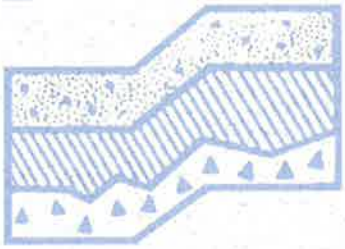
GEOTECHNICAL REPORT

Proctor Parcels
King County Parcels 2726059026 and 9024
Redmond, Washington

Project No. T-7474



Terra Associates, Inc.

Prepared for:

Quadrant Homes
Bellevue, Washington

Third Revision – May 24, 2017

TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

Third Revision – May 24, 2017
Project No. T-7474

Mr. Corey Watson
Quadrant Homes
15900 SE Eastgate Way, Suite 300
Bellevue, Washington 98008

Subject: Geotechnical Report
Proctor Parcels
King County Parcels 2726059026 and 9024
Redmond, Washington

Dear Mr. Watson:

As requested, we conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

In our opinion, there are no geotechnical conditions that would preclude the planned residential development. Residences can be supported on conventional spread footings bearing on competent native soils underlying the organic surface soils or on structural fill placed on competent native soils. Floor slabs and pavements can be similarly supported. Soil conditions are not suitable for infiltration facilities. Conventional detain with controlled release facilities will be required for management of development stormwater.

Detailed recommendations addressing these issues and other geotechnical design considerations are presented in the attached report. We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

Alexander Dendy, E.I.T.
Staff Engineer

Charles R. Tie, L.E.G., L.H.G.
Project Manager

Theodore J. Schepper, P.E.
President

5-24-17

THEODORE J. SCHEPPER — STATE OF WASHINGTON — 26742 — REGISTERED PROFESSIONAL ENGINEER

12220 113th Avenue NE, Ste. 130, Kirkland, Washington 98034
Phone (425) 821-7777 • Fax (425) 821-4334

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1.0 PROJECT DESCRIPTION

The proposed project site is currently vacant property. Based on a site plan prepared by KPFF, the site will be developed with multiple townhome buildings and an apartment building along with associated infrastructure improvements. The project will be developed in three phases. Phase I will consist of construction of 80 to 100 townhomes in 18 buildings in the western third of the site. This phase will also include infrastructure improvements consisting of access off of NE 124th Street and Willows Road, the internal roadway connecting 124th and Willows, and the stormwater detention vault on the east side of the property. Phase II will consist of construction of an apartment building in the eastern third of the site. The apartment building will include up to 300 units. Phase III development is located in the central third of the site and will consist of construction of the remaining townhomes. This will include another 80 to 100 townhome units in 12 buildings.

Site grading plans indicate that cuts up to a maximum depth of about 18 feet in the northwest area of the site with fills in the central and western areas of the site on the order of one to eight feet will be required to establish design roadway and building pad grades. Grade transitions will be accommodated by sloped embankments and site retaining walls/rockeries. Retaining wall heights will range from 2 to 12 feet.

Stormwater will be routed for detention and controlled release from a vault located in the northeast corner of the site along Willows Road.

Building plans are not available; however, we expect that the structures would be two- to three-story, wood-frame structures, with their main floors constructed at grade. Foundation loads should be relatively light, in the range of 2 to 3 kips per foot for bearing walls and 25 to 50 kips for isolated columns.

The recommendations contained in the following sections of this report are preliminary and 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

We explored subsurface conditions at the site by observing conditions in 16 borings drilled to maximum depths of about 20 feet below existing surface grades using a track-mounted drilling rig. 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 Redmond Zoning Code
- Seismic design parameters per the current International Building Code (IBC)
- Site preparation and grading
- Relative slope stability
- Excavations
- Foundations
- Slab-on-grade floors
- Rockeries
- Infiltration feasibility
- Drainage
- Utilities
- Pavements

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 structural environment are beyond Terra Associates' purview. A building envelope specialist or contactor should be consulted to address these issues, as needed.

3.0 SITE CONDITIONS

3.1 Surface

The site is a 15.38-acre parcel located southwest of and adjacent to the intersection of NE 124th Street and Willows Road in Redmond, Washington. The approximate location of the site is shown on Figure 1. The property slopes down to the east to the Sammamish River Valley.

The property consists of three distinct topographic areas. The first area is a prominent bench located in the western half of the site. This bench has a slope down towards the east with an inclination on the order of five to ten percent. The elevation in this area ranges from a high of about Elev. 140 feet to about the Elev. 115 foot contour. This area is predominantly a pasture area that is seasonally mowed. There are clusters of trees in this area as well. The northern margin of this upper area is the right-of-way for NE 124th Street. NE 124th Street occupies an area that was cut to provide a suitable grade for the arterial road. The sides of the cut are a combination of open sloped excavation and a retaining wall that is up to 12 feet in height. Some of the open slopes above the retaining wall are up to 80 percent in inclination or heights of up to 20 feet. No seepage was observed on the road cuts or from the base of the retaining wall. The terrain west, above the western property line is a broad valley feature within the glacial drift plateau above the Sammamish Valley. There is a driveway and curb cut that provides access to this upper western portion of the site from NE 124th Street.

A shallow swale appears to have been graded across the western portion of the site that drains towards the second distinct topographic element, a deeply incised ravine. The ravine extends from the southwest down towards the east and defines the southern property line. The ravine has side slopes with inclinations on the order of 40 to 70 percent. The ravine sidewalls are 10 to 20 feet high in the western end of the ravine and reach 30 to 40 feet in height through the center of the property. The ravine is forested and has a continuous cover of underbrush. A sub drain from the adjacent property to the south drains into the upper end of the ravine and accounts for a majority of the base flow. Iron bacteria have bloomed along the outlet of the drain suggesting that the drain is a sub drain of some sort on the adjacent property. It is not known what contribution surface water may provide to the drainage quantity. We observed seepage zones along the northern back of the ravine. We did not observe any signs of instability or excessive erosion in the ravine. Approximate seepage locations observed during our reconnaissance are shown on attached Figure 8.

The third distinct area is the broad east facing slope that is east of the first area and north of the ravine. This slope is forested and has inclinations of about 10 to 20 percent for a height of about 60 feet. There is a paved driveway that provides access to the lower portion of the slope area from Willows Road. There are the remains of a house and small outbuildings located on the slope area. No seepage zones were noted on the slope area; however, we have observed seepage along the toe of the slope during past wet seasons.

3.2 Soils

To explore the subsurface soil conditions, Terra Associates observed the drilling of 16 test borings. We also reviewed test pit logs prepared by others for the site and explorations conducted by others for prior street improvements on Willows Road along the east margin of the site and of NE 124th Street along the northern margin of the site.

The soils observed in the test borings consist of glacial outwash deposits in the western portion of the site transitioning to glacial till-like deposits to the east. Soils in the western site area consist predominantly of medium dense and stiff interbedded layers of silty sand, sandy silt, and silt interpreted to be recessional outwash. Four to six feet of medium dense silty sand fill was observed overlying these native soils at Test Borings B-2 and B-3. This fill is likely associated with grading completed for construction of NE 124th Street. Ground conditions transition to layers of dense to very dense silty sand with gravel and gravelly sand with silt along a line delineated by Test Borings B-5, B-8, B-9, and B-16.

The *Geologic map of the Kirkland quadrangle, King County Washington*, by J.P. Minard (1983) shows site geology mapped predominantly as recessional outwash (Qvr). Pre-Fraser till (Qtu) is mapped along the eastern flank of the site with Fraser age Vashon till (Qvt) mapped to the south. Soils conditions observed in the test borings in the western site area are consistent with recessional outwash deposition. Soils in the eastern site area are more consistent with the Pre-Fraser or Fraser age till deposits.

Detailed descriptions of the subsurface conditions we observed in the test borings are presented on the Test Boring Logs in Appendix A and Exploration Logs by Others in Appendix B. The approximate locations of the explorations are shown on Figure 2. Figure 3 presents a generalized west to east geologic section through the center of the site.

3.3 Groundwater

We observed groundwater seepage between depths of about eight to ten feet in the west hilltop area. The water occupies thin layers of more permeable fine sand within silt beds. The near-surface silt and silty fine sand soils observed in the borings and previous test pits are typically mottled indicating that a shallow perched groundwater table has developed at times.

No groundwater seepage was observed in the mid-slope area. Explorations below Elev. 70 feet were observed to have seepage zones. We observed seepage zones in the ravine along the southern property line. The seepage zones were typically near the base of the side slopes. These areas can be seen on attached Figure 8.

Test Borings B-1, B-9, B-12, and B-15 were converted to monitoring wells. The water levels in these wells were observed after drilling on August 15, 2016 and again on February 10, 2017. The observed water levels are recorded in Table 1 below, depths are in feet below existing ground surface elevation.

Table 1 – Monitoring Well Observations
Depth to Groundwater (feet)

Monitoring Well	August 15, 2016 Depth (ft.)	February 10, 2017 Depth (ft.)	Elevation
B-1	3.90	0.54	74.86
B-9	Dry	1.57	111.03
B-12	7.4	7.28	119.32
B-15	8.42	0.37	123.6

We evaluated the hydraulic conductivity of the soils exposed to the screened portion of these wells by performing slug tests. During the slug tests, we bailed the wells lowering the water levels to depths of about 7 to 12 feet below the ground surface elevations. We then recorded that rate of recharge in the wells using a water level indicator. An average permeability ranging from 0.097 to 0.326 feet per day is indicated by the testing.

The occurrence of shallow perched groundwater is typical for sites underlain by relatively impermeable soils. We expect that perched groundwater levels and flow rates will fluctuate seasonally and will typically reach their highest levels during and shortly following the wet winter months typically October through May. We expect that the groundwater conditions observed during our August 2016 field work are representative of seasonal low levels.

3.4 Geologic Hazards

We evaluated site conditions for the presence of geologic hazards. Section 21.64.060 (Geologically Hazardous Areas) of the City of Redmond Zoning Code (RZC) defines geologically hazardous areas as erosion hazard areas, landslide hazard areas, and seismic hazard areas.

3.4.1 Erosion Hazard Areas

Section 21.64.060A.1.a of the RZC defines erosion hazard areas as "...lands or areas underlain by soils identified by the U.S. Department of Agriculture Soil Conservation Service (SCS) as having "severe" or "very severe" rill and inter-rill erosion hazards. This includes, but is not limited to, the following group of soils when they occur on slopes of 15 percent or greater: Alderwood-Kitsap (AkF), Alderwood gravelly sandy loam (AgD), Kitsap silt loam (KpD), Everett (EvD), and Indianola (InD)."

The Soil Conservation Service (SCS) has classified the soils underlying the upland portions of the site as Kitsap silt loam (KpB) on 2 to 8 percent slopes. They are formed from lacustrine (lake) sediments containing minor amounts of volcanic ash. The mid and lower slope is shown as Alderwood gravelly sandy loam, 6 to 15 percent slopes (AgC). The steeper northern slope is classified as AgD. Alderwood soils are described as formed over till, which is generally consistent with the soils observed in the test pits. The SCS describes the erosion hazard of AgC soils as moderate, which does not meet the criteria for an erosion hazard area. AgD soils are classified as an erosion hazard area.

The site is not shown as being within a City of Redmond designated erosion hazards area on the Erosion Hazard Area Map dated May 28, 2005.

The site soils will be susceptible to erosion when exposed during construction. In our opinion, mitigation can be accomplished through proper implementation and maintenance of Best Management Practices (BMPs) for erosion prevention and sedimentation control will adequately mitigate the erosion potential in the planned development area. Erosion protection measures as required by the City of Redmond will need to be in place prior to and during grading activity on the site.

3.4.2 Landslide Hazard Areas

Section 21.64.060A.1.b of the RZC defines landslide hazard areas as "...areas potentially subject to significant or severe risk of landslides based on a combination of geologic, topographic, and hydrogeologic factors.

They include areas susceptible because of any combination of bedrock, soil, slope, slope aspect, structure, hydrology, or other factors. They are areas of the landscape that are at a high risk of failure or that presently exhibit downslope movement of soil and/or rocks and that are separated from the underlying stationary part of the slope by a definite plane of separation. The plane of separation may be thick or thin and may be composed of multiple failure zones depending on local conditions, including soil type, slope gradient, and groundwater regime." Landslide hazard areas include the following:

i. Areas of historic failures, such as:

   a. Areas designated as quaternary slumps or landslides on maps published by the United States Geologic Survey (USGS).

   b. Those areas designated by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) as having a "severe" limitation for building site development.

ii. Areas containing a combination of slopes steeper than 15 percent, springs or groundwater seepage, and hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock.

iii. Areas that have shown movement during the Holocene epoch (from 10,000 years ago to the present) or which are underlain or covered by mass wastage debris of that epoch.

iv. Slopes that are parallel or subparallel to planes of weakness in subsurface materials.

v. Slopes having gradients steeper than 80 percent subject to rockfall during seismic shaking.

vi. Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action.

vii. Any area with a slope 40 percent or steeper with a vertical relief of 10 feet or more.

Localized areas of the slopes which run along NE 124th Street and Willows Road as well as portions of the ravine in the southeast of the site have slopes that are steeper than 40 percent with slope heights ranging between about 10 feet and 30 feet. This geometry meets the criteria for a landslide hazard area given in above Item vii. The slopes located along NE 124th Street, Willows Road and the ravine side slopes are shown as being landslide hazard areas on City of Redmond Map 64.7, Landslide Hazards, dated March 12, 2016. As such, a landslide hazard buffer of 50 feet would be necessary from the top and toe of these slopes to any project improvements.

Based on the results of our study and stability analysis presented in a later section of this report, in our opinion, the landslide hazard area buffer can be reduced from 50 feet to 15 feet from the top of these slopes. No clearing should occur on the slope areas that are steeper than 40 percent or within their respective 15-foot setback areas. Unless reviewed by Terra Associates, no fills should be placed within 15 feet of the top of slopes steeper than 40 percent within the ravine area or along the northern margin of the site. No infiltration facilities for runoff from impermeable surfaces should be placed within 100 feet of the northern slopes above NE 124th Street or above the slopes within the ravine that defines the southern property limits. Additionally, stormwater must be prevented from flowing uncontrolled over the face of these slopes. 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.

3.4.3 Seismic Hazard Areas

Section 21.64.060A.1.c of the RZC defines seismic hazard areas as "...lands subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, soil liquefaction, or surface faulting."

Based on the soil and groundwater conditions we observed at the site, it is our opinion that the risk for damage resulting from earthquake induced slope failure, ground settlement, surface faulting, or soil liquefaction is negligible. Therefore, in our opinion, unusual seismic hazard areas do not exist at the site, and design in accordance with local building codes for determining seismic forces would adequately mitigate impacts associated with ground shaking.

The site is not shown as being within a Seismic hazard area on the City of Redmond Seismic Hazard area map, dated April 16, 2011.

3.5 Seismic Design Parameters

Based on the site soil conditions and our knowledge of the area geology, per the 2015 International Building Code (IBC), site class "C" should be used in structural design. Based on this site class, in accordance with the 2015 IBC, the following parameters should be used in computing seismic forces:

Seismic Design Parameters (IBC 2015)

Spectral response acceleration (Short Period), S_{Ms}	1.254
Spectral response acceleration (1 – Second Period), S_{M1}	0.636
Five percent damped .2 second period, S_{Ds}	0.836
Five percent damped 1.0 second period, S_{D1}	0.424

Values determined using the United States Geological Survey (USGS) Ground Motion Parameter Calculator accessed on August 31, 2016 at the web site.

3.6 Wellhead Protection Area

The site is not located close to any of the existing City of Redmond Water Wells. The current City of Redmond map shows the site as being within Wellhead Protection Area 4. Wellhead Protection Area 4 is all areas of the City of Redmond that are outside of Wellhead Protection Areas 1 through 3 and are outside of the project 10-year time of travel to the city water wells. The City of Redmond requires the stormwater management manual Best Management Practices to be followed in Wellhead Protection Area 4. Development of the site as planned would have no impact on the groundwater resource, in our opinion.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

Based on our study, there are no geotechnical conditions that would preclude the planned development. Buildings can be supported on conventional spread footings bearing on competent native soils underlying organic topsoil or on structural fill placed on the competent native soils. Floor slabs and pavements can be similarly supported.

The site soils contain a sufficient amount of fines (silt- and clay-sized particles) such that they will be difficult to compact as structural fill when too wet or too dry. If grading activities will take place during the winter season, the owner should be prepared to import free-draining granular material for use as structural fill and backfill.

Detailed recommendations regarding these issues and other geotechnical design considerations are provided in the following sections of this report. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

To prepare the site for construction, all vegetation, organic surface soils, and other deleterious materials should be stripped and removed from below building and roadway locations. We expect surface stripping depths of about six to ten inches will be required to remove the organic surficial soils. Stripped vegetation debris should be removed from the site. Organic soils will not be suitable for use as structural fill, but may be used for limited depths in nonstructural areas or for landscaping purposes. Demolition of existing structures should include removal of existing foundations and abandonment of underground septic systems and other buried utilities. Abandoned utility pipes that fall outside of new building areas can be left in place provided they are sealed to prevent intrusion of groundwater seepage and soil. Once clearing and grubbing operations are complete, cut and fill operations to establish desired building grades can be initiated.

A representative of Terra Associates, Inc. should examine all bearing surfaces to verify that conditions encountered are as anticipated and are suitable for placement of structural fill or direct support of building and pavement elements. Our representative may request proofrolling exposed surfaces with a heavy rubber-tired vehicle to determine if any isolated soft and yielding areas are present. If unstable yielding areas are observed, they should be cut to firm bearing soil and filled to grade with structural fill. If the depth of excavation to remove unstable soils is excessive, use of geotextile fabric such as Mirafi 500X or equivalent in conjunction with structural fill can be considered in order to limit the depth of removal. In general, our experience has shown that a minimum of 18 inches of clean, granular structural fill over the geotextile fabric should establish a stable bearing surface.

The native soils observed at the site contain a sufficient amount of fines (silt and clay size particles) that will make them difficult to compact as structural fill if they are too wet or too dry. Accordingly, the ability to use these soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions when site grading activities take place. Soils that are too wet to properly compact could be dried by aeration during dry weather conditions, or mixed with an additive such as cement or lime to stabilize the soil and facilitate compaction. If an additive is used, additional Best Management Practices (BMPs) for its use will need to be incorporated into the Temporary Erosion and Sedimentation Control (TESC) plan for the project. Soils that are dry of optimum should be moisture conditioned by controlled addition of water and blending prior to material placement.

If grading activities are planned during the wet winter months, or if they are initiated during the summer and extend into fall and winter, the owner should be prepared to import wet weather structural fill. For this purpose, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

*Based on the 3/4-inch fraction.

Prior to use, Terra Associates, Inc. should examine and test all materials imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-698 (Standard Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard. In nonstructural areas, the degree of compaction can be reduced to 90 percent.

4.3 Relative Slope Stability

As noted above, the southern and eastern portions of the development will be located adjacent to the top of steep slopes. The steep slope located along the northern margin of the site will be regraded and supported by a retaining wall, effectively eliminating the steep slope. The existing and proposed cross sections of the northern slope can be seen on Figure 6, Cross Section D-D'. Per City of Redmond requirements, those portions of the development located near steep slopes would need to maintain a minimum 50-foot buffer at the crest of those portions of the slopes which are 40 percent or greater. The buffer can be reduced to 15 feet when a qualified professional demonstrates through technical studies that the reduction will adequately protect the proposed and surrounding development from the critical landslide hazard.

