

**Report of Geotechnical
Engineering Services**

Modera West Linn

West Linn, Oregon

September 16, 2025

Geotechnical ■ Environmental ■ Special Inspections

Columbia West
Engineering, Inc



September 16, 2025

MCRT Investments LLC
720 SW Washington Street, Suite 720
Portland, OR 97205

Attention: Chad Encinas

**Re: Report of Geotechnical Engineering Services
Modera West Linn
Tannler Drive and Blankenship Road
West Linn, Oregon
CWE Project: MCRT-1-01-1**

Columbia West Engineering, Inc. (Columbia West) is pleased to present this report of geotechnical engineering services for the Modera West Linn project located in West Linn, Oregon. Our services were conducted in accordance with the Professional Services Contract for Projects in Oregon between MCRT Investments LLC and Columbia West dated July 9, 2025.

We appreciate the opportunity to work on the project. Please contact us if you have any questions regarding this report.

Sincerely,



Najib A. Kalas, PE
Principal Engineer



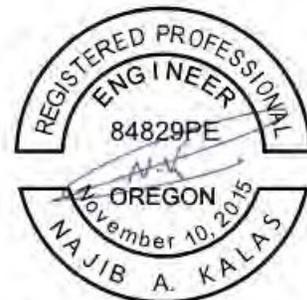
Brett A. Shipton, PE, GE
Principal Engineer

cc: Tim Urben, MCRT Investments LLC

GLW:NAK:BAS:kat

Attachments

Document ID: MCRT-1-01-1-091625-geor-rev.docx



EXPIRES: 06/30/27

January 27, 2026

MCRT Investments LLC
720 SW Washington Street, Suite 720
Portland, OR 97205

Attention: Chad Encinas

**Re: Addendum 1
Onsite Infiltration
Modera West Linn
Tannler Drive and Blankenship Road
West Linn, Oregon
CWE Project: MCRT-1-01-1**

INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) is pleased to submit this addendum to the geotechnical engineering report for the Modera West Linn project located in West Linn, Oregon.¹

INFILTRATION SYSTEMS

As summarized in our report, our site explorations generally encountered root zone and topsoil underlain by zones of silt (colluvium). Also, prior explorations (by others) encountered localized zone of undocumented fill. Decomposed to weathered basalt was encountered below the topsoil, fill, and silt units.

Due to the presence of steep slopes at the site and subsurface conditions summarized above, we do not recommend that stormwater drainage be infiltrated on the site. Stormwater should be routed to an appropriate stormwater management system.



¹ Columbia West 2025. *Report of Geotechnical Engineering Services; Modera West Linn; Tannler Drive and Blankenship Road; West Linn, Oregon*, dated September 16, 2025, CWE Project: MCRT-1-01-1.

We appreciate the opportunity to submit this addendum. Please do not hesitate to contact us if you have questions or require additional information.

Sincerely,

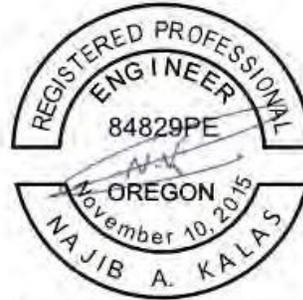


Najib A. Kalas, PE
Principal Engineer

cc: Tim Urban, MCRT Investments LLC
Sam Rodriguez, MCRT Investments LLC
Ryan Mosher, Harper Houf Peterson Righellis, Inc

NAK

Document ID: MCRT-1-01-1-012726-geoa-1



EXECUTIVE SUMMARY

This executive summary presents the primary geotechnical considerations associated with the proposed Modera West Linn project located in West Linn, Oregon. Our conclusions and recommendations are based on the subsurface information presented in the report and proposed development information provided by the design team. Detailed discussion of the geotechnical considerations summarized here is presented in respective sections of the report.

- Shallow basalt bedrock was encountered at the site. The upper portion of the bedrock is weathered and decomposed and was possible to excavate using small excavator with a toothed bucket. The underlying intact bedrock could not be penetrated by the excavator, even with significant effort. Some site cuts are proposed below intact bedrock elevations, which will likely require specialized excavation methods such as hydraulic breakers, rock trenchers, or blasting.
- Contract bid documents should require that contractors list a unit cost for rock excavation using in-place (bank) volumes, which can be measured by surveying. The unit cost should not be provided in excavated (swelled) volumes, which are more difficult to accurately measure.
- Based on the results of our explorations and analysis, proposed structures can be supported by spread footings bearing on firm, native soil and rock or engineered structural fill overlying undisturbed native material. Differential settlement may result where buildings are founded partially on bedrock and partially on soil. Differential settlement can be minimized by use of compacted gravel pads for footings established over the native silt or gravelly soil. Our foundation recommendations are provided in Section 6.1 (Foundation Support).
- Floor slabs for some of the structures may also span soil and bedrock. There is a potential for differential settlement or reflection cracking of floor slabs along bedrock/soil interfaces. We recommend that the floor slab base section be increased to a minimum of 12 inches along such interfaces. More detailed recommendations are presented in Section 6.2 (Floor Slabs).
- Liquefaction, lateral spreading, and fault rupture are not considered hazards at the site.
- Near-surface, fined-grained soil is sensitive to disturbance and softening when at a moisture content that is above optimum. Granular access pads and staging areas will be necessary to minimize damage to exposed subgrade soil during construction. Subgrade protection is discussed in Section 7.2 (Construction Traffic and Staging).
- Moisture conditioning (drying) of on-site silt and gravelly soil will be required to use the material as structural fill. Accordingly, on-site soil will likely only be suitable for use as structural fill during the dry season.

- The on-site basalt can be used as general structural fill, provided it is adequately processed to smaller particles sizes and to a well-graded (non-uniform) state.
- Groundwater may become perched on the shallow bedrock during periods of persistent rainfall and may impact site cuts, retaining walls, and below-grade structures. Adequate drainage will be essential behind retaining walls to intercept perched groundwater flow and convey it away from proposed structures. Foundation perimeter drains will also be required where upslope footing excavations extend below the level of the basalt rock surface.
- The conceptual site and grading plan dated August 29, 2025, indicates that significant cuts of up to approximately 25 feet and associated retaining walls may be proposed at the site. Our scope of services did not include exploration of the intact basalt using rock coring techniques. For proposed cuts and walls exceeding 15 feet in height, we recommend additional exploration via rock coring to evaluate the presence of bedding planes and assess the feasibility of constructing large, over-steepened cuts into the rock. We should also be contacted to review site grading plans as they are developed to provide appropriate recommendations for additional exploration and analysis. Further, we recommend that site retaining walls be designed on a case-by-case basis with input from a qualified geotechnical engineer. Based on the current conceptual plan, we anticipate that up to three borings with rock coring to depths between approximately 25 and 35 feet BGS will be required.

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ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AC	asphalt concrete
ACP	asphalt concrete pavement
ASCE	American Society of Civil Engineers
ASTM	ASTM International
BGS	below ground surface
CRBG	Columbia River Basalt Group
g	gravitational acceleration (32.2 feet/second ²)
H:V	horizontal to vertical
km	kilometer(s)
MCE	maximum considered earthquake
OSHA	Occupational Safety and Health Administration
OSSC	2024 Oregon Standard Specifications for Construction
pcf	pounds per cubic foot
pci	pounds per cubic inch
PG	performance grade
psf	pounds per square foot
psi	pounds per square inch
SOSSC	State of Oregon Structural Specialty Code
USGS	U.S. Geological Survey
WGS 84	World Geodetic System 1984

REPORT OF GEOTECHNICAL ENGINEERING SERVICES MODERA WEST LINN WEST LINN, OREGON

1.0 INTRODUCTION

Columbia West is pleased to submit this report of geotechnical engineering services for the Modera West Linn project located in West Linn, Oregon. The 11.41-acre site is located northwest of the intersection of Tannler Drive and Blankenship Road. The site is shown relative to surrounding physical features on Figure 1. Existing conditions and current exploration locations are shown on Figure 2. A description of our field exploration program and the exploration logs are presented in Appendix A. A description of the laboratory testing program and the test results are presented in Appendix B. Prior explorations by others are presented in Appendix C. Abbreviations and acronyms used herein are defined immediately following the Table of Contents.

2.0 PROJECT UNDERSTANDING

The conceptual site and grading plan dated August 29, 2025, shown on Figure 3, indicates that the proposed development includes several up to four-story, wood-framed residential buildings; mixed-use residential and commercial buildings; a community center/clubhouse; carports; garages; and office buildings with associated infrastructure, including swimming pools, pavement, and utilities. Tannler Drive will be realigned to accommodate the proposed development.

Foundation loads were not available at the time of this report; however, we have assumed maximum column and wall loads will be less than 200 kips and less than 4.5 kips per lineal foot, respectively. We estimate the distributed slab live load is less than 100 psf. Preliminary spot-grading information provided by the design team indicates that deep cuts and associated retaining walls with exposed heights of up to approximately 25 feet are planned for the proposed development. Fills on the order of approximately 10 feet or more may also be proposed. We should be contacted to revise our recommendations if the assumptions stated above are incorrect.

3.0 BACKGROUND

In preparing this report, we reviewed the following documents that contain relevant information regarding the site:

- *Report of Geotechnical Engineering Services; Willamette 205 Corporate Center; Blankenship Road and Tannler Drive; West Linn, Oregon, prepared by GeoDesign, Inc., dated July 7, 2006*
- *Report of Geotechnical Engineering Services; NWC of Tannler & Blankenship; Tannler Drive and Blankenship Road; West Linn, Oregon, prepared by GeoDesign, Inc., dated July 28, 2014*

These investigations included 33 test pit excavations that were explored to depths between 3.3 and 13.5 feet BGS. In general, the prior test pit explorations encountered silt to varying depths overlying basalt bedrock. Layers of silty gravel and gravelly silt with cobbles were encountered between the silt and bedrock units in some test pits, which were interpreted as colluvium or

decomposed bedrock. The upper portion of the underlying bedrock was described as decomposed to weathered and fractured and transitions to intact bedrock with depth. The ground surface was reported to be covered by an approximately 2- to 8-inch-thick root zone from surface vegetation. Abundant shrub roots were reportedly observed to depths of 12 to 18 inches. Slow to moderate groundwater seepage was reported in three of the test pits at depths between 3.5 and 10 feet BGS. The findings of our current subsurface exploration program are supplemented by the exploration logs from the 2006 and 2014 reports, which are presented in Appendix C.

4.0 PURPOSE AND SCOPE

The purpose of our services was to provide geotechnical engineering recommendations for use in design and construction of the proposed development. Specifically, we completed the following tasks:

- Reviewed information available in Columbia West's files from previous geological and geotechnical studies conducted at and in the vicinity of the site, including test pit logs and associated laboratory testing prepared by GeoDesign for the site in 2006 and 2014.
- Coordinated and managed the field exploration program, which included locating public and private utilities, coordinating site access, and scheduling subcontractors and Columbia West field staff.
- Excavated 10 test pits to depths between 2 and 6 feet BGS.
- Observed subsurface conditions, maintained continuous logs of the explorations, and collected samples at representative intervals.
- Completed a laboratory testing program using select soil samples collected from the explorations, which included the following:
 - Ten moisture content determinations in general accordance with ASTM D2216
 - Four particle-size analyses in general accordance with ASTM D1140
 - Two Atterberg limits tests in general accordance with ASTM D4318
- Prepared this geotechnical report that includes the following:
 - Summary of soil and groundwater conditions at the site
 - Assessment of seismic hazards
 - Recommendations for foundation support, including allowable bearing capacity, estimated foundation settlement, and lateral resistance parameters for shallow foundations
 - Recommendations for floor slab subgrade preparation
 - Recommendations for retaining walls, including lateral earth pressures, backfill, compaction, and drainage
 - Recommendations for site preparation, including grading and drainage, stripping depths, fill type for imported material, compaction criteria, trench excavation and backfill, use of on-site soil, and wet/dry weather earthwork
 - Recommendations for bedrock excavation
 - Recommendations for managing identified groundwater conditions that may affect the performance of structures and site improvements
 - Recommendations for AC pavement design for on-site access drives and parking areas, including subbase, base course, and AC paving thicknesses
 - Code-based seismic design parameters in accordance with the 2022 SOSSC

5.0 SITE CONDITIONS

5.1 GEOLOGY

The site is located on an upland terrace extending southeast from the Tualatin Mountains. The Tualatin Mountains form the physiographic boundary between the Portland Basin to the north and east, the Tualatin Basin to the west, and the Central Willamette Valley to the south. These basins are part of the larger Puget Sound-Willamette Valley physiographic province, a tectonically active lowland situated between the Coast Range to the west and the Cascade Mountains to the east (Orr and Orr 1999).

Geologic mapping by Schlicker and Finlayson (1979) and Madin (2009) indicates that near-surface geology consists of Miocene-aged (16 million to 12 million years old) basalt flows of the CRBG. The CRBG is a series of basalt flows that originated from southeastern Washington and northeastern Oregon.

5.2 SURFACE CONDITIONS

The 11.41-acre site is bounded by Tannler Drive to the east, Blankenship Road to the south, commercial development to the west, and residential development to the north. The site is generally open, vacant, and covered by grasses and brush. Scattered mature trees are present in the north portion of the site and along property boundaries. The site slopes up to the north, with grades ranging from approximately 12 to 17 percent. Site elevations range from approximately 384 feet at the northern site boundary to 200 feet adjacent to Blankenship Road (WGS 84).

5.3 SUBSURFACE CONDITIONS

Subsurface conditions were explored by excavating 10 test pits (TP-1 through TP-10) to depths between 2 and 6 feet BGS. Our subsurface exploration program was supplemented with previous subsurface explorations conducted at the site by GeoDesign (GeoDesign 2006, 2014). GeoDesign's explorations included 33 test pits excavated to depths between 3.3 and 13.5 feet BGS.

The recent exploration locations are shown on Figures 2 and 3. A description of our field exploration program and the exploration logs are presented in Appendix A. A description of the laboratory testing program and the test results are presented in Appendix B. Prior exploration locations, exploration logs, and laboratory test results prepared by GeoDesign are presented in Appendix C. A summary of the subsurface conditions is presented below.

5.3.1 Root Zone and Topsoil

All of our test pits were explored through surface vegetation consisting of 8 to 12 inches of topsoil and a 2- to 5-inch-thick root zone. The topsoil generally consists of silt with gravel and trace organics. Previous explorations by GeoDesign encountered 2- to 8-inch-thick root zones with up to 18 inches of topsoil that contains abundant shrub roots.

5.3.2 Undocumented Fill

Undocumented fill was encountered in test pit TP-11 of GeoDesign's 2006 field investigation and extends to a depth of 4 feet BGS. The fill consists of silt with trace to some gravel and trace clay.

5.3.3 Silt (Colluvium)

Underlying the topsoil in test pits TP-1 through TP-7, and TP-10, medium stiff silt with varying proportions of gravel extends to depths between 1.5 and 5 feet BGS. This unit represents colluvium. The tested moisture content of the silt ranged from 12 to 23 percent at the time of exploration. Atterberg limits testing indicates that the silt exhibits medium plasticity. Previous explorations by GeoDesign encountered the silt to similar depths.

5.3.4 Decomposed Basalt

Underlying the topsoil in test pits TP-8 and TP-9 and the silt layer in test pit TP-6, gravelly silt to silty gravel extends to depths of 3 to 4 feet BGS. The gravelly silt is stiff to very stiff and the silty gravel is medium dense to very dense. This unit represents decomposed residual soil of the underlying basalt bedrock. The silt and gravel constituents vary across the site based on the degree of decomposition. Our excavator was able to penetrate this unit without much difficulty. Previous explorations by GeoDesign also encountered this unit, which was observed to be up to 8 feet thick. The tested moisture content of the unit ranged from 11 to 33 percent at the time of exploration.

5.3.5 Basalt

All of our test pits met refusal on basalt at depths between 2 and 6 feet BGS. The observed depth to refusal in each test pit is shown on Figures 2 and 3. Many of the previous explorations by GeoDesign also met refusal on basalt at depths between 3.3 and 13.5 feet BGS. The upper portion of the bedrock is generally decomposed to weathered and fractured. Weathering appears to generally decrease with depth. The excavator was able to penetrate the weathered zones of basalt but was unable to penetrate the intact basalt, even with significant effort. Our scope of services did not include exploration of the intact basalt using rock coring techniques. Accordingly, we are unable to assess the degree of weathering and fracturing of the intact basalt. The upper rock layers exposed in the test pits are generally moderately to intensely fractured and very close to close jointed. Based on our experience and prior observations of deep rock coring in the site vicinity, we believe that the upper portion of the intact bedrock is likely highly to slightly weathered and very intensely to moderately fractured.

5.3.6 Groundwater

Groundwater was not observed in our current explorations. Slow to moderate groundwater seepage was reported in three of the previous test pits at depths between 3.5 and 10 feet BGS. According to Snyder (2008), the approximate elevation of the static groundwater table at the site is 175 feet. This elevation corresponds to an approximate depth to groundwater of 25 to 210 feet BGS depending on location and ground surface elevation. Groundwater levels are also subject to seasonal variation and may rise during extended periods of increased precipitation or flooding. During and after periods of rainfall, groundwater will likely become perched on the shallow bedrock formation and travel downslope where it could manifest at the ground surface or in walls where the top of bedrock is exposed by cuts or below-grade structures.

5.4 SEISMIC HAZARDS

5.4.1 Liquefaction

Liquefaction is a phenomenon caused by a rapid increase in pore water pressure that reduces the effective stress between soil particles. Granular soil, which relies on interparticle friction for

strength, undergoes a loss of strength until the excess pore pressures dissipate. In general, loose, saturated sand soil with low silt and clay content is the most susceptible to liquefaction. Low plasticity, silty sand and silt may be moderately susceptible to liquefaction under relatively higher levels of ground shaking. Based on our explorations and the observed shallow depth to bedrock, liquefaction is not considered a hazard at the site.

5.4.2 Lateral Spreading

Lateral spreading is a liquefaction-related seismic hazard and occurs on gently sloping or flat sites underlain by liquefiable sediment adjacent to an open face, such as a riverbank. Liquefied soil adjacent to an open face can flow toward the open face, resulting in lateral ground displacement. Since liquefaction is not a hazard at the site, lateral spreading is not a geotechnical design consideration for the project.

5.4.3 Fault Rupture

Based on USGS interactive fault mapping, the nearest mapped fault to the site is the Canby-Molalla fault, which is located approximately 3 km southwest of the site (USGS 2025). As such, fault rupture is not considered a hazard at the site.

