GEODESIGN INC

REPORT OF GEOTECHNICAL ENGINEERING SERVICES

Kuebler Boulevard Property

Mass Grading and Medical Office Building Phase

27th Avenue and Kuebler Boulevard SE

Salem, Oregon

For

PacTrust

March 30, 2012

GeoDesign Project: PacTrust-162-01

GEODESIGN INC

March 30, 2012

PacTrust
15350 SW Sequoia Parkway, Suite 300
Portland, OR 97224

Attention: Mr. Matt Oyen

Report of Geotechnical Engineering Services
Kuebler Boulevard Property
Mass Grading and Medical Office Building Phase
27th Avenue and Kuebler Boulevard SE
Salem, Oregon
GeoDesign Project: PacTrust-162-01

GeoDesign, Inc. is pleased to submit this report of geotechnical engineering services associated with the current mass grading and medical office building phase at the KBP site. The KBP site is located southwest of the intersection between Kuebler Boulevard SE and 27th Avenue in Salem, Oregon. Our services for this project were conducted in general accordance with January 19, 2012 revised proposal.

We appreciate the opportunity to be of service to PacTrust. Please call if you have questions regarding this report.

Sincerely,

GeoDesign, Inc.

George Saunders, P.E., G.E.
Principal Engineer

cc: Mr. Josh Wells, Westech Engineering, Inc. (via email only)

GPS:kt
Attachments
Three copies submitted
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1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services associated with the current mass grading and medical office building phase at the KBP site. The KBP site is located southwest of the intersection between Kuebler Boulevard SE and 27th Avenue in Salem, Oregon. The site location relative to surrounding features is provided on Figure 1. The preliminary plan for development of the KBP site is shown on Figure 2, and the location of the proposed medical office building is shown on Figure 3.

This phase of the project will include the mass grading of the site for future construction and the construction of the proposed medical office building. Preliminary plans indicate that the medical office building will be an 18,000-square-foot, single-story structure with associated parking. Foundation loads were not available at the time of this report; however, we anticipate that the column and continuous foundation loads will be less than 60 kips and 3.5 kips per lineal foot, respectively. We assume the floor slab loads will be less than 150 psf.

In general, the preliminary grading plan indicates that the western half of the site will primarily be cuts and the eastern half of the site will primarily be fills. The deepest cuts (approximately 12 feet) are toward the northwestern corner of the site, and the thickest fills will be located at the northeastern (15 feet) and southeastern (10 feet) corners of the site.

For your reference, definitions of all acronyms used herein are defined at the end of this document.

2.0 SCOPE OF SERVICES

The purpose of our geotechnical engineering evaluation was to explore the subsurface conditions at the site and provide geotechnical engineering recommendations for design and construction. Our scope of work is presented below.

2.1 MASS GRADING

- Coordinated and managed the field investigation, including public utility locates, access preparation, and scheduling of subcontractors and GeoDesign field staff.
- Completed 32 test pit explorations using a trackhoe equipped with rock teeth to depths up to 15 feet BGS. Located all explorations using a hand-held GPS unit.
- Obtained soil samples for laboratory testing, and maintained a log of encountered soil, rock, and groundwater conditions in each exploration.
- Completed the following laboratory tests:
  - Thirty-eight moisture content determinations
  - Six Atterberg limits determinations
- Provided recommendations for site preparation, grading and drainage, compaction criteria for both on-site and imported materials, fill type for imported materials, procedures for use of on-site soils, and wet weather earthwork procedures.
- Evaluated groundwater conditions at the site, and provided general recommendations for dewatering during construction and subsurface drainage, if required.

- Provided recommendations for the use of on-site native and fill materials for support of floor slabs and pavements.
- Provide a report summarizing our explorations, laboratory testing, and recommendations.

2.2 MEDICAL OFFICE BUILDING

Incorporated the following information for the medial office building into our report:

- Provided geotechnical engineering recommendations for design and construction of shallow spread foundations, including allowable design bearing pressure and minimum footing depth and width.
- Provided geotechnical engineering recommendations for the design and construction of concrete slabs-on-grade, including an anticipated value for subgrade reaction modulus.
- Recommended design criteria for retaining walls, including lateral earth pressure, allowable bearing pressure for retaining wall footings, backfill type, compaction requirements, and drainage
- Evaluated design pavement sections, including base course and AC thicknesses, for parking areas and access roads based on design criteria provided by others.
- Provided recommendations for subsurface drainage of footings and floor slabs, if necessary.
- Provided recommendations for use in the design of conventional retaining walls, including backfill and drainage requirements and lateral earth pressures.
- Provided recommendations for the IBC site coefficient and our evaluation of the liquefaction and lateral spreading potential of site soils.

3.0 SITE CONDITIONS

3.1 GEOLOGIC CONDITIONS

3.1.1 Geologic Setting

The site is located in the Salem Hills, which is a structural high located within the Willamette Valley physiographic province. The Willamette Valley is a seismically active tectonic lowland located between the Coast Range to the west and the Cascade Mountains to the east (Orr and Orr, 1999). Basement rock in the vicinity of the site generally consists of Miocene age (approximately 17 million to 6 million years old) CRBG (Bela, 1981; Ma, et al., 2009). The CRBG comprises a series of thick basalt flows that filled lowland areas throughout much of the northern Willamette Valley. The basalt was subsequently faulted by the compressional tectonics of the region, including the uplifted Salem Hills where the site is located. The Columbia River Basalt is estimated to be hundreds of feet thick in areas near the site (Tolan and Beeson, 2000).

Two members of the CRBG are identified in the vicinity of the site that includes the Frenchman Springs Member and the underlying Sentinel Bluffs Member (Bela, 1981; Ma, et al., 2009). The two CRBG members represent distinct basalt flows that are separated by an unconformity. The unconformity represents a hiatus in basalt flow coverage that resulted in widespread, deep surficial weathering of the upper Sentinel Bluffs basalt flows and deposition of fluvial volcaniclastic and siliciclastic sandstone and siltstone units. The unconformity (referred to as the Vantage Horizon) was subsequently covered by flows of the Frenchman Springs. Tectonic uplift

and block faulting of the CRBG units have exposed the basalt units to incision by stream erosion down to the Vantage Horizon within the CRBG. Groundwater springs and seeps are reported to be common where the unconformity is exposed.

Water well records from the site vicinity on file with the Oregon Water Resources Department indicate clayey soils and weathered rock extending to depths ranging between 7 and 30 feet BGS. Basalt bedrock was reported to underlie the clayey soils and weathered rock and extend up to 200 feet BGS in the site vicinity. These materials may represent weathered volcanic deposits (unconformity) located between the Wanapum Basalt and the underlying Grande Ronde Basalt.

3.1.2 Faults and Seismicity

The Willamette Valley is a seismically active area resulting from the compressional tectonics that characterize the Pacific Northwest. Several northwest- and northeast-striking faults have been mapped in bedrock exposures and are inferred below sedimentary cover in the Willamette Valley lowland (Blakely, et al., 2000; Personius, et al., 2002; Ma et al., 2009). The Salem Hills have been tectonically faulted to form a series of short, discontinuous, and intersecting block faults resulting from brittle deformation of the CRBG flows from regional tectonics (Tolan and Beeson, 2000). These faults may have been active in the last million years, but their seismicity is uncertain (Personius, 2002). Several of these fault strands are mapped approximately ¼ mile east of the site. No faults are mapped within the site boundary.

3.2 SURFACE CONDITIONS

In general, the site topography varies between approximately elevation 380 feet at the northwest corner of the site and 340 feet at the northeast corner of the site. The site is relatively undeveloped with grass, shrubs, and trees; however, it includes structures in the central and northeastern portion of the site. The majority of the trees are located at the south-central and east-central portions and along the northwestern boundary of the site. Boulders are present at the ground surface toward the south-central portion of the site, and surface water was present during our January 2012 explorations at the base of the small draws along the southeastern and northeastern corners of the site. Based on review of Google Earth, we note that up to three structures formally in the central portion of the site were removed between December 2005 and August 2006.

3.3 SUBSURFACE CONDITIONS

3.3.1 General

We explored the site by advancing 32 test pit explorations (TP-1 through TP-32) to depths up to 15 feet BGS. Copies of the exploration logs and results of the laboratory testing are provided in the Appendix of this report. The locations of all of our explorations are shown on Figures 2 and 3.

The depths of the explorations were based on the preliminary grading plan, which indicates cuts up to 12 feet within the northwestern portion of the site and fills at the eastern half of the site. Our explorations within the deeper cut areas were completed to depths up to 14 to 15 feet BGS, unless refusal was encountered at an earlier depth. In general, the explorations in the fill areas were completed to shallower depths.

In general, the soil conditions encountered topsoil underlain by clay and silt underlain by decomposed and/or intensely weathered basalt. Refusal within the decomposed/weathered basalt was encountered at several of the explorations. Figures 2 and 3 summarize the depth to refusal as well as the depth to groundwater seepage. The following sections provide a more detailed description of the subsurface units encountered at the site.

3.3.2 Topsoil

The surface 6 to 12 inches of soil generally consists of topsoil. The surface 2 to 3 inches of the topsoil includes a thick root zone and, where encountered, roots associated with shrub and small trees extending to 6 inches.

3.3.3 Clay and Silt

Clay and silt were encountered below the topsoil. Generally, clay/silt soil extends to depths of 2 to 3 feet BGS; however, this material was not encountered at TP-27 and extends to depths explored (11 feet BGS) at TP-30 and TP-32. The clay/silt varies between red-brown and brown, with a consistency generally ranging between medium stiff and stiff, with variable amounts of sand and gravel. Cobbles and boulders were encountered at several of the explorations, and, as discussed in the "Surface Conditions" section of this report, boulders are present at the ground surface over portions of the site. The soil likely represents residual soil derived from severely weathered basalt.

At the time of our explorations, the moisture contents of the soil generally varied between 29 and 35 percent. Atterberg limits tests of selected samples indicated relatively high plasticity.

3.3.4 Decomposed and Intensely Weathered Basalt

The clay and silt is underlain by decomposed or intensely weathered basalt rock. In general, the decomposed/weathered material consists of gravel with variable soundness rock contained within a clay matrix. Within the surface layers of the material, the rock is relatively friable; however, with depth, the hardness of the aggregate increased. Vesicular rock structure was noted at several explorations. Relatively competent rock was encountered at TP-17 and TP-18 at depths of 7.5 to 8.5 feet BGS. Interflow zones of highly plastic residual soil were encountered at TP-4, TP-12, TP-14, TP-19, and TP-21.

The explorations were completed using a Takeuchi TB175 trackhoe equipped with rock teeth, which was capable of excavating up to 13 feet into the decomposed/weathered material. Refusal was encountered at several of the explorations (TP-1, TP-2, TP-6, TP-9, TP-10, TP-15, TP-17, TP-18, TP-21, and TP-25) and, when encountered, varied between depths of 7.5 feet (TP-17) and 13.5 feet BGS (TP-1). The majority of the refusal conditions were due to excavation obstruction by a boulder.

At the time of our explorations, the moisture contents of the soil matrix generally varied between 30 and 86 percent. Atterberg limits tests of selected samples of the soil matrix indicated relatively high plasticity.

3.3.5 Groundwater

In addition to the surface water observed at the base of the small draws along the southeastern and northeastern corners of the site, groundwater seepage was encountered at several of the explorations at depths varying between 2.5 and 12 feet BGS. The groundwater seepage varied between slow and rapid.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on our review of the proposed preliminary grading plan and the results of our explorations, laboratory testing, and analyses, it is our opinion that the proposed development plans can be constructed at the site. Relative to the City of Salem Chapter 69 Landslide Hazards, and relative to the proposed preliminary grading plan and the recommendations provided below, it is our opinion that the site has a low landslide risk.

We anticipate the following items will have an impact on the proposed work:

- Our explorations encountered a relatively thin layer of clay and silt underlain by decomposed/weathered basalt. With the exception of at two locations, clay/silt surface soil generally extends to depths of 2 to 3 feet BGS.
- The moisture contents of the clay/silt soil generally varied between 29 and 35 percent and the moisture contents of the soil matrix of the decomposed/weathered basalt generally varied between 30 and 86 percent. The moisture content required for compacting the soil will be considerably less than these values and moisture conditioning will be required to use the material as structural fill.
- The Atterberg limits tests on selected samples of the near-surface clay/silt and underlying decomposed/weathered basalt indicated relatively high plasticity. High plasticity materials are more difficult to properly moisture condition for use as structural fill.
- In general, the decomposed/weathered material consists of gravel with variable soundness rock contained within a clay matrix. Within the surface layers of this material, the rock is relatively friable; however, with depth, the hardness of the aggregate increased. Cobbles and boulders were encountered in the near-surface clay/silt as well as the underlying decomposed/weathered basalt. Both the gravel nature and the presence of cobbles and boulders further challenge conventional moisture conditioning using farming discs.
- The near-surface soils are sensitive to disturbance when at a moisture content that is above optimum. The subgrade should be protected from disturbance and damage by construction traffic.
- It is our opinion that the medical office building can be supported on standard shallow foundations. Because of the deeper compressible soils encountered at the northeast (TP-30) and southeast (TP-32) corners of the site, some preloading and surcharging maybe necessary for the future structures to be located in these areas (see "Surcharge and Preload" section of this report).

Our specific recommendations are provided in the following sections of this report. Our design recommendations for the medical office building area are provided in the "Design" section of this

report. The recommendations for the mass grading of the site (including the medical office building area) are provided in the "Construction" section of this report.

5.0 DESIGN

5.1 GENERAL

The following sections provide our design recommendations for the medial office building. All site preparation and structural fill should be prepared as recommended in the "Construction" section of this report.

5.2 SHALLOW FOUNDATIONS

5.2.1 General

Based on the preliminary grading plan and foundation loads as previously stated, and assuming the site is prepared as recommended in the "Construction" section of this report, it is our opinion the proposed medical office building can be supported on conventional spread footings bearing on firm native soils or structural fill underlain by firm native soils. Foundation elements should not be supported on undocumented fill materials. If present, undocumented fill materials should be removed and replaced with structural fill.

5.2.2 Dimensions and Capacities

Continuous wall and isolated spread footings should be at least 16 and 20 inches wide, respectively. The bottom of exterior footings should be at least 18 inches below the lowest adjacent exterior grade. The bottom of interior footings should be established at least 12 inches below the base of the slab.

Footings bearing on subgrade prepared as recommended above should be sized based on an allowable bearing pressure of 2,500 psf. This is a net bearing pressure; the weight of the footing and overlying backfill can be ignored in calculating footing sizes. The recommended allowable bearing pressure applies to the total of dead plus long-term live loads and may be doubled for short-term loads such as those resulting from wind or seismic forces.

Based on our analysis and experience with similar soils, total post-construction settlement should be less than 1 inch, with post-construction differential settlement of less than ½ inch over a 50-foot span.

5.2.3 Resistance to Sliding

Lateral loads on footings can be resisted by passive earth pressure on the sides of the structures and by friction on the base of the footings.

Our analysis indicates that the available passive earth pressure for footings confined by native soils and structural fills is 350 pcf modeled as an equivalent fluid pressure. Typically, the movement required to develop the available passive resistance may be relatively large. Therefore, we recommend using a reduced passive pressure of 250 pcf equivalent fluid pressure. Adjacent floor slabs, pavements, or the upper 12-inch depth of adjacent unpaved areas should not be

considered when calculating passive resistance. In addition, in order to rely on passive resistance, a minimum of 10 feet of horizontal clearance must exist between the face of the footings and any adjacent down slopes.

