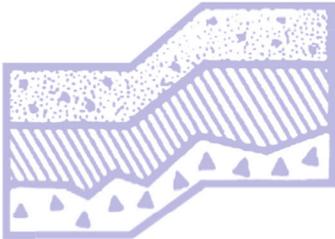




## **CRITICAL AREAS REPORT**

**Walsh Hills  
1711 Terrace Avenue  
Snohomish, Washington**

**Project No. T-8204**



## **Terra Associates, Inc.**

**Prepared for:**

**D.R. Horton  
Kirkland, Washington**

**October 23, 2020**



# TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology  
and  
Environmental Earth Sciences

October 23, 2020  
Project No. T-8204

Ms. Raelyn Hulquist  
D.R. Horton  
11241 Slater Avenue NE, Suite 200  
Kirkland, Washington 98033

Subject: Critical Areas Report  
Walsh Hills  
1711 Terrace Avenue  
Snohomish, Washington

Dear Ms. Hulquist:

As requested, we have completed a critical areas study for the subject project. The attached report presents our findings and conclusions for the geologic critical areas.

This report has been completed following Section 14.255.060 and 12.275.040 of the City of Snohomish Municipal Code (SMC). Based on our review of the SMC, the project site contains two geologic critical areas, an erosion hazard area and a landslide hazard area. The majority of the proposed development does not impact the geologic critical areas; however, the proposed discharge pipe for the detention vault will extend through the erosion hazard area and landslide hazard area.

In our opinion, the proposed modifications to the critical areas can be completed in a manner so that the critical area is protected post construction, provided the recommendations presented in this report are incorporated into project design and construction.

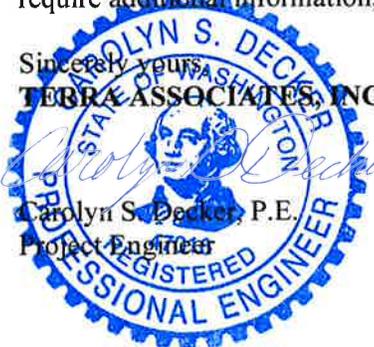
This report has been prepared by Carolyn S. Decker, P.E. a geotechnical engineer with over 14 years' experience in geotechnical engineering and geologic hazard studies. The contact information for Carolyn S. Decker can be found at the bottom of this page.

We trust the information presented in this report is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely,  
TERRA ASSOCIATES, INC.

  
Carolyn S. Decker, P.E.  
Project Engineer

10-23-2020



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# **Critical Area Report Walsh Hills 1711 Terrace Avenue Snohomish, Washington**

## **1.0 PROJECT DESCRIPTION**

The project consists of redeveloping the site with 113 single-family residential building lots along with 2 stormwater detention vaults, associated utilities, landscaping, and access. The eastern steep slope would remain undeveloped. Based on the grading plan prepared by CPH Consultants, dated May 12, 2020 grading to achieve building lot and roadway elevations will consist of cuts and fills from 1 to 20 feet. Part of the grading consists of constructing a maximum 18-foot retaining wall near the top of the steep slope. Other vertical grade transitions will be supported with retaining walls as well.

Site stormwater will be collected and directed to one of two stormwater detention vaults located in the southeast and southwest corners of the site. The discharge pipe for the southeast vault will extend to the east down the steep slope and connect to the existing stormwater system.

The recommendations contained in the following sections of this report are based on our understanding of the above design features. We should review design drawings as they become available to verify that our recommendations have been properly interpreted and incorporated into project design and to amend or supplement our recommendations, if required.

## **2.0 SCOPE OF WORK**

On August 29, 2019, we observed the soil and groundwater conditions in 8 test pits excavated with a track-mounted mini-excavator to depths of approximately 3 to 10 feet below existing surface grades. On September 17, 2019 and September 18, 2019, we supplemented this data by drilling 2 borings to depths of 100 feet below existing surface grades. Using the results of our field study and laboratory testing, analyses were undertaken to develop geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Geologic Hazards per the City of Snohomish Municipal Code.
- Relative slope stability.

It should be noted that recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion, and stability. Design and performance issues with respect to moisture as it relates to the structure environment are beyond Terra Associates' purview. A building envelope specialist or contractor should be consulted to address these issues, as needed.

### **3.0 SITE CONDITIONS**

#### **3.1 Surface**

The site is an approximately 19.3-acre parcel located at 1711 Terrace Avenue in Snohomish, Washington. The approximate site location is shown on Figure 1.

The majority of the site is currently developed with a single-family residential structure, an office building, eight warehouse buildings, and associated access and landscaping. The eastern portion of the site is undeveloped and covered with a moderate forest and associated understory. Site topography is generally flat with a slight slope from west to east that transitions to a steep slope in the eastern, undeveloped portion of the site. The relatively flat portion of the site has an overall relief of approximately 30 feet. The eastern steep slopes have an overall relief of approximately 210 feet.

#### **3.2 Soils**

In general, the soil conditions observed consist of approximately six to eight inches of organic topsoil overlying medium dense to very dense silty sand with varying amounts of gravel (weathered and unweathered glacial till) to the termination of the test pits. The exception to this general condition was observed in Test Pit TP-3 where we observed approximately nine feet of medium dense till-like and organic fills overlying the unweathered glacial till deposits.

The test borings showed the glacial till soils are present to the termination of the test borings. We observed an approximately 4- to 8-foot thick layer of hard silt with sandy interbeds at approximately 45 to 55 feet below current site grades.

The *Geologic Map of the Snohomish Quadrangle, Snohomish County, Washington* by J.P. Minard (1985) maps the site as Till (Qvt). The native soils observed in the test pits and test borings are generally consistent with this mapped geology.

The preceding is intended to be a general review of the soil conditions encountered. For more detailed descriptions, please refer to the Test Pit and Test Boring Logs in Appendix A. The approximate location of the test pits and test borings is shown on attached Figure 2.

#### **3.3 Groundwater**

No groundwater seepage was observed in the test pits. We observed light to moderate groundwater seepage in Test Boring B-1 at depths of 23 and 50 feet, and in Test Boring B-2 at depths of 6 and 56 feet. The shallow seepage at Test Boring B-2 was observed at the contact between the upper weathered till and underlying unweathered till. Additionally, we did observe mottled soils, which is typically an indication that shallow, perched, groundwater seepage develops during the wet winter months. We expect that perched groundwater levels and flow rates at the site will fluctuate seasonally with the highest levels occurring during and shortly following the winter months (November through May).

The deeper points of seepage observed in the test borings were observed within coarsely grained zones at the interface between the unweathered till and hard silts as well as atop silt interbeds. This groundwater seepage would not be significantly affected by seasonal weather variations and will be present during the drier summer and fall months.

### **3.4 Geologic Hazards/Critical Areas**

We evaluated site conditions for the presence of geologic hazards including erosion hazard areas and landslide hazard areas in accordance with the City of Snohomish Municipal Code, specifically Section 14.275. The project site contains an erosion hazard area and landslide hazard area in the eastern portion of the site. The only proposed construction within these hazards is the stormwater outfall pipe that will be constructed along the face of the slope.

#### ***3.4.1 Erosion Hazard Areas***

Section 14.275.010.B.1 of the City of Snohomish Municipal Code (SMC) defines erosion hazard areas as “areas identified by the U.S. Department of Agriculture’s Natural Resources Conservation Service as having a moderate-to-severe, severe, or very severe rill and inter-rill (sheet wash) erosion hazard.”

The soils observed in the western and central portions of the site are classified as Tokul gravelly medial loam, zero to eight percent slopes by the United States Department of Agriculture Natural Resources Conservation Service (NRCS). Over these portions of the site with the existing slope gradients, these soils will have a slight potential for erosion when exposed. The soils observed in the eastern, steep slope portion of the site are classified as Tokul-Winston gravelly loams, 25 to 65 percent slopes by the NRCS. Over this portion of the site with the existing slope gradients, these soils will have a severe potential for erosion when exposed. Therefore, this eastern slope meets the above criteria for an erosion hazard area per the SMC.

A small section of the eastern portion of the site that is mapped as a severe erosion hazard will be disturbed when the proposed stormwater outfall pipe is installed along the face of the slope. Therefore, additional erosion protection measures will be required for the erosion hazard area. Implementation of temporary and permanent Best Management Practices (BMPs) for preventing and controlling erosion will be required and will mitigate the erosion hazard. As a minimum, we recommend implementing the following erosion and sediment control BMPs prior to, during, and immediately following construction activities at the site.

#### ***Prevention***

- Limit site clearing and grading activities to the relatively dry months (typically May through September).
- Limit disturbance to areas where construction is imminent.
- Locate temporary stockpiles of excavated soils no closer than ten feet from the crest of the slope.
- Provide temporary cover for cut slopes and soil stockpiles during periods of inactivity. Temporary cover may consist of durable plastic sheeting that is securely anchored to the ground surface or straw mulch.
- Establish permanent cover over exposed areas that will not be disturbed for a period of 30 days or more by seeding, in conjunction with a mulch cover or appropriate hydroseeding.

### ***Containment***

- Install a silt fence along site margins and downslope of areas that will be disturbed. The silt fence should be in place before clearing and grading is initiated.
- Intercept surface water flow and route the flow away from the slope to a stabilized discharge point. Surface water must not discharge at the top or onto the face of the steep slope.
- Provide on-site sediment retention for collected runoff.

The contractor should perform daily review and maintenance of all erosion and sedimentation control measures at the site.

Provided the erosion measures as outlined above are following during construction, the impact to the erosion hazard area or downslope area is expected to be minimal.

The calculated slope retreat rate for the site is approximately 0.5 inches per year. However, we would note that there is evidence on the site of larger erosive events that have occurred in the past. The calculated slope retreat rate is based on a typical yearly rainfall.

### ***3.4.2 Landslide Hazard Areas***

Section 14.275.010.B.2 of the SMC defines landslide hazard areas as “areas subject to landslides based on geology, soils, topography, and hydrology, including:

- a. Areas delineated by the U.S. Department of Agriculture’s Natural Resources Conservation Service as having a severe limitation for building site development.
- b. Areas mapped by the Washington Department of Ecology (Coastal Zone Atlas) or the Washington State Department of Natural Resources (slope stability mapping) as unstable (U or Class 3), unstable old slides (UOS or Class 4), or unstable recent slides (URS or Class 5).
- c. Areas designated as quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published by the U.S. Geological Survey or Washington State Department of Natural Resources.
- d. Areas where the following coincide: slopes steeper than 15 percent, relatively permeable sediment overlying a relatively impermeable sediment or bedrock, and groundwater seepage.
- e. Areas that have shown movement in the past 10,000 years or that are underlain or covered by mass wastage debris of that time frame.
- f. Slopes that are parallel or sub-parallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials.
- g. Slopes steeper than 80 percent subject to rock fall during seismic shaking.
- h. Areas potentially unstable because of rapid stream incision, stream bank erosion, and undercutting by wave action.
- i. Areas at risk from snow avalanches.
- j. Canyons or active alluvial fans subject to debris flows or catastrophic flooding.
- k. Slopes of 40 percent or steeper with a vertical relief of 10 or more feet except areas composed of consolidated rock.”

Existing site topography in the western and central portions of the site consists of a slight slope with little to no risk of mass movement due to geologic, topography, or hydrologic factors. The steep slope located in the eastern portion of the site has an overall relief of approximately 210 feet with grades of up to 85 percent, meeting condition ‘k’ listed above. Therefore, the eastern portion of the site would be considered a landslide hazard area per the SMC. As such, the code-required setbacks and buffers will need to be included in the drawings.

***Slope Stability***

Part of our investigation was to determine the appropriate buffers and setbacks for the proposed development from the eastern steep slope. In order to determine the buffers and setbacks, we have completed three slope stability analyses. The analyses were performed at locations designated as Cross Sections A-A’, B-B’, and C-C’ using the computer program Slide 2018. The approximate cross section location is shown on Figure 2.

Our analysis considered both static and pseudostatic (seismic) conditions. A horizontal acceleration of 0.15g was used in the pseudostatic analysis to simulate slope performance under earthquake loading. This value is based on the maximum considered earthquake (MCE) peak ground acceleration (PGA) adjusted for pseudostatic analysis following procedures outlined in Section 6.2.2 of the FHWA-NHI-11-032 Seismic Design – Geotechnical Features Manual.

Based on our field exploration, laboratory testing, and previous experience with similar soil types, we chose the following parameters for our analysis:

**Table 1 – Slope Stability Analysis Soil Parameters**

<b>Soil Type</b>	<b>Unit Weight (pcf)</b>	<b>Friction Angle (Degrees)</b>	<b>Cohesion (psf)</b>
Dense to very dense silty SAND with gravel (unweathered till)	125	40	500

The results of our slope stability analysis, as shown by the lowest safety factors for each condition, are presented in the following table:

**Table 2 – Slope Stability Analysis Results**

<i>Cross Section</i>	<b>Minimum Safety Factors</b>	
	<i>Existing Conditions</i>	<i>Post Construction</i>
A-A’	1.88 (Seismic FS = 1.37)	1.88 (Seismic FS = 1.37)
B-B’	1.57 (Seismic FS = 1.20)	1.57 (Seismic FS = 1.20)
C-C’	2.15 (Seismic FS = 1.54)	1.91 (Seismic FS = 1.38)

Based on our analysis, the proposed construction must maintain a 10-foot buffer with a 15-foot building setback from the crest of the steep slope. No clearing should occur on the slope areas that are steeper than 40 percent or within their respective 10-foot buffer areas. In our opinion, a slope monitoring and inspection program would not be necessary as construction activities are not planned to take place on the steep slopes. The results of our analysis are attached in Appendix B.

