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

March 4, 2021

Mark Perkoski
Mark_perkoski@edwardrose.com

RE: Geotechnical Recommendations & Responses
Oslo Bay Apartments
SR 305
Poulsbo, Washington

In accordance with your authorization, Cobalt Geosciences, LLC has prepared this letter to present responses to City of Poulsbo comments with related geotechnical recommendations.

In preparation of this letter, we have reviewed the following documents:

- City of Poulsbo Memorandum dated February 2, 2021,
- Geotechnical and Stormwater Review letter by Aspect Consulting dated January 12, 2021,
- Geotechnical Engineering Report by EnviroSound Consulting dated August 14, 2020 and updated November 23, 2020,
- Civil Plans by Team 4 Engineering dated November 23, 2020.

Comment Letter Responses

The following items are geotechnical-related comments from the Aspect Consulting letter (underlined) followed by our discussions and recommendations.

(11) The report mentions slopes steeper than 40 percent on the southwest portion of the site near Dogfish Creek with no further discussion. Please include a discussion and any appropriate analysis and setback recommendations to confirm that the development will not impact these slope areas.

We have reviewed the previous geotechnical report, provided plans, and online geologic and topographic mapping. The southwest portion of the site includes south facing slopes with magnitudes of 15 to about 100 percent with total relief of about 100 feet. While most of the areas have low to moderate slope magnitudes, the slope system includes several ravine features that were likely created through erosion and mass wasting after glacial retreat. The steeper slopes are located within the ravine areas.

While there is some potential for soil creep in areas with slope magnitudes of above 40 percent, the risk of global instability appears to be low at this time. There are two buildings located above the slope system. Building 13 will be situated northwest of the steeper slope systems and at least 150 feet from the top of the steeper slopes. This building will be situated near and/or on a structural fill slope that will be created through benching of the native soils. This will require full-time geotechnical oversight to verify proper benching, fill compaction, and final grading.

Building 12 is shown to be setback at least 150 feet north of the ravine features. There is a detention pond shown near the top of steeper slope systems. The toe of the south pond berm appears to be setback approximately 25 feet from the top of the steeper slope systems. Grading and creation of the detention pond will require full-time geotechnical oversight to verify benching and fill slope construction meet project requirements.

Slope stability analyses have been performed through the detention pond areas, yielding factors of safety above required minimum levels. The building setbacks that are shown are adequate.

(12) Given the project scope, it is unreasonable to assume it can be completed during the dry season. The contractor should be prepared to manage these conditions per the recommendations of the geotechnical engineer, City guidelines, and the grading, TESC and SWPPP plans.

As with any site underlain by glacial till and which requires extensive cut and fill placement, it is imperative that the contractor and owners understand that additional erosion control measures, including dust control are often necessary. We anticipate that water trucks and possibly sprinklers will be necessary to maintain dust control during the summer months. Proper temporary erosion control measures must be in place prior to and during all earthwork activities.

During winter months, we anticipate that the native soils will have moisture contents that will prohibit or at least severely limit there use as fill. We anticipate that the contractor will either stop work and secure the site or import suitable structural fill that can be compacted to meet requirements.

(13) The report and wall exhibits indicate that MSE walls up to 16 will be constructed. Engineering designs that include global and internal analyses should be completed and provided for these walls.

It is our understanding that final wall designs and applicable global and internal analyses will be provided during the final permitting submission. If necessary, we can provide wall design analyses and slope stability analyses for these wall systems.

(14) Structural fill recommendations are not sufficient. Glacial till will be very difficult for reuse based on the fines content and the standard structural fill specifications for various uses around the site, particularly as wall backfill. Structural fill meeting standard WSDOT and City requirements should be imported for wall backfill, foundation subgrade, pavement subgrade, and utility trench backfill.

Glacial till soils can be used as structural fill in specific areas provided the soils are within 3 percent of the optimum moisture content as determined by the ASTM D1557 Test Method (modified proctor) and meet compaction requirements.

As discussed with the City of Poulsbo and Aspect Consulting, all structural fills used within public right-of-way will meet WSDOT specifications. We can provide comments on the specific WSDOT specifications to be utilized for the various proposed fills upon request. Gravel borrow will likely be required behind MSE walls and in utility trenches. Common borrow may be suitable in some locations.

Within the remainder of the site, we anticipate that the native soils will be used as structural fill provided they meet project specifications and requirements for moisture content and dry density.

In general, we anticipate that the weathered glacial till (usually the upper 5 to 15 feet) will require aeration during the summer months to achieve moisture contents that will allow compaction to required standards. The weathered till is often more than 5 percent over optimum except for during the summer months.

The unweathered glacial till typically has an in situ moisture content of 2 to 4 percent over optimum. These soils may require some drying prior to compaction.

For most of the till soils, drying during the summer months (late June through September) will likely be necessary.