Slope stability analyses were completed to evaluate if impacts to the slopes or to the development would occur with a buffer reduction to 15 feet. The analyses were performed at three locations identified as Cross Sections B-B', C-C', and E-E' using the computer program SLIDE 7.0. The cross-section locations are shown on Figure 2. Geologic sections showing test pits and test borings used for interpretation are attached as Figures 3 through 7. Development of the sections and interpreted groundwater conditions were also based on our reconnaissance of the ravine as noted on Figure 8.

Our analysis considered both the static and pseudostatic (seismic) conditions. Horizontal accelerations of 0.16g, and 0.18g were used in the pseudostatic analyses to simulate slope performance under earthquake loading. These values were determined for each of the slope cross sections 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 soil strength parameters for our analysis:

Table 2 – Slope Stability Analysis Soil Strength Parameters

Soil Type	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Structural fill	125	34	0
Interbedded silt, sand, silty sand, and silty sand with gravel	115	35	100
Hard SILT	120	30	500
Very dense silty SAND with gravel and silty GRAVEL with sand	130	38	75

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

Table 3 – Slope Stability Analysis Results

Conditions Analyzed	Minimum Safety Factors		
	Cross Section B-B'	***Cross Section C-C'***	***Cross Section E-E'***
Post-Construction	2.141 (Seismic FS = 1.469)	1.594 (Seismic FS = 1.112)	3.708 (Seismic FS = 2.526)

Based on the results of our analysis and our observations during our reconnaissance, it is our opinion that the slopes are stable from a deep seated failure perspective. Therefore, it is our opinion that the development buffers can be reduced from 50 feet to 15 feet without having a negative impact on the global slope stability or placing the proposed development at risk from impact due to instability. The graphical output of the analyses are attached in Appendix C.

4.4 Excavations

All excavations at the site associated with confined spaces, such as lower building level retaining walls, must be completed in accordance with local, state, and federal requirements. Based on the Washington State Safety and Health Administration (WSHA) regulations, the medium dense to dense native soils would typically be classified as Type C soils. Unweathered, dense to very dense till and till-like soils would typically be classified as Type A soils.

Accordingly, for temporary excavations of more than 4 feet and less than 20 feet in depth, the side slopes in Type C soils should be laid back at a slope inclination of 1.5:1 (Horizontal:Vertical) or flatter. Temporary excavations in Type A soils can be laid back at inclinations of 0.75:1 or flatter. For temporary excavation slopes less than 8 feet in height in Type A soils, the lower 3.5 feet can be cut to a vertical condition with a 0.75:1 slope graded above. For temporary excavation slopes greater than 8 feet in height up to a maximum height of 12 feet, the slope above the 3.5-foot high vertical portion should be laid back to an inclination of 1:1 or flatter. No vertical cut with a backslope immediately above is allowed for excavation depths that exceed 12 feet. In this case, a 4-foot high vertical cut with an equivalent horizontal bench to the cut slope toe is required. If there is insufficient room to complete the excavations in the manner discussed above, or if excavations greater than 20 feet deep are planned, you may need to use temporary shoring to support the excavations.

Seepage of perched groundwater should be anticipated within excavations. In our opinion, the volume of water and rate of flow into the excavation should be relatively minor and would not be expected to impact the stability of the excavations when completed as described above. Conventional sump pumping procedures along with a system of collection trenches, if necessary, should be capable of maintaining a relatively dry excavation for construction purposes in these soils.

The above information is provided solely for the benefit of the owner and other design consultants, and should not be construed to imply that Terra Associates, Inc. assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

4.5 Foundations

Residential structures may be supported on conventional spread footing foundations bearing on competent native soils or on structural fill placed above the native soils. Foundation subgrades should be prepared, as recommended in Section 4.2 of this report.

Perimeter foundations exposed to the weather should bear at a minimum depth of 1.5 feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth below the floor slab. We recommend designing foundations for a net allowable bearing capacity of 3,000 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used in design. With the anticipated loads and this bearing stress applied, building settlements should be less than one-half inch total and one-fourth inch differential.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressure acting on the sides of the footings may also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf). We recommend not including the upper 12 inches of soil in this computation because they can be affected by weather or disturbed by future grading activity. This value assumes the foundations will be constructed neat against competent native soil or the excavations are backfilled with structural fill, as described in Section 4.2 of this report. The recommended passive and friction values include a safety factor of 1.5.

4.6 Slab-on-Grade Floors

Slab-on-grade floors may be supported on a subgrade prepared as recommended in Section 4.2 of this report. Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer composed of clean, coarse sand or fine gravel that has less than three percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting uniform curing of the slab and can actually serve as a water supply for moisture seeping through the slab and affecting floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained.

4.7 Rockery Construction

A rockery is not intended to function as an engineered structure to resist lateral earth pressure as a retaining wall is. The primary function of a rockery is to cover the exposed soil face to reduce the potential for erosion. All rockery construction should conform to the Associated Rockery Contractors (ARC) Standard Rock Wall Construction Guidelines.

We recommend limiting cut rockeries to a height of eight feet when facing undisturbed dense native soils, and four feet where placed against unreinforced structural fill. Where buildings will be constructed above and adjacent to rockery construction, the foundations should be lowered to prevent surcharge loading on the rockery. Foundation depths should provide for a theoretical 1:1 influence line extending from the footing edge to pass beneath the rockery base.

Where rockeries of four feet or less will be constructed against structural fill, the structural fill should be overbuilt and then cut back prior to constructing the rockery. This will provide a more competent and stable soil face behind the rockery. If rockeries placed against fill will be surcharged with foundation or slope loads within a distance equal to the exposed height of the rockery and in those locations where rockeries against fill will be greater than four feet in height, the fill should be reinforced using a geogrid or geotextile material.

4.8 Infiltration Feasibility

Based on the conditions observed in our test borings, it is our opinion that on-site infiltration is not a viable option for management of site stormwater. Soil conditions consist predominantly of low permeability materials that would not support or allow infiltration discharge. Additionally, infiltration facilities placed higher on the site will increase seepage that will daylight in the ravine and could impact the current stable ravine slopes.

4.9 Stormwater Detention

As we understand, on-site detention of stormwater runoff will be provided by a buried vault located in the northeastern portion of the planned development area. We did not have the conceptual vault location or dimensions at the time of our subsurface exploration, and therefore, did not investigate subsurface conditions to the proposed bottom of vault elevation. We anticipate that dense to very dense glacial deposits exist at the planned bottom of vault elevation; however, this should be verified prior to construction.

Vault foundations supported by dense to very dense native soils at a depth greater than 8 feet may be designed for an allowable bearing capacity of 6,000 psf. For short-term loads, such as seismic, a one-third increase in this allowable capacity can be used. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressure acting on the sides of the vault footings may also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf).

The magnitude of earth pressures developing on the vault walls will depend in part on the quality and compaction of the wall backfill. We recommend placing and compacting wall backfill as structural fill as recommended in Section 4.2.

To prevent development of hydrostatic pressure and uplift on the vault, wall drainage must be installed. A typical recommended wall drainage detail is shown on Figure 9. If it is not possible to discharge collected water at the footing invert elevation, we recommend setting the invert elevation of the wall drainpipe equivalent to the outfall invert and connecting the drain to the outfall pipe for discharge.

With the recommended wall backfill and drainage, we recommend designing the vault walls for an earth pressure imposed by an equivalent fluid weighing 50 pcf. For any portion of the wall that falls below the invert elevation of the wall drain, an earth pressure equivalent to a fluid weighing 85 pcf should be used. For evaluating walls under seismic loading, an additional uniform earth pressure equivalent to 8H psf, where H is the height of the below-grade wall in feet, can be used. These values assume a horizontal backfill condition. If necessary, a uniform horizontal traffic surcharge value of 75 psf should be included in design of vault walls.

The vault could be subject to uplift pressures if drainage is not provided the full depth of the structure. The weight of the structure and the weight of the backfill soil above its foundation will provide resistance to uplift. A soil unit weight of 125 pcf can be used for the vault backfill provided the backfill is placed and compacted as structural fill as recommended in Section 4.2.

4.10 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. No concentrated runoff should be directed to or allowed to descend the steeper northern and southern slopes on the site.

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.

4.11 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) or City of Redmond requirements. At minimum, trench backfill should be placed and compacted as structural fill as described in Section 4.2 of this report. As noted, soils excavated on-site should generally be suitable for use as backfill material. However, the vast majority of the site soils are fine grained and moisture sensitive; therefore, moisture conditioning may be necessary to facilitate proper compaction. If utility construction takes place during the winter, it may be necessary to import suitable wet weather fill for utility trench backfilling.

4.12 Pavements

Pavement subgrade should be prepared as described in the Section 4.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. The subgrade should be proofrolled with heavy rubber-tire construction equipment such as a loaded 10-yard dump truck to verify this condition.

The pavement design section is dependent upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. For residential access, with traffic consisting mainly of light passenger vehicles with only occasional heavy traffic, and with a stable subgrade prepared as recommended, we recommend the following pavement sections:

- Two inches of hot mix asphalt (HMA) over six inches of crushed rock base (CRB)
- Four inches full depth HMA over prepared subgrade

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for ½-inch class HMA and CRB.

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability. For optimum pavement performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

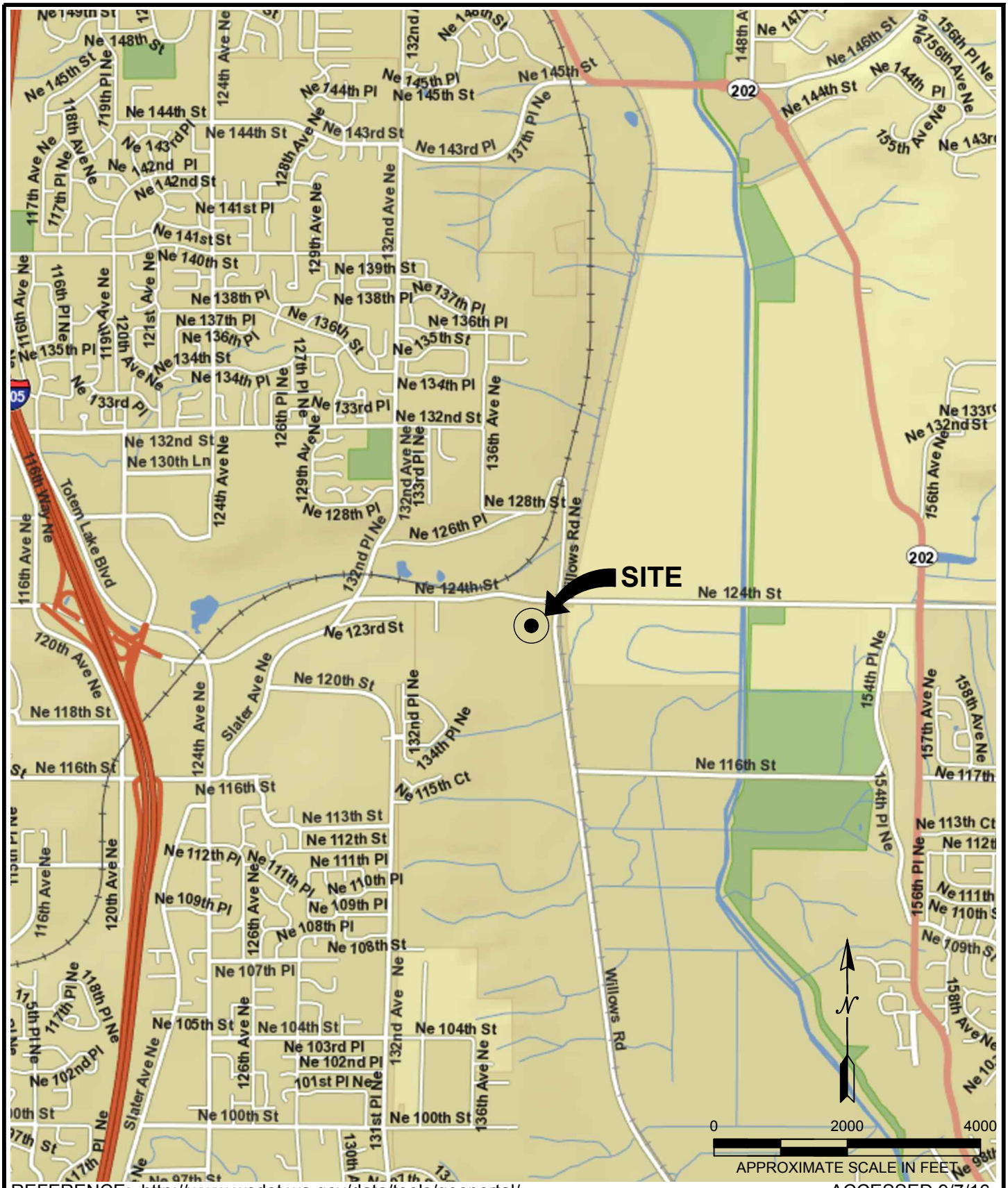
5.0 ADDITIONAL SERVICES

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.

6.0 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 Proctor Parcels project. This report is for the exclusive use of Quadrant Homes and their authorized representatives. No other warranty, expressed or implied, is made.

The analyses and preliminary recommendations presented in this report are based on data obtained from our on-site test borings and the included site explorations performed by others. 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: http://www.wsdot.wa.gov/data/tools/geoportal/ ACCESSED 9/7/16

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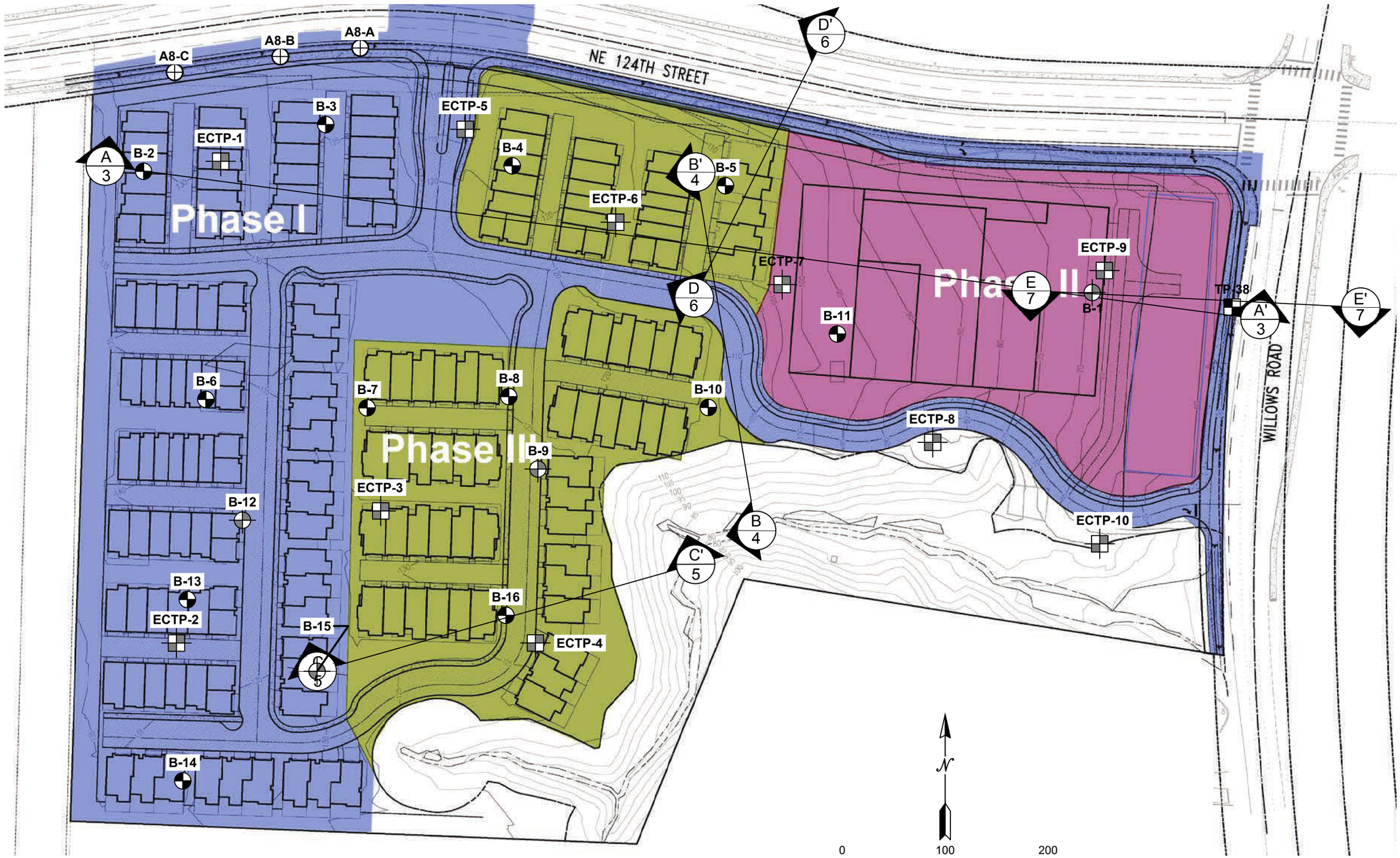
VICINITY MAP
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474	Date MAY 2017	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 KPFF.