In addition to the slope stability analysis, we completed a reconnaissance of the steep slope. During our reconnaissance, we did not observe any evidence of deep-seated landslides. No tension cracks, leaning, or pistoled butted trees and no head scarps associated with a deep-seated failure were observed. What we did observe was evidence of several skin slides or erosion areas throughout the slope. These are common on steep slopes because during heavy precipitation events the upper loose soils become saturated and slide along the more competent material. This can manifest as mud flowing down the slope and becoming deposited in a less steep area or on the lower roadway. The skin slides or erosion are typically not an indication of slope instability but simple erosion that can occur. Contributing to the precipitation that falls directly on this slope, there is also the overland flows from the adjacent flat parcel area that currently flow unmitigated toward the slope. This precipitation combines with the precipitation that falls directly on the slope and can contribute to the skin slides or erosion. Once the project is completed, the flows from the project area will be captured and directed to the sites stormwater system preventing some precipitation from reaching the slopes. The post construction drainage should assist in preventing some skin slides or erosion from occurring.

Provided the construction measures for the outfall pipe are followed as outlined below, the impact to the landslide hazard area or downslope areas is expected to be minimal.

### **3.5 Foundations**

The residential structures may be supported on conventional spread footing foundations bearing on competent native soils, competent existing fill, or on structural fill placed above the competent soils. The foundations for all structures should follow the buffers outlined above.

### **3.6 Stormwater Facilities**

As noted above, site stormwater will be collected and directed to one of two stormwater detention vaults located in the southeast or southwest corners of the site. The southeast vault is near the top of the steep slope. The vault has been modeled in the above stability analysis and the proposed location is suitable from a stability standpoint. The vault should remain outside of the 10-foot buffer and 15-foot building setback lines.

#### ***Pipe Anchors***

The discharge pipe for the southeast detention vault will extend down the eastern steep slope and connect to the existing storm system at the base of the slope.

As we understand, the pipe that will be used for the outfall will consist of an 18-inch diameter HDPE pipe. The pipe would be anchored or secured at the top and would then be placed on the slope surface. HDPE pipe will move on the slope due to thermal expansion and contraction. To limit movement, hillside anchors or guides need to be installed at set intervals on the installation alignment. Based on a preliminary analysis using a relatively straight alignment, we expect the hillside anchors will need to be placed approximately every 15 feet. We should re-evaluate this spacing based on the actual pipe alignment when it is finalized. This installation is similar to stormwater outfalls installed on steep slopes throughout the Puget Sound area.

Analysis indicates the 18-inch diameter HDPE pipe can be secured at the top using a cast-in-place concrete block or anchor. For the estimated 400 feet of pipe a concrete block with a weight equal to 233 cubic feet of unreinforced concrete will be needed. A typical concrete anchor design detail is shown on Figure 3.

The HDPE alignment down the slope must limit impact to the existing vegetation and trees. We recommend all trees that are currently on the slope remain and the HDPE pipe bend around the trunks of the trees, if necessary. To limit vegetation removal and maintain low vegetation surface cover, we recommend suspending the HDPE pipe a minimum distance of six inches (plus or minus two inches) above the slope surface using pipe anchor guides as shown on Figure 4. Removal of existing vegetation should be limited with vegetation only removed as needed to install the guide anchors. Areas disturbed by construction must be restored by planting or reseeding and covering with long-term erosion control matting.

### **3.7 Drainage**

#### ***Surface***

Final exterior grades should promote free and positive drainage away from the building areas. We recommend providing a positive drainage gradient away from the building perimeter. If a positive gradient cannot be provided, provisions for collection and disposal of surface water adjacent to the structure should be provided.

#### ***Subsurface***

We recommend installing a continuous drain along the outside lower edge of the perimeter building foundations. The drains can be laid to grade at an invert elevation equivalent to the bottom of footing grade. The drains can consist of four-inch diameter perforated PVC pipe that is enveloped in washed ½- to ¾-inch gravel-sized drainage aggregate. The aggregate should extend six inches above and to the sides of the pipe. The foundation drains and roof downspouts should be tightlined separately to an approved point of controlled discharge. All drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once each year.

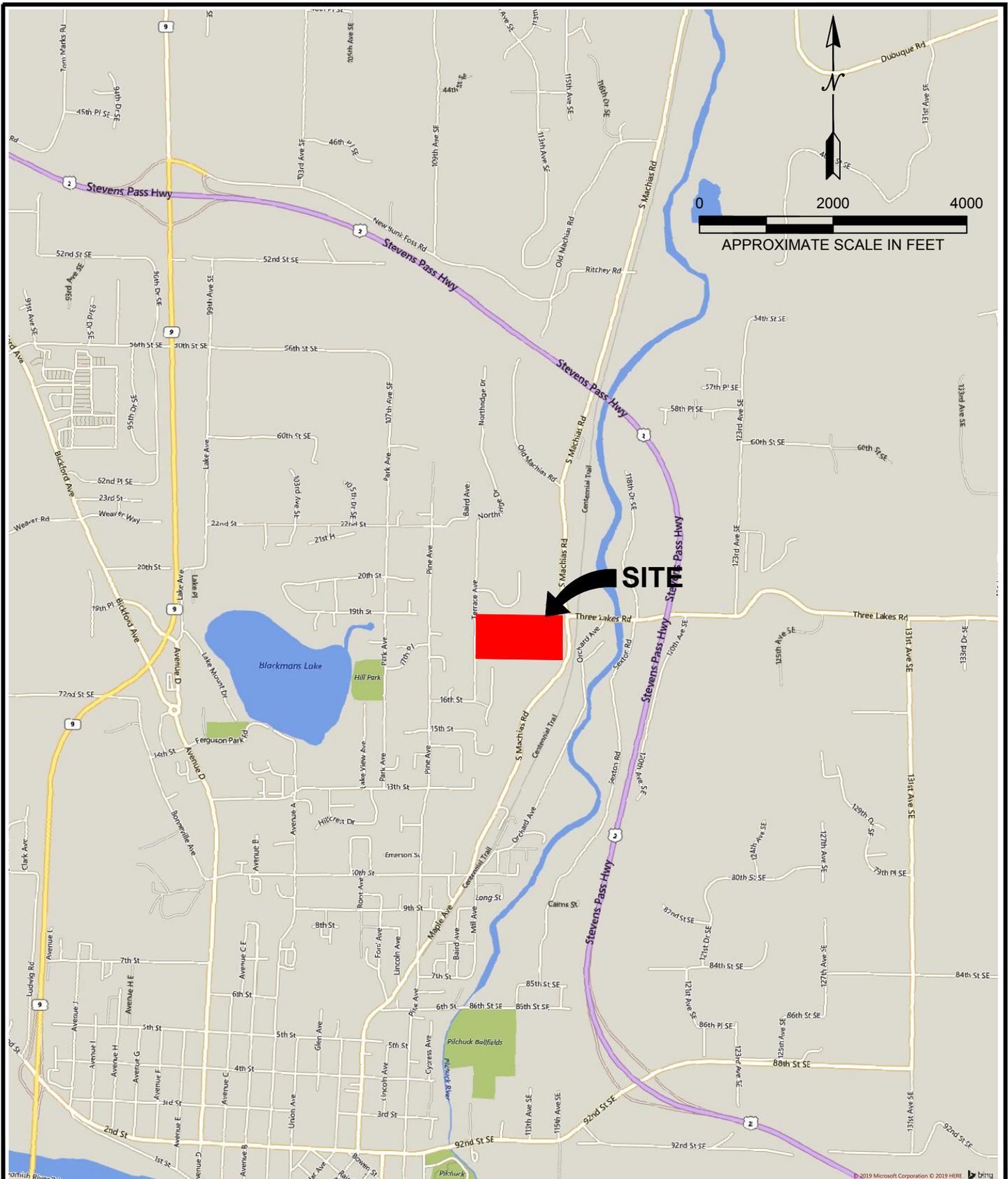
### **4.0 ADDITIONAL SERVICES**

Terra Associates, Inc. should review the final designs and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented in project design. We should also provide geotechnical services during construction in order to observe compliance with our design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

## **5.0 LIMITATIONS**

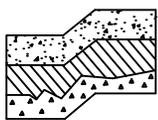
We prepared this report in accordance with generally accepted geotechnical engineering practices. This report is the copyrighted property of Terra Associates, Inc. and is intended for specific application to the Walsh Hills project in Snohomish, Washington. This report is for the exclusive use of D.R. Horton and their authorized representatives. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based on data obtained from the subsurface explorations completed on-site. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.



REFERENCE: <https://www.bing.com/maps>

ACCESSED 9/10/19



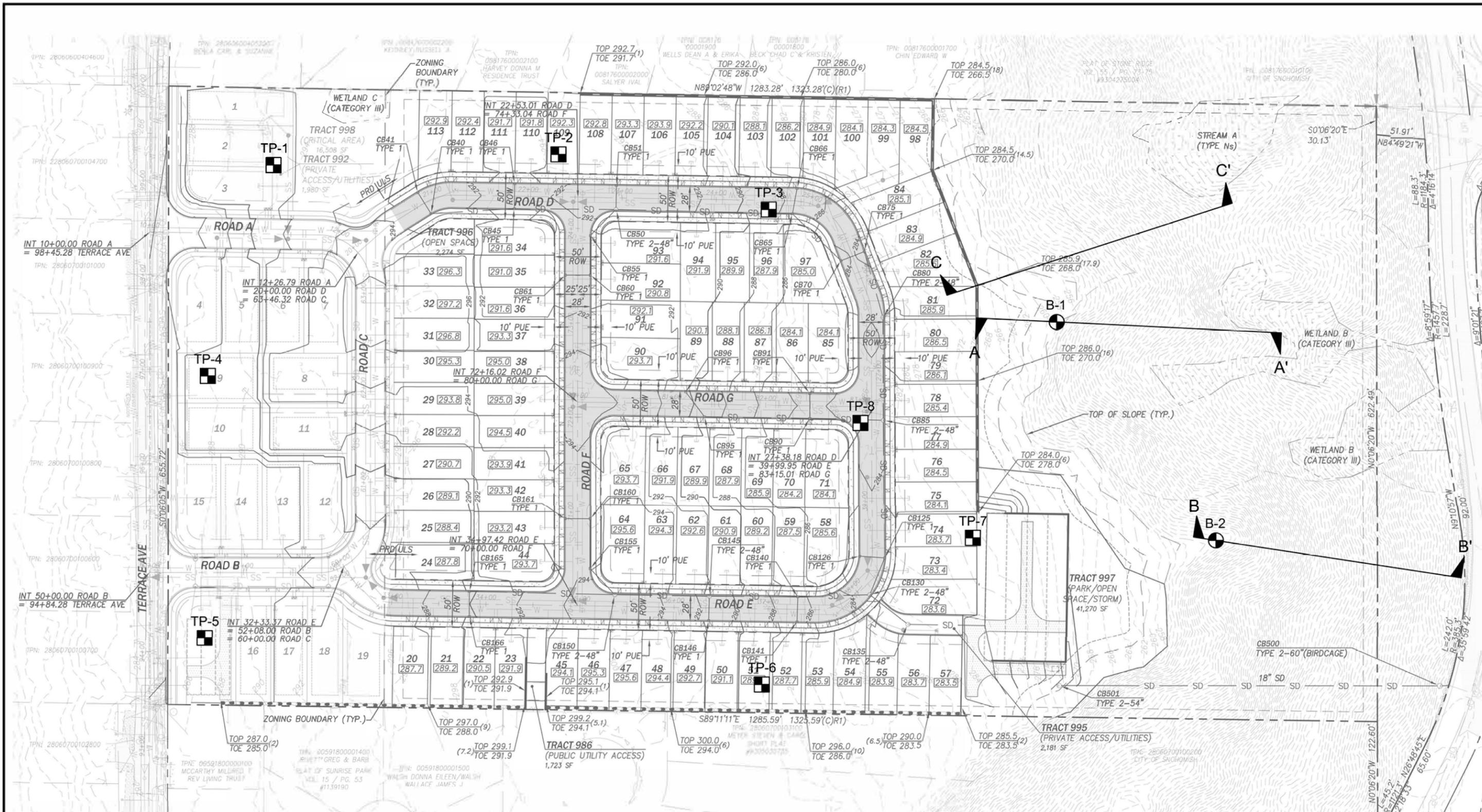
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 Geology and  
 Environmental Earth Sciences