For footings in contact with native soil, a coefficient of friction equal to 0.35 may be used when calculating resistance to sliding.

5.2.4 Construction Considerations

All footing and floor subgrades should be evaluated by a representative of GeoDesign to evaluate the bearing conditions. Observations should also confirm that all loose or soft material, organics, unsuitable fill, prior topsoil zones, and softened subgrades, if present, have been removed. Localized deepening of footing excavations may be required to penetrate any deleterious materials.

If footing excavations are conducted during wet weather conditions, we recommend that a minimum of 3 inches of granular material be placed and compacted until well keyed at the base of the excavations. The granular material reduces water softening of subgrade soils, reduces subgrade disturbance during placement of forms and reinforcement, and provides clean conditions for the reinforcing steel.

5.3 SEISMIC DESIGN CONSIDERATIONS

5.3.1 IBC Parameters

Based on our explorations, the parameters in Table 1 should be used to compute seismic base shear forces if the building is designed using the applicable provisions of the 2010 SOSSC. We selected the site class (D) based on the results of our explorations. The exploration logs suggest that it may be possible to use a site class of C due to the presence of dense gravel as well as the anticipated shallow depth to basalt bedrock. However, more extensive field testing is required to adequately evaluate the site class. Changing the site class to C would result in less stringent seismic design requirements. GeoDesign can perform the required field testing upon request from the design team.

Table 1. IBC Seismic Design Parameters

Seismic Design Parameter	Short Period	1 Second
Maximum Considered Earthquake Spectral Acceleration	S_s = 0.78 g	S_1 = 0.33 g
Site Class	D	
Site Coefficient	F_a = 1.19	F_v = 1.73
Adjusted Spectral Acceleration	S_{MS} = 0.93 g	S_{M1} = 0.58
Design Spectral Response Acceleration Parameters	S_{DS} = 0.62 g	S_{D1} = 0.39 g
Design Spectral Peak Ground Acceleration	0.25 g	

5.3.2 Liquefaction

Liquefaction can be defined as the sudden loss of shear strength in a soil due to an excessive buildup of pore water pressure. Liquefied soil layers generally follow a path of least resistance to dissipate pore pressures, often resulting in sudden surface settlement, sand boils or ejections, and/or lateral spreading in extreme cases. Clean, loose, uniform or silty, fine-grained, saturated sands are particularly susceptible to liquefaction. Lateral spreading is a liquefaction-related seismic hazard. Areas subject to lateral spreading are typically gently sloping or flat sites underlain by liquefiable sediments adjacent to an open face, such as riverbanks. Liquefied soils adjacent to open faces may "flow" in that direction, resulting in lateral displacement and surface cracking. Based on the findings of our subsurface exploration and anticipated groundwater elevation, it is our opinion that there is a low risk of liquefaction at the site.

5.4 FLOOR SLABS

Satisfactory subgrade support for building floor slabs supporting up to 150 psf area loading can be obtained provided the building pad is prepared as described in the "Construction" section of this report. To help reduce moisture transmission and slab shifting, we recommend a minimum 6-inch-thick layer of floor slab base rock be placed and compacted over a subgrade that has been prepared in conformance with the "Site Preparation" section of this report. The floor slab base rock should meet the requirements in the "Structural Fill" section of this report and be compacted to at least 95 percent of ASTM D 1557.

While groundwater is unlikely to be encountered within the slab subgrade materials, the native soils are fine grained and will tend to maintain a high moisture content. The installation of a vapor barrier may be warranted in order to reduce the potential for moisture transmission through, and efflorescence growth on, the floor slabs. In addition, flooring manufacturers often require vapor barriers to protect flooring and flooring adhesives and will warrant their product only if a vapor barrier is installed according to their recommendations.

If the project includes highly moisture-sensitive flooring, then we recommend that 10- or 15-mil Stego Wrap be considered for this project. The recommended procedures for installing Stego Wrap are to pour the floor slab concrete directly over the vapor barrier. We recommend that the structural engineer be contacted to determine if the mix design for the concrete should be modified assuming the above-referenced construction sequence. Actual selection and design of an appropriate vapor barrier, if needed, should be based on discussions among members of the design team.

Slabs should be reinforced according to their proposed use and per the structural engineer's recommendations. Load-bearing concrete slabs may be designed assuming a modulus of subgrade reaction, k, of 150 pounds per square inch per inch.

5.5 RETAINING STRUCTURES

5.5.1 Assumptions

While we are not aware of significant retaining walls at the site, we provide the following general recommendations. Our retaining wall design recommendations are based on the following assumptions: (1) the walls consist of conventional, cantilevered retaining walls, (2) the walls are

less than 8 feet in height, (3) the backfill is drained, and (4) the backfill has a slope flatter than 4H:1V. Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project varies from these assumptions.

5.5.2 Wall Design Parameters

Unrestrained site walls that retain native soils should be designed to resist active earth pressures of 40 to 60 pcf when supporting slopes between 4H:1V and 2H:1V, respectively. Where retained slopes are between inclinations of 4H:1V and 2H:1V, the designer may linearly interpolate between these active earth pressures. For the embedded building walls, a superimposed seismic lateral force should be calculated based on a dynamic force of $6H^2$ pounds per lineal foot of wall, where H is the height of the wall in feet, and applied at 0.6H from the base of the wall.

If retaining walls are restrained from rotation prior to being backfilled, the aforementioned active earth pressures shall be increased by 15 pcf. If other surcharges (e.g., slopes steeper than 2H:1V, foundations, vehicles, etc.) are located within a horizontal distance from the back of a wall equal to twice the height of the wall, then additional pressures may need to be accounted for in the wall design. Our office should be contacted for appropriate wall surcharges based on the actual magnitude and configuration of the applied loads.

The wall footings should be designed in accordance with the guidelines provided in the appropriate portion of the "Shallow Foundation" section of this report.

5.5.3 Wall Drainage and Backfill

The above design parameters have been provided assuming that back-of-wall drains will be installed to prevent buildup of hydrostatic pressures behind all walls. If a drainage system is not installed, then our office should be contacted for revised design forces.

The backfill material placed behind the walls and extending a horizontal distance of ½H, where H is the height of the retaining wall, should consist of retaining wall select backfill placed and compacted in conformance with the "Materials" section of this report.

A minimum 6-inch-diameter perforated collector pipe should be placed at the base of the walls. The pipe should be embedded in a minimum 2-foot-wide zone of angular drain rock that is wrapped in a drainage geotextile fabric and extends up the back of the wall to within 1 foot of the finished grade. The drain rock and drainage geotextile fabric should meet specifications provided in the "Materials" section of this report. The perforated collector pipes should discharge at an appropriate location away from the base of the wall. The discharge pipe(s) should not be tied directly into stormwater drain systems, unless measures are taken to prevent backflow into the wall's drainage system.

Settlements of up to 1 percent of the wall height commonly occur immediately adjacent to the wall as the wall rotates and develops active lateral earth pressures. Consequently, we recommend that construction of flatwork adjacent to retaining walls be postponed at least four weeks after backfilling of the wall, unless survey data indicates that settlement is complete prior to that time.

5.6 PAVEMENTS

Pavements should be installed on compacted subgrade or new engineered fills prepared in conformance with the "Construction" section of this report. Our pavement recommendations are based on the following assumptions:

- The top 12 inches of soil subgrade below the roadway alignment is compacted to at least 92 percent of its maximum density per ASTM D 1557.
- A resilient modulus of 4,000 psi was estimated for a compacted soil or undisturbed firm native subgrade.
- A resilient modulus of 20,000 psi was estimated for base rock.
- Initial and terminal serviceability indices of 4.2 and 2.5, respectively.
- Reliability and standard deviations of 85 percent and 0.45, respectively.
- Structural coefficients of 0.42 and 0.10 for the asphalt and base rock, respectively.
- Structural coefficient of 0.08 for cement-amended subgrade.

The traffic loading for the facility is not known. Based on our experience with similar facilities, we have assigned ESAL values of 8,000 and 60,000 for automobile parking areas and access lanes, respectively. If any of these assumptions are incorrect, our office should be contacted with the appropriate information so that the pavement designs can be revised.

Table 2. Minimum Pavement Thicknesses with Compacted Soil Subgrade

Traffic Loading (ESALs)	AC (inches)	Base Aggregate (inches)
8,000	3.0	7.0
60,000	3.5	11.0

Due to the moist soil conditions found at the site, it may be very difficult, particularly during rainy periods, to properly moisture condition and compact the roadway subgrade in accordance with the "Site Preparation" section of this report. As an alternative to moisture conditioning and compaction, the subgrade may be amended with cement. This will allow for construction of the pavement sections without disturbing the sensitive soil subgrade. If this method is chosen, the subgrade should be amended to a depth of 12 inches. The pavement sections may also be modified as shown in Table 3.

Table 3. Alternative Minimum Pavement Sections with Amended Subgrade[1]

Traffic Loading (ESALs)	AC (inches)	Base Rock (inches)
8,000	3.0	4.0
60,000	3.5	6.0

1. Cement-amended soil to a depth of 12 inches with a minimum seven-day unconfined compressive strength of 100 psi.

The AC and base aggregate should meet the requirements outlined in the "Materials" section of this report.

Construction traffic should be limited to non-building unpaved portions of the site or haul roads. Construction traffic should not be allowed on new pavements. If construction traffic is to be allowed on newly constructed road sections, an allowance for this additional traffic will need to be made in the design pavement section.

6.0 CONSTRUCTION

6.1 SITE PREPARATION

6.1.1 Demolition

Site development will include demolition and removal of existing structures or utilities that may be present underneath areas to be improved. Demolition includes complete removal of the buildings, concrete slabs, and footings. We understand some prior structures have been removed; however, portion of the foundation element may remain. Abandoned utilities, if present, will need to be removed and the resulting excavations backfilled. All prior or existing septic systems should be removed and water wells, if present, should be decommissioned in accordance with Oregon Water Resources Department requirements.

In general, demolished material should be transported off site for disposal. Demolished asphalt and concrete may be used in structural fill provided it can be processed or crushed to meet the requirements provided in the "Structural Fill" section of this report.

Excavations left from demolition and removal of existing structures should be backfilled with compacted structural fill in accordance with recommendations in the "Structural Fill" section of this report.

6.1.2 Grubbing and Stripping

Trees and shrubs should be removed from fill areas. In addition, root balls should be grubbed out to the depth of the roots, which could exceed 3 feet BGS. Depending on the methods used to remove the root balls, considerable disturbance and loosening of the subgrade could occur during site grubbing. We recommend that soil disturbed during grubbing operations be removed to expose firm, undisturbed subgrade. The resulting excavations should be backfilled with structural fill.

The existing topsoil zone should be stripped and removed from all fill areas. Based on our explorations, the average depth of stripping will be approximately 3 inches, although greater stripping depths may be required to remove localized zones of loose or organic soil. Greater stripping depths (approaching 12 inches) may be anticipated in areas with thicker vegetation and shrubs, in all forested areas, and along the base of draws. The actual stripping depth should be based on field observations at the time of construction. Stripped material should be transported off site for disposal or used in landscaped areas. In addition, and as discussed in the "Preload and Surcharge" section of this report, stripped material can be used for preload and surcharge material.

6.1.3 Topsoil Zone

The surface 6 to 12 inches of soil generally consists of topsoil. Within all proposed structural fill, pavement, and improvement areas (and for a 5-foot margin beyond such areas) and where less than 1 foot of cut is required, we recommend that the surface 12 inches of the stripped subgrade be removed and replaced with structural fill or scarified and compacted (to a depth of 12 inches) as recommended for structural fill.

As discussed in the "Structural Fill" section of this report, the native soil can be sensitive to small changes in moisture content and will be difficult, if not impossible, to compact adequately during wet weather. While scarification and compaction of the subgrade is the best option for subgrade improvement, it will likely only be possible during extended dry periods and following moisture conditioning of the soil. As discussed further on in this report, cement amendment is an option for conditioning the soils for use as structural fill during periods of wet weather or when drying the soil is not an option.

6.1.4 Subgrade Evaluation

Upon completion of stripping and subgrade stabilization, and prior to the placement of fill or pavement improvements, the exposed subgrade should be evaluated by proofrolling. The subgrade should be proofrolled with a fully loaded dump truck or similarly heavy, rubber-tire construction equipment to identify soft, loose, or unsuitable areas. A member of our geotechnical staff should observe the proofrolling to evaluate yielding of the ground surface. During wet weather, subgrade evaluation should be performed by probing with a foundation probe rather than proofrolling. Areas that appear soft or loose should be improved in accordance with subsequent sections of this report.

6.2 CONSTRUCTION CONSIDERATIONS

The fine-grained soils present on this site are easily disturbed. If not carefully executed, site preparation, utility trench work, and roadway excavation can create extensive soft areas and significant repair costs can result. Earthwork planning, regardless of the time of year, should include considerations for minimizing subgrade disturbance.

If construction occurs during or extends into the wet season, or if the moisture content of the surficial soil is more than a couple percentage points above the optimum moisture content, site stripping and cutting may need to be accomplished using track-mounted equipment. Likewise, the use of granular haul roads and staging areas will be necessary for support of construction traffic during the rainy season or when the moisture content of the surficial soil is more than a few percentage points above the optimum moisture content. The base rock thickness for pavement areas is intended to support post-construction design traffic loads. This design base rock thickness may not support construction traffic or pavement construction when the subgrade soils are wet. Accordingly, if construction is planned for periods when the subgrade soils are wet, staging and haul roads with increased thicknesses of base rock will be required. The amount of staging and haul road areas, as well as the required thickness of granular material, will vary with the contractor's sequencing of a project and type/frequency of construction equipment. Based on our experience, between 12 and 18 inches of imported granular material is generally required in staging areas and between 18 and 24 inches in haul roads areas. Stabilization material may be used as a substitute provided the top 4 inches of material consists of imported granular material.

The actual thickness will depend on the contractor's means and methods and, accordingly, should be the contractor's responsibility. In addition, a geotextile fabric should be placed as a barrier between the subgrade and imported granular material in areas of repeated construction traffic. The imported granular material, stabilization material, and the geotextile fabric should meet the specifications in the "Materials" section of this report.

As an alternative to thickened crushed rock sections, haul roads and utility work zones may be constructed using cement-amended subgrades overlain by a crushed rock wearing surface. If this approach is used, the thickness of granular material in staging areas and along haul roads can typically be reduced to between 6 and 9 inches. This recommendation is based on an assumed minimum unconfined compressive strength of 100 psi for subgrade amended to a depth of 12 to 16 inches. The actual thickness of the amended material and imported granular material will depend on the contractor's means and methods and, accordingly, should be the contractor's responsibility. Cement amendment is discussed in the "Materials" section of this report.

