12.0 in.

**HEAVY DUTY**

<b>Asphaltic Concrete</b>	<b>Aggregate Base*</b>	<b>Compacted Subgrade* **</b>
3.5 in.	6.0 in.	12.0 in.

**PORTLAND CEMENT CONCRETE (RIGID) PAVEMENT**

<b>Min. PCC Depth</b>	<b>Aggregate Base*</b>	<b>Compacted Subgrade* **</b>
6.0 in.	6.0 in.	12.0 in.

\* 95% compaction based on ASTM Test Method D1557

\*\* A proof roll may be performed in lieu of in place density tests

Aggregate base typically consists of 1-1/4-inch minus crushed rock with a possible 2 inch layer of 5/8-inch minus for a leveling course.

The asphaltic concrete depth in the flexible pavement tables should be a surface course type asphalt, such as Washington Department of Transportation (WSDOT) 1/2 inch HMA. The rigid pavement design is based on a Portland Cement Concrete (PCC) mix that has a 28 day compressive strength of 4,000 pounds per square inch (psi). The design is also based on a concrete flexural strength or modulus of rupture of 550 psi.

December 8, 2020

## 9.0 Construction Field Reviews

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Cobalt Geosciences should be retained to provide part time field review during construction in order to verify that the soil conditions encountered are consistent with our design assumptions and that the intent of our recommendations is being met. This will require field and engineering review to:

- Monitor and test structural fill placement and soil compaction
- Observe bearing capacity at footing locations
- Monitor excavation
- Proofroll pavement areas
- Verify drainage placement
- Monitor temporary and permanent erosion control

Geotechnical design services should also be anticipated during the subsequent final design phase to support the structural design and address specific issues arising during this phase. Field and engineering review services will also be required during the construction phase in order to provide a Final Letter for the project.

## 10.0 Closure

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This report was prepared for the exclusive use of AW Property Group, LLC and their appointed consultants. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should first be approved in writing by Cobalt Geosciences, LLC.

The recommendations contained in this report are based on assumed continuity of soils with those of our test holes, and assumed structural loads. Cobalt Geosciences should be provided with final architectural and civil drawings when they become available in order that we may review our design recommendations and advise of any revisions, if necessary.

Use of this report is subject to the Statement of General Conditions provided in Appendix A. It is the responsibility of AW Property Group, LLC who is identified as “the Client” within the Statement of General Conditions, and its agents to review the conditions and to notify Cobalt Geosciences should any of these not be satisfied.

LIMITED GEOTECHNICAL INVESTIGATION  
MERCER ISLAND, WASHINGTON



December 8, 2020

Respectfully submitted,

**Cobalt Geosciences, LLC**

***Original signed by:***



December 8, 2020

Phil Haberman, PE, LG, LEG  
Principal

**APPENDIX A**  
Statement of General Conditions

## **Statement of General Conditions**

**USE OF THIS REPORT:** This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Cobalt Geosciences and the Client. Any use which a third party makes of this report is the responsibility of such third party.

**BASIS OF THE REPORT:** The information, opinions, and/or recommendations made in this report are in accordance with Cobalt Geosciences present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Cobalt Geosciences is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

**STANDARD OF CARE:** Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state of execution for the specific professional service provided to the Client. No other warranty is made.

**INTERPRETATION OF SITE CONDITIONS:** Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Cobalt Geosciences at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

**VARYING OR UNEXPECTED CONDITIONS:** Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Cobalt Geosciences must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Cobalt Geosciences will not be responsible to any party for damages incurred as a result of failing to notify Cobalt Geosciences that differing site or sub-surface conditions are present upon becoming aware of such conditions.

**PLANNING, DESIGN, OR CONSTRUCTION:** Development or design plans and specifications should be reviewed by Cobalt Geosciences, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Cobalt Geosciences cannot be responsible for site work carried out without being present.



**APPENDIX B**  
Figures: Vicinity Map, Site Plan

122°15.000' W

122°12.000' W

WGS84 122°11.000' W



Map created with **TOPOIG** ©2010 National Geographic ©2007 Tele Atlas, Rel. 1/2007

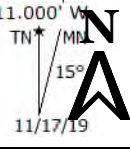
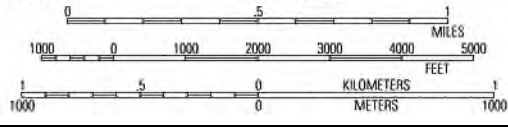
122°15.000' W