VICINITY MAP  
 WALSH HILLS  
 SNOHOMISH, WASHINGTON

Proj.No. T-8204

Date:OCT 2020

Figure 1



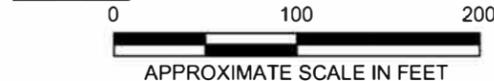
**NOTE:**

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

**REFERENCE:** SITE PLAN PROVIDED BY CPH CONSULTANTS.

**LEGEND:**

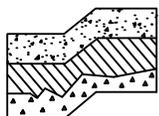
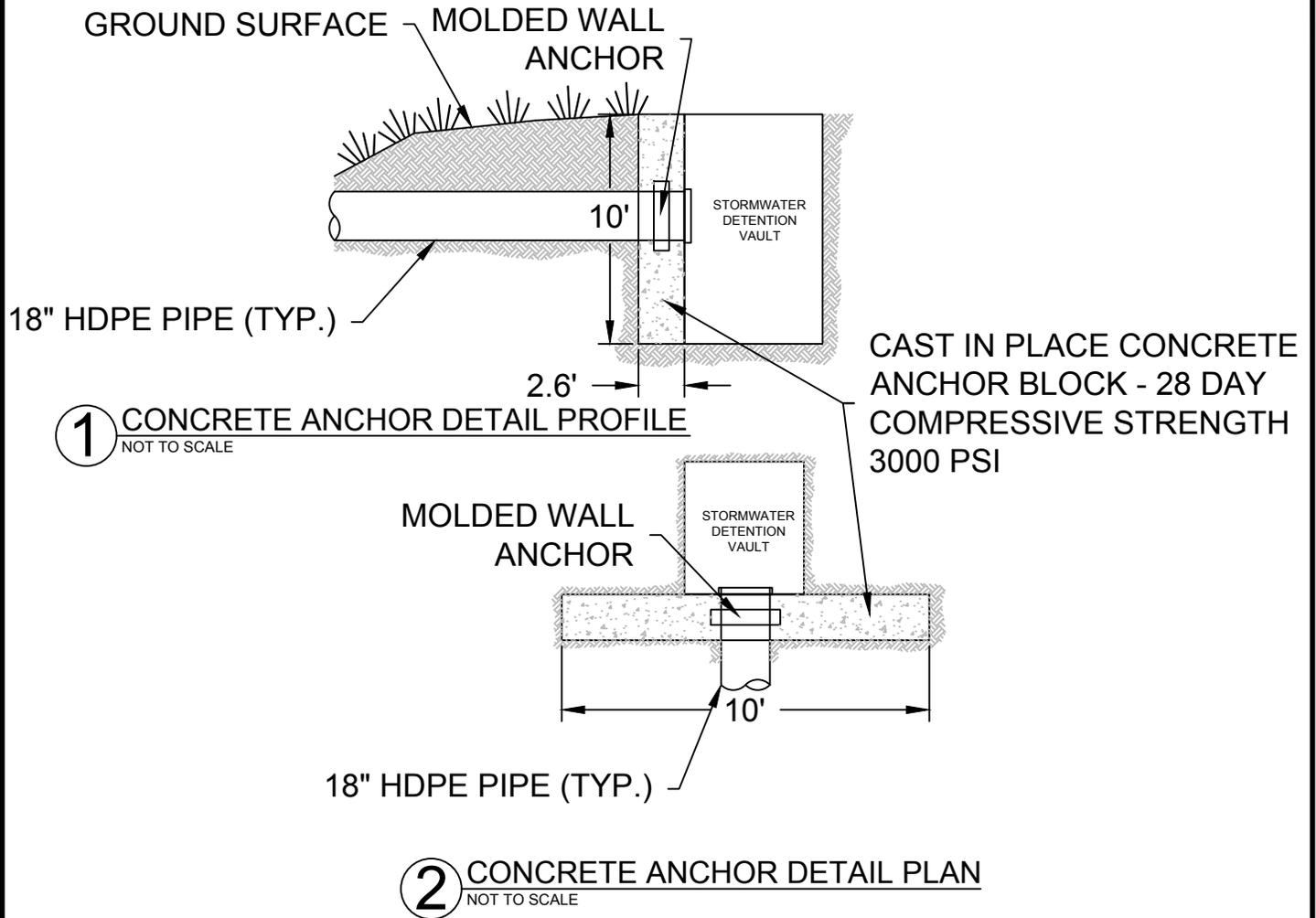
-  APPROXIMATE TEST PIT LOCATION
-  APPROXIMATE BORING LOCATION
-  APPROXIMATE CROSS SECTION LOCATION



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 Geology and Environmental Earth Sciences

**EXPLORATION LOCATION PLAN  
 WALSH HILLS  
 SNOHOMISH, WASHINGTON**

Proj.No. T-8204	Date: OCT 2020	Figure 2
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CONCRETE ANCHOR DETAIL  
 WALSH HILLS  
 SNOHOMISH, WASHINGTON

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Date:OCT 2020

Figure 3

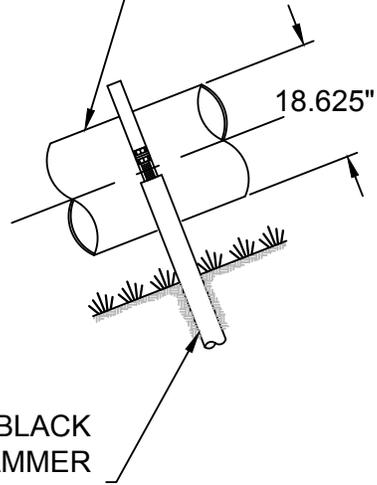
STANDARD PIPE CLAMP FOR  
20", OR 22" DIAMETER PIPE (TYP.)

7/8" BOLT CONNECTION  
FIELD FABRICATE (TYP.)

SLOPE SURFACE (TYP.)

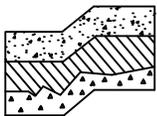


18" HDPE PIPE TO BE PLACED  
TANGENT TO THE BOTTOM I.D.  
OF THE PIPE CLAMP  
(TYP.)



2" DIAMETER EXTRA STONG BLACK  
PIPE PILE DRIVEN TO REFUSAL WITH 60 LB JACK HAMMER  
- REFUSAL CRITERIA -  
1" OF LESS PENETRATION AFTER 60 SECONDS (TYP.)

**1** HILLSIDE ANCHOR DETAIL  
NOT TO SCALE



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Associates, Inc.**  
Consultants in Geotechnical Engineering  
Geology and  
Environmental Earth Sciences

HILLSIDE ANCHOR DETAIL  
WALSH HILLS  
SNOHOMISH, WASHINGTON

Proj.No. T-8204

Date: OCT 2020

Figure 4

**APPENDIX A**  
**FIELD EXPLORATION AND LABORATORY TESTING**

**Walsh Hills**  
**Snohomish, Washington**

On August 29, 2019, we investigated subsurface conditions at the site by excavating 8 test pits with a track-mounted mini-excavator to depths of about 3 to 10 feet below existing grades. On September 17, 2019 and September 18, 2019, we supplemented this data by observing soil conditions at 2 borings drilled to depths of about 100 feet below existing surface grades. The test pit and boring locations were approximately determined in the field by sighting and pacing from existing surface features. The approximate test pit and test boring locations are shown on Figure 2. The Test Pit and Test Boring Logs are presented as Figures A-2 through A-11.

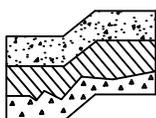
A geotechnical engineer from our office conducted the field exploration. Our representative classified the soil conditions encountered, maintained a log of each test pit and test boring, obtained representative soil samples, and recorded water levels observed during excavation. During drilling, soil samples were obtained in general accordance with ASTM Test Designation D-1586. Using this procedure, a 2-inch (outside diameter) split barrel sampler is driven into the ground 18 inches using a 140-pound hammer free falling a height of 30 inches. The number of blows required to drive the sampler 12 inches after an initial 6-inch set is referred to as the Standard Penetration Resistance value or N value. This is an index related to the consistency of cohesive soils and relative density of cohesionless materials. N values obtained for each sampling interval are recorded on the Test Boring Logs, Figures A-10 and A-11. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1.

Representative soil samples obtained from the test pits and test borings were placed in sealed plastic bags and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the Test Pit and Test Boring Logs. Grain size analyses were performed on select soil samples. The results are shown on Figures A-12 through A-14.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION	
<b>COARSE GRAINED SOILS</b>	More than 50% material larger than No. 200 sieve size	<b>GRAVELS</b> More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
			Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	More than 50% of coarse fraction is smaller than No. 4 sieve	<b>SANDS</b> More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
				SP	Poorly-graded sands, sands with gravel, little or no fines.
			Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
				SC	Clayey sands, sand-clay mixtures, plastic fines.
<b>FINE GRAINED SOILS</b>	More than 50% material smaller than No. 200 sieve size	<b>SILTS AND CLAYS</b> Liquid Limit is less than 50%	ML	Inorganic silts, rock flour, clayey silts with slight plasticity.	
			CL	Inorganic clays of low to medium plasticity. (Lean clay)	
			OL	Organic silts and organic clays of low plasticity.	
		<b>SILTS AND CLAYS</b> Liquid Limit is greater than 50%	MH	Inorganic silts, elastic.	
			CH	Inorganic clays of high plasticity. (Fat clay)	
			OH	Organic clays of high plasticity.	
<b>HIGHLY ORGANIC SOILS</b>			PT	Peat.	

### DEFINITION OF TERMS AND SYMBOLS

<b>COHESIONLESS</b>	<u>Density</u>	<u>Standard Penetration Resistance in Blows/Foot</u>	 2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
	Very Loose Loose Medium Dense Dense Very Dense	0-4 4-10 10-30 30-50 >50	 2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
<b>COHESIVE</b>	<u>Consistency</u>	<u>Standard Penetration Resistance in Blows/Foot</u>	 WATER LEVEL (Date)
	Very Soft Soft Medium Stiff Stiff Very Stiff Hard	0-2 2-4 4-8 8-16 16-32 >32	Tr TORVANE READINGS, tsf Pp PENETROMETER READING, tsf DD DRY DENSITY, pounds per cubic foot LL LIQUID LIMIT, percent PI PLASTIC INDEX N STANDARD PENETRATION, blows per foot



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UNIFIED SOIL CLASSIFICATION SYSTEM  
WALSH HILLS  
SNOHOMISH, WASHINGTON

Proj.No. T-8204

Date:OCT 2020

Figure A-1

# LOG OF TEST PIT NO. TP-1

FIGURE A-2

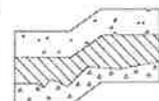
**PROJECT NAME:** Terrace Avenue Development      **PROJ. NO:** T-8204      **LOGGED BY:** MJX

**LOCATION:** Snohomish, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** August 29, 2019      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(7-inches organic TOPSOIL)		
1	1	Light brown silty SAND with gravel, fine sand, fine to coarse gravel, moist, scattered rootlets, trace cobbles, occasional boulder. (SM)	Medium dense	12.5
3	2	Gray silty SAND with gravel, fine to coarse sand, fine to coarse gravel, dry to moist, mottled, trace cobbles, occasional boulder, light cementation. (SM)	Dense	9.5
5	3	Test Pit terminated at approximately 5 feet. No groundwater seepage observed. No caving observed.		11.6
6				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-2

FIGURE A-3

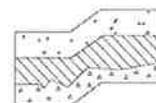
**PROJECT NAME:** Terrace Avenue Development      **PROJ. NO:** T-8204      **LOGGED BY:** MJX

**LOCATION:** Snohomish, Washington      **SURFACE CONDITIONS:** Brush & mulch      **APPROX. ELEV:** NA

**DATE LOGGED:** August 29, 2019      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(8-inches organic TOPSOIL)		
1	1	Light brown transitioning to reddish-brown silty SAND with gravel, fine sand, fine to coarse gravel, moist, scattered rootlets, occasional cobble, occasional boulder. (SM)	Medium dense	15.5
2				
3	2	Gray silty SAND with gravel, fine to medium sand, fine to coarse gravel, moist, trace cobbles, light cementation. (SM)		12.6
4			Dense	
5	3	Test Pit terminated at approximately 5 feet. No groundwater seepage observed. No caving observed.		11.4
6				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-3

FIGURE A-4

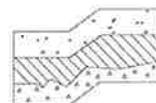
**PROJECT NAME:** Terrace Avenue Development      **PROJ. NO:** T-8204      **LOGGED BY:** MJX

**LOCATION:** Snohomish, Washington      **SURFACE CONDITIONS:** Blackberry bushes      **APPROX. ELEV:** NA

**DATE LOGGED:** August 29, 2019      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(8-inches organic TOPSOIL)		
1	1	FILL: Grayish-brown to gray silty SAND with gravel, fine to coarse sand, fine to coarse gravel, dry to moist, some mottling, trace organics, trace cobbles, occasional asphalt debris, occasional glass fragments, occasional plastic waste. (SM)	Medium dense	9.6
2				
3				
4	2			12.0
5	3			18.2
6	4			16.9
7	5	FILL: Black silty SAND, fine sand, moist, scattered organics, trace glass fragments. (SM)	Medium dense to dense	42.8
8				
9	6			38.1
10	7	Gray silty SAND with gravel, fine to medium sand, fine to coarse gravel, moist to wet, mottled. (SM)	Dense	19.2
11		Test Pit terminated at approximately 10 feet. No groundwater seepage observed. No caving observed.		
12				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-4

FIGURE A-5

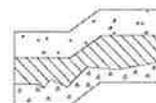
PROJECT NAME: Terrace Avenue Development PROJ. NO: T-8204 LOGGED BY: MJX

LOCATION: Snohomish, Washington SURFACE CONDITIONS: Grass APPROX. ELEV: NA

DATE LOGGED: August 29, 2019 DEPTH TO GROUNDWATER: NA DEPTH TO CAVING: NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(7-inches organic TOPSOIL)  Light brown silty SAND with gravel, fine sand, fine to coarse gravel, moist, scattered rootlets, trace cobbles, occasional boulder. (SM)		
1	1		Medium dense	12.9
2				
3	2	Gray silty SAND with gravel, fine to medium sand, fine to coarse gravel, dry to moist, mottled, trace cobbles, light cementation. (SM)	Dense	8.3
4	3	Test Pit terminated at approximately 4 feet. No groundwater seepage observed. No caving observed.		11.5
5				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-5

FIGURE A-6

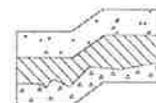
**PROJECT NAME:** Terrace Avenue Development      **PROJ. NO:** T-8204      **LOGGED BY:** MJX

**LOCATION:** Snohomish, Washington      **SURFACE CONDITIONS:** Grass      **APPROX. ELEV:** NA

**DATE LOGGED:** August 29, 2019      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(6-inches organic TOPSOIL)  Light brown silty SAND with gravel, fine sand, fine to coarse gravel, dry to moist, scattered rootlets. (SM)		
1	1		Medium dense	11.8
2				
3	2	Gray silty SAND with gravel, fine to medium sand, fine to coarse gravel, dry to moist, mottled, scattered cobbles, light cementation. (SM)	Dense	9.8
4	3			13.5
5		Test Pit terminated at approximately 4 feet. No groundwater seepage observed. No caving observed.		