6.3 SURCHARGE AND PRELOAD

6.3.1 General

Deeper deposits of compressible clay/silt soils were encountered at the small draws located at the northeast (TP-30) and southeast (TP-32) corners of the site. The preliminary development plans (Figure 2) indicate that a restaurant will be located in the northeast corner and a retail building will be located in the southeast corner. Both areas will require filling, with up to 15 feet required at the northeast corner and up to 10 feet at the southeast corner. The proposed restaurant will be located in an area that will likely have relatively similar filling (estimated at between 12 and 15 feet) and, given the small footprint, relatively similar soil conditions. The retail building will have variable filling (estimated at between 0 and 10 feet) and, given the larger footprint, variable thicknesses of compressible material (1 foot at TP-25, 0 feet at TP-25, 4 feet at TP-26, and likely thicker amounts given the greater than 11 feet observed at TP-32). Total settlement greater than the standard structural limits of 1 to 1½ inches may occur in the area of the proposed restaurant; however, differential settlements should be close to the standard of one-half of total settlement. Because of the variable thickness of compressible material and variable filling over the footprint of the proposed retail building, differential settlement could approach total settlement and likely exceed 1½ inches.

Additional analysis will be necessary to evaluate the settlement potential in these areas prior to building construction. One option is to install settlement plates during the Phase I mass grading to evaluate the settlement sensitivity and potential for excessive total and differential settlement in these areas. A preload represents loading the settlement-sensitive area to a load consistent to the final design load, which consists of the fill loads (soil and building base rock and concrete slab) plus the anticipated slab live loads. A surcharge represents applying loads above the design loads to accelerate the settlement of the soils. The options to consider include the following:

- Complete a limited preload consisting of constructing to the final design subgrade elevations. This approach would not fully preload to the design loads of the slab base rock, concrete, and slab live loads, but would remove the majority of the settlement that can be later evaluated using the settlement records (see "Preload and Surcharge Monitoring" section below) relative to the final design loads.
- Complete a full preload by constructing fill within the preload areas described above to the final slab grade plus the estimated slab live loads. Based on the intended use of the structures, the slab live loads likely correspond to between 150 and 250 for the restaurant and retail buildings, respectively, which would represent between 2 and 3 feet of fill over finished slab elevation.
- Complete a surcharge by placing fill above the preload grades identified above to accelerate settlement. Given the phased approach of this project, there may not be a need to accelerate the settlement process.

The preload or surcharge, if selected, should extend 5 feet beyond the footprint of the restaurant building and over the southeastern approximately two-thirds of the retail building (plus 5 feet beyond the eastern and southern building limits). The preload or surcharge material placed above the design subgrade elevations can consist of strippings or on-site soils. A common approach to generating preload/surcharge material is using material mined from the site. If this approach is used, we recommend that material not be mined below finished subgrades elevations within 40 feet the preload/surcharge areas described above.

Recommendations on monitoring preloads and surcharges are provided below.

6.3.2 Preload and Surcharge Monitoring

We recommend monitoring the settlement from the preload/surcharge by installing at least two settlement plates in the proposed restaurant footprint and at least three in the southeastern area of the proposed retail building. We request that GeoDesign establish the location of the settlement plates based on review of the final grading and site layout plans. A typical settlement plate detail is shown on Figure 4. For ease in handling, the casing and rod portions of the settlement plate are usually installed in 5-foot sections. As filling progresses, couplings are used to install additional sections. Continuity in the monitoring data is maintained by reading and recording the top of the measurement rod immediately prior to and following the addition of new sections. Care must be taken during fill construction not to bend or break the rods.

The settlement plates should be installed prior to site filling and immediately surveyed. Survey shots should be taken at each settlement plate at least twice per week during fill construction and for at least one month after fill construction, followed by once weekly thereafter. The settlement plates should be monitored using survey equipment with an accuracy of 1/100th of a foot and referenced to a stationary datum established at least 500 feet from the edge of the surcharge area. In addition to recording the elevation of the settlement plates during each survey event, a complete record of the surcharge history requires reading and recording the fill height at each settlement plate. The survey data should be supplied to GeoDesign within three days of the survey. We will provide a Microsoft Excel spreadsheet to the surveyors that can be used to transfer data via email.

6.4 PERMANENT SLOPES

Permanent cut and fill slopes should not exceed 2H:1V. Access roads and pavements should be located at least 5 feet from the top of cut and fill slopes. The setback should be increased to 10 feet for buildings. The slopes should be planted with appropriate vegetation to provide protection against erosion as soon as possible after grading. Surface water runoff should be collected and directed away from slopes to prevent water from running down the face of the slope.

6.5 EXCAVATION

6.5.1 Rock Excavation

The preliminary grading plans indicate that the majority of the cut greater than 2 feet will be completed in the northwestern portion of the site. In general, decomposed/weathered basalt rock will be encountered within the proposed cuts. The decomposed/weathered material consists of gravel with variable soundness rock contained within a clay matrix. Within the surface layers of the material, the rock is relatively friable; however, with depth, the hardness of the aggregate increased.

The explorations were completed using a Takeuchi TB175 trackhoe equipped with rock teeth, which was capable of excavating up to 13 feet into the decomposed/weathered material. Refusal was encountered at several of the explorations (TP-1, TP-2, TP-6, TP-9, TP-10, TP-15, TP-17, TP-18, TP-21, and TP-25), and when encountered, varied between depths of 7.5 (TP-17) and 13.5 (TP-1). The majority of the refusal conditions were due to excavation obstruction by a boulder, which in the confined space of a test pit, could not be removed. Based on our results, we anticipate that excavation equipment with hardened rock teeth can complete the mass grading to the proposed depths. If relatively competent and intact bedrock is encountered, we recommend defining rock excavation as material that cannot be excavated using a CAT 345 equipped with rock excavation teeth (or equivalent) or a CAT D8 dozer equipped with a rock ripper (or equivalent).

Utility trenches may result in slowed excavation and larger backfill volumes due to the presence of rock, the presence of cobbles and boulders, and related caving. Deep excavations that extend into relatively competent and intact bedrock material will likely require the use of special techniques, such as hydraulic breakers, drilling, and blasting.

6.5.2 Excavation and Shoring

Temporary excavation sidewalls should stand vertical to a depth of approximately 4 feet provided groundwater seepage is not observed in the sidewalls. Open excavation techniques may be used to excavate trenches with depths between 4 and 8 feet provided the walls of the excavation are cut at a slope of 1H:1V and groundwater seepage is not present. At this inclination, the slopes with loose gravel and cobbles may ravel and require some ongoing repair. Excavations should be flattened to 1½H:1V or 2H:1V if excessive sloughing or raveling occurs. In lieu of large open cuts, approved temporary shoring may be used for excavation support. A wide variety of shoring and dewatering systems are available. Consequently, we recommend that the contractor be responsible for selecting the appropriate shoring and dewatering systems.

If box shoring is used, it should be understood that box shoring is a safety feature used to protect workers and does not prevent caving. If the excavations are left open for extended

periods of time, then caving of the sidewalls may occur. The presence of caved material will limit the ability to properly backfill and compact the trenches. The contractor should be prepared to fill voids between the box shoring and the sidewalls of the trenches with sand or gravel before caving occurs.

All temporary excavation slopes and shoring systems are the sole responsibility of the contractor, as the contractor is in the best position to select these systems based on their means and methods.

6.5.3 Trench Dewatering

Dewatering will be required if groundwater is encountered. Pumping from a sump located within the trench may be effective in dewatering localized sections of trench. However, this method is unlikely to prove effective in dewatering long sections of trench or large excavations. In addition, the sidewalls of trench excavations will need to be flattened or shored if seepage is encountered.

Where groundwater seepage into shored excavations occurs, we recommend placing at least 1 foot of stabilization material at the base of the excavations. Trench stabilization material should meet the requirements provided in the "Structural Fill" section of this report.

We note that these recommendations are for guidance only. The dewatering of excavations is the sole responsibility of the contractor, as the contractor is in the best position to select these systems based on their means and methods.

6.6 DRAINAGE

As discussed in the "Subsurface Conditions" section of this report, surface water observed at the base of the small draws along the southeastern and northeastern corners of the site and slow to rapid groundwater seepage was encountered at several of the explorations at depths varying between 2.5 and 12 feet BGS. Where observed, groundwater seepage was generally encountered several feet below the depth of the cuts associated with the preliminary grading plan. However, groundwater seepage was encountered at a depth of 10 feet BGS at TP-10, which is estimated to be within a couple of proposed cut in this area.

Based on these results, some trench drains may be required in the areas of the deep cuts. We recommend that the extent, details, and layout be identified based on the conditions revealed during the mass excavation. In general, the trench drain should consist of 6-inch-diameter perforated drainpipe wrapped in a drainage geotextile filter. The geotextile and drain rock should meet the requirements provided in the "Materials" section of this report.

6.7 MATERIALS

6.7.1 Structural Fill

6.7.1.1 General

Fill should be placed on subgrade that has been prepared in conformance with the "Site Preparation" section of this report. A variety of material may be used as structural fill at the site. However, all material used as structural fill should be free of organic matter or other unsuitable materials and should meet the specifications provided in OSSC 00330 (Earthwork), OSSC 00400

(Drainage and Sewers), and OSSC 02600 (Aggregates), depending on the application. A brief characterization of some of the acceptable materials and our recommendations for their use as structural fill is provided below.

In locations where fills are to be placed against the side slopes of the draw area, level benches should be cut into the existing sloping surfaces to remove the surface loose material and should extend into the structural fill of the existing embankment. The benches should be a minimum of 10 feet wide or 1½ times the width of the compaction equipment, whichever is wider.

6.7.1.2 On-Site Soil

The material at the site should be suitable for use as general structural fill provided it is properly moisture conditioned; free of debris, organic materials, and particles over 6 inches in diameter; and meets the specifications provided in OSSC 00330.12 (Borrow Material).

Our explorations encountered a relatively thin layer (generally 2 to 3 feet) of clay and silt underlain by decomposed and weathered basalt. In general, the decomposed/weathered basalt consists of gravel with variable soundness rock contained within a clay matrix. Within the surface layers of this material, the rock is relatively friable; however, with depth, the hardness of the aggregate increased. Cobbles and boulders were encountered in the near-surface clay/silt as well as the underlying decomposed/weathered basalt.

The moisture contents of the clay/silt soil generally varied between 29 and 35 percent, and the moisture contents of the soil matrix of the decomposed/weathered basalt generally varied between 30 and 86 percent. The moisture content required for compacting the soil will be considerably less than these values and moisture conditioning (drying) will be required to use the material as structural fill. The Atterberg limits tests on selected samples of the near-surface clay/silt and underlying decomposed/weathered basalt indicated relatively high plasticity. High plasticity materials are more difficult to properly moisture condition for use as structural fill. Both the gravel nature of the decomposed/weathered basalt and the presence of cobbles and boulders in the clay/silt and the decomposed/weathered basalt will further challenge conventional moisture conditioning using farming discs.

As an alternative, use of the on-site silty material as structural fill may be acceptable if it is properly amended with portland cement.

When used as structural fill, native soils should be placed in lifts with a maximum uncompacted thickness of 6 to 8 inches and compacted to not less than 92 percent of the maximum dry density for fine-grained soils and 95 percent of the maximum dry density for granular soils, as determined by ASTM D 1557.

6.7.1.3 Imported Granular Material

Imported granular material used as structural fill should be pit- or quarry-run rock, crushed rock, or crushed gravel and sand and should meet the specifications provided in OSSC 00330.14 (Selected Granular Backfill) or OSSC 00330.15 (Selected Stone Backfill). The imported granular

material should also be angular, fairly well graded between coarse and fine material, have less than 5 percent by dry weight passing the U.S. Standard No. 200 Sieve, and have at least two fractured faces.

Imported granular material should be placed in lifts with a maximum uncompacted thickness of 12 inches and compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D 1557. During the wet season or when wet subgrade conditions exists, the initial lift should be approximately 18 inches in uncompacted thickness and should be compacted by rolling with a smooth-drum roller without using vibratory action.

6.7.1.4 Stabilization Material

Stabilization material used in staging or haul road areas, or as trench stabilization material, should consist of 4- or 6-inch-minus pit- or quarry-run rock, crushed rock, or crushed gravel and sand and should meet the specifications provided in OSSC 00330.15 (Selected Stone Backfill). The material should have a maximum particle size of 6 inches, less than 5 percent by dry weight passing the U.S. Standard No. 4 Sieve, and at least two mechanically fractured faces. The material should be free of organic matter and other deleterious material. Stabilization material should be placed in lifts between 12 and 24 inches thick and compacted to a firm condition.

6.7.1.5 Trench Backfill

Trench backfill placed beneath, adjacent to, and for at least 12 inches above utility lines (i.e., the pipe zone) should consist of well-graded granular material with a maximum particle size of 1½ inches and less than 10 percent by dry weight passing the U.S. Standard No. 200 Sieve and should meet the specifications provided in OSSC 00405.13 (Pipe Zone Material). The pipe zone backfill should be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D 1557, or as required by the pipe manufacturer or local building department. Within roadway alignments, the remainder of the trench backfill up to the subgrade elevation should consist of well-graded granular material with a maximum particle size of 2½ inches and less than 10 percent by dry weight passing the U.S. Standard No. 200 Sieve and should meet the specifications provided in OSSC 00405.14 (Trench Backfill; Class B, C, or D). This material should be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D 1557, or as required by the pipe manufacturer or local building department. The upper 3 feet of the trench backfill should be compacted to at least 95 percent of the maximum dry density, as determined by ASTM D 1557.

Outside of structural improvement areas (e.g., roadway alignments or building pads) trench backfill placed above the pipe zone may consist of general fill materials that are free of organics and materials over 6 inches in diameter and meet the specifications provided in OSSC 00405.14 (Trench Backfill; Class A, B, C, or D). This general trench backfill should be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D 1557, or as required by the pipe manufacturer or local building department.

6.7.1.6 Drain Rock

Drain rock should consist of angular, granular material with a maximum particle size of 2 inches and should meet the specifications provided in OSSC 00430.11 (Granular Drain Backfill Material). The material should be free of roots, organic matter, and other unsuitable materials; have less

than 2 percent by dry weight passing the U.S. Standard No. 200 Sieve (washed analysis); and have at least two mechanically fractured faces. Drain rock should be compacted to a well-keyed, firm condition.

6.7.1.7 Aggregate Base Rock

Imported granular material used as base rock for building floor slabs and pavements should consist of ¾- or 1½-inch-minus material (depending on the application) and meet the requirements in OSSC 00641 (Aggregate Subbase, Base, and Shoulders). In addition, the aggregate should have less than 5 percent by dry weight passing the U.S. Standard No. 200 Sieve. The base aggregate should be compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D 1557.

6.7.1.8 Retaining Wall Select Backfill

Backfill material placed behind retaining walls and extending a horizontal distance of ½H, where H is the height of the retaining wall, should consist of select granular material that meets the specifications provided in OSSC 00510.12 (Granular Wall Backfill). We recommend the select granular wall backfill be separated from general fill, native soil, and/or topsoil using a geotextile fabric that meets the specifications provided below for drainage geotextiles.

The wall backfill should be compacted to a minimum of 95 percent of the maximum dry density, as determined by ASTM D 1557. However, backfill located within a horizontal distance of 3 feet from a retaining wall should only be compacted to approximately 90 percent of the maximum dry density, as determined by ASTM D 1557. Backfill placed within 3 feet of the wall should be compacted in lifts less than 6 inches thick using hand-operated tamping equipment (such as jumping jack or vibratory plate compactors). If flatwork (sidewalks or pavements) will be placed atop the wall backfill, we recommend that the upper 2 feet of material be compacted to 95 percent of the maximum dry density, as determined by ASTM D 1557.

6.7.2 Geotextile Fabric

6.7.2.1 Subgrade Geotextile

Subgrade geotextile should conform to OSSC Table 02320-1 and OSSC 00350 (Geosynthetic Installation). The geotextile should have a Level "B" certification. A minimum initial aggregate base lift of 6 inches is required over geotextiles.

