Geotechnical Engineering Report

Costco Warehouse – CW# 17-0460
Kuebler Boulevard and 27th Avenue
Salem, Oregon
April 16, 2018
Terracon Project No. 82175107

Prepared for:
Costco Wholesale
Issaquah, Washington

Prepared by:
Terracon Consultants, Inc.
Mountlake Terrace, Washington

April 16, 2018

Terracon

Costco Wholesale
999 Lake Drive
Issaquah, Washington 98027
Attn: Mr. Peter Kahn
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Re: Geotechnical Engineering Report
Costco Warehouse – CW# 17-0406
Kuebler Boulevard and 27th Avenue
Salem, Oregon
Terracon Project No: 82175107

Dear Peter:

Terracon Consultants, Inc. (Terracon) has performed geotechnical engineering services for the referenced Costco Wholesale – Salem, Oregon project site. These services were conducted in general accordance with Terracon's Proposal No. PT9175002 dated November 8, 2017, Contract Amendment No. 1 dated December 22, 2018, and Contract Amendment No. 2 dated January 30, 2018. Services currently being performed under Contract Amendment No. 3, will be provided under separate cover.

This geotechnical engineering report presents the results of our subsurface explorations and provides geotechnical recommendations for project design and construction.

We appreciate the opportunity to be of service to you on this project. Please contact us if you have any questions concerning this report, or if we may be of further service.

Sincerely,
Terracon Consultants, Inc.

Tori Hesedahl, PE
Senior Staff Geotechnical Engineer

Tori Hesedahl FOR
James M. Schmidt, P.E., D.GE.
Vice President

Kristopher T. Hauck, PE
Principal

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EXECUTIVE SUMMARY

Project Information

A geotechnical study has been performed for the Costco Warehouse CW# 17-0460 project site located in Salem, Oregon at the southwest corner of Keubler Boulevard and 27th Avenue. Terracon's geotechnical study was performed in general accordance with the 2016 Costco Wholesale Development Requirements (CWDR).

The site is presently undeveloped with grass groundcover and a pocket of trees in the southwest corner of the site. Based on the available topographic survey, elevations at the site range from about 370 feet in the west portion of the site to about 340 feet at the northeast corner of the site. The center of the site generally slopes gently down toward the east. The north, east, and south margins of the site slope down from the central portion of the site to roadway grade.

Project information provided to us included a green ink grading plan from DOWL dated March 16, 2018, and Concept Site Plan DD11-27 dated April 11, 2018 from MG2. The site plan indicates an approximately 160,000 square foot (Master Footprint) Costco Wholesale warehouse with an integral receiving dock. We understand the warehouse will be a single-story, steel-framed and concrete masonry unit (CMU) structure, approximately 30 feet tall, with a concrete slab-on-grade floor system. A fuel facility is planned in the northeast portion of the site. We anticipate the fuel facility will consist of three 30,000-gallon underground storage tanks, fuel dispensers, and a pre-manufactured metal canopy. Paved parking/landscaping areas are planned on the majority of the site north and east of the proposed warehouse.

Subsurface Conditions

Terracon's geotechnical scope of services included advancing sixty-one (61) soil test borings to approximate depths of about 10 to 44 feet below existing site grades. We also conducted nine (9) test pit excavations at selected locations.

The Oregon Department of Geology and Mineral Industries (DOGAMI) published geologic information in an interactive map available online at *http://www.oregongeology.org/geologicmap/ (2009).* DOGAMI indicates the site is classified as basalt from the Grande Ronde Basalt formation. We believe soil encountered during our investigation generally agrees with mapped deposit conditions in varying degrees of decomposition.

Sandstone encountered in test pits (TP) TP-4 and TP-5 does not match the mapped description. The sandstone encountered matches the description for the next older unit, Eocene-Oligocene sedimentary rock. The nearest mapped exposure is approximately 5 miles to the west at about the same elevation as that encountered at the site. The test pits were terminated in the sandstone

so it is unknown whether this is a boulder or bedrock exposure. Based on observations, it is our opinion that this is likely a former sandstone hill top that was subsequently filled around and perhaps over by the Grande Ronde flood basalt.

The boundary between soil and rock is typically not sharply defined. A transitional zone termed "partially weathered rock" is normally found overlying bedrock. Partially weathered rock (PWR) is defined for engineering purposes as residual material with a standard penetration resistance exceeding 100 blows per foot (bpf).

The soil borings, and test pits indicate that subsurface conditions at the project site generally consist of silt or clay with varying proportion of sand and gravel. Topsoil thickness ranged from 0 to 36 inches across the site. Topsoil, PWR materials, and auger refusal materials (apparent rock) were encountered in 17 of the explorations. Residual soil ranged from loose to very dense in relative density and medium stiff to hard in consistency. Cobbles and boulders (up to 10 feet in diameter) were observed scattered over the ground surface, in discrete piles on the site, and partially exposed at ground surface. Cobbles and boulders were also logged in 12 of the explorations at locations scattered across the site, and at varying depts. Shallow auger refusals may be indicative of cobbles, boulders, or bedrock.

Conditions varied considerably across the site. Some notable exceptions to typical conditions are described.

- Very soft to soft clay and silt were encountered in boring F-3 at approximately 10 feet below existing ground surface (bgs). Soft silt was also encountered at approximately 2 ½ feet bgs in boring B-14.
- Cobbles and boulders were observed in Sandstone was encountered in test pits TP-4 and TP-5. A rubber-tired backhoe excavated these test pits from about 3 feet to the planned termination depth of 10 feet bgs.
- Existing, undocumented fill was observed in 21 of the explorations. Depth to bottom of the fill layer, where encountered, varied from ½ to 20 feet bgs. Borings with fill depths of up to 1 ½ feet bgs were scattered across the site. Two areas were observed to have fill depths greater than 1 ½ feet – the northwest corner in the vicinity of the fueling station and the south-central portion of the site under the east wall of the warehouse.
- Relic topsoil was encountered sporadically across the site underlying the undocumented fill. Soft fill soils with a thick remnant topsoil layer was encountered at the northeast corner of the building (boring B-4) to a depth of about 4 feet bgs and 8 feet below finished floor elevation.

Groundwater data from the VWPs indicate that level varies with precipitation on the site. The range of levels recorded at F-4 is from approximately elevation 341 feet to 346 feet. At W-6 the range of recorded values was from approximately elevation 338 to 351 feet. Occurrences of peaks and troughs in the data did not occur at the same time. The variation in levels and times at which extreme levels occurred

between the two piezometers indicates a complex groundwater regime which cannot be fully characterized by the available information. Observations from other explorations across the site also indicated that areas of perched water closer to ground surface are present, especially within the fill soils and/or where less weathered rock was encountered shallower to the surface.

Geotechnical Issues

The following geotechnical considerations were identified:

- the presence of cobbles, boulders, and zones of PWR
- total and differential settlement due to soft to stiff fine grained soil near footing elevations
- moisture sensitive soil
- existing fill
- groundwater elevation
- differing subgrade support due to site grading

Summary of Recommendations

- Site preparation should include stripping of existing topsoil and root mat, including complete removal of stumps/root systems of trees in the proposed warehouse and pavement areas. The stripped topsoil should not be used as structural fill.

- The near-surface soil encountered in the subsurface explorations across the site are moisture sensitive. As such, they are subject to softening and loss of support when they are wet. We recommend that site preparation and earthwork be performed between June and October when more favorable drying conditions typically occur, and rain events occur over shorter time periods. If mass grading is conducted outside of this timeframe, our recommendations should be revisited to account for mitigation of conditions associated with wet subgrade soil. A budget provision for cement treatment stabilization of the warehouse and pavement areas could be considered if site development is planned between late fall and early summer due to the moisture sensitivity of these materials.

- Costco's contractor should be prepared to deal with large boulders at the surface and buried below the ground surface. Boulder sizes visible at ground surface ranged from approximately basketball sized, to the size of a small automobile in the largest dimension. Single boulders were scattered across the site and there were several piles of boulders. Partially buried boulders were visible at ground surface. Heavy earthmoving equipment is anticipated to be necessary. It may be necessary to rip weathered and jointed sandstone over limited area.

- Shallow foundations are recommended for the proposed structures. The foundations should bear on at least a 2-foot thickness of properly placed and compacted select structural fill consisting of dense-graded aggregate base that extends at least 24 inches beyond the edge of the footing on all sides and is placed above stiff or better silt to lean clay. Thickness of select structural fill should be increased to 3 feet at the northeast and southeast corner of the warehouse, as shown on Exhibit A-7, due to existing undocumented fill. Extents of removal and replacement should correspondingly increase to 3 feet beyond the edge of footing on all sides.

- Support of footings, floor slabs, and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction testing services, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by performing additional testing and evaluation.

- Based on the results of the soil borings and the 2014 Oregon Structural Specialty Code, it is our opinion that a seismic Site Class D is appropriate for the site. We consider the risk of liquefaction, lateral spread, and ground rupture at the site to be low.

- Scarify, moisture condition, and recompact subgrade soil across the site (warehouse, fuel facility, and parking lot) to a minimum depth of 12 inches below subgrade.

- Based on the geotechnical characteristics of this site, the proposed Costco structure may be built with a non-reinforced slab-on-grade floor. It should be noted that the subgrade and base course materials are not designed to hold up to construction equipment (such as scrapers and haul trucks). Consequently, construction equipment may degrade the subgrade during placement. It is the contractor's responsibility to maintain the integrity of the subgrade during construction activities.

- Terracon typically recommends installation of a vapor barrier beneath the slab to mitigate potential moisture issues such as flooring performance and mold. However, we understand that Costco Wholesale has determined that moisture barriers are not to be used in construction of Costco Wholesale structures because of adverse effects on concrete curing and performance. Therefore, we have provided construction recommendations that do not include installation of a moisture barrier, with the understanding that there will be an increased risk for adverse moisture issues.

- It is our opinion that the on-site soil has a moderate corrosive potential to uncoated metal pipes.

- We recommend the use of Type I/II cement in concrete that will be in contact with the soil.

- It is Terracon's opinion that stormwater infiltration is not feasible at the proposed locations and elevations based on the groundwater level observations discussed in this section. We understand that the City of Salem has relaxed its requirements for stormwater infiltration on this site and that stormwater management will be accomplished with bio-swales with overflows connected to the storm sewer. Bottom elevation of the planned swales is 346 feet.

- Based on the available information, our opinion is that groundwater intrusion into the swales may be expected in the wet season. Furthermore, seepage may be expected from permanent cut slopes during the wet season which could cause sloughing depending on slope protection. Vegetation and rip rap are examples of measures that could be used to mitigate surficial sloughing

- Luminaire pole foundations should be designed using an allowable lateral bearing capacity of 200 pounds per square foot (psf) per foot of embedment.

- Select structural fill materials recommended in the Foundations, Floor Slabs, and Pavements sections should meet the requirements of the Oregon Department of Transportation 2018 Standard Specifications for Construction listed in the table below:

Fill Type [1]	OSSC 2018 Paragraph[3]	Acceptable Location for Placement
Dense-Graded Aggregate¾"-0 [2]	02630.10	Minimum 24-inch thickness below footings, except where it increases to 36-inches at NE and SE corners

1. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. During periods of wet weather, fines content should be limited to no more than 5 percent per our recommendations in the Wet Weather Earthwork section.
3. Oregon Standard Specification for Construction 2018, published by the Oregon State Department of Transportation

A summary of recommended pavement thicknesses is provided in the following tables.

Exterior Pavements			
Pavement Type	Material	Layer Thickness (inches)	
		Standard Duty / Fuel Center	Heavy Duty
Rigid	Portland Cement Concrete (4,000 psi)	9	9

	Aggregate Base Course	4	4
Flexible	Asphalt Surface Course 50-blow Marshall Mix / No Recycled Asphalt / Binder Grade PG 58-16	2 [1]	2 [1]
	Asphalt Base Course 50-blow Marshall Mix / Binder Grade PG 58-16	2	3
	Aggregate Base Course	6	10

1. Asphalt surface course minimum thickness of 1-3/4 inches in accordance with Costco "Asphalt Paving" specification, Section 321216, Part 1.2.C.
2. The Costco "Asphalt Paving" specification, Section 321216, Part 1.2.E allows use of pavement mix with 1-inch maximum aggregate size (MAS). The recommended Light Duty Asphalt Base Course thickness is thinner than 3 times the nominal maximum aggregate size for the 1-inch MAS mix. The 1-inch MAS mix should not be used for the Light Duty Asphalt Base Course.

- Terracon should be retained during the site grading phase of the project to observe earthwork and to perform the necessary testing and observations during subgrade preparation, proof-rolling, placement and compaction of controlled compacted fills, and backfilling of excavations to the completed subgrade.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** in the report should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
COSTCO WAREHOUSE – CW# 17-0460
KUEBLER BOULEVARD AND 27TH AVENUE SE
SALEM, OREGON 97302

Terracon Project No. 82175107
April 16, 2018

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services performed for the proposed Costco Wholesale warehouse to be located on Kuebler Boulevard in Salem, Oregon.

Terracon's geotechnical scope of services included advancing sixty-one (61) soil test borings to approximate depths of about 10 to 44 feet below existing site grades. We also conducted nine (9) test pit excavations at selected locations. The exploration locations are shown on the Site and Exploration Plan, Exhibit A-2, in Appendix A. Boring and Test Pit Logs are also presented in Appendix A.

The purpose of these services was to provide information and geotechnical engineering recommendations outlined in the Costco Wholesale Development Requirements, including, but not limited to:

- Subsurface soil conditions
- Earthwork construction
- Pavement design and construction
- Below-grade/retaining walls
- Stormwater infiltration
- Groundwater conditions
- Foundation design and construction
- Floor slab design and construction
- Seismic considerations
- Soil Corrosivity

2.0 PROJECT INFORMATION

2.1 Project Description

Project information provided to us included a green ink grading plan from DOWL dated March 16, 2018, and Concept Site Plan DD11-27 dated April 11, 2018 from MG2.

TEM	DESCRIPTION
Proposed construction	The site plan indicates an approximately 160,000 square foot (Master Footprint) Costco Wholesale warehouse with an integral receiving dock. A fuel facility is planned in the northeast portion of the site. Paved parking/landscaping areas are planned on the majority of the site north and east of the proposed warehouse.
Warehouse construction	We understand the warehouse will be a single-story, steel-framed and concrete masonry unit (CMU) structure approximately 30 feet tall with a concrete slab-on-grade floor system. We anticipate the fuel facility will contain three 30,000-gallon underground storage tanks, fuel dispensers, and a pre-manufactured metal canopy.
Maximum loads	The current Costco Wholesale Development Requirements (Version 2016) indicate the following structural loading conditions are generally applicable for the project: ■ Typical wall loading: 4.5 kips/foot (CMU or precast) ■ Typical column loading: 150 kips (snow regions ■ Typical canopy loading: 50 kips ■ Typical floor slab loading: 500 lbs/sq. foot (total), 350 lbs/sq. foot (live)
Maximum allowable settlement	Warehouse / Fuel Facility / Fuel Tanks Total: 1-inch Differential: ½ inch over 50 feet
Site plans	A preliminary layout plan and topographic site plan were provided to us. Preliminary grading information indicates that cuts and fills will be on the order of 5 to 10 feet or less.
Finish floor elevation	EL 365 feet (preliminary information)
Cut and fill slopes	Typical slope configurations for the area are 3H:1V (Horizontal to Vertical).

TEM	DESCRIPTION
Retaining walls	■ Low-height retaining walls are anticipated at loading docks. ■ An ecology block gravity wall with maximum retained height of approximately 11 feet is planned between the fueling station and the existing stormwater facility at the north east corner of the site. ■ A group of 4 retaining walls along the south side of the site, two of these have retained heights less than 4 feet, one with retained height of approximately 5.3 feet and the other with retained height of approximately 7.1 feet.
Below-grade areas	Buried underground storage tanks are planned for the fuel facility.

2.2 Site Description

ITEM	DESCRIPTION
Location	The site is located at the southeast corner of Kuebler Boulevard and 27th Avenue SE in Salem, Oregon. The property is located approximately 0.5 miles west of I-5. It is bound by Kuebler Boulevard on the north, 27th Avenue SE on the east, Boone Road SE on the south, and by developed land to the west. See the Site Location Plan in Appendix A.
Existing improvements	The site is currently undeveloped.
Current ground cover	The site is currently covered mostly by grass with a pocket of trees in the southwest corner of the site.
Existing topography	Based on the available topographic survey, elevations at the site range from about 370 feet in the western portion of the site to about 340 feet at the northeast corner of the site. The center of the site generally slopes gently down toward the east. The north, east, and south margins of the site slope down at between 2H:1V and 3H:1V (Horizontal to Vertical) from the central portion of the site to roadway grade.

Should any of the following information or assumptions be inconsistent with the planned construction, please let us know so that we may make any necessary modifications to our recommendations.

3.0 SUBSURFACE CONDITIONS

A discussion of the subsurface conditions encountered during our subsurface exploration program is presented in the following sections. During the planning stage of this project, we reviewed publicly available information that included subsurface investigations. This opinion is based upon information available in the public domain as well as Terracon's historical records in the vicinity of the project site. A summary of the reviewed information is provided in the following sections.

3.1 Site Geology

The Oregon Department of Geology and Mineral Industries (DOGAMI) published geologic information in an interactive map available online at *http://www.oregongeology.org/geologicmap/ (2009).* DOGAMI indicates the site is classified as basalt from the Grande Ronde Basalt formation. We believe soils encountered during our investigations agree with mapped deposit conditions in varying degrees of decomposition.

Sandstone encountered in test pits TP-4 and TP-5 does not match the mapped description. The sandstone encountered matches the description for the next older unit, Eocene-Oligocene sedimentary rock. The nearest mapped exposure is approximately 5 miles to the west at about the same elevation as that encountered at the site. The test pits were terminated in the sandstone so it is unknown whether this is a boulder or bedrock exposure. Based on observations, it is our opinion that this is likely a former sandstone hill top that was subsequently filled around and perhaps over by the Grande Ronde flood basalt.

The subsurface bedrock in this region has undergone differing rates of weathering. It is also not unusual for zones of partially weathered rock, boulders, and lenses of hard rock and to be present within the soil mantle above the general bedrock level. The typical residual soil profile consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands, which often consist of saprolites (native soils which maintain the original fabric of the parent rock). Generally, the soil becomes harder with depth to the top of parent crystalline rock or "massive bedrock" which occurs at depth.

The boundary between soil and rock is typically not sharply defined. A transitional zone termed "partially weathered rock" is normally found overlying bedrock. Partially weathered rock (PWR) is defined for engineering purposes as residual material with a standard penetration resistance exceeding 100 blows per foot (bpf).

3.1.1 Seismic Hazards

Seismic hazards resulting from earthquake motions can include slope instability, liquefaction, and surface rupture due to faulting or lateral spreading. Liquefaction is the phenomenon wherein soil strength is dramatically reduced when subjected to vibration or shaking.

We reviewed DOGAMI's Hazard Viewer, found online at http://www.oregongeology.org/hazvu/. The viewer categorizes the earthquake liquefaction from low, medium, and high; the expected earthquake shaking from light, moderate, strong, very strong, severe and violent; and the landslide susceptibility from low, moderate, high, and very high.

- Earthquake Liquefaction Hazard: Negligible
- Expected Earthquake Shaking: Strong to Very Strong
- Landslide Susceptibility due to Earthquake: Low to Moderate

The United States Geological Survey (USGS) Quaternary Fault and Fold Database of the United States published a report containing descriptions of two nearby faults:

1. The Waldo Hills Fault (No. 872) is located approximately 1.5 miles southeast of the site.

Information	Description
Length	12 km
Average Strike	N45°E
Sense of Movement	Normal
Dip Direction	Northwest
Slip-rate Category	Less than 0.2 mm/yr
Most recent prehistoric deformation	Undifferentiated Quaternary (<1.6Ma)

2. The Salem-Eola Hills Homocline (No. 719) is located approximately 5 miles southwest of the site and curves northward around the site while maintaining approximately the same distance.

Information	Description
Length	32 km
Average Strike	N26°W
Sense of Movement	Homocline
Dip Direction	2-4.5° Northeast
Slip-rate Category	Less than 0.2 mm/yr
Most recent prehistoric deformation	Undifferentiated Quaternary (<1.6Ma)

3.2 USDA Soil Survey

The United States Department of Agriculture Natural Resources Conservation Service has published a series of soil surveys with typical soil properties located within each county of Oregon. The majority of the site is mapped as Nekia Silty Clay Loam, 2 to 7 percent slopes (NeB) with the rest of the site mapped as Nekia Silty Clay Loam, 2 to 12 percent slopes (NeC), and Salkum Silty Clay Loam, 0 to 6 percent slopes (SlB) (see map below). The USDA characterizes the mapped soils as having the following characteristics:

Nekia Silty Clay Loam (NeB, NeC)

Parent Material: Residuum weathered from tuffs and basalt							
Depth (inches)	**USCS Symbols**	**Plasticity Index**	**Corrosion of Concrete**	**Corrosion of Steel**	**pH**	**% Silt & Clay**	**Hydrologic Group**
0 – 9	ML	10 – 15	Moderate	High	5.1 – 6.0	80-90	C
9 - 36	CL/GC	15 – 25				70-80	
36 - 40	Bedrock	N/A			N/A	N/A	N/A

Salkum Silty Clay Loam (SlB)

Parent Material: Residuum weathered from tuffs and basalt							
Depth (inches)	**USCS Symbols**	**Plasticity Index**	**Corrosion of Concrete**	**Corrosion of Steel**	**pH**	**% Silt & Clay**	**Hydrologic Group**
0 – 20	CL	15-20	Moderate	High	5.6-6.5	80-85	B
20 - 40	MH	15-25			4.5-6.0	80-100	
40-65	MH, ML	15-25				80-95	

3.3 Typical Subsurface Profile

The soil borings and test pits indicate that subsurface conditions at the project site generally consist of silt or clay with varying proportion of sand and gravel. Topsoil was generally very thin. PWR material or auger refusal material (apparent rock) were encountered in 25 of the explorations. Residual soil ranges from loose to very dense in relative density and medium stiff to hard in consistency. Cobbles and boulders were observed scattered over the ground surface, in discrete piles on the site, and partially exposed at ground. Cobbles and boulders were also logged in 12 of the explorations at locations scattered across the site, and at varying depts. Shallow auger refusals may be indicative of cobbles, boulders, or bedrock.

Based on the results of the borings, subsurface conditions in the can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/Density
Stratum 1	0 to 36 inches, typically less than 6 inches	Topsoil	Medium stiff to stiff
Stratum 2	0 to 20 feet	Existing Fill – Silty Sands (SM) and Sandy Silts (ML)	Loose to Medium Dense (SM) Soft to Stiff (ML)

Description	Approximate Depth to Bottom of Stratum (feet)	Material Encountered	Consistency/Density
Stratum 3	0 to greater than 20 feet	Residual Soil – Silty Sands (SM) and Sandy Silts (ML)	Medium Dense to Very Dense (SM) Stiff to Very Stiff (ML)
Stratum 4	18 to 40 feet	Partially Weathered Rock (PWR)	Very Dense/Hard
Stratum 5	1 to 44	Auger Refusal (Apparent Rock)	-

Conditions varied considerably across the site. Some notable exceptions to typical conditions are described.

- Very soft to soft clay and silt were encountered in boring F-3 at approximately 10 feet below existing ground surface (bgs)) and in boring W-7 from approximately 25 to 26 ½ feet. Soft silt was also encountered at approximately 2 ½ feet bgs in boring B-14.
- Cobbles and boulders were observed in Sandstone was encountered in test pits (TP) TP-4 and TP-5. A rubber-tired backhoe excavated these test pits from about 3 feet to the planned termination depth of 10 feet bgs.
- Existing, undocumented fill was observed in 37 of the explorations. Depth to bottom of the fill layer, where encountered, varied from ½ to 20 feet bgs. Borings with fill depths of up to 1 ½ feet bgs were scattered across the site. Two areas were observed to have fill depths greater than 1 ½ feet – the northwest corner in the vicinity of the fueling station and the south-central portion of the site under the east wall of the warehouse.
- Relic topsoil was encountered sporadically across the site underlying the undocumented fill. Soft fill soils with a thick remnant topsoil layer was encountered at the northeast corner of the building (boring B-4) to a depth of about 4 feet bgs and 8 feet below finished floor elevation.

Approximate depths to PWR and to auger refusal are presented in the following table:

Boring	Approximate Depth to PWR (feet)	Approximate Depth to Auger Refusal – Apparent Rock (feet)
B-1a	33	4
B-2	20	>20
B-3	20	>20
B-4	20	>21
B-6a	NOB	1

Boring	Approximate Depth to PWR (feet)	Approximate Depth to Auger Refusal – Apparent Rock (feet)
B-7	17	>20
B-8	17	17.4
B-9a	15	15.4
B-9b	17	17.1
B-10	20	>20
B-11	20	>20
B-12	10	12.1
B-15	40	44.1
F-4	40	>41.5
P-1	10	>10
P-2a	NOB	1.5
P-2b	5	5.9
P-3	9	>10
IT-1A	NOB	6
IT-1B	NOB	10.2
IT-1C	NOB	11.5
W-2A	NOB	6.5
W-2B	NOB	8.6
W-3A	NOB	2.75
W-3B	NOB	16.5

NOB – Not Observed

Conditions encountered in the subsurface explorations are described on the boring and test pit logs in Appendix A of this report. Stratification boundaries on the logs represent the approximate locations of changes in soil types; in-situ, the transition between materials may be gradual. It is possible that shallow PWR and rock may be encountered at locations between the borings and test pits conducted at the site.

3.4 Groundwater

The boreholes and test pits were observed while drilling/excavation and after completion for the presence and level of groundwater. Vibrating wire piezometers (VWP) were installed in borings F-4 and W-6 to measure water level at these locations. Water levels were recorded with a data logger. Data collected from the VWPs is presented on plots included in Appendix A. The water levels observed in the boreholes can be found on the boring logs in Appendix A, and are summarized below.

Boring Number[1]	Approximate Depth to Groundwater while Drilling (feet) [2]	Approximate Depth to Groundwater after Drilling (feet) [2]
B-2	20	N/A (Cave in at 2.6ft)
B-3	20	7.0 (0 hr. reading)
B-4	20	6.7 (0 hr. reading)
B-6b	15	N/A (Cave in at 4.6ft)
B-8	10	N/A
B-9a	N/A	6.7 (24 hr. reading)
B-9b	N/A	10.1 (24 hr. reading)
B-10	20	N/A (Cave in at 8.7ft)
B-13	21	N/A
B-16	15	7.1 (0 hr. reading)
B-17	15	7.6 (0 hr. reading)
B-18	N/A	6.8 (1.5 hr. reading)
B-19	15	6.6 (0 hr. reading)
B-20	15	5.5 (0 hr. reading)
B-21	7.5	5.8 (0 hr. reading)
F-3	20	8.8 (0 hr. reading)
F-4	20	11.0 (11/28/2017)
F-5	15	N/A
F-6	14	N/A
F-7	16	N/A
IT-1A	5	4
IT-1B	9	7
IT-1C	8	6
IT-2	12	12
W-1	25	N/A
W-4	18	14
W-5	11	N/A
W-6	11	12.1 (3/27/2018)
W-7	6	N/A
W-8	16	N/A
TP-1	Seepage observed at 8’	N/A
TP-3	Seepage observed at 9.5’	N/A
TP-6	Seepage observed at 1.5’	N/A
TP-7	Seepage observed at 2’	N/A

Boring Number[1]	Approximate Depth to Groundwater while Drilling (feet) [2]	Approximate Depth to Groundwater after Drilling (feet) [2]
TP-8	Seepage observed at 8.5’	N/A
TP-9	Seepage observed at 9’	N/A

1. Borings not listed did not encounter water during drilling and/or were not monitored afterward
2. Below ground surface.

Groundwater data from the VWPs indicate that level varies with precipitation on the site. The range of levels recorded at F-4 is from approximately elevation 341 feet to 346 feet. At W-6 the range of recorded values was from approximately elevation 338 to 351 feet. Occurrences of peaks and troughs in the data did not occur at the same time. The variation in levels and times at which extreme levels occurred between the two piezometers indicates a complex groundwater regime which cannot be fully characterized by the available information.