122°14.000' W

122°13.000' W

122°12.000' W

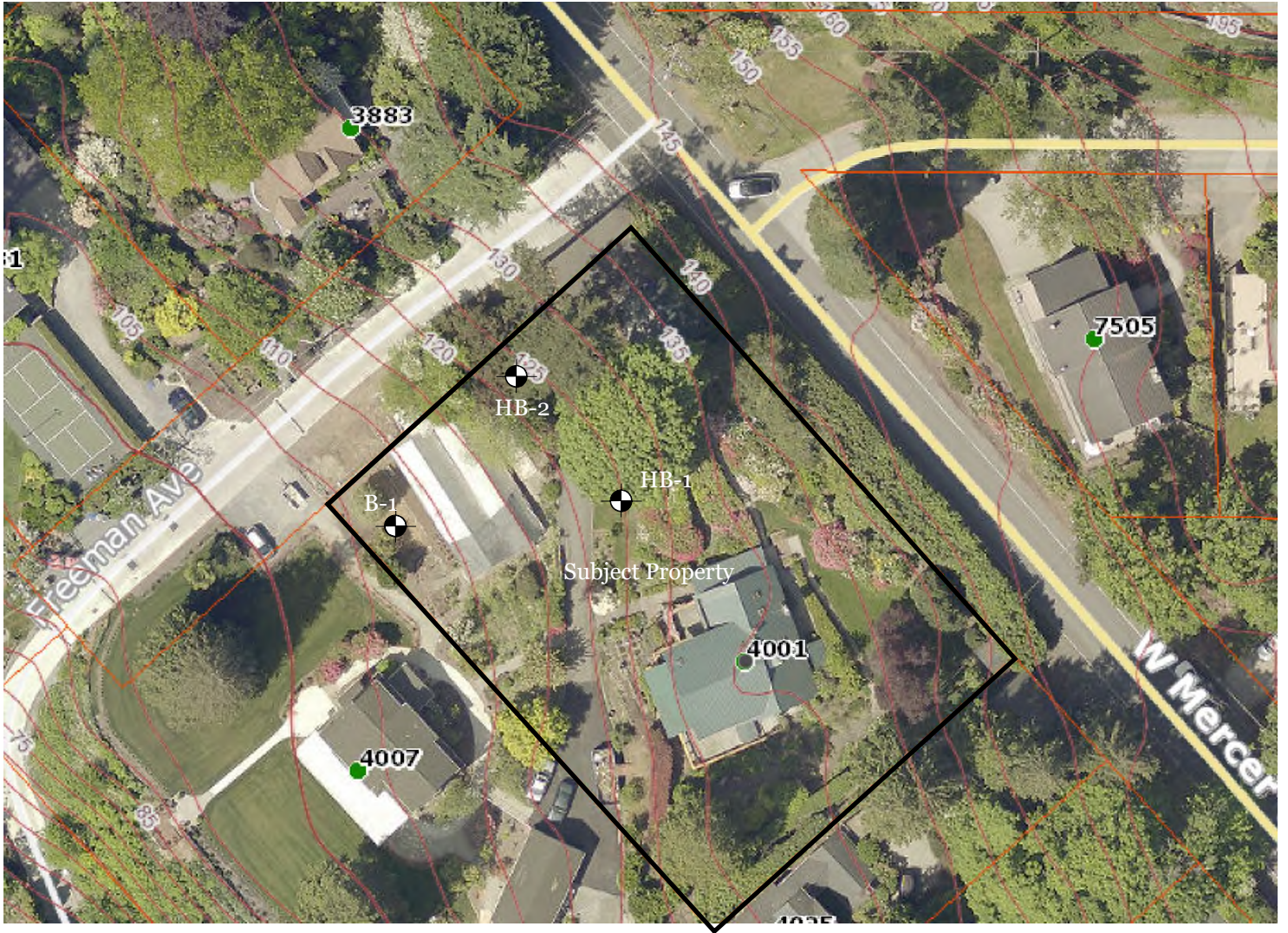
WGS84 122°11.000' W




Proposed Short Plat  
4001 W. Mercer Way  
Mercer Island, Washington

**VICINITY  
MAP  
FIGURE 1**

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**B-1**  
**HB-1**    Approximate  
 Boring and Hand Boring Location



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**SITE PLAN**  
  
**FIGURE 2**

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**APPENDIX C**  
Exploration Logs

## Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION	
<b>COARSE GRAINED SOILS</b> (more than 50% retained on No. 200 sieve)	Gravels (more than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravels, gravel-sand mixtures, little or no fines	
		Gravels with Fines (more than 12% fines)	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	
		Gravels with Fines (more than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures	
		Gravels with Fines (more than 12% fines)	GC	Clayey gravels, gravel-sand-clay mixtures	
	Sands (50% or more of coarse fraction passes the No. 4 sieve)	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines	
		Sands with Fines (more than 12% fines)	SP	Poorly graded sand, gravelly sands, little or no fines	
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures	
		Sands with Fines (more than 12% fines)	SC	Clayey sands, sand-clay mixtures	
		Silts and Clays (liquid limit less than 50)	Inorganic	ML	Inorganic silts of low to medium plasticity, sandy silts, gravelly silts, or clayey silts with slight plasticity
			Inorganic	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
Organic	OL		Organic silts and organic silty clays of low plasticity		
Silts and Clays (liquid limit 50 or more)	Inorganic		MH	Inorganic silts, micaceous or diatomaceous fine sands or silty soils, elastic silt	
	Inorganic		CH	Inorganic clays of medium to high plasticity, sandy fat clay, or gravelly fat clay	
Organic	OH	Organic clays of medium to high plasticity, organic silts			
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor	PT	Peat, humus, swamp soils with high organic content (ASTM D4427)		