We anticipate that the native soils will be most feasible for use between about May and October of a typical year. As noted, drying and aeration may be required and as is typical, structural fill must meet compaction requirements and be within 3 percent of the optimum moisture content.

During the wet season, we recommend importing a structural fill material with no greater than 5 percent fines (Passing the No. 200 Sieve by Weight) and a maximum grain size of 3 inches.

The following quality control measures should be utilized as part of structural fill placement and compaction:

Density Testing Frequency

Utility Trenches

Min. 1 test per 12-inch-thick lift within 4 feet of the ground surface up to subgrade &

Min. 1 test per 200 lineal feet of trench length

Roads and Building Lot Fills

Min. 1 test every 12 inches vertically up to subgrade &

Min. 1 test every 2,000 cubic yards of backfill soil

MSE Walls

Min. 1 test per lift of fill up to subgrade &

Min. 1 test per 500 cubic yards of soil &

Min. 1 test per 100 lineal feet of backfill (along length of wall)

Note: it is not always feasible or possible to safely conduct density testing in trenches greater than about 4 feet in depth. For these areas, we recommend full-time fill compaction monitoring by the geotechnical engineer/testing agency to verify compaction efforts. Limited testing or probing may be feasible when trench boxes are in place.

Soil Sampling Frequency

A soil sample should be obtained for each distinct soil type (native or import). Proctor and sieve analyses (ASTM D1557 Test Method & ASTM D6913, respectively) should be performed for each soil type prior to their use on site as fill. Additional proctors and sieves are likely to be necessary. We recommend a minimum proctor frequency of every 10,000 cubic yards (of the same/similar soil type) and a minimum sieve analysis (to confirm gradation) of every 5,000 cubic yards of material.

(15) Perched groundwater is common in areas underlain by glacial till. Encountering perched groundwater during excavation work should be expected and discussed in the report, particularly because there may be perched water impacting the moisture-sensitive soils at the subgrade.

If seasonal perched groundwater is encountered during construction, we anticipate shallow sump excavations with small diameter pumps will be adequate to de-water utility trenches or other excavations. We anticipate that groundwater would be light to moderate in volume and have a relatively slow rate of recharge. Groundwater zones are typically limited in thickness at the base of the weathered till and can be managed without well points or other extensive de-watering methods.

If excavations encounter groundwater, the soils that are removed will likely not be suitable for use as structural fill unless significant drying and aeration takes place.

(16) The slope stability sections do not include groundwater. We recommend including a perched groundwater table in the analyses.

We have prepared updated slope stability analyses using an assume perched groundwater table above the unweathered till. Our analyses used the soil parameters and geometry from the EnviroSound report. Factors of safety are above required minimum values. These analyses are attached.

(17) There is a typo in the report. Section 3.9.6 references a Section 2.9.4 which does not exist.

EnviroSound personnel have confirmed that the correct reference is Section 3.9.4.

Closure

The information presented herein is based upon professional interpretation utilizing standard practices and a degree of conservatism deemed proper for this project. We emphasize that this report is valid for this project as outlined above and for the current site conditions and should not be used for any other site.