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-6

FIGURE A-7

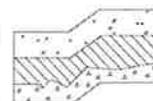
**PROJECT NAME:** Terrace Avenue Development      **PROJ. NO:** T-8204      **LOGGED BY:** MJX

**LOCATION:** Snohomish, Washington      **SURFACE CONDITIONS:** Brush      **APPROX. ELEV:** NA

**DATE LOGGED:** August 29, 2019      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(8-inches organic TOPSOIL) Light brown silty SAND, fine sand, dry to moist, scattered rootlets, trace gravel. (SM)		
1	1		Medium dense	12.3
2		Light gray silty SAND with gravel, fine sand, fine to coarse gravel, dry, light cementation. (SM)	Dense	
3	2	Test Pit terminated at approximately 3 feet. No groundwater seepage observed. No caving observed.		6.7

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-7

FIGURE A-8

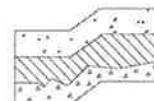
**PROJECT NAME:** Terrace Avenue Development      **PROJ. NO:** T-8204      **LOGGED BY:** MJX

**LOCATION:** Snohomish, Washington      **SURFACE CONDITIONS:** Grass & brush      **APPROX. ELEV:** NA

**DATE LOGGED:** August 29, 2019      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(7-inches organic TOPSOIL)		
1	1	Brown transitioning to gray silty SAND, fine sand, moist, scattered rootlets, trace gravel. (SM)	Medium dense	26.2
2	2			15.0
3	3			10.9
4		*Mottling observed below approximately 4.5 feet*		
6	4	Gray silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist, trace cobbles, light cementation. (SM)	Dense	12.9
7	5	Test Pit terminated at approximately 7 feet. No groundwater seepage observed. No caving observed.		11.4
8				

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF TEST PIT NO. TP-8

FIGURE A-9

**PROJECT NAME:** Terrace Avenue Development      **PROJ. NO:** T-8204      **LOGGED BY:** MJX

**LOCATION:** Snohomish, Washington      **SURFACE CONDITIONS:** Brush      **APPROX. ELEV:** NA

**DATE LOGGED:** August 29, 2019      **DEPTH TO GROUNDWATER:** NA      **DEPTH TO CAVING:** NA

Depth (ft)	Sample No.	Description	Consistency/ Relative Density	W (%)
0		(8-inches organic TOPSOIL)		
1	1	Brown to reddish-brown silty SAND with gravel, fine sand, fine to coarse gravel, moist, scattered rootlets, trace cobbles. (SM)	Medium dense	18.8
2				
3	2	Brownish-gray silty SAND, fine to medium sand, moist, trace gravel. (SM)		16.0
4				
5	3			11.9
6	4	Gray silty SAND with gravel, fine to medium sand, fine to coarse gravel, moist, mottled, trace cobbles, occasional boulder. (SM)	Dense	15.0
7	5			13.7
8		Test Pit terminated at approximately 7 feet. No groundwater seepage observed. No caving observed.		

NOTE: This subsurface information pertains only to this test pit location and should not be interpreted as being indicative of other locations at the site.



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# LOG OF BORING NO. B-1

Figure No. A-10

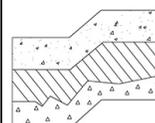
Project: Terrace Avenue Development Project No: T-8204 Date Drilled: September 18, 2019

Client: D.R. Horton Driller: Boretac Logged By: MJX

Location: Snohomish, Washington Depth to Groundwater: 23 Feet, 50 Feet Approx. Elev: ~255 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot			Moisture Content (%)
				10	30	50	
0		Black silty SAND, fine sand, moist, scattered organics. (SM) (Organic TOPSOIL)	Dense				31 30.9 4.7
5		Brown SAND with silt, fine to medium sand, moist, trace organics. (SP-SM)	Medium Dense				28 6.5 10.2
10		Gray silty SAND with gravel, fine to medium sand, fine to coarse gravel, moist, occasional sand with silt layer. (SM)  *Mottling observed in 5-foot sample*	Very Dense				50/6" 9.8
15		Brownish-gray sandy SILT to SILT with sand, fine sand, moist, scattered gravel. (ML)	Dense				76 5.7
20			Hard				46 10.4
25		Gray silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist to wet, slightly mottled. (SM)	Very Stiff				32 15.8
30			Dense				26 8.8
35			Very Dense				46 12.5
							50/6" 15.3
							50/6" 11.1

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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# LOG OF BORING NO. B-1

Figure No. A-10

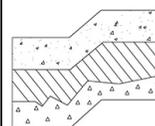
Project: Terrace Avenue Development Project No: T-8204 Date Drilled: September 18, 2019

Client: D.R. Horton Driller: Boretac Logged By: MJX

Location: Snohomish, Washington Depth to Groundwater: 23 Feet, 50 Feet Approx. Elev: ~255 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot			Moisture Content (%)	
				10	30	50		
35		Gray silty SAND with gravel, fine to coarse sand, fine to coarse gravel, moist to wet, slightly mottled. (SM)	Very Dense					
40						50/5"	10.7	
45							50/4"	11.0
50							50/6"	16.4
55				Gray SILT, moist, occasional sand with silt seam. (ML)	Hard			50/6"
60		Gray silty SAND, fine to medium sand, moist to wet. (SM)	Very Dense			92	14.8	
65		Gray SILT, moist. (ML)	Hard			93/6"	17.2	
70		Brown silty SAND, fine to medium sand, moist, occasional silt inclusions. (SM)	Very Dense			50/4"	14.3	

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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# LOG OF BORING NO. B-1

Figure No. A-10

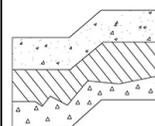
Project: Terrace Avenue Development Project No: T-8204 Date Drilled: September 18, 2019

Client: D.R. Horton Driller: Boretac Logged By: MJX

Location: Snohomish, Washington Depth to Groundwater: 23 Feet, 50 Feet Approx. Elev: ~255 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot			Moisture Content (%)	
				10	30	50		
70		Brown silty SAND, fine to medium sand, moist, occasional silt inclusions. (SM)	Very Dense					
75							50/4"	16.7
80							50/6"	15.5
85							50/4"	19.6
90							50/6"	17.5
95							50/6"	20.3
100		*Material becomes dark gray.						
100		Test boring terminated at approximately 100 feet. Light to moderate perched groundwater seepage observed at approximately 23 feet and 50 feet.						
105								

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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# LOG OF BORING NO. B-2

Figure No. A-11

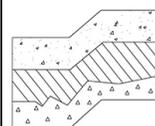
Project: Terrace Avenue Development Project No: T-8204 Date Drilled: September 17, 2019

Client: D.R. Horton Driller: Boretac Logged By: MJX

Location: Snohomish, Washington Depth to Groundwater: 6 Feet, 56 Feet Approx. Elev: ~240 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot			Moisture Content (%)
				10	30	50	
0		Black silty SAND, fine sand, moist, scattered organics. (SM) (Organic TOPSOIL)	Dense				27.4
5		Light brown silty SAND with gravel, fine sand, fine to coarse gravel, dry. (SM)					5.5
5		Gray silty SAND with gravel, fine to medium sand, fine to coarse gravel, moist. (SM)	Very Dense				7.8
10							9.8
10			Dense				10.4
15							13.1
15			Dense				10.9
20							6.9
25			Very Dense				9.1
30							7.1
35							9.9

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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# LOG OF BORING NO. B-2

Figure No. A-11

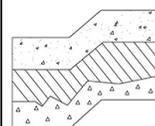
Project: Terrace Avenue Development Project No: T-8204 Date Drilled: September 17, 2019

Client: D.R. Horton Driller: Borettec Logged By: MJX

Location: Snohomish, Washington Depth to Groundwater: 6 Feet, 56 Feet Approx. Elev: ~240 Feet

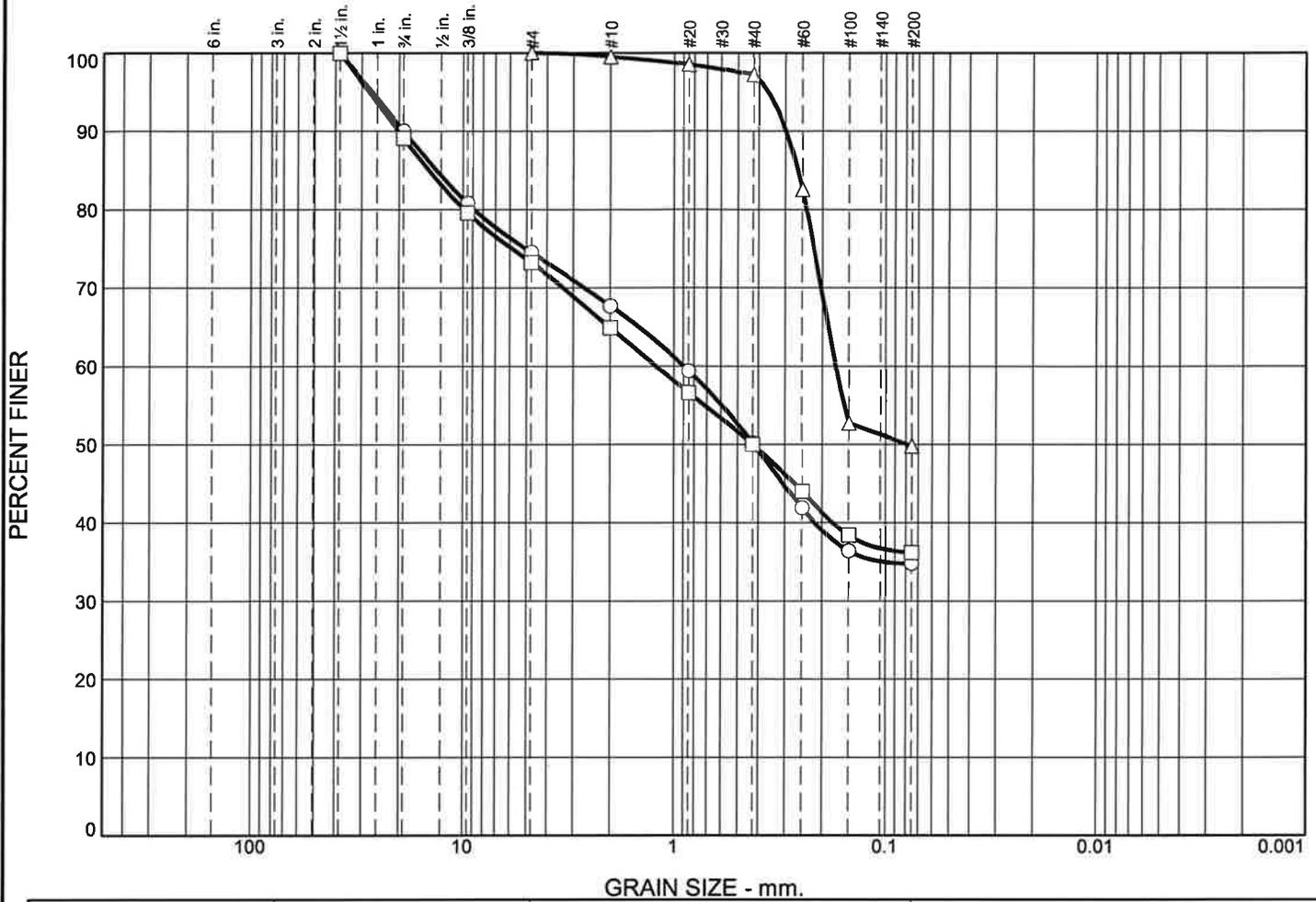
Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot			Moisture Content (%)	
				10	30	50		
70		Grayish-brown silty SAND, fine to medium sand, moist, scattered silt inclusions. (SM)	Very Dense					
75							50/6"	8.0
80							83	9.0
85							50/5"	8.9
90							93/6"	7.9
95							50/4"	7.1
100							50/6"	6.1
105		Test boring terminated at approximately 100 feet. Light perched groundwater seepage observed at approximately 6 feet and 56 feet.						

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpreted as being indicative of other areas of the site



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# Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	10.0	15.5	6.8	17.5	15.4	34.8			
□	0.0	10.9	15.9	8.3	14.9	13.8	36.2			
△	0.0	0.0	0.0	0.5	2.3	47.4	49.8			
⊗	LL	PL	D85	D60	D50	D30	D15	D10	C <sub>c</sub>	C <sub>u</sub>
○			13.3443	0.8966	0.4195					
□			14.4649	1.2153	0.4250					
△			0.2631	0.1732	0.0787					