6.7.2.2 Drainage Geotextile

Drainage geotextile should conform to Type 2 material of OSSC Table 02320-1 and OSSC 00350 (Geosynthetic Installation). The geotextile should have a Level "B" certification. A minimum initial aggregate base lift of 6 inches is required over geotextiles.

6.7.3 Soil Amendment with Cement

As an alternative to the use of imported granular material for wet weather structural fill, an experienced contractor may be able to amend the on-site soils with portland cement to obtain suitable support properties. Successful use of soil amendment depends on the use of correct mixing techniques, soil moisture content, and amendment quantities. Soil amending should be conducted in accordance with the specifications provided in OSSC 00344 (Treated Subgrade). We remind the contractor that variable amounts of oversize materials (cobble- and boulder-size

material) exists at the site and these materials generally need to be removed prior to treatment to prevent damage to the specialty tilling equipment used in cement amendment. Efforts to remove oversize material should not damage the subgrade below the cement treatment depth.

Portland cement-amended soils are hard and have low permeability. These soils do not drain well, nor are they suitable for planting. Future planted areas should not be cement amended, if practical, or accommodations should be made for drainage and planting. Moreover, cement amending soil within building areas must be done carefully to avoid trapping water under floor slabs. We should be contacted if this approach is considered. Cement amendment should not be used if runoff during construction cannot be directed away from adjacent wetlands.

Specific recommendations, based on exposed site conditions, for soil amending can be provided if necessary. However, for preliminary design purposes, we recommend a target strength for cement-amended soils of 100 psi. The amount of cement used to achieve this target generally varies with moisture content and soil type. It is difficult to predict field performance of soils to cement amendment due to variability in soil response, and we recommend laboratory testing to confirm expectations. Given the relatively high plasticity of the soil, if the soil moisture content is in the range of 25 to 45 percent, we recommend a cement ratio of 5 to 8 percent by weight of dry soil is recommended. We recommend assuming a minimum cement ratio of 6 percent. The amount of cement added to the soil may need to be adjusted based on field observations and performance. Moreover, depending on the time of year and moisture content levels during amendment, water may need to be applied during tilling to appropriately condition the soil moisture content. The amount of cement used during treatment should be based on an assumed soil dry unit weight of 110 pcf.

In order to utilize wet on-site soils that would not otherwise be suitable for structural fill, they may be amended and placed as fill over a subgrade prepared in conformance with the "Site Preparation" section of this report. Typically, a minimum curing of four days is required between treatment and construction traffic access. Consecutive lifts of fill may be treated immediately after the previously lift has been amended and compacted (e.g., the four-day wait period does not apply). However, where the final lift of fill is a building or roadway subgrade, then the four-day wait period is in effect.

Treatment depths for subgrades, haul roads, and staging areas are typically on the order of 12, 16, and 12 inches, respectively. We recommended a seven-day, unconfined compressive strength of at least 100 psi. To protect the cement-treated surfaces from abrasion or damage, the finished surface should be covered with 4 to 6 inches of imported granular material. The crushed rock typically becomes contaminated with soil during construction. Contaminated base rock should be removed and replaced with clean rock in pavement areas. The actual thickness of the amended material and imported granular material will depend on the anticipated traffic, as well as the contractor's means and methods, and accordingly, should be the contractor's responsibility.

6.7.4 AC

6.7.4.1 HMAC

The AC should be Level 3, ½-inch, dense HMAC according to OSSC 00745 (Hot Mixed Asphalt Concrete) and compacted to 91 percent of the maximum specific gravity of the mix, as determined by AASHTO T209. Minimum lift thickness is 2.0 inches for ½-inch HMAC. Asphalt binder should be performance graded and conform to PG 64-22 or better. If a thin asphalt overlay is selected, the nominal aggregate size should be reduced to 3/8 inch.

6.8 EROSION CONTROL

The site soils are susceptible to erosion; therefore, erosion control measures should be carefully planned and in place before construction begins. Surface water runoff should be collected and directed away from slopes to prevent water from running down the slope face. Erosion control measures (such as straw bales, sediment fences, and temporary detention and settling basins) should be used in accordance with local and state ordinances.

7.0 OBSERVATION OF CONSTRUCTION

Satisfactory foundation and earthwork performance depends to a large degree on quality of construction. Sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications. Subsurface conditions observed during construction should be compared with those encountered during the subsurface exploration. Recognition of changed conditions often requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect if subsurface conditions change significantly from those anticipated.

We recommend that GeoDesign be retained to observe earthwork activities, including stripping, proofrolling of the subgrade and repair of soft areas, footing subgrade preparation, performing laboratory compaction and field moisture-density tests, observing final proofrolling of the pavement subgrade and base rock, and asphalt placement and compaction.

8.0 LIMITATIONS

We have prepared this report for use by PacTrust and members of the design and construction teams for the proposed project. The data and report can be used for bidding or estimating purposes, but our report, conclusions, and interpretations should not be construed as warranty of the subsurface conditions and are not applicable to other nearby building sites.

Exploration observations indicate soil conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect soil strata or water level variations that may exist between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, re-evaluation will be necessary.

The site development plans and design details were preliminary at the time this report was prepared. When the design has been finalized and if there are changes in the site grades or location, configuration, design loads, or type of construction for the buildings, and walls, the

conclusions and recommendations presented may not be applicable. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a written modification or verification.

The scope does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in this area at the time the report was prepared. No warranty, express or implied, should be understood.

♦ ♦ ♦

We appreciate the opportunity to be of service to you. Please call if you have questions concerning this report or if we can provide additional services.

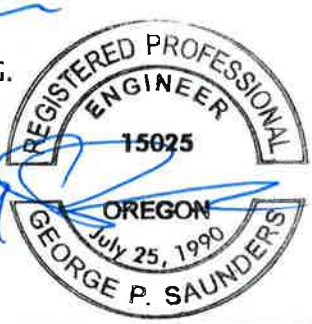
Sincerely,

GeoDesign, Inc.

Charles M. Clough, R.G., C.E.G.
Project Engineering Geologist

Exp 4/30/13

George Saunders, P.E., G.E.
Principal Engineer



EXPIRES: 6/30/13

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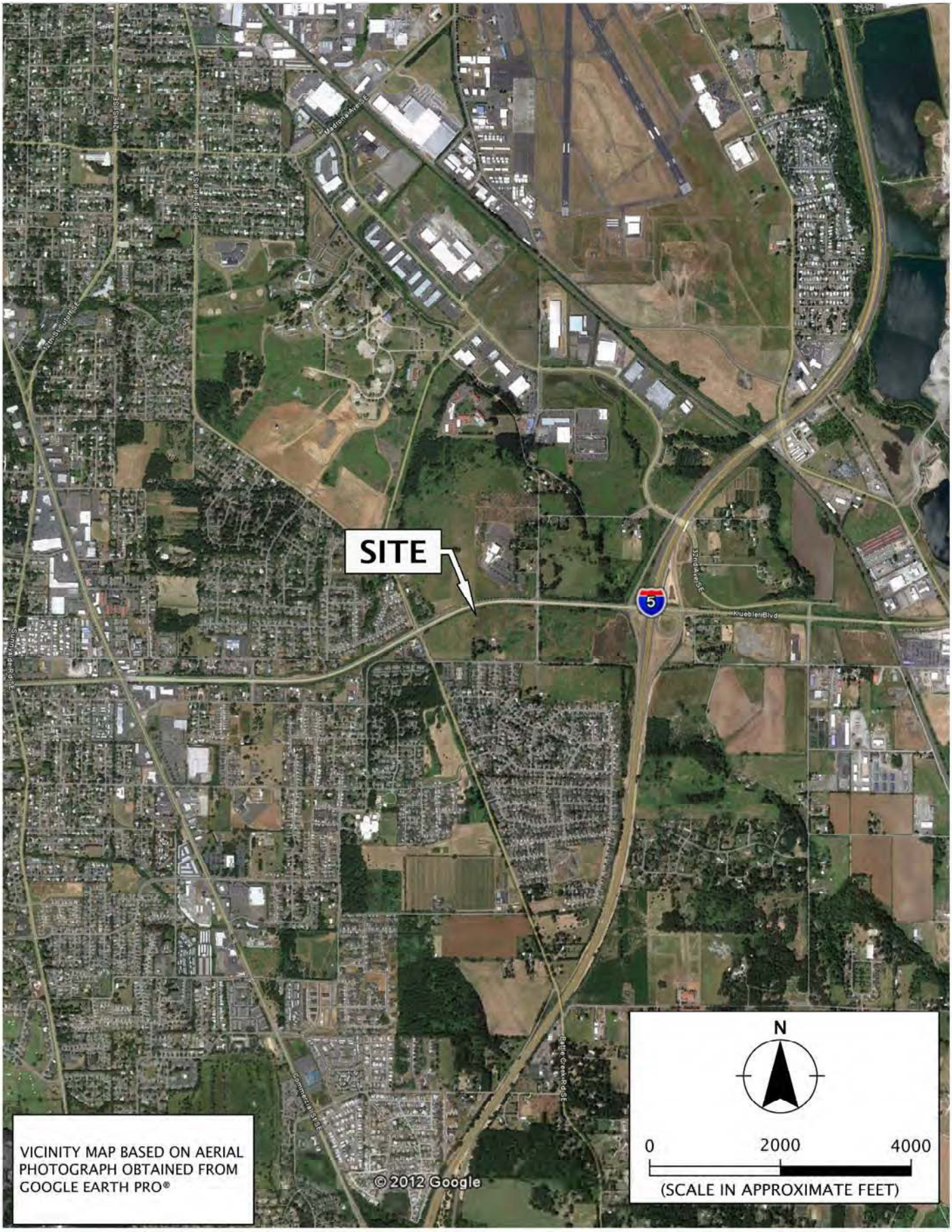
FIGURES



VICINITY MAP BASED ON AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH PRO®

GEODESIGN INC
15575 SW Sequoia Parkway - Suite 100
Portland OR 97224
Off 503.968.8787 Fax 503.968.3068

PACTRUST-162-01	**VICINITY MAP**	
MARCH 2012	KUEBLER BOULEVARD PROPERTY SALEM, OR	**FIGURE 1**

Printed By: mmiller | Print Date: 3/30/2012 8:58:12 AM
File Name: J:\M-R\PacTrust\PacTrust-162\PacTrust-162-01\Figures\CAD\PacTrust-162-01-VM01.dwg | Layout: FIGURE 1

KUEBLER BOULEVARD SE

27TH AVENUE

BATTLE CREEK ROAD SE

BOONE ROAD SE

TP-1 (13.5)

TP-2 (10.0)

TP-3 (>12.5)

TP-4 (>15.0) [7]

TP-5 (>15.0) [5]

TP-6 (10.0)

TP-7 (>14.5)

TP-8 (>14.5)

TP-9 (12.5)

TP-10 (11.5) [10']

TP-11 (>13.0) [6]

TP-12 (>13.5) [6]

TP-13 (>10.0) [2.5]

TP-14 (>14.0) [4]

TP-15 (9.0)

TP-16 (>13.0)

TP-17 (7.5)

TP-18 (11.0)

TP-19 (>12.0) [3.5]

TP-20 (>14.0) [6.5]

TP-21 (7.0)

TP-22 (>10.0) [5.5]

TP-23 (>13.0) [8]

TP-24 (>10.0) [9]

TP-25 (8.0)

TP-26 (>8.0) [2.5]

TP-27 (>9.0)

TP-28 (>10.0) [9.5]

TP-29 (>8.0)

TP-30 (>11.0) [5]

TP-31 (>11.0)

TP-32 (>11.0) [4.5]

RETAIL
14,400 SF

RESTAURANT
6,500 SF

OFFICE
14,000 SF

OFFICE
14,000 SF

RETAIL
20,500 SF
2.50 ACRES
4.0/1,000 PARKING

GROCERY
51,500 SF
4.24 ACRES
4.0/1,000 PARKING RATIO

RETAIL
132,362 SF
9.95 ACRES
3.0/1,000 PARKING RATIO

RETAIL
10,000 SF
0.88 ACRES

BANK
4,000 SF
0.62 ACRES

RESTAURANT
6,500 SF
1.22 ACRES

276.76'

315.17'

58.80'

682.34'

166.6'

456.41'

LEGEND:

TP-1	TEST PIT
(13.0)	DEPTH TO REFUSAL (FEET)
[5]	DEPTH TO GROUNDWATER SEEPAGE (FEET)

N

0 150 300

(SCALE IN FEET)

SITE PLAN BASED ON DRAWING PROVIDED BY PACTRUST AND WESTECH, FEBRUARY 23, 2012

SITE PLAN

FIGURE 2

KUEBLER BOULEVARD PROPERTY
SALEM, OR

PACTRUST-162-01

MARCH 2012

GeoDesign
15575 SW Sequoia Parkway - Suite 100
Portland OR 97224
Off 503.968.8787 Fax 503.968.3068

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File Name: J:\M-R\PacTrust\PacTrust-162\PacTrust-162-01\Figures\CAD\PacTrust-162-01-SP01.dwg | Layout: FIGURE 2

KUEBLER BOULEVARD SE

27TH AVENUE

BATTLE CREEK ROAD SE

BOONE ROAD SE

OFFICE
14,000 SF

OFFICE
18,000 SF

276.76'

315.17'

58.80'

682.34'

166.6'

456.41'

TP-1
(13.5)

TP-2
(10.0)

TP-3
(>12.5)

TP-4
(>15.0)
[7]

TP-5
(>15.0)
[5]

TP-6
(10.0)

TP-7
(>14.5)

TP-8
(>14.5)

TP-9
(12.5)

TP-10
(11.5)
[10']

TP-11
(>13.0)
[6]

TP-12
(>13.5)
[6]

TP-13
(>10.0)
[2.5]

TP-14
(>14.0)
[4]

TP-15
(9.0)

TP-16
(>13.0)

TP-17
(7.5)

TP-18
(11.0)

TP-19
(>12.0)
[3.5]

TP-20
(>14.0)
[6.5]

TP-21
(7.0)

TP-22
(>10.0)
[5.5]

TP-23
(>13.0)
[8]

TP-24
(>10.0)
[9]

TP-25
(8.0)

TP-26
(>8.0)
[2.5]

TP-27
(>9.0)

TP-28
(>10.0)
[9.5]

TP-29
(>8.0)

TP-30
(>11.0)
[5]

TP-31
(>11.0)

TP-32
(>11.0)
[4.5]

LEGEND:

TP-1	TEST PIT
(13.5)	DEPTH TO REFUSAL (FEET)
[5]	DEPTH TO GROUNDWATER SEEPAGE (FEET)

N

0 150 300

(SCALE IN FEET)

SITE PLAN BASED ON DRAWING PROVIDED BY
PACTRUST AND WESTECH, FEBRUARY 23, 2012

PHASE I DEVELOPMENT

KUEBLER BOULEVARD PROPERTY
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FIGURE 3