6.0 DESIGN

6.1 FOUNDATION SUPPORT

6.1.1 General

The proposed structures can be supported by spread footings bearing on firm, native soil and rock or engineered structural fill overlying undisturbed native material. For structures near slopes, we recommend foundations have sufficient embedment to provide a minimum 10-foot offset from the free face of the slopes. For existing slopes steeper than 2H:1V or foundations located behind retaining walls, we recommend that foundations or foundation-supporting elements be embedded such that they are set back at least 5 feet from a 2H:1V grade projected from the base of the slope or wall as shown on Figure 4. The minimum footing offsets and embedments indicated above may be ignored for foundations bearing on basalt bedrock.

Foundations should not be supported by undocumented fill, soft soil, or disturbed soil. If encountered, these materials should be improved or completely removed and replaced with structural fill. If footing subgrade soil is above its optimum moisture content at the time of subgrade preparation, we recommend that a minimum of 4 inches of compacted aggregate be placed over exposed subgrade soil to protect it from foot traffic. The aggregate should consist of imported granular material as described in Section 7.4.1 (Structural Fill). Columbia West should observe exposed subgrade prior to placement of crushed aggregate to confirm that the foundation subgrade is prepared in accordance with the recommendations in this report.

6.1.2 Bearing Capacity

Continuous wall and isolated spread footings should be at least 18 inches and 24 inches wide, respectively. The bottoms of exterior footings should be at least 18 inches below the lowest adjacent exterior grade. The bottoms of interior footings should be established at least 12 inches below the base of the slab.

Footings bearing on native silt or silty gravel/gravelly silt subgrade prepared as recommended above should be sized based on an allowable bearing pressure of 2,500 psf. The bearing pressure can be increased to 3,000 psf for footings established on gravel pads and 8,000 psf for footings established on bedrock. These are net bearing pressures; the weight of the footing and overlying backfill can be ignored in calculating footing sizes. The recommended allowable bearing pressures apply to the total of dead plus long-term live loads and may be increased by one-third for short-term loads such as those resulting from wind or seismic forces.

6.1.3 Settlement

There is potential for differential settlement between adjacent columns where one is founded directly on bedrock and the other on native silty soil. Based on the expected column loads, our analyses indicate that columns founded directly on native silt or silty gravel could experience settlement magnitudes up to approximately 0.75 inch, while settlement of columns on bedrock will be negligible. Therefore, the total differential settlement will be up to 0.75 inch.

If this level of differential settlement is not acceptable, we recommend that all foundations be established on either bedrock or 1-foot-thick compacted gravel pads overlying native soil. We estimate that the total settlement for footings established on gravel pads will be less than 0.5 inch; differential settlement between adjacent columns on gravel pads and bedrock will also be less than 0.5 inch. Footing pads should extend at least 6 inches beyond the edges of the footing and consist of imported granular material as described in Section 7.4.1 (Structural Fill). The on-site basalt can be used if it is processed to meet the requirements of imported granular material.

6.1.4 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 bases of the footings. Our analysis indicates that the available passive earth pressure for footings confined by on-site silt and gravelly soil or structural fill is 350 pcf, modeled as an equivalent fluid pressure. The recommended passive pressure can be increased to 800 pcf for footings confined entirely by intact basalt bedrock. Adjacent floor slabs, pavement, or the upper 12-inch depth of 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 faces of the footings and any adjacent downslopes.

For footings in contact with the on-site native silt, a coefficient of friction equal to 0.30 may be used when calculating resistance to sliding. This value may be increased to 0.40 for footings in contact with basalt bedrock, silty gravel, or compacted gravel pads.

6.1.5 Subgrade Observation and Preparation

All footing subgrade should be evaluated by a representative of Columbia West to confirm suitable bearing conditions. Observations should also confirm that loose or soft material, organic material, unsuitable fill, prior topsoil zones, and softened subgrade have been removed. Localized deepening of footing excavations may be required to penetrate any deleterious or soft material, particularly during wet weather conditions. Footing excavations should be backfilled with compacted crushed aggregate.

Excavations that extend into the underlying basalt may require special excavation considerations as discussed in Section 7.3 (Excavation).

6.2 FLOOR SLABS

Floor slabs can be supported on firm, competent, native soil or engineered structural fill prepared as described in this report. Floor slabs with maximum floor loads of 150 psf may be designed assuming a modulus of subgrade reaction, k , of 150 pci.

To provide a capillary break, slabs should be underlain by at least 6 inches of compacted crushed aggregate that contains less than 5 percent fines by dry weight. Geotextile may be used below the crushed aggregate layer to increase subgrade support. Recommendations for floor slab aggregate base and subgrade geotextile are discussed in Section 7.4 (Materials).

We anticipate that floor slabs may be founded partially on bedrock and partially on soil. There is a potential for differential settlement or reflection cracking of floor slabs along bedrock/soil transitions. We recommend that the floor slab base section be increased to a minimum of 12 inches along such transitions to reduce the potential for excessive differential settlement. The thickened section should extend laterally at least 15 feet on either side of the interface. Since the exact location of the soil/rock interface is impossible to predict, sufficient field observation will be necessary during slab preparation to identify these conditions.

The on-site soil will tend to maintain a moderate to 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. Actual selection and design of an appropriate vapor barrier, if needed, should be based on discussions among members of the design team.

All slab subgrade should be evaluated by a member of our geotechnical staff to confirm suitable bearing conditions. Observations should also confirm that loose or soft material, organic material, unsuitable fill, prior topsoil zones, and softened subgrade have been removed and replaced with structural fill. In addition, contaminated base rock for the slabs should be removed and replaced prior to pouring the slab.

6.3 SEISMIC DESIGN CRITERIA

Seismic design for the proposed structures is prescribed by the 2022 SOSSC, which references ASCE 7-16. Based on the results of our subsurface explorations, the site soil and rock conditions meet the criteria for Site Class B. Seismic design parameters for Site Class B are presented in Table 1.

Table 1. Seismic Design Parameters in Accordance with ASCE 7-16

Parameter	Short Period (T_s)	1-Second Period (T_1)
MCE spectral response acceleration, S	$S_s = 0.837 \text{ g}$	$S_1 = 0.378 \text{ g}$
Site class	B	
Site coefficient, F	$F_a = 0.9$	$F_v = 0.8$
Adjusted spectral response acceleration, S_M	$S_{MS} = 0.75 \text{ g}$	$S_{M1} = 0.30 \text{ g}$
Design spectral response acceleration, S_D	$S_{DS} = 0.50 \text{ g}$	$S_{D1} = 0.20 \text{ g}$

6.4 RETAINING STRUCTURES

6.4.1 Assumptions

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. We recommend that a qualified geotechnical engineer perform design calculations for the larger on-site walls once the wall type and geometry has been determined.

The following design parameters may be applicable for larger walls that may be proposed. However, if design is performed by others, Columbia West should review preliminary wall plans to determine if the design parameters are suitable and should review the final wall calculations.

Retaining walls may not be necessary where intact bedrock is encountered. However, we recommend additional exploration via rock coring to evaluate the presence of bedding planes; assess the feasibility of constructing large, over-steepened cuts into the rock; and assess the potential need for retaining walls. Based on the current conceptual plan, we anticipate that at least three borings with rock coring to depths between approximately 25 and 35 feet BGS will be required.

We expect that walls can be constructed directly on top of the intact bedrock. In this case, the project team should consider installing fascia over the entire wall to create a uniform appearance.

6.4.2 Wall Design Parameters

Unrestrained site walls that retain native soil and decomposed bedrock should be designed to resist active earth pressures of 35 to 55 pcf when supporting slopes between 4H:1V and 2H:1V, respectively. These values can be reduced to 25 to 30 pcf for wall supporting moderately weathered bedrock at the same slope angles. Where retained slopes are between inclinations of 4H:1V and 2H:1V, the designer may linearly interpolate between these active earth pressures. For embedded building walls, seismic lateral forces can be modeled assuming a force of $6H^2$ pounds per lineal foot of wall, where H is the height of the wall in feet, and applied as a distributed load with centroid located at $0.6H$ from the base of the wall, where H is the height of the wall.

If retaining walls are restrained from rotation prior to being backfilled, the aforementioned active earth pressures should 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, additional pressures should be accounted for in the wall design. Lateral earth pressures induced by surcharge loads may be estimated using the criteria presented on Figure 5.

The wall footings should be designed in accordance with the guidelines in Section 6.1 (Foundation Support).

6.4.3 Wall Drainage and Backfill

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

Backfill placed behind the walls and extending a horizontal distance of $\frac{1}{2}H$, where H is the height of the retaining wall, should consist of retaining wall select backfill placed and compacted in conformance with Section 7.4.1 (Structural Fill).

A minimum 6-inch-diameter, perforated collector pipe should be placed at the bases 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 walls to within 1 foot of the finish grade. The drain rock and drainage geotextile fabric should meet the specifications in Section 7.4 (Materials). The perforated collector pipes should discharge at an appropriate location away from the bases of the walls. The discharge pipes should not be tied directly into stormwater drain systems, unless measures are taken to prevent backflow into the drainage systems of the walls.

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

6.5 PAVEMENT

We understand that private AC pavement may be proposed for on-site access drives and vehicle parking. Pavement should be installed on compacted subgrade or new engineered fill prepared in conformance with Section 7.1 (Site Preparation). Pavement improvements in the public right-of-way should adhere to jurisdictional guidelines.

6.5.1 Design Values

At the time this report was prepared, the volume of traffic for the development was unknown. Consequently, we have provided pavement sections for automobile-only parking, automobile-only drive aisles, and drive aisles that will also service heavy vehicle traffic (i.e., garbage trucks, semitrucks, etc.). Our pavement recommendations are based on the following design parameters and assumptions:

- Resilient moduli for subgrade soil and aggregate base material were assumed to be 4,000 psi and 20,000 psi, respectively.
- Pavement design life of 20 years with no expected traffic growth.

- Initial and terminal serviceability indices of 4.2 and 2.5, respectively.
- Reliability of 85 percent and standard deviation of 0.4.
- Pavement may be exposed to a fire apparatus load of 75,000 pounds on an infrequent basis.

6.5.2 AC Pavement Sections

Recommended AC pavement sections are presented in Table 2. Material properties and compaction recommendations for AC and aggregate base layers are presented in Section 7.4 (Materials).

Table 2. AC Pavement Sections

Pavement Use	Trucks per Day	AC ¹ (inches)	Aggregate Base ¹ (inches)
Automobile parking	0	2.5	8
Automobile-only drive aisles	0	3	9
Heavy truck areas	Up to 10	4	10.5
	Up to 25	4.5	12.5
	Up to 50	5	14

1. All thicknesses are intended to be the minimum acceptable.

The material thicknesses in Table 2 are intended to be minimum acceptable values for the final condition. The aggregate base thicknesses do not account for construction traffic, and haul roads and staging areas should be used as described in Section 7.2 (Construction Traffic and Staging).

6.6 DRAINAGE

6.6.1 Temporary

During work at the site, the contractor should be made responsible for temporary drainage of surface water as necessary to prevent standing water and/or erosion at the working surface. During rough and finished grading of the site, the contractor should keep all pads and subgrade free of ponding water.

6.6.2 Surface

The ground surface at finished pads should be sloped away from their edges at a minimum 2 percent gradient for a distance of at least 5 feet. Roof drainage from buildings should be directed into solid, smooth-walled drainage pipes that carry the collected water to the storm drain system.

6.6.3 Curtain Drains and Foundation Drains

It is likely that groundwater will become perched on the basalt bedrock layer during periods of persistent rainfall. Groundwater flow could impact downslope buried structures or could daylight in site cuts. Adequate drainage is essential behind retaining walls to serve as a curtain drain to intercept perched groundwater and convey it away from the planned structures. The drain should

be sloped to a suitable discharge point. The following section provides recommendations for retaining wall drains are presented in Section 6.4.3 (Wall Drainage and Backfill).

If upslope footing excavations extend into the weathered and intact bedrock, perimeter footing drains should be installed to convey the perched water away from the structures. The footing drains should be constructed at a minimum slope of approximately 0.5 percent and pumped or drained by gravity to a suitable discharge point. The drains should consist of 4-inch-diameter, perforated drainpipe embedded in a minimum 1-foot-wide zone of crushed drain rock, should extend to near the ground surface, and should be wrapped in geotextile fabric. The invert elevation of the drainpipe should be installed at the base of the footing. The drain rock and drainage geotextile should meet the requirements specified in Section 7.4 (Materials).

6.7 PERMANENT SLOPES

Permanent cut and fill slopes in the on-site soil and decomposed bedrock may be constructed up to 15 feet tall to a gradient as steep as 2H:1V. However, cut slopes over 15 feet tall should be limited to a gradient of 2.5H:1V or should be partially retained by a retaining wall. Slopes in moderately weathered basalt bedrock may be constructed to 1H:4V, provided they are observed by a registered geologist or geotechnical engineer. Slopes that will be maintained by mowing should not be constructed steeper than 3H:1V.

Rock slopes should be evaluated to determine if bedding planes exist, which would require flatter cuts or permanent support. Our scope of services did not include exploration of the intact basalt using rock coring techniques. For proposed walls exceeding 15 feet in height, we recommend additional exploration via rock coring to evaluate the presence of bedding planes; assess the feasibility of constructing large, over-steepened cuts into the rock; and assess the potential need for retaining walls. We should also be contacted to review final site grading plans as they are developed to provide appropriate recommendations for additional exploration and analysis.

Newly constructed fill slopes should be overconstructed by at least 12 inches and then trimmed back to the required slope to maintain a firm face. Access roads and pavement 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, unless special foundation considerations are implemented. As discussed in Section 6.1 (Foundation Support), for existing slopes steeper than 2H:1V or foundations located behind retaining walls, we recommend that foundations or foundation-supporting elements be embedded such that they are set back at least 5 feet from a 2H:1V grade projected from the base of the slope or wall as shown on Figure 4. Soil 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.

6.7.1 Slope Stability

Our field explorations indicate that subsurface conditions consist of a relatively thin layer of silt overlying decomposed to intact basalt bedrock. The natural slope of the ground surface is approximately 4H:1V or flatter. Published geologic hazard data indicate that the site is not mapped within an area of landslide topography, slump, debris flow, or other seismic hazards

(Schlicker and Finlayson 1979). The nearest ancient landslide feature is mapped more than 0.5 mile east of the site, which resulted from the excavation of the nearby interstate at the toe of the landslide.

Preliminary spot-grading plans indicate that on-site material will generally be cut and filled in a terraced topography, which will likely improve global slope stability. Based on the preliminary spot-grading plan and the quality of the underlying bedrock, it is our opinion that there is a low risk of landsliding at the site. However, as discussed above, large cuts into bedrock may expose bedding planes that could not be observed within our test pit explorations. The presence of bedding planes could impact local stability of proposed cuts and should be evaluated via supplemental borings with rock coring as discussed in prior sections prior to finalizing project grading plans.

7.0 CONSTRUCTION

7.1 SITE PREPARATION

7.1.1 Stripping and Grubbing

The existing root zone should be stripped and removed from all proposed structural fill, pavement, and building areas and for a 5-foot margin around such areas. Based on the current and previous explorations, the depth of removal will generally range from approximately 2 to 8 inches. Thick root masses were also observed in some isolated areas to depths of 12 to 18 inches. The actual stripping depth should be based on field observations at the time of construction. Stripped material should be transported offsite for disposal or used in landscaped areas.

Existing trees or shrubs should be removed from pavement and building areas. In addition, root balls should be grubbed out to the depth of the roots. 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.

7.1.2 Subgrade Evaluation

Upon completion of stripping and prior to the placement of structural fill, exposed subgrade soil should be evaluated by proof rolling with a fully loaded dump truck or similar heavy, rubber-tired construction equipment. When the subgrade is too wet for proof rolling or inaccessible to a loaded dump truck, a foundation probe may be used to identify areas of soft, loose, or unsuitable soil. Subgrade evaluation should be performed by Columbia West. If soft or yielding subgrade areas are identified during evaluation, we recommend the subgrade be over excavated and backfilled with compacted imported granular fill.

7.2 CONSTRUCTION TRAFFIC AND STAGING

Near-surface, fine-grained soil will be easily disturbed during construction. If not carefully executed, site preparation, excavation, and grading can create extensive soft areas, resulting in significant repair costs. Earthwork planning should include considerations for minimizing subgrade disturbance, particularly during wet weather conditions.

If construction occurs during wet weather conditions or if the moisture content of the surficial soil is more than a few percentage points above optimum, site stripping and cutting may need to be accomplished using track-mounted equipment. Under these conditions, granular access pads and staging areas will also be necessary provide a firm support base and sustain 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 areas supporting construction traffic. In areas of heavy construction traffic, geotextile separation fabric may be placed between the subgrade soil and imported granular material to increase subgrade support and minimize fines migration into the aggregate base layer.

As an alternative to thickened crushed rock sections, haul roads and utility work zones may be constructed using cement-amended subgrade 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.

Project stakeholders should understand that wet weather construction is risky and costly. Proper construction methods and techniques are critical to overall project integrity and should be observed and documented by Columbia West.

7.3 EXCAVATION

7.3.1 Basalt Bedrock

The upper portions of the basalt bedrock are weathered and fractured and could generally be penetrated to varying degrees by an excavator. While excavation of weathered bedrock is expected to be more difficult than the silt, we do not expect special excavation equipment to be necessary in the moderately weathered to decomposed material. Excavators used for the current and previous explorations could not penetrate the intact bedrock. Special excavation techniques such as hydraulic breakers, rock trenchers, or blasting will likely be required to excavate the intact basalt bedrock where test pits encountered refusal. The observed depth to refusal on basalt for the current explorations are shown on Figures 2 and 3. The depth to weathered and intact bedrock encountered in the previous explorations are shown on the 2006 Figure 2 and 2014 Figure 2 presented in Appendix C.

The contract bid documents should require that contractors list a unit cost for rock excavation using in-place (bank) volumes, which can be measured by surveying. The unit cost should not be provided in excavated (swelled) volumes, which are more difficult to accurately measure.

7.3.2 Rockfall Hazards

Grading and excavation should be conducted by the earthwork contractor in a sequence that will prevent overhanging rock material that might become dislodged. The contractor should also be responsible for providing protection for property and personnel. This might include sloping of cut

areas, building protective berms, or providing catchment netting or equipment at the base of a slope excavation, depending on the final grading plan and construction sequence.

7.3.3 Trench Cuts and Shoring

Trench cuts in the silt and gravelly soil should stand near vertical to a depth 4 feet, with moderate potential for raveling. 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, groundwater seepage is not present, and with the understanding that some raveling may occur. The trenches should be flattened to a stable inclination if excessive raveling or caving occurs. Trenches in the bedrock should stand near vertical and should not require shoring. Some minor raveling should be expected in closely fractured zones of the basalt.