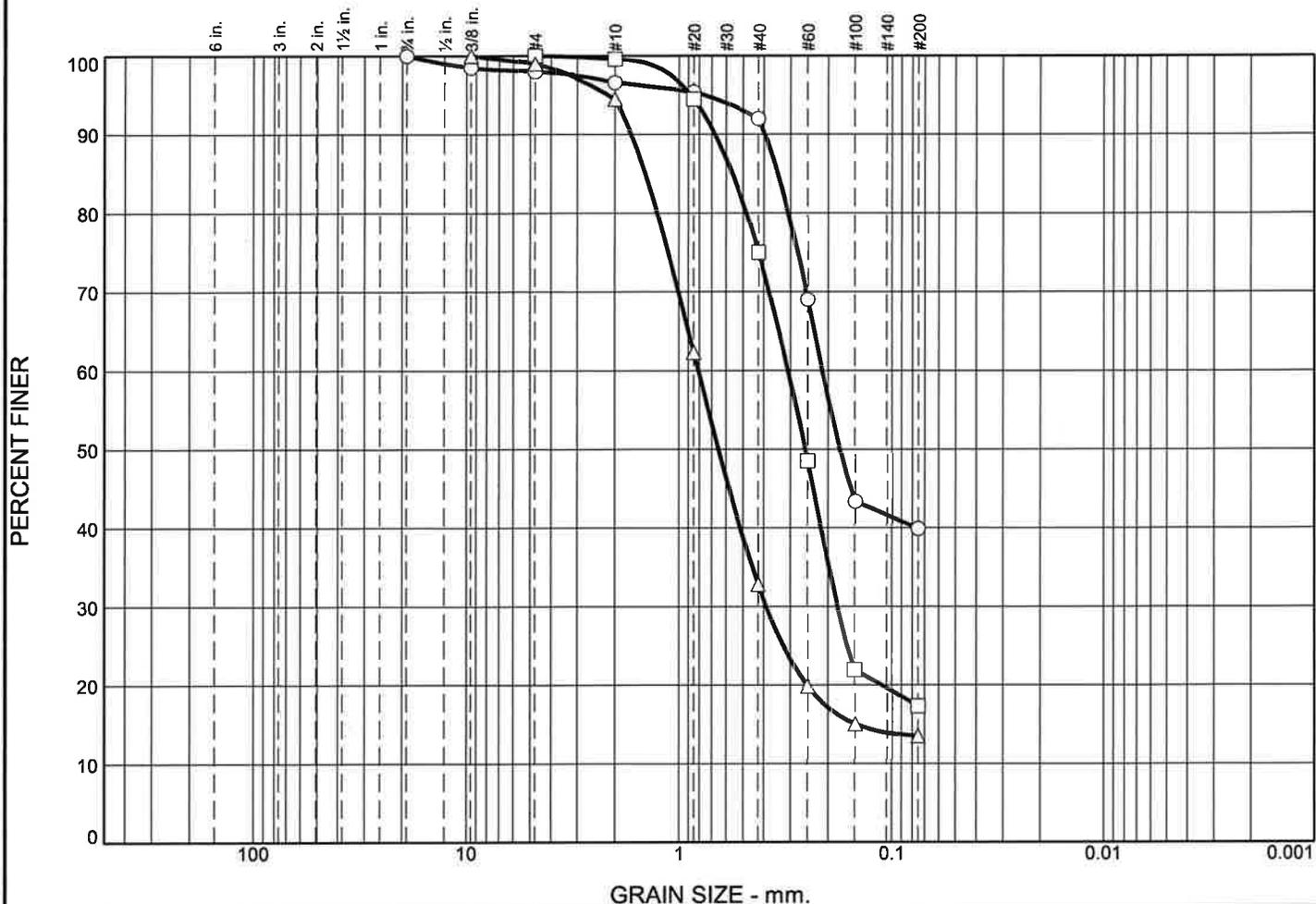
Material Description	USCS	AASHTO
○ silty SAND with gravel	SM	
□ silty SAND with gravel	SM	
△ silty SAND	SM	

<b>Project No.</b> T-8204 <b>Client:</b> D.R. Horton <b>Project:</b> Terrace Avenue Development  ○ <b>Location:</b> Test Pit TP-3 <b>Depth:</b> -4 feet <b>Sample Number:</b> 2 □ <b>Location:</b> Test Pit TP-4 <b>Depth:</b> -1.5 feet <b>Sample Number:</b> 1 △ <b>Location:</b> Test Pit TP-7 <b>Depth:</b> -4 feet <b>Sample Number:</b> 3	<b>Remarks:</b> ○ Tested on September 10, 2019 □ Tested on September 10, 2019 △ Tested on September 10, 2019
<b>Terra Associates, Inc.</b>  <b>Kirkland, WA</b>	

Figure A-12

Tested By: FQ

# Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines			
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay		
○	0.0	0.0	2.0	1.4	4.6	52.1	39.9			
□	0.0	0.0	0.0	0.4	24.6	57.7	17.3			
△	0.0	0.0	1.0	4.5	61.7	19.3	13.5			
×	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
○			0.3448	0.2133	0.1765					
□			0.5627	0.3082	0.2566	0.1805				
△			1.4424	0.8090	0.6511	0.3896	0.1469			

Material Description	USCS	AASHTO
○ silty SAND	SM	
□ Silty SAND	SM	
△ Silty SAND	SM	

<b>Project No.</b> T-8204 <b>Client:</b> D.R. Horton <b>Project:</b> Terrace Avenue Development  ○ <b>Location:</b> Test Pit TP-8 <b>Depth:</b> -3.5 feet <b>Sample Number:</b> 2 □ <b>Location:</b> Test Boring B-1 <b>Depth:</b> -3 feet <b>Sample Number:</b> 2 △ <b>Location:</b> Test Boring B-1 <b>Depth:</b> -60 feet <b>Sample Number:</b> 18	<b>Remarks:</b> ○ Tested on September 10, 2019 □ Tested on October 1, 2019 △ Tested October 1, 2019
<b>Terra Associates, Inc.</b>  <b>Kirkland, WA</b>	

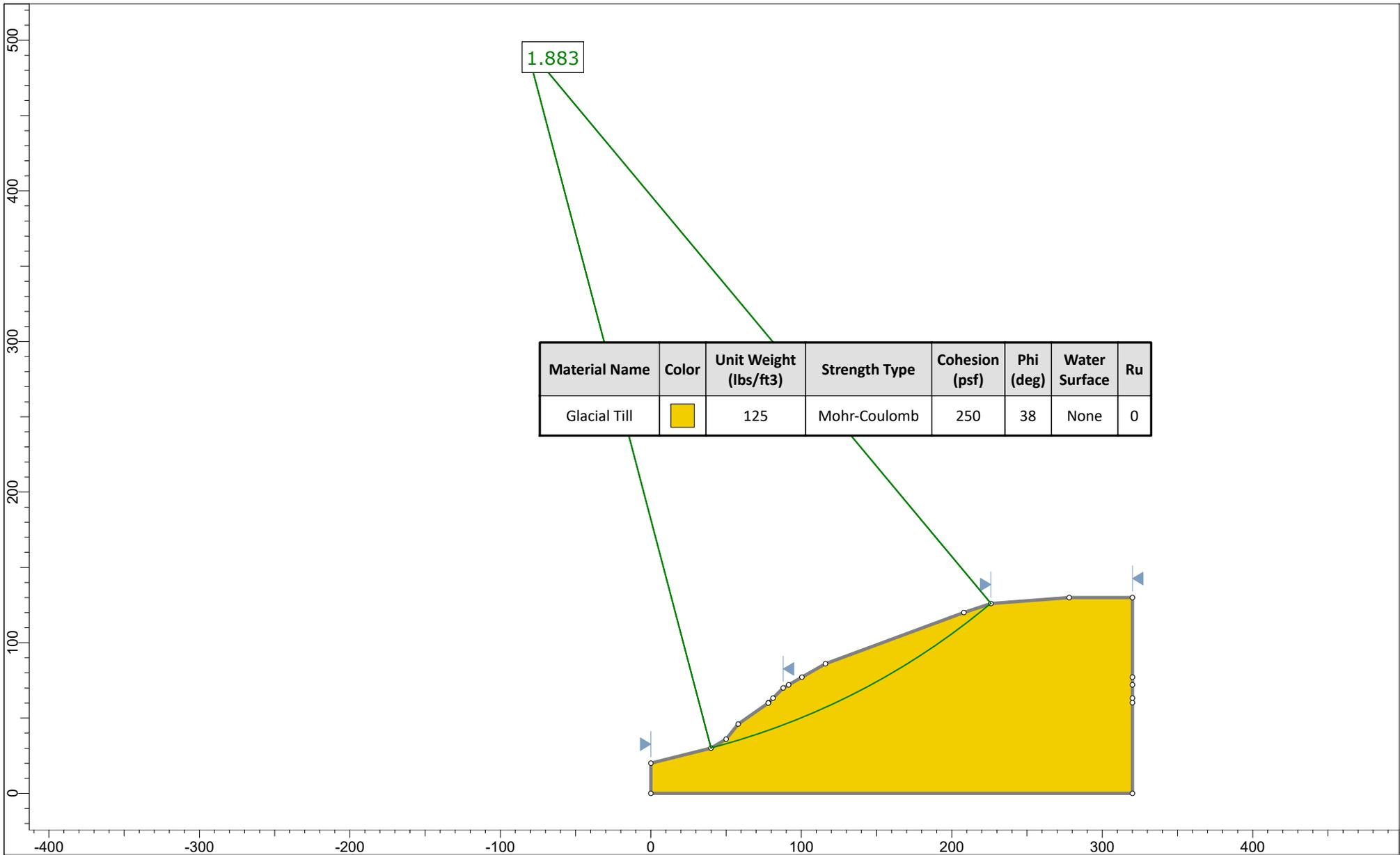
Figure A-13

Tested By: FQ



**APPENDIX B**

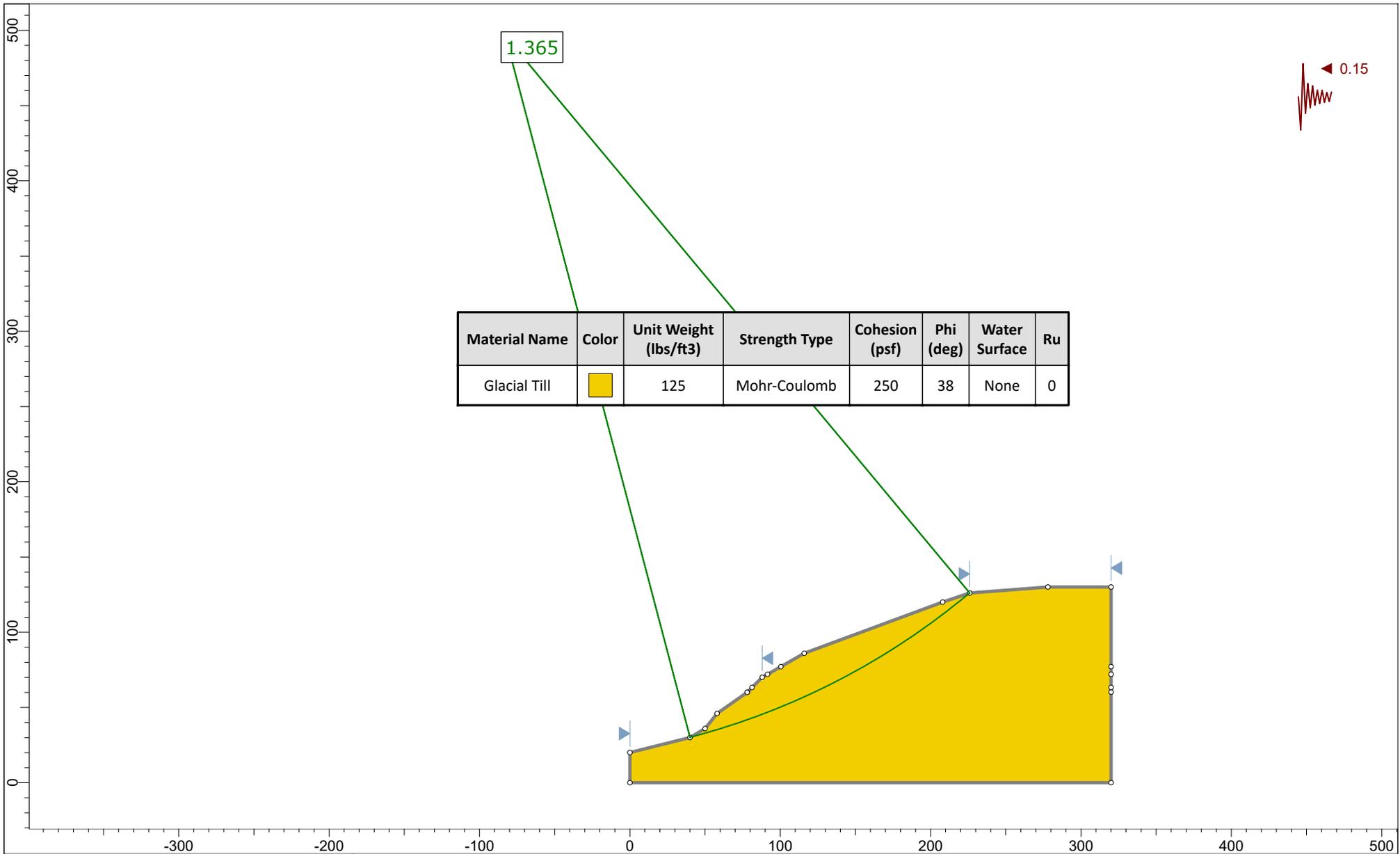
**SLIDE OUTPUT**



1.883

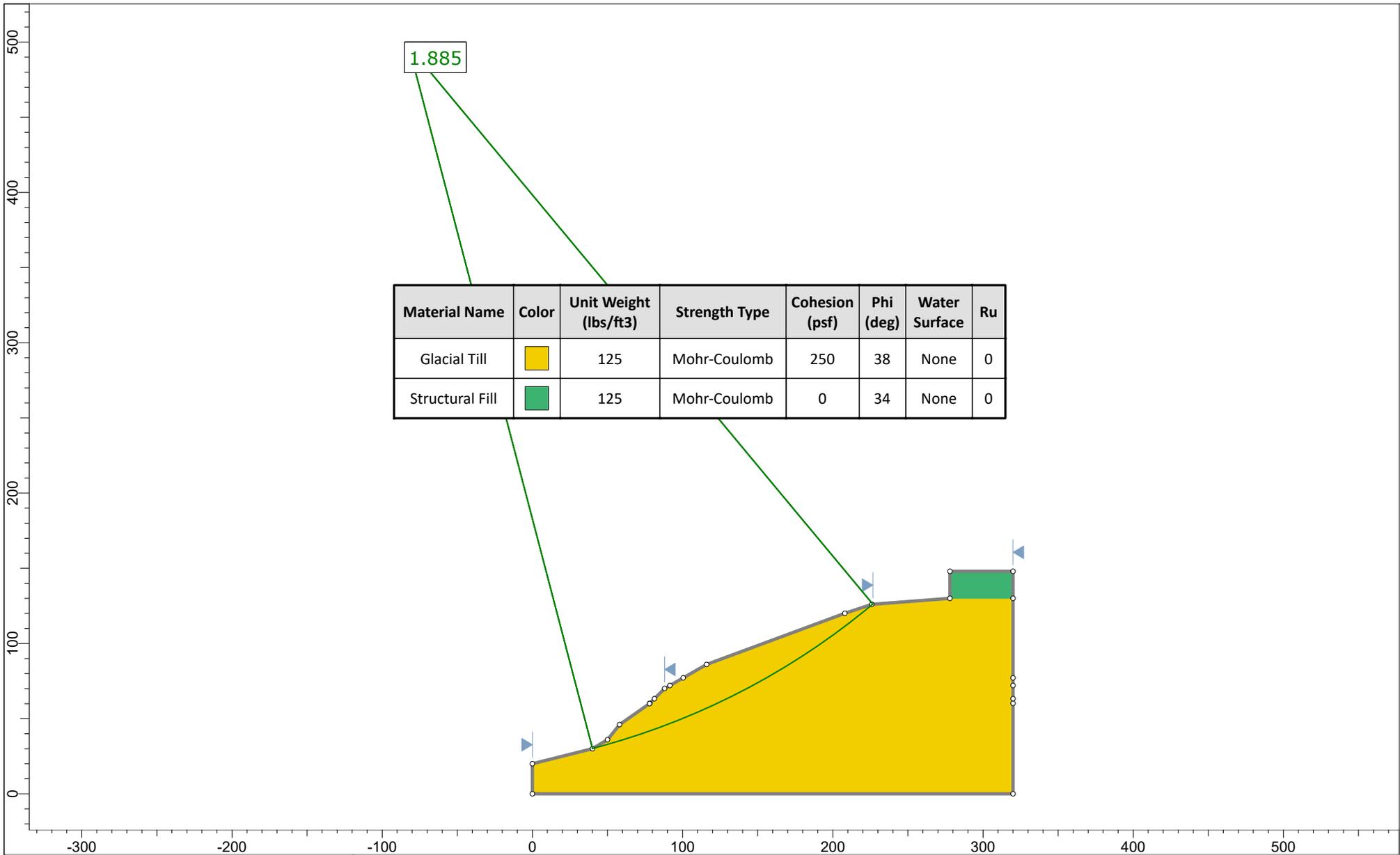
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	Yellow	125	Mohr-Coulomb	250	38	None	0

