Cobalt Geosciences, LLC
P.O. Box 82243
Kenmore, Washington 98028

May 17, 2021

Mark Perkoski
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RE: Geotechnical Evaluation
Oslo Bay Apartments – SR 305 Stormwater Feasibility
SR 305
Poulsbo, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to present the results of our geotechnical evaluation at the referenced site. Specifically, this evaluation discusses infiltration feasibility design recommendations for off-site (right-of-way) stormwater management systems located along SR 305 near Vetter Road.

Area and Project Description

The project area includes the east shoulder of SR305 near Vetter Road NE in Poulsbo, Washington. Figure 1 shows the specific vault location and adjacent topography/features. Most of the site consists of a shallow ditch along the shoulder of the highway.

There are slope systems and rockery walls along the northeast margin of the proposed vault location. The rockery wall is up to 8 feet tall in places and appears to face cuts in native cuts in moderately steep slope areas to the northeast. Slopes in the vicinity of the project area are 20 to 50 percent and are well vegetated with understory and variable diameter trees.

The project includes excavation and placement of an infiltration gallery system within the low-lying ditch east-northeast of the highway. The vault has planned depths of 12 to 17 feet below existing elevations.

Area Geology

The Geologic Map of the Lofall Quadrangle, indicates that the site is near the contacts between Vashon Ice Contact Deposits, Glacial Drift, and possible Vashon Recessional Outwash.

These deposits include mixtures and layers of silty-sand with gravel, poorly graded sand with gravel and silt, and in some areas, sandy silt. The recessional deposits are typically medium dense (normally consolidated) while the drift and ice contact deposits are typically dense below a weathered zone. These soils can be locally permeable.

Soil & Groundwater Conditions

As part of our evaluation, we excavated two test pits within the area of the proposed vault.

The explorations encountered approximately 6 inches of grass and topsoil underlain by approximately 2.5 to 3 feet of loose to medium dense, silty-fine to medium grained sand with gravel (Fill). These materials were underlain by 4.5 to 5.5 feet of loose to medium dense, silty-fine to medium grained sand with gravel (Weathered Vashon Ice Contact Deposits?). These materials were underlain by dense to very dense, silty-fine to medium grained sand trace gravel (Vashon Ice Contact Deposits?), which continued to the termination depths of the explorations.

Groundwater was present below about 3 feet below grade in the test pits. The groundwater continued to the termination depths of the explorations. It is more typical to encounter a perched groundwater table that terminates on a dense aquitard, such as glacial till. At this site, the soils are relatively sandy, resulting in a thicker groundwater regime.

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.

Conclusions and Recommendations

General

The site is underlain by areas of fill and at depth by relatively dense glacially consolidated soils. Groundwater was encountered in our test pits within 3 feet of the ground surface. We reviewed nearby explorations. Most of these explorations encountered groundwater at similar depths in soils of similar composition. Infiltration of stormwater runoff is not feasible based on the high groundwater table in this area.

We anticipate that a detention vault or other similar system may be required for stormwater management. We can provide soil parameters and temporary shoring recommendations upon request and once a preliminary design has been prepared.

Stormwater Management Feasibility

We encountered areas of fill underlain by medium dense to dense mixtures and layers of silty-sand to poorly graded sand with gravel in our test pits. Groundwater was present at approximately 3 feet below grade extending to the termination depths of the explorations. There was surface water present in some areas.

Infiltration is not feasible due to the presence of shallow groundwater. Based on a review of nearby explorations, groundwater may be persistent in this area. In other words, groundwater may be present throughout a typical year at variable depths.

We anticipate that a concrete detention vault will be required to provide storage for runoff from impervious surfaces in the right-of-way.

We should be provided with final plans for review to determine if the intent of our recommendations has been incorporated or if additional modifications are needed.

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.

CLOSURE

This report was prepared for the exclusive use of Edward Rose 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 Edward Rose 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.

Sincerely,

Cobalt Geosciences, LLC

5/17/2021
Phil Haberman, PE, LG, LEG
Principal

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.