Sincerely,

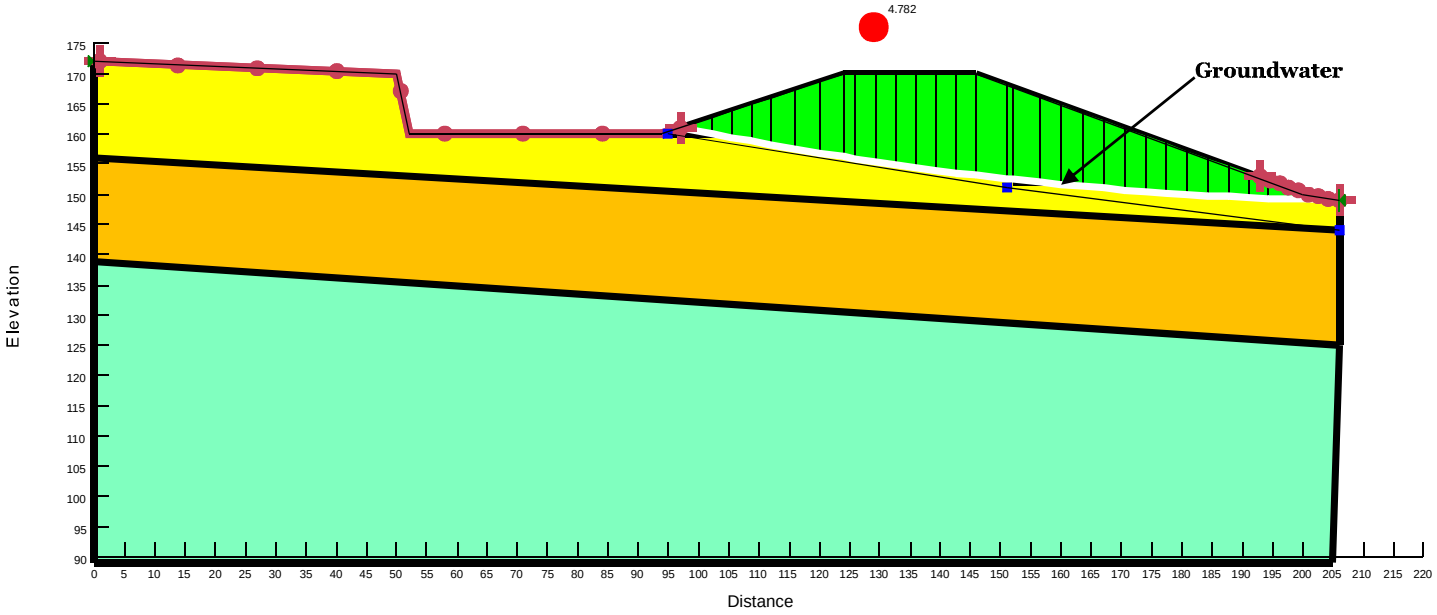
Cobalt Geosciences, LLC

3/4/2021

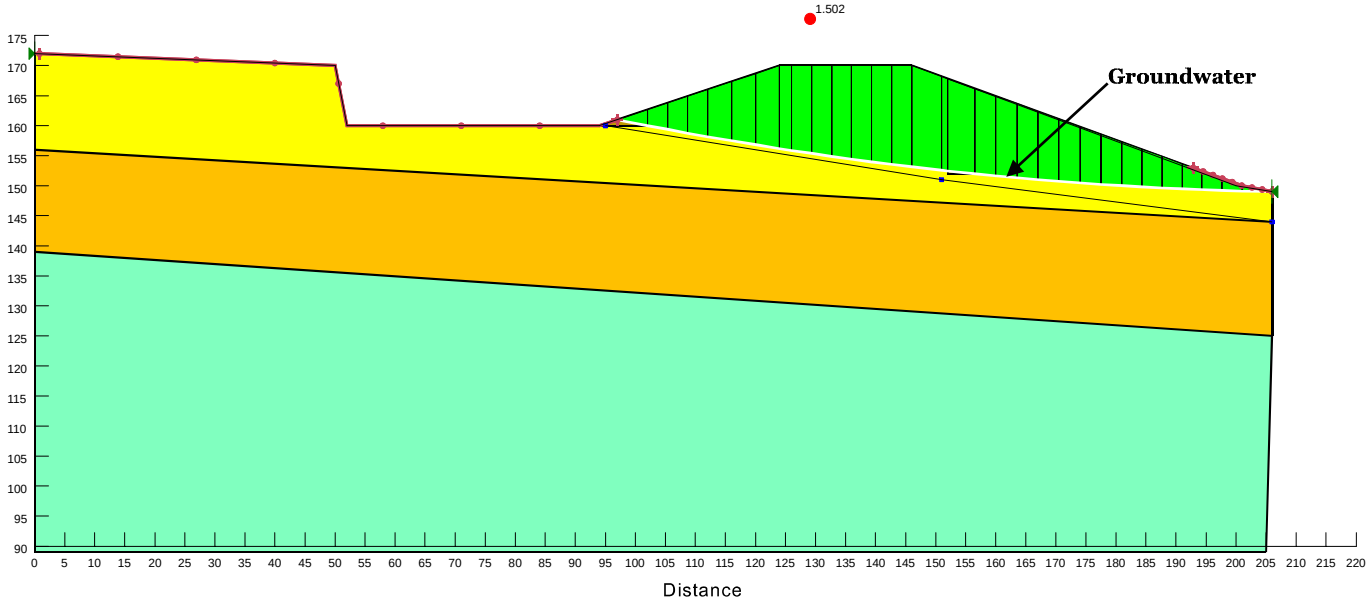
Phil Haberman, PE, LG, LEG
Principal

Attachments

Section A - Static Stability FS 4.782



Section A - Seismic Stability FS 1.502



Note: geometry and soil parameters are from the EnviroSound report