	Project			<b>Terrace Ave Development</b>		
	Analysis Description			Cross Section A-A' - Existing Conditions		
	Drawn By	C. Decker	Scale	1:1060	Company	Terra Associates, Inc.
	Date	October 2, 2019		File Name	Cross-section A-A'.slmd	



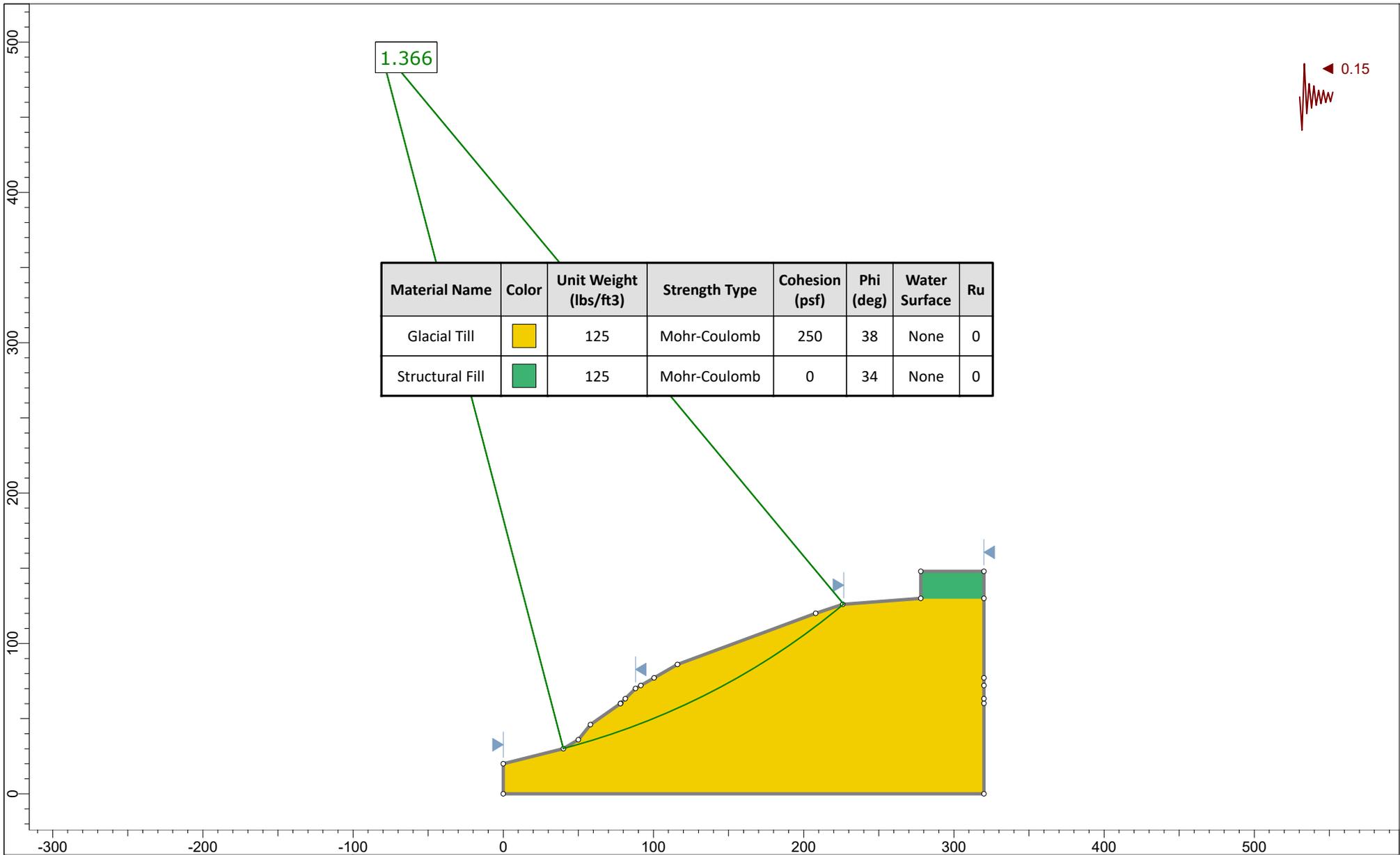
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	125	Mohr-Coulomb	250	38	None	0

	<i>Project</i>			<b>Terrace Ave Development</b>				
	<i>Analysis Description</i>			Cross Section A-A' - Existing Conditions - Seismic				
	<i>Drawn By</i>		C. Decker	<i>Scale</i>		1:1060	<i>Company</i>	Terra Associates, Inc.
	<i>Date</i>			October 2, 2019		<i>File Name</i>		Cross-section A-A'.slmd



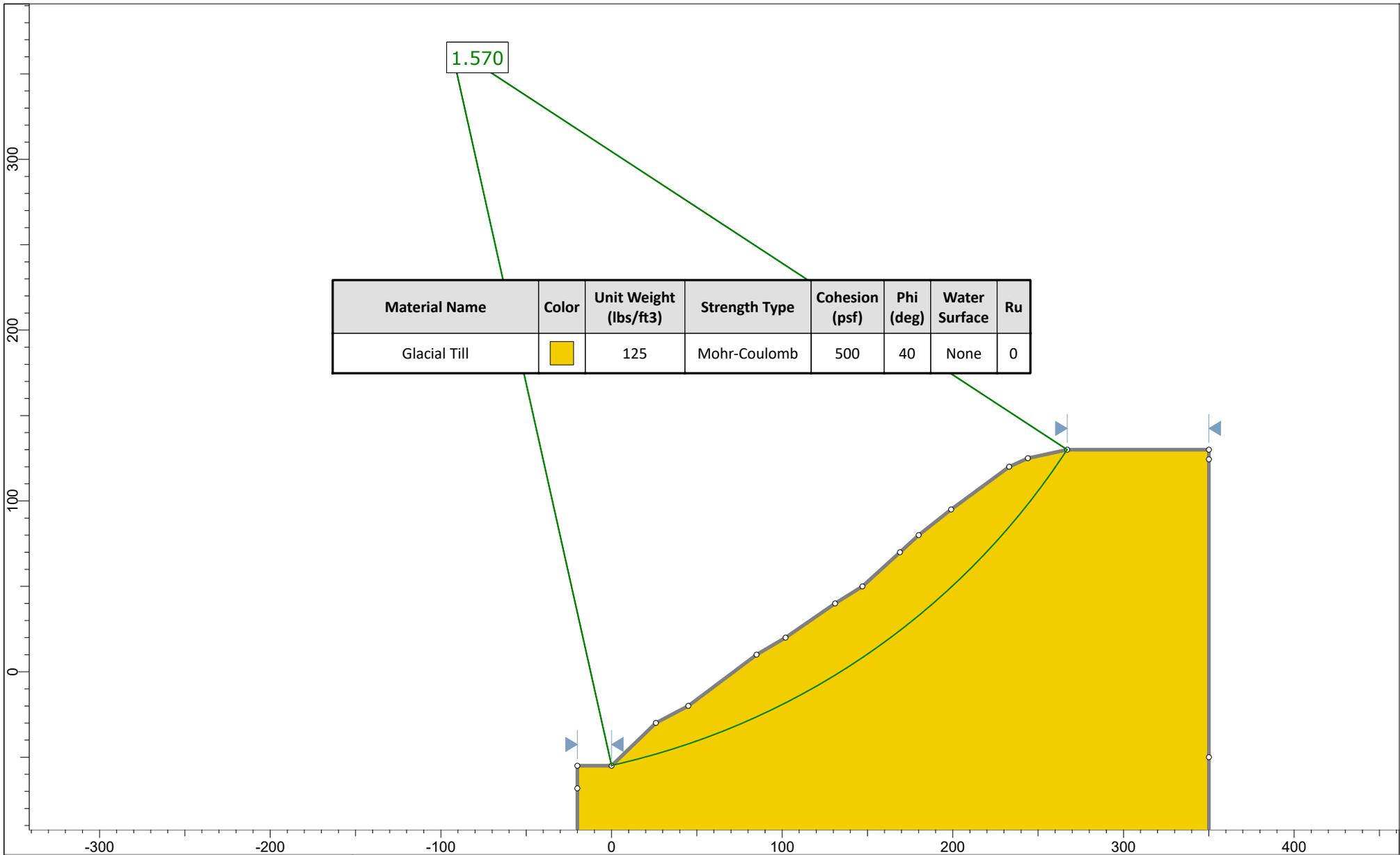
Material Name	Color	Unit Weight (lbs/ft <sup>3</sup> )	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="color: yellow;">■</span>	125	Mohr-Coulomb	250	38	None	0
Structural Fill	<span style="color: green;">■</span>	125	Mohr-Coulomb	0	34	None	0

	<i>Project</i> <b>Terrace Ave Development</b>		
	<i>Analysis Description</i> Cross Section A-A' - Post Construction		
	<i>Drawn By</i> C. Decker	<i>Scale</i> 1:1062	<i>Company</i> Terra Associates, Inc.
	<i>Date</i> May 15, 2020		<i>File Name</i> Cross-section A-A'.slmd



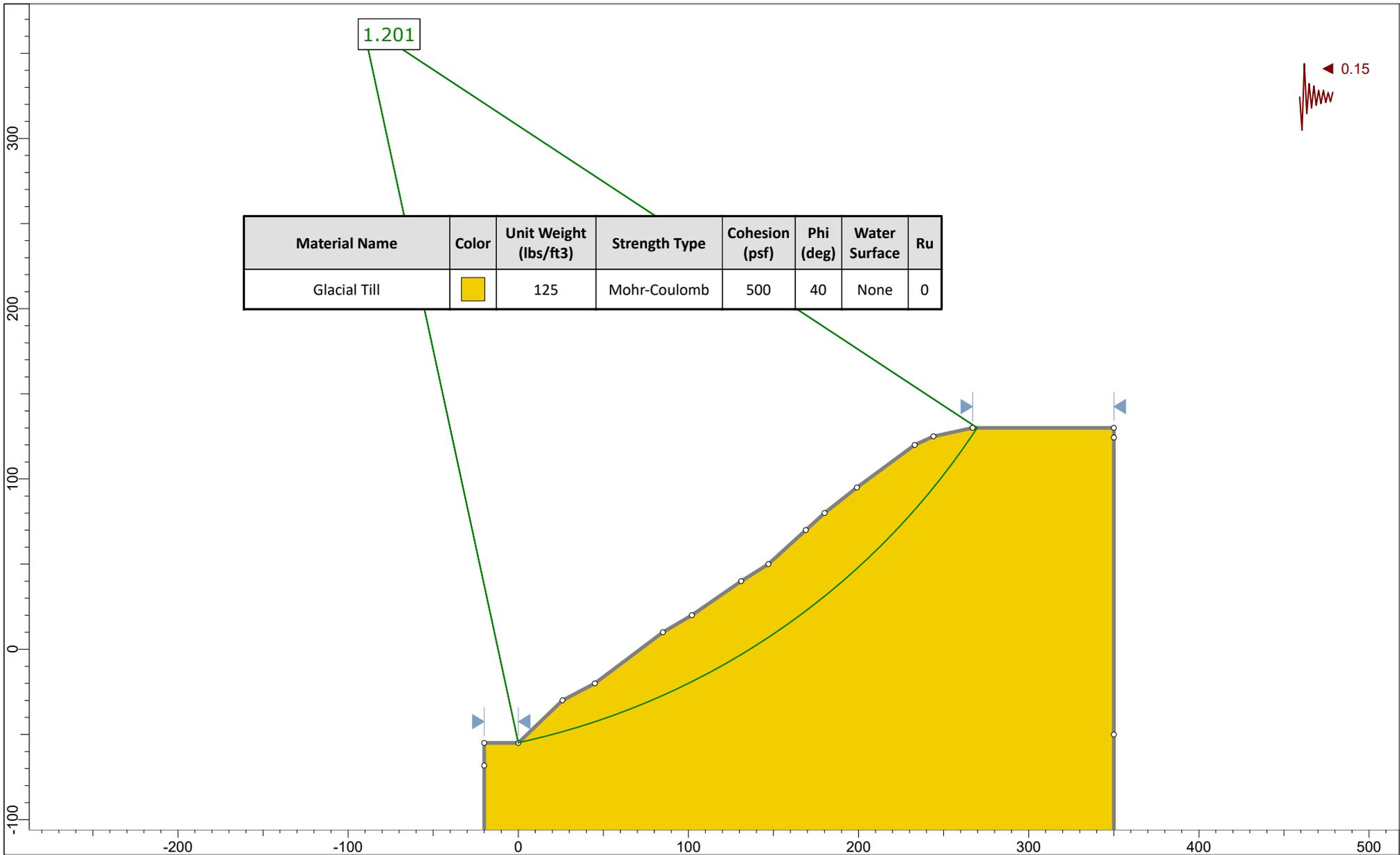
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	125	Mohr-Coulomb	250	38	None	0
Structural Fill	<span style="display:inline-block; width:15px; height:15px; background-color:green;"></span>	125	Mohr-Coulomb	0	34	None	0