LEGEND:

- APPROXIMATE TEST PIT LOCATION BY OTHERS
- APPROXIMATE BORING LOCATION BY TERRA ASSOCIATES
- APPROXIMATE BORING LOCATION BY OTHERS
- APPROXIMATE TEST PIT LOCATION BY OTHERS
- APPROXIMATE BORING WITH MONITORING WELL LOCATION BY TERRA ASSOCIATES

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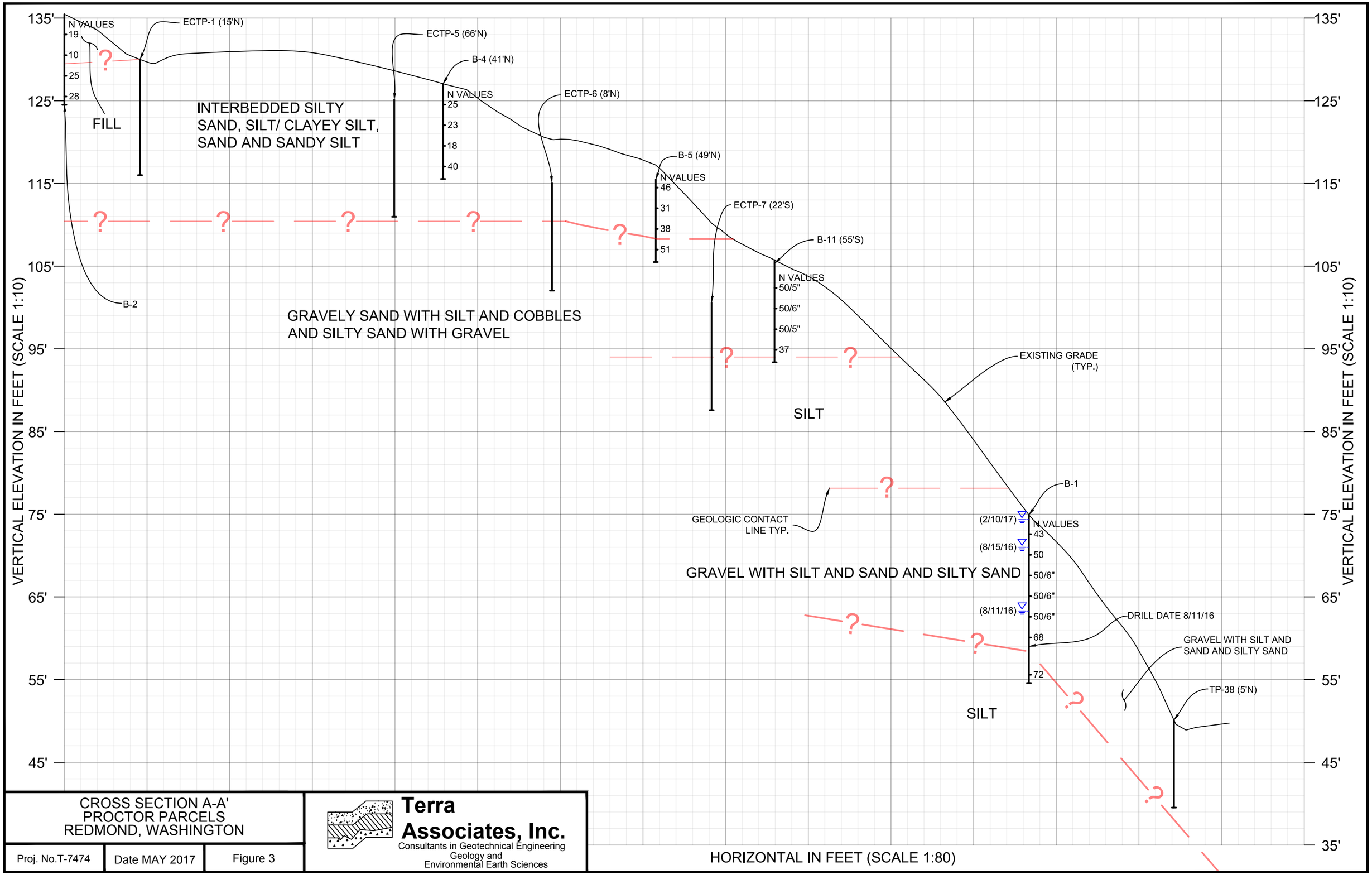
EXPLORATION LOCATION PLAN
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474	Date MAY 2017	Figure 2



CROSS SECTION A-A'
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474	Date MAY 2017	Figure 3

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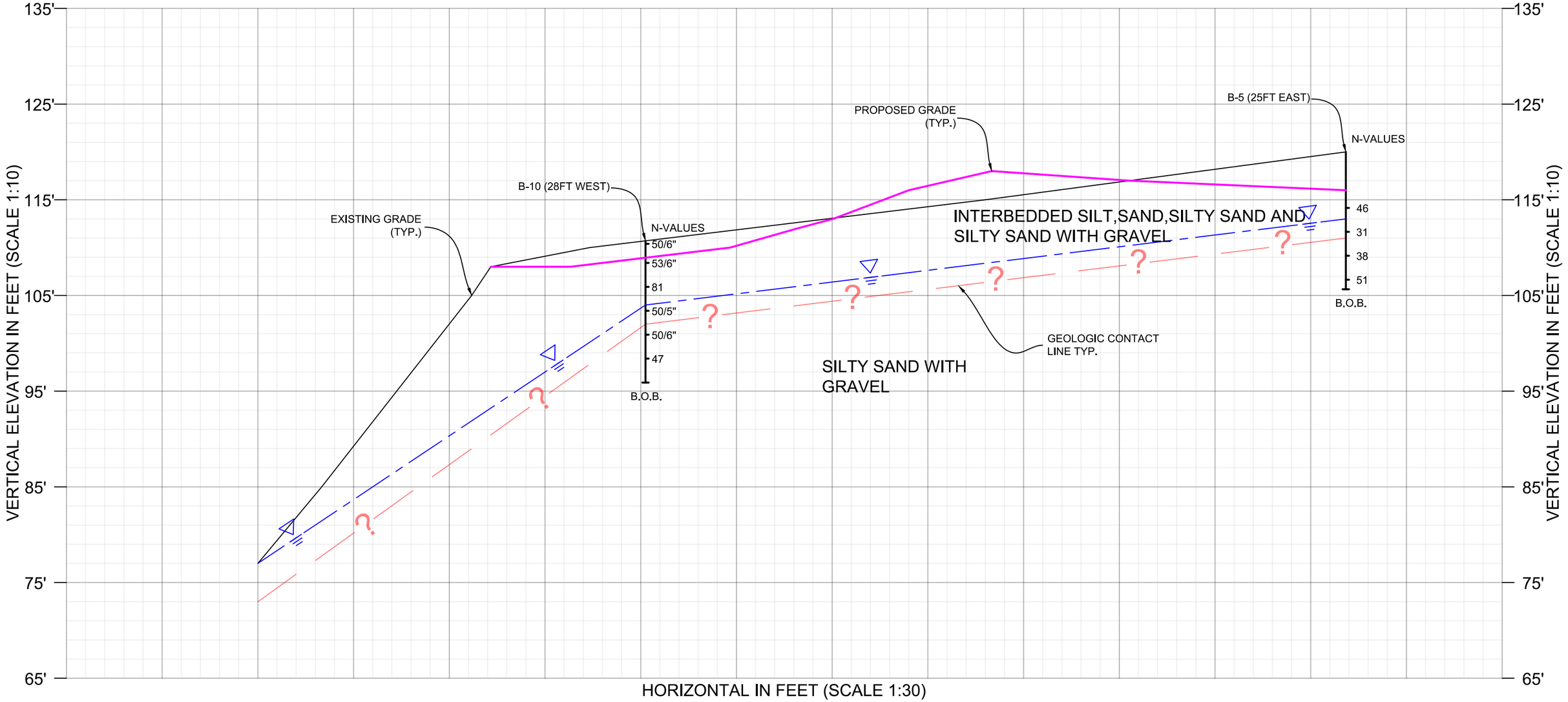

CROSS SECTION B-B'
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474	Date MAY 2017	Figure 4

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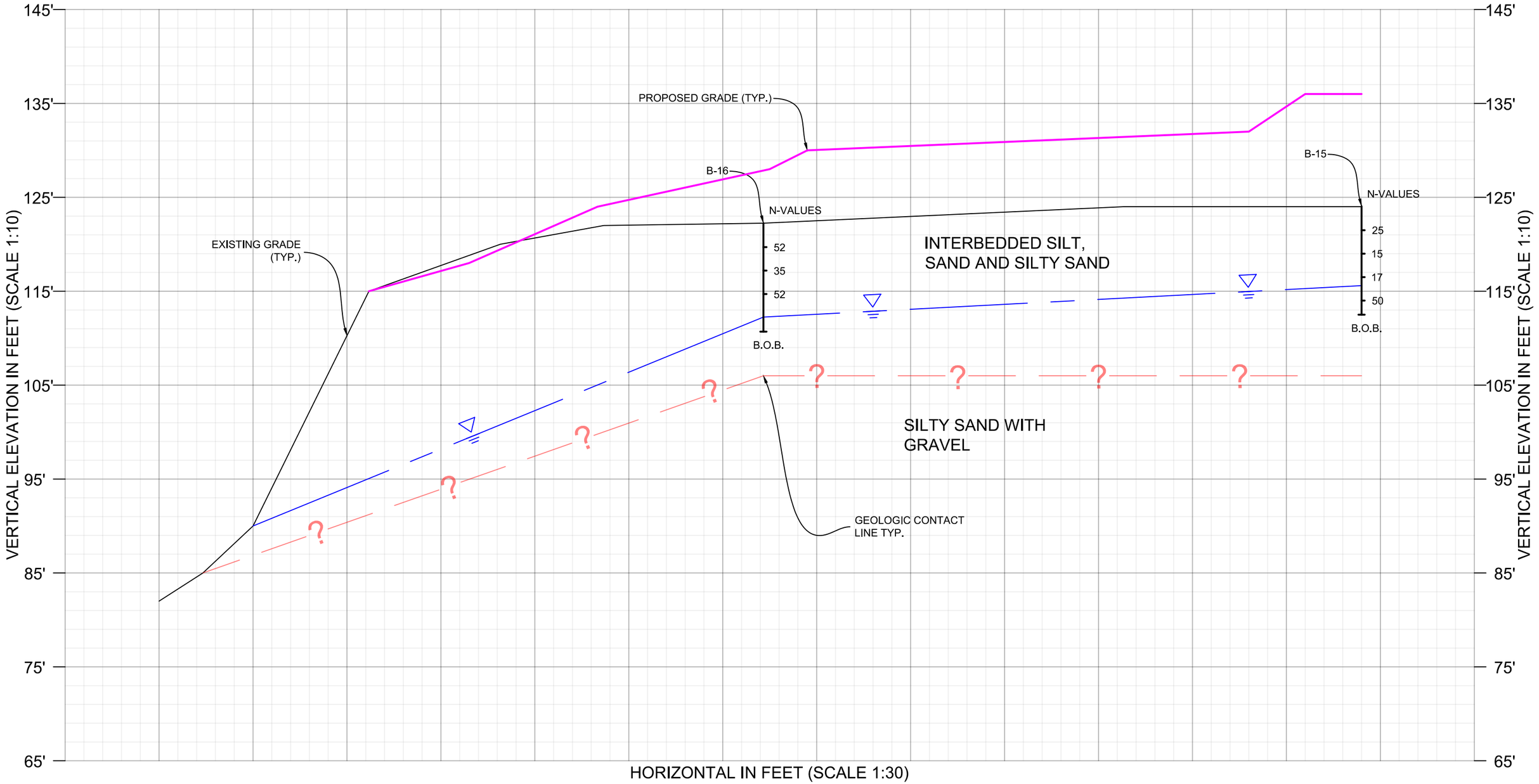
Environmental Earth Sciences



CROSS SECTION C-C'
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474 | Date MAY 2017 | Figure 5

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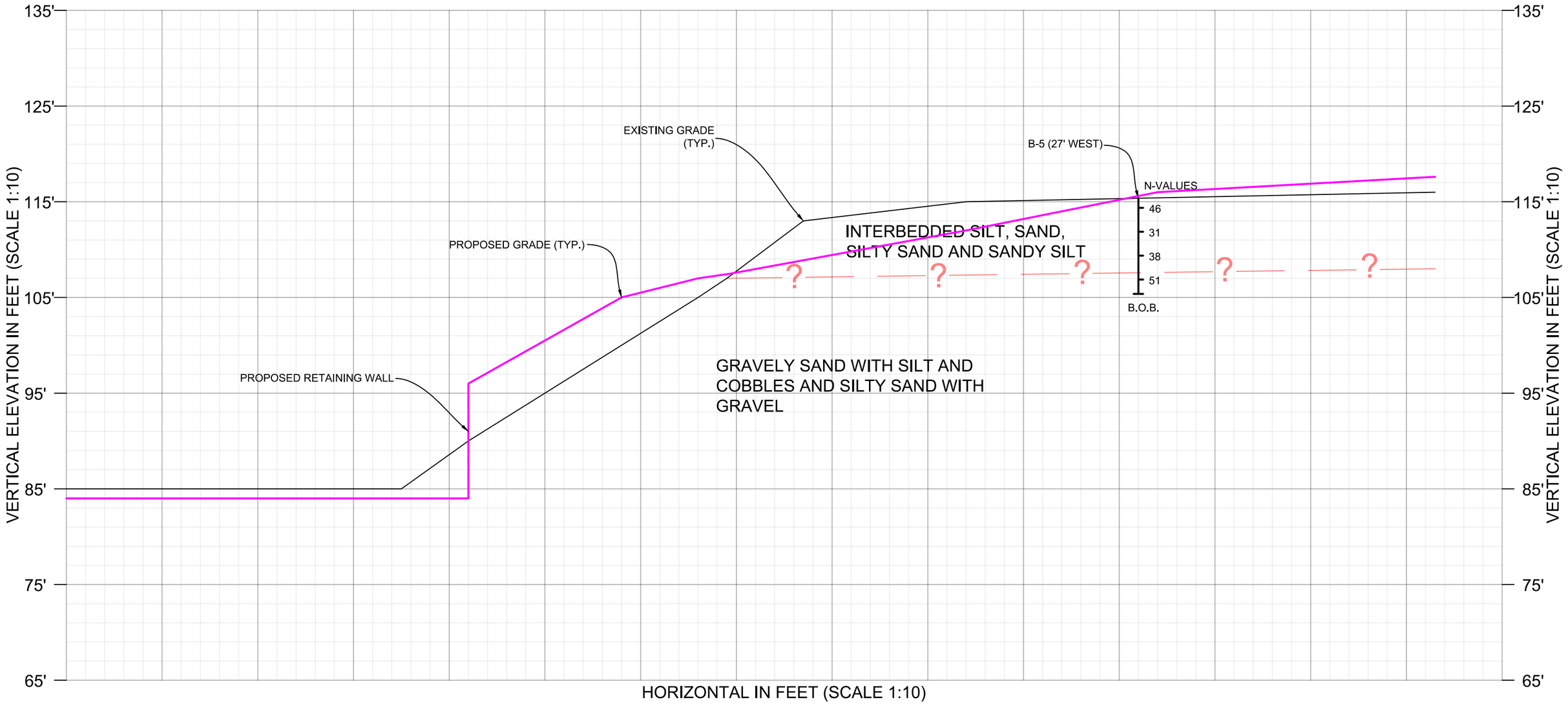
Environmental Earth Sciences



CROSS SECTION D-D'
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474	Date MAY 2017	Figure 6

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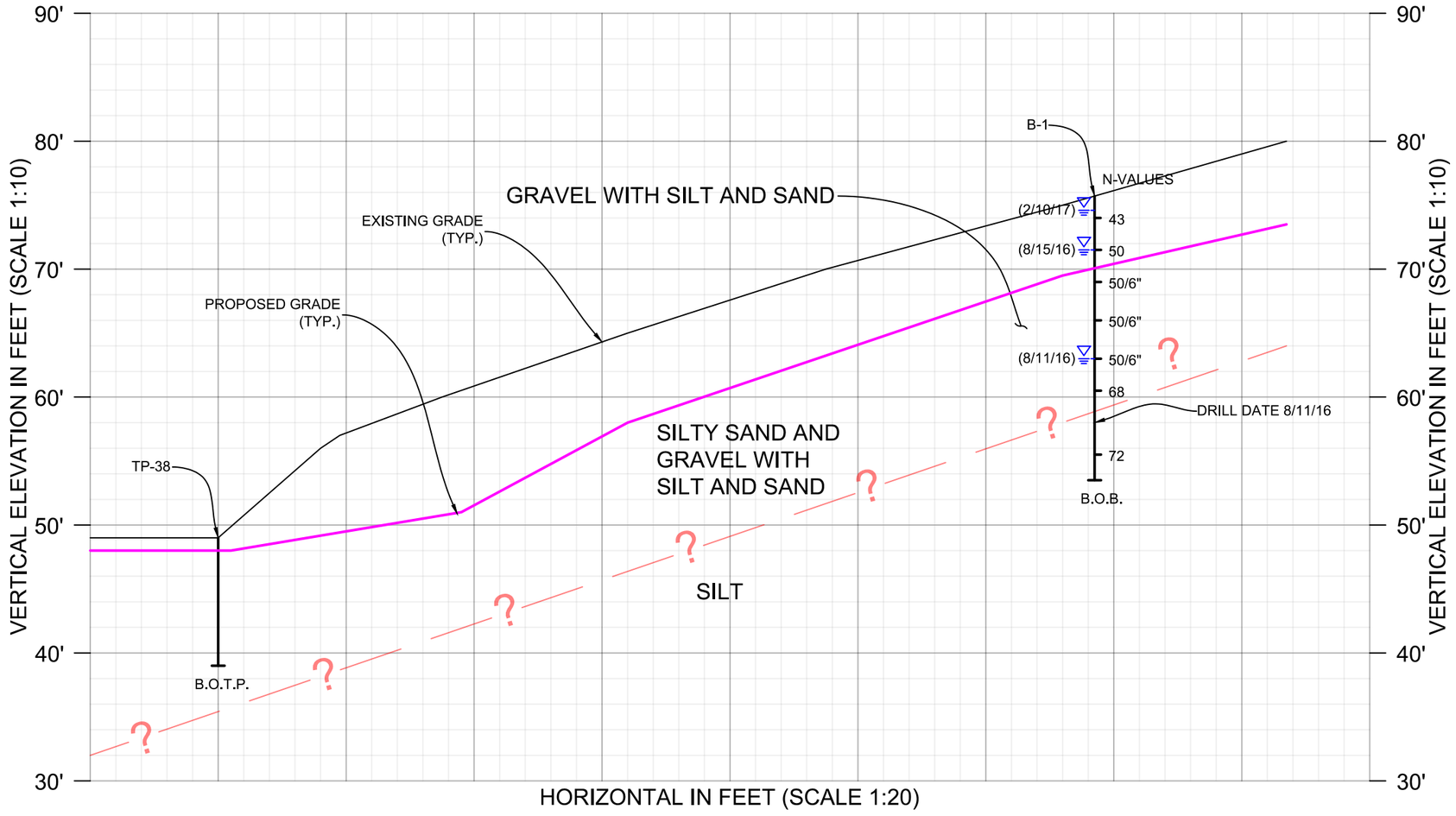

CROSS SECTION E-E'
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474	Date MAY 2017	Figure 7

Terra Associates, Inc.
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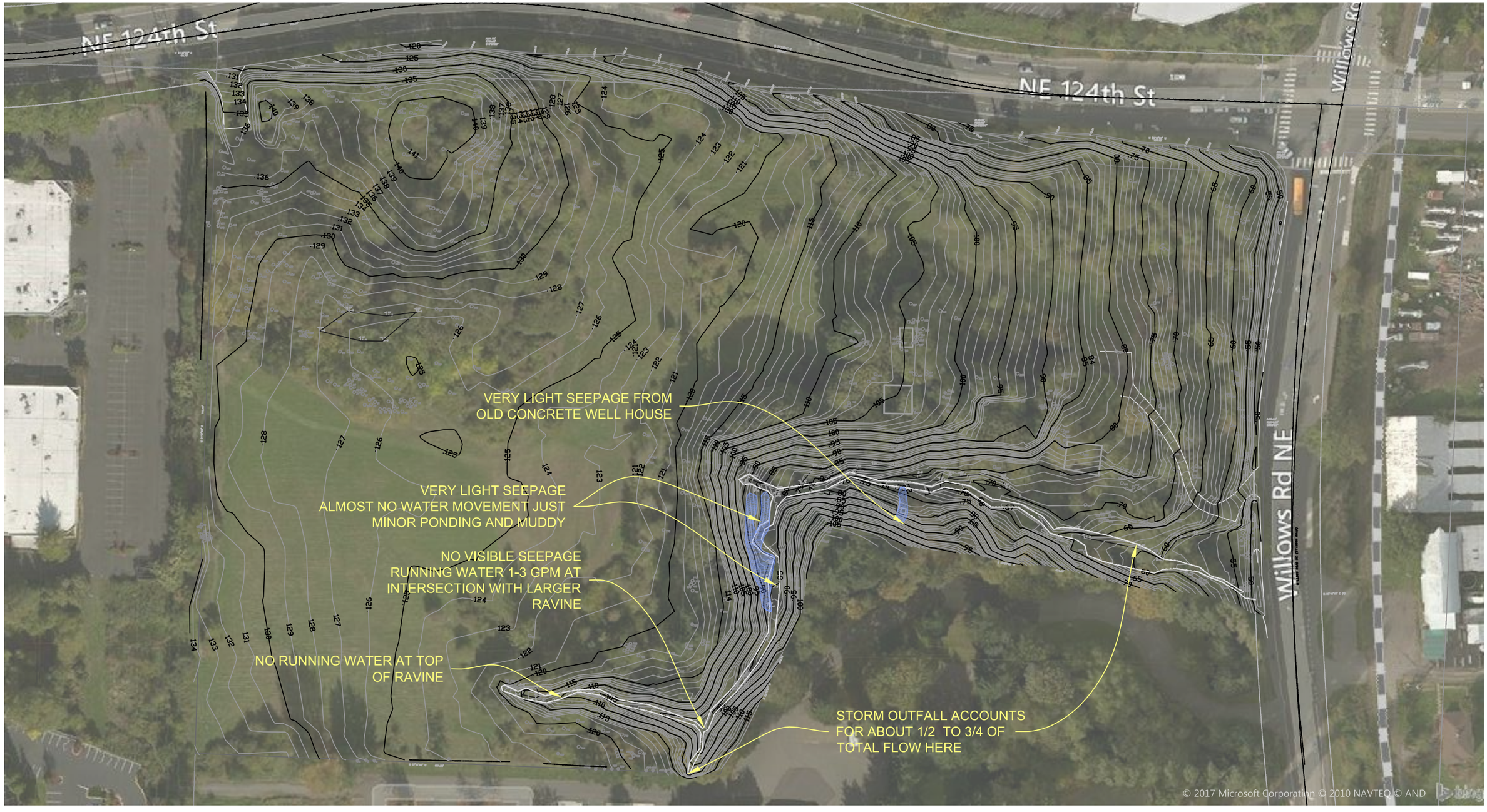
Environmental Earth Sciences



NOTE:

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REFERENCE: SITE PLAN PROVIDED BY KPFF.