Observations from other explorations across the site also indicated that areas of perched water closer to ground surface are present, especially within the fill soils and/or where less weathered rock was encountered shallower to the surface.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. The period of time over which groundwater levels were recorded is insufficient to characterize seasonal variation. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

3.5 Laboratory Testing

As outlined in the Costco’s site development criteria and based on our experience, the following analytical laboratory testing was performed by Terracon and independent analytical laboratories.

- Moisture content
- Plastic limit/liquid limit
- Particle size distribution
- Soil resistivity, soil pH, sulfates/chlorides
- Modified Proctor testing
- California Bearing Ratio
- Topsoil analysis

The results of the laboratory testing are presented on the individual boring logs and in Appendix B. Soil samples will be stored for a period 12 months following completion of our report, or until the completion of construction.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The primary considerations for site development are:

- the presence of cobbles, boulders, and zones of PWR
- total and differential settlement due to soft to stiff fine grained soil near footing elevations
- moisture sensitive soil
- existing fill
- groundwater elevation
- differing subgrade support due to site grading

Support of footings, floor slabs, and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction testing services, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by performing additional testing and evaluation.

Auger refusal on apparent rock near finish floor elevation occurred at borings B-1 and B-6. Sandstone was encountered in test pits TP-4 and TP-5. These explorations are located near the northwest corner of the warehouse. Boulders ranging from approximately basketball sized, to the size of a small automobile were visible at ground surface to our exploration team. Cobbles and boulders were logged in 12 of our explorations. Contractors should be prepared to deal with automobile sized boulders. Partially buried boulders were visible at ground surface. It is possible boulders larger than those observed are present on the site. Heavy earthmoving equipment is anticipated to be necessary. It may be necessary to rip sandstone over limited area. It is possible that shallow PWR and rock may be encountered at locations other than those disclosed by the explorations at the site.

Residual soil at the site is moisture sensitive and will lose strength and stability and will become difficult to adequately compact as their moisture content increases. Performing site earthwork

between June and October will reduce the potential for earthwork problems associated with wet soils.

Performing site preparation and earthwork at other times of the year increases the potential for having to perform remedial work on the subgrade soils. Construction traffic over wet subgrades should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades. If the subgrade should become, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and re-compacted. The use of lime treatment generally reduces the plasticity of clays and silts, makes them less susceptible to moisture fluctuations, and may make them more workable during wetter periods of the year.

In our opinion, the existing fill, and native soil at the site are suitable for support of shallow foundations, floor slabs, and pavements. Shallow foundations bearing on at least 2 feet of select structural fill over approved subgrade soil can be designed based on a soil bearing capacity of 3,000 pounds per square foot (psf). Due to the depth and consistency/density of existing fill soil observed in the borings, areas in the northeast and southeast corners of the building should be supported on at least 3 feet of select structural fill. We recommend scarifying, moisture conditioning, and re-compacting the upper 1-foot of native soil below floor slabs, sidewalks, and pavements prior to placing base course or structural fill. If subgrades are to be prepared outside of the season window described above (June to October), scarifying and compacting may be unfeasible. Therefore, removal and replacement with select fill may be necessary and should be evaluated at the time of construction.

Terracon should review the final grading plan so that we may make modifications to our recommendations as necessary.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations to the completed subgrade.

Geotechnical engineering recommendations for foundation systems and other earth-related phases of the project are outlined below. The recommendations contained in this report are based upon the results of data presented herein, engineering analyses, and our current understanding of the proposed project.

4.2 Earthwork

The following presents recommendations for site preparation, excavation, subgrade preparation and placement of structural fills on the project. The recommendations presented for design and

construction of earth-supported elements including foundations, slabs and pavements are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon personnel. The evaluation of earthwork should include observation and testing of structural fill, subgrade preparation, ground improvement and other geotechnical conditions encountered during the construction of the project.

4.2.1 Site Preparation

Site preparation should begin by removing the existing vegetation from the site. After the existing vegetation is removed, the site should be grubbed and the topsoil stripped and stockpiled for use in re-vegetating landscape areas or disposed of off-site. Topsoil depth observed in the explorations varied between 0 and 3 feet, but depths of 6 inches or less are anticipated for the majority of the site. Deeper stripping and grubbing depths may be required to completely remove the roots of trees however.

After site stripping, we recommend scarification, moisture conditioning, and recompaction of the entire site. Following recompaction, the site should be proof-rolled. Proof-rolling should be performed with a loaded, tandem-axle dump truck or similar rubber-tired construction equipment with a minimum gross weight of 20,000 lb. The proof-rolling operations should be observed by a representative of the geotechnical engineer and should be performed after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade and to reduce the amount of remedial work required.

If the exposed soil surface exhibits excessive deflection, pumping, or rutting under the proof-rolling operation, we recommend over-excavation of soft/unstable soil and replacement with structural fill. The extent to which over-excavation and replacement will be required will likely be reduced if the site preparation and earthwork are performed during warmer and drier periods of the year.

4.2.2 Subgrade Stabilization

Based on the outcome of the proof-rolling operations, some undercutting or subgrade stabilization may be expected, especially during wet periods of the year. Methods of stabilization, which are outlined below, could include scarification and re-compaction and/or removal of unstable materials and replacement with granular fill (with or without geotextiles). The most suitable method of stabilization, if required, will be dependent upon factors such as schedule, weather, size of area to be stabilized and the nature of the instability.

- **Scarification and Re-compaction** - It may be feasible to scarify, dry, and re-compact the exposed granular (existing trench backfill) soils at the site during periods of dry weather. This method should not be planned for the fine-grained native soils because they will not be feasible. The success of this procedure would depend primarily upon the extent of the

disturbed area. Stable subgrades may not be achievable if the thickness of the soft soil is greater than about 1 to 1½ feet.

- **Granular Fill** - The use of crushed stone or gravel could be considered to improve subgrade stability. Typical undercut depths would range from about ½ foot to 2 feet. The use of high modulus geotextiles i.e., engineering fabric, should be limited to outside of the Building Ground Improvements area. The maximum particle size of granular material placed immediately over geotextile fabric or geogrid should not exceed 2 inches.
- **Chemical Stabilization** - Improvement of subgrades with Portland cement, lime kiln dust, or Class C fly ash could be considered for unstable and plastic soil. Chemical modification should be performed by a pre-qualified contractor having experience with successfully stabilizing subgrades in the project area on similar sized projects with similar soil conditions.

Over-excavations should be backfilled with structural fill material placed and compacted in accordance with the following sections of this report. Subgrade preparation and selection, placement, and compaction of structural fill should be performed under engineering controlled conditions in accordance with the project specifications.

4.2.3 Material Requirements

General Structural Fill

General structural fill material should consist of approved materials, free of deleterious material and particles larger than about 4 inches. Deleterious material includes wood, organic waste, or any other extraneous or objectionable material. Organic content should be less than 3 percent by weight. The maximum particle size criteria may be relaxed by the geotechnical engineer of record depending on construction techniques, material gradation, allowable lift thickness and observations during fill placement. Soil for use as general structural fill material should conform to the following specifications:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Fine Grain Soil[2]	CL and ML (LL<45; PI<25)	All locations and elevations, except where select structural fill is specified
Granular Soil	GW, GP, SW, SP, GM[2], SM[2], GC[2], SC[2],	All locations and elevations, except where select structural fill is specified
On-site soil[2]	SM, ML	All locations and elevations, except where select structural fill is specified

1. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. Not suitable during periods of wet weather. See Wet Weather Earthwork section for further details.

Onsite material is expected to be suitable for reuse as general structural fill from based on the criteria above. However, the near surface soil at the site is predominantly fine grained and is considered moisture sensitive. Suitability for reuse will depend on the moisture content of the soil

at the time of construction. Moisture conditioning may be required to reuse onsite soil, including tilling and windrowing to dry back soil that is too wet of optimum to achieve adequate compaction. Drying back of soil is expected to be impossible during the wet season, which typically lasts from about October to May of the following year.

Select Structural Fill

Select structural fill materials recommended in the Foundations, Floor Slabs, and Pavements sections should meet the following specifications:

Fill Type [1]	OSSC 2018 Paragraph[3]	Acceptable Location for Placement
Dense-Graded Aggregate¾"-0 [2]	02630.10	Minimum 24-inch thickness below footings, except where it increases to 36-inches at NE and SE corners

1. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.
2. During periods of wet weather, fines content should be limited to no more than 5 percent per our recommendations in the Wet Weather Earthwork section.
3. Oregon Standard Specification for Construction 2018, published by the Oregon State Department of Transportation

4.2.4 Compaction Requirements

Recommendations for compaction under standard Proctor and modified Proctor compaction criteria are presented in the following table. The Costco development requirements reference the modified Proctor compaction test (ASTM D1557) as the basis for compaction of granular soil and standard Proctor (ASTM D698) for fine-grained soil. Our experience in Oregon indicates that the modified and standard Proctor compaction tests are both used commonly in the area, as appropriate based on soil type. For this project, we recommend standard Proctor criteria based on the fine grained nature of the onsite soil. We recommend that structural fill be tested for moisture content and relative density during placement. Should the results of the in-place density tests indicate that the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

The following table indicates recommended compaction criteria:

ITEM	PERCENT COMPACTION (ASTM D 698) STANDARD	MOISTURE CONTENT	MINIMUM COMPACTION TESTING FREQUENCY PER LIFT
Scarified & Recompacted Site Subgrades	**95 minimum**	-2% to +2% of optimum	1 per 10,000 Square Feet
Under Buildings and Structures	98 minimum	-2% to +2% of optimum	1 per 10,000 Square Feet
Beneath Pavements and Walkways	98 minimum	-2% to +2% of optimum	1 per 15,000 Square Feet
Behind Retaining Walls (within 5 feet)	95 minimum 100 maximum	-2% to +2% of optimum	1 per 15,000 Square Feet
Utility trench backfill	98 minimum	-2% to +2% of optimum	1 per 150 Linear Feet
Lawns or Unimproved areas	92 minimum	-2% to +2% of optimum	1 per 20,000 Square Feet

Structural fill materials should be placed in horizontal, loose lifts not exceeding 9 inches in thickness and should be thoroughly compacted. Where light compaction equipment is used, as is customary within utility trenches and behind retaining walls, the lift thickness may need to be reduced to achieve the desired degree of compaction. Soil removed which will be used as structural fill should be protected from rain to aid in preventing an increase in moisture content.

When placing fill in areas of the site where existing slopes are steeper than 5H:1V the area should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be wide enough to accommodate compaction and earth moving equipment and to allow placement of horizontal lifts of fill.

4.2.5 Difficult Excavation

Based on the depths to auger refusal and the planned finish grade elevations, boulders and/or localized zones of PWR and sandstone may be encountered. Boulders ranging from about basketball size to the size of a small automobile were visible at ground surface during the time of our explorations. PWR and rock will be difficult to excavate from confined excavations such as utility trenches. Terracon's opinion is that the site earthwork can be accomplished with large, heavy duty earthwork equipment. Even with larger equipment, some of these boulders may require considerable effort such the use of pneumatic hammers to excavate. PWR and sandstone can often be ripped in open cuts with larger dozers equipped with a single tooth ripper. However, this should be evaluated based on the required depth of excavation and actual rock materials encountered. Difficult excavation requirements can be further assessed following review of the final grading plan.

We recommend that a rock excavation definition be included in the grading contract for clarity. Rock excavation can be defined in many ways, a method specification based on the grading equipment commonly used in the project area is typical. The following is a guideline rock excavation specification for your review.

In Mass Excavation:	Material occupying an original volume of more than 1 cubic yard which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rating of not less than 56,000 pounds usable pull (Caterpillar D-8K or larger) or the excavator listed below.
In Trench Excavation:	Material occupying an original volume of more than 1/2 cubic yard which cannot be excavated with a track excavator having a bucket curling rate of not less than 25,700 pounds, using a rock bucket and rock teeth (Caterpillar 225 or larger).

Actual field conditions usually display a gradual weathering progression with poorly defined and uneven boundaries between layers of different materials. Rock levels in areas of weathered basalt can vary considerably in short horizontal distances and may be at higher or lower elevation between our boring locations.

We recommend that a contingency for difficult excavation requirements be provided for in the contract documents.

4.2.6 Grading and Drainage

Adequate positive drainage should be provided during construction and maintained throughout the life of the development to prevent an increase in moisture content of the foundation, pavement and backfill materials.

Gutters and downspouts should not discharge directly adjacent to the warehouse in landscape areas. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water away from structures. Splash-blocks should also be considered below hose bibs and water spigots. Paved surfaces which adjoin the warehouse should be sealed with caulking or other sealant to prevent moisture infiltration at the warehouse envelope; maintenance should be performed as necessary to maintain the seal.

4.2.7 Slopes

Typical slope configurations in unreinforced compacted fill and cuts are generally flatter than 2H:1V in the area of the subject site. If steeper slopes are required for site development, stability

analyses should be completed to design the final grading plan. At your request, site specific slope stability analysis could be performed based on the final site grading plans. The face of all fill slopes should be compacted to the minimum specification for fill embankments. Alternately, fill slopes can be overbuilt and trimmed to compacted material.

4.2.8 Groundwater Control

Groundwater was not encountered within the open boreholes at depths expected to affect warehouse or pavement construction. Specific recommendations for the underground storage tanks (USTs) are in Section 4.4. Localized perched water conditions may develop during extended periods of wet weather as water infiltrating the surface soils becomes trapped above less permeable material. We expect that positively grading excavations to direct flow to sumps that are continuously pumped should be adequate to remove groundwater inflow if encountered. Ultimately, the choice of any necessary dewatering methods is the Contractor's.

4.2.9 Temporary Excavation Slopes

The residual soils in the borings would be considered Type C soil with respect to OSHA trench excavation safety guidelines. Despite the in-situ stiffness of the on-site soils, the materials are prone to loss of strength when exposed to moisture. If Type C soils are encountered, temporary slopes created by utility trench excavation should be cut at a ratio of 1.5H:1V or flatter.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Safety and Health Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will most likely be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable temporary excavations and should shore, slope, or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

4.2.10 Construction Considerations

Residual soil at the site is moisture sensitive and will lose strength and stability and will become difficult to adequately compact as their moisture content increases above about 2 percent above optimum. Performing site earthwork between June and October will reduce the potential for earthwork problems associated with wet soil.

Performing site preparation and earthwork at other times of the year increases the potential for having to perform remedial work on the subgrade soil. Construction traffic over wet subgrades should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades. If the subgrade should become, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and re-compacted. The use of lime treatment generally reduces the

plasticity of clays and silts, makes them less susceptible to moisture fluctuations, and may make them more workable during wetter periods of the year.

Protecting the exposed subgrade soil from infiltration of surface water by keeping the site grades sloped to promote runoff in advance of rain events will also reduce the potential for needing to perform remedial work on wet subgrades. We also recommend that exposed subgrades be "sealed" by rolling them with rubber-tired equipment or smooth drum rollers at the end of each work day and in advance of anticipated precipitation.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation, proof-rolling, placement and compaction of controlled compacted fills, backfilling of excavations to the completed subgrade, and prior to placing reinforcing steel in the footing excavations.

4.2.11 Wet Weather Earthwork

The near-surface soils have appreciable fines content (silt and clay-sized soil finer than the standard U.S. No. 200 mesh sieve) based on our visual observations and lab testing. As such, these soils are considered to be highly moisture sensitive. The suitability of soil used for structural fill or utility trench backfill depends primarily on their grain-size distribution and moisture content when they are placed. As the fines content increases, soils become more sensitive to small changes in moisture content. Soil containing more than about 5 percent fines (by weight) cannot be consistently compacted to a firm, unyielding condition when the moisture content is more than about 2 percentage points above or below optimum. Optimum moisture content is the moisture content at which the maximum dry density for the material is achieved in the laboratory following ASTM procedures.

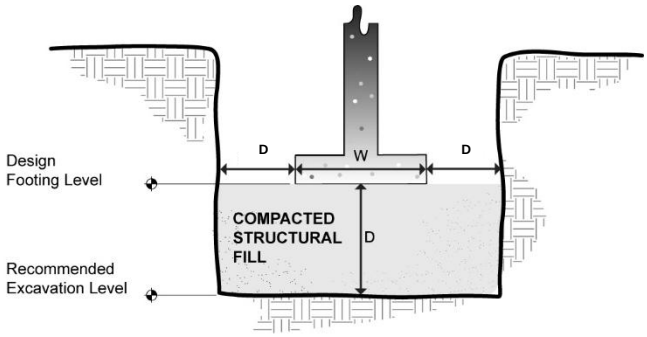
If inclement weather or in situ soil moisture content prevents the use of on-site material as structural fill, we recommend the use of import granular fill containing less than 5 percent by weight passing the U.S. No. 200 sieve, based on the fraction passing the U.S. No. 4 sieve.

To maintain moisture content, we recommend that all stockpiled soils for use as compacted fill be protected with polyethylene sheeting anchored to withstand local wind conditions.

4.3 Foundations

Shallow foundations are recommended for the proposed structures. The foundations should bear on at least a 2-foot thickness of properly placed and compacted select structural fill consisting of dense-graded aggregate base that extends at least 24 inches beyond the edge of the footing on all sides. Thickness of select structural fill should be increased to 3 feet at the northeast and southeast corners of the warehouse, as shown on Exhibit A-7, due to existing undocumented fill. Extents of removal and replacement should correspondingly increase to 3 feet beyond the edge of footing on all sides.

The successful performance of shallow foundations will be dependent upon appropriate site preparation and evaluation of the foundation bearing conditions at the time of foundation construction. Any unsuitable subgrade soils should be stabilized in place or be excavated and replaced with structural fill as described by the sketch below.



Overexcavation / Backfill

4.3.1 Design Recommendations

Design recommendations for a shallow foundation system are presented in the following table and paragraphs.

Description	Value
Net allowable bearing capacity [1]	3,000 psf
Minimum embedment below lowest adjacent finished grade for frost protection and protective embedment [2]	24 inches
Minimum width for continuous wall footings	24 inches
Minimum width for isolated column footings	24 inches
Approximate total settlement [3]	Up to 1 inch
Estimated differential settlement [3]	Less than L/500 along walls. Less than ½ inch over 50 feet between interior columns.
Passive Lateral Resistance	300 pounds per cubic foot (pcf) (unfactored)
Coefficient of Friction	0.35 (unfactored)

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation.
2. The footing embedment depth recommended exceeds the frost depth for the area. Footings should be embedded 24 inches due to settlement reasons.

3. The actual magnitude of settlement that will occur beneath the foundations would depend upon the variations within the subsurface soil profile, the structural loading conditions and the quality of the foundation excavation. The estimated total and differential settlements listed assume that the foundation related earthwork and the foundation design are completed in accordance with our recommendations. Support of footings on or above existing fill soils is discussed in this report. However, even with the recommended construction testing services, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill, but can be reduced by performing additional testing and evaluation.

Uplift resistance of shallow foundations should be based on the weight of the foundation concrete and the soil overlying the plan area of the foundation. We recommend a soil unit weight of 90 pcf for uplift calculations.

4.3.2 Construction Considerations

We recommend that the footing excavations be observed and evaluated by a representative of Terracon prior to placing reinforcing steel and concrete. The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed as soon as practical after excavating to reduce moisture exposure and bearing soil disturbance. Should the soils at the bearing level become excessively disturbed or saturated, the affected soil should be removed prior to placing concrete.

4.4 Underground Storage Tanks

Underground storage tanks (USTs) are expected to be locates in the northeast corner of the site to provide fuel storage for the fueling station. Maximum fill depths of up to 20 feet were encountered in the borings near the anticipated UST location. We assume that the bottom of the UST excavations will be approximately 20 feet below finish grade.

Groundwater level from the piezometer installed in boring F-4 near the expected UST location is approximately at the anticipated base elevation of the excavation. Terracon did not conduct a groundwater study of sufficient duration to estimate seasonal groundwater level fluctuation. We recommend that USTs be anchored against buoyant forces. The bottom of the excavation may be below the water table. We anticipate that continuously pumped shallow sumps in the bottom of the excavation will be sufficient to control groundwater in the excavation.

4.5 Seismic Considerations

Based on the N-values from the soil test borings, it is our opinion that a 2014 Oregon Structural Specialty Code (OSSC) Site Class D is appropriate for the site. The OSSC requires a site soil profile determination extending a depth of 100 feet for seismic site classification. This seismic site class

definition considers that auger refusal indicating apparent bedrock encountered at termination depths in our borings continues below the termination depths.

Based on groundwater conditions observed, on the relative density/consistency of site soil, and the silt and clay content of the subsurface soil, it is our opinion that the risk of liquefaction of site soil is low.

Based on our review of the available fault information, it is our opinion that the risk of surface rupture due to ground faulting is very low.

We do not consider the site to be within the proximity of seismic hazard zones that would indicate the need for a separate Engineering Geology Investigation or Geologic Hazards Evaluation.

4.6 Floor Slabs

4.6.1 Design Recommendations

The subgrade soil for the floor slabs is expected to be on-site low to moderate plasticity naturally occurring or structural fill soil. Based on these considerations and provided the site is prepared as outlined in this report, it is our opinion that the floor slabs do not require specific design considerations for swell potential. For the anticipated soil subgrade conditions, reinforcing steel will not be required in the floor slab.

Description	Value
Interior floor system	Slab-on-grade concrete.[1]
Subgrade	Approved existing low to moderate plasticity native soil or controlled structural fill. Subgrades are to be scarified and compacted to a depth of 12 inches.
Sub-base	Not required.
Stone base	6 inches dense-graded aggregate base course
Modulus of subgrade reaction[3]	150 pounds per square inch per in (psi/in) for point loading conditions

Description	Value
1. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation. 2. We recommend subgrades be maintained at the proper moisture condition until floor slabs and pavements are constructed. If the subgrade should become desiccated prior to construction of floor slabs and pavements, the affected material should be removed or the materials scarified, moistened, and re-compacted. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs. 3. The native soil at subgrade are expected to develop a subgrade modulus value of 150 psi/in when they are approved as undisturbed residual soils or controlled structural fill. Soft or unstable subgrade will be remediated by scarifying and re-compacting or by over-excavation and replacement.	

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Sub-drainage systems do not appear necessary.

Terracon typically recommends installation of a vapor barrier beneath the slab to mitigate potential moisture issues such as flooring performance and mold. However, we understand that Costco Wholesale has determined that moisture barriers are not to be used in construction of Costco Wholesale structures because of adverse effects on concrete curing and performance. Therefore, we have provided construction recommendations that do not include installation of a moisture barrier, with the understanding that there will be an increased risk for adverse moisture issues.

4.6.2 Construction Considerations

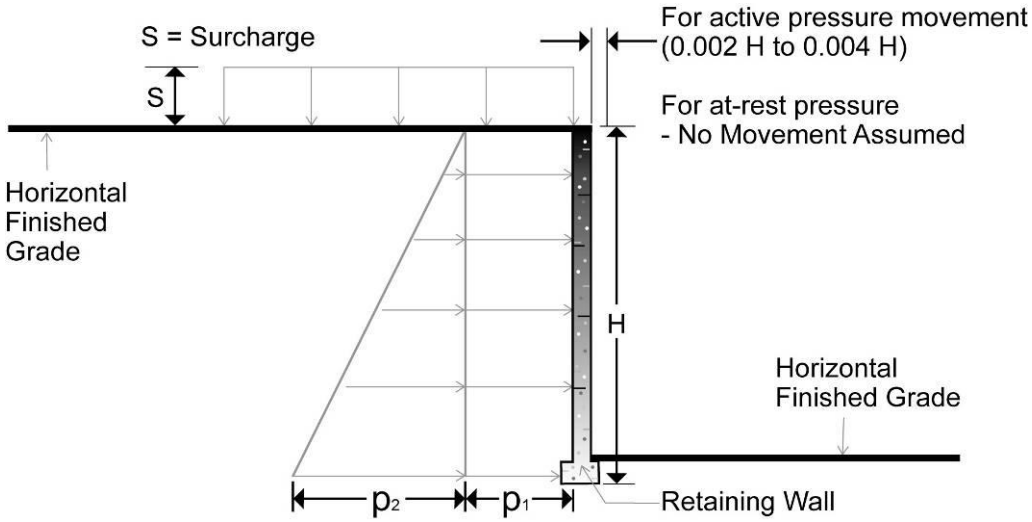
On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base stone and concrete and corrective action may be required.

We recommend that the area underlying the floor slab be rough-graded and then proof-rolled with a minimum of four passes of a loaded tandem axle dump truck under observation of a Terracon representative. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are observed should be repaired by removing and replacing the affected material with properly placed and compacted structural fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the aggregate base course and concrete.

4.7 Retaining/Below Grade Walls

The lateral earth pressure recommendations herein are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls. Modular block wall design and construction recommendations will be provided under separate cover as an addendum to this report.

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free standing cantilever retaining walls and assumes wall movement. The "at rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



EARTH PRESSURE COEFFICIENTS

Earth Pressure Conditions	Coefficient for Backfill Type	Equivalent Fluid Density, p_2 (pcf)	Surcharge Pressure, p_1 (psf)
Active (Ka)	Granular - 0.29	35	(0.29)S
	Sandy Silt/Silty Sand - 0.36	40	(0.36)S
At-Rest (Ko)	Granular - 0.46	60	(0.46)S
	Sandy Silt/Silty Sand - 0.53	65	(0.53)S
Ultimate Passive (Kp)	Granular - 3.4	400	---
	Sandy Silt/Silty Sand – 2.8	300	---

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 **H** to 0.004 **H**, where **H** is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 120 pcf
- Horizontal backfill, compacted between 95 and 98 percent of standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against structures should consist of granular soils or low plasticity cohesive soil. For the granular values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. To calculate the resistance to sliding, a value of 0.35 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

We recommend foundation drains for exterior footings and walls be constructed in accordance with CWDR Detail 16_17.

If controlling hydrostatic pressure behind the wall as described above is not possible, then combined hydrostatic and lateral earth pressures should be calculated for lean clay backfill using an equivalent fluid weighing 90 and 100 pcf for active and at-rest conditions, respectively. For granular backfill, an equivalent fluid weighing 85 and 90 pcf should be used for active and at-rest, respectively. These pressures do not include the influence of surcharge, equipment or pavement loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

4.8 Pavements

4.8.1 Subgrade Preparation

On most project sites, the site grading is accomplished relatively early in the construction phase. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to improve the surface temporarily. As a result, the flatwork and pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend scarifying, moisture conditioning, and re-compaction of the top 12 inches of the subgrade. Following reworking of the subgrade, we recommend that the pavement subgrades be proof-rolled within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and re-compacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired according to the recommendations in the Subgrade Stabilization section of this report. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

4.8.2 Design Considerations

The following concrete pavement designs are based upon the design methods described in the "AASHTO Guide for Design of Pavement Structures 1993" published by the American Association of State Highway and Transportation Officials and a 20-year design period. The following asphalt pavement designs are based upon the design methods described in the Asphalt Institute Manual Series No. 1 (MS-1).

A CBR value of 5 was used for the untreated subgrade thickness design. Per the Costco Wholesale Development Requirements, the following traffic values were used in developing the pavement thickness design.

Heavy Duty: 30 trucks per day over a 20-year design life
Standard Duty: 6,600 cars per day over a 20-year design life

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to parking lots and drives should slope down from pavement edges at a minimum 2 percent;
- The subgrade and the pavement surface should have a minimum 2 percent slope to promote proper surface drainage;
- Radial finger drains at catch basins per CWDR Detail 16-16;
- Install joint sealant and seal cracks immediately.

4.8.3 Minimum Pavement Thicknesses

Recommended minimum pavement and stone base thicknesses are listed in the tables below.

Exterior Pavements

Pavement Type	Material	Layer Thickness (inches)	
		Standard Duty / Fuel Center	Heavy Duty
Rigid	Portland Cement Concrete (4,000 psi)	9	9
	Aggregate Base Course	4	4
Flexible	Asphalt Surface Course 50-blow Marshall Mix / No Recycled Asphalt / Binder Grade PG 58-16	2 [1]	2 [1]
	Binder Course 50-blow Marshall Mix / Binder Grade PG 58-16	2	3
	Aggregate Base Course	6	10

1. Asphalt surface course minimum thickness of 1-3/4 inches in accordance with Costco "Asphalt Paving" specification, Section 321216, Part 1.2.C.
2. The Costco "Asphalt Paving" specification, Section 321216, Part 1.2.E allows use of pavement mix with 1-inch maximum aggregate size (MAS). The recommended Light Duty Asphalt Base Course thickness is thinner than 3 times the nominal maximum aggregate size for the 1-inch MAS mix. The 1-inch MAS mix should not be used for the Light Duty Asphalt Base Course.