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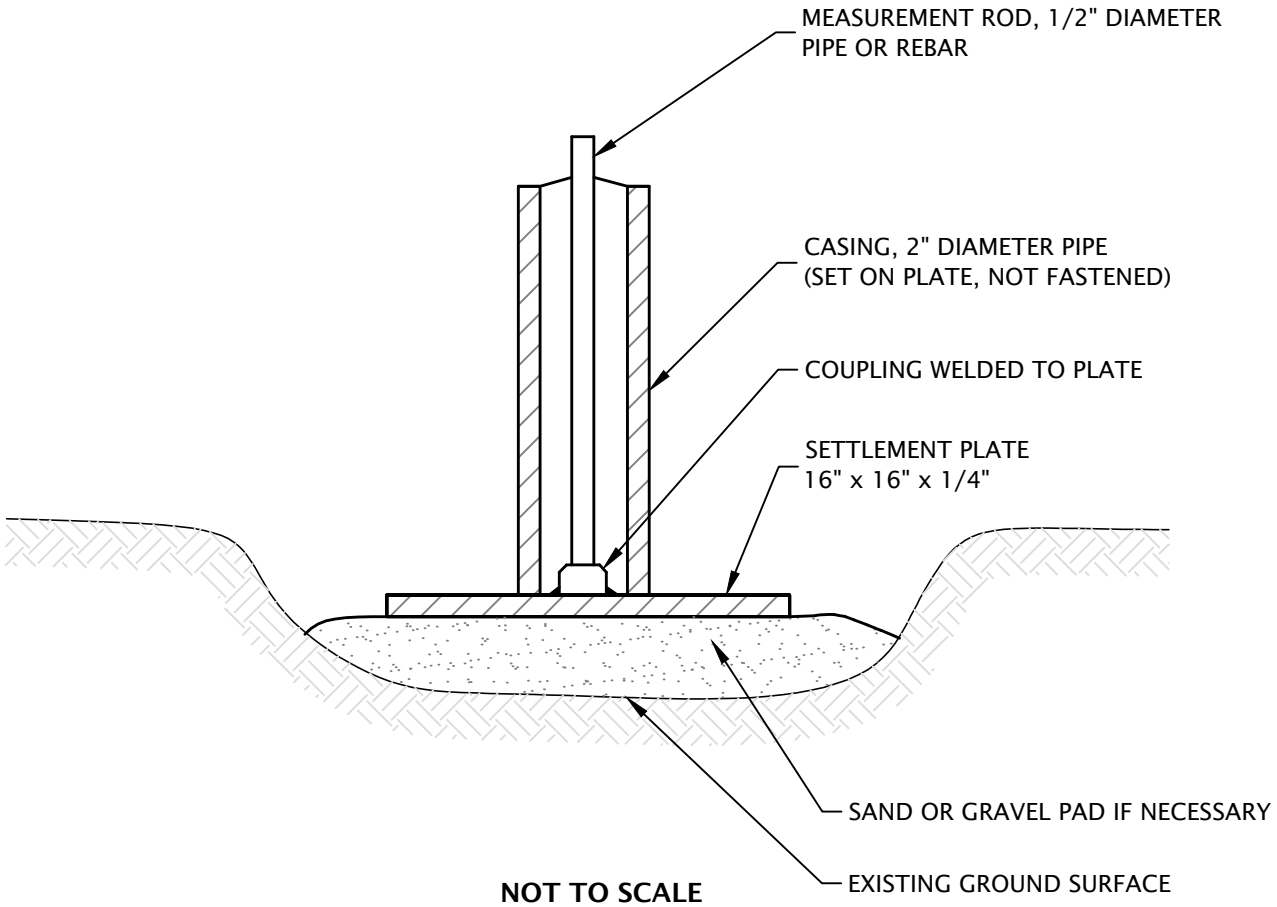
File Name: J:\M-R\PacTrust\PacTrust-162\PacTrust-162-01\Figures\CAD\PacTrust-162-01-SP01.dwg | Layout: FIGURE 3



NOT TO SCALE

NOTES:

1. INSTALL MARKERS ON FIRM GROUND OR ON SAND OR GRAVEL PADS IF NEEDED FOR STABILITY. TAKE INITIAL READING ON TOP OF ROD AND AT ADJACENT GROUND LEVEL PRIOR TO PLACING ANY FILL.

2. FOR EASE IN HANDLING, ROD AND CASING ARE USUALLY INSTALLED IN 5-FOOT SECTIONS. AS FILL PROGRESSES, COUPLINGS ARE USED TO INSTALL ADDITIONAL LENGTHS. CONTINUITY IS MAINTAINED BY READING THE TOP OF THE MEASUREMENT ROD, THEN IMMEDIATELY ADDING THE NEW SECTION AND READING THE TOP OF THE ADDED ROD. BOTH READINGS ARE RECORDED.

3. RECORD THE ELEVATION OF THE TOP OF THE MEASUREMENT ROD IN EACH MARKER AT THE RECOMMENDED TIME INTERVALS. EACH TIME, NOTE THE ELEVATION OF THE ADJACENT FILL SURFACE.

4. READ THE MARKER TO THE NEAREST 0.01 FOOT, OR 0.005 FOOT IF POSSIBLE. NOTE THE FILL ELEVATION TO THE NEAREST 0.1 FOOT.

5. THE ELEVATIONS SHOULD BE REFERENCED TO A TEMPORARY BENCHMARK LOCATED ON STABLE GROUND AT LEAST 500 FEET FROM THE EMBANKMENT.

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PACTRUST-162-01	**SETTLEMENT PLATE DETAIL**	
MARCH 2012	KUEBLER BOULEVARD PROPERTY SALEM, OR	**FIGURE 4**

APPENDIX

APPENDIX

FIELD EXPLORATIONS

GENERAL

We explored the site by advancing 32 test pit explorations (TP-1 through TP-32) at the approximate locations of the explorations are shown on Figures 2 and 3. The test pit explorations were completed up to 15 feet BGS on January 30 and 31, 2012 by Dan J. Fischer Excavating, Inc. of Forest Grove, Oregon, using a Takeuchi TB175 trackhoe equipped with rock teeth. Our explorations were located by taping from site physical features as well as GPS coordinates. The GPS coordinates of the explorations are included on the exploration logs. The locations of the explorations should be considered accurate only to the degree implied by the methods used.

A member of our geologic staff observed the explorations. We obtained representative samples of the various soils encountered in the explorations for geotechnical laboratory testing. Grab samples were obtained during the explorations from the test pit walls and/or base using the excavator bucket.

Classifications and sampling intervals are presented on the exploration logs included in this appendix.

SOIL CLASSIFICATION

The soil samples were classified in accordance with the "Explorations Key" (Table A-1) and "Soil Classification System" (Table A-2), which are included in this appendix. The exploration logs indicate the depths at which the soils or their characteristics change, although the change actually could be gradual. If the change occurred between sample locations, the depth was interpreted. Classifications and sampling intervals are presented on the exploration logs in this appendix.

LABORATORY TESTING

We visually examined soil samples obtained from the explorations to confirm field classifications. We also performed the following laboratory testing.

MOISTURE CONTENT

We tested the natural moisture content of selected samples obtained from the explorations in general accordance with ASTM D 2216. The natural moisture content is a ratio of the weight of the water to soil in a test sample and is expressed as a percentage. The moisture contents are presented on the exploration logs in this appendix.

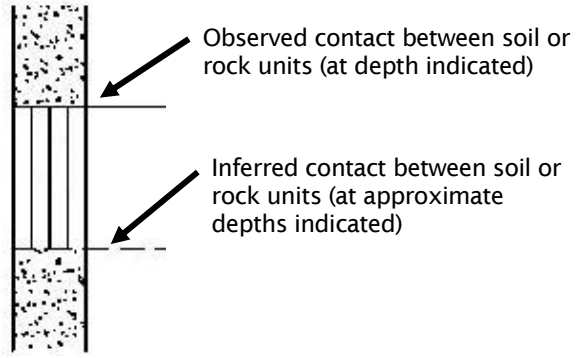
ATTERBERG LIMITS TESTING

The Atterberg limits (plastic and liquid limits) were performed on selected samples in accordance with ASTM D 4318. The plastic limit is defined as the moisture content where the soil becomes

brittle. The liquid limit is defined as the moisture content where the soil begins to act similar to a liquid. The plasticity index is the difference between the liquid and plastic limits. The test results are presented in this appendix.

SYMBOL	SAMPLING DESCRIPTION
	Location of sample obtained in general accordance with ASTM D 1586 Standard Penetration Test with recovery
	Location of sample obtained using thin-wall Shelby tube or Geoprobe® sampler in general accordance with ASTM D 1587 with recovery
	Location of sample obtained using Dames & Moore sampler and 300-pound hammer or pushed with recovery
	Location of sample obtained using Dames & Moore and 140-pound hammer or pushed with recovery
	Location of sample obtained using 3-inch-O.D. California split-spoon sampler and 140-pound hammer
	Location of grab sample
	Rock coring interval
	Water level during drilling
	Water level taken on date shown

Graphic Log of Soil and Rock Types



GEOTECHNICAL TESTING EXPLANATIONS

ATT	Atterberg Limits	PP	Pocket Penetrometer
CBR	California Bearing Ratio	P200	Percent Passing U.S. Standard No. 200 Sieve
CON	Consolidation		
DD	Dry Density	RES	Resilient Modulus
DS	Direct Shear	SIEV	Sieve Gradation
HYD	Hydrometer Gradation	TOR	Torvane
MC	Moisture Content	UC	Unconfined Compressive Strength
MD	Moisture-Density Relationship	VS	Vane Shear
OC	Organic Content	kPa	Kilopascal
P	Pushed Sample		

ENVIRONMENTAL TESTING EXPLANATIONS

CA	Sample Submitted for Chemical Analysis	ND	Not Detected
P	Pushed Sample	NS	No Visible Sheen
PID	Photoionization Detector Headspace Analysis	SS	Slight Sheen
		MS	Moderate Sheen
ppm	Parts per Million	HS	Heavy Sheen

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EXPLORATION KEY

TABLE A-1

RELATIVE DENSITY - COARSE-GRAINED SOILS

Relative Density	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)
Very Loose	0 – 4	0 - 11	0 - 4
Loose	4 – 10	11 - 26	4 - 10
Medium Dense	10 – 30	26 - 74	10 - 30
Dense	30 – 50	74 - 120	30 - 47
Very Dense	More than 50	More than 120	More than 47

CONSISTENCY - FINE-GRAINED SOILS

Consistency	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)	Unconfined Compressive Strength (tsf)
Very Soft	Less than 2	Less than 3	Less than 2	Less than 0.25
Soft	2 - 4	3 – 6	2 - 5	0.25 - 0.50
Medium Stiff	4 - 8	6 – 12	5 - 9	0.50 - 1.0
Stiff	8 - 15	12 – 25	9 - 19	1.0 - 2.0
Very Stiff	15 - 30	25 – 65	19 – 31	2.0 - 4.0
Hard	More than 30	More than 65	More than 31	More than 4.0

PRIMARY SOIL DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE-GRAINED SOILS (more than 50% retained on No. 200 sieve)	GRAVEL (more than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVELS (< 5% fines)	GW or GP	GRAVEL
		GRAVEL WITH FINES (≥ 5% and ≤ 12% fines)	GW-GM or GP-GM	GRAVEL with silt
			GW-GC or GP-GC	GRAVEL with clay
		GRAVELS WITH FINES (> 12% fines)	GM	silty GRAVEL
			GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	SAND (50% or more of coarse fraction passing No. 4 sieve)	CLEAN SANDS (<5% fines)	SW or SP	SAND
		SANDS WITH FINES (≥ 5% and ≤ 12% fines)	SW-SM or SP-SM	SAND with silt
			SW-SC or SP-SC	SAND with clay
		SANDS WITH FINES (> 12% fines)	SM	silty SAND
			SC	clayey SAND
			SC-SM	silty, clayey SAND
FINE-GRAINED SOILS (50% or more passing No. 200 sieve)	SILT AND CLAY	Liquid limit less than 50	ML	SILT
			CL	CLAY
			CL-ML	silty CLAY
			OL	ORGANIC SILT or ORGANIC CLAY
		Liquid limit 50 or greater	MH	SILT
			CH	CLAY
			OH	ORGANIC SILT or ORGANIC CLAY
HIGHLY ORGANIC SOILS			PT	PEAT

MOISTURE CLASSIFICATION

Term	Field Test
dry	very low moisture, dry to touch
moist	damp, without visible moisture
wet	visible free water, usually saturated

ADDITIONAL CONSTITUENTS

Secondary granular components or other materials such as organics, man-made debris, etc.

Percent	Silt and Clay In: Fine-Grained Soils	Silt and Clay In: Coarse-Grained Soils	Percent	Sand and Gravel In: Fine-Grained Soils	Sand and Gravel In: Coarse-Grained Soils
< 5	trace	trace	< 5	trace	trace
5 – 12	minor	with	5 – 15	minor	minor
> 12	some	silty/clayey	15 – 30	with	with
			> 30	sandy/gravelly	sandy/gravelly

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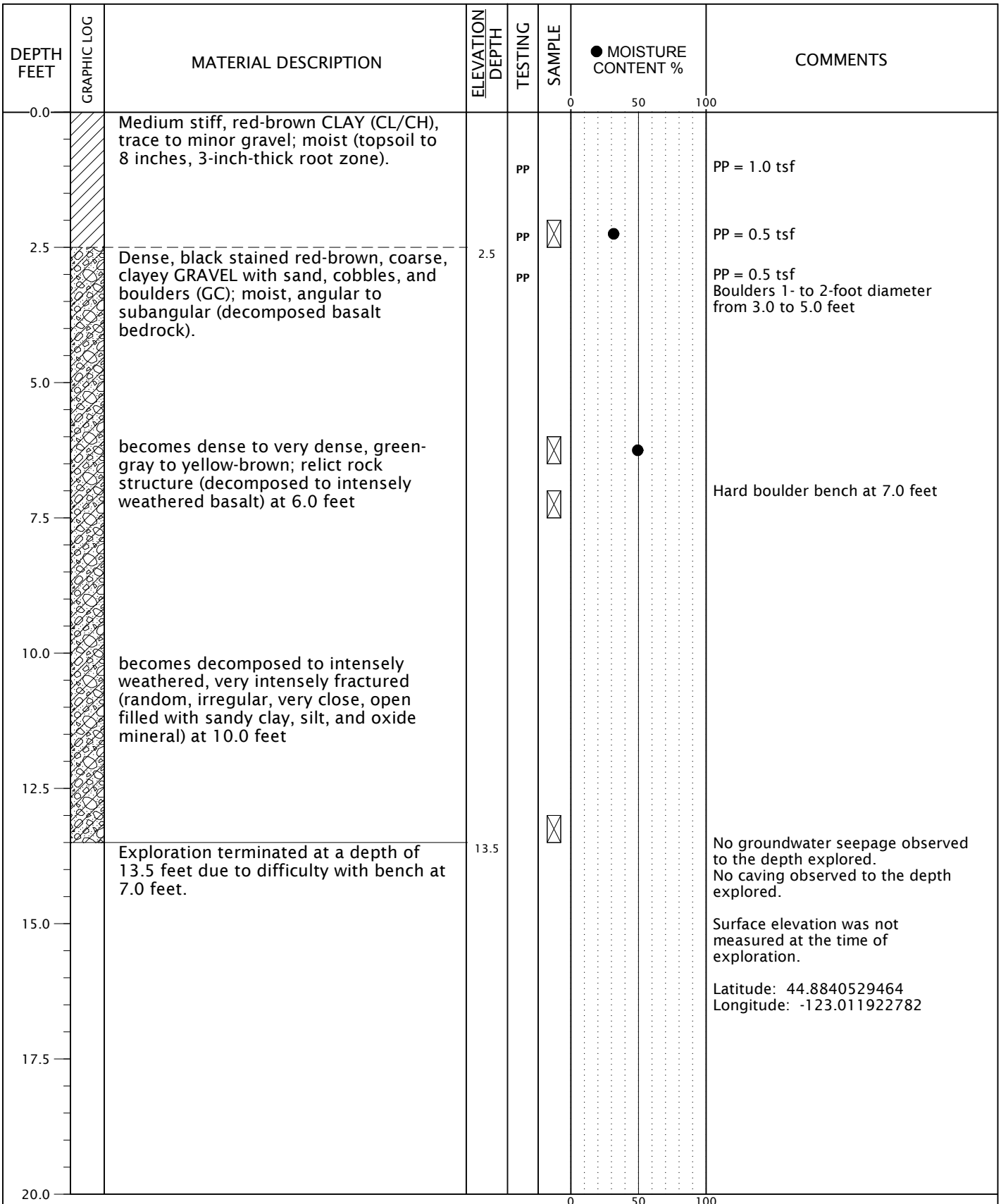
SOIL CLASSIFICATION SYSTEM