LEGEND:

APPROXIMATE SEEPAGE LOCATION

0 100 200

APPROXIMATE SCALE IN FEET

N

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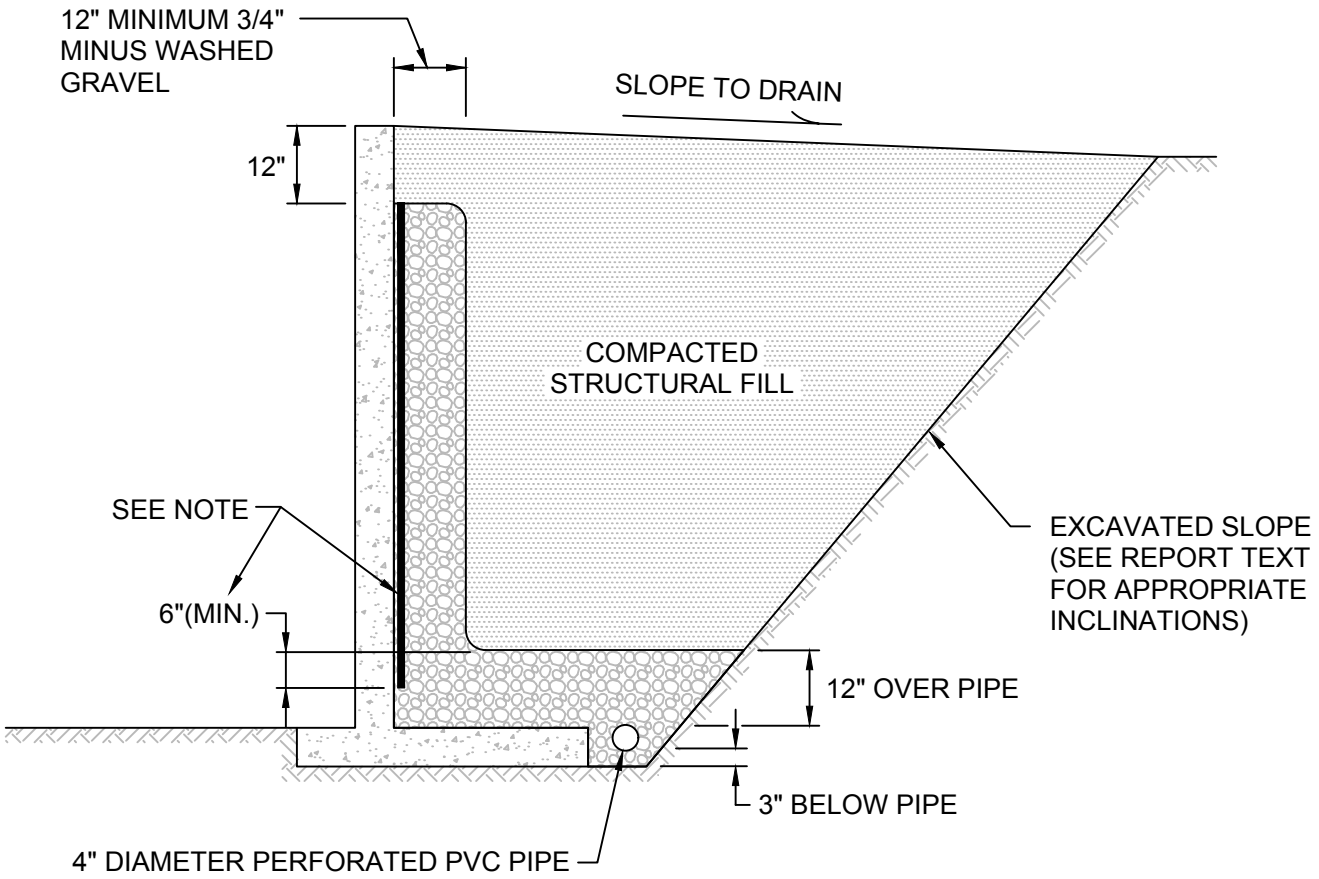
RAVINE RECONNASSANCE NOTES
PROCTOR PARCELS
KIRKLAND, WASHINGTON

Proj.No. T-7474 | Date: MAY 2017 | Figure 8



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.

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TYPICAL WALL DRAINAGE DETAIL
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474	Date MAY 2017	Figure 9

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

Proctor Parcels
Redmond, Washington

On August 10 and 11, 2016, we explored subsurface conditions at the site by drilling 15 borings to maximum depths of about 20 feet below existing surface grades using a track-mounted drill rig equipped with hollow stem augers. The test boring locations are shown on Figure 2. The exploration locations were surveyed prior to the drilling by KPFF. In the field, it was determined that one of the planned locations would duplicate information from a nearby boring and the location was deleted from the exploration program. The Boring Logs are presented on Figures A-2 through A-17.

Monitoring wells were installed in Boring B-1 in the northeast corner of the site and in Borings B-9, B-12, and B-15 in the upper bench area in the western half of the site.

An engineering geologist from our office conducted the field exploration. Our representative classified the soil conditions encountered, maintained a log of each test boring, obtained representative soil samples, and recorded water levels observed during drilling. 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-2 through A-17. 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 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 Boring Logs. Grain size analyses were performed on selected soil samples. The results are shown on Figures A-18 through A-21.

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS More than 50% material larger than No. 200 sieve size	**GRAVELS** 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.
	SANDS 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.
FINE GRAINED SOILS More than 50% material smaller than No. 200 sieve size	**SILTS AND CLAYS** 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.
	SILTS AND CLAYS Liquid Limit is greater than 50%		MH	Inorganic silts, elastic.
			CH	Inorganic clays of high plasticity. (Fat clay)
			OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat.

DEFINITION OF TERMS AND SYMBOLS

COHESIONLESS

Density	Standard Penetration Resistance in Blows/Foot
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	>50

COHESIVE

Consistancy	Standard Penetration Resistance in Blows/Foot
Very Soft	0-2
Soft	2-4
Medium Stiff	4-8
Stiff	8-16
Very Stiff	16-32
Hard	>32

I	2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
‖	2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
▼	WATER LEVEL (Date)
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
PROCTOR PARCELS
REDMOND, WASHINGTON

Proj. No.T-7474	Date MAY 2017	Figure A-1

LOG OF BORING NO. B-1

Figure No. A-2

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/11/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 75.4 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF △ 1 2 3 4 / SPT (N) ● Blows/ft ● 10 30 50 70 90	Observ. Well
1		(BRUSH, TOPSOIL)				
2		Tan, dry silty SAND with organics, topsoil. (Topsoil)	Dense to Very Dense	14.6		
3		Gray silty SAND with gravel, moist. (SM)			43	
4						
5				7.5	50	
6			Very Dense			
7				7.8		
8					50/6	
9						
10		Moderate gray, moist, GRAVEL with sand and silt. (GP-GM) (Till-like)		6.7	50/6	
11						
12				13.4		
13					50/6	
14						
15				8.4		
16					68	
17						
18		Moderate gray, moist, SILT, dilatant. (ML)	Hard		3.00 △	
19						
20				24.0	72	
21		Terminated at 20 feet. Perched groundwater encountered at 12.5 feet bgs at time of drilling (ATD). 2-inch Sch 40 PVC, 10 ft blank riser, 10 ft 0.01 screen. Filter sand is CSI 10-20, bentonite is 5/8" chip. Flushmount monument set. Ecology Tag #BIS-649				
22						
23						
24						
25						

Bentonite Seal

10-20 CSI Filter Sand

ATD

8-15-16

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

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LOG OF BORING NO. B-2

Figure No. A-3

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 135.5 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer ^ TSF ^ 1 2 3 4 SPT (N) Blows/ft 10 30 50 70 90
0		(BRUSH, GRAVEL)			
1		Tan, dry silty SAND with organics (roots, duff), topsoil. (Topsoil)			
2				17.2	
3		FILL: tan, dry, silty SAND with rootlets, layered silty sand/sandy silt. (SM)	Medium Dense		19
4					
5				29.7	10
6		Black, moist silty SAND with organics, historic topsoil. (Topsoil)			
7		Gray, moist silty SAND with interbeds of moist to wet SILT, oxidized orange in places. (SM)		30.1	
8			Medium Dense		25
9					
10				30.5	
10		Gray, moist silty SAND with interbeds of moist silt with organics. (ML)	Hard		28 4.5+
11					
12		Boring terminated at 11.5 feet. No groundwater encountered. Minor water in silt at 6.3-6.5 ft. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
13					
14					
15					

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

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LOG OF BORING NO. B-3

Figure No. A-4

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** Boretec **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 140.8 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF 1 2 3 4 △ / SPT (N) Blows/ft ● 10 30 50 70 90
0		(Brush, GRAVEL)			
1		FILL: Tan, dry silty SAND with organics (roots, duff). (SM)	Loose	12.5	9
4		Gray, dry to moist SILT, interbedded with silty SAND, oxidized orange in places. (ML) LL=34 PL=26	Stiff to Very Stiff	27.3	14 2.50
7				9.8	25
8		Gray to tan moist silty SAND, with interbeds of sandy silt. (SM)	Medium Dense	12.2	25
11		Boring terminated at 11.5 feet. No groundwater encountered. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
15					

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

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LOG OF BORING NO. B-4

Figure No. A-5

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 126.8 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF 1 2 3 4 △ / SPT (N) Blows/ft ● 10 30 50 70 90 ●
0		(GRASS and DUFF)			
1					
2					
3		No recovery - rock in shoe of sampler. Drill action is rough.	Medium Dense		25 ●
4					
5		Gray to tan moist silty SAND, with interbeds of sandy silt. (SM)		16.6 ✳	23 ●
6					
7				22.7 ✳	
8		Gray, dry to moist SILT, interbedded with silty SAND, oxidized orange in places. (ML)	Very Stiff to Hard		18 ● 3.5-4.5 △
9					
10				18.9 ✳	40 ● 4.5+ △
11					
12		Boring terminated at 11.5 feet. No groundwater encountered. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
13					
14					
15					

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

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LOG OF BORING NO. B-5

Figure No. A-6

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/11/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 117.1 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF △ 1 2 3 4 ● SPT (N) Blows/ft ● 10 30 50 70 90
		(GRASS)			
1		Tan to gray dry silty SAND. (SM)			
2				6.9	
3			Dense		46
4					
5		Tan dry to moist SILT with sand, rootlets, with traces of sand oxidized orange. (ML)	Hard	20.9	31 4.5+
6					
7		Tan dry to moist silty SAND with interbeds of sandy silt oxidized orange in places. (SM)	Dense	6.3	38
8					
9		Tan gravelly silty SAND, dry to moist, till-like. (SM)	Very Dense	4.8	
10					51
11					
12		Boring terminated at 11.5 feet. No groundwater encountered. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
13					
14					
15					

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

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LOG OF BORING NO. B-6

Figure No. A-7

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 126.8 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer TSF 1 2 3 4 / SPT (N) Blows/ft 10 30 50 70 90
		(BRUSH)			
1		Orange-gray dry sandy SILT/silty SAND with gravel, oxidized orange mottling. (ML/SM)			
2				20.7	
3			Very Stiff		28
4					
5		Tan dry to moist silty SAND with interbeds of sandy silt oxidized orange in places. (SM)	Dense	15.9	40 4.5+
6					
7				20.7	
8		Gray dry to moist SILT with sand, rootlets, with traces of sand oxidized orange. (ML)			37 4.5+
9		LL=38 PL=32	Hard		
10				29.4	28
11					
12		Boring terminated at 11.5 feet. No groundwater encountered. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
13					
14					
15					

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

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LOG OF BORING NO. B-7

Figure No. A-8

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 126.3 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer TSF 1 2 3 4 / SPT (N) Blows/ft 10 30 50 70 90
		(BRUSH, GRASS)			
1					
2		Orange-gray dry to moist SILT with oxidized mottling in orange, woody debris (roots). (ML)		33.3	
3			Very Stiff		22 ● 4.00 △
4					
5				23.5	
6			Hard		33 ● 4.5+ △
7				8.3	
8		Grayish-tan dry to moist silty SAND with interbeds of sandy silt oxidized orange in places. (SM)	Very Dense		63 ●
9					4.5+ △
10				13.2	
		Moderate gray moist SILT with interbeds of tan silty sand with water, and tan silt. (ML)	Hard		36 ●
11					
12		Boring terminated at 11.5 feet. No groundwater encountered. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
13					
14					
15					

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

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Consultants in Geotechnical Engineering, Geology and Environmental Earth Sciences

LOG OF BORING NO. B-8

Figure No. A-9

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 124.9 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF 1 2 3 4 △ SPT (N) Blows/ft • 10 30 50 70 90
0		(GRASS, 3 inches of SOD)			
1		Gray to tan dry silty SAND. (SM)			
2				11.2	
3			Medium Dense		14
4					
5		Tan moist silty SAND with clay, with interbeds of SAND, oxidized orange in places. (SM)		26.6	11
6					
7				10.8	
8					35
9		Tan moist silty SAND with gravel, oxidation (orange) around some gravel clasts. Transition to silty sand above is abrupt. Grades to moderate gray, increased moisture with depth. (SM)	Dense to Very Dense		
10					68
11					
12		Boring terminated at 11.5 feet. No groundwater encountered. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
13					
14					
15					

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

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LOG OF BORING NO. B-9

Figure No. A-10

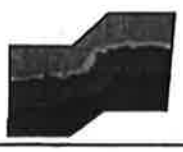
Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 112.6 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer TSF 1 2 3 4 / SPT (N) Blows/ft 10 30 50 70 90	Observ. Well
0		(GRASS, 3 inches SOD)				
1–10		Tan dry silty SAND with gravel, oxidized orange around some gravel clasts, with interbeds of silty sand, silty gravelly sand. (SM/GM)	Dense	9.1 at 5; 10.1 at 7; 9.5 at 10	52 at 3; 41 at 5; 38 at 8	Bentonite; 10-20 Sand; ATD
10–11		Moderate gray, moist, gravelly SAND with silt. (SP-SM) (Till-like)	Very Dense		50-5" at 10	
12–20		Terminated at 11.5 feet. Saturated interbed encountered at 10.5 to 11.5 feet bgs at time of drilling (ATD). 2-inch Sch 40 PVC, 10 ft blank riser, 10 ft 0.01 screen. Filter sand is CSI 10-20, bentonite is 5/8" chip. Flushmount monument set. Ecology Tag #BIS-648. 8-15-16 Well is dry.				

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



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LOG OF BORING NO. B-10

Figure No. A-11

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/11/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 112.4 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF 1 2 3 4 △ SPT (N) Blows/ft • 10 30 50 70 90
0		(GRASS, 3 inches of SOD)			
1					
2				8.9	
3		Gray to tan dry silty SAND with gravel, lightly oxidized orange in places, with interbeds of silty sand and silt. (SM/GM)			50-6"
4					
5				6.8	53-6"
6			Very Dense		
7				12.5	
8					81
9		Tan to moderate gray moist silty SAND with interbeds of fine gravel, sand with silt, oxidized orange interbeds. (SM)			
10					50-5"
11					
12					
13					50-6"
14					
15		Moderate gray moist gravelly SAND with silt, with light oxidation to orange on clasts. (SP-SM)			47
16					
17		Boring terminated at 16.5 feet. No groundwater encountered. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
18					
19					
20					

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

Terra Associates, Inc.

Consultants in Geotechnical Engineering, Geology and Environmental Earth Sciences

LOG OF BORING NO. B-11

Figure No. A-12

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/11/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 104.7 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF △ 1 2 3 4 SPT (N) Blows/ft 10 30 50 70 90
0		(BRUSH, GRAVEL)			
1					
2					
3		Light gray dry GRAVEL with sand, oxidized orange around some clasts. (GP)			50-5"
4					
5				3.5	50/6"
6			Very Dense		
7				5.3	
8					50/5"
9					
10				10.1	
11		Tan moist SILT with interbed of oxidized sand. (ML)	Hard		37
12		Boring terminated at 11.5 feet. No groundwater encountered. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
13					
14					
15					

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

Terra Associates, Inc.

Consultants in Geotechnical Engineering, Geology and Environmental Earth Sciences

LOG OF BORING NO. B-12

Figure No. A-13

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 126.6 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer TSF 1 2 3 4 / SPT (N) Blows/ft 10 30 50 70 90	Observ. Well
0		(GRASS, 3 inches SOD)				
1						
2				23.9		Bentonite
3		Moderate to light gray, moist sandy SILT/silty SAND, in interbeds of two to six inches, with rootlets. (SM/ML)			29	
4			Very Stiff to Stiff			
5				23.9	12	
6						
7				17.7		10-20 Sand
8					12	ATD
9		Moderate gray, moist, gravelly SAND with silt. (SP-SM) (Till-like)				
10			Very Dense	6.1	74	
11						
12		Terminated at 11.5 feet. Saturated interbed encountered at 8.5 to 9.5 feet bgs at time of drilling (ATD). 2-inch Sch 40 PVC, 10 ft blank riser, 10 ft 0.01 screen. Filter sand is CSI 10-20, bentonite is 5/8" chip. Flushmount monument set. Ecology Tag #BIS-647.				
13						
14						
15		8-15-16 SWL 7.4 ft. bgs.				