Use of a trench shield or other approved temporary shoring is recommended in the silt and gravelly soil where sloping is not possible. If a conventional shield is used, the contractor should limit the length of open trench. If shoring is used, we recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation. All excavations should be made in accordance with applicable OSHA and state regulations.

7.3.4 Temporary Dewatering

Perched groundwater will likely be encountered in excavations during and following periods of persistent rainfall. Groundwater flowing into open excavations should be removed by pumping from a sump. The pump should be capable of handling variable flow rates. Water should be routed to a suitable discharge point.

7.3.5 Open Excavations

Open excavations will be necessary for building cuts. Cuts up to 15 feet in slightly weathered to intact bedrock will likely stand vertical and may not require shoring or sloping. However, rock scaling may be required to mitigate rockfall hazards. Cuts exceeding 15 feet into bedrock may require flatter inclinations, unless additional exploration and evaluation indicate that vertical cuts are feasible. We recommend that cuts in the overlying silt, gravelly soil, and highly weathered basalt be sloped in accordance with OSHA regulations. Temporary shoring may be possible to support cuts in soil, but may be difficult to install due to the underlying bedrock. If shoring is used, we recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation.

7.4 MATERIALS

7.4.1 Structural Fill

7.4.1.1 General

Areas proposed for fill placement should be appropriately prepared as described in Section 7.1 (Site Preparation). Engineered fill placement should be observed by Columbia West. Compaction of engineered structural fill should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. Field compaction testing should be performed for each vertical foot of engineered fill placed.

Various materials may be acceptable for use as structural fill. Structural fill should be free of organic material or other unsuitable material and meet the specifications provided in the following sections. Representative samples of proposed engineered structural fill should be submitted for laboratory testing and approval by Columbia West prior to placement.

7.4.1.2 On-Site Soil

The on-site native soil is generally suitable for use as structural fill, provided it is free of debris, organic material, or other unsuitable material and has no particles larger than 6 inches in diameter. Gravelly or chipped bedrock material may need to be crushed or processed to achieve smaller particle sizes before placing as fill.

On-site silty soil will be difficult, if not impossible, to adequately compact at all times of the year, except the dry summer months. We expect that moisture conditioning (drying) will be required to use on-site silty soil for structural fill. Accordingly, extended dry weather will be required to adequately condition the soil for use as structural fill.

The native gravel soil contains varying amounts of silt. As silt content increases, sensitivity to moisture also increases. It should not be assumed that the silty gravel will be able to be adequately compacted during wet weather.

The weathered and intact bedrock will have to be crushed and processed into a smaller, well-graded distribution prior to placement as structural fill. When placed as embankment fill, the material should have no particles larger than 6 inches in diameter. Occasional cobbles up to 10 inches in diameter may be acceptable in the on-site soil, provided they are dispersed in the fill, they do not create voids in the fill matrix, and compaction can be achieved by sufficiently large equipment. Compaction equipment should impart enough energy to break cobbles. Fill containing oversized material should be closely monitored by qualified geotechnical field staff. Fine grading of gravelly soil may result in segregating cobbles or coarse gravel from the sandy/fine gravel matrix, resulting in unsatisfactory (poorly graded or "boney") fill. Fill material should be maintained as well graded with gravelly and sandy material for proper compaction during fill placement and mass grading.

If the native basalt will be processed and used as aggregate base or trench backfill, it should meet the requirements listed further in this section. When used as structural fill, on-site soil should be placed in lifts with a maximum uncompacted thickness of 8 inches and compacted to not less than 95 percent of maximum dry density as determined by ASTM D1557.

7.4.1.3 Imported Granular Material

Imported granular material should consist of pit- or quarry-run rock, crushed rock, or crushed gravel and sand. The imported granular material should also be durable, angular, and fairly well graded between coarse and fine material; should have less than 5 percent fines by dry weight; and should have at least two mechanically fractured faces. Imported granular material should be placed in loose lifts not exceeding 12 inches in thickness and compacted to at least 95 percent of maximum dry density as determined by ASTM D1557. During wet weather conditions or where wet subgrade conditions are present, the initial loose lift of granular fill should be approximately 18 inches thick and should be compacted with a smooth-drum roller operating in static mode.

7.4.1.4 Trench Backfill

Trench backfill placed below, adjacent to, and up to 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 7 percent fines by dry weight. Material should meet the specifications of OSSC 00405.13 (Pipe Zone Material). Pipe zone backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer.

Within pavement areas, the remainder of the trench backfill up to subgrade elevation should consist of well-graded granular material with a maximum particle size of 2½ inches and less than 7 percent fines by dry weight. The material should meet the specifications of OSSC 00405.14 (Trench Backfill; Class B, C, or D). This material should be compacted to at least 92 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer. The upper 3 feet of the trench backfill should be compacted to at least 95 percent of modified maximum dry density.

Outside of structural areas, trench backfill placed above the pipe zone may consist of general fill material that has a maximum particle size of 6 inches, is free of organic material, and meets the specifications of OSSC 00405.14 (Trench Backfill; Class A, B, C, or D). This general trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D1557 or as required by the local jurisdictional agency or pipe manufacturer.

7.4.1.5 Stabilization Material

Stabilization material should consist of pit- or quarry-run rock, crushed rock, or crushed gravel meeting the specifications of OSSC 00330.16 (Stone Embankment Material). The material should have at least two fractured faces, a maximum particle size of 6 inches, and less than 5 percent by dry weight passing the U.S. Standard No. 4 sieve. Stabilization material should be free of organic material or other unsuitable material.

Stabilization material should be placed in loose lifts between 12 and 18 inches thick and compacted to a firm, unyielding condition with a smooth-drum roller operating without vibratory action. If stabilization material is used to stabilize soft subgrade beneath pavement or construction haul roads, a geotextile should be placed as a separation barrier between the soil subgrade and the stabilization material. Geotextile is not required where stabilization material is used to stabilize the bases of utility trenches. Placement of stabilization material should conform to the specifications of OSSC 00331 (Subgrade Stabilization).

7.4.1.6 Drain Rock

Drain rock should consist of angular, granular material with a maximum particle size of 2 inches and less than 2 percent fines by dry weight. Drain rock should be free of roots, organic material, and other unsuitable material and should have at least two mechanically fractured faces. Drain rock should be compacted to a firm, unyielding condition. Drain rock should be completely wrapped in a geotextile drainage fabric meeting the requirements presented below.

7.4.1.7 Retaining Wall Backfill

Backfill material placed behind retaining walls and extending a horizontal distance of $\frac{1}{2}H$, where H is the height of the retaining wall, should consist of imported granular material as described above and should have less than 7 percent fines by dry weight. We recommend the 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 maximum dry density as determined by ASTM D1557. However, backfill located within a horizontal distance of 3 feet from a retaining wall should only be compacted to approximately 90 percent of maximum dry density as determined by ASTM D1557. 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 a jumping jack or vibratory plate compactor). If flatwork (sidewalks or pavement) will be placed atop the wall backfill, we recommend that the upper 2 feet of material be compacted to 95 percent of maximum dry density as determined by ASTM D1557.

7.4.1.8 Retaining Wall Leveling Pad

Imported granular material placed at the bases of retaining wall footings should consist of select granular material. The granular material should be $\frac{3}{4}$ - to 1-inch-minus aggregate size and should have at least two mechanically fractured faces. The leveling pad material should be placed in a 6- to 12-inch-thick lift and compacted to not less than 95 percent of maximum dry density as determined by ASTM D1557.

7.4.1.9 Floor Slab Aggregate Base

Aggregate base for building floor slabs should consist of $\frac{3}{4}$ - or 1 $\frac{1}{2}$ -inch-minus (as applicable), imported granular material meeting the requirements of OSSC 00641 (Aggregate Subbase, Base, and Shoulders). Slab aggregate base should have less than 5 percent fines by dry weight. During the dry season, aggregate base may contain up to 10 percent fines by dry weight. Slab aggregate base should be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557.

7.4.2 Pavement

7.4.2.1 AC

The AC should be Level 2, $\frac{1}{2}$ -inch, dense ACP according to OSSC 00744 (Asphalt Concrete Pavement) and compacted to 92 percent of the theoretical maximum density of the mix as determined by AASHTO T 209. The minimum and maximum lift thicknesses are 2 inches and 3 inches, respectively, for $\frac{1}{2}$ -inch ACP. Asphalt binder should be performance graded and conform to PG 64-22 or better. The binder grade should be adjusted depending on the aggregate gradation and amount of recycled asphalt pavement and/or recycled asphalt shingles in the contractor's mix design submittal.

7.4.2.2 Cold Weather Paving Considerations

In general, AC paving is not recommended during cold weather (temperatures less than 40 degrees Fahrenheit). Compacting under these conditions can result in low compaction and premature pavement distress.

Each AC mix design has a recommended compaction temperature range that is specific for the particular AC binder used. In colder temperatures, it is more difficult to maintain the temperature of the AC mix as it can lose heat while stored in the delivery truck, as it is placed, and in the time between placement and compaction. In Oregon, the AC surface temperature during paving should be at least 40 degrees Fahrenheit for lift thickness greater than 2.5 inches and at least 50 degrees Fahrenheit for lift thickness between 2 and 2.5 inches.

If AC paving activities must take place during cold weather construction as defined above, the contractor and design team should discuss options for minimizing risk of pavement serviceability.

7.4.2.3 Pavement Aggregate Base

Aggregate base for pavement should consist of ¾- or 1½-inch-minus (as applicable) imported granular material meeting the requirements of OSSC 02630.10 (Dense-Graded Aggregate). Pavement aggregate base should have less than 5 percent fines by dry weight. During the dry season, aggregate base may contain up to 10 percent fines by dry weight. Pavement aggregate base should be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557.

7.4.3 Geotextile Fabric

7.4.3.1 Subgrade Geotextile

Subgrade geotextile should conform to OSSC Table 02320-4 and OSSC 00350 (Geosynthetic Installation). A minimum initial aggregate base lift of 6 inches is required over geotextiles. All drainage aggregate and stabilization material should be underlain by a subgrade geotextile.

7.4.3.2 Drainage Geotextile

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

7.5 EROSION CONTROL

Soil at this site is susceptible to erosion by wind and water; therefore, erosion control measures should be carefully planned and installed before construction begins. Surface water runoff should be collected and directed away from sloped areas to prevent water from running down the slope face. Measures that can be employed to reduce erosion include the use of silt fences, hay bales, buffer zones of natural growth, sedimentation ponds, and granular haul roads. All erosion control methods should be in accordance with local jurisdiction standards.

8.0 OBSERVATION OF CONSTRUCTION

Satisfactory pavement, earthwork, and foundation performance depends to a large degree on the 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. Columbia West should be retained to observe subgrade preparation, fill placement, foundation excavations, drainage system installation, and pavement placement and to review laboratory compaction and field moisture-density information.

Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated.

9.0 LIMITATIONS

We have prepared this report for use by the addressee and members of the design and construction team for the proposed project. This report is subject to the limitations expressed in Appendix D.



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,

Handwritten signature of Greg L. Williamson in black ink.

Greg L. Williamson, PE
Senior Geotechnical Engineer

Handwritten signature of Najib A. Kalas in blue ink.

Najib A. Kalas, PE
Principal Engineer

Handwritten signature of Brett A. Shipton in blue ink.

Brett A. Shipton, PE, GE
Principal Engineer

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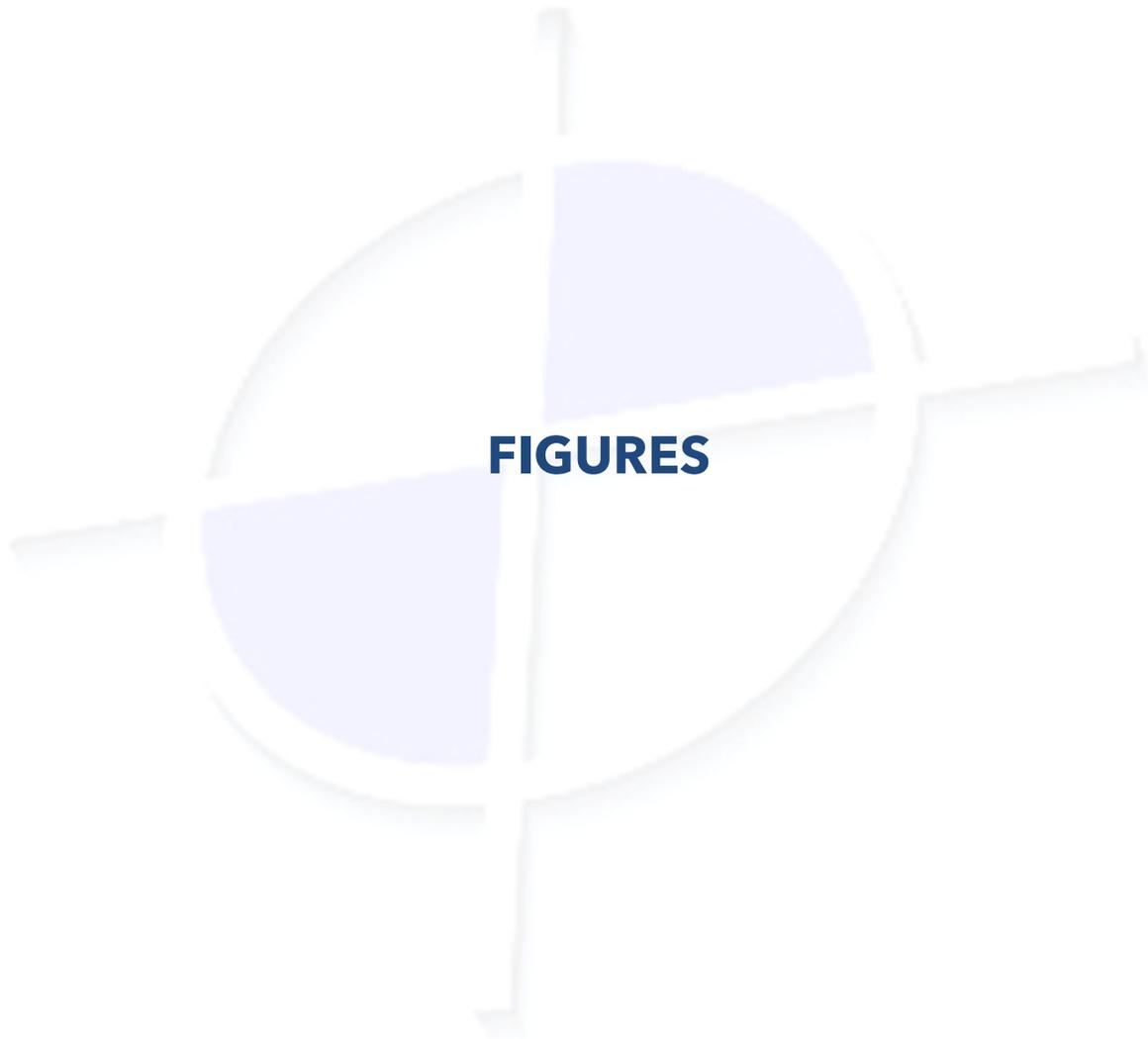
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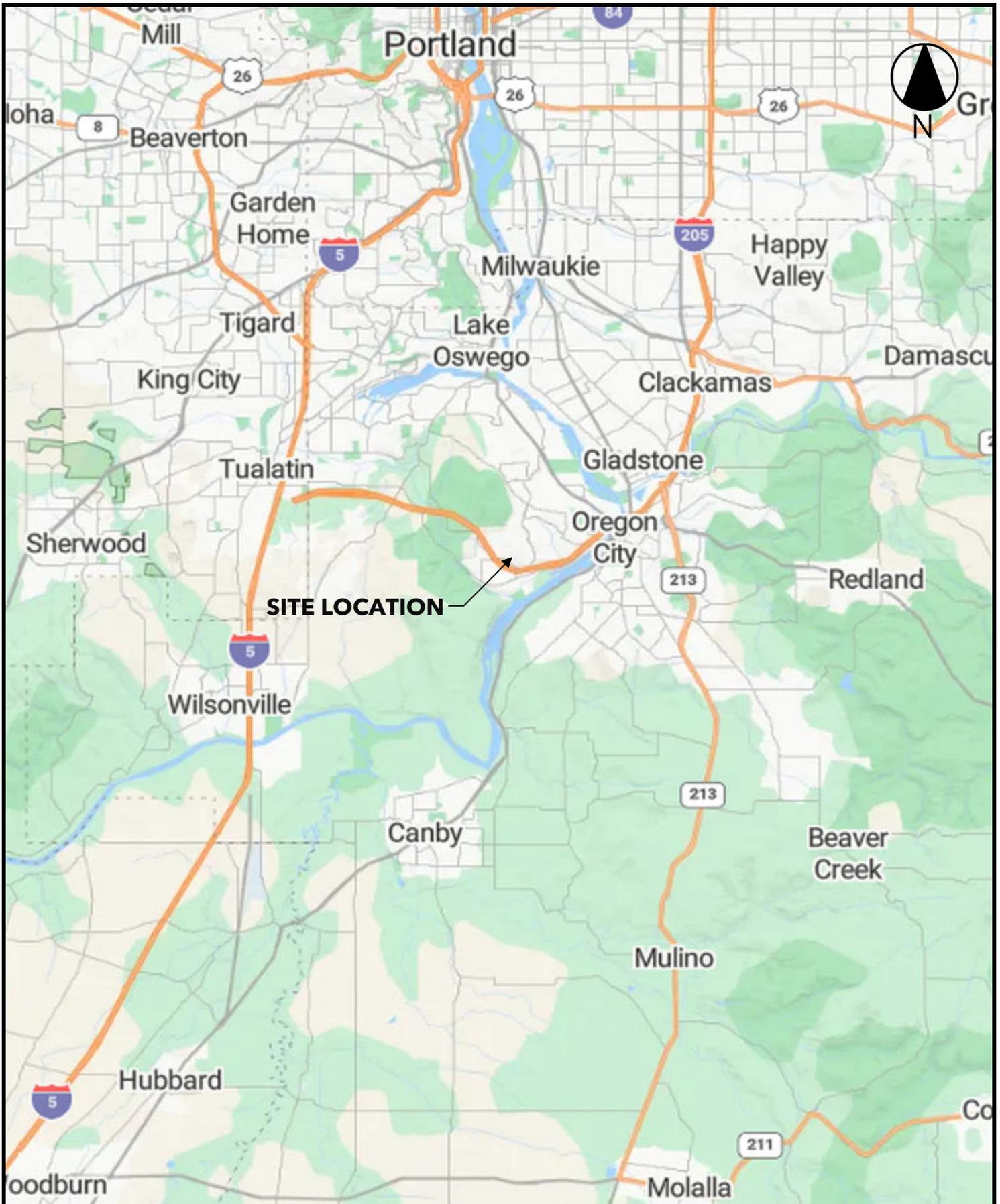
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FIGURES





- LEGEND**
-  SITE BOUNDARY
 -  TEST PIT
 - (6) DEPTH TO REFUSAL ON BASALT (FEET BGS)

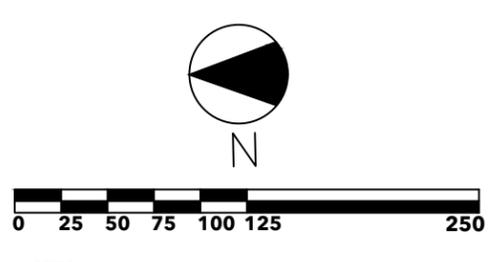


NOTES:
 1. AERIAL PHOTO SOURCED FROM GOOGLE EARTH.
 2. EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
 3. REFER TO REPORT TEXT FOR EXPLORATION DESCRIPTIONS.