Note: Pavement materials and construction must meet the Costco Master Specification for Asphalt Paving that contains very specific pavement material (asphalt, aggregate and concrete) criteria and construction practices to be used with respect to compaction and material sampling. The general contractor and pavement construction subcontractor should be aware that asphalt and concrete mix designs must be submitted to the design architect and Terracon at least 45 days prior to the scheduled production and laydown for review and approval.

We recommend a Portland cement concrete (PCC) pavement be utilized in entrance and exit sections, loading dock areas, or other areas where extensive wheel maneuvering are expected. Although not required for structural support, the base course layer is recommended to develop a more stable subgrade for concrete truck traffic associated with the pavement construction. Proper joint spacing (12 to 15 feet) will also be required to prevent loss of load transfer across saw-cut crack control joints. All joints should be properly sealed to reduce water infiltration.

The dumpster pad should be large enough to support the wheels of the truck which will bear the load of the dumpster. We recommend a minimum of 10 inches of PCC (4,000 psi 28-day compressive strength) underlain by 6 inches of aggregate base course for the dumpster pad.

4.8.4 Concrete Sidewalks

Concrete sidewalks around the warehouse should be 6 inches thick and supported on a minimum 4-inch thick layer of aggregate base course. The concrete and stone should be placed on an

approved soil subgrade. We recommend that the concrete be mixed with proper air-entrainment and have a 28-day unconfined compressive strength of 4,000 psi. A 4,500 psi compressive strength is recommended if de-icing chemicals will be used regularly on the surface of the sidewalks.

4.8.5 Pavement / Sidewalk Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and as such, periodic maintenance should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Preventive maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

4.9 Light Poles

Light poles are expected to be installed in landscaped and pavement areas. Pole foundations should be designed assuming unconstrained conditions. The soils surrounding the pole foundations / bases are expected to consist of stiff or medium dense to dense native residual soils or controlled, structural fill material. Pole foundations should be designed using an allowable lateral bearing capacity of 200 psf per foot of embedment.

4.10 Stormwater Management

The City of Salem requires 80 percent of annual stormwater to be treated onsite, and that onsite facilities have capacity to control the 2-year and 10-year precipitation events. Terracon provided a preliminary infiltration rate for flow control design in our draft geotechnical engineering report for this project, dated January 12, 2018. Preliminary stormwater infiltration pond locations and elevations were proposed based, in part, on this rate. Both ponds were proposed to be located along the east side of the site, one to the north and the other to the south. We returned to the field to perform additional exploration and testing to confirm this rate and to collect additional information related to groundwater levels at the proposed infiltration pond locations in late January 2018.

Borings IT-1 and IT-2 were planned in the proposed north and south infiltration pond locations, respectively. Borehole infiltration tests were planned at a depth of 17.5 feet in IT-1, and 15 feet in IT-2. Three attempts were made to advance IT-1 to the planned test elevation with each meeting early refusal at depths ranging from approximately 6 to 11 feet bgs. Boring IT-2 was successfully

advanced to the planned test depth, however static water levels were observed to be approximately 3 to 4 feet above the planned test elevation. These conditions precluded performing infiltration testing as planned.

Terracon collected additional data from the VWPs in borings F-4 and installed another VWP in boring W-6. Data collected from F-4 on January 30, 2018 indicates groundwater levels were approximately 7 feet above the proposed bottom elevation of the north pond, and approximately at the elevation of the south pond. Data collected from F-4 on February 18, 2018 indicates water levels fell approximately 4 feet from a peak on January 30, 2018. Data collected from W-6 on February 18, 2018 indicate water levels less than 5 feet below the bottom of the south infiltration pond.

It is Terracon's opinion that stormwater infiltration is not feasible at the proposed locations and elevations based on the groundwater level observations discussed in this section. We understand that the City of Salem has relaxed its requirements for stormwater infiltration on this site and that stormwater management will be accomplished with bio-swales with overflows connected to the storm sewer. Bottom elevation of the planned swales is 346 feet.

Groundwater data collected on April 8, 2018 indicate the highest recorded groundwater level at F-4 of elevation 346. Highest recorded groundwater level at W-6 was at elevation 351. Existing stormwater features around the site include a pond in the middle of the site, a ditch along 27th Avenue SE, and a City owned facility at the corner of 27th Avenue SE and Kuebler Boulevard.

Based on the available information, our opinion is that groundwater intrusion into the swales may be expected in the wet season. Furthermore, seepage may be expected from permanent cut slopes during the wet season which could cause sloughing depending on slope protection. Vegetation and rip rap are examples of measures that could be used to mitigate surficial sloughing.

We recommend that we be onsite to observe excavation of the permanent cut slopes going down to the proposed bio-swales. The purpose for our being onsite would be to look for indications of groundwater fluctuation and/or seepage at the cut face. We would make recommendations for measures to mitigate areas where potential for instability and surficial sloughing exists. Even with careful observation during construction, sloughing and instability of cut slopes may not become apparent until after construction.

4.11 Corrosivity

Soil samples from three borings were composited then tested for pH, soil resistivity, chloride and sulfate. The test results are presented in Appendix B and summarized below:

Analysis	Results
Soil pH	7.76
Water Soluble Sulfate	83 mg/kg
Chlorides	30 mg/kg
Resistivity	7,760 ohm-cm

Based on our review of the laboratory testing, it appears that the on-site soils have a moderate corrosive potential to uncoated metal pipes. With respect to concrete, we recommend the use of Type I/II cement in concrete that will be in contact with the soil.

4.12 Water Quality

We have assumed that domestic water for the development will be provided from the City of Salem Public Works Department. A copy of their annual water quality report (as posted on their internet site) is included in Appendix B.

4.13 Additional Study

Terracon will be performing additional explorations at retaining wall locations near the northeast corner of the site and near the southeast corner of the warehouse to assess soil parameters for wall design. We also plan to excavate test pit explorations in the proposed retail pad on the north side of the site. Results of these explorations will be issued in an addendum to this report.

5.0 GENERAL COMMENTS

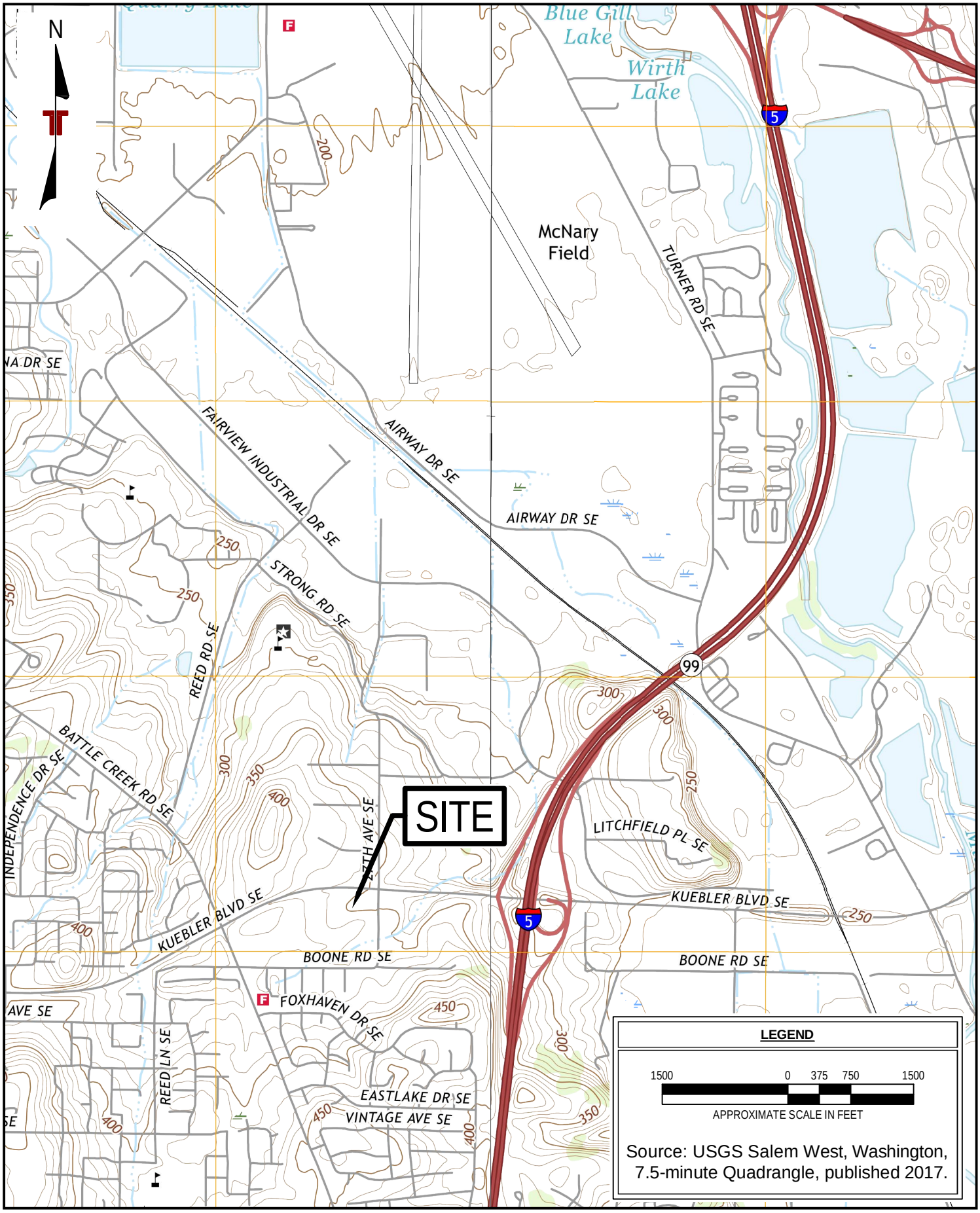
Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION



Project Mngr:	JMS
Drawn By:	AMP
Checked By:	TLH
Approved By:	JMS

Project No.	82175107
Scale:	AS SHOWN
File No.	Exhibit A-1
Date:	January 2018

Terracon
Consulting Engineers and Scientists
21905 64th Avenue W., Ste 100 Mountlake Terrace, WA 98043
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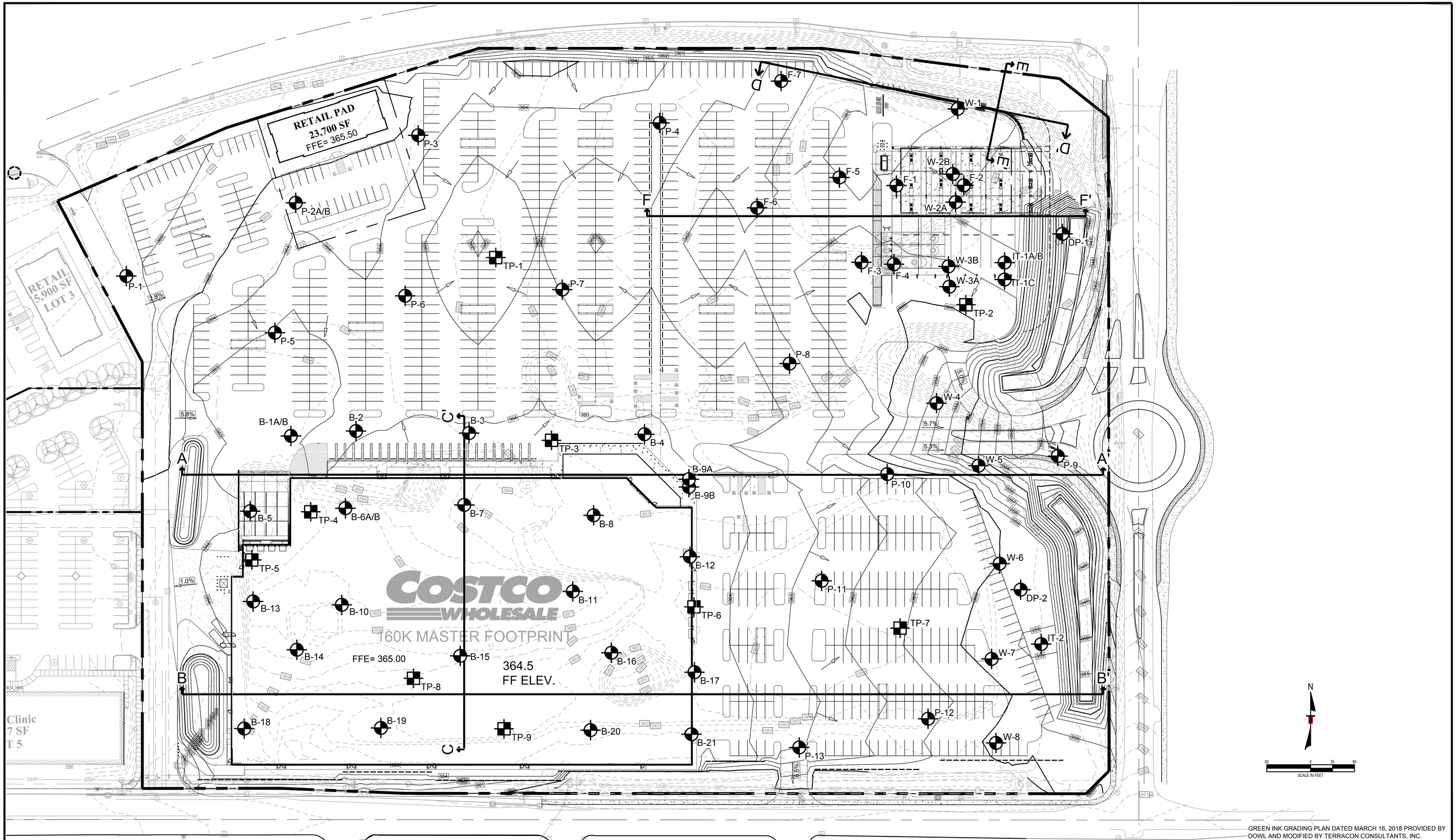
SITE LOCATION PLAN

Costco Warehouse CW# 17-0460
Kuebler Boulevard & 27th Avenue
Salem, Oregon

EXHIBIT

A-1



GREEN INK GRADING PLAN DATED MARCH 16, 2018 PROVIDED BY DOWL AND MODIFIED BY TERRACON CONSULTANTS, INC.

LEGEND

B-1 — APPROXIMATE LOCATION OF BORING

TP-1 — APPROXIMATE LOCATION OF TEST PIT

A A' — APPROXIMATE LOCATION OF CROSS SECTION LINE

Project Mngr:	JMS
Drawn By:	AMP
Checked By:	TLH
Approved By:	JMS

Project No.	82175107
Scale:	AS SHOWN
File No.	Exhibit A-2
Date:	April 2018

Terracon
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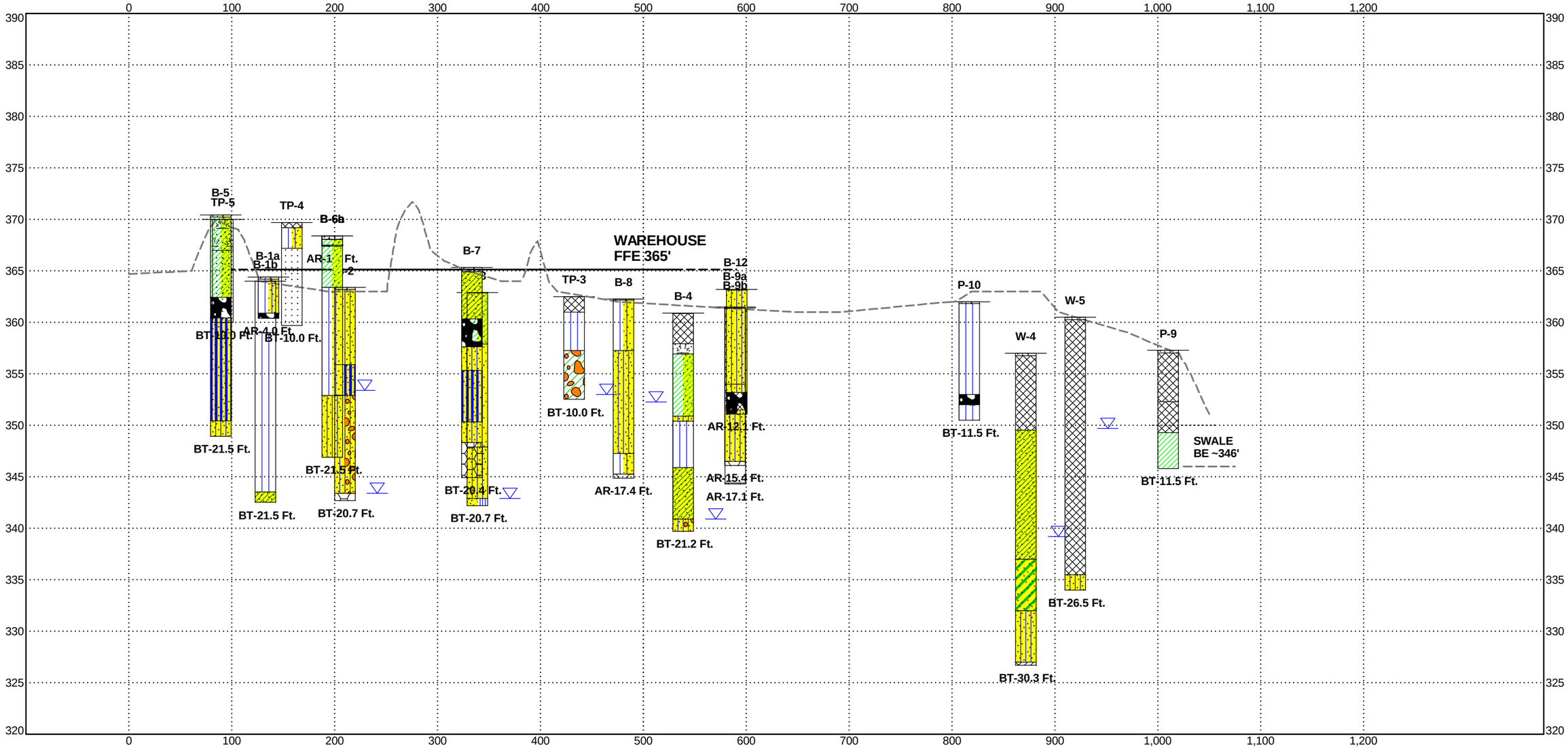
SITE AND EXPLORATION PLAN

Costco Warehouse CW# 17-0460
Kuebler Boulevard & 27th Avenue
Salem, Oregon

EXHIBIT
A-2

◄ A

A' ►



Explanation

B-1a — Borehole Number

Moisture Content — %w — LL PL — Liquid and Plastic Limits

Sampling (See General Notes) — Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil | Silt with Sand | Boulders and Cobbles | Silt | Sandy Lean Clay

Silty Sand | Sandy Silt | Silty Sand with Gravel | Basalt | Lean Clay with Sand

NOTES:

See Exhibit A-2 for orientation of soil profile.
See General Notes in Appendix C for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: J. Schmidt	Project No.: 82175107
Drawn by: T. Hesedahl	Scale: horiz 1":100', vert 1"=10'
Approved by: J. Schmidt	File Name: ExhA3
Date: 4/16/2018	

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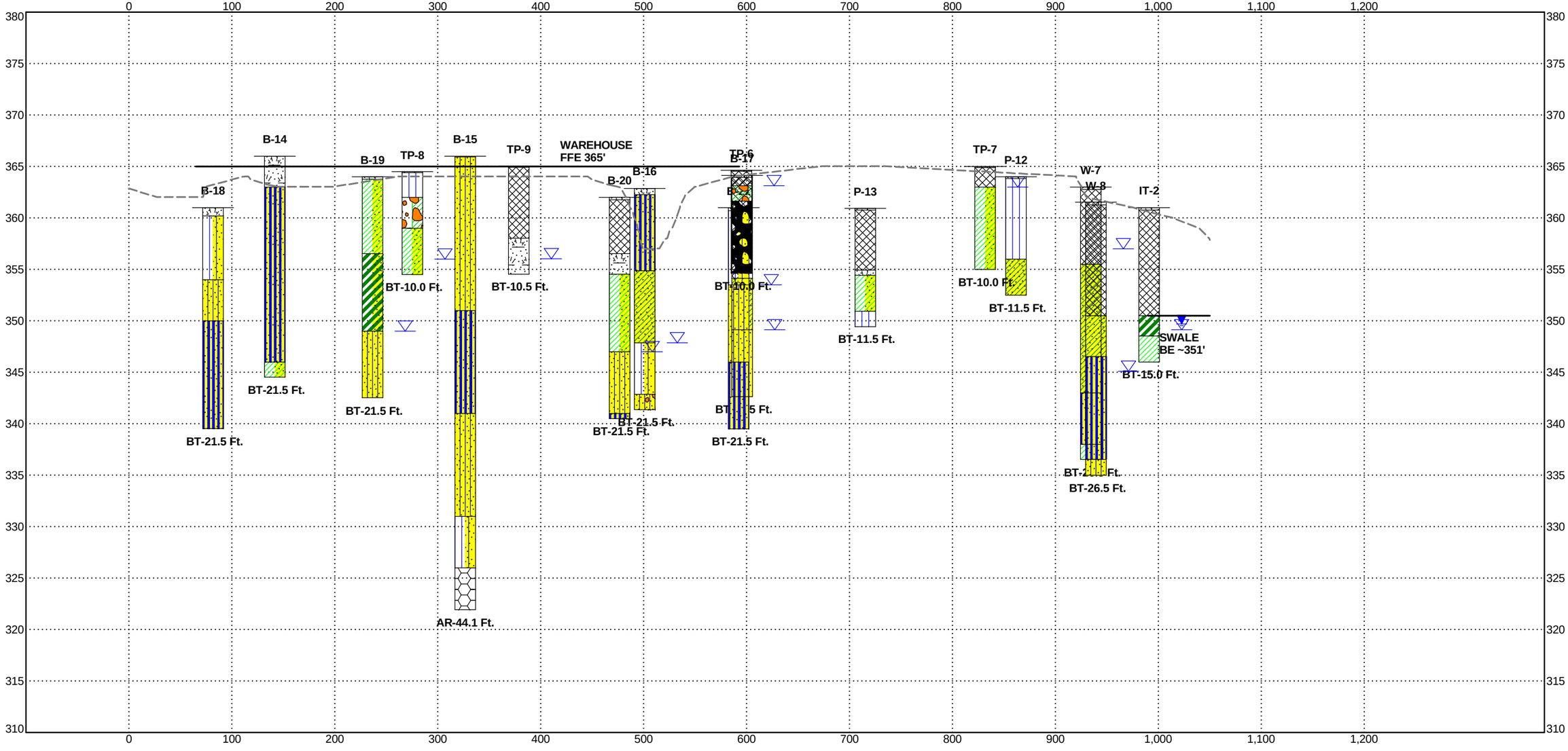
SUBSURFACE PROFILE

Section A-A'
COSTCO WAREHOUSE CW# 17-0460
KUEBLER BOULEVARD & 27TH AVENUE
SALEM, OR

EXHIBIT 3

B

B'



Explanation

B-14 — Borehole Number

Moisture Content — %w

LL PL — Liquid and Plastic Limits

Sampling (See General Notes)

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil | Sandy Silt | Lean Clay with Sand | Silty Sand | Silt with Sand

Basalt | Sandy Lean Clay | Silty Sand with Gravel | Fill (made ground) | Fat Clay with Sand

NOTES:

See Exhibit A-2 for orientation of soil profile.
See General Notes in Appendix C for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: J. Schmidt	Project No.: 82175107
Drawn by: T. Hesedahl	Scale: horiz 1":100', vert 1"=10'
Approved by: J. Schmidt	File Name: ExhA4
Date: 4/16/2018	

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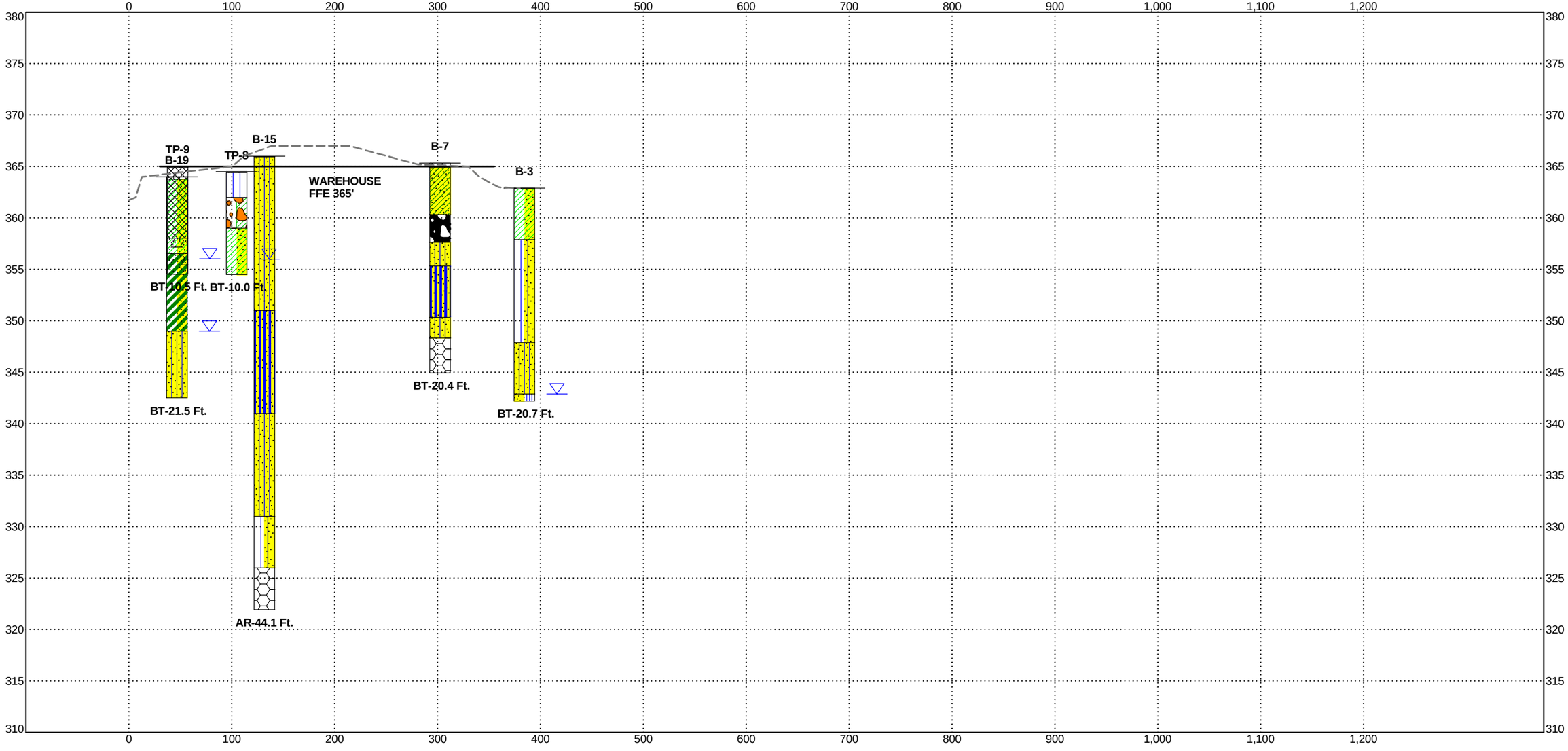
SUBSURFACE PROFILE

Section B-B'
COSTCO WAREHOUSE CW# 17-0460
KUEBLER BOULEVARD & 27TH AVENUE
SALEM, OR

EXHIBIT 4

C

C'



Explanation

B-3 — Borehole Number

Moisture Content — %w

LL PL — Liquid and Plastic Limits

Sampling (See General Notes)