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

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Consultants in Geotechnical Engineering, Geology and Environmental Earth Sciences

LOG OF BORING NO. B-13

Figure No. A-14

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 125.1 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % (Wp |-----x-----| Wl; 10 30 50 70 90)	Pocket Penetrometer TSF (1 2 3 4) / SPT (N) Blows/ft (10 30 50 70 90)
0		(BRUSH)			
2		Tan moist sandy SILT, oxidized orange in interbeds with more sand, black organics, tan silt. Water in some of the more permeable layers. (ML)		17.3	18
5				26.3	23; 3.00
6			Very Stiff		
7				22.0	
8					27; 4.5+
9		Moderate gray moist SILT with sand. (ML)	Hard		
10				19.8	
11					33
12		Boring terminated at 11.5 feet. Light groundwater encountered from sandy zones. Boring backfilled with 5/8" bentonite chips to 2 feet bgs, then soil used to close boring.			
15					

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

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LOG OF BORING NO. B-14

Figure No. A-15

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 129.2 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF △ 1 2 3 4 SPT (N) ● Blows/ft ● 10 30 50 70 90
0		(GRASS)			
1					
2		Moderate gray moist silty SAND, oxidized orange in some interbeds. (SM)	Medium Dense	13.9	
3					20
4					
5				27.9	
6		Moderate gray moist SILT with sand to clayey SILT, oxidized in some interbeds. (ML) LL=37 PL=28			9
7				22.1	
8		Moderate gray moist sandy SILT/silty SAND, with rootlets, decomposed plant debris, faint bedding. (ML/SM)	Stiff		20
9					
10				21.6	
11					19
12		Boring terminated at 11.5 feet. Seepage encountered at 10 feet. Boring backfilled with bentonite to 2 feet bgs, then soil above.			
13					
14					
15					

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

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LOG OF BORING NO. B-15

Figure No. A-16

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 124.0 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF △ 1 2 3 4 SPT (N) • Blows/ft • 10 30 50 70 90	Observ. Well
0		(GRASS, 6 inches SOD)				
1						
2		Moderate to light gray, dry silty SAND, in interbeds of two to six inches, with rootlets. (SM)		15.0		
3					25	
4						
5			Medium Dense	28.7		
6		Moderate gray, dry silty SAND, oxidized orange in places. (SM)			15	
7						
8		Dark gray moist poorly graded SAND with decomposed organics, and silty sand interbeds. (SP/SM)		38.2	17	
9						
10		Moderate gray SILT with sand interbeds, woody decomposed organics in silt. (ML)	Hard	25.7	50	
11		LL=29 PL=25				
12		Terminated at 11.5 feet. Perched groundwater encountered. 2-inch Sch 40 PVC, 5 ft blank riser, 5 ft 0.01 screen. Filter sand is CSI 10-20, bentonite is 5/8" chip. Flushmount monument set. Ecology Tag #BIS-646.				Bentonite
13						
14		8-15-16 SWL 8.42 ft. bgs.				10-20 Sand
15						

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

Terra Associates, Inc.

Consultants in Geotechnical Engineering, Geology and Environmental Earth Sciences

LOG OF BORING NO. B-16

Figure No. A-17

Project: Proctor Property **Project No:** T-7474 **Date Drilled:** 8/10/2016

Client: Quadrant **Driller:** BORETEC **Logged By:** PLR

Location: Kirkland, Washington **Approx. Elev:** 122.2 Feet

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	Moisture Content % Wp |-----x-----| Wl 10 30 50 70 90	Pocket Penetrometer △ TSF △ 1 2 3 4 / SPT (N) ● Blows/ft ● 10 30 50 70 90
0		(GRASS)			
1					
2		Moderate gray moist sandy SILT, oxidized orange in some interbeds, with rootlets. (ML)		20.9	4.5+ △
3		LL=31 PL=23	Hard		52 ●
4					
5				20.8	35 ● 4.5+ △
6					
7				15.2	
8		Grades to reddish-brown silty gravelly SAND, interbedded with gray silty sand. (SM)			52 ●
9			Very Dense		
10				7.8	50/6" ●
11		Moderate gray silty SAND with gravel, moist. (SM)			
12		Boring terminated at 11.5 feet. Seepage encountered at 10 feet. Boring backfilled with bentonite to 2 feet bgs, then soil above.			
13					
14					
15					

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

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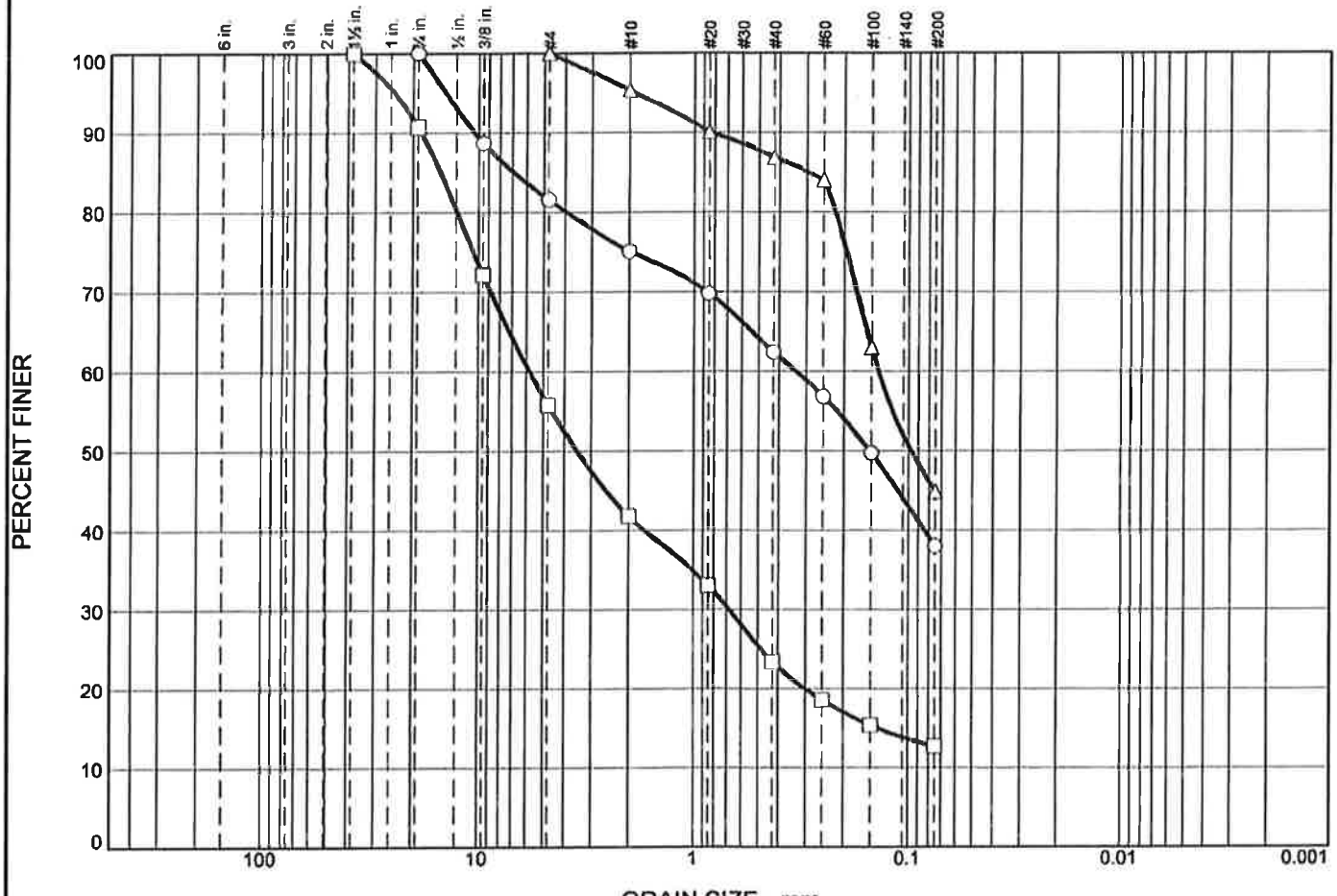
Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	18.4	6.5	12.7	24.4	38.0	
□	0.0	9.3	34.9	14.0	18.4	10.7	12.7	
△	0.0	0.0	0.0	4.7	8.4	42.0	44.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
○			6.9109	0.3348	0.1529					
□			15.0182	5.7980	3.4944	0.6820	0.1383			
△			0.2978	0.1391	0.0974					

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

Project No. T-7474 **Client:** Quadrant Homes

Project: Proctor Property

○ **Location:** MW-1 **Depth:** 2.5 feet

□ **Location:** MW-1 **Depth:** 5 feet

△ **Location:** B-2 **Depth:** 2.5 feet

Remarks:

○ Tested on 9-6-2016

□ Tested on 8-16-2016

△ Tested on 9-6-2016

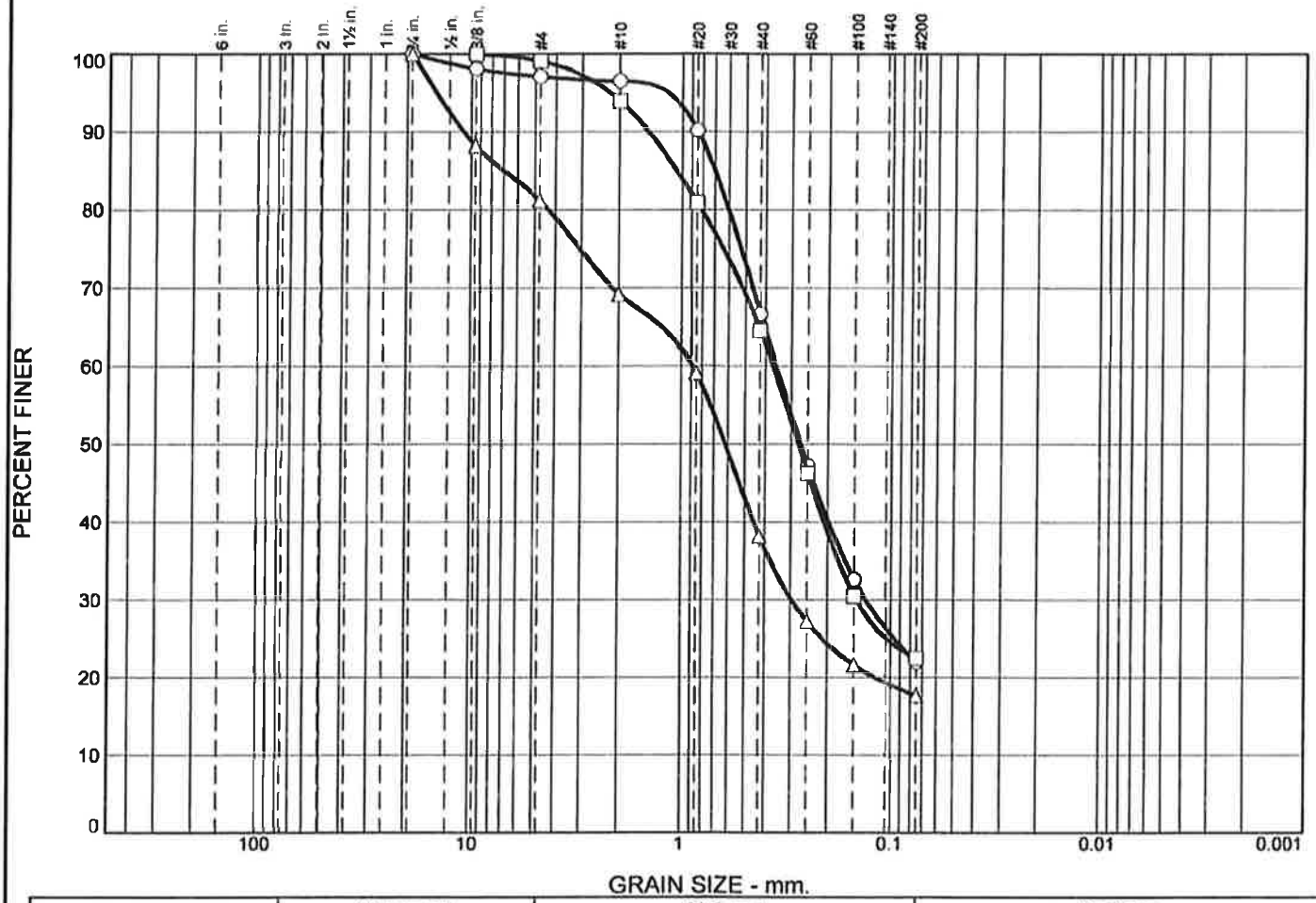
Terra Associates, Inc.

Kirkland, WA

Figure A-18

Tested By: FQ

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.9	0.6	29.8	44.7	22.0	
□	0.0	0.0	0.9	5.2	29.3	42.1	22.5	
△	0.0	0.0	18.8	12.0	31.0	20.5	17.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7006	0.3566	0.2705	0.1322				
□			1.0657	0.3681	0.2770	0.1466				
△			7.0040	0.8858	0.6177	0.2966				

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

Project No. T-7474 **Client:** Quadrant Homes

Project: Proctor Property

○ **Location:** B-5 **Depth:** 2.5 feet

□ **Location:** B-8 **Depth:** 2.5 feet

△ **Location:** B-8 **Depth:** 7.5 to 10 feet

Remarks:

○ Tested on 9-6-2016

□ Tested on 9-6-2016

△ Tested on 8-16-2016

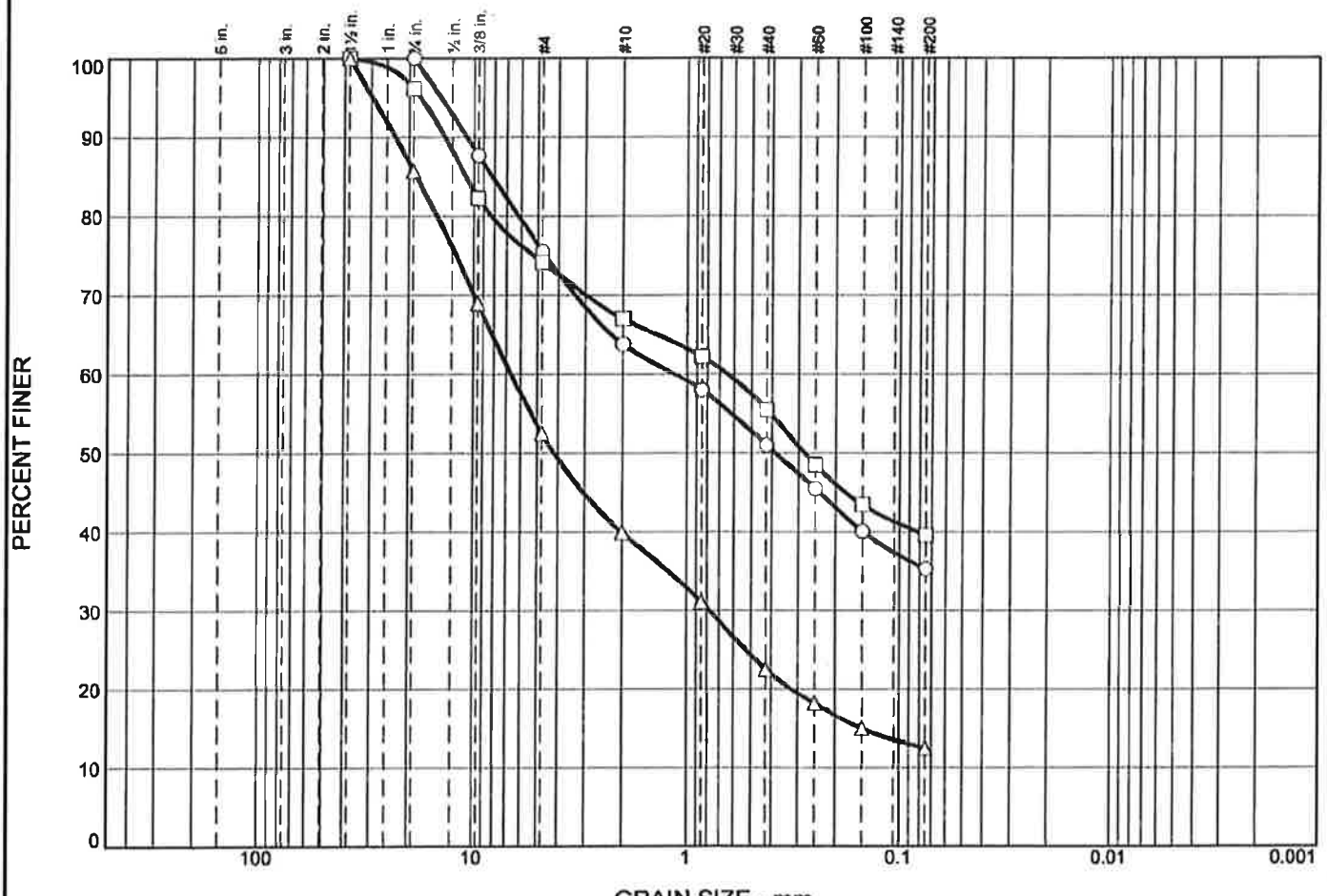
Terra Associates, Inc.

Kirkland, WA

Figure A-19

Tested By: FQ

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	24.5	11.7	12.8	15.7	35.3	
□	0.0	3.9	22.0	7.1	11.5	15.9	39.6	
△	0.0	14.3	33.2	12.6	17.4	10.0	12.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_U
○			8.1911	1.1421	0.3863					
□			10.9350	0.6448	0.2814					
△			18.4635	6.6436	4.1656	0.7771	0.1500			

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

Project No. T-7474 **Client:** Quadrant Homes

Project: Proctor Property

○ **Location:** B-9 **Depth:** 5 feet

□ **Location:** B-10 **Depth:** 2.5 feet

△ **Location:** B-11 **Depth:** 5 to 7.5 feet

Terra Associates, Inc.

Kirkland, WA

Remarks:

○ Tested on 9-6-2016

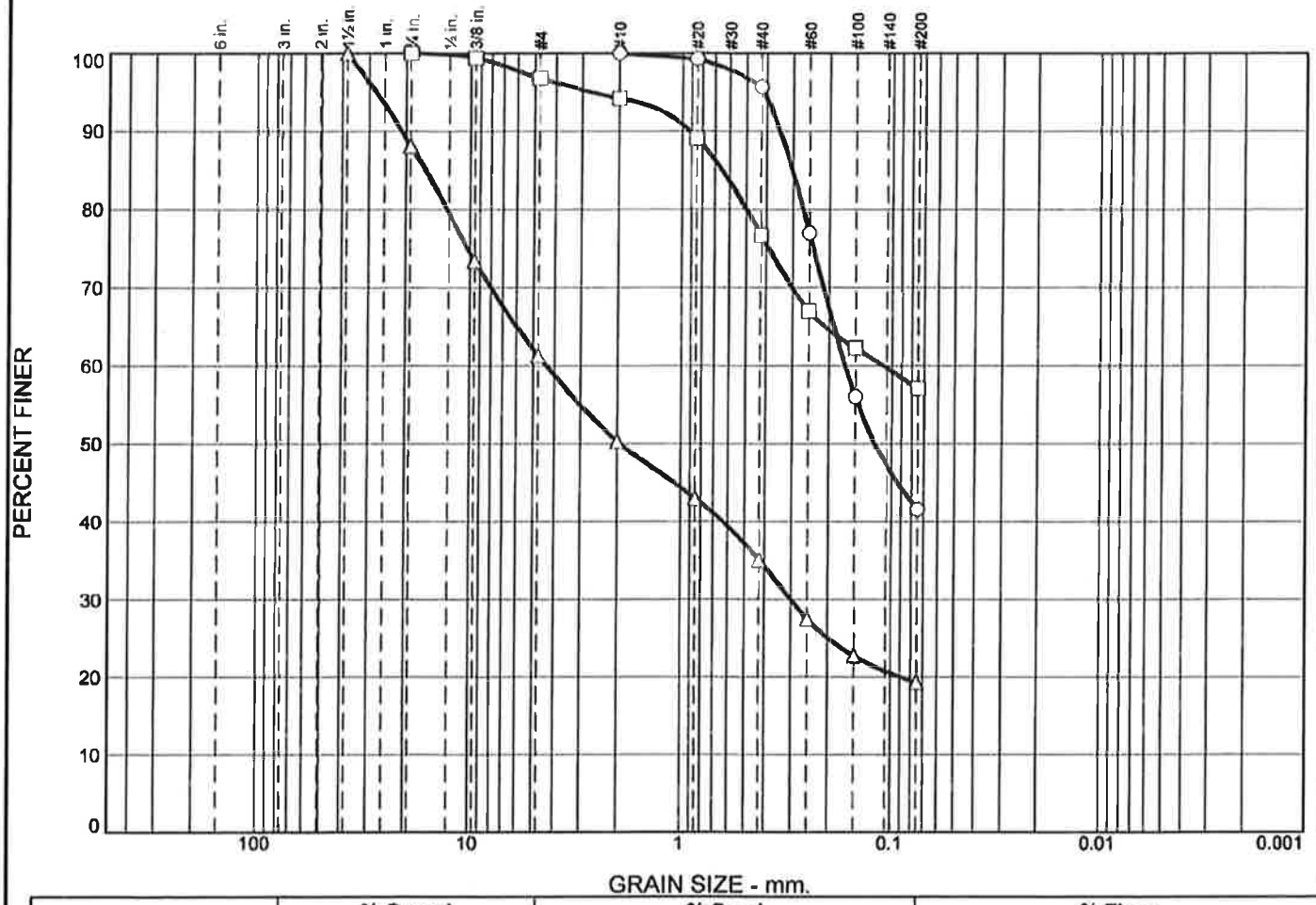
□ Tested on 9-6-2016

△ Tested on 8-16-2016

Figure A-20

Tested By: FQ

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.3	54.1	41.6	
□	0.0	0.0	3.2	2.6	17.5	19.6	57.1	
△	0.0	11.9	26.8	11.0	15.2	15.8	19.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3031	0.1679	0.1209					
□			0.6496	0.1098						
△			16.3752	4.3544	1.9394	0.3004				

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

Project No. T-7474 **Client:** Quadrant Homes

Project: Proctor Property

○ **Location:** B-14 **Depth:** 2.5

□ **Location:** B-16 **Depth:** 7.5 feet

△ **Location:** B-16 **Depth:** 10 feet

Terra Associates, Inc.