TABLE A-2



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TEST PIT TP-1

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KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-1

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff, red-brown CLAY (CL/CH); moist (topsoil to 8 inches, 3-inch-thick root zone).		PP			PP = 0.5 tsf
			ATT PP	☒	●	PP = 0.5 tsf LL = 51% PL = 21%
2.5	Medium dense to dense, black stained red-brown, fine to coarse, clayey GRAVEL with boulders (GC); moist, subangular, boulders are 1- to 2-foot diameter (decomposed bedrock).	2.5	PP			PP = 0.5 tsf
5.0	becomes yellow-brown, coarse; angular at 5.5 feet					
7.5	becomes intensely weathered, very intensely fractured (random, irregular, very close, open filled with clay, silt, and oxide) at 7.0 feet			☒	●	
	becomes dense to very dense, with boulders at 9.0 feet					
10.0	Exploration terminated at a depth of 10.0 feet due to refusal on boulder.	10.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88347627930 Longitude: -123.01166478500
12.5						
15.0						
17.5						
20.0						

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EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-2

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FIGURE A-2

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).					
2.5					☒	●	
		Stiff, black stained red-brown CLAY with sand and gravel (CL/CH); moist, block structure (decomposed bedrock).	3.0				
5.0		Dense, black stained red-brown to yellow-brown, fine to coarse, clayey GRAVEL with cobbles (GC); moist, subangular to angular (decomposed to intensely weathered basalt bedrock).	5.0				
7.5		boulder at 8.0 feet					
		becomes dense to very dense; relict rock structure at 9.0 feet			☒		
10.0							
12.5		Exploration completed at a depth of 12.5 feet.	12.5		☒		No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88304327880 Longitude: -123.01138845400
15.0							
17.5							
20.0						0 50 100	

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TEST PIT TP-3

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FIGURE A-3

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

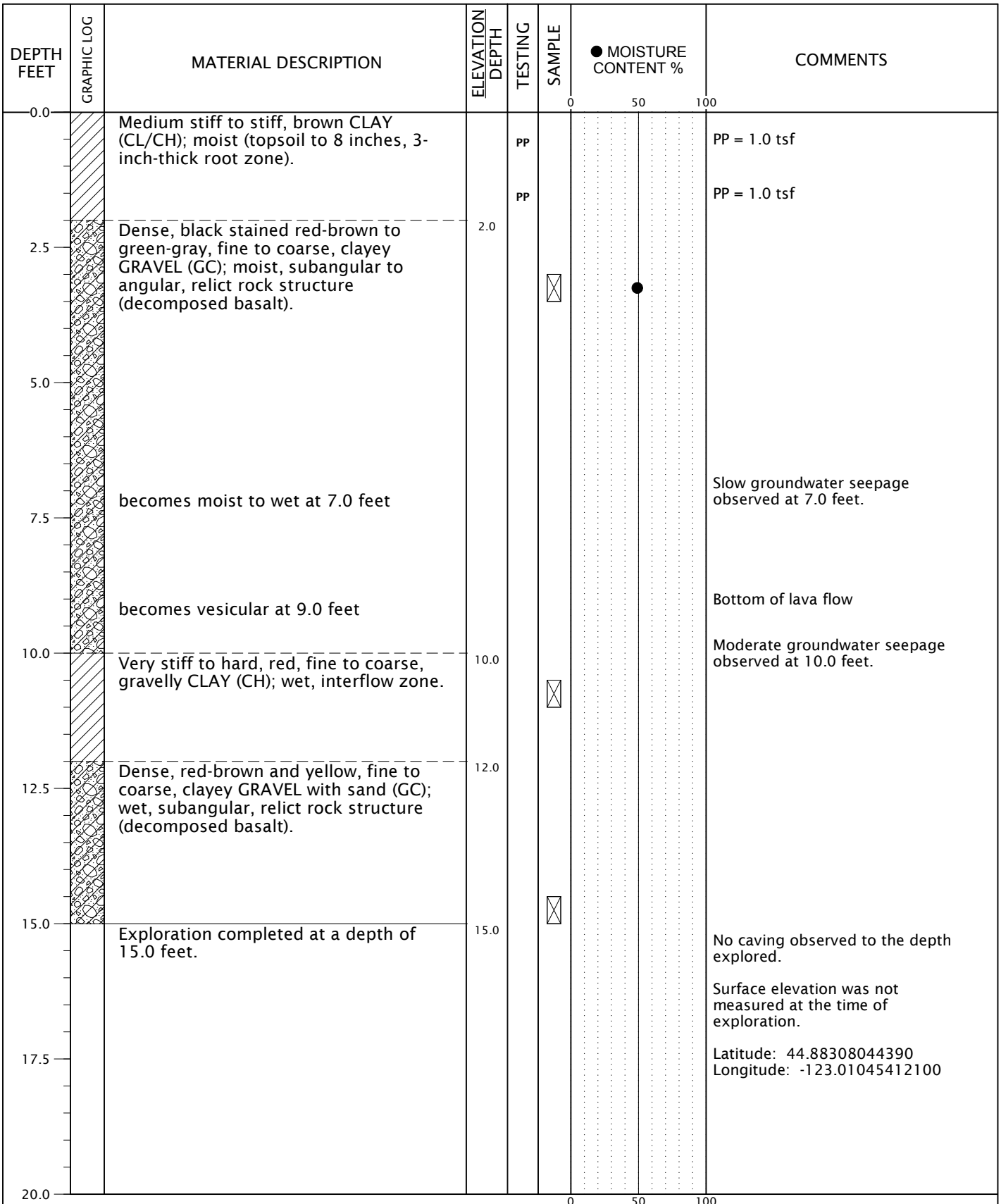

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FIGURE A-4

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff, red-brown CLAY with boulders (CL/CH); moist (topsoil to 10 inches, 2-inch-thick root zone).		PP			PP = 1.0 tsf
			PP			PP = 1.0 tsf
2.5			PP	☒	●	PP = 1.0 tsf
	Medium dense, black stained red-brown to yellow-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	3.0				
5.0						Slow groundwater seepage observed at 5.5 feet.
	becomes dense, coarse; moist to wet, angular to subangular, relict rock structure at 6.0 feet					
7.5	becomes dense to very dense at 8.0 feet			☒	●	
10.0						
12.5	with yellow veining at 13.0 feet					
	becomes dark gray-brown, red, and yellow; vesicular at 14.0 feet					
15.0	Exploration completed at a depth of 15.0 feet.	15.0		☒		No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88357061070 Longitude: -123.01050161800
17.5						
20.0						

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FIGURE A-5

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, red-brown CLAY (CL/CH); moist (topsoil to 8 inches, 2-inch-thick root zone).		PP			PP = 1.0 tsf
		Dense, black stained red-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular to angular (decomposed basalt).	1.5		☒	●	
2.5							
5.0		becomes dense to very dense, yellow-brown and red-brown; relict rock structure at 6.0 feet					
7.5					☒	●	
10.0		with yellow veining at 9.5 feet boulder at 10.0 feet Exploration terminated at a depth of 10.0 feet due to refusal.	10.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88383777850 Longitude: -123.01118728300
12.5							
15.0							
17.5							
20.0							

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TEST PIT TP-6

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SALEM, OR

FIGURE A-6

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff, red-brown CLAY (CL/CH); moist (topsoil to 8 inches, 2-inch-thick root zone).		PP			PP = 1.5 tsf
			PP			PP = 0.5 tsf
2.5	becomes sandy, some gravel at 2.0 feet			☒	●	
	Dense, black stained red-brown, fine to coarse, clayey GRAVEL with cobbles (GC); moist, subangular (decomposed basalt).	3.0				
5.0						
7.5	becomes dense to very dense, yellow-brown and red-brown with black staining; relict rock structure (decomposed to intensely weathered basalt) at 6.5 feet		ATT	☒	●	LL = 57% PL = 39%
10.0						
12.5	becomes green-gray, red-brown, and black at 12.0 feet			☒		
	with boulders at 14.0 feet					
	Exploration completed at a depth of 14.5 feet.	14.5				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88445077750 Longitude: -123.01057628000
15.0						
17.5						
20.0						

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TEST PIT TP-7

MARCH 2012

KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-7

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	COMMENTS
0.0	Medium stiff, red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).		PP	PP = 1.0 tsf
			PP	PP = 1.0 tsf
2.5	Dense, black stained red-brown and yellow-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular to angular (decomposed basalt).	2.5		
5.0	relict rock structure at 5.0 feet			
	with yellow veining at 6.0 feet			
7.5	becomes dense to very dense; intensely weathered at 8.0 feet			
10.0				
12.5				
14.5	Exploration completed at a depth of 14.5 feet.	14.5		No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88476544310 Longitude: -123.00994544500
15.0				
17.5				
20.0				

GRAPHIC LOG

SAMPLE

● MOISTURE CONTENT %

0 50 100

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LOGGED BY: CMC

COMPLETED: 01/30/12

EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-8

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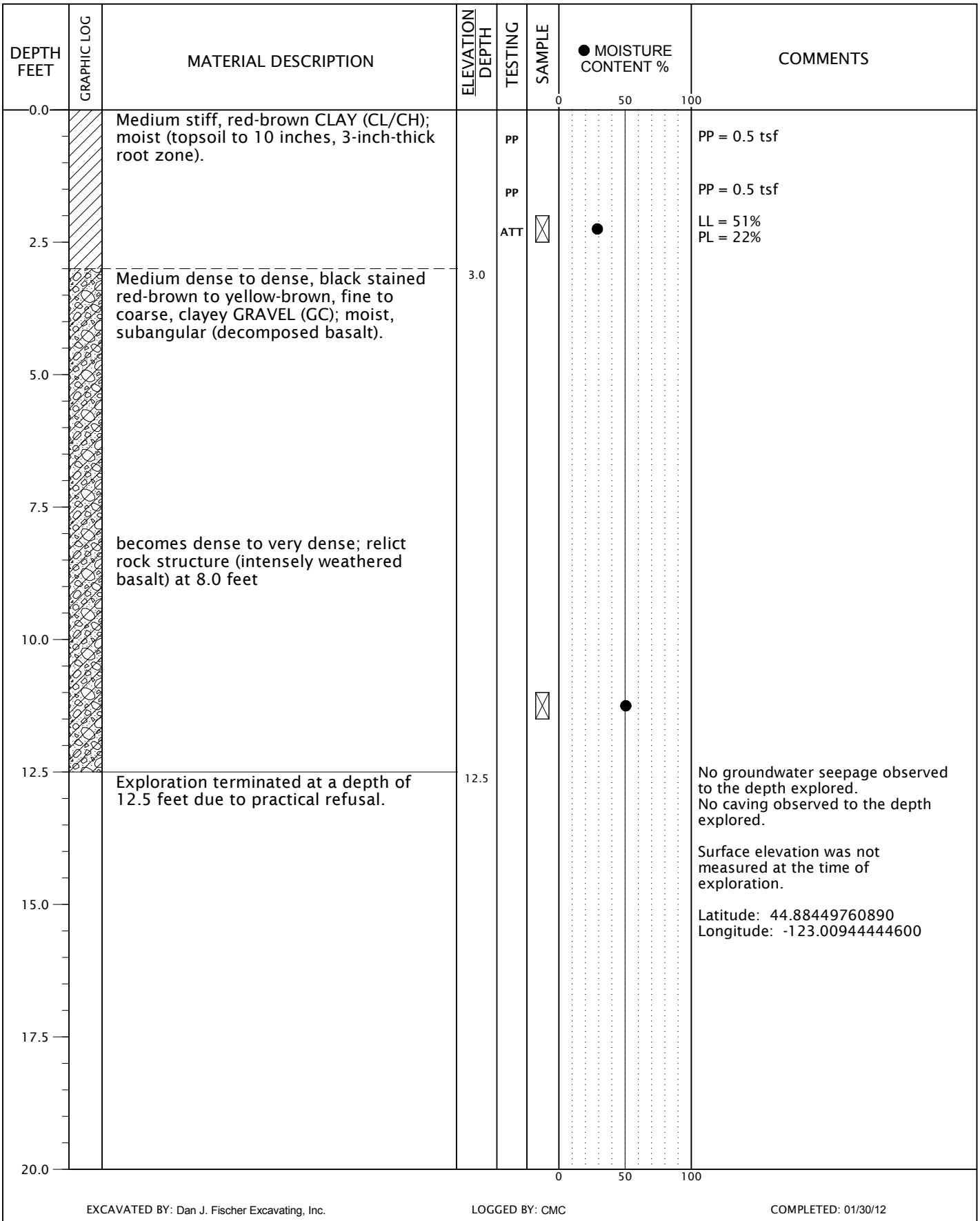
SALEM, OR

FIGURE A-8

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT



TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

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TEST PIT TP-9

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SALEM, OR

FIGURE A-9

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff, red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 2-inch-thick root zone).		PP			PP = 0.5 tsf
			PP			PP = 0.5 tsf
2.5			ATT	☒	●	LL = 58% PL = 23%
			PP			PP = 2.0 tsf
	Medium dense, black stained red-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular.	3.5				
5.0	becomes dense to very dense, yellow-brown, with boulders (intensely weathered basalt) at 5.5 feet					
7.5				☒	●	
10.0	becomes red-brown and gray, with boulders; moist to wet at 10.0 feet					Slow groundwater seepage observed at 10.0 feet.
				☒		
	Exploration terminated at a depth of 11.5 feet due to practical refusal.	11.5				No caving observed to the depth explored.
12.5						Surface elevation was not measured at the time of exploration.
						Latitude: 44.88402227620 Longitude: -123.00982511600
15.0						
17.5						
20.0						

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: CMC COMPLETED: 01/30/12

EXCAVATION METHOD: trackhoe (see report text)

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PACTRUST-162-01

TEST PIT TP-10

MARCH 2012

KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-10

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff, brown CLAY (CL/CH); moist (topsoil to 8 inches, 3-inch-thick root zone).		PP			PP = 0.5 tsf
	Medium dense to dense, black stained red-brown to yellow-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	1.0				
2.5				☒	●	
	with cobbles at 4.0 feet					
5.0						Slow groundwater seepage observed at 6.0 feet.
	becomes dense to very dense; moist to wet, relict rock structure (decomposed to intensely weathered basalt) at 6.0 feet			☒		
7.5						
10.0						
12.5						
	Exploration completed at a depth of 13.0 feet.	13.0				No caving observed to the depth explored.
						Surface elevation was not measured at the time of exploration.
15.0						Latitude: 44.88357910870 Longitude: -123.00935445200
17.5						
20.0						