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil

Lean Clay with Sand

Silt with Sand

Silty Sand

Poorly-graded Sand with Silt

Sandy Lean Clay

Boulders and Cobbles

Sandy Silt

Basalt

Fat Clay with Sand

NOTES:

See Exhibit A-2 for orientation of soil profile.
See General Notes in Appendix C for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: J. Schmidt	Project No.: 82175107
Drawn by: T. Hesedahl	Scale: horiz 1":100', vert 1"=10'
Approved by: J. Schmidt	File Name: ExhA5
Date: 4/16/2018	

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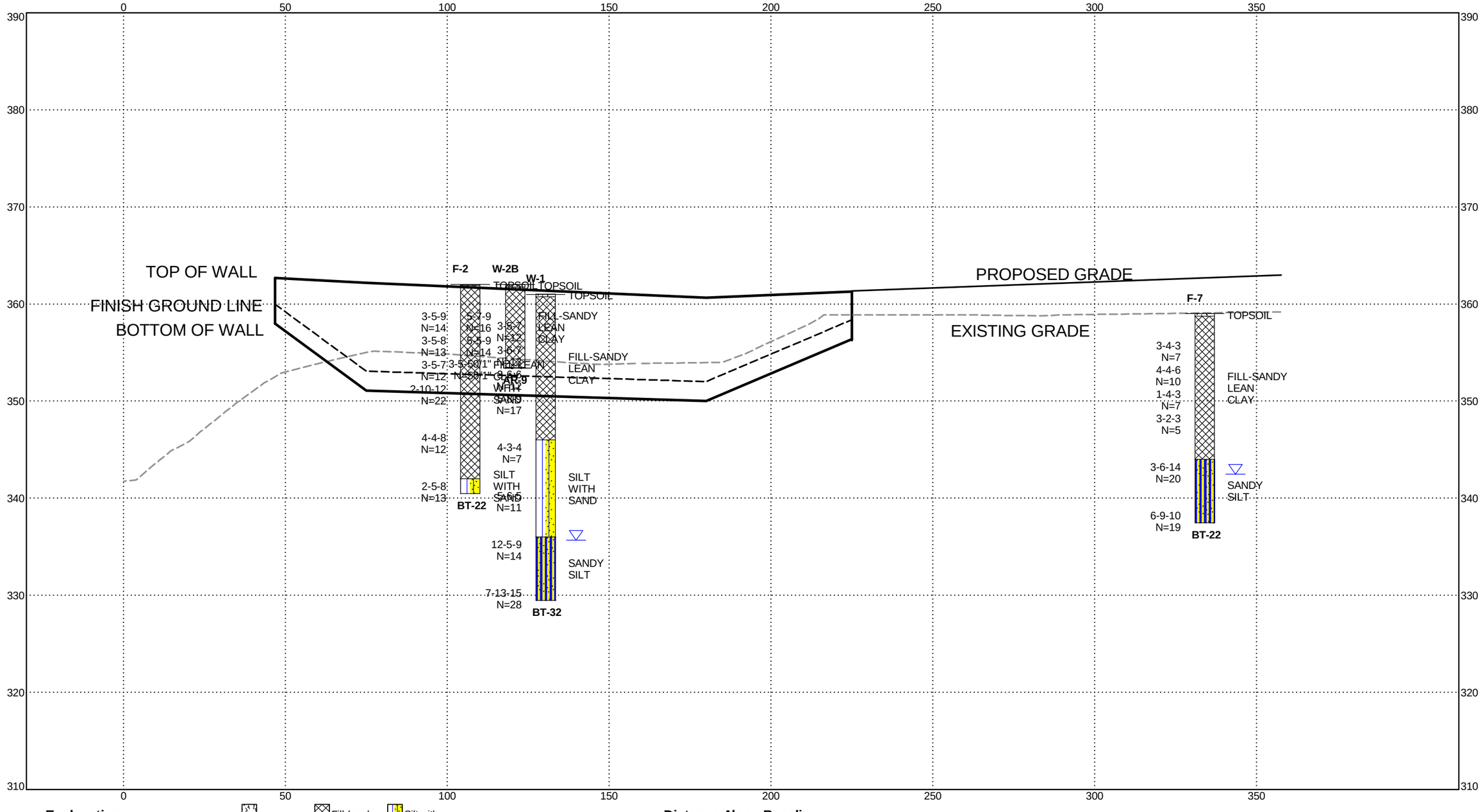
SUBSURFACE PROFILE

Section C-C'
COSTCO WAREHOUSE CW# 17-0460
KUEBLER BOULEVARD & 27TH AVENUE
SALEM, OR

EXHIBIT 5

D
Northeast Retaining Wall

D'
Northeast Retaining Wall'



Explanation

F-2 — Borehole Number
Borehole Lithology
AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.
Water Level Reading after drilling.

Topsoil
Fill (made ground)
Silt with Sand
Sandy Silt
Boulders and Cobbles

NOTES:
See Exhibit A-2 for orientation of soil profile.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: J. Schmidt	Project No.: 82175107
Drawn by: T. Hesedahl	Scale: Horiz. 1":30' Vert. 1"=10'
Approved by: J. Schmidt	File Name: 82175107_D-D
Date: 4/5/2018	

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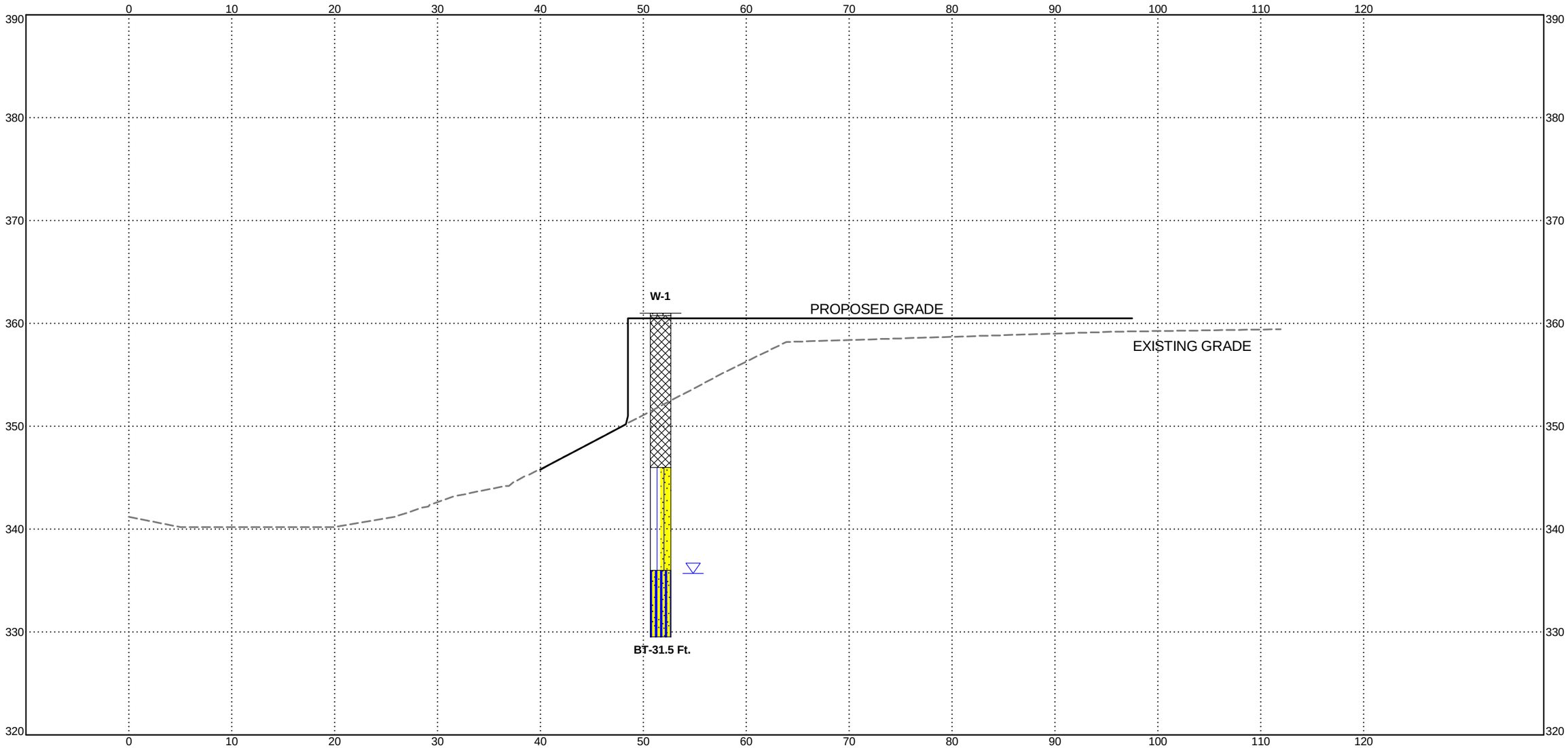
SUBSURFACE PROFILE

Section D-D'
COSTCO WAREHOUSE CW# 17-0460
KUEBLER BOULEVARD AND 27TH AVENUE
SALEM, OR

EXHIBIT
6

E

E'



Topsoil

Fill (made ground)

Silt with Sand

Sandy Silt

Explanation

W-1 — Borehole Number

Moisture Content — %w

LL PL — Liquid and Plastic Limits

Sampling (See General Notes)

Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

NOTES:

See Exhibit A-2 for orientation of soil profile.
See General Notes in Appendix C for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: J. Schmidt	Project No.: 82175107
Drawn by: T. Hesedahl	Scale: Vert. and Horiz 1"=10'
Approved by: J. Schmidt	File Name: 82175107
Date: 4/16/2018	

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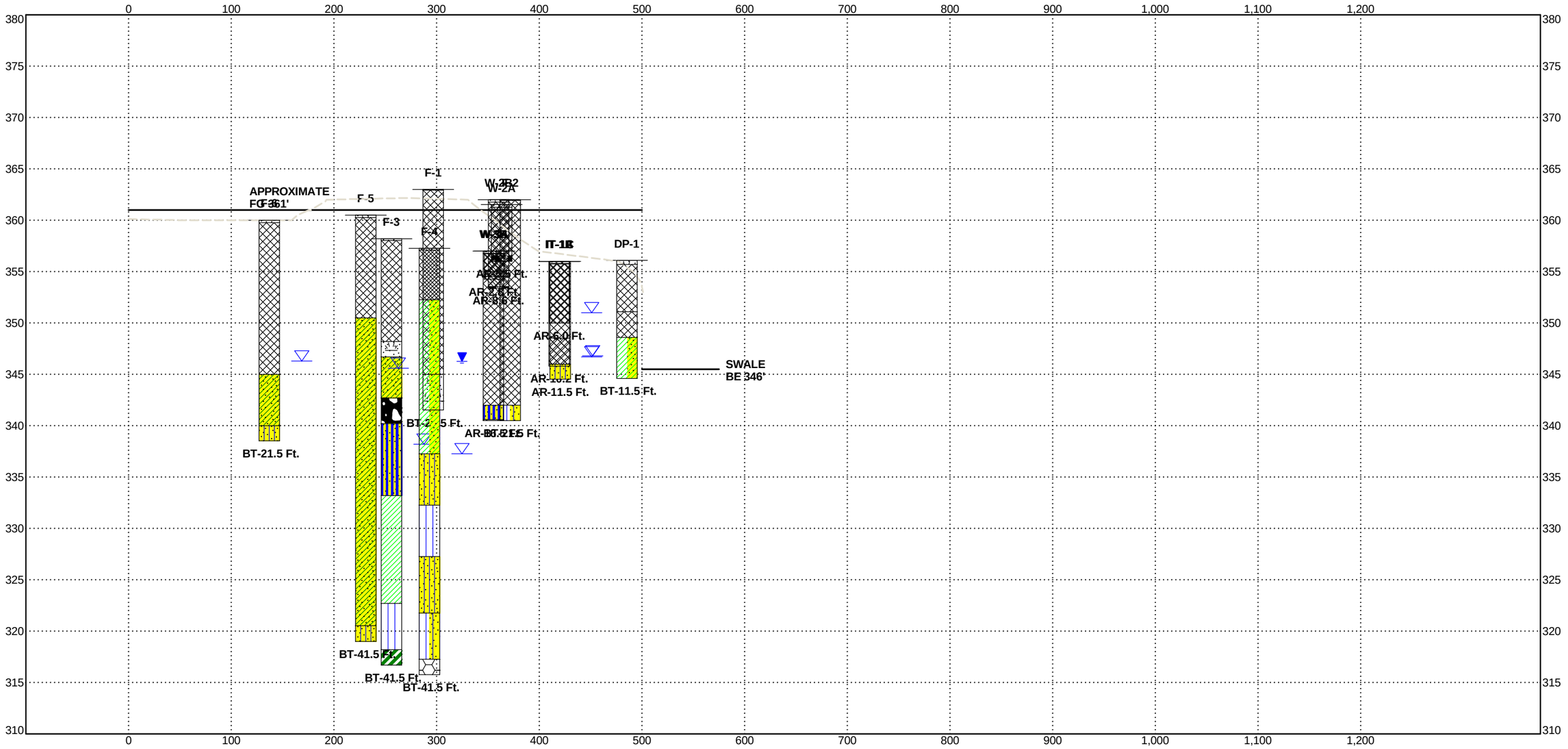
SUBSURFACE PROFILE

Section E-E'
COSTCO WAREHOUSE CW# 17-0460
KUEBLER BOULEVARD & 27TH AVENUE
SALEM, OR

EXHIBIT 7

F

F'



Explanation

F-1 — Borehole Number

Moisture Content — %w

LL PL — Liquid and Plastic Limits

Sampling (See General Notes) — Borehole Lithology

AR / BT — Borehole Termination Type

Water Level Reading at time of drilling.

Water Level Reading after drilling.

Topsoil | Fill (made ground) | Silt with Sand | Sandy Lean Clay | Boulders and Cobbles

Sandy Silt | Lean Clay | Silt | Fat Clay | Lean Clay with Sand

NOTES:

See Exhibit A-2 for orientation of soil profile.
See General Notes in Appendix C for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: J. Schmidt	Project No.: 82175107
Drawn by: T. Hesedahl	Scale: horiz 1":100', vert 1"=10'
Approved by: J. Schmidt	File Name: ExhA6
Date: 4/16/2018	

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SUBSURFACE PROFILE

Section F-F'
COSTCO WAREHOUSE CW# 17-0460
KUEBLER BOULEVARD & 27TH AVENUE
SALEM, OR

EXHIBIT 8

RETAIL PAD
23,700 SF
FFE= 365.50

RETAIL
5,900 SF
LOT 3

COSTCO WHOLESALE
160K MASTER FOOTPRINT
FFE= 365.00

Clinic
7 SF
T 5

2.8%
5.8%
1.0%
5.0%
5.7%
5.8%
6.5%

N

50 0 25 50
SCALE IN FEET

GREEN INK GRADING PLAN DATED MARCH 16, 2018 PROVIDED BY DOWL AND MODIFIED BY TERRACON CONSULTANTS, INC.

LEGEND

AREA OF 2' OVEREX BENEATH FOOTINGS

AREA OF 3' OVEREX BENEATH FOOTINGS

Project Mngr:	JMS
Drawn By:	AMP
Checked By:	TLH
Approved By:	JMS

Project No.	82175107
Scale:	AS SHOWN
File No.	Exhibit A-7
Date:	April 2018

Terracon
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FOOTING OVEREXCAVATION PLAN

Costco Warehouse CW# 17-0460
Kuebler Boulevard & 27th Avenue
Salem, Oregon

EXHIBIT
A-9

Field Exploration Description

The field exploration program was executed in two phases. The first phase consisted of 49 explorations which took place in December 2017. We returned to the site in January 2018 to drill 13 additional borings for proposed retaining walls, stormwater infiltration facilities, and revised fuel station location.

The exploration locations were laid out in the field using a hand-held GPS unit. Of the 49 December 2017 explorations advanced for this project, 38 of these locations were surveyed by DOWL. Positions of the remaining exploration locations were determined with a hand-held, commercial grade GPS unit. Ground surface elevations of the un-surveyed explorations were estimated from the provided site topographic survey. The locations of the explorations and elevations should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with hollow stem augers advanced by a rotary drill rig, except boring B-15 which was advanced by mud rotary drilling methods for purposes of calculating the Soil Site Class. Samples of the soil encountered in the borings were obtained using the split-barrel and thin-wall sampling procedures. The samples were tagged for identification, sealed to reduce moisture loss, and taken to the laboratory for further examination, testing, and classification. Following the completion of drilling, the borings were backfilled with bentonite chips.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the SPT values and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count (N) value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Vibrating wire piezometers were installed in borings F-4 and W-6. Data loggers were installed to monitor groundwater levels. The highest and lowest recorded water elevations are shown on the boring logs. Plots of the collected data are also presented in this appendix.

Field logs of the borings were prepared by Terracon's representative. The logs included visual classifications of the materials encountered as well as interpretation of the subsurface conditions between samples. The boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory evaluation of the samples. The boring locations are shown on Exhibit A-2. The boring logs are presented in Appendix A. General Notes to log terms and symbols are presented in Appendix C.

Test pits were excavated by a backhoe. The test pits were supervised and monitored by a Terracon engineer. The test pit locations are shown on Exhibit A-2. Test pit logs are presented Appendix A. Bulk surface soil samples were collected from some of the test pit excavations in order to perform various laboratory tests. These samples were collected from near-surface soils in areas anticipated to be near the design subgrade elevation.

BORING LOG NO. B-1a

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8841° Longitude: -123.0089°
Northing: 454044.395 Easting: 1350273.994

Approximate Surface Elev: 364.39 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	364+/-	**TOPSOIL**, ~2 inches of topsoil									
		SILT WITH SAND (ML), dark reddish brown, stiff			X	14	2-4-10 N=14	2.0 (HP)			
		banded with tan sand			X	10	3-50/5"				
3.5	361+/-										
4.0	360.5+/-	**POORLY GRADED SAND WITH GRAVEL (SP)**, gray, very dense, weathered boulder									
		Auger Refusal at 4 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:
Refusal encountered on boulder. Boring moved 3 feet west and redrilled as B-1b

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 | Boring Completed: 12-07-2017
Drill Rig: CME 75 | Driller: Steadfast Services
Project No.: 82175107 | Exhibit: A-11

BORING LOG NO. B-1b

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8841° Longitude: -123.0089°
Northing: 454044.395 Easting: 1350270.994

Approximate Surface Elev: 364 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	Pre-drill to 5 feet before sampling									
5.0	359+/-	5								
	SILT (ML), trace sand, red, tan, white and black, stiff, mottled, weak cementation, cemented in horizontal bedding planes			X	18	6-6-9 N=15	2.0 (HP)			
				X	18	2-5-10 N=15	1.5 (HP)			
		10		X	18	4-7-13 N=20				
	driller notes gravel lens between roughly 16.5 and 17.5 feet	15		X	18	3-9-19 N=28	2.0 (HP)			
20.5	343.5+/-	20								
	SANDY LEAN CLAY (CL), red, stiff, homogeneous			X	6	3-5-12 N=17	1.5 (HP)			
21.5	342.5+/-									
	Boring Terminated at 21.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:
Re-drill of B-1a

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-11

BORING LOG NO. B-2

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8841° Longitude: -123.00864°
Northing: 454050.014 Easting: 1350348.229

Surface Elev.: 363.37 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	363	**TOPSOIL**, ~2 inches of topsoil									
		SILTY SAND (SM), trace gravel, fine grained, brown and black, medium dense									
					X	18	2-4-7 N=11				
			5								
					X	18	2-4-7 N=11				
7.5	356										
		SANDY SILT (ML), brown and black, stiff			X	18	2-4-7 N=11	2.0 (HP)			
10.5	353		10								
		SILTY SAND WITH GRAVEL (SM), fine to medium grained, angular, black with red and yellow, loose			X	18	2-4-5 N=9	2.25 (HP)			
			15								
					X	18	2-7-9 N=16				
		medium dense									
20.0	343.5			▽							
20.7	342.5	**BASALT**, gray, free water observed in sampler	20		X	8	31-50/2"				
		Boring Terminated at 20.7 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *20' While drilling*

2.6' Borehole cave in

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-12

BORING LOG NO. B-3

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88409° Longitude: -123.00814°
Northing: 454047.664 Easting: 1350477.112

Surface Elev.: 362.89 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.0 **TOPSOIL**, less than 1" of topsoil	363									
LEAN CLAY WITH SAND (CL), trace gravel, low to medium plasticity, brown to reddish brown, very stiff				X	12	1-12-15 N=27	2.75 (HP)			
5.0	358	5		X	18	4-5-7 N=12	2.5 (HP)			
SILT WITH SAND (ML), nonplastic, brown and black, stiff to very stiff			▽							
low plasticity				X	18	1-4-6 N=10	2.75 (HP)			
		10		X	18	1-4-9 N=13	1.5 (HP)			
15.0	348	15		X	18	2-14-36 N=50				
SILTY SAND (SM), fine grained, brown and black, very dense, weak cementation										
20.0	343	20	▽							
20.7 **POORLY GRADED SAND WITH SILT (SP-SM)**, coarse to medium grained, angular, black, very dense	342			X	6	4-50/2"				
Boring Terminated at 20.7 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *20' While drilling*
▽ *7.0' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017
Drill Rig: D-50 Driller: Holocene
Project No.: 82175107 Exhibit: A-13

BORING LOG NO. B-4

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88409° Longitude: -123.00736°
Northing: 454046.339 Easting: 1350677.111

Surface Elev.: 360.90 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.0	361	**TOPSOIL**, less than 1" of topsoil									
		FILL - SILT WITH SAND (ML), low plasticity, brown, very soft									
3.0	358				X	18	1-2-4 N=6	0.25 (HP)			
4.0	357	**TOPSOIL (CL)**, medium plasticity, dark brown, medium stiff, ~12 inches of relic topsoil, roots									
		LEAN CLAY WITH SAND (CL), low to medium plasticity, brown, gray and black, very stiff	5	▽	■	24					
		brown and black			X	18	3-7-11 N=18	3.75 (HP)			
10.0	351		10								
10.5	350.5	**SILTY SAND (SM)**, tan, medium dense			X	18	11-10-12 N=22	1.5 (HP)			
		SILT (ML), trace sand, low plasticity, brown, gray and black, stiff to very stiff									
15.0	346		15								
		SANDY LEAN CLAY (CL), trace gravel, low to medium plasticity, black with yellow and red, stiff			X	18	2-3-5 N=8	1.25 (HP)			
20.0	341		20	▽							
21.2	339.5	**SILTY SAND WITH GRAVEL (SM)**, subangular, yellow and brown, very dense, mottled, black gravel			X	14	26-42-50/2"				
		Boring Terminated at 21.2 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *20' While drilling*
▽ *6.7' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017
Drill Rig: D-50 Driller: Holocene
Project No.: 82175107 Exhibit: A-14

BORING LOG NO. B-5

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88385° Longitude: -123.0091°
Northing: 453958.622 Easting: 1350227.606

Surface Elev.: 370.42 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.2	370	**TOPSOIL**, ~2 inches of topsoil
		LEAN CLAY WITH SAND (CL), low to medium plasticity, reddish brown, medium stiff
8.0	362.5	**POORLY GRADED SAND WITH GRAVEL (SP)**, fine grained, gray, weathered boulder
10.0	360.5	**SANDY SILT (ML)**, low plasticity, reddish brown and black, very stiff
		plate like pieces of black, broken rock
20.0	350.5	**SILTY SAND (SM)**, fine grained, reddish brown, dense, cemented laminations
21.5	349	***Boring Terminated at 21.5 Feet***

DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	13	2-2-3 N=5	0.75 (HP)			
5	15			56		
	18	5-5-31 N=36	3.0 (HP)			
10	18	10-10-7 N=17	2.25 (HP)			
15	8	10-14-7 N=21	2.75 (HP)			
20	16	6-19-20 N=39				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

5.2' Borehole cave in

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-04-2017 | Boring Completed: 12-04-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-15

BORING LOG NO. B-6a

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88386° Longitude: -123.00868°
Northing: 453962.013 Easting: 1350336.174

Surface Elev.: 368.38 (Ft.)

DEPTH	ELEVATION (Ft.)
0.3 **TOPSOIL**, ~4 inches of Topsoil	368
0.9 **LEAN CLAY WITH SAND**, brown	367.5
1.0 **BOULDER**	367.5
Auger Refusal at 1 Foot	

GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:
Refusal encountered on boulder. Boring moved 5 feet west and redrilled as B-6b

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-16

BORING LOG NO. B-6b

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88386° Longitude: -123.00868°
Northing: 453962.013 Easting: 1350336.174

Surface Elev.: 368.38 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.3	368	**TOPSOIL**, ~4 inches of Topsoil
		LEAN CLAY WITH SAND (CL), trace cobbles, low to medium plasticity, brown, medium stiff, blows overstated on gravel
5.0	363.5	**SILT WITH SAND (ML)**, low plasticity, brown and black, very stiff
		grades to sandy silt
		stiff
15.5	353	**SILTY SAND (SM)**, fine grained, gray and yellow, medium dense
		bown, gray, yellow and red, mottled
21.5	347	***Boring Terminated at 21.5 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			10	3-12-16 N=28	0.75 (HP)			
5			18	5-10-12 N=22	2.0 (HP)	42		
			18	3-7-10 N=17	2.5 (HP)	41		26
10			18	3-7-7 N=14	1.5 (HP)			
15	▽		18	4-7-8 N=15				
20			18	8-10-12 N=22				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:
Re-drill of B-6a

WATER LEVEL OBSERVATIONS

▽ *15' While drilling*

4.6' Borehole cave in

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 | Boring Completed: 12-06-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-16

BORING LOG NO. B-7

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88387° Longitude: -123.00816°
Northing: 453965.771 Easting: 1350471.623

Surface Elev.: 365.32 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.4	365	**TOPSOIL**, ~5 inches of Topsoil
		SANDY LEAN CLAY (CL), trace cobbles, low to medium plasticity, brown, stiff
5.0	360.5	
		SILTY SAND WITH GRAVEL (SM), gray, weathered boulder
7.7	357.5	
		SILTY SAND (SM), trace gravel, brown and gray, medium dense
10.0	355.5	
		SANDY SILT (ML), low plasticity, brown and gray, stiff to very stiff, rust staining
15.0	350.5	
		SILTY SAND (SM), brown and gray, medium dense, weak cementation
17.0	348.5	
		BASALT, gray, chatter in drill indicates rock starts at ~17 feet
20.4	345	
		Boring Terminated at 20.4 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		10	2-4-19 N=23	1.5 (HP)			
5		12	19-29-45 N=74				
		18	16-7-11 N=18				
10		18	7-8-7 N=15	1.75 (HP)			
15		16	7-14-15 N=29				
20		1	50/5"				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 | Boring Completed: 12-06-2017

Drill Rig: D-50 | Driller: Holocene

Project No.: 82175107 | Exhibit: A-17

BORING LOG NO. B-8

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88383° Longitude: -123.00759°
Northing: 453953.92 Easting: 1350619.117

Surface Elev.: 362.24 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.1	362									
TOPSOIL, ~1 inch of Topsoil										
SILT WITH SAND (ML), low plasticity, brown, very stiff to hard				X	5	7-11-12 N=23	4.5+ (HP)			
5.0	357	5								
SILTY SAND (SM), fine grained, brown and gray, dense, rust stains				X	18	6-15-19 N=34				
medium dense				X	18	8-12-13 N=25				
fine to coarse grained, gray, red and yellow		10	▽	X	18	8-8-11 N=19				
15.0	347	15								
SILT WITH SAND (ML), nonplastic, gray, very stiff, rust stains				X	18	6-8-12 N=20	2.5 (HP)			
17.0	345									
17.4 **BEDROCK**, gray	345			X	1	50/5"				
Auger Refusal at 17.4 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *10' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-05-2017 | Boring Completed: 12-05-2017

Drill Rig: D-50 | Driller: Holocene

Project No.: 82175107 | Exhibit: A-18

BORING LOG NO. B-9a

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88394° Longitude: -123.00717°
Northing: 453995.121 Easting: 1350727.495

Surface Elev.: 361.48 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.1	361.5	**FILL - TOPSOIL**, topsoil < 1".
		FILL - SILTY SAND (SM), brown to reddish brown, medium dense, black laminations
7.5	354	
		FILL - SANDY SILT (ML), low to medium plasticity, black,gray and red brown, very stiff, heterogeneous
10.0	351.5	
		SILTY SAND (SM), trace gravel, brown, dense
15.0	346.5	
15.4	346	**BEDROCK**
		Auger Refusal at 15.4 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)
5		18	4-8-9 N=17	
		18	4-18-13 N=31	
10		16	8-11-12 N=23	2.25 (HP)
		14	21-18-14 N=32	
15		0	50/5"	

WATER LEVEL OBSERVATIONS: ▽ 6.7' After 24 hours

WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:
Refusal encountered on possible boulder or bedrock. Boring moved 10 feet south and redrilled as B-9b

WATER LEVEL OBSERVATIONS

Groundwater not observed

▽ *6.7' After 24 hours*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-04-2017 | Boring Completed: 12-04-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-19

BORING LOG NO. B-9b

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88392° Longitude: -123.00717°
Northing: 453986.307 Easting: 1350727.537

Surface Elev.: 361.37 (Ft.)