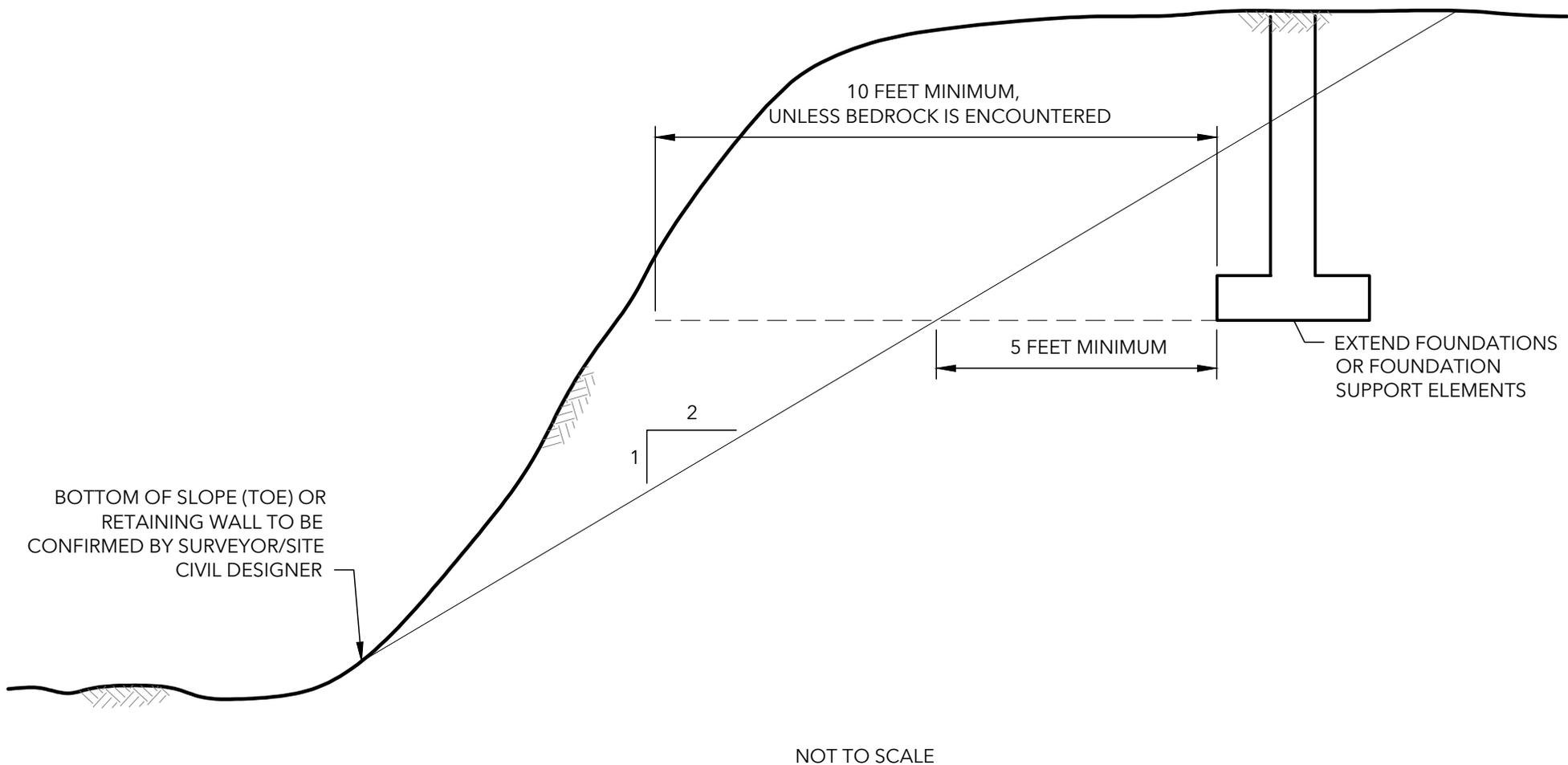


LEGEND

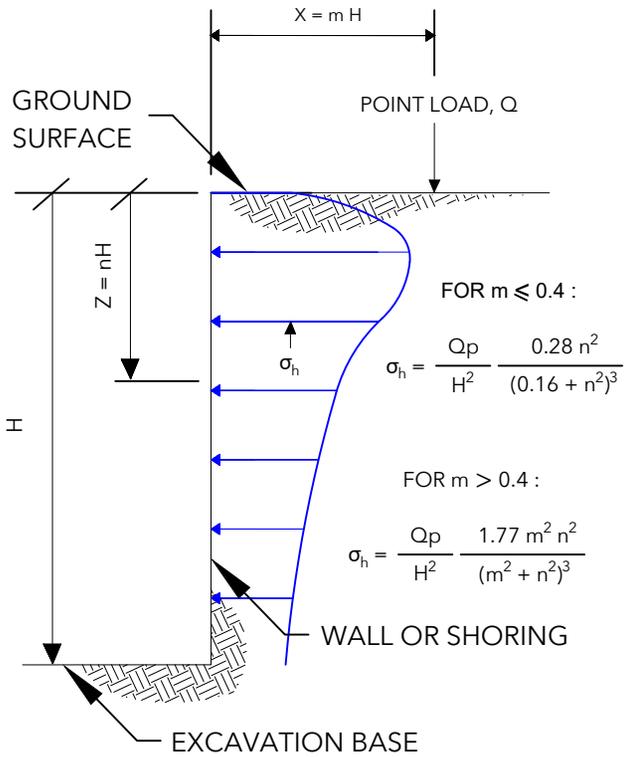
	SITE BOUNDARY
	TEST PIT
(6)	DEPTH TO REFUSAL ON BASALT (FEET BGS)



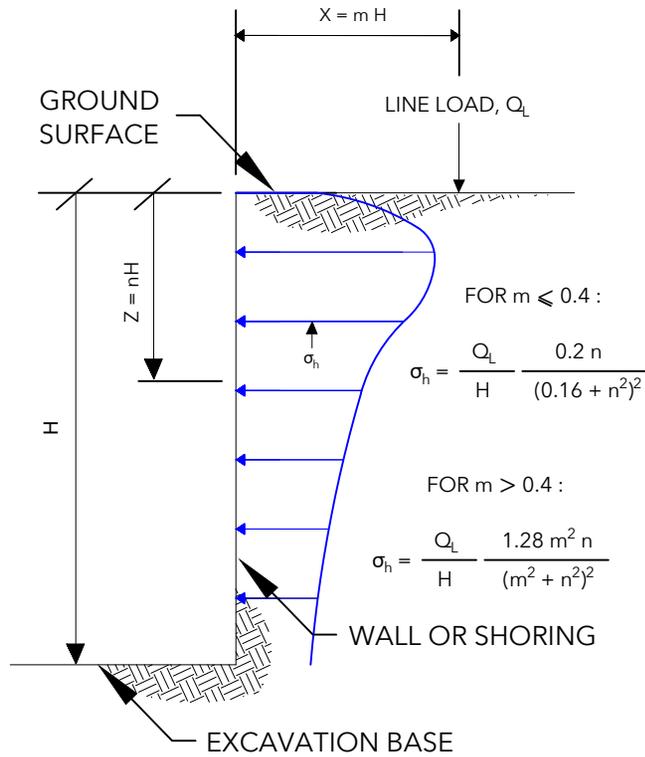
NOTES:
 1. CONCEPTUAL SITE AND GRADING PLAN PREPARED BY HILL ARCHITECTS, DATED AUGUST 29, 2025.
 2. EXPLORATION LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.
 3. REFER TO REPORT TEXT FOR EXPLORATION DESCRIPTIONS.



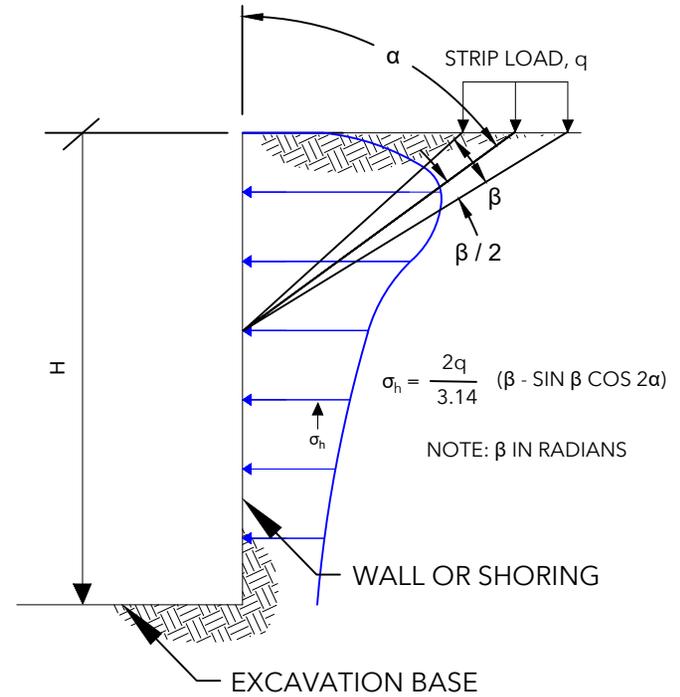
VERTICAL POINT LOAD



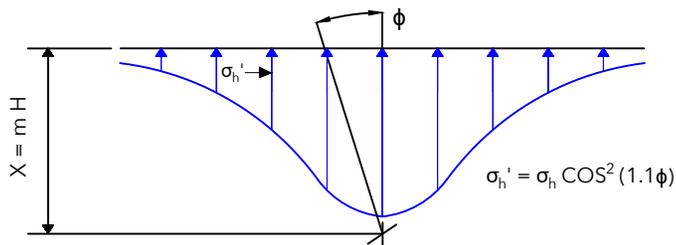
LINE LOAD PARALLEL TO WALL



STRIP LOAD PARALLEL TO WALL



VERTICAL POINT LOAD
HORIZONTAL PRESSURE DISTRIBUTION



NOTES:

1. FIGURE SHOULD BE USED JOINTLY WITH RECOMMENDATIONS PRESENTED IN THE REPORT TEXT.
2. LATERAL EARTH PRESSURES ASSUME RIGID WALLS WITH BACKFILL MATERIALS HAVING A POISSON'S RATIO OF 0.5.
3. TOTAL LATERAL EARTH PRESSURES RESULTING FROM COMBINED LOADS MAY BE CALCULATED USING SUPERPOSITION.
4. DRAWING IS NOT TO SCALE.



APPENDIX A

APPENDIX A FIELD EXPLORATIONS

GENERAL

We explored subsurface conditions at the site by excavating 10 test pits (TP-1 through TP-10) to depths between 2 and 6 feet BGS. Excavation services were provided by Dan J. Fischer Excavating, Inc. of Forest Grove, Oregon, on August 8, 2025, using a Hitachi ZX40 track-mounted excavator. The explorations were conducted under the supervision of Columbia West personnel. The exploration logs are presented in this appendix.

The approximate exploration locations are shown on Figures 2 and 3. The locations were determined in the field by pacing or measuring from existing site features. This information should be considered accurate only to the degree implied by the methods used.

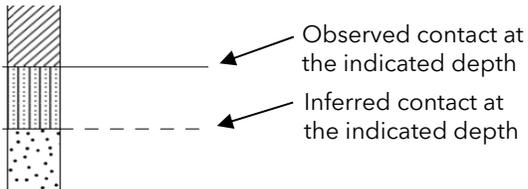
SOIL AND ROCK SAMPLING

Representative disturbed samples of soil and rock observed in the test pit explorations were collected from the test pit walls and base using the excavator bucket. Sampling methods and intervals are shown on the exploration logs.

SOIL AND ROCK CLASSIFICATION

The soil and rock encountered in the explorations were classified in the field in accordance with the "Exploration Legend," "Soil Classification System," and "Rock Classification System," which are presented in this appendix. The exploration logs indicate the depths at which the soil and rock characteristics change, although the change could be gradual. If the change occurred between sample locations, the depth was interpreted. Classifications are shown on the exploration logs.

EXPLORATION LEGEND

SAMPLER TYPE	DESCRIPTION	
SPT	Sample collected from the indicated depth in general accordance with ASTM D1586, <i>Standard Test Method Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils</i> , using an SPT sampler and 140-pound hammer	
SH	Sample collected from the indicated depth in general accordance with ASTM D1587, <i>Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes</i> , using a thin-walled Shelby tube, or in general accordance with ASTM D6519, <i>Standard Practice for Sampling of Soil Using the Hydraulically Operated Stationary Piston Sampler</i> , using a thin-walled tube	
D&M	Sample collected from the indicated depth in general accordance with ASTM D3550, <i>Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils</i> , using a Dames & Moore sampler and 140-pound hammer or pushed	
CSS	Sample collected from the indicated depth in general accordance with ASTM D3550, <i>Standard Practice for Thick Wall, Ring-Lined, Split Barrel, Drive Sampling of Soils</i> , using a 3-inch-outside diameter California split-spoon sampler and 140-pound hammer	
DP	Sample collected from the indicated depth in general accordance with ASTM D6282, <i>Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations</i> , using a direct-push soil sampler	
GRAB	Grab sample collected from the indicated depth	
CORE	Pavement or rock core interval at the indicated depth	

GEOTECHNICAL ABBREVIATIONS

ATT	Atterberg limits	PP	Pocket penetrometer
CBR	California bearing ratio	P200	Percent passing No. 200 sieve
CON	Consolidation test	RES	Resilient modulus
DD	Dry density	SIEV	Sieve analysis
DS	Direct shear	TS	Torvane shear
HYD	Hydrometer	tsf	Tons per square foot
MC	Moisture content	UC	Unconfined compressive strength
MD	Moisture-density relationship	UU	Unconsolidated undrained triaxial test
NP	Non-plastic	VS	Vane shear
OC	Organic content	WD	Wet density

ENVIRONMENTAL ABBREVIATIONS

CA	Sample submitted for chemical analysis	ND	Not detected
PID	Photoionization detector headspace analysis	NS	No sheen
ppm	Parts per million	SS	Slight sheen
		MS	Moderate sheen
		HS	Heavy sheen

SOIL CLASSIFICATION SYSTEM

PARTICLE-SIZE CLASSIFICATION

COMPONENT	ASTM / USCS		AASHTO	
	Size Range	Sieve Size Range	Size Range	Sieve Size Range
Boulders	Greater than 300 mm	Greater than 12 inches	--	--
Cobbles	75 mm to 300 mm	3 inches to 12 inches	Greater than 75 mm	Greater than 3 inches
Gravel	75 mm to 4.75 mm	3 inches to No. 4 sieve	75 mm to 2.00 mm	3 inches to No. 10 sieve
Coarse	75 mm to 19.0 mm	3 inches to 3/4-inch sieve	--	--
Fine	19.0 mm to 4.75 mm	3/4-inch to No. 4 sieve	--	--
Sand	4.75 mm to 0.075 mm	No. 4 to No. 200 sieve	2.00 mm to 0.075 mm	No. 10 to No. 200 sieve
Coarse	4.75 mm to 2.00 mm	No. 4 to No. 10 sieve	2.00 mm to 0.425 mm	No. 10 to No. 40 sieve
Medium	2.00 mm to 0.425 mm	No. 10 to No. 40 sieve	--	--
Fine	0.425 mm to 0.075 mm	No. 40 to No. 200 sieve	0.425 mm to 0.075 mm	No. 40 to No. 200 sieve
Fines (Silt and Clay)	Less than 0.075 mm	Passing No. 200 sieve	Less than 0.075 mm	Passing No. 200 sieve

CONSISTENCY FOR FINE-GRAINED SOIL

CONSISTENCY	SPT N-VALUE (blows per foot)	D&M N-VALUE (blows per foot)	POCKET PENETROMETER (unconfined compressive strength [tsf])
Very soft	0 to 2	0 to 3	Less than 0.25
Soft	2 to 4	3 to 6	0.25 to 0.5
Medium stiff	4 to 8	6 to 12	0.5 to 1.0
Stiff	8 to 15	12 to 25	1.0 to 2.0
Very stiff	15 to 30	25 to 65	2.0 to 4.0
Hard	Greater than 30	Greater than 30	Greater than 4.0

RELATIVE DENSITY FOR COARSE-GRAINED SOIL

RELATIVE DENSITY	SPT N-VALUE (blows per foot)	D&M N-VALUE (blows per foot)
Very loose	0 to 4	0 to 11
Loose	4 to 10	11 to 26
Medium dense	10 to 30	26 to 74
Dense	30 to 50	74 to 120
Very dense	Greater than 50	Greater than 120

MOISTURE DESIGNATIONS

TERM	FIELD IDENTIFICATION
Dry	Very low moisture, dry to touch
Moist	Damp, color appears darkened, without visible moisture, cohesive soil will clump, sand will bulk
Wet	Visible free water, usually saturated

ADDITIONAL CONSTITUENTS

PERCENT	SILT AND CLAY IN		PERCENT	SAND AND GRAVEL IN		PERCENT	SECONDARY MATERIAL
	Fine-Grained Soil	Coarse-Grained Soil		Fine-Grained Soil	Coarse-Grained Soil		Organics and Man-Made Debris
< 5	trace	trace	< 5	trace	trace	< 4	trace
5 - 12	minor	with	5 - 15	minor	minor	4 - 12	some
> 12	some	silty/clayey	15 - 30	with	with		
			> 30	sandy/gravelly	with		

ROCK CLASSIFICATION SYSTEM

STRENGTH	DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH (psi)
Extremely weak (R0)	Easily indented by thumbnail	35 to 150
Very weak (R1)	Scratched with fingernail, peeled by knife, indented by rock pick	150 to 725
Weak (R2)	Peeled by knife, indented by rock pick	725 to 3,500
Medium strong (R3)	Cannot be peeled or scraped with a knife	3,500 to 7,250
Strong (R4)	Requires more than one blow with a rock hammer to fracture it	7,250 to 14,500
Very strong (R5)	Requires many blows with a rock hammer to fracture it	14,500 to 36,250
Extremely strong (R6)	Can only be chipped with a rock hammer	Greater than 36,250