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: CMC COMPLETED: 01/30/12

EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-11

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FIGURE A-11

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff to stiff, red-brown CLAY (CL/CH); moist (topsoil to 8 inches, 3-inch-thick root zone).		PP			PP = 1.0 tsf
			PP			PP = 1.5 tsf
	becomes sandy, trace gravel at 2.0 feet			☒	●	
2.5	Medium dense to dense, black stained red-brown to green-brown, fine to coarse, clayey GRAVEL (GC); moist to wet, subangular (decomposed basalt).	2.5				
5.0						Slow to moderate groundwater seepage observed at 6.0 feet.
	becomes wet; vesicular at 7.0 feet			☒		
7.5						
10.0						
	Stiff, red to orange, gravelly CLAY (CL/CH); wet (interflow zone).	11.0				
12.5						
	Medium dense, red-brown, fine to coarse, clayey GRAVEL with sand (GC); wet, subangular (decomposed top of basalt flow).	13.0	ATT	☒	●	LL = 89% PL = 50%
	Exploration completed at a depth of 13.5 feet.	13.5				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88328710950 Longitude: -123.00979345300
15.0						
17.5						
20.0						

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EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-12

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, red-brown CLAY (CL/CH); moist (topsoil to 8 inches, 3-inch-thick root zone).					
2.5		becomes wet at 2.5 feet					Moderate to rapid groundwater seepage observed at 2.5 feet.
		Medium dense, red-brown to brown, fine to coarse, clayey GRAVEL (GC); wet, subangular (decomposed basalt).	3.5				
5.0					☒		
7.5							
10.0		Exploration completed at a depth of 10.0 feet.	10.0				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88298160850 Longitude: -123.00927112200
12.5							
15.0							
17.5							
20.0						0 50 100	

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FIGURE A-13

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

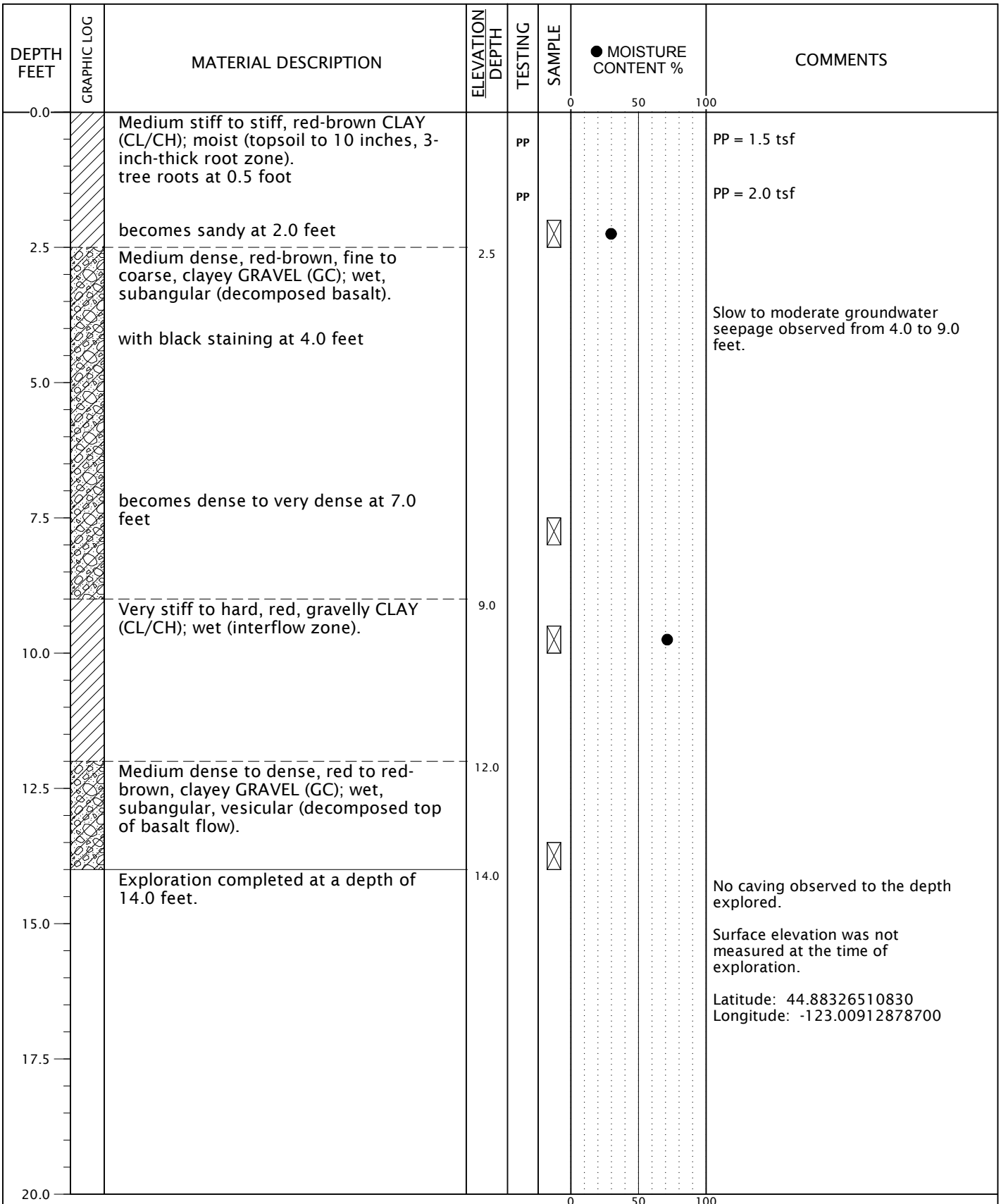

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FIGURE A-14

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	COMMENTS
0.0	Medium stiff, brown to red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 2-inch-thick root zone).		PP	PP = 1.0 tsf
			PP	PP = 0.5 tsf
2.5	Medium dense, black stained red-brown to green-gray, fine to coarse, clayey GRAVEL with boulders (GC); moist, subangular (decomposed basalt).	2.5		
5.0	becomes dense to very dense at 5.5 feet			
7.5	with boulders at 7.0 feet			
	Exploration terminated at a depth of 9.0 feet due to practical refusal on boulders.	9.0		No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88425744140 Longitude: -123.00895778100
10.0				
12.5				
15.0				
17.5				
20.0				

SAMPLE / MOISTURE CONTENT %: 0 50 100

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FIGURE A-15

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff, red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).					
	becomes stiff, sandy at 2.0 feet					
2.5	Medium dense, black stained red-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	3.0				
5.0	becomes dense; relict rock structure (decomposed to intensely weathered basalt) at 6.0 feet					
7.5	becomes gray-brown with black staining (intensely weathered basalt) at 9.0 feet					
10.0	becomes vesicular at 12.5 feet					
12.5	Exploration completed at a depth of 13.0 feet.	13.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88500210820 Longitude: -123.00898111000
15.0						
17.5						
20.0						

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EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-16

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff to stiff, red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).		PP			PP = 1.5 tsf
	with gravel at 2.0 feet		PP			PP = 1.0 tsf
2.5	Medium dense, black stained red-brown to orange, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	2.5				
5.0	becomes dense to very dense, coarse, with boulders; angular, relict rock structure at 5.0 feet					
	becomes very dense, red-brown and gray at 7.0 feet					Hard excavating at 7.0 feet
7.5	becomes intensely to moderately weathered, moderately fractured (competent bedrock) at 7.5 feet	7.5				No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
	Exploration terminated due to refusal at a depth of 7.5 feet.					Surface elevation was not measured at the time of exploration. Latitude: 44.88456127400 Longitude: -123.00852077900
10.0						
12.5						
15.0						
17.5						
20.0						

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EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-17

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Stiff, red-brown CLAY with boulders and cobbles (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).		PP			PP = 1.5 tsf
				PP			PP = 1.0 tsf
2.5		Medium dense to dense, black stained red-brown, fine to coarse, clayey GRAVEL with cobbles and boulders (GC); moist, subangular (decomposed basalt).	2.5		☒	●	
5.0		becomes dense to very dense; angular, relict rock structure at 6.0 feet becomes red-brown and gray, with boulders at 7.0 feet					
7.5		becomes intensely to moderately weathered, moderately fractured (competent bedrock) at 8.5 feet					Hard excavating at 8.5 feet
10.0					☒		
		Exploration terminated due to practical refusal at a depth of 11.0 feet.	11.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88388377380 Longitude: -123.00840645000
12.5							
15.0							
17.5							
20.0						0 50 100	

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FIGURE A-18

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Stiff, red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).		PP			PP = 1.5 tsf
				PP			PP = 1.0 tsf
2.5		becomes stiff to very stiff, sandy at 2.0 feet			☒	●	
		becomes moist to wet at 3.5 feet					Slow groundwater seepage observed at 3.5 feet.
		Stiff, yellow to red SILT (ML/MH), some gravel and clay; moist to wet (interflow zone).	4.0				
5.0							
		Medium dense to dense, red-brown, fine to coarse, clayey GRAVEL (GC); wet, subangular, vesicular (decomposed basalt flow top).	7.0		☒		
7.5							
10.0		becomes coarse; angular at 10.0 feet					
		Exploration completed at a depth of 12.0 feet.	12.0				Rapid groundwater seepage observed at 12.0 feet. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88316177360 Longitude: -123.00832178700
12.5							
15.0							
17.5							
20.0							

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EXCAVATION METHOD: trackhoe (see report text)

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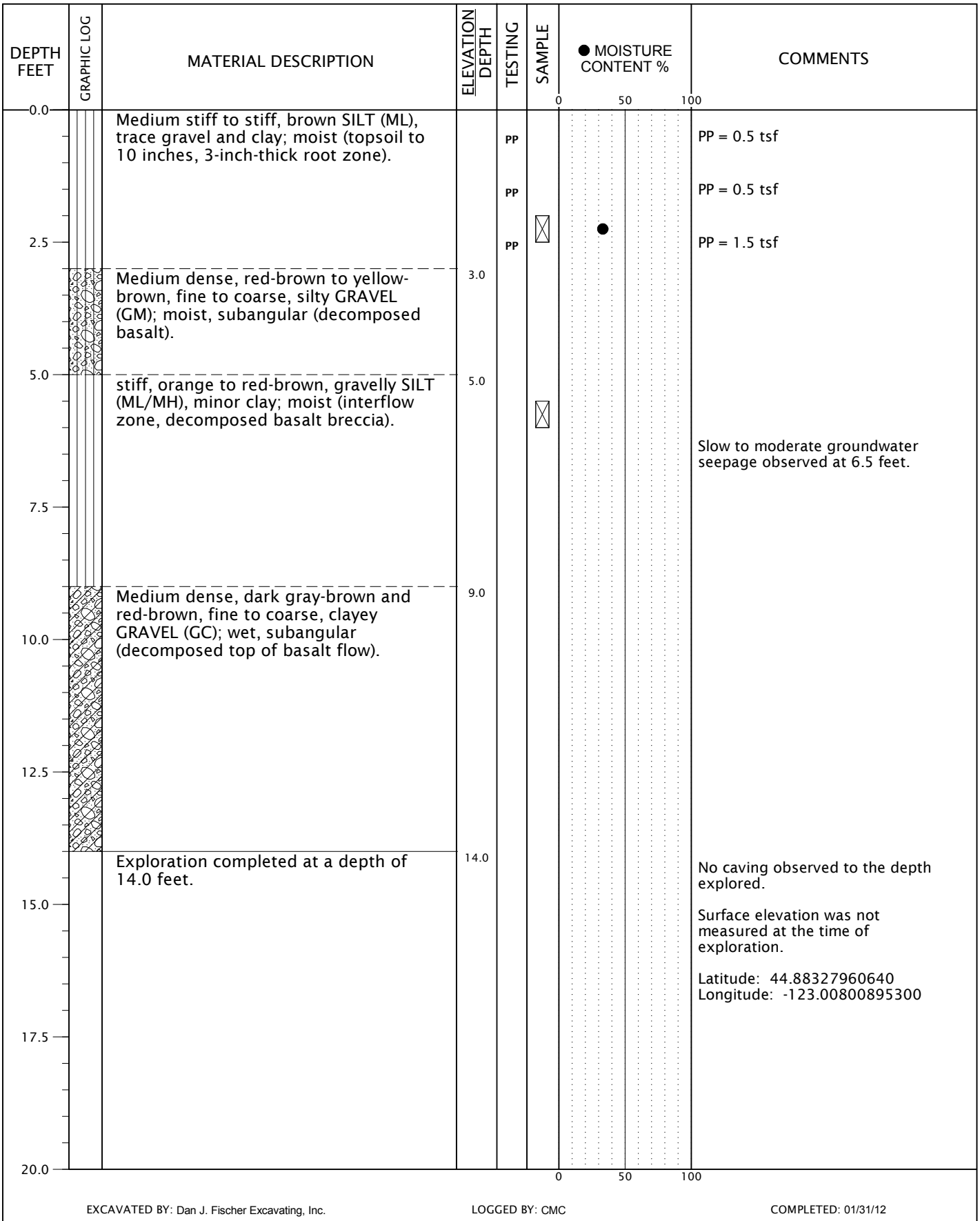
FIGURE A-19



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EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-20

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Stiff, red-brown CLAY (CL/CH), some sand; moist (topsoil to 8 inches, 2-inch-thick root zone).		PP			PP = 1.0 tsf
		Medium dense to dense, black stained red-brown to yellow-brown, fine to coarse, clayey GRAVEL with cobbles and boulders (GC); moist, subangular (decomposed basalt).	1.0		☒	●	
2.5		becomes very dense at 4.0 feet					
5.0					☒		
		Exploration terminated due to refusal on large boulders (>3-foot diameter) at a depth of 7.0 feet.	7.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88423860650 Longitude: -123.00804111500
7.5							
10.0							
12.5							
15.0							
17.5							
20.0						0 50 100	

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FIGURE A-21

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff, red-brown CLAY with boulders (CL/CH); moist (topsoil to 8 inches, 2-inch-thick root zone).		PP			PP = 1.0 tsf
			PP			PP = 0.5 tsf
2.5	Medium dense, black stained red-brown to yellow-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	2.5				
5.0	becomes medium dense to dense, coarse; moist to wet, angular, relict rock structure at 5.5 feet					Slow groundwater seepage observed at 5.5 feet.
7.5	becomes very dense, red-brown and gray, with boulders at 7.0 feet					
10.0	Exploration completed at a depth of 10.0 feet.	10.0				No caving observed to the depth explored.
						Surface elevation was not measured at the time of exploration.
						Latitude: 44.88519460650 Longitude: -123.00798010900
12.5						
15.0						
17.5						
20.0						

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EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-22

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DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff, red-brown CLAY (CL/CH), minor gravel; moist (topsoil to 8 inches, 2-inch-thick root zone).		PP			PP = 0.5 tsf
	Medium dense to dense, black stained red-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	1.5				
2.5				☒	●	
5.0	becomes dense to very dense, coarse; angular at 6.0 feet			☒		
7.5						Slow groundwater seepage observed at 8.0 feet.
10.0	becomes red-brown and black; wet, vesicular at 10.0 feet			☒		
12.5						
	Exploration completed at a depth of 13.0 feet.	13.0				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88483943890 Longitude: -123.00741827800
15.0						
17.5						
20.0						