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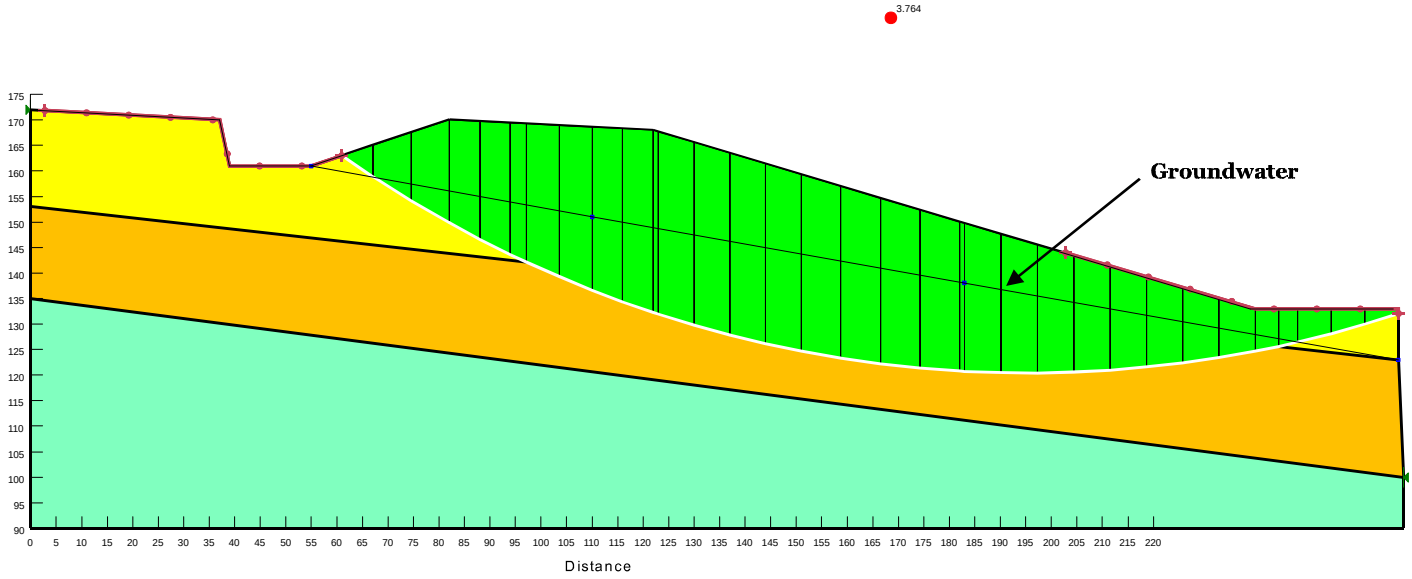
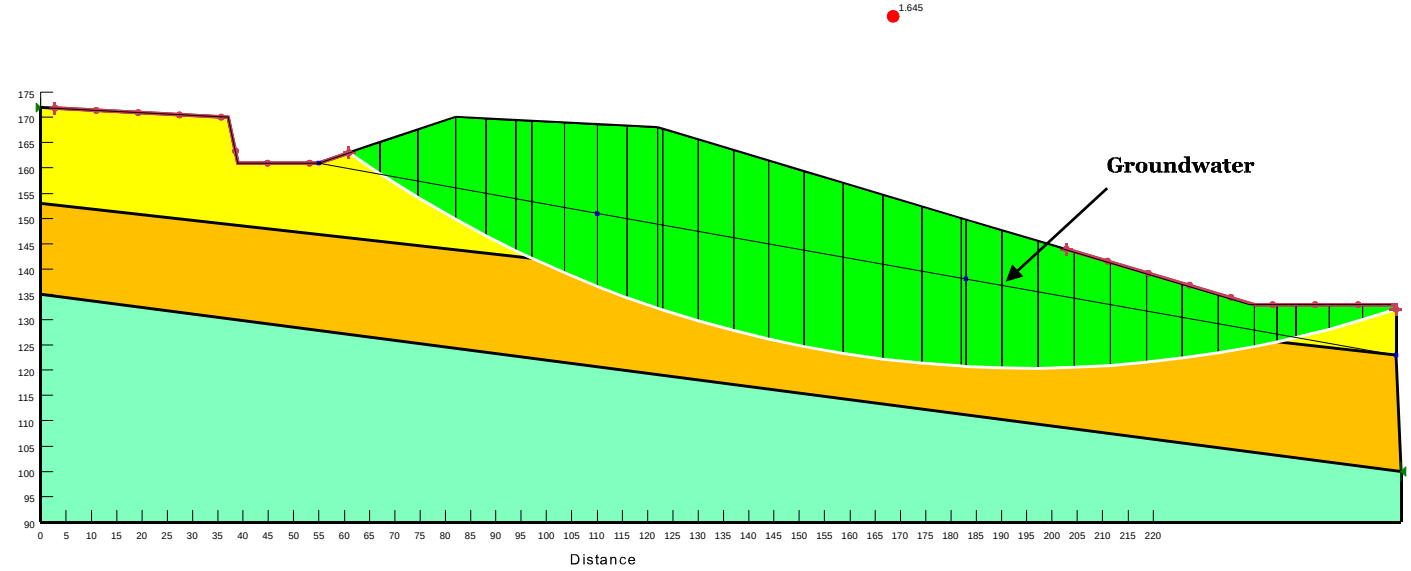
Section B - Static Stability FS 3.764



Section B - Seismic Stability FS 1.645



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