WEATHERING	DESCRIPTION
Decomposed	A soil formed in place with original texture of rock destroyed
Completely weathered	Rock wholly weathered but rock texture preserved
Highly weathered	Rock weakened so that large pieces can be broken by hand
Moderately weathered	Rock mass is decomposed locally
Slightly weathered	Discoloration along discontinuities
Fresh	No visible signs of weathering or discoloring

JOINT SPACING	DESCRIPTION
Very close	Less than 0.2 foot
Close	0.2 foot to 1 foot
Moderately close	1 foot to 3 feet
Wide	3 feet to 10 feet
Very wide	Greater than 10 feet

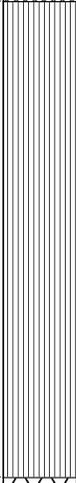
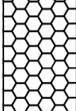
FRACTURING	FRACTURE SPACING
Very intensely fractured	Chips, fragments, with scattered short core lengths
Intensely fractured	0.1 foot to 0.3 foot with scattered fragments
Moderately fractured	0.3 foot to 1 foot
Slightly fractured	1 foot to 3 feet
Very slightly fractured	Greater than 3 feet
Unfractured	No fractures observed

HEALING	DESCRIPTION
Not healed	Discontinued surface, fractured zone, sheared material, filling is not cemented
Partly healed	Less than 50% of fractures or sheared zone bonding
Moderately healed	Greater than 50% fractures or sheared zone bonding
Totally healed	All fragments are bonded

QUALITY	RQD (percent)
Very poor	Less than 25
Poor	25 to 50
Fair	51 to 75
Good	76 to 90

Rock quality designation (RQD) is a measure of quality of rock core taken from a borehole. The length of core pieces is measured along the center line of the pieces. All pieces of intact rock core equal to or greater than 100 millimeters (4 inches) long are summed and divided by the total length of the core run to obtain RQD value

PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 12:30 PM
LOGGED BY S. Chandra **TIME COMPLETED** 12:45 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	ATTEBERG LIMITS (LL-PL-Pi)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (12 inches of topsoil, 3-inch-thick root zone).	1.0			
	Grab	TP1.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium).		22	40-27-13	
5	Grab	TP1.2			Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist.	5.0			
					Exploration terminated at 6 feet due to refusal on basalt.	6.0			

GROUNDWATER: Not observed

CAVING: Not observed

PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 12:56 PM
LOGGED BY S. Chandra **TIME COMPLETED** 1:09 PM

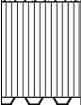
DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	FINES (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (8 inches of topsoil, 3-inch-thick root zone).	0.7			
	Grab	TP2.1	ML/MH		Medium stiff, brown gravelly SILT, moist, medium plasticity, gravel is fine to coarse (colluvium).		12	61	
						4.0			
5	Grab	TP2.2			Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist.	5.5			

Exploration terminated at 5.5 feet due to refusal on basalt.

GROUNDWATER: Not observed

CAVING: Not observed

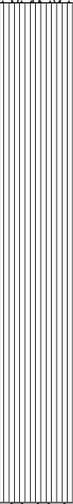
PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 1:12 PM
LOGGED BY S. Chandra **TIME COMPLETED** 1:20 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (8 inches of topsoil, 2-inch-thick root zone).	0.7		
			ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium).	1.5		
					Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist.	2.0		
Exploration terminated at 2 feet due to refusal on basalt.								
5								

GROUNDWATER: Not observed

CAVING: Not observed

PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/09/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 1:35 PM
LOGGED BY S. Chandra **TIME COMPLETED** 1:48 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	FINES (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (10 inches of topsoil, 3-inch-thick root zone).	0.8			
	Grab	TP4.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium).		13	76	
5	Grab	TP4.2			Medium strong to strong (R3-R4), gray BASALT, decomposed to moderately weathered, very close to close jointed, weak to moderate induration, moist.	5.0			
					Exploration terminated at 5.5 feet due to refusal on basalt.	5.5			

GROUNDWATER: Not observed

CAVING: Not observed

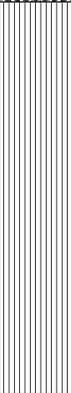
PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 2:00 PM
LOGGED BY S. Chandra **TIME COMPLETED** 2:15 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (10 inches of topsoil, 3-inch-thick root zone).	0.8		
			ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium).		18	
	Grab	TP5.1				3.0		
					Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist.	4.0		
	Grab	TP5.2						
5	Exploration terminated at 4 feet due to refusal on basalt.							

GROUNDWATER: Not observed

CAVING: Not observed

PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 2:19 PM
LOGGED BY S. Chandra **TIME COMPLETED** 2:25 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	FINES (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (8 inches of topsoil, 3-inch-thick root zone). 0.7				
	Grab	TP6.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium). 2.0		23		
	Grab	TP6.2			Stiff to very stiff, brown-gray gravelly SILT with cobbles, moist, gravel is fine to coarse (decomposed to weathered basalt). 4.0		19	52	
5	Exploration terminated at 4 feet due to refusal on basalt.								

GROUNDWATER: Not observed
CAVING: Not observed

BoreDM Template: Test Pit Template - New

PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 2:28 PM
LOGGED BY S. Chandra **TIME COMPLETED** 2:40 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	ATTEBERG LIMITS (LL-PL-Pi)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (10 inches of topsoil, 3-inch-thick root zone).	0.8			
	Grab	TP7.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium).		17	50-34-16	
					2.0				
	Grab	TP7.2			Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist.				
						3.0			

Exploration terminated at 3 feet due to refusal on basalt.

5

GROUNDWATER: Not observed

CAVING: Not observed

PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 2:47 PM
LOGGED BY S. Chandra **TIME COMPLETED** 2:57 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (12 inches of topsoil, 5-inch-thick root zone).	1.0		
			GM		Medium dense to very dense, brown-gray silty GRAVEL with sand and cobbles, moist (decomposed to weathered basalt). Trace organics (rootlets) at 2 feet.		33	
3.0	Grab	TP8.1						
Exploration terminated at 3 feet due to refusal on basalt.								
5								

GROUNDWATER: Not observed

CAVING: Not observed

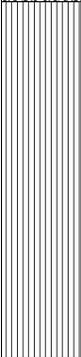
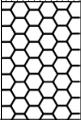
PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 3:05 PM
LOGGED BY S. Chandra **TIME COMPLETED** 3:15 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	FINES (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (8 inches of topsoil, 3-inch-thick root zone).	0.7			
			GM		Medium dense to very dense, brown-gray silty GRAVEL with sand and cobbles, moist (decomposed to weathered basalt).				
Grab		TP9.1					11	25	
						3.0			
Exploration terminated at 3 feet due to refusal on basalt.									
5									

GROUNDWATER: Not observed
CAVING: Not observed

BoreDM Template: Test Pit Template - New

PROJECT NAME Modera West Linn **CLIENT** MCRT Investments LLC
PROJECT NO. MCRT-1-01-1 **PROJECT CITY, STATE** West Linn, Oregon
CONTRACTOR Dan J. Fischer Excavating, Inc. **DATE COMPLETED** 08/08/2025
EQUIPMENT Hitachi ZX40, 2-foot toothed **TIME STARTED** 3:32 PM
LOGGED BY S. Chandra **TIME COMPLETED** 3:50 PM

DEPTH (ft)	SAMPLE TYPE	SAMPLE ID	USCS	GRAPHIC LOG	MATERIAL DESCRIPTION	POCKET PEN (tsf)	MOISTURE CONTENT (%)	REMARKS
					Medium stiff, brown SILT with gravel, trace organics (roots), moist (12 inches of topsoil, 4-inch-thick root zone).	1.0		
	Grab	TP10.1	ML/MH		Medium stiff, brown SILT with gravel, moist, medium plasticity, gravel is fine to coarse (colluvium).		12	
						4.0		
	Grab	TP10.2			Extremely weak to medium strong (R0-R3), brown-gray BASALT, decomposed to moderately weathered, very close to close jointed, moist.	5.0		
5	Exploration terminated at 5 feet due to refusal on basalt.							

GROUNDWATER: Not observed

CAVING: Not observed



APPENDIX B

APPENDIX B LABORATORY TESTING

GENERAL

Laboratory testing was conducted on select soil and rock samples collected in the field to confirm field classifications and determine the index engineering properties. The laboratory classifications are shown on the exploration logs if those classifications differed from the field classifications. The locations of the tested samples are shown on the exploration logs. Descriptions of the tests are presented below and the test results are presented in this appendix.

PARTICLE-SIZE ANALYSIS

Particle-size analyses were completed on select soil samples in general accordance with ASTM D1140 (P200). This test is a quantitative determination of the percent passing the U.S. Standard No. 200 sieve by dry weight of the specimen.

MOISTURE CONTENT DETERMINATION

The natural moisture content of select soil samples was determined in general accordance with ASTM D 2216. The natural moisture content is a ratio of the weight of the water to dry soil in a test sample and is expressed as a percentage.

ATTERBERG LIMITS TESTING

Atterberg limits (plastic and liquid limits) testing was performed on select soil samples in general accordance with ASTM D4318. 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.

MOISTURE CONTENT, PERCENT PASSING NO. 200 SIEVE BY WASHING

PROJECT Moderna West Linn West Linn, Oregon	CLIENT MCRT Investments LLC 720 SW Washington Street, Suite 720 Portland, OR 97205	PROJECT NO. MCRT-1-01-1
		ISSUE DATE 08/21/25
		PAGE 1 of 1
		DATE SAMPLED 08/08/25
		SAMPLED BY S. Chandra

LABORATORY TEST DATA

TEST PROCEDURE

ASTM D2216 - Method A, ASTM D1140

LAB ID	CONTAINER MASS (g)	MOIST MASS + CONTAINER (g)	DRY MASS + CONTAINER (g)	AFTER WASH DRY MASS + CONTAINER (g)	FIELD ID	SAMPLE DEPTH (ft)	PERCENT MOISTURE CONTENT	PERCENT PASSING NO. 200 SIEVE
S25-1668	86.38	362.99	313.18	-	TP1.1	2	22%	-
S25-1669	574.85	860.98	829.57	674.67	TP2.1	2.5	12%	61%
S25-1670	550.40	969.18	922.53	639.68	TP4.1	2.5	13%	76%
S25-1671	87.94	235.35	213.33	-	TP5.1	2.5	18%	-
S25-1672	87.42	275.70	240.46	-	TP6.1	1	23%	-
S25-1673	1,538.1	4,958.4	4,420.4	2,912.6	TP6.2	2.5	19%	52%
S25-1674	87.70	373.48	331.38	-	TP7.1	1	17%	-
S25-1675	787.4	2,252.3	1,886.3	-	TP8.1	2.5	33%	-
S25-1676	1,535.3	5,540.5	5,156.5	4,246.4	TP9.1	2.5	11%	25%
S25-1677	776.3	1,895.9	1,774.0	-	TP10.1	2.5	12%	-

NOTES: Sample weight received for Lab ID: S25-1673, and 1676 did not meet the minimum size requirements; entire sample used for analysis.	DATE TESTED 08/14/25	TESTED BY G. Hausmann, L. Gunderson
		

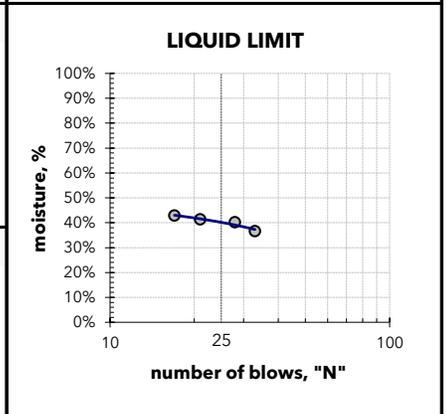
ATTERBERG LIMITS REPORT

PROJECT Moderna West Linn West Linn, Oregon	CLIENT MCRT Investments LLC 720 SW Washington Street, Suite 720 Portland, OR 97205	PROJECT NO. MCRT-1-01-1	
		ISSUE DATE 08/21/25	PAGE 1 of 1
		LAB ID S25-1668	FIELD ID TP1.1
		DATE SAMPLED 08/08/25	SAMPLED BY S. Chandra

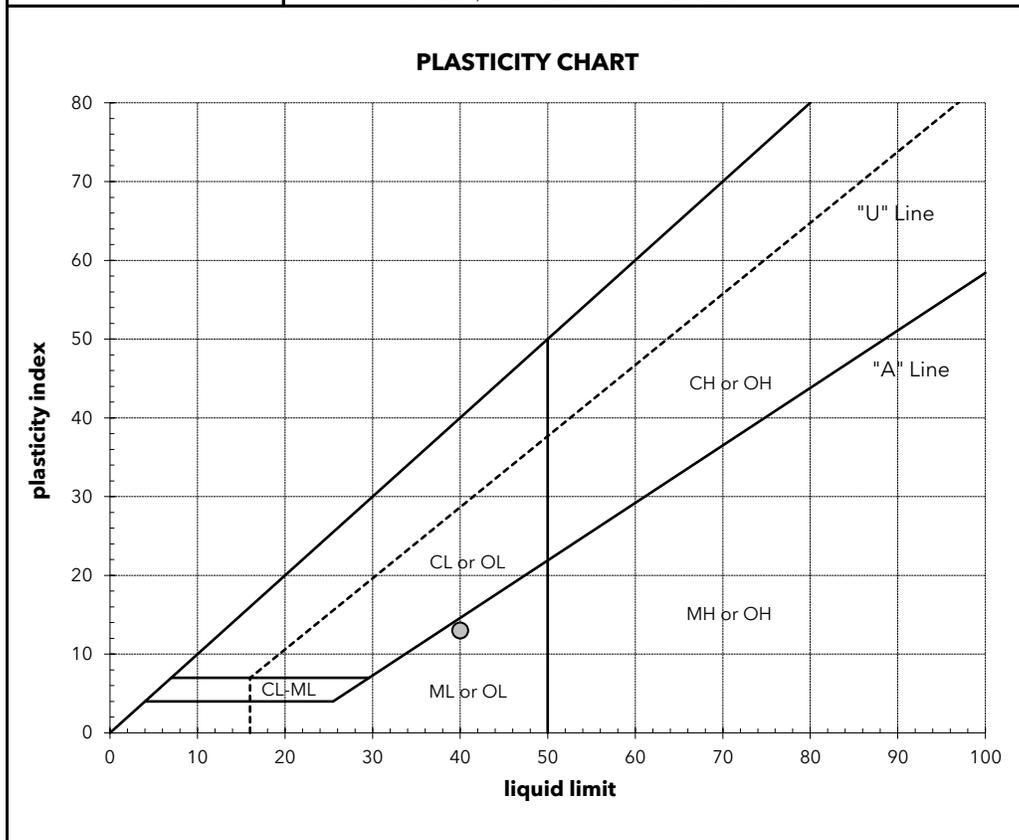
MATERIAL DATA	MATERIAL SOURCE Test Pit TP-1 depth = 2 feet	USCS SOIL TYPE no data provided
----------------------	----------------------------------------------------	------------------------------------

LABORATORY TEST DATA	TEST PROCEDURE ASTM D4318 - Method A
LABORATORY EQUIPMENT Liquid Limit Machine, Hand Rolled	

ATTERBERG LIMITS	LIQUID LIMIT DETERMINATION																														
liquid limit = 40	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>①</th> <th>②</th> <th>③</th> <th>④</th> </tr> </thead> <tbody> <tr> <td>wet soil + pan weight, g =</td> <td>33.16</td> <td>32.80</td> <td>31.06</td> <td>29.69</td> </tr> <tr> <td>dry soil + pan weight, g =</td> <td>29.90</td> <td>29.41</td> <td>28.12</td> <td>27.03</td> </tr> <tr> <td>pan weight, g =</td> <td>20.99</td> <td>20.97</td> <td>21.01</td> <td>20.82</td> </tr> <tr> <td>N (blows) =</td> <td>33</td> <td>28</td> <td>21</td> <td>17</td> </tr> <tr> <td>moisture, % =</td> <td>36.6 %</td> <td>40.2 %</td> <td>41.4 %</td> <td>42.8 %</td> </tr> </tbody> </table>		①	②	③	④	wet soil + pan weight, g =	33.16	32.80	31.06	29.69	dry soil + pan weight, g =	29.90	29.41	28.12	27.03	pan weight, g =	20.99	20.97	21.01	20.82	N (blows) =	33	28	21	17	moisture, % =	36.6 %	40.2 %	41.4 %	42.8 %
	①	②	③	④																											
wet soil + pan weight, g =	33.16	32.80	31.06	29.69																											
dry soil + pan weight, g =	29.90	29.41	28.12	27.03																											
pan weight, g =	20.99	20.97	21.01	20.82																											
N (blows) =	33	28	21	17																											
moisture, % =	36.6 %	40.2 %	41.4 %	42.8 %																											
plastic limit = 27																															
plasticity index = 13																															



SHRINKAGE	PLASTIC LIMIT DETERMINATION																									
shrinkage limit = n/a	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>①</th> <th>②</th> <th>③</th> <th>④</th> </tr> </thead> <tbody> <tr> <td>wet soil + pan weight, g =</td> <td>27.16</td> <td>27.17</td> <td></td> <td></td> </tr> <tr> <td>dry soil + pan weight, g =</td> <td>25.84</td> <td>25.88</td> <td></td> <td></td> </tr> <tr> <td>pan weight, g =</td> <td>20.87</td> <td>21.01</td> <td></td> <td></td> </tr> <tr> <td>moisture, % =</td> <td>26.6 %</td> <td>26.5 %</td> <td></td> <td></td> </tr> </tbody> </table>		①	②	③	④	wet soil + pan weight, g =	27.16	27.17			dry soil + pan weight, g =	25.84	25.88			pan weight, g =	20.87	21.01			moisture, % =	26.6 %	26.5 %		
	①	②	③	④																						
wet soil + pan weight, g =	27.16	27.17																								
dry soil + pan weight, g =	25.84	25.88																								
pan weight, g =	20.87	21.01																								
moisture, % =	26.6 %	26.5 %																								
shrinkage ratio = n/a																										



ADDITIONAL DATA

% gravel =	n/a
% sand =	n/a
% silt and clay =	n/a
% silt =	n/a
% clay =	n/a
moisture content =	22%