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: CMC COMPLETED: 01/31/12

EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-23

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Stiff, red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 2-inch-thick root zone).		PP			PP = 1.0 tsf
				PP			PP = 1.0 tsf
2.5		Medium dense to dense, black stained red-brown, fine to coarse, clayey GRAVEL with boulders (GC); moist, subangular (decomposed basalt).	2.5		☒	●	
5.0		becomes dense to very dense; angular at 5.0 feet					
7.5					☒		Slow groundwater seepage observed at 9.0 feet.
		becomes moist to wet (intensely weathered basalt) at 9.0 feet					
10.0		Exploration completed at a depth of 10.0 feet.	10.0				No caving observed to the depth explored.
							Surface elevation was not measured at the time of exploration.
							Latitude: 44.88401393850 Longitude: -123.00724978300
12.5							
15.0							
17.5							
20.0							

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EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-24

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DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Stiff, red-brown CLAY (CL/CH), minor gravel; moist (topsoil to 8 inches, 2-inch-thick root zone).					
		Dense to very dense, black stained red-brown, fine to coarse, clayey GRAVEL with cobbles and boulders (GC); moist to wet, subangular to angular (decomposed to intensely weathered basalt).	1.0				
2.5							Difficult excavating at 4.0 feet
5.0		becomes green-gray, black, and red-brown; angular (intensely weathered, intensely fractured basalt) at 5.0 feet			☒	●	
7.5		with boulders at 7.5 feet					
		Exploration terminated at a depth of 8.0 feet due to refusal on boulders.	8.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88353477200 Longitude: -123.00736578500
10.0							
12.5							
15.0							
17.5							
20.0							

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EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-25

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, brown CLAY (CL/CH); moist (topsoil to 12 inches, 3-inch-thick root zone).		PP			PP = 1.0 tsf
				PP			PP = 0.5 tsf
2.5		becomes gray-brown; wet at 2.5 feet		ATT	☒	●	LL = 48% PL = 25% Rapid groundwater seepage observed at 2.5 feet.
		Medium dense, black stained and yellow veined gray-brown, fine to coarse, clayey GRAVEL (GC); wet, subangular to angular (decomposed basalt).	4.0				
5.0							
7.5					☒		
		Exploration completed at a depth of 8.0 feet.	8.0				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88306493760 Longitude: -123.00673862100
10.0							
12.5							
15.0							
17.5							
20.0							

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EXCAVATION METHOD: trackhoe (see report text)

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FIGURE A-26

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium dense, brown, silty GRAVEL with cobbles and boulders (GM); moist (topsoil to 6 inches, 3-inch-thick root zone).					
		Medium dense, black stained red-brown to yellow-brown, clayey GRAVEL (GC); wet, subangular to angular (decomposed to intensely weathered basalt).	2.0		☒	●	
5.0							
7.5		becomes dense to very dense, dark green-gray and red-brown at 8.0 feet			☒		
		Exploration completed at a depth of 9.0 feet.	9.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88376910470 Longitude: -123.00696728400
10.0							
12.5							
15.0							
17.5							
20.0							

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FIGURE A-27

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff to stiff, red-brown CLAY with boulders (CL/CH); moist (topsoil to 12 inches, 2-inch-thick root zone).		PP			PP = 1.0 tsf
			PP			PP = 1.0 tsf
2.5	Medium dense to dense, black stained red-brown to yellow-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	2.5				
5.0						
7.5	becomes dense, dark gray and red-brown, coarse; angular, vesicular at 7.0 feet					
	becomes moist to wet at 9.0 feet					Slow groundwater seepage observed at 9.5 feet.
10.0	Exploration completed at a depth of 10.0 feet.	10.0				No caving observed to the depth explored.
						Surface elevation was not measured at the time of exploration.
12.5						Latitude: 44.88431677110 Longitude: -123.00677478100
15.0						
17.5						
20.0						

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: CMC COMPLETED: 01/31/12

EXCAVATION METHOD: trackhoe (see report text)

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PACTRUST-162-01

TEST PIT TP-28

MARCH 2012

KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-28

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, red-brown CLAY with boulders (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).		PP			PP = 0.5 tsf
		Medium dense, black stained red-brown to yellow-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	1.5		☒	●	
2.5							
		becomes medium dense to dense, with cobbles and boulders at 4.0 feet					
5.0							
7.5					☒		
		Exploration completed at a depth of 8.0 feet.	8.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88524643810 Longitude: -123.00696777600
10.0							
12.5							
15.0							
17.5							
20.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: CMC COMPLETED: 01/31/12

EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-29

MARCH 2012

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SALEM, OR

FIGURE A-29

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Medium stiff to stiff, red-brown CLAY with cobbles (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).		PP			PP = 1.0 tsf
			PP			PP = 1.5 tsf
2.5	becomes stiff, sandy at 3.0 feet		PP	☒	●	PP = 3.0 tsf
5.0	becomes moist to wet, weakly indurated, blocky structure at 5.0 feet			☒		Slow groundwater seepage observed at 5.0 feet.
7.5						
	with red-brown and gray-brown mottles at 9.0 feet					Moderate groundwater seepage observed at 9.0 feet.
10.0				☒		
	Exploration completed at a depth of 11.0 feet.	11.0				No caving observed to the depth explored.
12.5						Surface elevation was not measured at the time of exploration.
						Latitude: 44.88491726930 Longitude: -123.00570877800
15.0						
17.5						
20.0						

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: CMC COMPLETED: 01/31/12

EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-30

MARCH 2012

KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-30

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0		Medium stiff, red-brown CLAY (CL/CH), some gravel; moist (topsoil to 10 inches, 3-inch-thick root zone).		PP			PP = 0.5 tsf
		Medium dense, black stained red-brown, fine to coarse, clayey GRAVEL (GC); moist, subangular (decomposed basalt).	1.5		☒	●	
2.5							
5.0					☒		
		becomes dense to very dense, red-brown and dark gray with yellow veining, coarse; angular, vesicular (decomposed to intensely weathered basalt breccia) at 6.0 feet					
7.5							
10.0		becomes gray-brown, yellow-brown, and red-brown at 10.0 feet					
		Exploration completed at a depth of 11.0 feet.	11.0				No groundwater seepage observed to the depth explored. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration. Latitude: 44.88424293620 Longitude: -123.00588761500
12.5							
15.0							
17.5							
20.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: CMC COMPLETED: 01/31/12

EXCAVATION METHOD: trackhoe (see report text)

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TEST PIT TP-31

MARCH 2012

KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-31

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	MOISTURE CONTENT % (0 50 100)	COMMENTS
0.0	Stiff, brown to red-brown CLAY (CL/CH); moist (topsoil to 10 inches, 3-inch-thick root zone).		PP			PP = 1.0 tsf
			PP			PP = 1.0 tsf
			PP			PP = 2.5 tsf
2.5	becomes very stiff, sandy at 3.0 feet		PP	☒	●	PP = 4.0 tsf
						Slow groundwater seepage observed at 4.5 feet.
5.0	with gravel and cobbles at 6.0 feet					
7.5	Stiff to very stiff, yellow-brown, red-brown, and dark gray, gravelly SILT (ML/MH), minor clay; moist to wet, vesicular, relict rock structure (decomposed basalt breccia).	7.5		☒		
10.0						
	Exploration completed at a depth of 11.0 feet.	11.0				No caving observed to the depth explored.
12.5						Surface elevation was not measured at the time of exploration.
						Latitude: 44.88360910260 Longitude: -123.00573978500
15.0						
17.5						
20.0						

EXCAVATED BY: Dan J. Fischer Excavating, Inc. LOGGED BY: CMC COMPLETED: 01/31/12

EXCAVATION METHOD: trackhoe (see report text)

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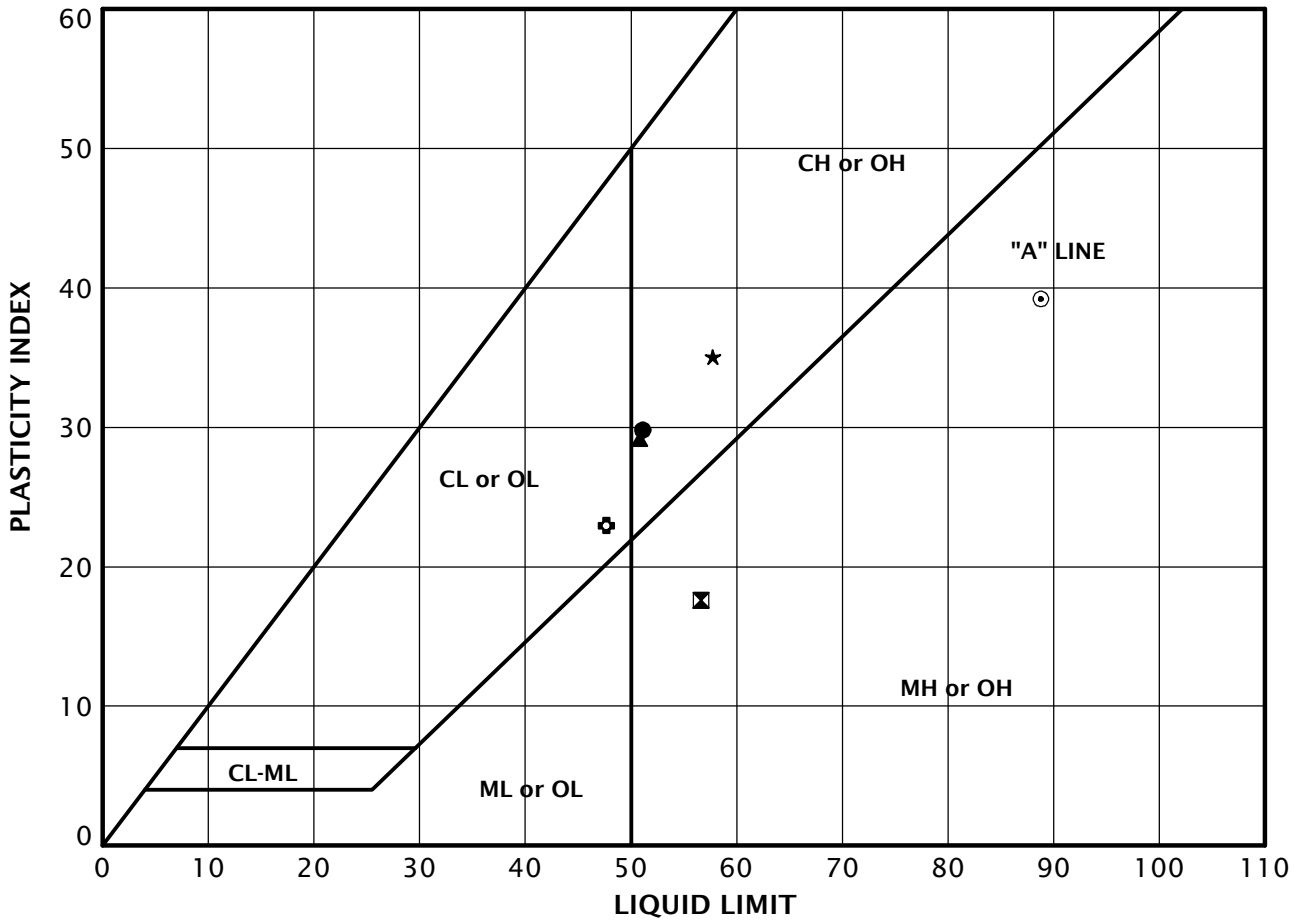
TEST PIT TP-32

MARCH 2012

KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-32

TEST PIT LOG - 1 PER PAGE PACTRUST-162-01-TP1_32.GPJ GEODESIGN.GDT PRINT DATE: 3/30/12:KT



KEY	EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	MOISTURE CONTENT (PERCENT)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
●	TP-2	2.0	29	51	21	30
⊠	TP-7	8.0	49	57	39	18
▲	TP-9	2.0	29	51	22	29
★	TP-10	2.0	32	58	23	35
⊙	TP-12	13.0	86	89	50	39
✿	TP-26	2.0	34	48	25	23

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PACTRUST-162-01	**ATTERBERG LIMITS TEST RESULTS**	
MARCH 2012	KUEBLER BOULEVARD PROPERTY SALEM, OR	**FIGURE A-33**

SAMPLE INFORMATION			MOISTURE CONTENT (PERCENT)	DRY DENSITY (PCF)	SIEVE			ATTERBERG LIMITS		
EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	ELEVATION (FEET)			GRAVEL (PERCENT)	SAND (PERCENT)	P200 (PERCENT)	LIQUID LIMIT (PERCENT)	PLASTIC LIMIT (PERCENT)	PLASTICITY INDEX (PERCENT)
TP-1	2.0		32							
TP-1	6.0		49							
TP-2	2.0		29					51	21	30
TP-2	7.0		37							
TP-3	2.0		30							
TP-4	3.0		49							
TP-5	2.0		31							
TP-5	8.0		63							
TP-6	2.0		41							
TP-6	8.0		55							
TP-7	2.0		31							
TP-7	8.0		49					57	39	18
TP-8	3.0		32							
TP-8	9.0		54							
TP-9	2.0		29					51	22	29
TP-9	11.0		51							
TP-10	2.0		32					58	23	35
TP-10	7.0		48							
TP-11	3.0		46							
TP-12	2.0		28							
TP-12	13.0		86					89	50	39
TP-14	2.0		30							
TP-14	9.5		71							
TP-15	2.0		30							
TP-15	7.0		49							
TP-16	3.5		32							
TP-16	9.0		44							

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SUMMARY OF LABORATORY DATA

MARCH 2012

KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-34

SAMPLE INFORMATION			MOISTURE CONTENT (PERCENT)	DRY DENSITY (PCF)	SIEVE			ATTERBERG LIMITS		
EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	ELEVATION (FEET)			GRAVEL (PERCENT)	SAND (PERCENT)	P200 (PERCENT)	LIQUID LIMIT (PERCENT)	PLASTIC LIMIT (PERCENT)	PLASTICITY INDEX (PERCENT)
TP-17	2.0		28							
TP-17	7.0		43							
TP-18	3.0		30							
TP-19	2.0		35							
TP-20	2.0		33							
TP-21	2.0		30							
TP-22	2.0		30							
TP-23	3.0		39							
TP-24	2.0		29							
TP-25	5.0		40							
TP-26	2.0		34					48	25	23
TP-27	3.0		41							
TP-28	2.0		28							
TP-29	2.0		28							
TP-30	3.0		35							
TP-31	2.0		42							
TP-32	3.0		35							

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SUMMARY OF LABORATORY DATA
(continued)

MARCH 2012

KUEBLER BOULEVARD PROPERTY
SALEM, OR

FIGURE A-34

ACRONYMS

ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AC	asphalt concrete
ASTM	American Society for Testing and Materials
BGS	below ground surface
CRBG	Columbia River Basalt Group
ESAL	equivalent single-axle load
g	gravitational acceleration (32.2 feet/second^2)
GPS	global positioning system
H:V	horizontal to vertical
HMAC	hot mixed asphalt concrete
IBC	International Building Code
KBP	Kuebler Boulevard property
OSSC	Oregon Standard Specifications for Construction (2008)
pcf	pounds per cubic foot
psf	pounds per square foot
psi	pounds per square inch
SOSSC	State of Oregon Structural Specialty Code