Kirkland, WA

Remarks:

○ Tested on 9-6-2016

□ Tested on 8-16-2016

△ Tested on 8-16-2016

Figure A-21

Tested By: FQ

APPENDIX B

FIELD EXPLORATION BY OTHERS

TEST PIT NO. 1

Logged By SB

Date 6/1/84

Elev. 129.5

Depth (ft.)	USCS	Soil Description	W (%)	
0		(6" TOPSOIL)	44	
			47	
	ml	tan orange mottled clayey SILT, moist, very stiff		
5			31	q_u=3.15 tsf
		(becomes less clayey w/trace of very fine sand)		LL=36
				PI=8
			20	
			23	
10		(transition layer w/compressed wood pieces, hard)	36	
	ml	gray SILT w/clay, trace of fine sand, hard, below plastic limit	18	
			▽	
15		Test Pit terminated at 14' below existing grade. Moderate groundwater seepage encountered at 4', 7' and 13' during excavation.		
20				

Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY

TEST PIT LOGS

13 ACRE TRACT
KING COUNTY, WASHINGTON

Proj. No. 2333	Date June '84	Plate 4

TEST PIT NO. 2

Logged By SB

Date 6/1/84

Elev. 126.0

Depth (ft.)	USCS	Soil Description	W (%)	
0		brown silty TOPSOIL	44	
	ml	tan clayey very fine sandy SILT, w/roots to 3', very stiff (above plastic limit)	26	
5		grading to tan clayey SILT, below plastic limit, very stiff at 5'	31	$q_u \Rightarrow 4.5$ tsf
	ml	gray clayey SILT w/wood fragments, below plastic limit, hard	19	
		(w/minor mottled sandy zones at 8')	23	
10	sm	brown silty SAND, very fine, wet, dense	22	
	ml	gray clayey very fine sandy SILT, below plastic limit, hard (w/sand lenses at 13.5')		
15				
		Test Pit terminated at 16' below existing grade. Moderate groundwater seepage encountered at 2', 5', 9', 13.5' and 15' during excavation.		
20				

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TEST PIT LOGS

13 ACRE TRACT
KING COUNTY, WASHINGTON

Proj. No. 2333	Date June '84	Plate 5

TEST PIT NO. 3

Logged By SB

Date 6/1/84

Elev. 121.0

Depth (ft.)	USCS	Soil Description	W (%)	
0		brown fine sandy SILT w/roots, damp to wet, loose (TOPSOIL)	61	
		(brown sandy gravel lense, water bearing at 1.5')		
	ml	tan orange mottled silty CLAY to clayey SILT, w/scattered roots, below plastic limit, stiff	32	q_u=1.75 tsf LL=47 PI=18
5		grading to		
	ml	gray clayey SILT, below plastic limit, hard	24	
10		grades to gray clayey very fine sandy SILT, below plastic limit, hard at 11.5'	22	
15	gm	gray silty sandy GRAVEL to gravelly SAND, w/occasional angular cobbles, wet, very dense	16	
		Test Pit terminated at 15.5' below existing grade. Moderate groundwater seepage encountered at 2' and 14' during excavation.		
20				

Earth Consultants Inc.
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TEST PIT LOGS
13 ACRE TRACT
KING COUNTY, WASHINGTON

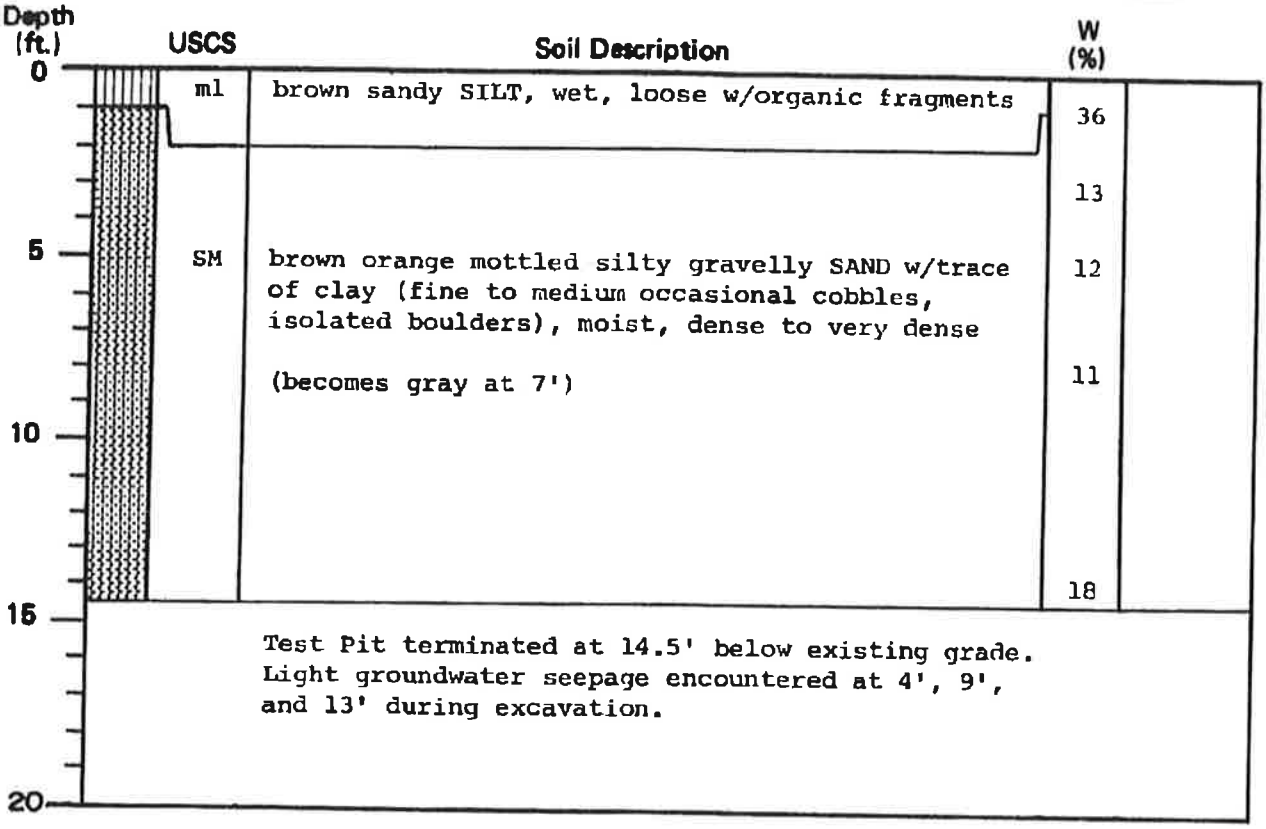
Proj. No. 2333	Date June '84	Plate 6

TEST PIT NO. 4

Logged By SB

Date 6/1/84

Elev. 117.0



Earth Consultants Inc.
GEOTECHNICAL ENGINEERING & GEOLOGY

TEST PIT LOGS
13 ACRE TRACT
KING COUNTY, WASHINGTON

Proj. No. 2333	Date June '84	Plate 7

TEST PIT NO. 5

Logged By SB

Date 6/1/84

Elev. 125.0

Depth (ft.)	USCS	Soil Description	W (%)	
0	ml	TOPSOIL	26	
	gm	tan silty sandy GRAVEL, moist, dense		
5	SM/SP	tan SAND w/some silt, very fine to fine, moist, dense	13	
	ml	tan w/orange mottling clayey SILT, below plastic limit, very stiff	29	$q_u \Rightarrow 4.5$ tsf
10	ml	gray clayey SILT, below plastic limit, hard, w/organic fragments	43 30	
15		Test Pit terminated at 14.2' below existing grade. Groundwater seepage encountered at 11.5 during excavation.		
20				

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TEST PIT LOGS
13 ACRE TRACT
KING COUNTY, WASHINGTON

Proj. No. 2333	Date June '84	Plate 8

TEST PIT NO. 6

Logged By SB

Date 6/1/84

Elev. 115.0

Depth (ft.)	USCS	Soil Description	W (%)
0		silty TOPSOIL	
	ml	tan orange mottled clayey SILT w/gravel lense, below plastic limit, very stiff	24
5	gp/gm	tan orange mottled sandy GRAVEL w/some silt, fine to medium, moist, very dense	
10		(becomes wet at 10.5')	
15		Test Pit terminated at 13.2' below existing grade. Moderate groundwater seepage encountered at 11.5' during excavation.	
20			

Earth Consultants Inc.
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TEST PIT LOGS

13 ACRE TRACT
KING COUNTY, WASHINGTON

Proj. No.	Date	Plate
2333	June '84	9

TEST PIT NO. 7

Logged By SB

Date 6/1/84

Elev. 100.0

Depth (ft.)	USCS	Soil Description	W (%)	Lab Data
0	ml	(6" TOPSOIL) brown orange mottled gravelly sandy SILT, moist, medium dense to dense	17	
5	GP/GM	brown orange mottled sandy GRAVEL w/some silt, fine, moist, dense (becomes slightly wet at 8.5') (12" layer of tan orange mottled clayey sandy SILT, moist, hard, from 10.5' to 11.5')	5	
10		Test Pit terminated at 12.5' below existing grade. No groundwater seepage encountered during excavation.		
15				

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TEST PIT LOGS
13 ACRE TRACT
KING COUNTY, WASHINGTON

Proj. No. 2333	Date June '84	Plate 10

TEST PIT NO. 8

Logged By SB

Date 6/1/84

Elev. 86.0

Depth (ft.)	USCS	Soil Description	W (%)
0	SM/SP	(6" TOPSOIL) tan gravelly SAND w/silt to gravelly silty SAND, very fine to fine, moist, dense	17
5	gp/gm	tan orange mottled sandy GRAVEL, w/some silt, moist, very dense, slight cementation.	7
10	sp	tan orange mottled gravelly SAND w/trace of silt, moist to wet, very dense (becomes gray at 13.5')	7 5
15		Test Pit terminated at 14.2' below existing grade. No groundwater seepage encountered during excavation.	
20			

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TEST PIT LOGS

13 ACRE TRACT
KING COUNTY, WASHINGTON

Proj. No. 2333	Date June '84	Plate 11

TEST PIT NO. 9

Logged By SB
Date 6/1/84
Elev. 77.0

Depth (ft.)	USCS	Soil Description	W (%)	Lab Data
0	ml	(4" sod) reddish brown gravelly sandy SILT, moist, loose to medium dense		
	ml	tan orange mottled gravelly sandy SILT, moist, dense, w/slight cementation		
5	sm/sp	gray gravelly SAND, fine to medium w/silt, moist, dense to very dense (becomes moist to wet, increased gravels, very dense at 7.5')		
10	gp	tan orange mottled grading to gray sandy GRAVEL, w/trace of silt, water bearing, very dense		
		Test Pit terminated at 11.5' below existing grade Moderate groundwater seepage encountered below 8.5' during excavation.		
15				

TEST PIT NO. 10

Logged By SB
Date 6/1/84
Elev. 61.0

Depth (ft.)	USCS	Soil Description	W (%)	Lab Data
0	sp	(6" TOPSOIL) brown orange mottled gravelly SAND, fine to medium, w/trace of silt, moist, loose (becoming medium dense at 2')	44	
5	sp/sm	gray gravelly SAND w/some silt, moist, dense (thin iron oxidized zone at 7') (increasing gravels from 7' to 9') (decreasing gravels, isolated large cobbles at 10')		
10	gp/gm	gray sandy GRAVEL, fine to medium, w/some silt, wet, very dense		
		Test Pit terminated at 12' below existing grade. Light groundwater seepage encountered at 3.5' and 7', and heavy seepage at 11' during excavation.		
15				

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TEST PIT LOGS
13 ACRE TRACT
KING COUNTY, WASHINGTON

Proj. No. 2333 | Date June '84 | Plate 12

LOG OF TEST PIT NO. 38

Location: West side of existing road (Sta. 152 + 30). **Elevation:**

Surface Conditions:

Depth in feet	Moisture %	Sample	Symbol	DESCRIPTION	REMARKS
1				Topsoil — Sandy Silt; loose	
2				SILTY SAND (Till) — occasional sand lenses within very dense till (up to 1-2' thick and several feet long).	
3					
4					
5					
6					
7					
8					
9					
10				Bottom of test pit at depth 10'. No groundwater encountered.	
11					
12					
13					
14					
15					

Approved for publication ____ by ____

WILLOWS ROAD LID
Redmond, Washington
for City of Redmond

Project No. 79-5209

ConverseWardDavisDixon Geotechnical Consultants

Drawing No. 51

MASTERLG 4/7/95

SOIL DESCRIPTION

STA.: 124+28 OFFSET: 39 R
Surface Elevation: Approx. 120 Feet

Depth, Ft.	Soil Log
0	Stiff, light brown, slightly clayey, fine sandy SILT; moist; trace of coarse sand and gravel; iron-oxide stains; occasional wood debris; (Fill) SM.
4.0	Stiff to hard, brown, clayey SILT interlayered with medium dense to dense, silty, fine SAND; moist; iron-oxide stains; ML/SM.
10.0	Very dense, brown to gray, silty, sandy GRAVEL; wet; GM.
24.0	Hard, gray, clayey SILT to fine, sandy SILT; moist; scattered organics and gravel; ML.
28.0	Very dense, gray, silty, fine SAND; wet; silt pockets; occasional gravel; SM.
32.0	Very dense, gray, slightly silty, sandy GRAVEL; wet; GM.
35.5	BOTTOM OF BORING COMPLETED 12/27/94

Samples: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Ground Water Depth, Ft.: Observed During Drilling

Standard Penetration Resistance (140 lb. weight, 30" drop)
▲ Blows per foot

Depth, Ft.	Blows per foot
5	60/6"
10	62/6"
15	50/5"
20	50/2"
25	70/6"
30	75
35	61/6"
40	
45	

0 20 40 60

● % Water Content
Plastic Limit |—●—| Liquid Limit
Natural Water Content

LEGEND

- • Sample Not Recovered
- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Surface Seal
- Annular Sealant
- Piezometer Screen
- Grout
- Water Level

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. Refer to KEY for explanation of 'Soil Log' symbols and definitions.
5. USC letter symbol based on visual classification.

N.E. 124th Street Improvements
King County, Washington

LOG OF BORING A8-A

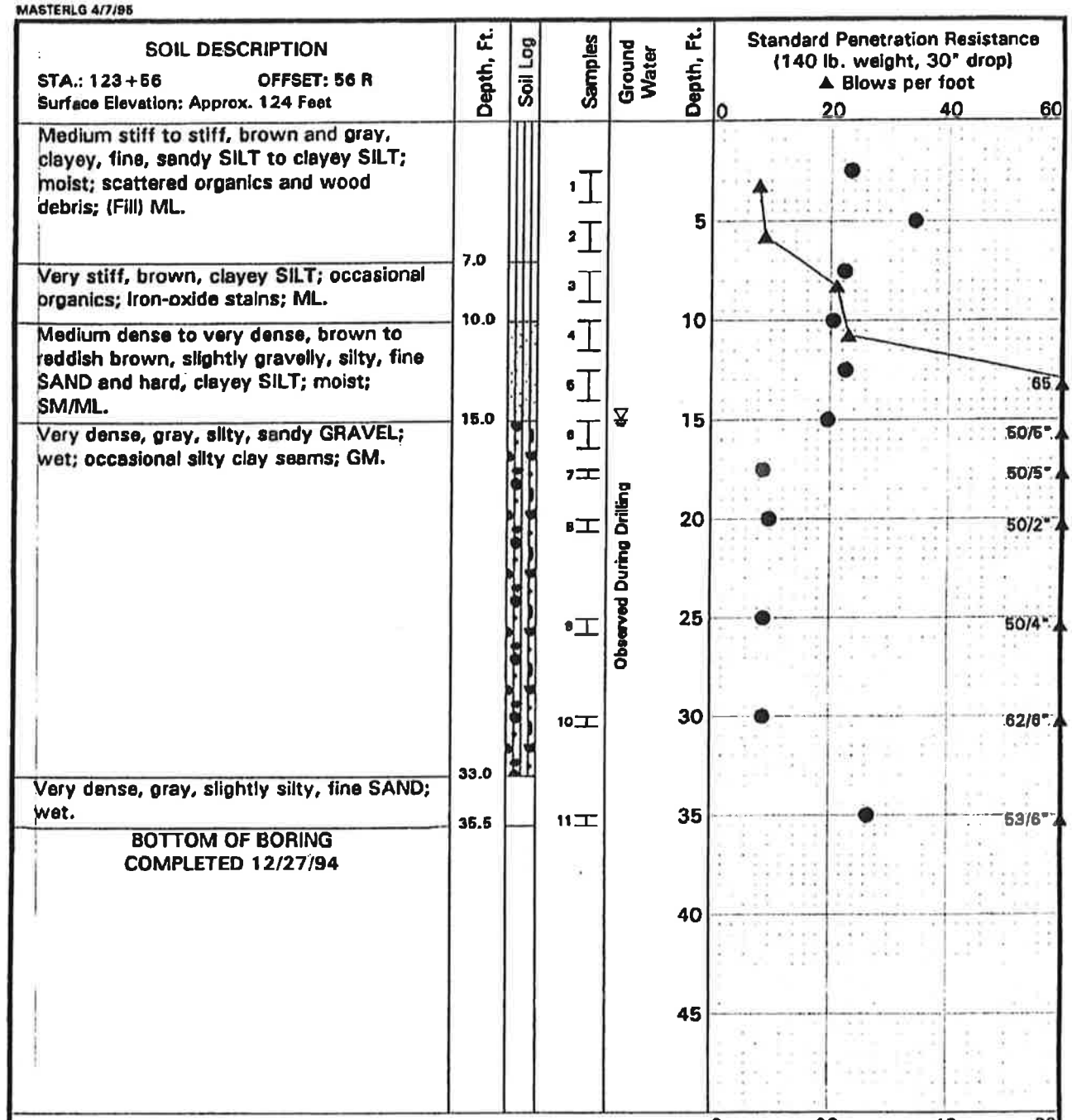
December 1994 W-6575-01

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 2

DRAFT

MASTERLG 4/7/95



LEGEND

- Sample Not Recovered
- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Surface Seal
- Annular Sealant
- Piezometer Screen
- Grout
- Water Level

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the data specified and may vary.
4. Refer to KEY for explanation of 'Soil Log' symbols and definitions.
5. USC letter symbol based on visual classification.