DATE TESTED 08/19/25	TESTED BY G. Hausmann
	

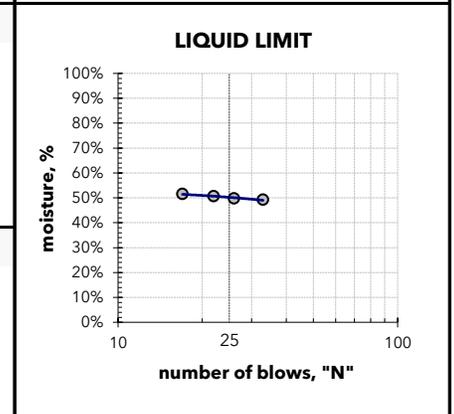
ATTERBERG LIMITS REPORT

PROJECT Moderna West Linn West Linn, Oregon	CLIENT MCRT Investments LLC 720 SW Washington Street, Suite 720 Portland, OR 97205	PROJECT NO. MCRT-1-01-1	
		ISSUE DATE 08/21/25	PAGE 1 of 1
		LAB ID S25-1674	FIELD ID TP7.1
		DATE SAMPLED 08/08/25	SAMPLED BY S. Chandra

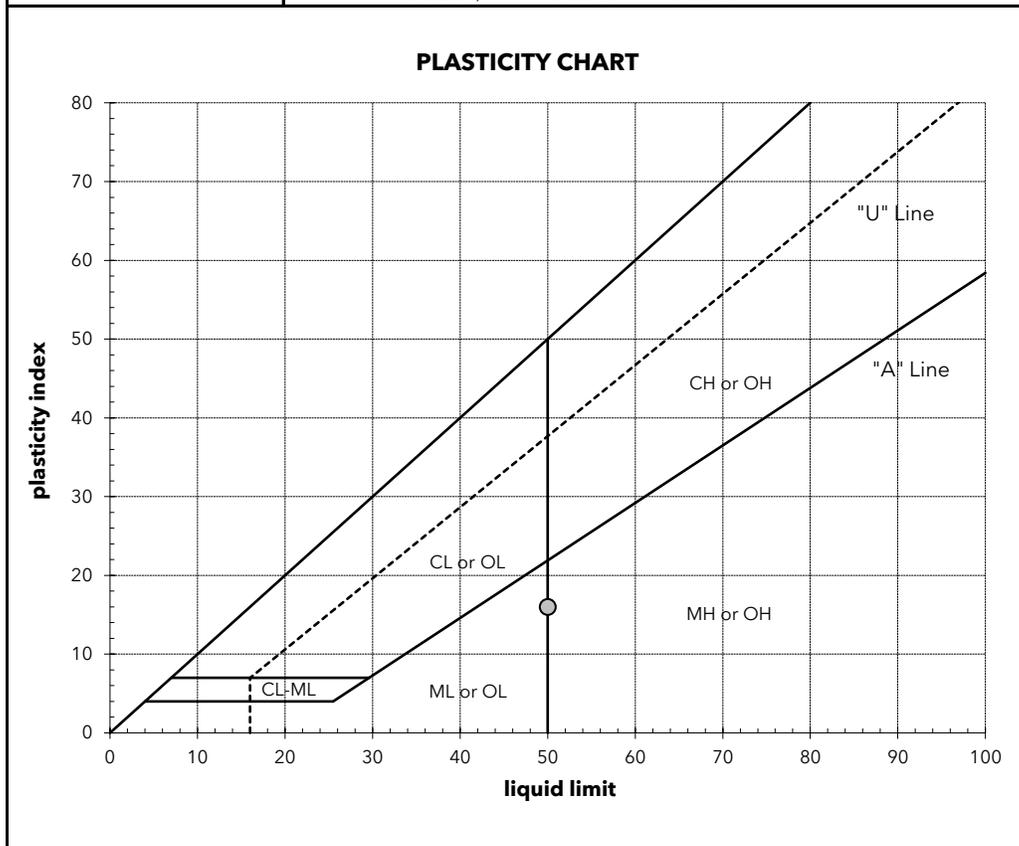
MATERIAL DATA	MATERIAL SOURCE Test Pit TP-7 depth = 1 foot	USCS SOIL TYPE no data provided
----------------------	----------------------------------------------------	------------------------------------

LABORATORY TEST DATA	TEST PROCEDURE ASTM D4318 - Method A
LABORATORY EQUIPMENT Liquid Limit Machine, Hand Rolled	

ATTERBERG LIMITS	LIQUID LIMIT DETERMINATION																														
liquid limit = 50	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>①</th> <th>②</th> <th>③</th> <th>④</th> </tr> </thead> <tbody> <tr> <td>wet soil + pan weight, g =</td> <td>31.09</td> <td>31.61</td> <td>31.24</td> <td>29.81</td> </tr> <tr> <td>dry soil + pan weight, g =</td> <td>27.76</td> <td>28.09</td> <td>27.60</td> <td>26.62</td> </tr> <tr> <td>pan weight, g =</td> <td>20.99</td> <td>21.01</td> <td>20.42</td> <td>20.43</td> </tr> <tr> <td>N (blows) =</td> <td>33</td> <td>26</td> <td>22</td> <td>17</td> </tr> <tr> <td>moisture, % =</td> <td>49.2 %</td> <td>49.7 %</td> <td>50.7 %</td> <td>51.5 %</td> </tr> </tbody> </table>		①	②	③	④	wet soil + pan weight, g =	31.09	31.61	31.24	29.81	dry soil + pan weight, g =	27.76	28.09	27.60	26.62	pan weight, g =	20.99	21.01	20.42	20.43	N (blows) =	33	26	22	17	moisture, % =	49.2 %	49.7 %	50.7 %	51.5 %
	①	②	③	④																											
wet soil + pan weight, g =	31.09	31.61	31.24	29.81																											
dry soil + pan weight, g =	27.76	28.09	27.60	26.62																											
pan weight, g =	20.99	21.01	20.42	20.43																											
N (blows) =	33	26	22	17																											
moisture, % =	49.2 %	49.7 %	50.7 %	51.5 %																											
plastic limit = 34																															
plasticity index = 16																															



SHRINKAGE	PLASTIC LIMIT DETERMINATION																									
shrinkage limit = n/a	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>①</th> <th>②</th> <th>③</th> <th>④</th> </tr> </thead> <tbody> <tr> <td>wet soil + pan weight, g =</td> <td>27.95</td> <td>27.82</td> <td></td> <td></td> </tr> <tr> <td>dry soil + pan weight, g =</td> <td>26.15</td> <td>26.09</td> <td></td> <td></td> </tr> <tr> <td>pan weight, g =</td> <td>20.87</td> <td>21.02</td> <td></td> <td></td> </tr> <tr> <td>moisture, % =</td> <td>34.1 %</td> <td>34.1 %</td> <td></td> <td></td> </tr> </tbody> </table>		①	②	③	④	wet soil + pan weight, g =	27.95	27.82			dry soil + pan weight, g =	26.15	26.09			pan weight, g =	20.87	21.02			moisture, % =	34.1 %	34.1 %		
	①	②	③	④																						
wet soil + pan weight, g =	27.95	27.82																								
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pan weight, g =	20.87	21.02																								
moisture, % =	34.1 %	34.1 %																								
shrinkage ratio = n/a																										



ADDITIONAL DATA

% gravel =	n/a
% sand =	n/a
% silt and clay =	n/a
% silt =	n/a
% clay =	n/a
moisture content =	17%

DATE TESTED 08/18/25	TESTED BY G. Hausmann
	



APPENDIX C

APPENDIX C SUBSURFACE EXPLORATION BY OTHERS

This appendix presents figures, exploration logs, and laboratory test results associated with subsurface exploration programs conducted by GeoDesign at the site on February 23, 2006, and February 20, 2014. The 2006 subsurface exploration program included 16 test pits to depths between 3.3 and 11 feet BGS. The 2014 subsurface exploration program included 17 test pits to depths between 4 and 13.5 feet BGS. The figures, test pit logs, and laboratory test results were appended to the following geotechnical engineering reports:

- *Report of Geotechnical Engineering Services; Willamette 205 Corporate Center; Blankenship Road and Tannler Drive; West Linn, Oregon, dated July 7, 2006*
- *Report of Geotechnical Engineering Services; NWC of Tannler & Blankenship; Tannler Drive and Blankenship Road; West Linn, Oregon, dated July 28, 2014*



EXPLANATION:

- TP-1 TEST PIT
- (5) DEPTH TO INTACT BEDROCK

NOTE:

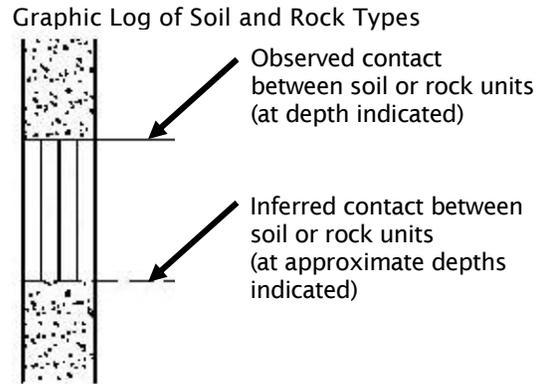
(11+) INDICATES THAT BEDROCK WAS NOT ENCOUNTERED



SITE PLAN BASED ON DRAWING PROVIDED BY GROUP MACKENZIE

KEY TO TEST PIT AND BORING LOG SYMBOLS

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 sampler and 140-pound hammer or pushed with recovery
	Location of grab sample
	Rock coring interval
	Water level during drilling
	Water level taken on date shown



GEOTECHNICAL TESTING EXPLANATIONS

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

ENVIRONMENTAL TESTING EXPLANATIONS

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

SOIL CLASSIFICATION SYSTEM

CONSISTENCY - 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

SOIL CLASSIFICATION NAME

Name and Modifier Terms		Constituent Percentage
Coarse-grained	GRAVEL, SAND	>50%
	sandy, gravelly	30 - 50%
	silty, clayey	15 - 50%
	some (gravel, sand)	15 - 30%
	some (silt, clay)	5 - 15%
	trace (gravel, sand)	
	trace (silt, clay)	<5%
Fine-grained	CLAY, SILT	>50%
	silty, clayey	30 - 50%
	sandy, gravelly	
	some (sand, gravel)	15 - 30%
	some (silt, clay)	
	trace (sand, gravel)	5 - 15%
	trace (silt, clay)	
Organic	PEAT	50 - 100%
	organic (soil name)	15 - 50%
	(soil name) with some organics	5 - 15%

MOISTURE CLASSIFICATION

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

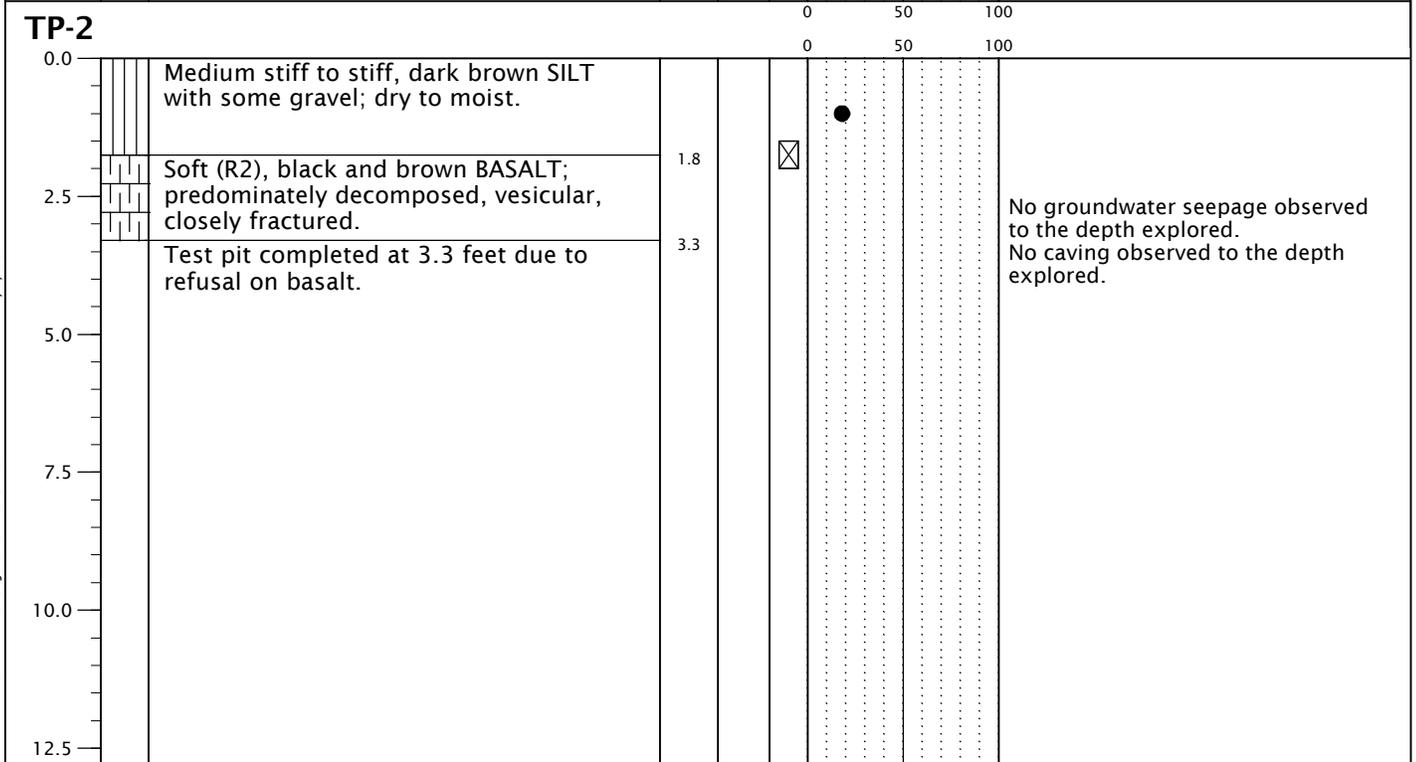
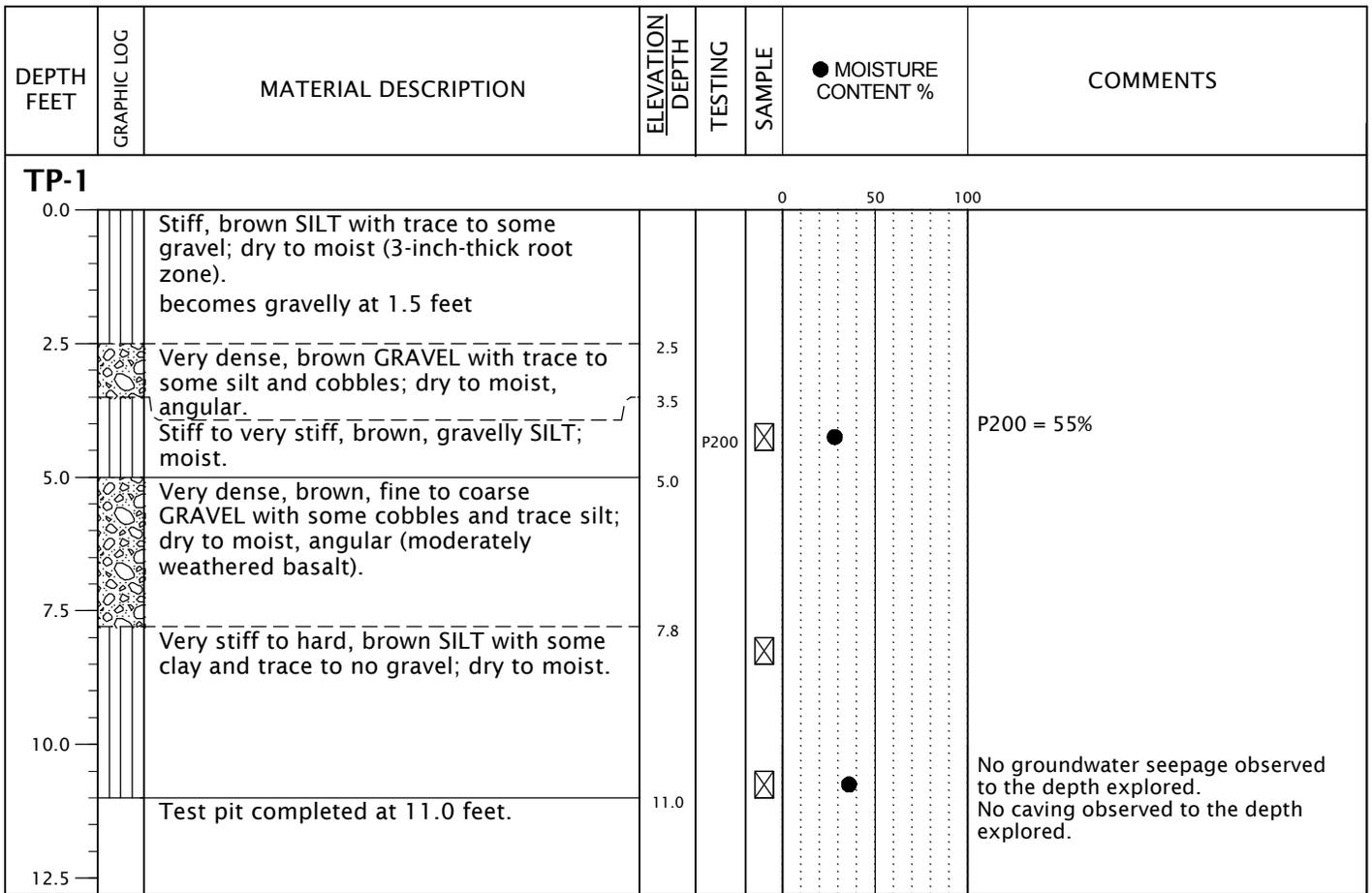
GRAIN SIZE CLASSIFICATION

Description	Sieve*	Observed Size
boulders	-	>12"
cobbles	-	3" - 12"
gravel	coarse	0.75" - 3"
	fine	#4 - 0.75"
sand	coarse	#10 - #4
	medium	#40 - #10
	fine	#200 - #40
finer	<#200	<0.0029"

* Use of #200 field sieve encouraged

ROCK CLASSIFICATION GUIDELINES

HARDNESS	DESCRIPTION	
Extremely Soft (R0) Very Soft (R1) Soft (R2) Medium Hard (R3) Hard (R4) Very Hard (R5)	Indented by thumbnail Can be peeled by pocket knife or scratched with finger nail Can be peeled by a pocket knife with difficulty Can be scratched by knife or pick Can be scratched with knife or pick only with difficulty Cannot be scratched with knife or sharp pick	
WEATHERING	DESCRIPTION	
Decomposed Predominantly Decomposed Moderately Weathered Slightly Weathered Fresh	Rock mass is completely decomposed Rock mass is more than 50% decomposed Rock mass is decomposed locally Rock mass is generally fresh No discoloration in rock fabric	
JOINT SPACING	DESCRIPTION	
Very Close Close Moderate Close Wide Very Wide	Less than 2 inches 2 inches to 1 foot 1 foot to 3 feet 3 feet to 10 feet Greater than 10 feet	
FRACTURING	FRACTURE SPACING	
Very Intensely Fractured Intensely Fractured Moderately Fractured Slightly Fractured Very Slightly Fractured Unfractured	Chips and fragments with a few scattered short core lengths 0.1 foot to 0.3 foot with scattered fragments intervals 0.3 foot to 1 foot with most lengths 0.6 foot 1 foot to 3 feet Greater than 3 feet No fractures	
HEALING	DESCRIPTION	
Not Healed Partly Healed Moderately Healed Totally Healed	Discontinuity surface, fractured zone, sheared material or filling not re-cemented Less than 50% of fractured or sheared material Greater than 50% of fractured or sheared material All fragments bonded	
 15575 SW Sequoia Parkway - Suite 100 Portland OR 97224 Off 503.968.8787 Fax 503.968.3068	ROCK CLASSIFICATION GUIDELINES	TABLE A-3



TEST PIT LOG - 2 PER PAGE BLACKHAWK-1-01-TP1-16.GPJ GEODESIGN.GDT PRINT DATE: 7/6/06:KT

EXCAVATED BY: Western States Soil Conservation, Inc.