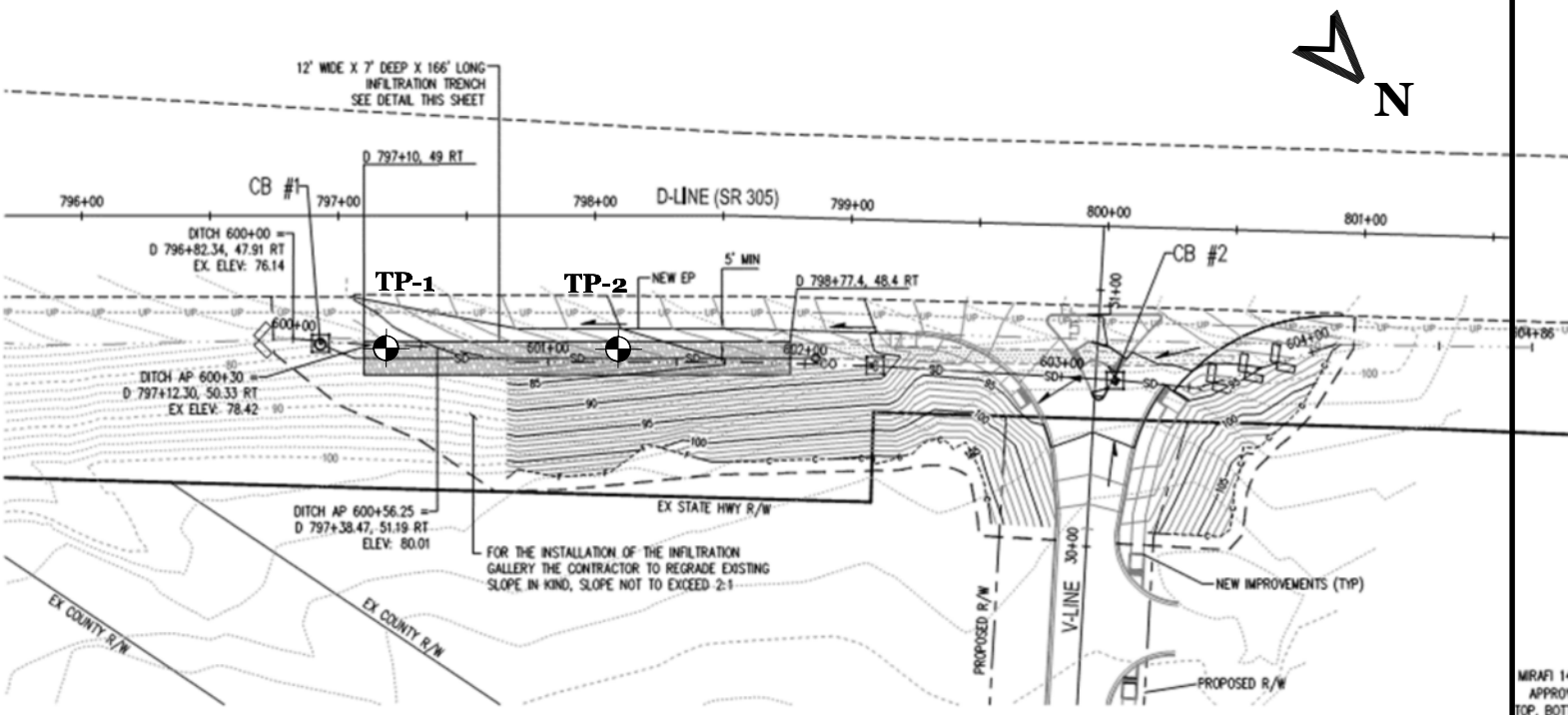
BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Cobalt Geosciences present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of 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.

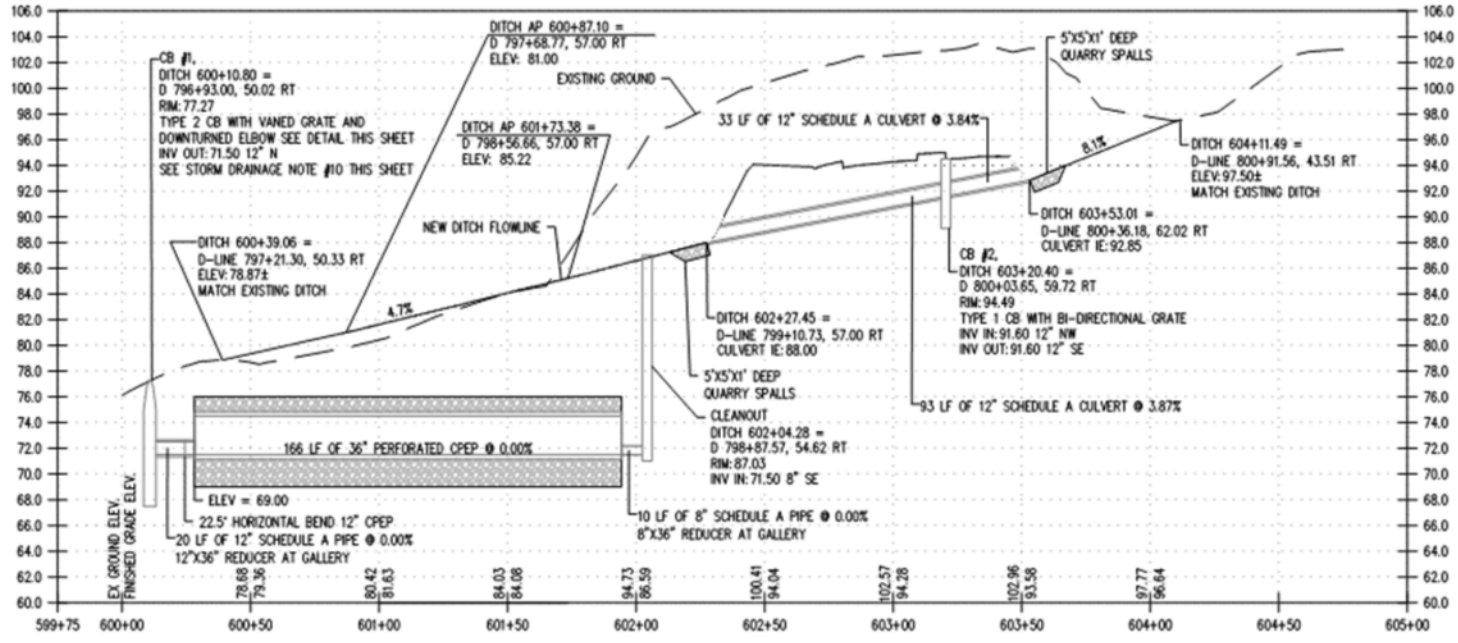
STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state of execution for the specific professional service provided to the Client. No other warranty is made.