Classification of Soil Constituents
<p>MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).</p> <p>Minor constituents compose 12 to 50 percent of the soil and precede the major constituents (i.e., silty SAND). Minor constituents preceded by "slightly" compose 5 to 12 percent of the soil (i.e., slightly silty SAND).</p> <p>Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).</p>

Grain Size Definitions	
Description	Sieve Number and/or Size
Fines	< #200 (0.08 mm)
Sand	#200 to #40 (0.08 to 0.4 mm)
-Fine	#40 to #10 (0.4 to 2 mm)
-Medium	#10 to #4 (2 to 5 mm)
-Coarse	
Gravel	#4 to 3/4 inch (5 to 19 mm)
-Fine	3/4 to 3 inches (19 to 76 mm)
-Coarse	
Cobbles	3 to 12 inches (75 to 305 mm)
Boulders	> 12 inches (305 mm)

Relative Density (Coarse Grained Soils)		Consistency (Fine Grained Soils)	
N, SPT, Blows/FT	Relative Density	N, SPT, Blows/FT	Relative Consistency
0 - 4	Very loose	Under 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
Over 50	Very dense	15 - 30	Very stiff
		Over 30	Hard

Moisture Content Definitions	
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table



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Soil Classification Chart

Figure C1

# Log of Boring B-1

Date: November 19, 2020

Depth: 9.5'

Initial Groundwater: 2'

Contractor: CN

Elevation:

Sample Type: Split Spoon

Method: Hollow Stem Auger

Logged By: PH    Checked By: SC

Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)					
								Plastic Limit	Liquid Limit				
								SPT N-Value					
								0	10	20	30	40	50
2			2 2 3		SM	Loose to medium dense, silty-fine to medium grained sand with grave, yellowish brown to grayish brown, moist to wet. (Pre-Olympia Glacial and Non-Glacial Deposits)  -local organics within the top 2 feet.	▼	■	■				
4			5 5 6					■					
6			4 3 9					■					
8			100/5		GP	Dense to very dense, gravel with sand trace silt, grayish brown, moist to wet?, (Pre-Olympia Deposits)							
10						End of Boring 9.5'							
12													
14													
16													
18													
20													
22													
24													
26													
28													
30													
32													
34													



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**Boring  
 Log**

# Log of Hand Boring HB-1

Date: November 19, 2020	Depth: 5'	Initial Groundwater: None
Contractor:	Elevation: N/A	Sample Type: Grab
Method: Hand Auger	Logged By: PH    Checked By: SC	Final Groundwater: N/A


Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)					
								Plastic Limit	Liquid Limit				
								SPT N-Value					
								0	10	20	30	40	50
				[Graphic: Horizontal lines]		Vegetation/Topsoil							
1				[Graphic: Yellow sand pattern]	SM	Loose to medium dense, silty-fine to medium grained sand trace gravel, dark yellowish brown to yellowish brown, moist. (Pre-Olympia Deposits)							
2	[Graphic: Black square]												
3													
4	[Graphic: Black square]					Refusal on rock							
5						End of Hand Boring 5'							
6													
7													
8													
9													
10													

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------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------	------------------------

# Log of Hand Boring HB-2

Date: November 19, 2020	Depth: 5'	Initial Groundwater: None
Contractor:	Elevation: N/A	Sample Type: Grab
Method: Hand Auger	Logged By: PH    Checked By: SC	Final Groundwater: N/A

Depth (Feet)	Interval	% Recovery	Blows/6"	Graphic Log	USCS Symbol	Material Description	Groundwater	Moisture Content (%)					
								Plastic Limit	Liquid Limit				
								SPT N-Value					
								0	10	20	30	40	50
				[Graphic: Horizontal lines]		Vegetation/Topsoil							
1				[Graphic: Yellow dots]	SM	Loose to medium dense, silty-fine to medium grained sand trace gravel, dark yellowish brown to yellowish brown, moist. (Pre-Olympia Deposits)							
2	[Graphic: Black square]												
3													
4	[Graphic: Black square]					Refusal on rock							
5						End of Hand Boring 5'							
6													
7													
8													
9													
10													

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