N.E. 124th Street Improvements
King County, Washington

LOG OF BORING A8-B

December 1994 W-6575-01

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 3

DRAFT

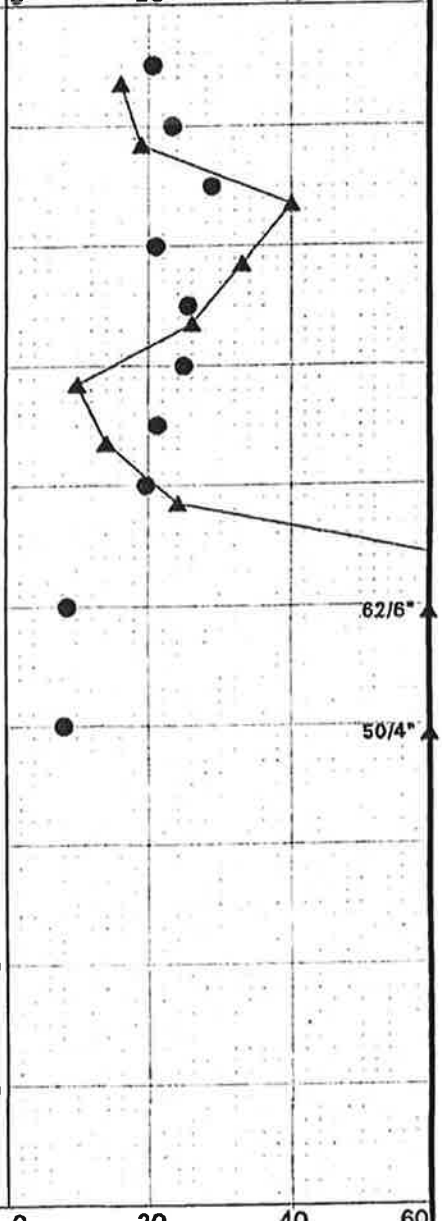
MASTERLG 4/7/95

SOIL DESCRIPTION

STA.: 121+64 OFFSET: 56 R
Surface Elevation: Approx. 128 Feet

Depth, Ft.	Soil Log	Samples	Ground Water	Depth, Ft.
0.2				
Asphalt.				
Medium dense, light brown, silty, fine SAND; moist; layers of fine, sandy silt; iron-oxide stains; SM. (Fill?)		1 2 3 4 5 6		
7.0				
Very stiff to hard, gray, clayey SILT; moist; layers of dark brown, organic silt; silty, fine sand pockets; ML.				
14.0				
Stiff, gray, silty CLAY; moist; silty, fine sand pockets; CL.		6	Observed During Drilling	
17.0				
Medium dense, gray, slightly silty, fine SAND; wet; trace of medium sand; SM.		7 8		
23.0				
Very dense, gray, silty, sandy GRAVEL; wet; GM.		9 10		
30.8				
BOTTOM OF BORING COMPLETED 12/28/94				

Standard Penetration Resistance
(140 lb. weight, 30" drop)
▲ Blows per foot



LEGEND

- • Sample Not Recovered
- ⌶ 2" O.D. Split Spoon Sample
- ⌶ 3" O.D. Shelby Tube Sample
- Surface Seal
- Annular Sealant
- Piezometer Screen
- Grout
- Water Level

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. Refer to KEY for explanation of 'Soil Log' symbols and definitions.
5. USC letter symbol based on visual classification.

N.E. 124th Street Improvements
King County, Washington

LOG OF BORING A8-C

December 1994 W-6575-01

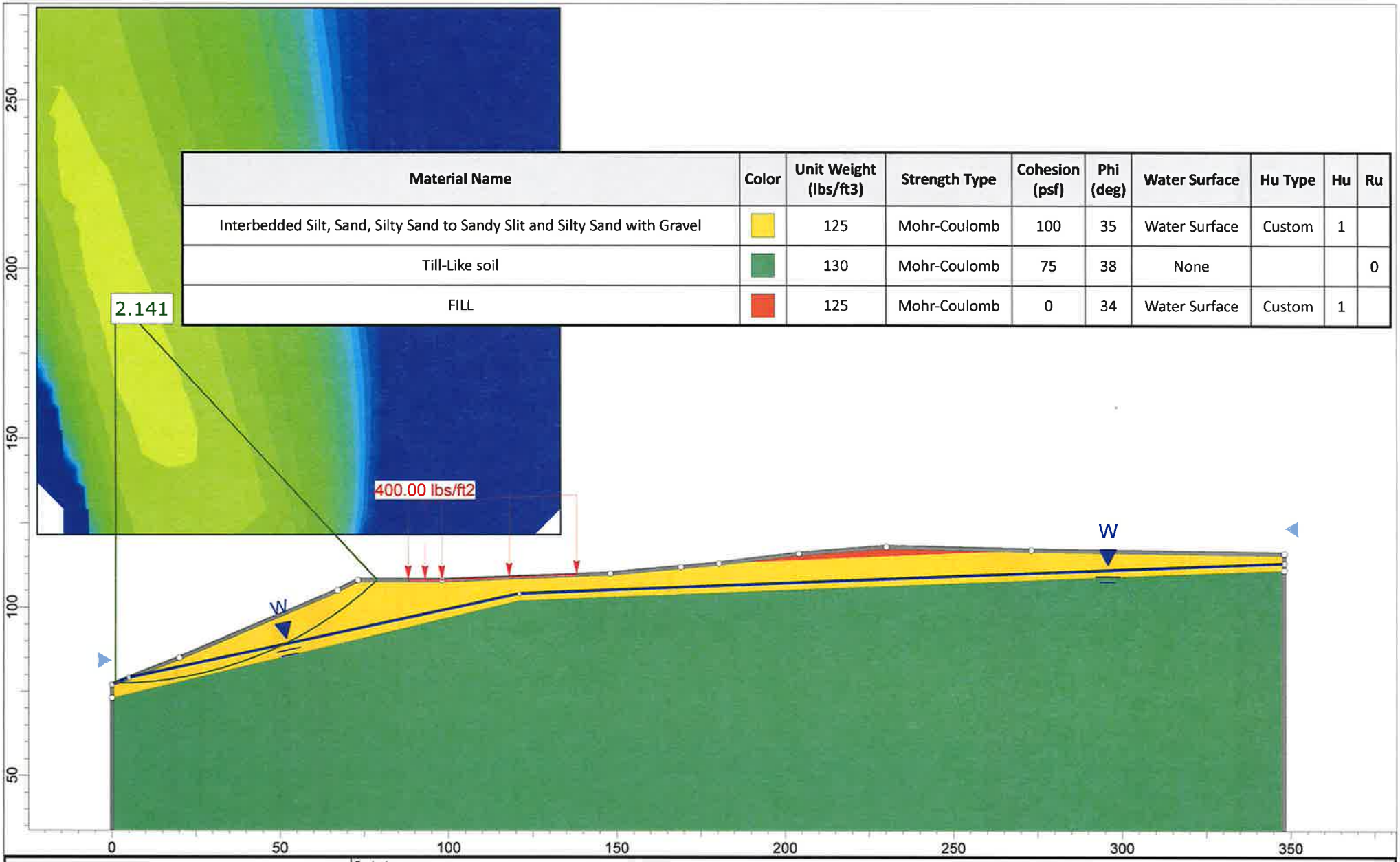
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. 4

DRAFT

APPENDIX C

SLOPE STABILITY ANALYSIS GRAPHICAL OUTPUT

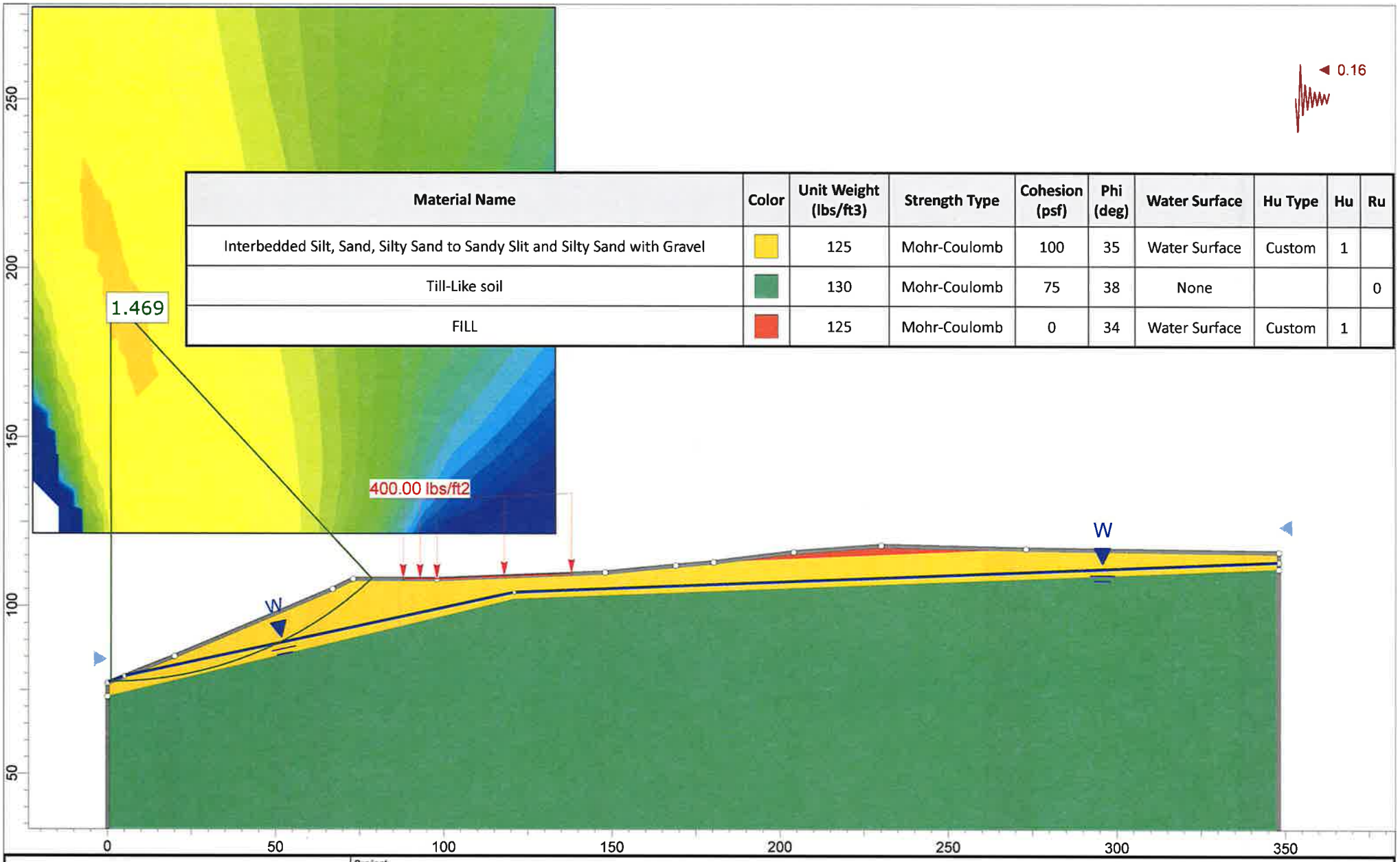


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Interbedded Silt, Sand, Silty Sand to Sandy Slit and Silty Sand with Gravel		125	Mohr-Coulomb	100	35	Water Surface	Custom	1	
Till-Like soil		130	Mohr-Coulomb	75	38	None			0
FILL		125	Mohr-Coulomb	0	34	Water Surface	Custom	1	

rocscience

SLIDEINTERPRET 7.022

Project	Proctor Parcels		
Analysis Description	Cross Section B-B' Static		
Drawn By	A. Dendy	Scale 1:473	Company Terra Associates
Date	2/14/2017, 1:24:01 PM		File Name 7474 Proctor Parcels updated (2-14-2017).slmd



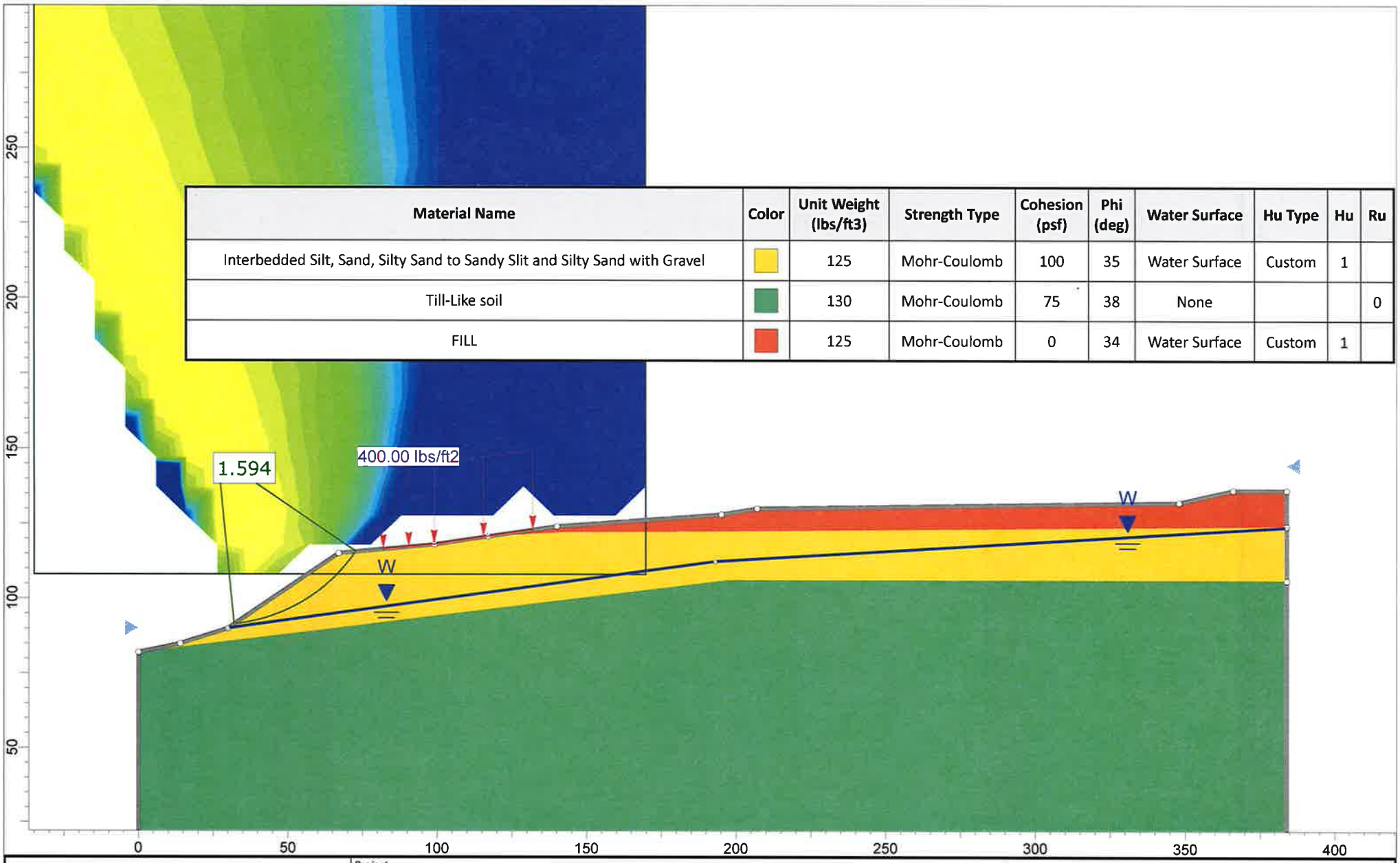
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Interbedded Silt, Sand, Silty Sand to Sandy Slit and Silty Sand with Gravel		125	Mohr-Coulomb	100	35	Water Surface	Custom	1	
Till-Like soil		130	Mohr-Coulomb	75	38	None			0
FILL		125	Mohr-Coulomb	0	34	Water Surface	Custom	1	

rocscience

SLIDEINTERPRET 7.022

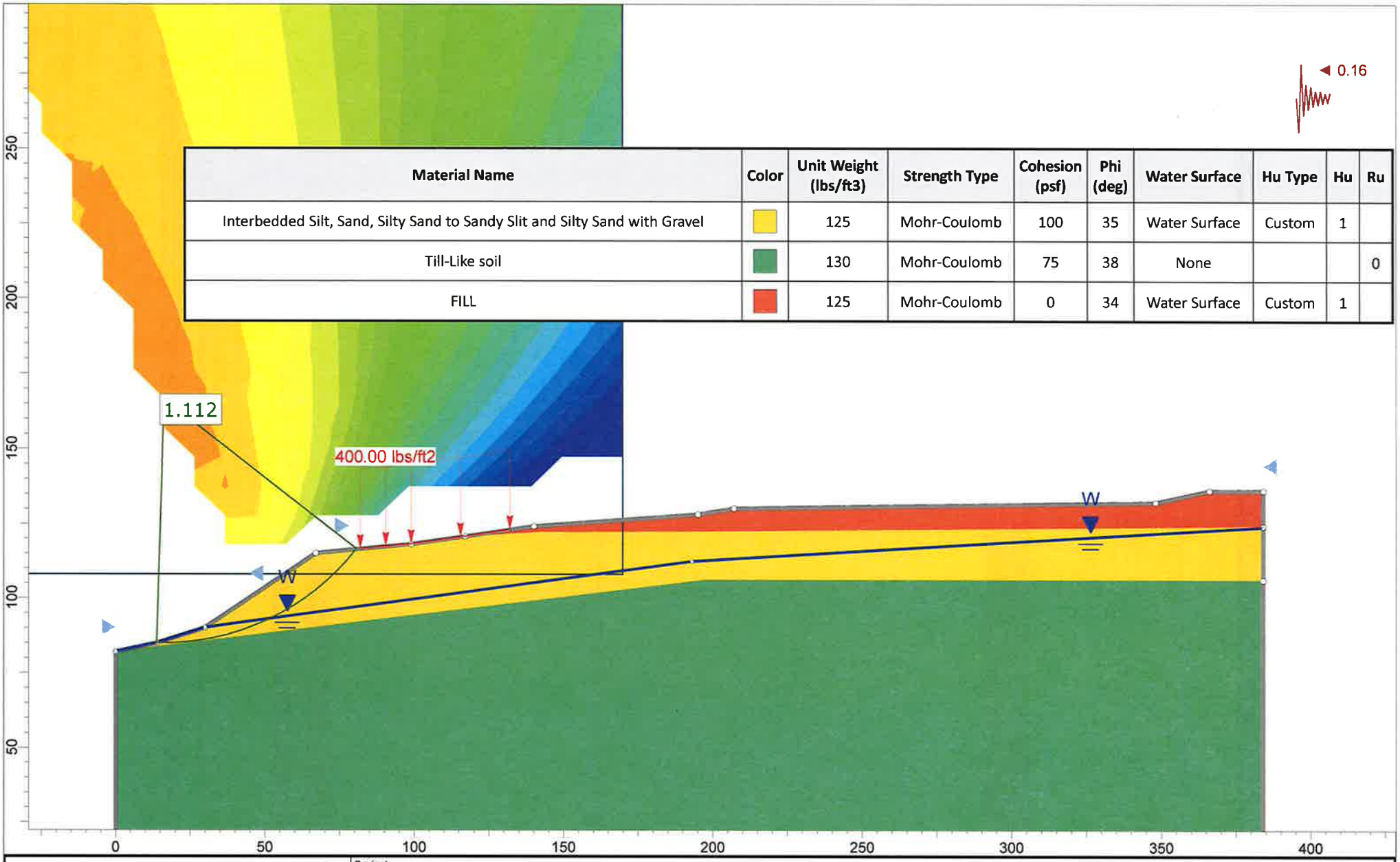
Project	Proctor Parcels				
Analysis Description	Cross Section B-B' Pseudostatic				
Drawn By	A. Dendy	Scale	1:473	Company	Terra Associates
Date	2/14/2017, 1:24:01 PM			File Name	7474 Proctor Parcels updated (2-14-2017).slmd