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
Predrill 17' before sampling			5								
			10	▽							
			15								
17.0	344.5										
17.1 **BEDROCK**	344.5					0	50/1"				
Auger Refusal at 17.1 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:
Re-drill of B-9a

WATER LEVEL OBSERVATIONS

Groundwater not observed

▽ *10.1' After 24 hours*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-04-2017 | Boring Completed: 12-04-2017

Drill Rig: D-50 | Driller: Holocene

Project No.: 82175107 | Exhibit: A-19

BORING LOG NO. B-10

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88356° Longitude: -123.0087°
Northing: 453851.892 Easting: 1350331.999

Surface Elev.: 367.44 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.3	367	**TOPSOIL**, ~3 inches of topsoil
		SANDY SILT (ML), low plasticity, brown, black and gray, very stiff, mottled
5.0	362.5	
		SILTY SAND (SM), fine grained, brown and gray, medium dense, rust stains
7.5	360	
		SANDY SILT (ML), low plasticity, brown and black, stiff
10.5	357	
11.5	356	**COBBLE**, gray
		SANDY SILT (ML), brown, observed in cuttings
15.0	352.5	
		POORLY GRADED GRAVEL (GP), medium dense, material type assumed based on drilling action
20.0	347.5	
20.4	347	**BEDROCK**, gray and black
		Boring Terminated at 20.4 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		18	3-8-9 N=17	2.25 (HP)			
5		18	3-8-12 N=20		49	NP	50
		18	3-5-7 N=12	2.25 (HP)			
10		10	2-50/5"	1.75 (HP)			
		0	5-6-10 N=16				
15							
20		1	14-50/5"				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *20' While drilling*

8.7' Borehole cave in

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 | Boring Completed: 12-06-2017

Drill Rig: D-50 | Driller: Holocene

Project No.: 82175107 | Exhibit: A-20

BORING LOG NO. B-11

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8836° Longitude: -123.00769°
Northing: 453867.174 Easting: 1350595.324

Surface Elev.: 367.50 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.0	367.5	**TOPSOIL**, ~36 inches of topsoil
3.0	364.5	
4.0	363.5	**COBBLE**
		SANDY SILT (ML), low plasticity, brown, black and gray stiff
7.5	360	
		COBBLE, gray
10.0	357.5	
		SILT WITH SAND (ML), low plasticity, brown, stiff
15.0	352.5	
		SANDY LEAN CLAY (CL), low to medium plasticity, dark brown with yellow and red, stiff, mottled
20.0	347.5	
20.2	347.3	**BEDROCK**, gray
		Boring Terminated at 20.2 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			4	3-5-12 N=17				
5			18	6-10-9 N=19	1.25 (HP)			
			0.5	12-16-19 N=35				
10			6	4-6-6 N=12				
15			18	2-3-2 N=5	1.5 (HP)			
20			2	50/2"				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

10.9' Borehole cave in

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-21

BORING LOG NO. B-12

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8837° Longitude: -123.00717°
Northing: 453906.732 Easting: 1350728.895

Surface Elev.: 363.18 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS
0.1	363				
TOPSOIL, <1 inch of topsoil					
SILTY SAND (SM), fine grained, light brown to reddish brown, medium dense					
				6	7-12-12 N=24
brown and black		5			
				18	2-7-11 N=18
				18	4-8-14 N=22
10.0	353	10			
POSSIBLE COBBLE OR BEDROCK, gray and brown				16	16-26-50/4"
12.1	351				
Auger Refusal at 12.1 Feet				0.5	50/1"

WATER LEVEL OBSERVATIONS | LABORATORY HP (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-05-2017 | Boring Completed: 12-05-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-22

BORING LOG NO. B-13

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88357° Longitude: -123.00909°
Northing: 453855.725 Easting: 1350230.943

Surface Elev.: 367.89 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.2	367.5	**TOPSOIL**, ~2 inches of topsoil
		SANDY SILT (ML), low plasticity, brown and gray, very stiff, rust stains
5.0	363	
		SANDY LEAN CLAY (CL), low to medium plasticity, gray, black and red, very stiff, mottled
10.0	358	
		SILT WITH SAND (ML), low plasticity, brown, stiff
		grades to sandy, very stiff
		grades brown, red and yellow, medium stiff
21.5	346.5	
		Boring Terminated at 21.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		X	18	4-5-10 N=15	3.0 (HP)			
5		X	18	6-13-12 N=25	4.5+ (HP)	36		55
		X	18	3-8-9 N=17	2.0 (HP)			
10		X	18	3-5-7 N=12	2.75 (HP)			
15		X	18	3-10-15 N=25	4.5+ (HP)			
20	▽	X	18	2-2-4 N=6	0.75 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *21' While drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-23

BORING LOG NO. B-14

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8834° Longitude: -123.0088°
Northing: 453800 Easting: 1350280

Approximate Surface Elev: 366 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)
		TOPSOIL, ~36 inches of topsoil			
3.0	363+/-				
		SANDY SILT (ML), nonplastic, gray and red, very stiff to hard, laminated, ~1/8" lamination	6	0-1-1 N=2	0.25 (HP)
			16	2-12-16 N=28	4.5+ (HP)
		grades to low plastic, brown and gray, very stiff, rust stains	18	7-13-8 N=21	2.5 (HP)
		black laminations	18	7-8-5 N=13	2.0 (HP)
			18	2-8-13 N=21	2.5 (HP)
20.0	346+/-				
		LEAN CLAY WITH SAND (CL), medium plasticity, yellow, very stiff, homogeneous	18	2-6-7 N=13	2.75 (HP)
21.5	344.5+/-				
		Boring Terminated at 21.5 Feet			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-24

BORING LOG NO. B-15

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8834° Longitude: -123.0082°
Northing: 453795 Easting: 1350465

Approximate Surface Elev: 366 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.1 **TOPSOIL**, ~1 inch of topsoil	366+/-								
SILTY SAND (SM), trace gravel, brown, black and gray, loose			X	14	1-3-4 N=7				
		5	X	18	4-3-4 N=7		54	NP	43
medium dense			X	18	11-13-10 N=23				
grades gray and brown, very dense, weak cementation		10	X	18	31-41-28 N=69				
15.0	351+/-	15	X	18	10-11-13 N=24	2.0 (HP)			
SANDY SILT (ML), low plasticity, reddish brown to red, and yellow, very stiff									
grades gray with red and yellow, stiff		20	X	18	6-4-5 N=9	1.5 (HP)			
25.0	341+/-		■	18					
		25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Mud Rotary - Tri-Cone Cutting Head

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed due to mud rotary methods

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-05-2017 Boring Completed: 12-05-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-25

BORING LOG NO. B-15

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8834° Longitude: -123.0082°
Northing: 453795 Easting: 1350465

Approximate Surface Elev: 366 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND (SM), brownish gray with yellow, black and green, very dense, mottled, weak cementation					18	16-25-39 N=64				
		30								
grades brownish gray with black, moderate cementation					18	25-36-31 N=67				
35.0	331+/-	35								
SILT WITH SAND (ML), low plasticity, yellow and black, soft					18	3-6-45 N=51	0.5/ 4.5+			
grades brown to dark gray, hard, blocky										
40.0	326+/-	40								
BEDROCK, gray					1	50/2"				
44.1	322+/-									
Auger Refusal at 44.1 Feet					0	50/1"				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Mud Rotary - Tri-Cone Cutting Head

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed due to mud rotary methods

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-05-2017 | Boring Completed: 12-05-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-25

BORING LOG NO. B-16

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8834° Longitude: -123.00752°
Northing: 453797.257 Easting: 1350639.388

Surface Elev.: 362.86 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.6	362.5	**TOPSOIL**, ~7 inches of topsoil
		SANDY SILT (ML), low plasticity, brown and gray, stiff
8.0	355	
		SANDY LEAN CLAY (CL), low to medium plasticity, red and yellow, stiff, mottled
15.0	348	
		SILT WITH SAND (ML), low plasticity, yellow, olive green and red, stiff
20.0	343	
		SILTY SAND WITH GRAVEL (SM), gray, red and yellow, medium dense, stratified, 4 - 6" thick strata
21.5	341.5	
		Boring Terminated at 21.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		18	2-4-5 N=9	4.5+ (HP)			
		22					
10		18	10-8-7 N=15	1.75 (HP)			
		18	2-4-6 N=10	2.25 (HP)			
15		18	3-4-5 N=9	1.5 (HP)			
20		18	6-4-6 N=10				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

15' While drilling
7.1' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-05-2017 Boring Completed: 12-05-2017
Drill Rig: D-50 Driller: Holocene
Project No.: 82175107 Exhibit: A-26

BORING LOG NO. B-17

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88334° Longitude: -123.00715°
Northing: 453775.093 Easting: 1350734.114

Surface Elev.: 364.11 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.2	364	**TOPSOIL**, ~2 inches of topsoil
		FILL - LEAN CLAY WITH SAND (CL), low to medium plasticity, brown and gray, stiff
		very stiff
		trace gravel, bits of straw observed in sample
10.0	354	
		SANDY LEAN CLAY (CL), low to medium plasticity, brown, yellow, red and black, stiff
15.0	349	
		SILTY SAND (SM), gray with yellow and red, medium dense
		trace gravel
21.5	342.5	
		Boring Terminated at 21.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		18	2-3-6 N=9	2.0 (HP)			
5		18	4-8-10 N=18	3.25 (HP)			
		18	4-7-8 N=15	3.25 (HP)			
10		18	2-4-5 N=9	2.75 (HP)			
15		18	5-6-8 N=14				
20		18	8-12-8 N=20				

WATER LEVEL OBSERVATIONS: ▽ 15' While drilling; ▽ 7.6' At completion of drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-05-2017 Boring Completed: 12-05-2017
Drill Rig: D-50 Driller: Holocene
Project No.: 82175107 Exhibit: A-27

BORING LOG NO. B-18

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8832° Longitude: -123.0092°
Northing: 453710 Easting: 1350220

Approximate Surface Elev: 361 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.8	360+/-	**TOPSOIL**, ~10 inches
		SILT WITH SAND (ML), low plasticity, red and yellow, stiff
7.0	354+/-	
		SILTY SAND (SM), red brown and yellow, loose to medium dense
		grades fine to coarse
11.0	350+/-	
		SANDY SILT (ML), low plasticity, reddish brown, stiff
		brown to reddish-yellow
		grades gray-brown with thin yellow strata
21.5	339.5+/-	
		Boring Terminated at 21.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		18	2-3-4 N=7	2.0 (HP)			
5		22					
		18	4-5-6 N=11	2.0 (HP)			
10		18	5-6-7 N=13				
15		18	4-9-10 N=19	3.0 (HP)			
20		18	5-11-9 N=20	2.5 (HP)			

WATER LEVEL OBSERVATIONS: ▽ 6.8' at 90 Minutes

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

▽ *6.8' at 90 Minutes*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-04-2017 Boring Completed: 12-04-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-28

BORING LOG NO. B-19

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8832° Longitude: -123.0085°
Northing: 453710 Easting: 1350375

Approximate Surface Elev: 364 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	LITHOLOGY	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)
0.3	364+/-	**TOPSOIL**, ~3 inches of topsoil					
		LEAN CLAY WITH GRAVEL (CL), low to medium plasticity, light brown to brown, stiff		X	18	2-3-5 N=8	2.0 (HP)
		grades sandy	5	X	18	2-3-5 N=8	1.75 (HP)
7.5	356.5+/-						
		FAT CLAY WITH SAND (CH), medium to high plasticity, red and yellow, stiff to very stiff, mottled		X	18	3-5-8 N=13	3.5 (HP)
		grades to yellow, homogenous	10	X	18	3-5-8 N=13	2.0 (HP)
15.0	349+/-						
		SILTY SAND (SM), fine grained, brown with black and green, medium dense, mottled	15	X	18	3-5-8 N=13	
		fine to coarse grained, brown, black, gray and yellow	20	X	18	5-11-8 N=19	
21.5	342.5+/-						
		Boring Terminated at 21.5 Feet					

ATTERBERG LIMITS: LL-PL-PI

WATER CONTENT (%)

PERCENT FINES

WATER LEVEL OBSERVATIONS: ▽ at 5 and 15

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *15' While drilling*
▽ *6.6' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-05-2017 Boring Completed: 12-05-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-29

BORING LOG NO. B-20

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8832° Longitude: -123.0076°
Northing: 453710 Easting: 1350615

Approximate Surface Elev: 362 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	362+/-	**TOPSOIL**, ~3 inches of topsoil
		FILL - SILT WITH SAND (ML), low plasticity, brown, medium stiff to stiff
5.5	356.5+/-	
		SILT WITH SAND (ML), low plasticity, grayish brown, soft, rootlets observed, possible relic topsoil
7.5	354.5+/-	
		LEAN CLAY WITH SAND (CL), low to medium plasticity, gray, brown, red and black, very stiff
		grades sandy
15.0	347+/-	
		SILTY SAND (SM), fine grained, gray, brown and black, medium dense
		grades dense
21.0	341+/-	
21.5	340.5+/-	**SANDY SILT (ML)**, nonplastic, gray and yellow, very hard
		Boring Terminated at 21.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		18	1-3-3 N=6	1.75 (HP)			
		18	1-3-2 N=5	2.0/ 0.50			
10		18	7-11-16 N=27	2.5 (HP)			
		18	8-8-11 N=19	2.75 (HP)			
15		18	4-8-12 N=20				
20		18	5-17-41 N=58				

WATER LEVEL OBSERVATIONS: ▽ at 5 and 15

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *15' While drilling*
▽ *5.5' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-05-2017 Boring Completed: 12-05-2017
Drill Rig: D-50 Driller: Holocene
Project No.: 82175107 Exhibit: A-30

BORING LOG NO. B-21

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88315° Longitude: -123.00717°
Northing: 453704.441 Easting: 1350730.693

Surface Elev.: 360.97 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.3	360.5									
TOPSOIL, Topsoil - 3.5 inches											
SILT WITH SAND (ML), soft to medium stiff											
					X	12	3-5-11 N=16	0.25 (HP)			
grades reddish brown, rock in sampler tip, blows possibly overstated			5	▽	X	12	4-5-7 N=12	0.5 (HP)			
	7.5	353.5		▽							
SILTY SAND (SM), fine to medium grained, brown,gray,yellow and black, medium dense, heterogeneous, rock in sampler tip, blows possibly overstated					X	18	3-4-6 N=10	1.5 (HP)			
free water in sampler, shelby tube collapsed during sampling due to buried obstruction (probable boulder or cobble)			10		■	12					
					X	18	5-5-7 N=12				
	15.0	346	15								
SANDY SILT (ML), trace gravel, brown and black, stiff, black faces appear slickensided					X	18	4-6-10 N=16	3.75 (HP)			
			20		X	18	3-5-6 N=11				
	21.5	339.5									
Boring Terminated at 21.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *7.5' While drilling*
▽ *5.8' At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-04-2017 | Boring Completed: 12-04-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-31

BORING LOG NO. F-1

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8848° Longitude: -123.0059°
Northing: 454330 Easting: 1350965

Approximate Surface Elev: 363 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.1 **TOPSOIL**, ~1 inch of topsoil	363+/-								
FILL - SANDY LEAN CLAY (CL), trace gravel, low to medium plasticity, brown and black, very stiff, black faces appear slickensided			X	16	3-5-6 N=11	3.25 (HP)			
		5	X	12	2-6-6 N=12	2.5 (HP)			
stiff			X	12	2-4-4 N=8	1.75 (HP)			
very stiff		10	X	12	5-6-7 N=13	2.5 (HP)			
		15	■	23					
18.0	345+/-		X	16	4-4-4 N=8	2.5/ 0.50			
SANDY SILT (ML), low plasticity, gray and dark brown, soft, rootlets, possible relic topsoil		20	X	18	2-3-2 N=5	1.0 (HP)			
21.5	341.5+/-								
Boring Terminated at 21.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-32

BORING LOG NO. F-2

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8848° Longitude: -123.0062°
Northing: 454330 Easting: 1351040

Approximate Surface Elev: 362 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.1 **TOPSOIL**, ~1 inch of topsoil	362+/-									
FILL - LEAN CLAY WITH SAND (CL), low to medium plasticity, brown, very stiff				X	16	3-5-9 N=14	3.25 (HP)			
		5		X	14	3-5-8 N=13	2.5 (HP)			
dark brown				X	14	3-5-7 N=12	3.25 (HP)			
from 10 to 15 feet cuttings indicate no change in material		10		X	1	2-10-12 N=22				
		15		X	0	4-4-8 N=12				
20.0	342+/-									
SILT WITH SAND (ML), low plasticity, brown, black and yellow, very stiff		20		X	18	2-5-8 N=13	3.0 (HP)			
21.5	340.5+/-									
Boring Terminated at 21.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-33

BORING LOG NO. F-3

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88462° Longitude: -123.0064°
Northing: 454242.43 Easting: 1350924.463

Surface Elev.: 358.18 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.2	358	**TOPSOIL**, ~2 inches of topsoil
		FILL - LEAN CLAY (CL), trace sand, low to medium plasticity, brown, light brown and black, stiff, black faces appear slickensided
		very stiff
10.0	348	
11.5	346.5	**LEAN CLAY (CL)**, trace sand, medium plasticity, dark brown, very soft, possible relic topsoil
15.5	342.5	**SANDY LEAN CLAY (CL)**, low to medium plasticity, brown
18.0	340	**BOULDER**, gray, ~2.5' thick based on drilling action
25.0	333	**SANDY SILT (ML)**, nonplastic, brown, stiff

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		14	2-4-6 N=10	1.75 (HP)			
5		2	4-8-7 N=15				
		18	3-5-8 N=13	2.75 (HP)			
10		18	0-0-0 N=0	0.5 (HP)			
15		4	17-50/2"				
20		14	9-5-3 N=8	1.5 (HP)			
25							

WATER LEVEL OBSERVATIONS: ▽ 20' While drilling; ▽ 8.8' At completion of drilling

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 | Boring Completed: 12-07-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-34

BORING LOG NO. F-3

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88462° Longitude: -123.0064°
Northing: 454242.43 Easting: 1350924.463

Surface Elev.: 358.18 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
LEAN CLAY (CL), trace sand, low to medium plasticity, red, yellow and brown, stiff, mottled				X	18	2-3-5 N=8	2.5 (HP)			
grades to yellow and red, medium stiff to stiff		30		X	18	0-2-2 N=4	1.25 (HP)			
35.5	322.5	35		X	18	0-1-1 N=2	1.0 (HP)			
SILT (ML), trace sand, low plasticity, gray, soft										
40.0	318	40		X	18	0-0-1 N=1	0.25 (HP)			
FAT CLAY (CH), medium to high plasticity, white and gray, very soft										
41.5	316.5									
Boring Terminated at 41.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

20' While drilling

8.8' At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-34

BORING LOG NO. P-1

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88459° Longitude: -123.00964°
Northing: 454226.65 Easting: 1350086.388

Surface Elev.: 366.77 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2 **TOPSOIL**, ~2 inches of topsoil	366.5									
1.0 **FILL - SILT WITH GRAVEL (ML)**, low to medium plasticity, brown, stiff	366			X	12	3-3-5 N=8				
SILT (ML), low plasticity, reddish brown, stiff, weak cementation										
				X	16	3-7-7 N=14				
		5		X	16	5-6-8 N=14	1.0 (HP)			
driller notes gravel very stiff				X	15	3-13-14 N=27	2.0 (HP)			
		10		X	14	4-16-50/2"	2.0 (HP)			
11.2 hard, strong cementation, cemented zones of black and brown foliated material	355.5									
Boring Terminated at 11.2 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 | Boring Completed: 12-06-2017

Drill Rig: CME 75 | Driller: Steadfast Services

Project No.: 82175107 | Exhibit: A-36

BORING LOG NO. P-2a

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88482° Longitude: -123.00889°
Northing: 454310.129 Easting: 1350279.539

Surface Elev.: 363.76 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.2	363.5									
		TOPSOIL, ~2 inches of topsoil									
	1.5	362.5			X	14	8-4-4 N=8	1.5 (HP)			
		SANDY SILT WITH GRAVEL (ML), low plasticity, reddish brown, stiff, gravel composed of dark brown to black cemented material									
		Auger Refusal at 1.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:
Refusal encountered on possible boulder or bedrock. Boring moved 6 feet west and redrilled as P-2b

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-37

BORING LOG NO. P-2b

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88482° Longitude: -123.00889°
Northing: 454310.129 Easting: 1350279.539

Surface Elev.: 363.76 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	Predrill 2.5' before sampling									
2.5	361.5									
3.0	**SANDY SILT WITH GRAVEL (ML)**, low plasticity, brown, stiff 361			X	6	5-33-40 N=73				
	BOULDER, gray				12					
5.0	359	5								
5.9	**SILT WITH SAND (ML)**, trace gravel, low plasticity, reddish brown, stiff 358			X	11	2-50/5"	2.0 (HP)			
	Auger Refusal at 5.9 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:
Re-drill of P-2a

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-37

BORING LOG NO. P-3

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88503° Longitude: -123.00835°
Northing: 454387.041 Easting: 1350419.166

Surface Elev.: 362.84 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	0.2	362.5									
	TOPSOIL, ~2 inches of topsoil										
	LEAN CLAY WITH GRAVEL (CL), low to medium plasticity, brown and black, stiff, black faces appear slickensided				X	14	4-4-7 N=11	3.0 (HP)			
	2.5	360.5									
	SANDY LEAN CLAY (CL), trace gravel, low to medium plasticity, dark tan, brown and black, very stiff, black faces appear slickensided				X	18	7-17-16 N=33	3.5 (HP)			
			5		X	18	6-12-14 N=26	3.5 (HP)			
					X	13	6-6-28 N=34				
	9.0	354									
	BEDROCK, gray, drilling action indicates hard materials at 9 feet										
	10.4	352.5	10		X	6	50/5"				
	Boring Terminated at 10.4 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-38

BORING LOG NO. P-4

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88506° Longitude: -123.00729°
Northing: 454401.143 Easting: 1350694.43

Surface Elev.: 360.54 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	360									
TOPSOIL, ~4 inches of topsoil										
FILL - LEAN CLAY WITH SAND (CL), low to medium plasticity, brown to dark brown, stiff				X	14	1-5-6 N=11	2.5 (HP)			
		5		X	12	3-3-11 N=14	2.25 (HP)			
7.5	353									
LEAN CLAY WITH SAND (CL), low to medium plasticity, dark brown, medium stiff, possible relic topsoil				X	10	1-2-3 N=5	1.0 (HP)			
grades to brown, very stiff		10		X	18	7-17-9 N=26	3.25 (HP)			
11.5	349									
Boring Terminated at 11.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-39

BORING LOG NO. P-5

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88441° Longitude: -123.00899°
Northing: 454162.148 Easting: 1350255.463

Surface Elev.: 363.43 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.1	363.5								
TOPSOIL, ~1 inches of topsoil									
SILT (ML), low plasticity, reddish brown and black, stiff, black faces appear slickensided			X	16	2-2-7 N=9	2.0 (HP)			
			X	16	3-9-5 N=14	3.5 (HP)			
		5							
6.0	357.5		X	16	6-7-12 N=19	2.0 (HP)			
SANDY SILT (ML), low plasticity, reddish brown and gray, very stiff, laminated, ~1/8 inch thick lamination of reddish brown silt and gray sand									
			X	18	8-9-14 N=23	3.0 (HP)			
10.5	353	10							
SILT (ML), low plasticity, reddish brown and black, very stiff, black faces appear slickensided			X	18	4-7-11 N=18				
11.5	352								
Boring Terminated at 11.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-40

BORING LOG NO. P-6

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8845° Longitude: -123.0084°
Northing: 454205 Easting: 1350405

Approximate Surface Elev: 362 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.2	362+/-	**TOPSOIL**, ~2 inches of topsoil
		SILT WITH SAND (ML), low plasticity, reddish brown, very stiff
		stiff
		very stiff
6.0	356+/-	
		BOULDER, gray
7.5	354.5+/-	
8.0	354+/-	**SILT (ML)**, low plasticity, reddish brown and black, very stiff, black faces appear slickensided
		BOULDER, gray
10.0	352+/-	
		SILT (ML), low plasticity, reddish brown and black, very stiff, black faces appear slickensided
11.5	350.5+/-	
		Boring Terminated at 11.5 Feet

DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	14	4-5-12 N=17	2.0 (HP)			
	18	3-4-7 N=11	1.0 (HP)			
5	18	2-8-26 N=34	2.0 (HP)			
	10	18-50/5"				
10	18	3-6-6 N=12	2.5 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-41

BORING LOG NO. P-7

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8844° Longitude: -123.0075°
Northing: 454210 Easting: 1350585

Approximate Surface Elev: 361 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2	361+/-							
TOPSOIL, ~2 inches of topsoil								
SILT (ML), trace sand, low plasticity, reddish brown, stiff, tan sand lenses			15	3-5-7 N=12	3.75 (HP)			
drilling action indicates cobble			12	4-6-5 N=11	2.0 (HP)			
brown and black, very stiff, black faces appear slickensided		5	16	4-6-14 N=20	3.25 (HP)			
laminated, ~1/8 inch thick laminations of reddish brown silt and black cemented gravel			18	3-6-8 N=14	3.25 (HP)			
		10	18	3-6-8 N=14	2.0 (HP)			
11.5	349.5+/-							
Boring Terminated at 11.5 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-42

BORING LOG NO. P-8

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8842° Longitude: -123.0066°
Northing: 454125 Easting: 1350845

Approximate Surface Elev: 358 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.2	358+/-	**TOPSOIL**, ~2 inches of topsoil
		SANDY SILT (ML), nonplastic, light brown to brown, stiff
		low plasticity
8.0	350+/-	
		SILT (ML), trace sand, low plasticity, dark brown and yellow, stiff
11.5	346.5+/-	
		Boring Terminated at 11.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	X	18	2-5-16 N=21	1.75 (HP)			
5							
	X	18	1-3-4 N=7	2.0 (HP)			
	X	18	7-8-10 N=18	1.5 (HP)			
10							
	X	18	2-4-8 N=12	1.5 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-43

BORING LOG NO. P-9

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88401° Longitude: -123.00555°
Northing: 454021.44 Easting: 1351148.246

Surface Elev.: 357.27 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	357								
TOPSOIL, ~3 inches of topsoil									
FILL - SILTY SAND (SM), fine grained, light brown, brown and black, medium dense, weak cementation, black faces appear slickensided			X	16	2-6-9 N=15				
5.0	352.5	5							
FILL - SANDY SILT (ML), nonplastic, brown and black, stiff, black faces appear slickensided			X	16	2-5-5 N=10	1.5 (HP)			
8.0	349.5								
LEAN CLAY (CL), trace sand, medium plasticity, dark brown, medium stiff, roots, possible relic topsoil low to medium plasticity, brown and dark brown			X	16	1-3-2 N=5	0.75 (HP)			
		10							
11.5 red and yellow	346		X	18	1-2-3 N=5	1.0 (HP)			
Boring Terminated at 11.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 | Boring Completed: 12-07-2017

Drill Rig: D-50 | Driller: Holocene

Project No.: 82175107 | Exhibit: A-44

BORING LOG NO. P-10

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8839° Longitude: -123.0062°
Northing: 454000 Easting: 1350955