LOGGED BY: BBP

COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)



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BLACKHAWK-1-01

JULY 2006

TEST PIT

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-1

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
TP-3							
0.0		Stiff, brown SILT with trace clay; dry to moist (6-inch-thick root zone).					No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5							
4.1		grades with trace gravel and cobbles at 4.0 feet	4.1				
4.3		Soft to medium hard (R2-R3), light gray-brown BASALT; moderately to slightly weathered, closely fractured. Test pit completed at 4.3 feet due to refusal on basalt.	4.3				
5.0							
7.5							
10.0							
12.5							

TP-4							
0.0		Stiff, brown SILT with trace to some clay; moist (5-inch-thick root zone).					No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5							
3.0		grades to light brown and clayey with brown and black mottles at 3.0 feet					
5.0		grades with trace gravel and angular cobbles (colluvium) at 5.0 feet					
5.5		encountered single cobbles (10-inch diameter) at 5.5 feet	6.0				
6.5		Dense to very dense, yellow-gray GRAVEL with some cobbles and trace silt; dry to moist, angular (colluvium).	6.5				
7.2		Dense to very dense, yellow-gray, fine to coarse SAND with some clay and trace fine gravel; moist, subrounded to angular. Test pit completed at 7.2 feet due to refusal on basalt.	7.2				
7.5							
10.0							
12.5							

EXCAVATED BY: Western States Soil Conservation, Inc.

LOGGED BY: BBP

COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)



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Portland OR 97224
Off 503.968.8787 Fax 503.968.3068

BLACKHAWK-1-01

JULY 2006

TEST PIT

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-2

TEST PIT LOG - 2 PER PAGE BLACKHAWK-1-01-TP1-16.GPJ GEODESIGN.GDT PRINT DATE: 7/6/06:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
------------	-------------	----------------------	-----------------	---------	--------	----------------------	----------

TP-5

0.0		Stiff, brown SILT with trace clay; moist (3-inch-thick root zone).				0 50 100	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5				3.0	3.7	0 50 100	
5.0		Soft to medium hard (R2-R3), gray BASALT with brown staining; moderate to slightly weathered, slightly fractured (1- to 8-inch spacing). Test pit completed at 3.7 feet due to refusal on basalt.				0 50 100	
7.5						0 50 100	
10.0						0 50 100	
12.5						0 50 100	

TP-6

0.0		Stiff, brown SILT with trace to some gravel and cobbles and trace clay; dry to moist (8-inch-thick root zone).				0 50 100	No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5				3.0	4.0	0 50 100	
5.0		Stiff, dark brown, gravelly SILT with some organics; dry to moist (colluvium). Stiff, dark brown SILT with trace to some gravel and some organics; dry to moist (colluvium). grades to no gravel at 5.5 feet				0 50 100	
7.5						0 50 100	
10.0		Test pit completed at 10.2 feet.				0 50 100	
12.5						0 50 100	

EXCAVATED BY: Western States Soil Conservation, Inc.

LOGGED BY: BBP

COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)



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Portland OR 97224
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BLACKHAWK-1-01

TEST PIT

JULY 2006

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-3

TEST PIT LOG - 2 PER PAGE BLACKHAWK-1-01-TP1-16.GPJ GEODESIGN.GDT PRINT DATE: 7/6/06:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
TP-7							
0.0		Stiff, brown SILT with trace clay; dry to moist (4-inch-thick root zone).					No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5		encountered two boulders (14-inch diameter) at 3.0 feet					
3.5		grades with some gravel and cobbles at 3.5 feet	4.0				
5.0		Soft to medium hard (R2-R3), gray BASALT with brown staining; moderately weathered, closely fractured (1 to 6 inches), slightly fractured.					
7.5		grades to extremely soft to very soft (R0-R1) at approximately 7.0 feet	8.0		☒		
8.0	grades to red-brown with yellow breccia at 7.5 feet	Test pit completed at 8.0 feet due to refusal on basalt.					

TP-8							
0.0		Medium stiff to stiff, brown SILT with trace clay; moist (2-inch-thick root zone).					No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5		grades to yellow-brown with some clay at 3.5 feet					
5.0		Very dense, brown, silty GRAVEL; dry to moist, poorly graded, angular, few cobbles up to 8-inch diameter (colluvium).	5.5				
7.5		Hard, brown, clayey SILT; dry.	6.5		☒	●	
9.0		Extremely soft (R0), dark gray BASALT with brown stains; decomposed to intensely weathered.	7.5		☒	●	
9.0	Test pit completed at 9.0 feet.						

EXCAVATED BY: Western States Soil Conservation, Inc.

LOGGED BY: BBP

COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)



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Portland OR 97224
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BLACKHAWK-1-01

JULY 2006

TEST PIT

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-4

TEST PIT LOG - 2 PER PAGE BLACKHAWK-1-01-TP1-16.GPJ GEODESIGN.GDT PRINT DATE: 7/6/06:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
TP-9							
0.0		Stiff, brown SILT with trace to some clay; moist (7-inch-thick root zone).				0 50 100	
2.5							
5.0		grades to no clay at 4.5 feet			☒	●	
7.5							
8.0		Dense to very dense, brown, fine to coarse GRAVEL with some fine to coarse sand and silt; moist, poorly graded, subrounded to subangular.	8.0				Minor caving observed at 8.0 feet.
10.0				P200	☒	●	P200 = 18%
10.7		Test pit completed at 10.7 feet.	10.7				No groundwater seepage observed to the depth explored.
12.5							

TP-10							
0.0		Medium stiff to stiff, brown SILT with trace to some clay; moist (6-inch-thick root zone).				0 50 100	
2.5							
4.5		Dense to very dense, brown-gray, fine to coarse GRAVEL with some fine to coarse cobbles and silt and trace sand; moist, subrounded to subangular.	4.5		☒	●	
5.0							
7.5		grades to very fractured, decomposed basalt at 7.0 feet					
8.8		Test pit completed at 8.8 feet.	8.8		☒		No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
10.0							
12.5							

EXCAVATED BY: Western States Soil Conservation, Inc.

LOGGED BY: BBP

COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)



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

BLACKHAWK-1-01

JULY 2006

TEST PIT

WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-5

TEST PIT LOG - 2 PER PAGE BLACKHAWK-1-01-TP1-16.GPJ GEODESIGN.GDT PRINT DATE: 7/6/06:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
TP-11							
0.0		Medium stiff, dark brown SILT with trace to some gravel and trace clay; moist (fill).					No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5							
5.0		Stiff, brown SILT with trace to some clay; dry to moist, few roots.	4.0				
7.5		Dense to very dense, brown-gray GRAVEL with some silt and cobbles; moist, angular (colluvium).	6.0	☒		●	
10.0		Extremely soft to very soft (R0-R1), yellow-gray BASALT; decomposed, closely fractured (1 to 5 inches). Test pit completed at 10.0 feet.	9.0	☒			
12.5			10.0	☒			

TP-12							
0.0		Medium stiff to stiff, brown SILT with some clay; moist (7-inch-thick root zone).					No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5							
5.0		Stiff, gray-brown, clayey SILT with brown mottles; moist.	3.5	☒		●	
7.5		Very dense, brown-gray GRAVEL with some cobbles and trace sand and silt; moist, subrounded to angular.	5.0				
10.0		grades to fine to coarse with some sand and silt at 8.5 feet becomes subrounded to subangular at 9.0 feet Test pit completed at 10.8 feet.	10.8	☒			
12.5							

EXCAVATED BY: Western States Soil Conservation, Inc.

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BLACKHAWK-1-01

JULY 2006

TEST PIT

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FIGURE A-6

TEST PIT LOG - 2 PER PAGE BLACKHAWK-1-01-TP1-16.GPJ GEODESIGN.GDT PRINT DATE: 7/6/06:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
TP-13							
0.0		Stiff, brown SILT with trace to some clay; moist (8-inch-thick root zone)				0 50 100	
2.5		becomes blocky with trace clay at 2.0 feet					
3.0		Dense to very dense, fine to coarse GRAVEL with trace to some silt, sand, and cobbles; dry to moist, subrounded to angular (colluvium).			☒	●	
5.0							
7.5							
10.0							
11.0		Test pit completed at 11.0 feet.	11.0		☒		No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
12.5							

TP-14							
0.0		Stiff, brown SILT with trace sand; moist (8-inch-thick root zone).				0 50 100	
2.5		grades to gravelly at 1.5 feet					
3.0		Extremely soft to soft (R0-R2), gray-brown BASALT; moderately weathered, closely fractured (2 to 6 inches).					
5.0		Test pit completed at 5.0 feet due to refusal on basalt.			☒	●	
7.5							
10.0							
12.5							

EXCAVATED BY: Western States Soil Conservation, Inc.

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EXCAVATION METHOD: backhoe (see report text)



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BLACKHAWK-1-01

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TEST PIT

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WEST LINN, OR

FIGURE A-7

TEST PIT LOG - 2 PER PAGE BLACKHAWK-1-01-TP1-16.GPJ GEODESIGN.GDT PRINT DATE: 7/6/06:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
TP-15							
0.0		Dense, brown, silty GRAVEL; dry to moist, poorly graded, angular (fill). Stiff, dark brown SILT with some organics; dry to moist.	0.7				No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5		Very soft to soft (R1-R2), brown BASALT with black stains; moderately to slightly weathered, closely fractured (2 to 8 inches), blocky.	3.3		☒		
5.0		Test pit completed at 3.3 feet due to refusal on basalt.					
7.5							
10.0							
12.5							

TP-16							
0.0		Stiff, brown, gravelly SILT with trace sand; dry to moist; angular gravel (5-inch-thick root zone).					No groundwater seepage observed to the depth explored. No caving observed to the depth explored.
2.5		Dense to very dense, gray-brown GRAVEL with trace to some silt, sand, and cobbles; dry to moist, poorly graded, subrounded to subangular (colluvium).	3.0				
5.0		Test pit completed at 11.0 feet.	11.0		☒	●	
7.5							
10.0							
12.5							

EXCAVATED BY: Western States Soil Conservation, Inc.

LOGGED BY: BBP

COMPLETED: 02/23/06

EXCAVATION METHOD: backhoe (see report text)



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BLACKHAWK-1-01

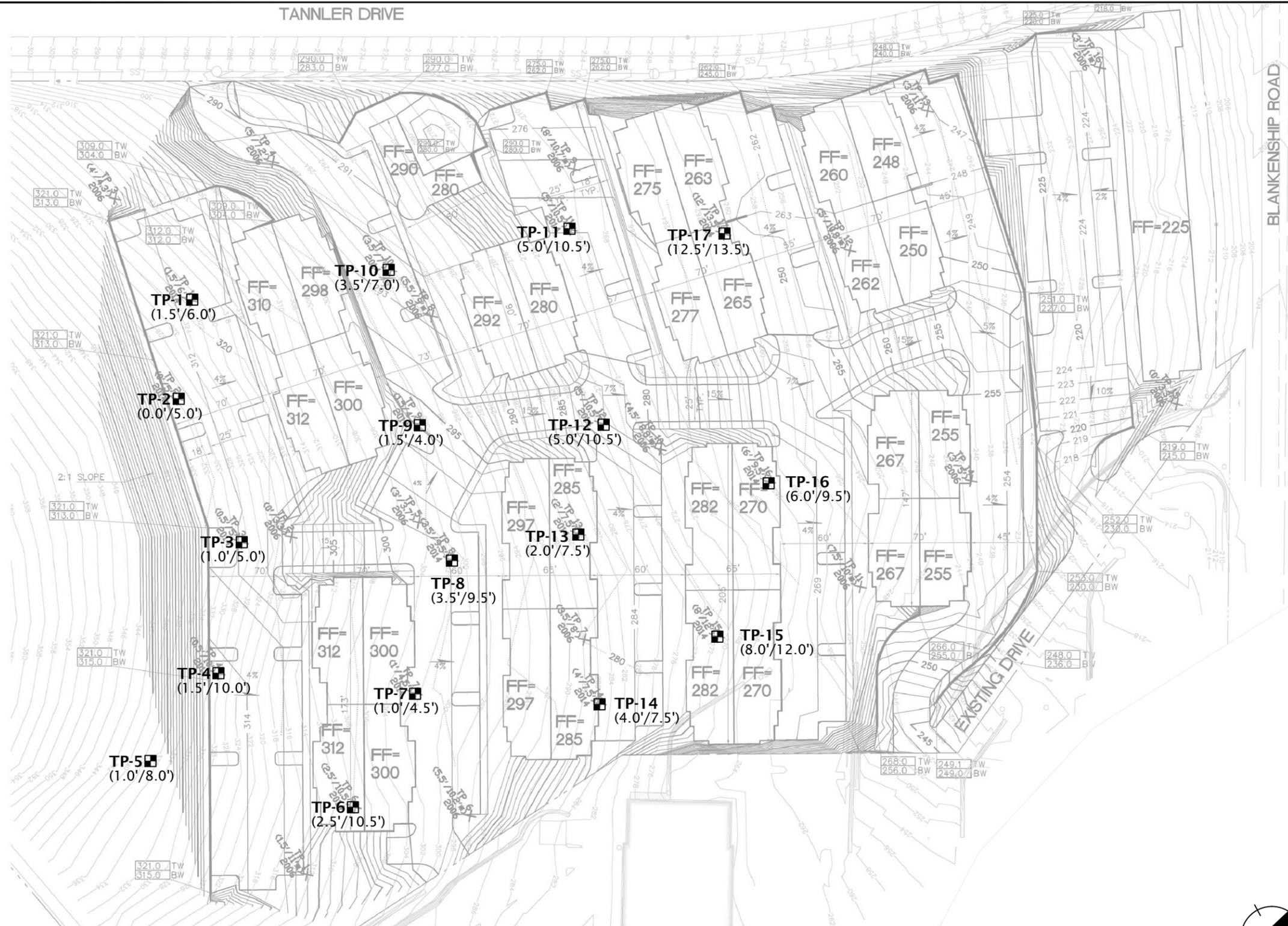
TEST PIT

JULY 2006

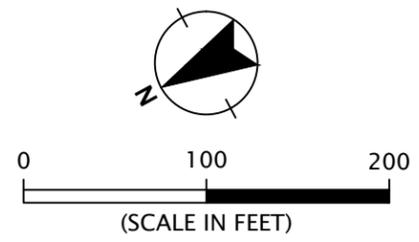
WILLAMETTE 205 CORPORATE CENTER
WEST LINN, OR

FIGURE A-8

TEST PIT LOG - 2 PER PAGE BLACKHAWK-1-01-TP1-16.GPJ GEODESIGN.GDT PRINT DATE: 7/6/06:KT



LEGEND:
 TP-1 (1.5'/11.0') TEST PIT
 DEPTH TO WEATHERED BASALT/DEPTH TO INTACT BASALT

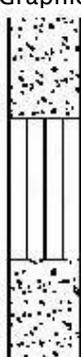


SITE PLAN BASED ON IMAGE OBTAINED FROM
 CONAM PROPERTIES, JULY 23, 2014

<p>15575 SW Sequoia Parkway - Suite 100 Portland OR 97224 Off 503.968.8787 Fax 503.968.3068</p>	<p>CONAM-1-01 JULY 2014</p>	<p>SITE PLAN NWC OF TANNLER & BLANKENSHIP WEST LINN, OR</p>	<p>FIGURE 2</p>
---------------------------------------------------------------------------------------------------------------------------	------------------------------------------	-------------------------------------------------------------------------------------------	-----------------

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



Observed contact between soil or rock units (at depth indicated)

Inferred contact between soil or rock units (at approximate depths indicated)

GEOTECHNICAL TESTING EXPLANATIONS

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

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			
				GRAVELS WITH FINES (> 12% fines)		GW-GC or GP-GC		GRAVEL with clay			
				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	
		SANDS WITH FINES (> 12% fines)				SW-SC or SP-SC		SAND with clay			
		FINE-GRAINED SOILS (50% or more passing No. 200 sieve)		SILT AND CLAY Liquid limit less than 50		GM		silty GRAVEL			
						GC		clayey GRAVEL			
						GC-GM		silty, clayey GRAVEL			
						SC		clayey SAND			
SILT AND CLAY Liquid limit 50 or greater				SM		silty SAND					
				SC		clayey SAND					
				SC-SM		silty, clayey SAND					
				ML		SILT					
HIGHLY ORGANIC SOILS		SILT AND CLAY Liquid limit less than 50		CL		CLAY					
				CL-ML		silty CLAY					
				OL		ORGANIC SILT or ORGANIC CLAY					
		SILT AND CLAY Liquid limit 50 or greater		MH		SILT					
				CH		CLAY					
				OH		ORGANIC SILT or ORGANIC CLAY					
PT		PEAT									
MOISTURE CLASSIFICATION			ADDITIONAL CONSTITUENTS								
Term		Field Test		Secondary granular components or other materials such as organics, man-made debris, etc.							
dry		very low moisture, dry to touch		Silt and Clay In:		Sand and Gravel In:					
				Percent		Percent					
moist		damp, without visible moisture		Fine-Grained Soils		Fine-Grained Soils					
				Coarse-Grained Soils		Coarse-Grained Soils					
wet		visible free water, usually saturated		< 5		< 5					
				5 - 12		5 - 15					
				trace		trace					
				minor		minor					
				some		with					
				silty/clayey		with					
				> 12		> 30					
				sandy/gravelly		Indicate %					
 15575 SW Sequoia Parkway - Suite 100 Portland OR 97224 Off 503.968.8787 Fax 503.968.3068			SOIL CLASSIFICATION SYSTEM				TABLE A-2				

HARDNESS	DESCRIPTION	
<p>Extremely Soft (R0) Very Soft (R1) Soft (R2) Medium Hard (R3) Hard (R4) Very Hard (R5)</p>	<p>Indented by thumbnail Can be peeled by pocket knife or scratched with finger nail Can be peeled by a pocket knife with difficulty Can be scratched by knife or pick Can be scratched with knife or pick only with difficulty Cannot be scratched with knife or sharp pick</p>	
WEATHERING	DESCRIPTION	
<p>Decomposed Predominantly Decomposed Moderately Weathered Slightly Weathered Fresh</p>	<p>Rock mass is completely decomposed Rock mass is more than 50% decomposed Rock mass is decomposed locally Rock mass is generally fresh No discoloration in rock fabric</p>	
JOINT SPACING	DESCRIPTION	
<p>Very Close Close Moderate Close Wide Very Wide</p>	<p>Less than 2 inches 2 inches to 1 foot 1 foot to 3 feet 3 feet to 10 feet Greater than 10 feet</p>	
FRACTURING	FRACTURE SPACING	
<p>Very Intensely Fractured Intensely Fractured Moderately Fractured Slightly Fractured Very Slightly Fractured Unfractured</p>	<p>Chips and fragments with a few scattered short core lengths 0.1 foot to 0.3 foot with scattered fragments intervals 0.3 foot to 1 foot with most lengths 0.6 foot 1 foot to 3 feet Greater than 3 feet No fractures</p>	
HEALING	DESCRIPTION	
<p>Not Healed Partly Healed Moderately Healed Totally Healed</p>	<p>Discontinuity surface, fractured zone, sheared material or filling not re-cemented Less than 50% of fractured or sheared material Greater than 50% of fractured or sheared material All fragments bonded</p>	
 <p>15575 SW Sequoia Parkway - Suite 100 Portland OR 97224 Off 503.968.8787 Fax 503.968.3068</p>	ROCK CLASSIFICATION SYSTEM	TABLE A-3

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %			COMMENTS
						0	50	100	
0.0		Medium stiff, brown SILT (ML), abundant shrub roots; moist (2-inch-thick root zone).							
1.5		Very soft to soft (R1-R2), gray-brown BASALT; decomposed to intensely weathered, moderately to intensely fractured.	1.5						
2.5									
5.0		soft to medium hard (R2-R3), gray; moderately to intensely weathered, moderately fractured at 4.0 feet							
6.0		Exploration terminated at a depth of 6.0 feet due to refusal.	6.0						
7.5									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.
10.0									
12.5									
15.0									

EXCAVATED BY: Dan J. Fischer Excavating, Inc.