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Interbedded Silt, Sand, Silty Sand to Sandy Slit and Silty Sand with Gravel		125	Mohr-Coulomb	100	35	Water Surface	Custom	1	
Till-Like soil		130	Mohr-Coulomb	75	38	None			0
FILL		125	Mohr-Coulomb	0	34	Water Surface	Custom	1	



rocscience	Project	Proctor Parcels		
	Analysis Description	Cross Section C-C' Static		
	Drawn By	A. Dendy	Scale 1:533	Company Terra Associates
	Date	2/14/2017, 12:38:24 PM		File Name 7474 Proctor Parcels updated (2-14-2017).slmd

SLIDEINTERPRET 7.022

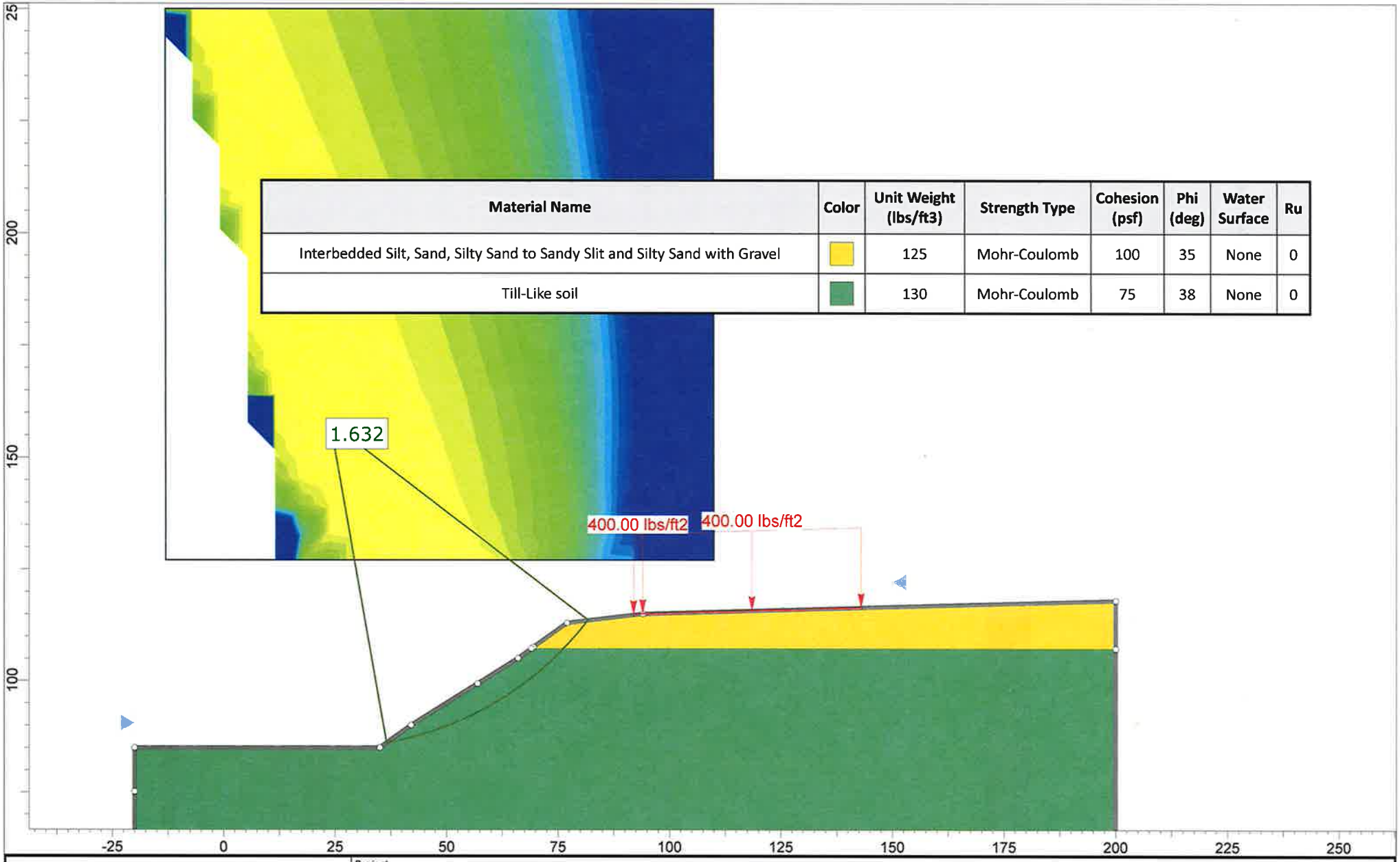


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Interbedded Silt, Sand, Silty Sand to Sandy Slit and Silty Sand with Gravel		125	Mohr-Coulomb	100	35	Water Surface	Custom	1	
Till-Like soil		130	Mohr-Coulomb	75	38	None			0
FILL		125	Mohr-Coulomb	0	34	Water Surface	Custom	1	

rocscience

SLIDEINTERPRET 7.022

Project	Proctor Parcels			
Analysis Description	Cross Section C-C' Pseudostatic			
Drawn By	A. Dendy	Scale	1:533	Company: Terra Associates
Date	2/14/2017, 12:38:24 PM			File Name: 7474 Proctor Parcels updated (2-14-2017).slmd

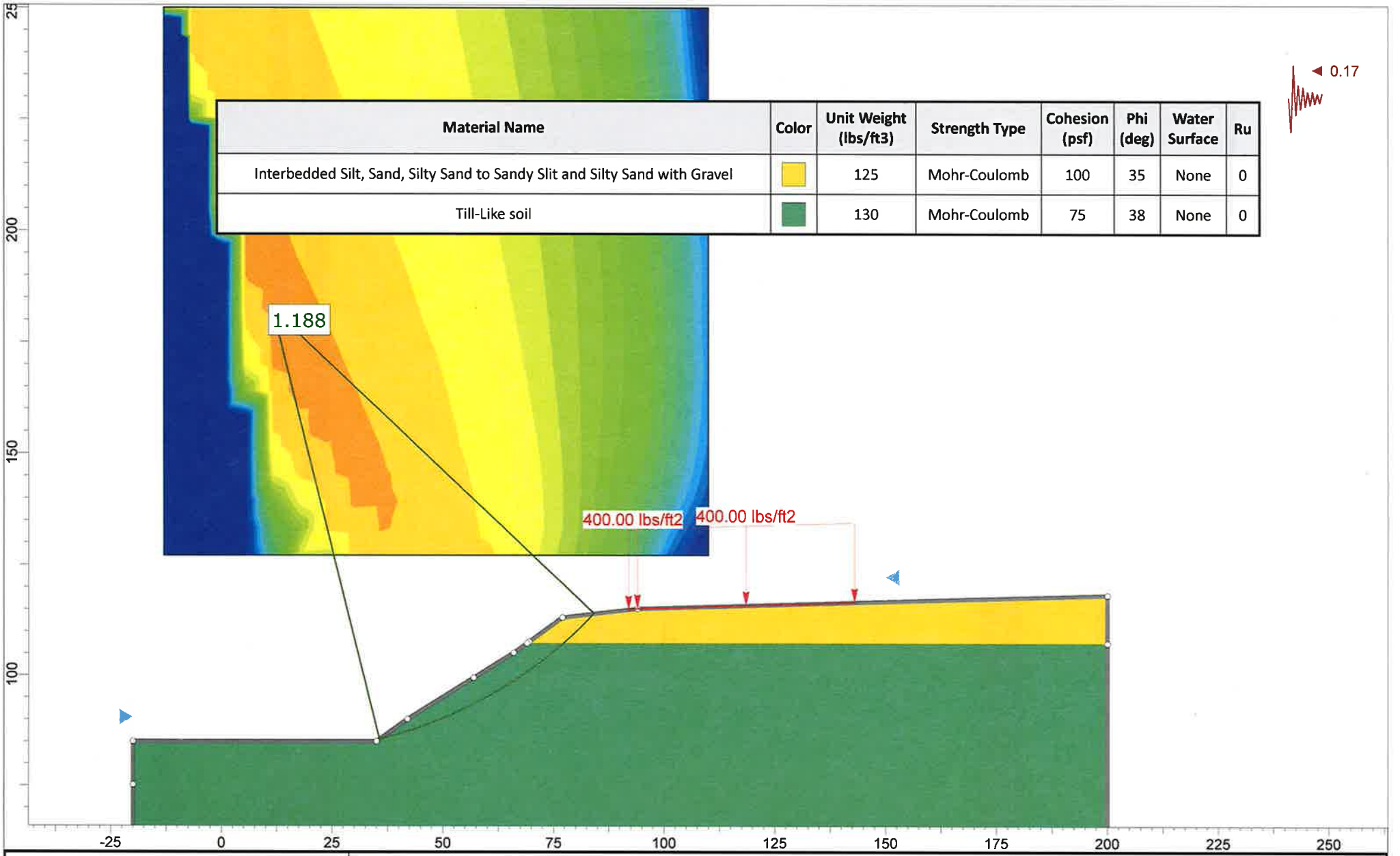


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Interbedded Silt, Sand, Silty Sand to Sandy Slit and Silty Sand with Gravel		125	Mohr-Coulomb	100	35	None	0
Till-Like soil		130	Mohr-Coulomb	75	38	None	0

rocscience

SLIDEINTERPRET 7.022

Project	Proctor Property			
Analysis Description	Cross Section D-D' Static			
Drawn By	A. Dendy	Scale	1:357	Company: Terra Associates
Date	1/12/2017, 2:39:27 PM			File Name: 7474 Proctor Property.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Interbedded Silt, Sand, Silty Sand to Sandy Slit and Silty Sand with Gravel		125	Mohr-Coulomb	100	35	None	0
Till-Like soil		130	Mohr-Coulomb	75	38	None	0

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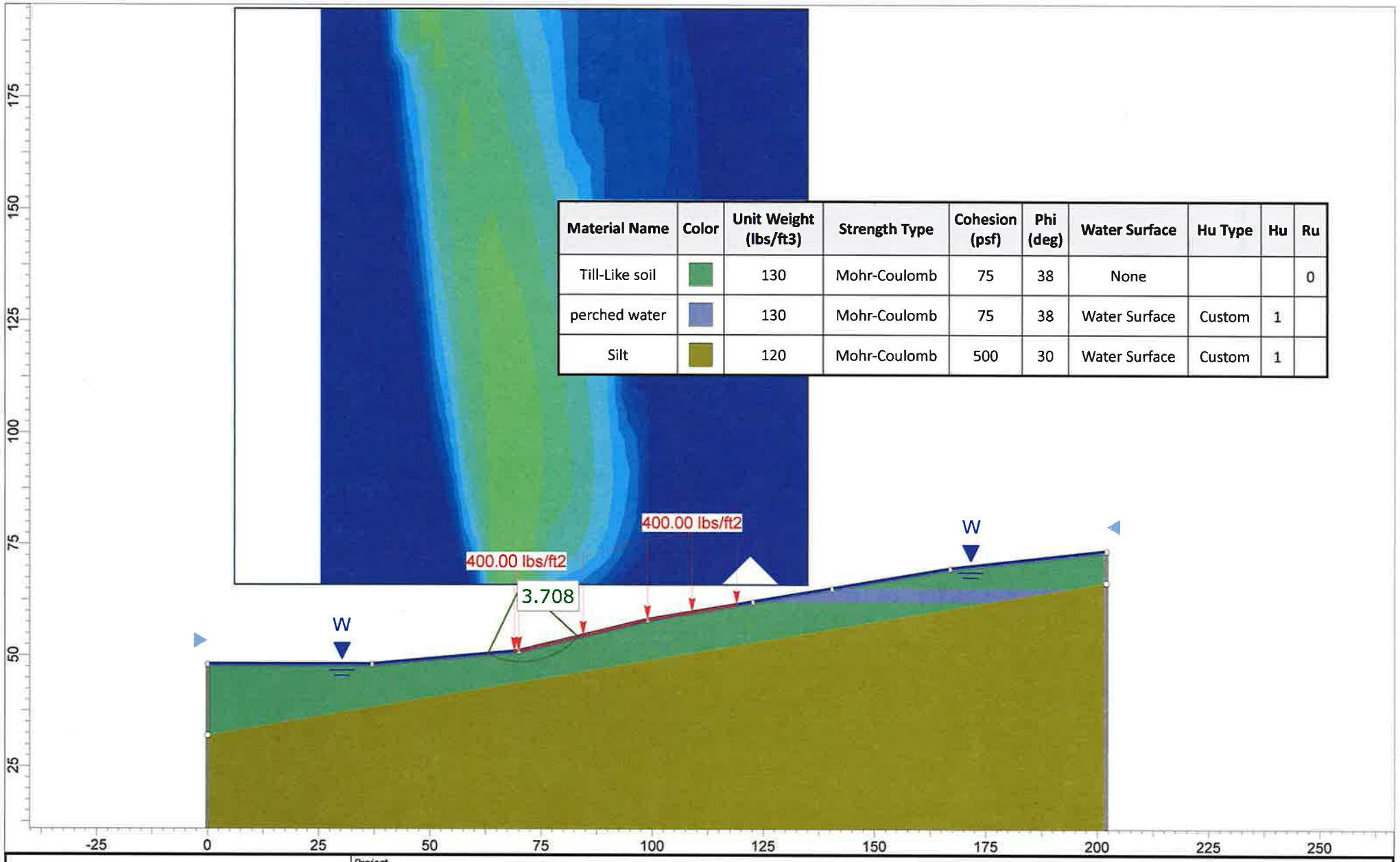
SLIDEINTERPRET 7.022

Project	Proctor Property			
Analysis Description	Cross Section D-D' Pseudostatic			
Drawn By	A. Dendy	Scale	1:357	Company: Terra Associates
Date	1/12/2017, 3:49:35 PM			File Name: 7474 Proctor Property.slmd

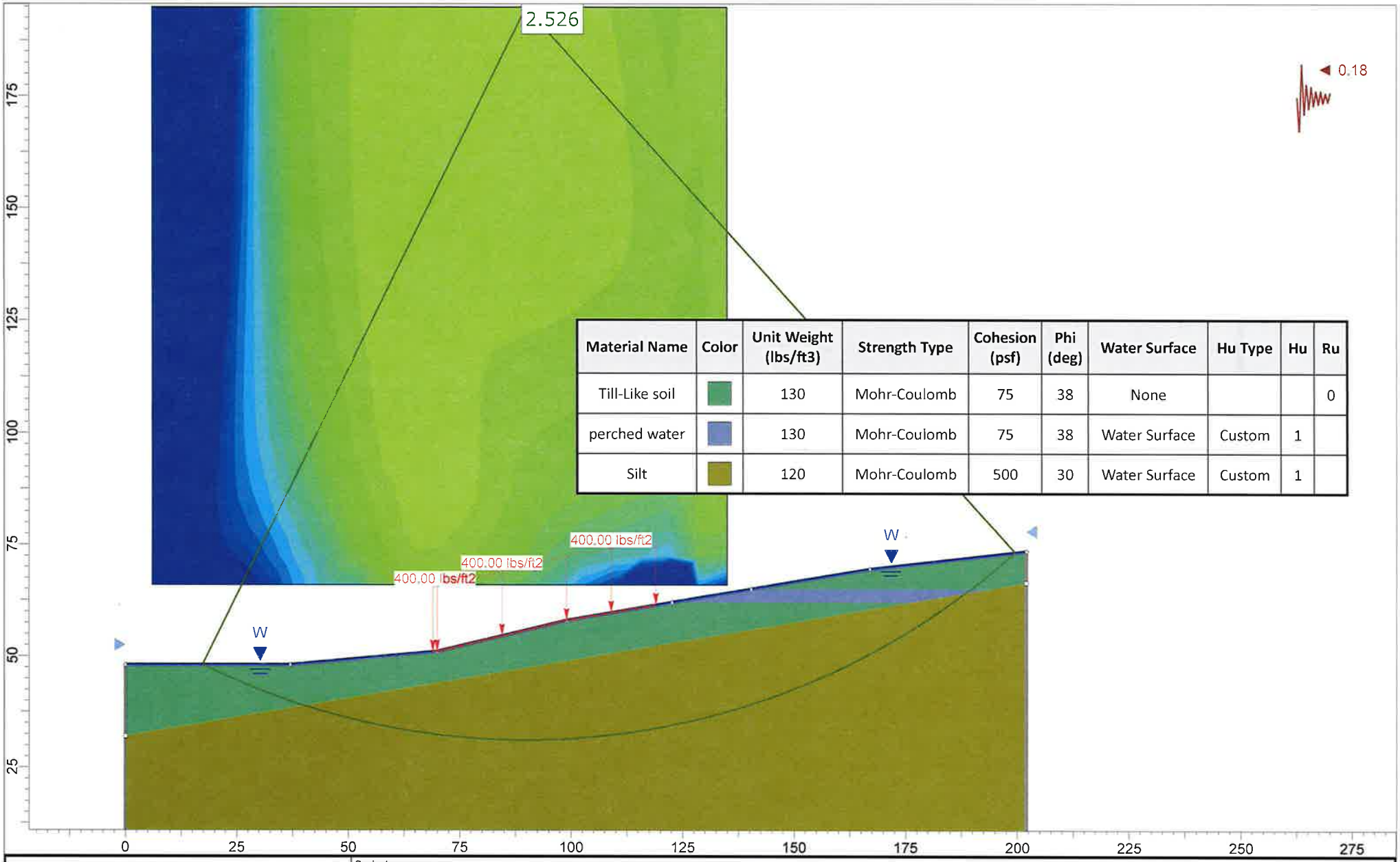


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Till-Like soil		130	Mohr-Coulomb	75	38	None			0
perched water		130	Mohr-Coulomb	75	38	Water Surface	Custom	1	
Silt		120	Mohr-Coulomb	500	30	Water Surface	Custom	1	

rocscience

SLIDEINTERPRET 7.022

Project	Proctor Parcels		
Analysis Description	Cross Section E-E' Static		
Drawn By	A. Dendy	Scale 1:357	Company Terra Associates
Date	2/14/2017, 2:28:13 PM		File Name 7474 Proctor Parcels updated (2-14-2017).slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Till-Like soil		130	Mohr-Coulomb	75	38	None			0
perched water		130	Mohr-Coulomb	75	38	Water Surface	Custom	1	
Silt		120	Mohr-Coulomb	500	30	Water Surface	Custom	1	

rocscience

SLIDEINTERPRET 7.022

Project	Proctor Parcels			
Analysis Description	Cross Section E-E' Pseudostatic			
Drawn By	A. Dendy	Scale	1:357	Company: Terra Associates
Date	2/14/2017, 2:28:13 PM			File Name: 7474 Proctor Parcels updated (2-14-2017).slmd