	Project			<b>Terrace Ave Development</b>		
	Analysis Description			Cross Section A-A' - Post Construction - Seismic		
	Drawn By	C. Decker	Scale	1:1062	Company	Terra Associates, Inc.
	Date	May 15, 2020		File Name	Cross-section A-A'.slmd	



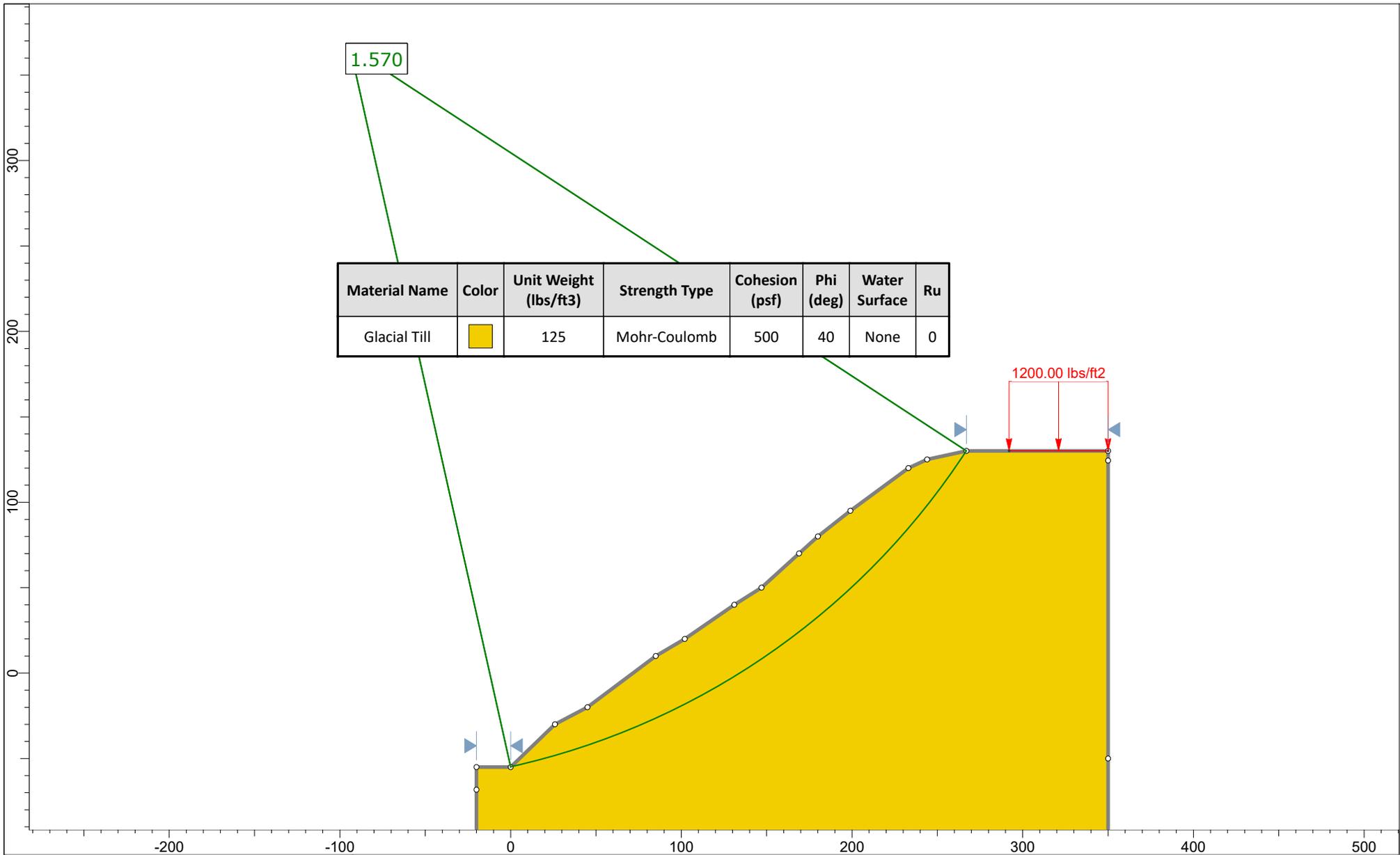
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	125	Mohr-Coulomb	500	40	None	0

	Project		<b>Terrace Ave Development</b>	
	Analysis Description		Cross Section B-B' - Existing Conditions	
	Drawn By	C. Decker	Scale	1:934
	Date	May 15, 2020	Company	Terra Associates, Inc.
			File Name	Cross Section B-B Detention Vault.slm



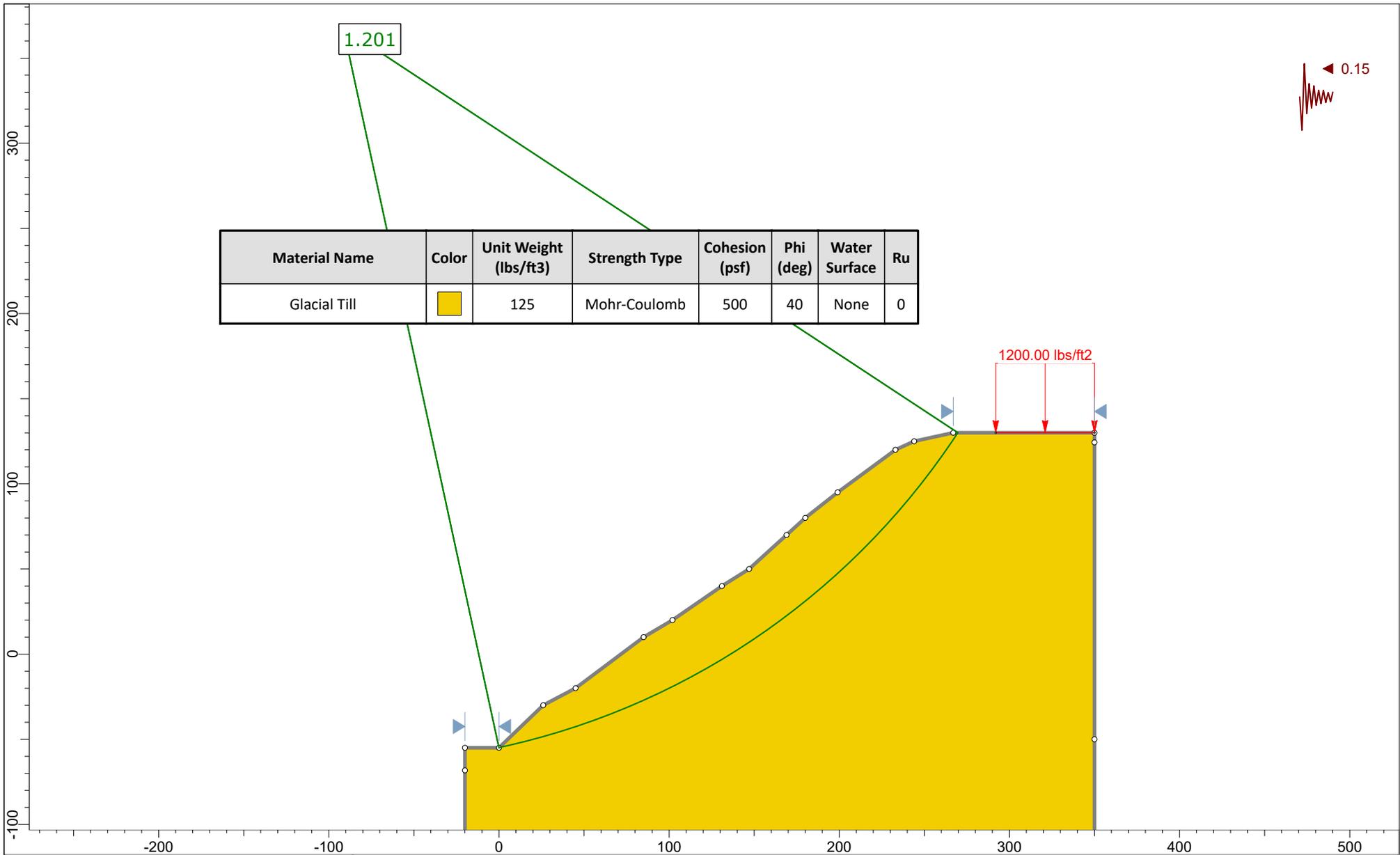
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	125	Mohr-Coulomb	500	40	None	0

	<i>Project</i>			<b>Terrace Ave Development</b>		
	<i>Analysis Description</i>			Cross Section B-B' - Existing Conditions - Seismic		
	<i>Drawn By</i>	C. Decker	<i>Scale</i>	1:937	<i>Company</i>	Terra Associates, Inc.
	<i>Date</i>	May 15, 2020		<i>File Name</i>	Cross Section B-B Detention Vault.slm	



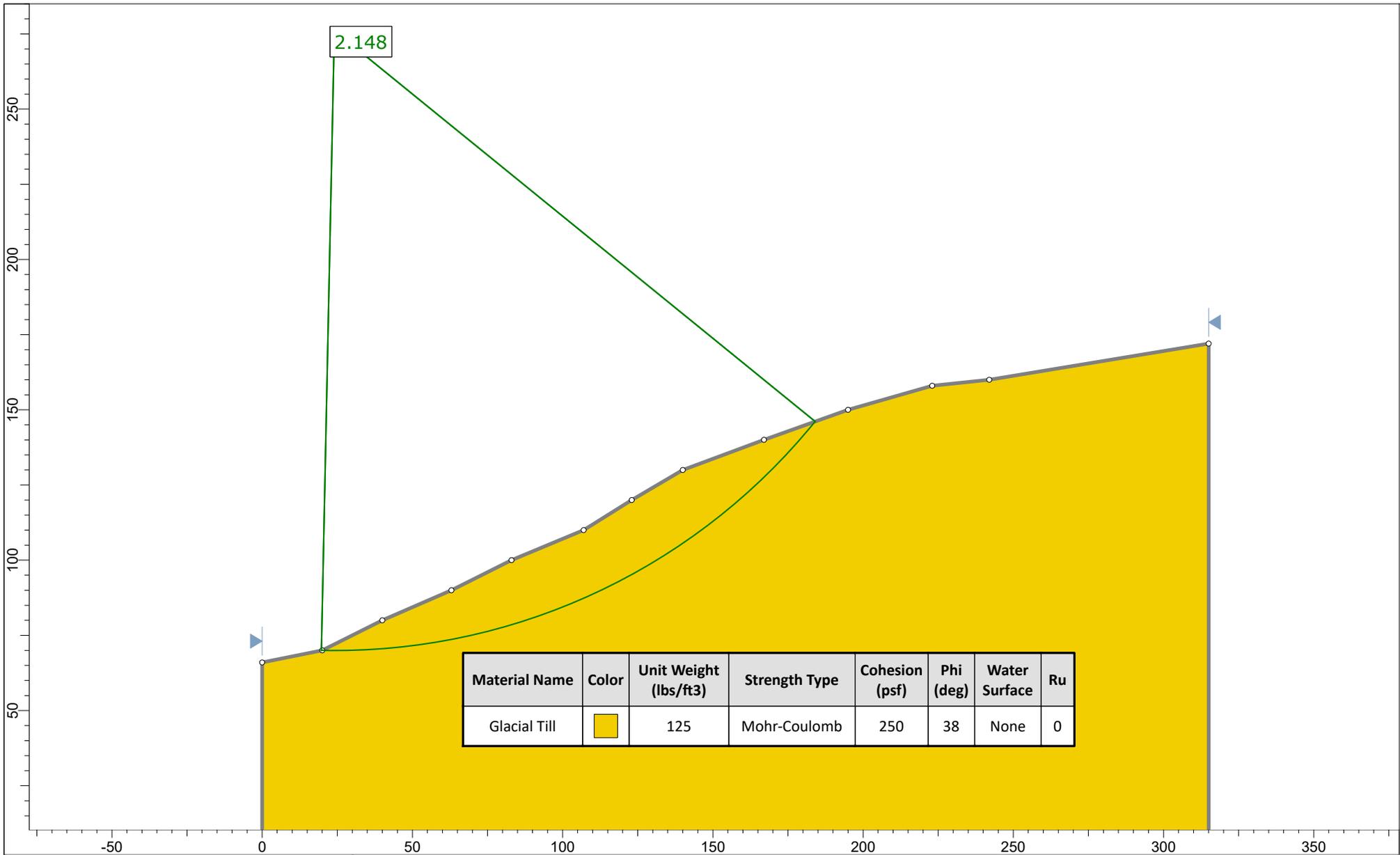
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	125	Mohr-Coulomb	500	40	None	0

	Project			<b>Terrace Ave Development</b>		
	Analysis Description			Cross Section B-B' - Post Construction		
	Drawn By	C. Decker	Scale	1:934	Company	Terra Associates, Inc.
	Date	May 15, 2020		File Name	Cross Section B-B Detention Vault.slm	