LOGGED BY: NAK

COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

TEST PIT LOG - 1 PER PAGE CONAM-1-01-TP1_17.GPJ GEODESIGN.GDT PRINT DATE: 7/28/14:KT



CONAM-1-01

TEST PIT TP-1

JULY 2014

NWC OF TANNER & BLAKENSHIP
WEST LINN, OR

FIGURE A-1

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to moderately weathered, moderately to very intensely fractured, abundant shrub roots (2-inch-thick root zone).				0 50 100	
		without shrub roots at 1.5 feet					
2.5		grades to medium hard (R3); moderately to intensely weathered, moderately fractured at 3.0 feet					
		soft to medium hard (R2-R3), gray; moderately to intensely weathered, moderately fractured at 4.0 feet					
5.0		Exploration terminated at a depth of 5.0 feet due to refusal.	5.0				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.
7.5							
10.0							
12.5							
15.0							

EXCAVATED BY: Dan J. Fischer Excavating, Inc.

LOGGED BY: NAK

COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)



CONAM-1-01

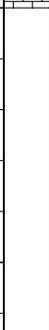
TEST PIT TP-2

JULY 2014

NWC OF TANNER & BLAKENSHIP
WEST LINN, OR

FIGURE A-2

TEST PIT LOG - 1 PER PAGE CONAM-1-01-TP1_17.GPJ GEODESIGN.GDT PRINT DATE: 7/28/14:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		TOPSOIL, abundant shrub roots (12-inch-thick root zone).					
1.0		Very soft to soft (R1-R2), brown-gray BASALT; decomposed to moderately weathered, moderately to very intensely fractured.	1.0				
2.5		soft to medium hard (R2-R3); moderately to intensely weathered, slightly to moderately fractured at 3.5 feet					
5.0		Exploration terminated at a depth of 5.0 feet due to refusal.	5.0				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.
7.5							
10.0							
12.5							
15.0							

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COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)



CONAM-1-01

TEST PIT TP-3

JULY 2014

NWC OF TANNER & BLAKENSHIP
WEST LINN, OR

FIGURE A-3

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		TOPSOIL, abundant shrub roots (18-inch-thick root zone).				0 50 100	
2.5		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to intensely weathered, moderately to very intensely fractured.	1.5				
5.0		gray-brown; decomposed at 5.0 feet slightly to moderately fractured at 5.5 feet					
7.5							
10.0		soft to medium hard (R2-R3) at 9.5 feet					
10.0		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.
12.5							
15.0						0 50 100	

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EXCAVATION METHOD: trackhoe (see report text)



CONAM-1-01

TEST PIT TP-4

JULY 2014

NWC OF TANNER & BLAKENSHIP
WEST LINN, OR

FIGURE A-4

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		TOPSOIL, abundant shrub roots (12-inch-thick root zone).				0 50 100	
1.0		Very soft to soft (R1-R2), brown BASALT; decomposed to intensely weathered, moderately to intensely fractured.	1.0				
2.5		soft to medium hard (R2-R3) at 3.0 feet					
5.0		extremely soft to very soft (R0-R1), gray-yellow; decomposed at 5.0 feet					
7.5		soft to medium hard (R2-R3) at 7.5 feet					
8.0		Exploration terminated at a depth of 8.0 feet due to refusal.	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.
10.0							
12.5							
15.0							

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LOGGED BY: NAK

COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)



CONAM-1-01

TEST PIT TP-5

JULY 2014

NWC OF TANNER & BLAKENSHIP
WEST LINN, OR

FIGURE A-5

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Medium stiff, brown SILT with gravel (ML), trace organics (rootlets), shrub roots; moist (2-inch-thick root zone).					
		without shrub roots at 1.5 feet					
2.5		Medium dense, brown, silty GRAVEL (GM); moist, fine to coarse and angular (decomposed basalt). with cobbles at 3.0 feet	2.5				
5.0							
7.5		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	7.0				
10.0		very soft to medium hard (R1-R3); moderately to intensely weathered at 10.0 feet					
		Exploration terminated at a depth of 10.5 feet due to refusal.	10.5				
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.
15.0							

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EXCAVATED BY: Dan J. Fischer Excavating, Inc.

LOGGED BY: NAK

COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)



CONAM-1-01

TEST PIT TP-6

JULY 2014

NWC OF TANNER & BLAKENSHIP
WEST LINN, OR

FIGURE A-6

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Medium stiff, brown SILT with gravel (ML), trace organics (rootlets), abundant shrub roots; moist (4-inch-thick root zone).					
1.0		Very soft to soft (R1-R2), brown-gray BASALT; decomposed to intensely weathered, moderately to very intensely fractured.	1.0				
2.5							
4.0		medium hard to hard (R3-R4); moderately to intensely weathered at 4.0 feet					
4.5		Exploration terminated at a depth of 4.5 feet due to refusal.	4.5				
5.0							
7.5							
10.0							
12.5							
15.0							

Slow groundwater seepage observed at 4.0 feet.

No caving observed to the depth explored.

Surface elevation was not measured at the time of exploration.

EXCAVATED BY: Dan J. Fischer Excavating, Inc.

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COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)

TEST PIT LOG - 1 PER PAGE CONAM-1-01-TP1_17.GPJ GEODESIGN.GDT PRINT DATE: 7/28/14:KT



CONAM-1-01

TEST PIT TP-7

JULY 2014

NWC OF TANNER & BLAKENSHIP
WEST LINN, OR

FIGURE A-7

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Soft to medium stiff, brown SILT (ML), some clay, trace organics (rootlets); moist (4-inch-thick root zone).				0 50 100	
2.5					⊗		Moderate caving observed at 1.5 feet.
3.5		Very soft to soft (R1-R2), brown and gray-yellow BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	3.5				
5.0		soft to medium hard (R2-R3); moderately to very intensely fractured at 5.0 feet					
7.5		medium hard (R3) at 7.0 feet					
9.5		Exploration terminated at a depth of 9.5 feet due to refusal.	9.5				No groundwater seepage observed to the depth explored. Surface elevation was not measured at the time of exploration.
10.0							
12.5							
15.0						0 50 100	

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EXCAVATION METHOD: trackhoe (see report text)



CONAM-1-01

TEST PIT TP-8

JULY 2014

NWC OF TANNER & BLAKENSHIP
WEST LINN, OR

FIGURE A-8

TEST PIT LOG - 1 PER PAGE CONAM-1-01-TP1_17.GPJ GEODESIGN.GDT PRINT DATE: 7/28/14:KT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Soft to medium stiff, brown SILT with gravel (ML), trace organics (rootlets), abundant fine roots; moist (4-inch-thick root zone). without fine roots at 1.0 foot				0 50 100	
2.5		Very soft to soft (R1-R2), brown and gray-black BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	1.5				
4.0		soft to medium hard (R2-R3); moderately to very intensely weathered, moderately to very intensely fractured at 3.5 feet Exploration terminated at a depth of 4.0 feet due to refusal.	4.0				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.
5.0							
7.5							
10.0							
12.5							
15.0						0 50 100	

EXCAVATED BY: Dan J. Fischer Excavating, Inc.

LOGGED BY: NAK

COMPLETED: 02/20/14

EXCAVATION METHOD: trackhoe (see report text)



CONAM-1-01

TEST PIT TP-9

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FIGURE A-9

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Soft to medium stiff, brown SILT (ML), some clay, trace organics; moist (4-inch-thick root zone).				0 50 100	Minor caving observed at 1.0 foot.
2.5		wood/roots at 2.0 feet medium stiff at 2.5 feet					
3.5		Extremely soft to very soft (R0-R1), brown BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	3.5				No groundwater seepage observed to the depth explored. Surface elevation was not measured at the time of exploration.
5.0							
7.0		soft to medium hard (R2-R3); moderately to intensely weathered, moderately to intensely fractured at 6.5 feet	7.0				
7.5		Exploration terminated at a depth of 7.0 feet due to refusal.					
10.0							
12.5							
15.0							

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EXCAVATION METHOD: trackhoe (see report text)



CONAM-1-01

TEST PIT TP-10

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FIGURE A-10

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Blackberry cuttings (2.0 inches).					
0.2		Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, abundant roots; moist. without abundant roots at 1.0 foot medium stiff, brown, none to trace organics at 1.5 feet stiff at 2.0 feet					
2.5							
4.0		brown-yellow at 4.0 feet					
5.0		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	5.0				
7.5							
8.0		very soft to soft (R1-R2), gray; vuggy at 8.0 feet					
9.0		moderately to intensely fractured at 9.0 feet					
10.0		soft to medium hard (R2-R3) at 10.0 feet					
10.5		Exploration terminated at a depth of 10.5 feet due to refusal.	10.5				Slow to moderate groundwater seepage observed at 10.0 feet. No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
12.5							
15.0							

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EXCAVATION METHOD: trackhoe (see report text)



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TEST PIT TP-11

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FIGURE A-11

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Blackberry cuttings (2.0 inches).					
0.2		Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, abundant blackberry roots; moist. without abundant blackberry roots at 1.0 foot medium stiff, brown, trace organics at 1.5 feet					
2.5		stiff at 2.5 feet					
4.5		brown-yellow at 4.5 feet					
5.0		Extremely soft to very soft (R0-R1), brown-gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	5.0				
7.5		gray; slightly to moderately fractured, vuggy at 7.5 feet					
10.0		Exploration terminated at a depth of 10.5 feet due to refusal.	10.5				
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.
15.0							

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EXCAVATION METHOD: trackhoe (see report text)



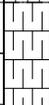
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FIGURE A-12

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Blackberry cuttings (2.0 inches). Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist.	0.2				Minor caving observed at 1.0 foot.
2.5		Very soft to soft (R1-R2), gray-brown BASALT; decomposed to intensely weathered, moderately to very intensely fractured.	2.0				
7.5		medium hard to hard (R3-R4); slightly to moderately weathered, moderately fractured at 7.0 feet Exploration terminated at a depth of 7.5 feet due to refusal.	7.5				
10.0							No groundwater seepage observed to the depth explored. Surface elevation was not measured at the time of exploration.
15.0							

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FIGURE A-13

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Blackberry cuttings (2.0 inches). Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist.	0.2				
2.5		medium stiff, brown, trace organics, without blackberry roots at 1.0 foot					
4.0		Very soft to soft (R1-R2), brown-gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	4.0				
5.0							
7.5		Exploration terminated at a depth of 7.5 feet due to refusal.	7.5				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.
10.0							
12.5							
15.0							

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FIGURE A-14

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Blackberry cuttings (2.0 inches). Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist - FILL. without blackberry roots at 1.0 foot	0.2				
2.5		medium stiff, with cobbles, trace gravel at 2.0 feet					
3.5		Medium stiff to stiff, brown SILT (MH), some clay, trace gravel; moist.					
5.0							
7.5							
8.0		Extremely soft to very soft (R0-R1), brown-yellow and gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	8.0				
10.0		very soft to soft (R1-R2); moderately to intensely weathered, moderately fractured at 10.5 feet					
11.5		soft to medium hard (R3-R5) at 11.5 feet					
12.0		Exploration terminated at a depth of 12.0 feet due to refusal.	12.0				
15.0							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.

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FIGURE A-15

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT %	COMMENTS
0.0		Blackberry cuttings (2.0 inches). Soft to medium stiff, dark brown SILT (ML), some clay, trace to some organics, blackberry roots; moist. medium stiff, brown, trace organics, without blackberry roots at 1.0 foot stiff at 2.0 feet	0.2				
2.5							
5.0							
6.0		Extremely soft to very soft (R0-R1), brown-yellow and gray BASALT; decomposed to intensely weathered, intensely to very intensely fractured.	6.0				
7.5							
9.5		soft to medium hard (R2-R3); moderately to intensely weathered, moderately to intensely fractured at 9.0 feet Exploration terminated at a depth of 9.5 feet due to refusal.	9.5				
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.
12.5							
15.0							

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FIGURE A-16



APPENDIX D

APPENDIX D REPORT LIMITATIONS AND IMPORTANT INFORMATION

Report Purpose, Use, and Standard of Care

This report has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and/or environmental consulting, and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This report has been prepared to meet the specific needs of specific individuals for the indicated site. It may not be adequate for use by other consultants, contractors, or engineers, or if change in project ownership has occurred. It should not be used for any other reason than its stated purpose without prior consultation with Columbia West Engineering, Inc. (Columbia West). It is a unique report and not applicable for any other site or project. If site conditions are altered, or if modifications to the project description or proposed plans are made after the date of this report, it may not be valid. Columbia West cannot accept responsibility for use of this report by other individuals for unauthorized purposes, or if problems occur resulting from changes in site conditions for which Columbia West was not aware or informed.

Report Conclusions and Preliminary Nature

This geotechnical or environmental report should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. The exploration and associated laboratory analysis of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the subject property. However, soil conditions may differ between tested locations at different seasonal times of the year, either by natural causes or human activity. Distinction between soil types may be more abrupt or gradual than indicated on the soil logs. This report is not intended to stand alone without understanding of concomitant instructions, correspondence, communication, or potential supplemental reports that may have been provided to the client.

Because this report is based upon observations obtained at the time of exploration, its adequacy may be compromised with time. This is particularly relevant in the case of natural disasters, earthquakes, floods, or other significant events. Report conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the subject property. Groundwater conditions, if presented in this report, reflect observed conditions at the time of investigation. These conditions may change annually, seasonally or as a result of adjacent development.

Additional Investigation and Construction Observation

Columbia West should be consulted prior to construction to assess whether additional investigation above and beyond that presented in this report is necessary. Even slight variations in soil or site conditions may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent construction observation and testing to verify soil conditions do not differ materially or significantly from the interpreted conditions utilized for preparation of this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Actual subsurface conditions are more readily observed and discerned during the earthwork phase of construction when soils are exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this report or future performance of structural facilities if another consultant is retained during the construction phase or Columbia West is not engaged to provide construction observation to the full extent recommended.

Collected Samples

Uncontaminated samples of soil or rock collected in connection with this report will be retained for thirty days. Retention of such samples beyond thirty days will occur only at client's request and in return for payment of storage charges incurred. All contaminated or environmentally impacted materials or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Report Contents

This geotechnical or environmental report should not be copied or duplicated unless in full, and even then only under prior written consent by Columbia West, as indicated in further detail in the following text section entitled Report Ownership. The recommendations, interpretations, and suggestions presented in this report are only understandable in context of reference to the whole report. Under no circumstances should the soil boring or test pit excavation logs, monitor well logs, or laboratory analytical reports be separated from the remainder of the report. The logs or reports should not be redrawn or summarized by other entities for inclusion in architectural or civil drawings, or other relevant applications.

Report Limitations for Contractors

Geotechnical or environmental reports, unless otherwise specifically noted, are not prepared for the purpose of developing cost estimates or bids by contractors. The extent of exploration or investigation conducted as part of this report is usually less than that necessary for contractor's needs. Contractors should be advised of these report limitations, particularly as they relate to development of cost estimates. Contractors may gain valuable information from this report, but should rely upon their own interpretations as to how subsurface conditions may affect cost, feasibility, accessibility and other components of the project work. If believed necessary or relevant, contractors should conduct additional exploratory investigation to obtain satisfactory data for the purposes of developing adequate cost estimates. Clients or developers cannot insulate themselves from attendant liability by disclaiming accuracy for subsurface ground conditions without advising contractors appropriately and providing the best information possible to limit potential for cost overruns, construction problems, or misunderstandings.

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Client does not own nor have rights to electronic media files that constitute this report, and under no circumstances should said electronic files be distributed or copied. Electronic media is susceptible to unauthorized manipulation or modification, and may not be reliable.

Consultant Responsibility

Geotechnical and environmental engineering and consulting is much less exact than other scientific or engineering disciplines, and relies heavily upon experience, judgment, interpretation, and opinion often based upon media (soils) that are variable, anisotropic, and non-homogenous. This often results in unrealistic expectations, unwarranted claims, and uninformed disputes against a geotechnical or environmental consultant. To reduce potential for these problems and assist relevant parties in better understanding of risk, liability, and responsibility, geotechnical and environmental reports often provide definitive statements or clauses defining and outlining consultant responsibility. The client is encouraged to read these statements carefully and request additional information from Columbia West if necessary.