Approximate Surface Elev: 362 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.2	362+/-	**TOPSOIL**, ~2 inches of topsoil
		SILT (ML), low plasticity, dark reddish brown, very stiff
		trace sand and gravel, light reddish brown, stiff, pockets of light tan sand and gravel
9.0	353+/-	
		BOULDER, gray
10.0	352+/-	
		SILT (ML), dark brown, stiff
11.5	350.5+/-	
		Boring Terminated at 11.5 Feet

DEPTH (Ft.)	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	14	6-7-16 N=23	4.0 (HP)			
	14	4-7-5 N=12	3.5 (HP)			
5						
	15	5-7-5 N=12	2.0 (HP)			
	4	5-7-7 N=14				
10	16	6-5-6 N=11	1.75 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-45

BORING LOG NO. P-11

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88362° Longitude: -123.00659°
Northing: 453879.207 Easting: 1350879.076

Surface Elev.: 364.80 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.2 **TOPSOIL**, ~2 inches of topsoil	364.5									
SILT (ML), trace gravel, low plasticity, brown and black, very stiff, black faces appear slickensided				X	16	9-9-18 N=27	3.75 (HP)			
				X	14	4-6-6 N=12	3.0 (HP)			
		5								
				X	15	4-6-9 N=15	3.25 (HP)			
pockets of light tan sand and gravel										
				X	15	4-8-8 N=16	3.5 (HP)			
		10								
				X	15	4-10-12 N=22	3.5 (HP)			
11.5	353.5									
Boring Terminated at 11.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-46

BORING LOG NO. P-12

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8832° Longitude: -123.006°
Northing: 453720 Easting: 1351000

Approximate Surface Elev: 364 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.2	364+/-	**TOPSOIL**, ~2 inches of topsoil
		SILT (ML), dark brown and black, very stiff, black faces appear slickensided
		reddish brown with gravel
		stiff
8.0	356+/-	
		SANDY LEAN CLAY (CL), dark tan, stiff
		yellow, reddish brown and black, stiff, mottled, black faces appear slickensided
11.5	352.5+/-	
		Boring Terminated at 11.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		14	2-6-9 N=15	3.5 (HP)			
		14	5-8-7 N=15	3.5 (HP)			
5		15	2-4-9 N=13	1.5 (HP)			
		15	3-7-9 N=16	1.5 (HP)			
10		16	6-7-9 N=16	1.75 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-06-2017 Boring Completed: 12-06-2017

Drill Rig: CME 75 Driller: Steadfast Services

Project No.: 82175107 Exhibit: A-47

BORING LOG NO. P-13

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8831° Longitude: -123.00669°
Northing: 453689.296 Easting: 1350853.522

Surface Elev.: 360.91 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.2	360.5	**TOPSOIL**, ~2 inches of topsoil
		FILL - SANDY LEAN CLAY (CL), low to medium plasticity, light brown to brown, stiff
6.0	355	
6.5	354.5	**LEAN CLAY WITH SAND (CL)**, trace organics, medium plasticity, dark brown, soft, roots, possible relic topsoil (~6 inches)
		LEAN CLAY WITH SAND (CL), low to medium plasticity, brown, medium stiff
10.0	351	
		SILT (ML), low plasticity, brown, yellow and black, soft, mottled
11.5	349.5	
		Boring Terminated at 11.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		18	1-2-5 N=7	1.5 (HP)			
5							
		14	1-4-8 N=12	2.0/ 0.5			
		18	1-2-3 N=5	0.75 (HP)			
10							
		18	1-1-1 N=2	0.5 (HP)			

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 | Boring Completed: 12-07-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-48

BORING LOG NO. DP-1

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8847° Longitude: -123.00552°
Northing: 454274.732 Easting: 1351153.641

Surface Elev.: 356.07 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.4	355.5								
TOPSOIL, ~5 inches of topsoil									
SANDY SILT (ML), nonplastic, brown and light brown, stiff			X	16	1-4-4 N=8	1.5 (HP)			
5.0	351								
LEAN CLAY WITH SAND (CL), medium plasticity, brown and dark brown, stiff		5	X	16	1-3-6 N=9	2.0 (HP)			
7.5	348.5								
LEAN CLAY WITH SAND (CL), medium plasticity, brown, stiff			X	10	0-3-4 N=7	2.0 (HP)			
		10	X	12	3-3-4 N=7	2.5 (HP)	33		78
11.5	344.5								
Boring Terminated at 11.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 | Boring Completed: 12-07-2017

Drill Rig: D-50 | Driller: Holocene

Project No.: 82175107 | Exhibit: A-49

BORING LOG NO. DP-2

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.88359° Longitude: 123.00571°
Northing: 453869.163 Easting: 1351105.929

Surface Elev.: 361.48 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.4	361	**TOPSOIL**, ~5 inches of topsoil
		SILT WITH SAND (ML), trace gravel, low plasticity, brown and gray, stiff, fragments of gray cobbles in sampler
8.5	353	**LEAN CLAY (CL)**, trace sand, medium plasticity, dark brown and gray, stiff, roots, possible relic topsoil
		low to medium plasticity, brown
11.5	350	***Boring Terminated at 11.5 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)
5		12	2-5-6 N=11	
		16	2-6-6 N=12	1.5 (HP)
		10	3-5-5 N=10	2.0 (HP)
10		18	4-6-7 N=13	2.0 (HP)

WATER LEVEL OBSERVATIONS

ATTERBERG LIMITS: LL-PL-PI

WATER CONTENT (%)

PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 Boring Completed: 12-07-2017

Drill Rig: D-50 Driller: Holocene

Project No.: 82175107 Exhibit: A-50

BORING LOG NO. IT-1A

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8846° Longitude: -123.0058°
Northing: 454237.63 Easting: 1351087.65

Approximate Surface Elev: 356 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	356+/-	**TOPSOIL**, 3 inches
		FILL - SANDY LEAN CLAY (CL), trace organics, brown with black spotting, stiff
		with gravel, brown and dark brown, highly weathered gravel
6.0	350+/-	***Auger Refusal at 6 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			10	2-3-6 N=9				
5			15	12-20-12 N=32				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-30-2018 | Boring Completed: 01-30-2018

Drill Rig: CME 850 | Driller: Holt Services

Project No.: 82175107 | Exhibit: A-60

BORING LOG NO. IT-1B

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8846° Longitude: -123.0058°
Northing: 454242 Easting: 1351087.65

Approximate Surface Elev: 356 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	FILL - , Drilled to 7.5 feet before sampling.									
7.5	348.5+/-									
	FILL - SANDY LEAN CLAY (CL), trace organics, brown with black spotting, trace rootlets				13	3-4-5 N=9				
10.0	346+/-									
10.2	no recovery				0	50/2"				
	Auger Refusal at 10.2 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

While drilling
After One Day

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-30-2018 | Boring Completed: 01-30-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-61

BORING LOG NO. IT-1C

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8845° Longitude: -123.0058°
Northing: 454212.05 Easting: 1351088.67

Approximate Surface Elev: 356 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	356+/-	**TOPSOIL**, 3 inches
		FILL - SANDY LEAN CLAY (CL), brown with black spotting, medium stiff
10.0	346+/-	
		SILTY SAND (SM), light brown
11.5	344.5+/-	
		Auger Refusal at 11.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5	▽							
			15	2-4-3 N=7				
	▽							
10			8	3-22-17 N=39				

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*
▽ *After One Day*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-30-2018 | Boring Completed: 01-30-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-62

BORING LOG NO. IT-2

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8834° Longitude: -123.0057°
Northing: 453807.18 Easting: 1351129.35

Approximate Surface Elev: 361 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.3	361+/-	**TOPSOIL**, 3 inches
		FILL - SANDY LEAN CLAY (CL), with gravel, angular, light brown and red, very stiff
		dark brown to brown, less gravel and sand
		stiff, highly weathered gravel
10.5	350.5+/-	**FAT CLAY (CH)**, medium to high plasticity, red with white veins, very stiff
12.5	348.5+/-	**LEAN CLAY (CL)**, with sand, tan and red, very stiff, highly weathered gravel
15.0	346+/-	***Boring Terminated at 15 Feet***

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		15	4-7-9 N=16 HP = 3.0 tsf				
5		13	5-6-9 N=15				
		12	3-4-10 N=14				
10		12	14-10-10 N=20 HP = 3.25 tsf				
		12	3-8-7 N=15 HP = 2.0 tsf				
15							

WATER LEVEL OBSERVATIONS: ▽ At completion of drilling; ▽ After One Day; ▼ After Two Days

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-29-2018 | Boring Completed: 02-01-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-63

BORING LOG NO. F-4

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88461° Longitude: -123.00626°
Northing: 454240.246 Easting: 1350961.507

Surface Elev.: 357.24 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.2	357	**TOPSOIL**, ~2 inches of topsoil
		FILL - SILT WITH SAND (ML), nonplastic, brown and black, stiff, black faces appear slickensided
5.0	352	**LEAN CLAY WITH SAND (CL)**, low to medium plasticity, brown and light brown, stiff
		grades medium stiff
		grades to black, yellow, orange and red, medium stiff to stiff, mottled
20.0	337	**SILTY SAND (SM)**, fine grained, gray and brown, loose
25.0	332	

INSTALLATION DETAILS: Cover; Bentonite Seal; Cement-Bentonite Grout

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)
5		12	1-3-6 N=9	1.5 (HP)
		18	1-4-8 N=12	2.25 (HP)
		18	2-4-6 N=10	2.0 (HP)
10		18	4-6-9 N=15	2.75 (HP)
15		18	2-3-6 N=9	1.0 (HP)
20		18	1-2-3 N=5	
25				

WATER LEVEL OBSERVATIONS; WATER CONTENT (%); ATTERBERG LIMITS (LL-PL-PI); PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

- *20' While Drilling*
- *15.4' on 12/19/2017*
- *11.0' on 1/28/2017*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 | Boring Completed: 12-07-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-35

BORING LOG NO. F-4

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88461° Longitude: -123.00626°
Northing: 454240.246 Easting: 1350961.507

Surface Elev.: 357.24 (Ft.)

DEPTH	ELEVATION (Ft.)	Description	Construction	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILT (ML), trace sand, low plasticity, red and yellow, stiff, mottled										
30.0	327						18	2-4-7 N=11	1.75 (HP)			
		SILTY SAND (SM), coarse grained, subangular, dark gray and brown, medium dense, 6 inch silt lens at 30.1 feet		30			18	2-5-7 N=12				
35.5	321.5		Cement-Bentonite Grout	35			18	12-20-12 N=32	3.75 (HP)			
		SILT WITH SAND (ML), low plasticity, dark gray, hard										
40.0	317			40			12	2-9-34 N=43				
		BEDROCK, gray										
41.5	315.5		Vibrating ~~Wire~~ Piezometer at 41' (S/N 1700280, P/N 52611028)									
		Boring Terminated at 41.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

- *20' While Drilling*
- *15.4' on 12/19/2017*
- *11.0' on 1/28/2017*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 12-07-2017 | Boring Completed: 12-07-2017
Drill Rig: D-50 | Driller: Holocene
Project No.: 82175107 | Exhibit: A-35

BORING LOG NO. F-5

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8849° Longitude: -123.0065°
Northing: 454338.98 Easting: 1350899.4

Approximate Surface Elev: 360.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	360.5+/-	**TOPSOIL**, 3 inches
		FILL - SANDY LEAN CLAY (CL), with gravel, fine grained, angular, light and dark brown
		very stiff
		stiff
10.0	350.5+/-	**SANDY LEAN CLAY (CL)**, with gravel, fine to medium grained, orangish brown, stiff, highly weathered gravel

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		15	5-8-8 N=16				
5		12	4-4-8 N=12				
		12	4-5-9 N=14				
10		12	4-6-7 N=13				
15		12	5-5-8 N=13				
20		12	5-4-9 N=13				
25							

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-01-2018 | Boring Completed: 02-01-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-64

BORING LOG NO. F-5

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8849° Longitude: -123.0065°
Northing: 454338.98 Easting: 1350899.4

Approximate Surface Elev: 360.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SANDY LEAN CLAY (CL), with gravel, fine to medium grained, orangish brown, stiff, highly weathered gravel *(continued)*									
		very stiff				15	10-8-13 N=21				
			30								
		tan and red				15	4-7-9 N=16 HP = 2.5 tsf				
			35								
		orangish brown with red and yellow streaks				10	7-7-11 N=18				
40.0	320.5+/-										
		SILTY SAND (SM), with gravel, dark gray, medium dense	40			12	4-3-9 N=12				
41.5	319+/-										
		Boring Terminated at 41.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-01-2018 | Boring Completed: 02-01-2018

Drill Rig: CME 850 | Driller: Holt Services

Project No.: 82175107 | Exhibit: A-64

BORING LOG NO. F-6

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8848° Longitude: -123.0068°
Northing: 454304.39 Easting: 1350805.47

Approximate Surface Elev: 360 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	360+/-	**TOPSOIL**, 3 inches
		FILL - SANDY SILT (ML), fine grained, light brown with black spotting, stiff
		trace gravel, angular
15.0	345+/-	
		SANDY LEAN CLAY (CL), fine to medium grained, very stiff
20.0	340+/-	
		SILTY SAND (SM), with gravel, fine grained, brown and orange, with black veins, medium dense
21.5	338.5+/-	
		Boring Terminated at 21.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS
5		12	4-7-7 N=14
		12	4-5-10 N=15
		15	3-6-8 N=14
10		12	2-5-8 N=13
15		12	6-7-12 N=19
20		12	7-12-13 N=25

LABORATORY HP (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-01-2018 | Boring Completed: 02-01-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-65

BORING LOG NO. F-7

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8852° Longitude: -123.0067°
Northing: 454448.94 Easting: 1350832.85

Approximate Surface Elev: 359 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS
0.3	359+/-	**TOPSOIL**, 3 inches				
		FILL - SANDY LEAN CLAY (CL), orangish brown, medium stiff, black spotting		X	13	3-4-3 N=7
		with gravel, stiff	5	X	12	4-4-6 N=10
		light brown to dark brown, medium stiff		X	12	1-4-3 N=7
		orangish brown, weathered gravel	10	X	10	3-2-3 N=5
15.0	344+/-	**SANDY SILT (ML)**, fine grained, light brown with black veins, very stiff	15	X	10	3-6-14 N=20
			20	X	10	6-9-10 N=19
21.5	337.5+/-	***Boring Terminated at 21.5 Feet***				

WATER LEVEL OBSERVATIONS: ▽ at 15 Ft.

LABORATORY HP (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-01-2018 | Boring Completed: 02-01-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-66

BORING LOG NO. W-1

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8851° Longitude: -123.006°
Northing: 454417.13 Easting: 1351034.21

Approximate Surface Elev: 361 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	361+/-	**TOPSOIL**, 3 inches
		FILL - SANDY LEAN CLAY (CL), trace gravel, orangish brown with black spotting, stiff
		fine to medium grained, dark brown and yellow, highly weathered gravel
		very stiff
15.0	346+/-	**SILT WITH SAND (ML)**, brown, medium stiff
		stiff
25.0	336+/-	

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS
5		15	3-5-7 N=12
		12	3-6-7 N=13
		15	3-6-6 N=12
10		13	5-8-9 N=17
15		10	4-3-4 N=7
20		12	5-6-5 N=11
25			

GRAPHIC LOG | WATER LEVEL OBSERVATIONS | LABORATORY HP (tsf) | WATER CONTENT (%) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-01-2018 | Boring Completed: 02-01-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-67

TEST PIT LOG NO. TP-1

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88464° Longitude: -123.00801°
Northing: 454247.727 Easting: 1350507.577

Surface Elev.: 362.22 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.2	362	**TOPSOIL**, ~2 inches of topsoil
1.0	361	**FILL - SILTY GRAVEL (GM)**, trace sand, reddish brown, loose
		CLAYEY GRAVEL (GC), with cobbles and boulders, brown, medium dense to very dense
		~6 foot long boulder with flat top
6.0	356	**CLAYEY SAND (SC)**, brown and black, medium dense to very dense, probable residual bedrock
10.0	352	***Test Pit Terminated at 10 Feet***

SAMPLE TYPE	LABORATORY HP (tsf)	WATER CONTENT (%)	PERCENT FINES
	2.0 (HP)		

DEPTH (Ft.): 5, 10

WATER LEVEL OBSERVATIONS: ▽ at 8'

INSTALLATION DETAILS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Seepage observed at 8'*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-51

TEST PIT LOG NO. TP-2

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88448° Longitude: 123.00594°
Northing: 454193.974 Easting: 1351043.483

Surface Elev.: 357.44 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.1	357.5	**TOPSOIL**, ~1 inches of topsoil
		FILL - CLAYEY GRAVEL (GC), trace sand, brown with red, loose to medium dense
2.5	355	
		CLAYEY GRAVEL (GC), with cobbles and boulders, reddish brown with black and white, medium dense to dense, probable residual bedrock
9.0	348.5	
		BOULDER
10.0	347.5	
		Test Pit Terminated at 10 Feet

GRAPHIC LOG | INSTALLATION DETAILS | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | LABORATORY HP (tsf) | WATER CONTENT (%) | PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-52

TEST PIT LOG NO. TP-3

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88407° Longitude: -123.00777°
Northing: 454039.442 Easting: 1350571.148

Surface Elev.: 362.50 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.0	362.5	**FILL - GRAVELLY LEAN CLAY (CL)**, reddish brown, stiff
1.5	361	**SILT (ML)**, trace sand, brown, medium stiff to stiff, rootlets observed at top of layer, possible relic topsoil
5.3	357.5	**CLAYEY GRAVEL (GC)**, gray and brown, dense to very dense, black and white veins, probable weathered bedrock gray, vesicular rock
10.0	352.5	***Test Pit Terminated at 10 Feet***

DEPTH (Ft.)	SAMPLE TYPE	LABORATORY HP (tsf)
0		
		4.5+ (HP)
		2.0 (HP)
5		
10		

INSTALLATION DETAILS

WATER LEVEL OBSERVATIONS

WATER CONTENT (%)

PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Seepage observed at 9.5'*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-53

TEST PIT LOG NO. TP-4

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88385° Longitude: -123.00884°
Northing: 453958.063 Easting: 1350296.615

Surface Elev.: 369.69 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.5	369	**FILL - WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM)**, gray and brown, medium dense
		SILT WITH SAND (ML), brown, soft to medium stiff
2.5	367	**SANDSTONE**, light gray to reddish brown, dense to very dense, excavates in blocks
10.0	359.5	***Test Pit Terminated at 10 Feet***

DEPTH (Ft.)	SAMPLE TYPE	LABORATORY HP (tsf)
		0.75 (HP)
5		
10		

INSTALLATION DETAILS

WATER LEVEL OBSERVATIONS

WATER CONTENT (%)

PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed due to mud rotary methods

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-54

TEST PIT LOG NO. TP-5

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.8837° Longitude: -123.0091°
Northing: 453903.061 Easting: 1350229.512

Surface Elev.: 370.00 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.0	370	**TOPSOIL**, trace cobbles, brown, soft to medium stiff, ~36 inches of topsoil, roots
3.0	367	**SANDSTONE**, tan to brown, dense to very dense, excavates in blocks
		with black veins
10.0	360	***Test Pit Terminated at 10 Feet***

DEPTH (Ft.)	SAMPLE TYPE	LABORATORY HP (tsf)	WATER CONTENT (%)	PERCENT FINES
0				
		0.75 (HP)		
5				
10				

INSTALLATION DETAILS

WATER LEVEL OBSERVATIONS

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-55

TEST PIT LOG NO. TP-6

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88354° Longitude: -123.00715°
Northing: 453849.576 Easting: 1350733.485

Surface Elev.: 364.63 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.1	364.5	**TOPSOIL**, ~1 inches of topsoil
1.5	363	**FILL - SILT WITH SAND (ML)**, trace gravel, brown, medium stiff
3.0	361.5	**GRAVELLY LEAN CLAY (CL)**, rounded, reddish brown, stiff
10.0	354.5	**COBBLES AND BOULDERS WITH SILT**, brown to black
		Test Pit Terminated at 10 Feet

SAMPLE TYPE	LABORATORY HP (tsf)	WATER CONTENT (%)	PERCENT FINES
	1.0 (HP)		
	4.5+ (HP)		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

Seepage observed at 1.5'

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-56

TEST PIT LOG NO. TP-7

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.8834° Longitude: -123.0062°
Northing: 453825 Easting: 1350970

Approximate Surface Elev: 365 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Description
0.1	365+/-	**TOPSOIL**, ~1 inches of topsoil
		FILL - SILT WITH SAND (ML), trace gravel, brown, medium stiff to stiff
2.0	363+/-	**LEAN CLAY WITH SAND (CL)**, trace gravel, reddish brown, medium stiff to stiff, probable weathered bedrock
10.0	355+/-	***Test Pit Terminated at 10 Feet***

DEPTH (Ft.)	SAMPLE TYPE	LABORATORY HP (tsf)
		3.0 (HP)
5		2.0 to 4.5+
10		

WATER LEVEL OBSERVATIONS: ▽ at 2.0

INSTALLATION DETAILS

WATER CONTENT (%)

PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Seepage observed at 2'*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-57

TEST PIT LOG NO. TP-8

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88333° Longitude: -123.00839°
Northing: 453768.173 Easting: 1350413.767

Surface Elev.: 364.47 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.1	364.5	**TOPSOIL**, ~1 inches of topsoil
		SILT (ML), trace sand, brown, soft to medium stiff
2.5	362	
		POORLY GRADED GRAVEL WITH CLAY (GP-GC), reddish brown, medium dense, black seams, probable weathered bedrock
5.5	359	
		LEAN CLAY WITH SAND (CL), gray with white, red, black and tan, stiff, probable decomposed bedrock
10.0	354.5	
		Test Pit Terminated at 10 Feet

DEPTH (Ft.)	SAMPLE TYPE	LABORATORY HP (tsf)
		0.75 (HP)
5		
10		

WATER LEVEL OBSERVATIONS: ▽ Seepage observed at 8.5'

INSTALLATION DETAILS

WATER CONTENT (%)

PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Seepage observed at 8.5'*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-58

TEST PIT LOG NO. TP-9

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION: See Exhibit A-2

Latitude: 44.88317° Longitude: -123.00799°
Northing: 453710.595 Easting: 1350516.958

Surface Elev.: 365.02 (Ft.)

DEPTH	ELEVATION (Ft.)	Description
0.1	365	**TOPSOIL**, ~1 inches of topsoil
		FILL - GRAVELLY LEAN CLAY (CL), reddish brown, medium stiff to stiff
7.0	358	**LEAN CLAY (CL)**, trace sand, dark brown, soft to medium stiff, rootlets, probable relic topsoil
10.5	354.5	***Test Pit Terminated at 10.5 Feet***

DEPTH (Ft.)	SAMPLE TYPE	LABORATORY HP (tsf)
		2.0 (HP)
		4.5+ (HP)
5		
10		

INSTALLATION DETAILS

WATER LEVEL OBSERVATIONS

WATER CONTENT (%)

PERCENT FINES

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: N/A

Advancement Method:
John Deere 35C Excavator

Abandonment Method:
Test pit backfilled with excavated soil upon completion.

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were provided by others.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Seepage observed at 9'*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Test Pit Started: 12-07-2017
Test Pit Completed: 12-07-2017
Excavator: Mini Trackhoe
Operator: Dan Fischer Excavating
Project No.: 82175107
Exhibit: A-59

BORING LOG NO. W-1

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8851° Longitude: -123.006°
Northing: 454417.13 Easting: 1351034.21

Approximate Surface Elev: 361 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
				▽							
					X	10	12-5-9 N=14				
			30								
					X	10	7-13-15 N=28				
31.5	329.5+/-										

SANDY SILT (ML), fine grained, dark brown, stiff

very stiff

Boring Terminated at 31.5 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 02-01-2018 | Boring Completed: 02-01-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-67

BORING LOG NO. W-2A

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8848° Longitude: -123.006°
Northing: 454310.98 Easting: 1351031.79

Approximate Surface Elev: 361.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	361.5+/-	**TOPSOIL**, 3 inches
		FILL - SANDY LEAN CLAY (CL), orangish brown, stiff
5.0	356.5+/-	Auger grinding
5.5	356+/-	**FILL - BOULDERS & COBBLES**, gray, Angular rock fragments in sampler
		Auger Refusal at 5.5 Feet

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS
		15	4-6-9 N=15
5		6	30-20-11 N=31

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-68

BORING LOG NO. W-2B

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8849° Longitude: -123.006°
Northing: 454342.89 Easting: 1351028.52

Approximate Surface Elev: 362 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	362+/-									
TOPSOIL, 3 inches										
FILL - SANDY LEAN CLAY (CL), trace gravel, brown and dark brown, very stiff, intermitten layers of sand and lean clay										
				X		5-7-9 N=16				
		5								
stiff				X		5-5-9 N=14				
				X		3-5-50/1"				
8.5	353.5+/-									
8.6 apparent rock	353.5+/-									
Auger Refusal at 8.6 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-69

BORING LOG NO. W-3A

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8845° Longitude: -123.0061°
Northing: 454214.61 Easting: 1351024.68

Approximate Surface Elev: 357 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	357+/-									
TOPSOIL, 3 inches										
FILL - SANDY SILT (ML), brown										
2.0	355+/-									
2.5	354.5+/-									
FILL - CLAYEY GRAVEL WITH SAND (GC), angular, brown and gray, very dense apparent rock					1	N=50/2"				
2.8	354.5+/-									
Auger Refusal at 2.75 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-70

BORING LOG NO. W-3B

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8846° Longitude: -123.0061°
Northing: 454237.63 Easting: 1351023.65

Approximate Surface Elev: 357 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	357+/-								
TOPSOIL, 3 inches									
FILL - SANDY LEAN CLAY (CL), fine grained, orangish tan, stiff			X	12	3-7-7 N=14				
orangish tan with black spotting, very stiff		5	X	15	2-6-11 N=17				
trace weathered gravel			X	15	5-9-11 N=20				
medium stiff		10	X	12	5-3-3 N=6				
15.0	342+/-	15	X	16	2-4-50 N=54				
SANDY SILT (ML), brown, medium stiff									
16.4	340.5+/-								
16.5 **BASALT**, broken gravel in sampler tip	340.5+/-								
Auger Refusal at 16.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-71

BORING LOG NO. W-4

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8842° Longitude: -123.006°
Northing: 454081.78 Easting: 1351010.07

Approximate Surface Elev: 357 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	LOG	DESCRIPTION
0.3	357+/-		**TOPSOIL**, 3 inches
			FILL - SILTY SAND (SM), fine grained, brown and grayish brown, dense, trace weathered gravel
7.5	349.5+/-		**SANDY LEAN CLAY (CL)**, fine to medium grained, low to medium plasticity, orangish brown with red and white streaks, stiff, highly weathered gravel
			red and yellow, very stiff
			with gravel
20.0	337+/-		**CLAYEY SAND (SC)**, with gravel, fine to medium grained, angular, orangish brown, dense, weathered gravel
25.0	332+/-		

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		X	12	4-13-20 N=33				
5		X	15	13-16-22 N=38				
		X	15	8-5-4 N=9				
10		X	15	5-7-8 N=15				
	▽							
15		X	12	5-9-9 N=18				
	▽							
20		X	15	12-15-24 N=39				
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*
▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-72

BORING LOG NO. W-4

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8842° Longitude: -123.006°
Northing: 454081.78 Easting: 1351010.07

Approximate Surface Elev: 357 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
SILTY SAND (SM), with gravel, fine grained, angular, grayish brown, dense					X	8	20-22-23 N=45				
30.0	327+/-										
30.3 apparent rock	326.5+/-		30		X	0	50/4" N=50/4"				
Boring Terminated at 30.33 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

While drilling

At completion of drilling

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 Boring Completed: 01-31-2018

Drill Rig: CME 850 Driller: Holt Services

Project No.: 82175107 Exhibit: A-72

BORING LOG NO. W-5

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.884° Longitude: -123.0059°
Northing: 454010.5 Easting: 1351058

Approximate Surface Elev: 360.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)
0.3	360.5+/-
25.0	335.5+/-

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			4-6-9 N=15 HP = 2.5 tsf			
5			5-7-10 N=17			
			4-6-10 N=16 HP = 2.5 tsf			
10			2-3-7 N=10			
15			6-7-8 N=15			
20			6-9-9 N=18			
25						