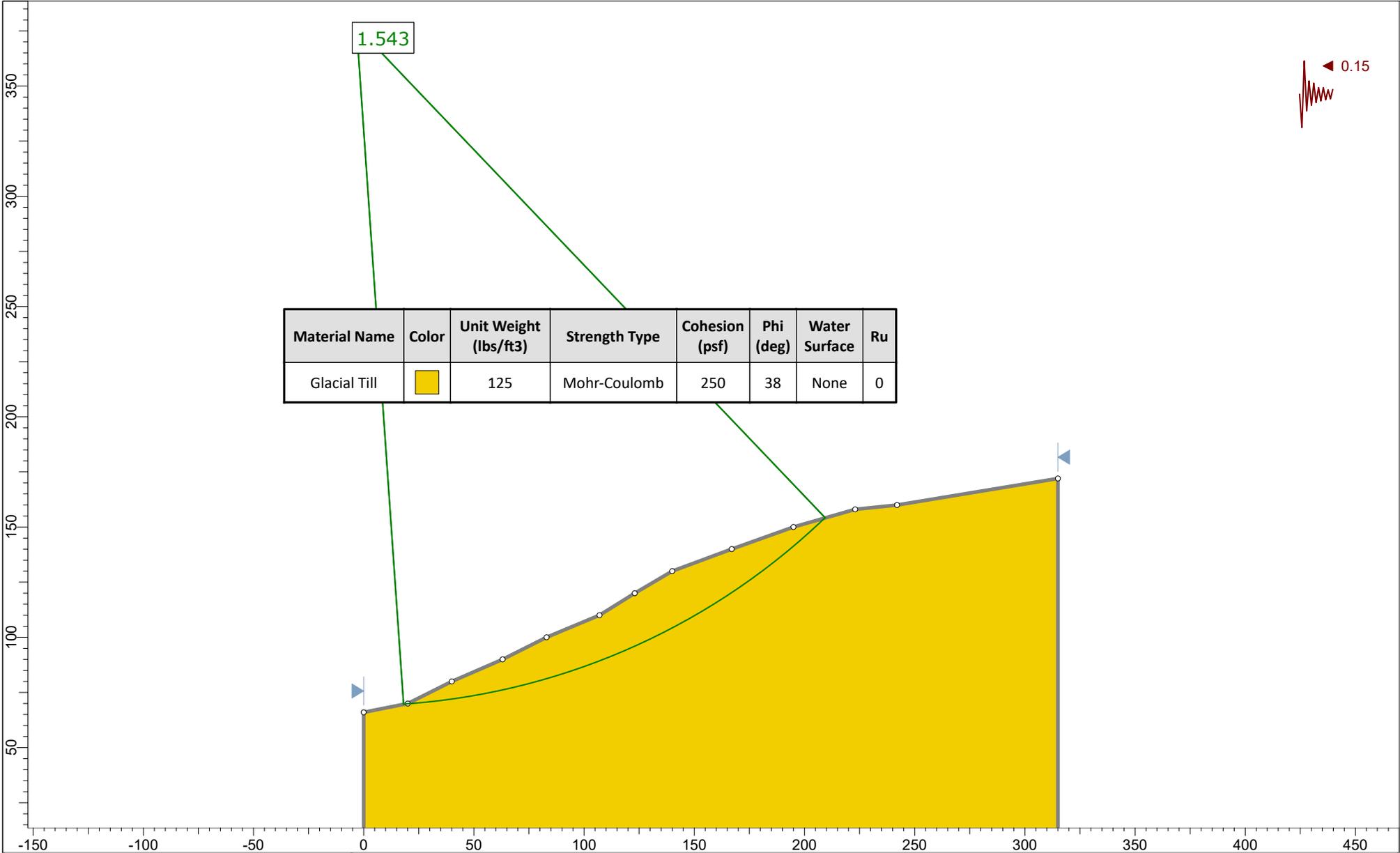
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	Yellow	125	Mohr-Coulomb	500	40	None	0

	Project			<b>Terrace Ave Development</b>		
	Analysis Description			Cross Section B-B' - Post Construction - Seismic		
	Drawn By	C. Decker	Scale	1:937	Company	Terra Associates, Inc.
	Date	May 15, 2020		File Name	Cross Section B-B Detention Vault.slmd	



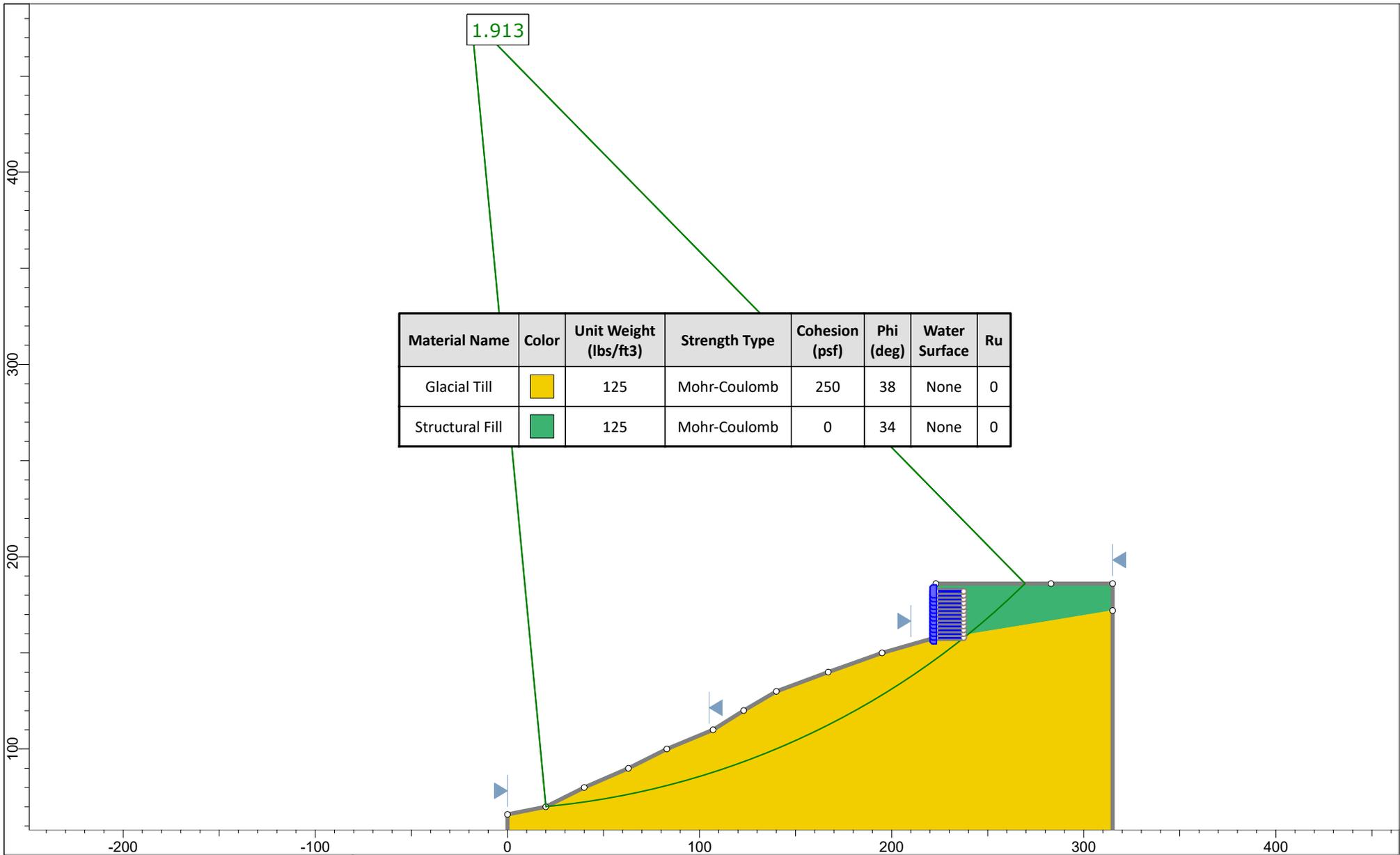
Material Name	Color	Unit Weight (lbs/ft <sup>3</sup> )	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	125	Mohr-Coulomb	250	38	None	0

	Project			<b>Terrace Avenue</b>		
	Analysis Description			Cross Section C-C' - Existing Conditions		
	Drawn By	C. Decker	Scale	1:531	Company	Terra Associates, Inc.
	Date	5/6/2020, 2:14:41 PM		File Name	Cross Section C-C'.slmd	



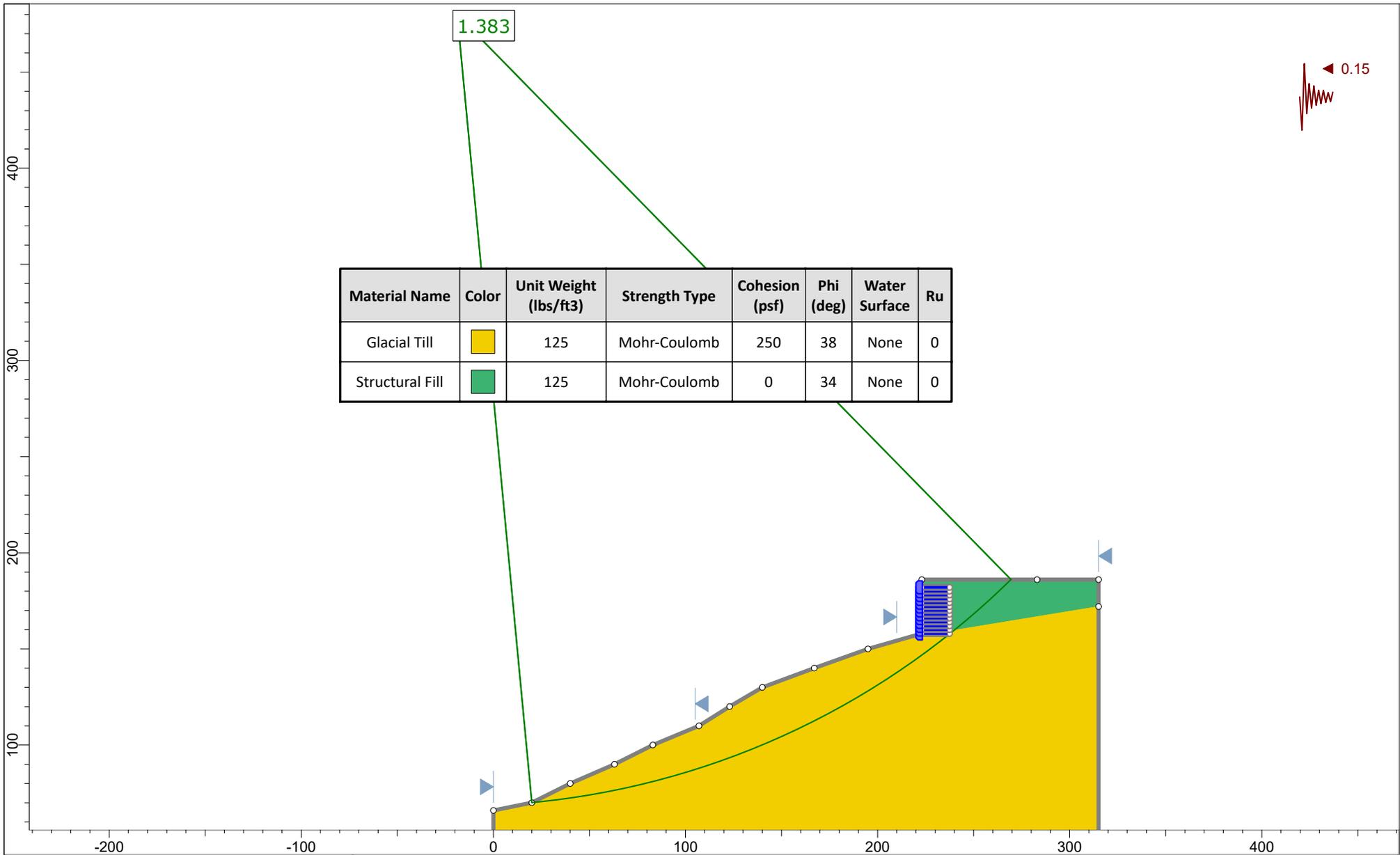
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	125	Mohr-Coulomb	250	38	None	0

	Project			<b>Terrace Avenue</b>		
	Analysis Description			Cross Section C-C' - Existing Conditions - Seismic		
	Drawn By	C. Decker	Scale	1:724	Company	Terra Associates, Inc.
	Date	5/6/2020, 2:14:41 PM		File Name	Cross Section C-C'.slmd	



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="color: yellow;">■</span>	125	Mohr-Coulomb	250	38	None	0
Structural Fill	<span style="color: green;">■</span>	125	Mohr-Coulomb	0	34	None	0

	<i>Project</i>			<b>Terrace Avenue</b>		
	<i>Analysis Description</i>			Cross Section C-C' - Post Construction Conditions		
	<i>Drawn By</i>	C. Decker	<i>Scale</i>	1:830	<i>Company</i>	Terra Associates, Inc.
	<i>Date</i>	5/6/2020, 2:14:41 PM		<i>File Name</i>	Cross Section C-C'.slmd	



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Glacial Till	<span style="color: yellow;">■</span>	125	Mohr-Coulomb	250	38	None	0
Structural Fill	<span style="color: green;">■</span>	125	Mohr-Coulomb	0	34	None	0

	<i>Project</i> <b>Terrace Avenue</b>		
	<i>Analysis Description</i> Cross Section C-C' - Post Construction Conditions - Seismic		
	<i>Drawn By</i> C. Decker	<i>Scale</i> 1:830	<i>Company</i> Terra Associates, Inc.
	<i>Date</i> 5/6/2020, 2:14:41 PM	<i>File Name</i> Cross Section C-C'.slmd	