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.





TP-1 **Approximate Test Pit Location**

Not to Scale

COBALT GEOSCIENCES	Geotechnical Evaluation Oslo Bay Apartments Poulsbo, Washington	**SITE PLAN** **FIGURE 1**	Cobalt Geosciences, LLC P.O. Box 82243 Kenmore, WA 98028 (206) 331-1097 www.cobaltgeo.com cobaltgeo@gmail.com

Unified Soil Classification System (USCS)

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS (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
			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
			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
			SP	Poorly graded sand, gravelly sands, little or no fines
		Sands with Fines (more than 12% fines)	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (50% or more passes the No. 200 sieve)	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
			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
			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

MAJOR constituents compose more than 50 percent, by weight, of the soil. Major constituents are capitalized (i.e., SAND).

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).

Trace constituents compose 0 to 5 percent of the soil (i.e., slightly silty SAND, trace gravel).

Grain Size Definitions

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

Relative Density (Coarse Grained Soils)

N, SPT, Blows/FT	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium dense
30 - 50	Dense
Over 50	Very dense

Consistency (Fine Grained Soils)

N, SPT, Blows/FT	Relative Consistency
Under 2	Very soft
2 - 4	Soft
4 - 8	Medium stiff
8 - 15	Stiff
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

Test Pit TP-1

Date: March 31, 2021	Depth: 10'	Groundwater: 3-5'
Contractor: Jim	Elevation: N/A	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description	Groundwater
				Grass/Topsoil/Rock	
1			SM	Medium dense, silty-fine to medium grained sand with gravel, dark yellowish brown to olive gray, moist to wet. (Fill)	
2					
3					
4			SM/ SP	Loose to medium dense, silty-fine to medium grained sand with gravel, grayish brown, wet. (Vashon Ice Contact Deposits?)	
5					
6					
7					
8			SM/ SP	Dense to very dense, silty-fine to medium grained sand with gravel, grayish brown to olive gray, wet. (Vashon Ice Contact Deposits?)	
9					
10				End of Test Pit 10'	

Moisture Content (%): Plastic Limit — Liquid Limit

DCP Equivalent N-Value: 0 10 20 30 40 50

Test Pit TP-2

Date: March 31, 2021	Depth: 10'	Groundwater: 3'
Contractor: Jim	Elevation: N/A	Logged By: PH Checked By: SC

Depth (Feet)	Interval	Graphic Log	USCS Symbol	Material Description	Groundwater
				Grass/Topsoil/Rock	
1			SM	Medium dense, silty-fine to medium grained sand with gravel, dark yellowish brown to olive gray, moist to wet. (Fill)	
2					
3					
4			SM/ SP	Loose to medium dense, silty-fine to medium grained sand with gravel, grayish brown, wet. (Vashon Ice Contact Deposits?)	
5					
6					
7					
8			SM/ SP	Dense to very dense, silty-fine to medium grained sand with gravel, grayish brown to olive gray, wet. (Vashon Ice Contact Deposits?)	
9					
10				End of Test Pit 10'	

Moisture Content (%): Plastic Limit — Liquid Limit

DCP Equivalent N-Value: 0 10 20 30 40 50

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Test Pit Logs

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