TOPSOIL, 3 inches

FILL - SANDY SILT (ML), trace gravel, fine grained, brown, black spotting, weathered gravel

very stiff

with gravel, fine to medium grained

dark brown, stiff

very stiff, moist to wet, white veins

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-73

BORING LOG NO. W-5

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.884° Longitude: -123.0059°
Northing: 454010.5 Easting: 1351058

Approximate Surface Elev: 360.5 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), with gravel, fine grained, brown, medium dense, yellow pockets of weathered gravel			X		18-9-10 N=19				
	26.5	334+/-									
		Boring Terminated at 26.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-73

BORING LOG NO. W-6

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8837° Longitude: -123.0058°
Northing: 453898.85 Easting: 1351082

Approximate Surface Elev: 362 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	GRAPHIC LOG	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0.3	362+/-		**TOPSOIL**, 3 inches									
			FILL - SANDY SILT (ML), trace gravel, orangish brown to with red spots									
			stiff				12	3-5-7 N=12 HP = 2.0 tsf				
				5			12	3-6-6 N=12				
			very stiff				15	3-6-10 N=16 HP = 3.0 tsf				
10.0	352+/-		**SANDY LEAN CLAY (CL)**, dark brown and brown with black spotting, medium stiff, highly weathered gravel	10	▽		15	2-2-5 N=7 HP = 0.5 tsf				
					▼							
15.0	347+/-		**SILTY SAND (SM)**, fine grained, brown with maroon, dense	15			15	12-13-18 N=31				
			medium dense	20			15	14-15-12 N=27				
				25	▽							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*
▽ *2/5/2018*
▼ *3/27/2018*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-74

BORING LOG NO. W-6

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8837° Longitude: -123.0058°
Northing: 453898.85 Easting: 1351082

Approximate Surface Elev: 362 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), fine grained, brown with maroon, dense *(continued)*									
	26.5	brown to gray 335.5+/-			X	15	13-12-12 N=24				
		Boring Terminated at 26.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

- *At completion of drilling*
- *2/5/2018*
- *3/27/2018*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-31-2018 | Boring Completed: 01-31-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-74

BORING LOG NO. W-7

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8834° Longitude: -123.0059°
Northing: 453790.22 Easting: 1351072.76

Approximate Surface Elev: 363 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	DESCRIPTION
0.3	363+/-	**TOPSOIL**, 3 inches
		FILL - SILT WITH SAND (ML), trace gravel, brown, stiff, weathered gravel
		trace organics, orangish brown
7.5	355.5+/-	**SANDY LEAN CLAY (CL)**, orangish brown, medium stiff to sitff, sand pockets
		tan to maroon, medium stiff
		tan and brown
20.0	343+/-	**SANDY SILT (ML)**, grayish brown, medium stiff, spots of bright tan
25.0	338+/-	

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			10	2-5-7 N=12				
5	▽		8	5-6-7 N=13				
			13	2-4-4 N=8 HP = 1.5 tsf				
10			12	3-3-4 N=7 HP = 1.0 tsf				
15			10	2-3-3 N=6				
20			10	1-2-4 N=6				
25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:
Cave in may have affected water level

WATER LEVEL OBSERVATIONS

▽ *After One Day*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-29-2018 | Boring Completed: 01-29-2018

Drill Rig: CME 850 | Driller: Holt Services

Project No.: 82175107 | Exhibit: A-75

BORING LOG NO. W-7

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8834° Longitude: -123.0059°
Northing: 453790.22 Easting: 1351072.76

Approximate Surface Elev: 363 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		LEAN CLAY (CL), tan to black, soft									
	26.5	336.5+/-			X	8	0-0-3 N=3				
		Boring Terminated at 26.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *After One Day*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-29-2018 | Boring Completed: 01-29-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-75

BORING LOG NO. W-8

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8831° Longitude: -123.0059°
Northing: 453694.46 Easting: 1351077.81

Approximate Surface Elev: 361.5 (Ft.) +/-

DEPTH	ELEVATION (Ft.)	Material Description
0.3	361.5+/-	**TOPSOIL**, 3 inches
		FILL - LEAN CLAY (CL), trace sand, fine grained, medium plasticity, brown with red spots, medium stiff
		orangish brown, stiff
		pockets of tan sand
11.0	350.5+/-	alternating layers of silty sand and lean clay with highly weathered gravel
		SANDY LEAN CLAY (CL), orangish brown with spots of tan, stiff, weathered gravel
15.0	346.5+/-	
		SANDY SILT (ML), brown with yellow spottiing and orange mottling, stiff
25.0	336.5+/-	

DEPTH (Ft.)	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
5		8	3-3-2 N=5				
		15	4-6-8 N=14 HP = 1.5 tsf				
		15	3-4-5 N=9 HP = 1.5 tsf				
10		15	3-4-5 N=9				
15	▽	10	4-4-6 N=10				
20		10	3-6-7 N=13				
25							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-29-2018 | Boring Completed: 01-29-2018

Drill Rig: CME 850 | Driller: Holt Services

Project No.: 82175107 | Exhibit: A-76

BORING LOG NO. W-8

PROJECT: Costco Warehouse CW# 17-0460

CLIENT: Costco Wholesale
Issaquah, WA

SITE: Kuebler Boulevard & 27th Avenue
Salem, OR

LOCATION See Exhibit A-2

Latitude: 44.8831° Longitude: -123.0059°
Northing: 453694.46 Easting: 1351077.81

Approximate Surface Elev: 361.5 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), with gravel, grayish brown with black spotting, medium dense, weathered gravel			X	15	6-9-14 N=23				
	26.5	335+/-									
		Boring Terminated at 26.5 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Boring backfilled with bentonite grout upon completion

See Exhibit A-8 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.
Elevations were interpolated from a topographic site plan.

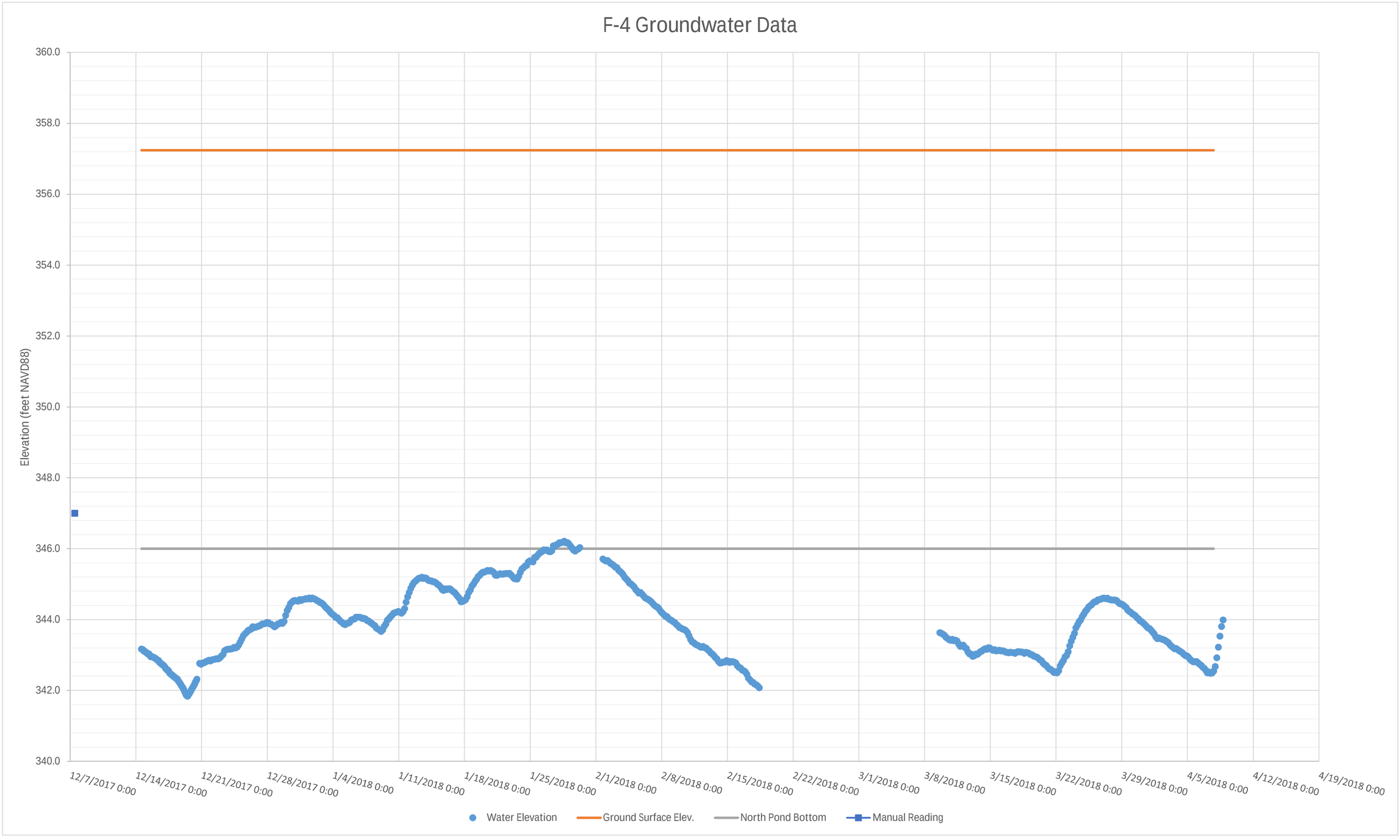
Notes:

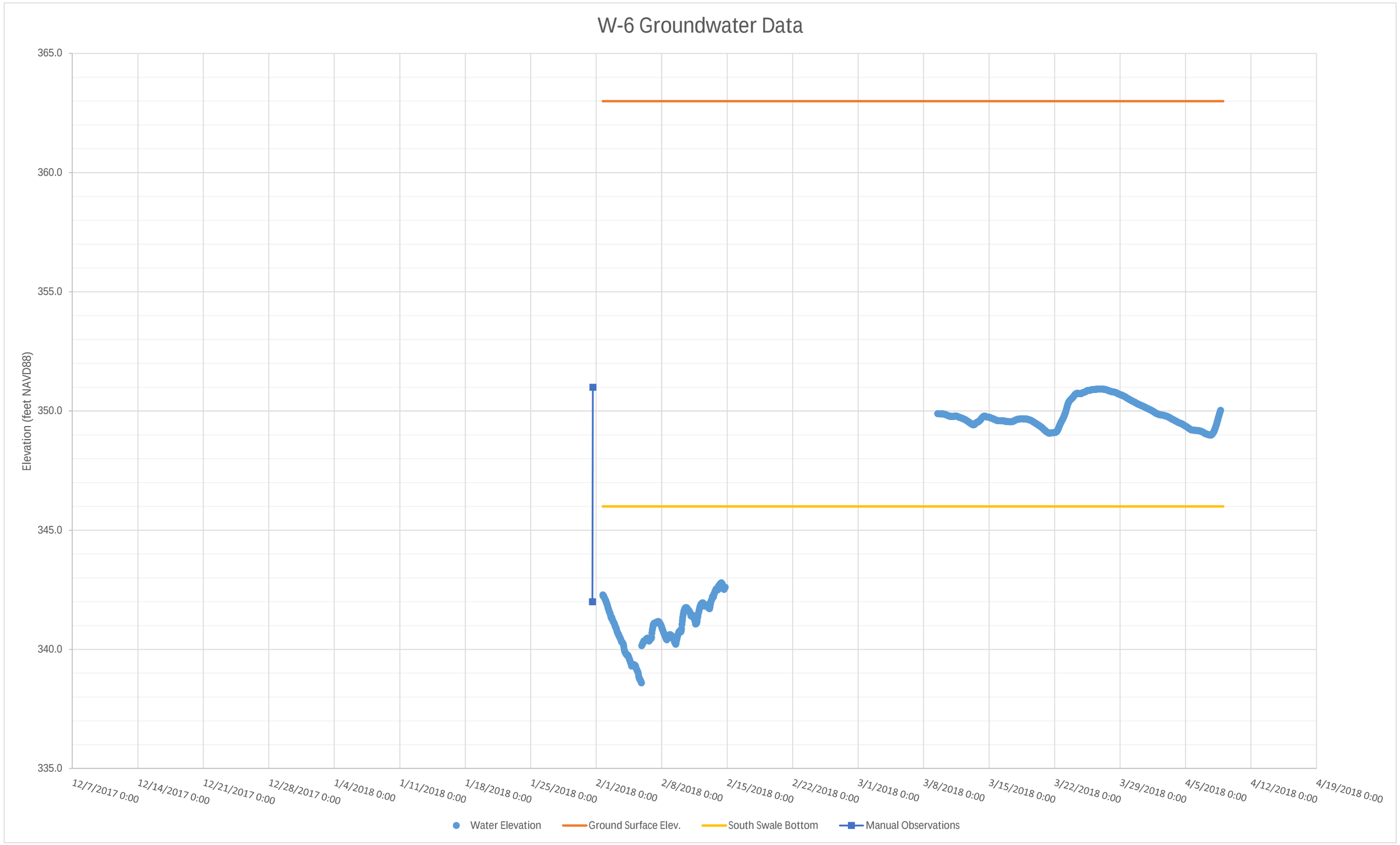
WATER LEVEL OBSERVATIONS

▽ *At completion of drilling*

Terracon
21905 64th Ave W Ste 100
Mountlake Terrace, WA

Boring Started: 01-29-2018 | Boring Completed: 01-29-2018
Drill Rig: CME 850 | Driller: Holt Services
Project No.: 82175107 | Exhibit: A-76


F-4 Groundwater Data
Elevation (feet NAVD88)
360.0
358.0
356.0
354.0
352.0
350.0
348.0
346.0
344.0
342.0
340.0
12/7/2017 0:00
12/14/2017 0:00
12/21/2017 0:00
12/28/2017 0:00
1/4/2018 0:00
1/11/2018 0:00
1/18/2018 0:00
1/25/2018 0:00
2/1/2018 0:00
2/8/2018 0:00
2/15/2018 0:00
2/22/2018 0:00
3/1/2018 0:00
3/8/2018 0:00
3/15/2018 0:00
3/22/2018 0:00
3/29/2018 0:00
4/5/2018 0:00
4/12/2018 0:00
4/19/2018 0:00
Water Elevation
Ground Surface Elev.
North Pond Bottom
Manual Reading


W-6 Groundwater Data
365.0
360.0
355.0
350.0
345.0
340.0
335.0
Elevation (feet NAVD88)
12/7/2017 0:00
12/14/2017 0:00
12/21/2017 0:00
12/28/2017 0:00
1/4/2018 0:00
1/11/2018 0:00
1/18/2018 0:00
1/25/2018 0:00
2/1/2018 0:00
2/8/2018 0:00
2/15/2018 0:00
2/22/2018 0:00
3/1/2018 0:00
3/8/2018 0:00
3/15/2018 0:00
3/22/2018 0:00
3/29/2018 0:00
4/5/2018 0:00
4/12/2018 0:00
4/19/2018 0:00
Water Elevation
Ground Surface Elev.
South Swale Bottom
Manual Observations

APPENDIX B
LABORATORY TESTING

Laboratory Testing Description

The boring logs and samples were reviewed by a geotechnical engineer who selected soil samples for testing. A brief description of the tests performed follows.

Selected samples were tested for particle size distribution and plastic limit/liquid limit (Atterberg limits) to aid in classifying the soils in accordance with the Unified Soil Classification System (USCS). The USCS is summarized in Appendix C. Fines content (the fraction passing the No. 200 sieve) and Atterberg limits are reported on the boring logs. Particle size distribution and Atterberg limit plots are included in this appendix.

In addition to the standard soil classification tests, other various tests were performed as detailed below in general accordance with the ASTM listed.

Standard Proctor
Terracon performed standard Proctor compaction testing using ASTM D698A on sample S-2 out of test pit TP-7.

California Bearing Ratio
Terracon performed a CBR test using ASTM D1883 on compacted specimens from sample S-2 out of test pit TP-7.

Corrosion Tests
Terracon performed lab electrical resistivity tests on a composite of selected samples using ASTM G57. In addition, pH and sulfate/chloride testing was conducted on the composite sample.

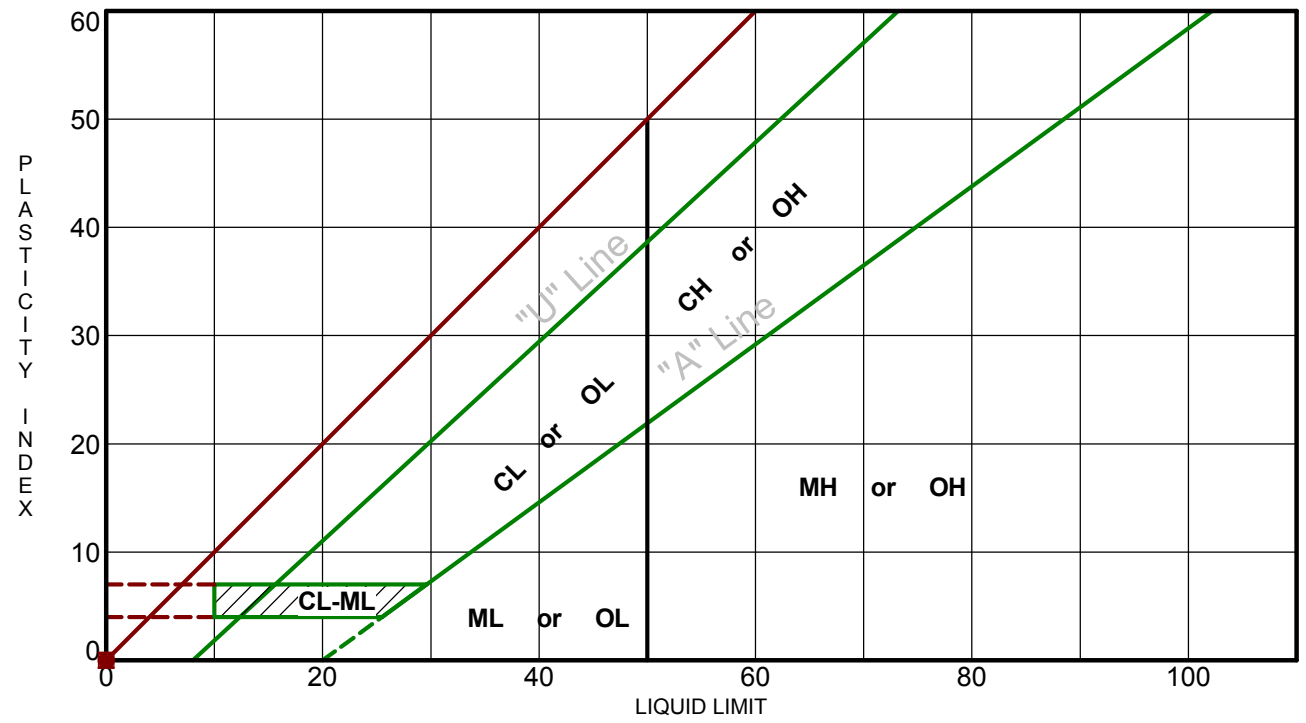
Topsoil Analysis
A & L Western Laboratories of Tigard, Oregon was selected to run topsoil analysis for the parameters detailed in the CWDR. The analysis was performed on a composite of selected split-barrel samples advanced from the ground surface at the site.

Water Quality
Water quality information was obtained from the City of Salem Public Works Department.

Laboratory test reports are included in this appendix.

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● B-10	5 - 6.5	NP	NP	NP	50	ML	SANDY SILT
⊠ B-15	5 - 6.5	NP	NP	NP	43	SM	SILTY SAND

PROJECT: Costco Warehouse CW# 17-0460

SITE: Kuebler Boulevard and 27th Avenue
Salem, OR

Terracon
4103 SE International Way Ste 300
Portland, OR

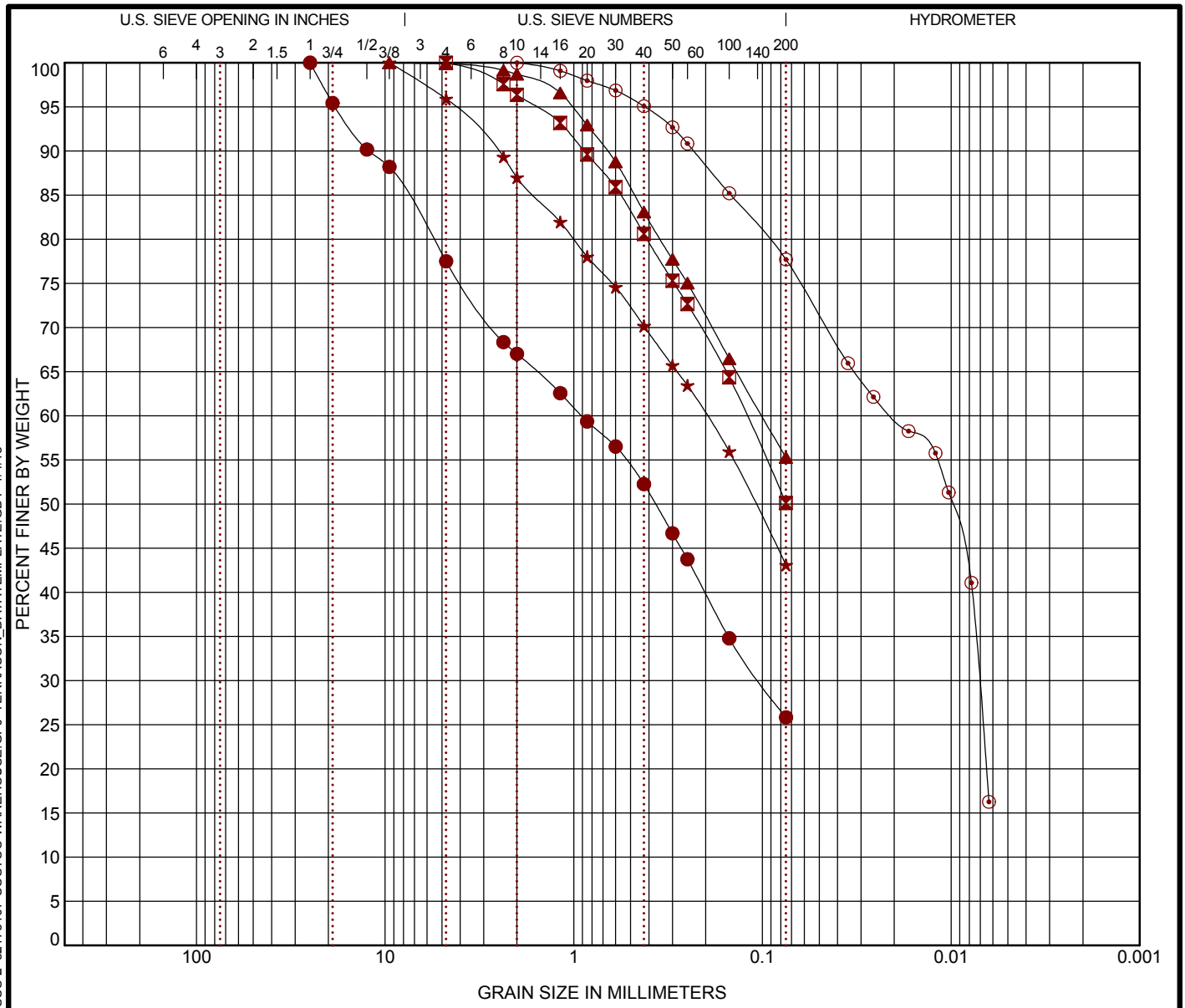
PROJECT NUMBER: 82175107

CLIENT: Costco Wholesale
Issaquah, WA

EXHIBIT: B-2

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-6b	7.5 - 9	SILTY SAND W/ GRAVEL (SM)	41					
⊠	B-10	5 - 6.5	SANDY SILT (ML)	49	NP	NP	NP		
▲	B-13	5 - 6.5	SANDY LEAN CLAY (CL)	36					
★	B-15	5 - 6.5	SILTY SAND (SM)	54	NP	NP	NP		
⊙	DP-1	10 - 11.5	LEAN CLAY W/ SAND (CL)	33					

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-6b	7.5 - 9	25	0.907	0.104		22.5	51.7		25.8	
⊠	B-10	5 - 6.5	4.75	0.121			0.0	49.9		50.1	
▲	B-13	5 - 6.5	9.5	0.101			0.1	44.6		55.3	
★	B-15	5 - 6.5	9.5	0.198			4.1	52.8		43.1	
⊙	DP-1	10 - 11.5	2	0.02	0.007		0.0	22.3		77.7	

PROJECT: Costco Warehouse CW# 17-0460

SITE: Kuebler Boulevard and 27th Avenue
Salem, OR

Terracon
4103 SE International Way Ste 300
Portland, OR

PROJECT NUMBER: 82175107

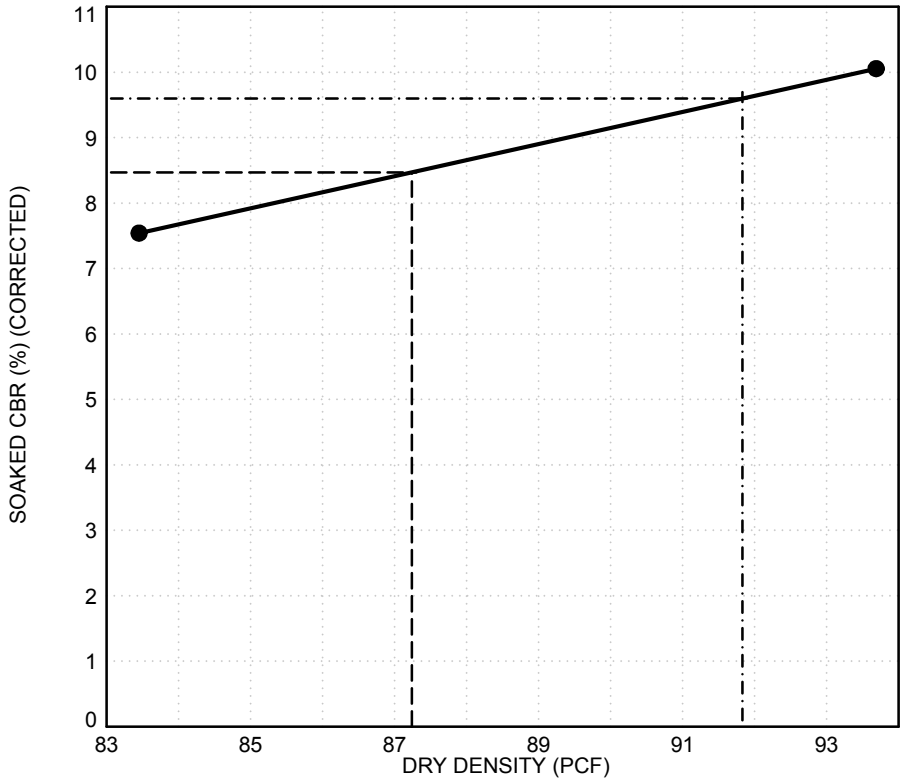
CLIENT: Costco Wholesale
Issaquah, WA

EXHIBIT: B-3

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 82175107 COSTCO WAREHOUSE.GPJ TERRACON_DATATEMPLATE.GDT 1/4/18

CALIFORNIA BEARING RATIO

ASTM D1883-07[2]



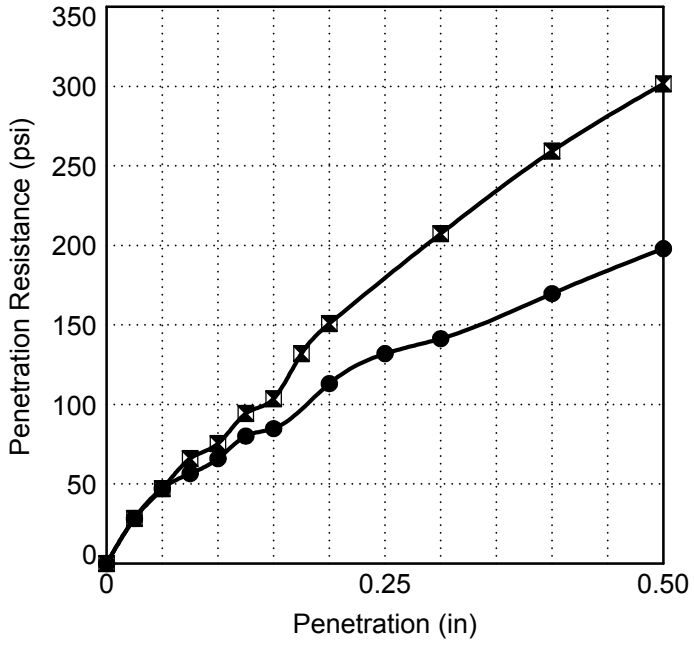
Source of Material **TP-7 1.0**

Description of Material **BROWN SILT W/ SAND (FILL)**

Remarks:

Percent Fines **%**

Atterberg Limits LL PL PI



Sample No.	1	3	
Sample Condition	Soaked		
Compaction Method	698A		
Maximum Dry Density, (pcf)	91.83	91.83	
Optimum Moisture Content, (%)	27.6	27.6	
Dry Density before Soaking, (pcf)	83.45	93.69	
Moisture Content, (%)			
After Compaction	27.6	27.8	28.3
Top 1" After Soaking	33.6	28.5	29.3
Surcharge,. (lbs)	10.00	10.00	
Swell, (%)	-1.00	-0.76	
Bearing Ratio, (%)	7.5	10.1	

Dry Density @ 90% 82.6 pcf

Dry Density @ 95% 87.2 pcf

Dry Density @ 100% 91.8 pcf

CBR @ 90% Density

CBR @ 95% Density 8.5

CBR @ 100% Density 9.6

PROJECT: Costco Warehouse CW# 17-0460

SITE: Kuebler Boulevard and 27th Avenue
Salem, OR

Terracon
4103 SE International Way Ste 300
Portland, OR

PROJECT NUMBER: 82175107

CLIENT: Costco Wholesale
Issaquah, WA

EXHIBIT: B-4

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. CBR 3PT REPORT 82175107 COSTCO WAREHOUSE.GPJ TERRACON_DATATEMPLATE.GDT 1/3/18

CHEMICAL LABORATORY TEST REPORT

Project Number: 82175107
Service Date: 01/08/18
Report Date: 01/09/18
Task:

Terracon
750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

Client

Project

Costco Wholesale- Salem, OR- Warehouse

Sample Submitted By: Terracon (82) **Date Received:** 1/5/2018 **Lab No: 18-0006**

Results of Corrosion Analysis

Sample Number	S-3, S-2, S-2
Sample Location	F-2, F-3, F-4
Sample Depth (ft.)	7.5, 5.0, 5.0
pH Analysis, AWWA 4500 H	7.76
Water Soluble Sulfate (SO4), ASTM D 516 (mg/kg)	83
Chlorides, ASTM D 512 (mg/kg)	30
Resistivity, ASTM G 57 (ohm-cm)	7760

Analyzed By: Trisha Campo
Chemist

A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE I BUILDING K-9 I PORTLAND, OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 17-361-064

CLIENT NO:

SEND TO: TERRACON
21905 64TH AVENUE
MOUNT LAKE TERRACE, WA 98043-

SUBMITTED BY: TORI HESEDAHL

GROWER: PROJ #82175107 SALEM OR

DATE OF REPORT: 01/08/18

SOIL ANALYSIS REPORT

SAMPLE ID	LAB NUMBER	Organic Matter		Phosphorus		Potassium	Magnesium	Calcium	Sodium	pH		Hydrogen	Cation Exchange Capacity	PERCENT CATION SATURATION (COMPUTED)				
		* % Rating	** ENR lbs/A	P1 (Weak Bray) **** * ppm	$NaHCO_3$-P (OlsenMethod) **** * ppm	K ***** * ppm	Mg *** * ppm	Ca *** * ppm	Na *** * ppm	Soil pH	Buffer Index	H meq/100g	C.E.C. meq/100g	K %	Mg %	Ca %	H %	Na %
PCOMP	59085	6.5VH	160	1VL	15**	267H	214M	1022L	13VL	5.2	6.2	4.0	11.6	5.9	15.2	43.9	34.5	0.5

** NaHCO3-P unreliable at this soil pH

SAMPLE NUMBER	Nitrogen NO_3-N ppm	Sulfur SO_4-S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Excess Lime Rating	Soluble Salts mmhos/cm	Chloride Cl ppm		PARTICLE SIZE ANALYSIS			
												SAND %	SILT %	CLAY %	SOIL TEXTURE
PCOMP	44VH	24M	0.8L	80VH	26VH	0.6L	0.1VL	L	0.6L						

* CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), AND VERY HIGH (VH).
** ENR - ESTIMATED NITROGEN RELEASE
*** MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM
**** MULTIPLY THE RESULTS IN ppm BY 4.6 TO CONVERT TO LBS. PER ACRE P_2O_5
***** MULTIPLY THE RESULTS IN ppm BY 2.4 TO CONVERT TO LBS. PER ACRE K_2O
MOST SOILS WEIGH TWO (2) MILLION POUNDS (DRY WEIGHT) FOR AN ACRE OF SOIL 6-2/3 INCHES DEEP

This report applies only to the sample(s) tested. Samples are retained a maximum of thirty days after testing.

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE I BUILDING K-9 I PORTLAND, OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 17-361-065 **CLIENT:** 99999

SUBMITTED BY:

SEND TO: TERRACON
21905 64TH AVENUE
MOUNT LAKE TERRACE, WA 98043-

GROWER: PROJ #82175107 SALEM OR

DATE OF REPORT: 01/05/18

SOIL PHYSICAL CHARACTERISTICS

Sample ID	Lab Number	% Sand	% Silt	% Clay	Soil Texture	Moisture @ 1/3 Bar	Moisture @ 15 Bar	Available Water %
PCOMP	59085	34	34	33	CLAY LOAM			

NOTES:

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 S.W. NIMBUS AVE I BUILDING K-9 I PORTLAND, OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 17-361-064 **CLIENT:** 9999

SUBMITTED BY: TORI HESEDAHL

SEND TO: TERRACON
21905 64TH AVENUE
MOUNT LAKE TERRACE, WA 98043-

GROWER: PROJ #82175107 SALEM O

DATE OF REPORT: 01/08/18

SOIL FERTILITY GUIDELINES

RATE: /1000 sq **PAGE:** 1

Sample ID	Lab Number	Crop	SOIL AMENDMENTS				Nitrogen N	Phosphate P_2O_5	Potash K_2O	Magnesium Mg	Sulfur SO_4-S	Zinc Zn	Manganese Mn	Iron Fe	Copper Cu	Boron B
			Dolomite	Lime	Gypsum	Elemental Sulfur										
PCOMP	59085	LANDSCAPE		160			1.0	7.0			0.3	*				*

COMMENTS

PRIOR TO PLANTING: Spread the above requirements per 1000 sq ft and mix into the top 6 inches of soil. Initially, limit nitrogen to 25-30 ppm NO3-N or 1.5 lb N/1000 sq ft, to avoid salt damage. SPLIT any extra nitrogen evenly over the active growing season. Adjust rate according to local conditions and requirements. Allow for adequate establishment first (up to 30 days).
* ZINC: Where levels are low, apply according to label instructions. Consider fertilizer brands that also contain zinc, although they may not be sufficient to correct a severe deficiency.
* BORON may not necessarily be deficient in the soil, and it is hard to correct an excessive application. Therefore, apply boron only if confirmed deficient through a leaf analysis.

NOTES:

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES, INC.

1311 Woodland Avenue, Suite 1 · Modesto, California 95351 · (209) 529-4080

Report No: 17-361-064 **Account No:** 9999

Send to: TERRACON
21905 64TH AVENUE
MOUNT LAKE TERRACE, WA 98043

Date Received: 12/27/2017
Date Reported: 01/05/2018

SOIL ANALYSIS REPORT – EXTRACTABLE ALUMINUM

Analyte: **Aluminum**
Detection Limit: **0.5 mg/kg (ppm)**
Method: **1 N KCl extractable aluminum WREP-125, 2nd Ed S -15.10**

Lab Number:	Sample ID:	Level Found mg/kg (ppm)
59085	PCOMP	4.2

A & L Western Agricultural Laboratories, Inc.

Rogell Rogers, CCA, PCA
Agronomist

A & L WESTERN AGRICULTURAL LABORATORIES

1311 WOODLAND AVE #1 • MODESTO, CALIFORNIA 95351 • (209) 529-4080 • FAX (209) 529-4736

REPORT NUMBER: 17-361-064 **CLIENT:** 99999

SUBMITTED BY: TORI HESEDAHL

SEND TO: TERRACON
21905 64TH AVENUE
MOUNT LAKE TERRACE, WA 98043-

GROWER: PROJ #82175107 SALEM OR

DATE OF REPORT: 01/09/18

SOIL SALINITY ANALYSIS REPORT

Sample ID	Lab Number	SAR	ESP	Na meq/L	Ca meq/L	Mg meq/L	pH	CO_3 meq/L	HCO_3 meq/L	E.C. dS/m	Cl meq/L	B ppm	Saturation %
PCOMP	59085	0.3	< 0.1	0.4	2.9	1.3	5.2	0.0	0.8	0.6	0.3	0.1	41.1

NOTES:

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES, INC.

1311 Woodland Avenue, Suite 1 · Modesto, California 95351 · (209) 529-4080

Report No: 17-361-064

Account No: 9999-D

Send to: TERRACON
21905 64TH AVENUE
MOUNT LAKE TERRACE, WA 98043

Grower: PROJ #82175107 SALEM OR

Submitted by: TORI HESEDAHL

Lab Number: 59085

Sample ID: PCOMP

Date Received: 12/27/2018
Date Reported: 01/09/2018

EPA 503 METALS SOIL ANALYSIS REPORT

Sample Preparation Method: EPA SW846-3050 B

Detection Limit mg/kg	Analyte	Level Found mg/kg	Method Code
0.25	Arsenic	BDL	EPA SW846-6010
0.03	Cadmium	BDL	EPA SW846-6010
0.1	Chromium	50.2	EPA SW846-6010
0.1	Copper	18.8	EPA SW846-6010
0.5	Lead	13.7	EPA SW846-6010
0.05	Mercury	0.90	EPA SW846-7471A
0.1	Molybdenum	0.2	EPA SW846-6010
0.1	Nickel	13.8	EPA SW846-6010
0.5	Selenium	BDL	EPA SW846-6010
0.05	Zinc	88.58	EPA SW846-6010
0.1	Silver	BDL	EPA SW846-6010
0.1	Vanadium	284.6	EPA SW846-6010

BDL - INDICATES THE LEVEL FOUND IS BELOW THE ESTABLISHED DETECTION LIMIT FOR THAT ANALYTE.
ANALYZED ON A DRY WEIGHT BASIS

A & L Western Agricultural Laboratories, Inc

Rogell Rogers, CCA, PCA
Agronomist

2017 Annual

Water Quality Report

Drinking Water Quality Data from 2016

CITY OF Salem AT YOUR SERVICE

Public Works Department

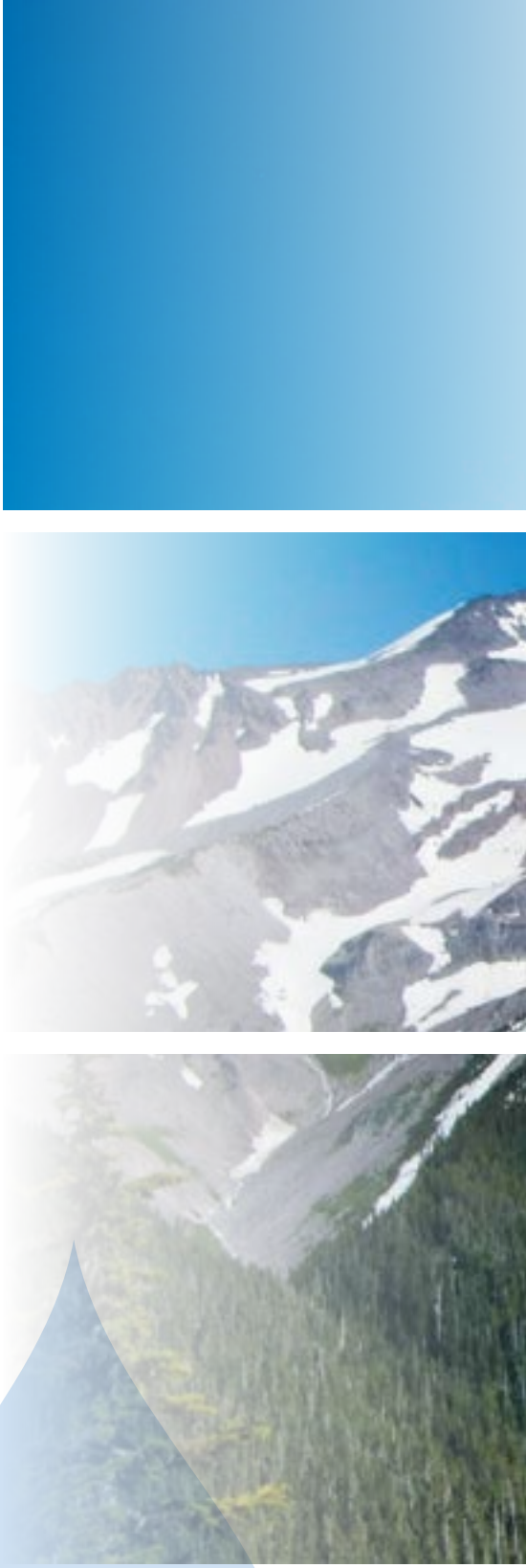
To our valued customers,

I am pleased to present the 2017 Annual Water Quality Report to you. The report contains important information about your drinking water, including where it comes from, how it is treated, and what, if any, contaminants it may contain. While many components of the report are mandated by the Environmental Protection Agency (EPA), the City of Salem prides itself in providing a more comprehensive report that is accessible to all our customers.

In 2016, City of Salem drinking water met or surpassed every public health requirement—more than 120 drinking water standards—set by the Oregon Health Authority and the EPA.

Water is the most valuable natural resource in the world today, and the City of Salem is fortunate to have an extremely high-quality, reliable, and abundant source. It's easy to take this precious resource for granted until you learn about the troubles other areas of the United States and the world are experiencing with their water supply. We often forget about the treatment process, hundreds of miles of water mains, pump stations, reservoirs, and dedicated staff it takes to deliver water to the average residential customer for less than a penny a gallon.

As always, the City of Salem strives to deliver high-quality water to your tap, as well as provide prompt service to our valued customers. For more information about Salem's drinking water, please visit **www.cityofsalem.net**.



Respectfully,

Dwayne Barnes
Utility Operations Manager, AIC
City of Salem Public Works Department

503-588-6211

Precipitation that falls in the
mountains
supplies most of our fresh water

H_2O

Water is the
most valuable
natural resource
in the world today

City of Salem Continues with Electronic Delivery of Annual Water Quality Report

The City of Salem is constantly exploring new ways to provide its customers with the best customer service while keeping costs low. After success last year with electronic delivery of the Annual report, the City is providing the same type of delivery for this year's Report. This favorable conversion will streamline the delivery of the Report, providing quicker access, and will significantly reduce costs associated with printing and mailing. The report is available on the City's website under Community Resources. However, if you prefer, hard copies are available at the Salem Civic Center, or you can request one by calling (503) 588-6333.

An average American uses
176 gallons
of water every day

Important Information Regarding Drinking Water

DRINKING WATER, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the U.S. Environmental Protection Agency (EPA) Safe Drinking Water Hotline at **1-800-426-4791**.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice about drinking water from their health care providers.

EPA and Centers for Disease Control guidelines on appropriate means to lessen the risk of infection by Cryptosporidium and other microbial contaminants are available from the Safe Drinking Water Hotline at **1-800-426-4791**.

¿Español?

Este documento contiene informacion importante sobre su agua potable. Si usted desea recibir una copia de este documento en español, por favor, llame al **503-588-6323** y pida una copia del reporte de calidad de agua o visite nuestra pagina electronica **www.cityofsalem.net/water**.

This document contains information about your potable water. If you would like to receive a copy of this document in Spanish, please call **503-588-6323** and ask for a water quality report or visit our website at **www.cityofsalem.net/water**.

Please Share!

If you are a manager or owner of a business or multifamily dwelling, please share this report with your employees or residents. If you would like additional copies, please call the Water Quality Hotline at **503-588-6323**.

What the EPA Wants You to Know about Contaminants in Source Waters

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or human activity. Contaminants that may be present in source water include:

Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.

Inorganic contaminants, such as salts and metals, which can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming.

Pesticides and herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.

Organic chemical contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production, and which can also come from gas stations, urban stormwater runoff, and septic systems.

Radioactive contaminants, which can be naturally-occurring or be the result of oil and gas production and mining activities.

In order to ensure tap water is safe to drink, the EPA establishes regulations that limit the amount of certain contaminants in water provided by public water systems. Food and Drug Administration regulations set limits for contaminants in bottled water that must provide the same protection of public health.

Understanding Salem's Source Water Assessment

THE CITY OF SALEM'S SOURCE WATER ASSESSMENT was completed in 2003 with assistance from the Oregon Department of Environmental Quality. It provides an inventory of potential contaminant sources that could pose a risk to water quality of the North Santiam, which is Salem's primary drinking water source. As required by the Federal Safe Drinking Water Act, the assessment also identifies sensitive areas where the water supply may be more vulnerable to impact by these potential contaminant sources. These sensitive areas include those close to bodies of water, and areas where runoff and erosion potentials are highest.

Contaminants in Drinking Water

The City continues to monitor activities that may impact its drinking water source, within the North Santiam River Watershed. Activities that contribute to contaminant sources such as runoff and erosion, which increases sediment and turbidity, includes loose dirt, topsoil, minerals, sand and silt from roads and highways. It can also result from excessive removal of vegetation from grazing animals, forest practices, and farming practices.

The City works together with federal and state agencies, as well as other groups and individuals to reduce these impacts to the drinking water source. City staff also samples and monitors at various sites within the City to assure safe and high quality water be provided to its customers.

Salem's Source Water Assessment is available on the City's website at www.cityofsalem.net/water. The report is also available by calling the Water Quality Hotline at **503-588-6323**, or by emailing a request to **water@cityofsalem.net**.

Salem's Sources for Drinking Water

FOR MORE THAN 75 YEARS, the City of Salem has been getting its drinking water supply from the North Santiam River. This unique river source flows roughly 90 miles from the high ridges of the Cascade Range down to the Mid-Willamette Valley towards Salem; an area of about 760 square miles. It provides high-quality river water for many communities along its route, and specifically for Salem, this high quality water is suitable for a more natural filtering process, called slow sand filtration, at the Geren Island Water Treatment Facility. Following slow sand filtration, the water is further disinfected by adding sodium hypochlorite (liquid chlorine), fluorosilicic acid (liquid fluoride) for fluoridation, and sodium carbonate (soda ash) which adjusts the pH and minimizes the corrosion of lead and copper from household plumbing.

Additionally, the City utilizes an Aquifer Storage and Recovery (ASR) system, which is located in south Salem. During the winter months, when flows in the river are high and there is a low demand for water by customers, treated drinking water is injected into the ASR system. The water is stored in a naturally existing aquifer located 350 feet below Woodmansee Park. During the summer months, when the river is flowing low and customer water demand is high, water is pumped back to the surface and recovered from the ASR system. The recovered water is treated with calcium hypochlorite (chlorine) for disinfection and then conveyed to the distribution system, serving the south Salem water customers.

Where Does Salem's Water Come From?

The supply of water begins with a raindrop that falls within the North Santiam Watershed boundary, on the west side of the Cascade Range. It flows over land and through soil into the North Santiam River. It is stored briefly at Detroit Dam until it is released to flow towards other small cities and City of Salem.

Salem's Water System *serves a population of 192,000 daily from the North Santiam River Watershed*

What Is in Salem's Drinking Water?

2016 Water Quality Data

from Geren Island Treatment Facility, Distribution System, and Salem Water Customers

TEST	DATE TESTED	UNIT	MCLG (MRDLG)	MCL (MRDL)	DETECTED LEVEL	LOWEST RANGE	HIGHEST RANGE	VIOLATION	MAJOR SOURCES
Inorganic									
Fluoride[1]	2016	ppm	4	4	Average: 0.64	0.50	0.71	NO	Erosion of natural deposits; water additive—promotes strong teeth
Nitrate	2016	ppm	10	10	0.10	One sample collected		NO	Runoff from fertilizer use; leaching from septic tanks; erosion of natural deposits
Nitrate-Nitrite	2016	ppm	10	10	0.10	One sample collected		NO	Runoff from fertilizer use; leaching from septic tanks; erosion of natural deposits
Barium	2016	ppm	2	2	0.002	One sample collected		NO	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Copper	2016	ppm	1.3	AL = 1.3	90th Percentile: 0.342 Homes exceeding: 0	< 0.03	0.56	NO	Corrosion of household plumbing systems
Lead	2016	ppb	0	AL = 15	90th Percentile: 5.9 Homes exceeding: 2	< 1.0	23	NO	Corrosion of household plumbing systems
Microbiological									
Turbidity	2016	NTU	N/A	TT	100% of samples meet turbidity standards Average: 0.13	0.05	0.34	NO	Erosion and soil runoff
Total coliform	Through March 31, 2016	No units	0	Presence of coliform bacteria in > 5% of monthly samples	360 samples collected; no coliform bacteria were present in any samples	None	None	NO	Naturally present in the environment
Fecal coliform or *E. coli* bacteria				0	Fecal coliform or *E. coli* bacteria were not detected				Human or animal fecal waste
Total coliform	Starting April 1, 2016		N/A	TT	1,080 samples collected; no coliform bacteria were present in any samples				Naturally present in the environment
E. coli bacteria			0	Routine and repeat samples are total coliform-positive and either *E. coli*-positive or the water supplier fails to collect repeat samples following *E. coli*-positive routine sample or system fails to analyze total coliform-positive repeat sample for *E. coli*	*E. coli* bacteria were not detected				Human and animal fecal waste
Disinfection By-Products, By-Product Precursors, and Disinfectant Residual									
Haloacetic acids	2016	ppb	0	60	Locational Running Annual Average: 35	3	57	NO	By-product of drinking water disinfection
Total Trihalomethanes	2016	ppb	0	80	Locational Running Annual Average: 40	14	53	NO	By-product of drinking water disinfection
Total Organic Carbon	2016	ppm	N/A	TT	Raw Water Annual Average: 1.24	0.87	2.0	NO	Naturally present in the environment
Chlorine Residual	2016	ppm	4.0	4.0	Entry Point Average: 1.18	0.41	1.57	NO	Remaining chlorine from disinfection process
Organic Constituents									
2, 4-D	2016	ppb	70	70	0.12	One sample collected		NO	Runoff from herbicide used on row crops
Unregulated Constituents									
Sodium	2016	ppm		20[2]	4.5	4.4	4.5	NO	Erosion of natural deposits

2016 Water Quality Data
from Aquifer Storage and Recovery Wells

TEST	DATE TESTED	UNIT	MCLG (MRDLG)	MCL (MRDL)	DETECTED LEVEL	LOWEST RANGE	HIGHEST RANGE	VIOLATION	MAJOR SOURCES
Inorganic									
Barium	2016	ppm	2	2	0.0021	One sample collected		NO	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Fluoride	2016	ppm	4	4	0.55	One sample collected		NO	Erosion of natural deposits; water additive—promotes strong teeth
Radioactive Constituents									
Combined Radium[2]	2014	pCi/L	0	5	1.01	One sample collected		NO	Erosion of natural deposits
Disinfection By-Products, By-Product Precursors, and Disinfectant Residual									
Haloacetic acids	2016	ppb	0	60	4.3	One sample collected		NO	By-product of drinking water disinfection
Total Trihalomethanes	2016	ppb	0	80	55	One sample collected		NO	By-product of drinking water disinfection
Total Organic Carbon	2016	ppm	N/A	TT	0.68	One sample collected		NO	Naturally present in the environment
Unregulated Constituents									
Sodium	2016	ppm		20[3]	6.8	One sample collected		NO	Erosion of natural deposits

[1] The City of Salem was conducting maintenance on the flouridation equipment from August 15, 2016–December 9, 2016.
[2] The City of Salem is required to report any detected contaminant within the last five years.
[3] EPA advisory level only.

Units of Measurement

Parts per Million (ppm)
One part per million is equal to one cup of food coloring in an Olympic size swimming pool (130,000 gallons)

Parts per Billion (ppb)
One part per billion is equal to one drop of food coloring in an Olympic size swimming pool (130,000 gallons)

Nephelometric Turbidity Unit (NTU)
The standard unit of measurement used in water analysis to measure turbidity in water samples.

Picocuries per Liter (pCi/L)
One part per billion of a curie per liter of water, used to measure radiation at very low levels.

Definitions

Maximum Contaminant Level Goal (MCLG)
The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

Maximum Contaminant Level (MCL)
The highest level of a contaminant allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

Action Level (AL)
The concentration of a contaminant which, if exceeded, triggers treatment or other requirements a water system must follow.

Treatment Technique (TT)
A required process intended to reduce the level of a contaminant in drinking water.

Maximum Residual Disinfectant Level (MRDL)
The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

Maximum Residual Disinfectant Level Goal (MRDLG)
The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contamination.

City Conducts Lead and Copper Sampling in 2016

IN 2016, THE CITY OF SALEM CONDUCTED LEAD and copper sampling as mandated by the Lead and Copper Rule (LCR). From June 1, 2016 through September 30, 2016, 89 water samples were collected from Tier 1 homes and analyzed for lead and copper. Of the 89 samples, only two samples exceeded the Action Level (AL) for lead and none of the samples exceeded the AL for copper.

The Oregon Health Authority requires that the City collect and analyze a minimum of 50 water samples from Tier 1 homes. Assessments made in the 1990s identified 147 Tier 1 homes in Salem that met the qualifications for ongoing lead and copper sampling. Tier 1 homes, built between 1983 and 1985, are considered most at risk because of lead or lead-based plumbing components used during construction.

If present, elevated levels of lead can cause serious health problems, especially for pregnant woman and young children. Lead in drinking water is mostly from materials and components in service lines and home plumbing. The City of Salem is responsible for providing high-quality drinking water, but cannot control the variety of materials used in plumbing components.

When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize your exposure is available from the Safe Drinking Water Hotline at 1-800-426-4791 or at **www.epa.gov/safewater/lead**.

Free Lead Testing for Salem Water Customers

The City of Salem offers free lead testing to its water customers. If you are concerned about the levels of lead in your home and would like to request a free test, please call the Water Quality Hotline at **503-588-6323**.

Other Results

Turbidity is a measure of water's clarity. High turbidity (muddy water) results from suspended soil and organic matter in water. This can increase the risk of contamination by interfering with the drinking water treatment process. All of the City's turbidity samples were below required levels.

Radon is a naturally-occurring radioactive gas found throughout the U.S., more often in groundwater than surface water. Radon levels taken from Salem's Aquifer Storage and Recovery (ASR) wells are consistent with levels typically found in Salem area groundwater.

Cryptosporidium is a harmful microbial pathogen found in surface water throughout the U.S. Cryptosporidium may cause cryptosporidiosis, an abdominal infection. Cryptosporidium must be ingested to cause disease and may be spread through means other than drinking water. Monitoring in 2016 did not detect Cryptosporidium in untreated North Santiam River source water.

Ways to Get Involved!

Salem City Council

Salem City Council is the policy-making body for the water system. The Council meets on the second and fourth Mondays of each month at 6 p.m. (in December, the first and second Monday at 6 p.m.). The meetings are open to the public and are held in the City Council Chambers in Room 240 of the Vern Miller Civic Center at 555 Liberty Street SE, Salem, Oregon. Feel free to call at 503-588-6091, or visit **www.cityofsalem.net** for more information.

North Santiam Watershed Council

The North Santiam Watershed Council members are local volunteers who act together to provide opportunities for stakeholders to cooperate in promoting, improving and sustaining the health of the North Santiam River Watershed, and its communities. The Council hosts events such as restoration project tours and river clean-ups during the year. Watershed Council meetings are open to the public and are held every second Thursday of each month (except December) at 6 p.m. at the Stayton Community Center at 400 West Virginia Street, Stayton, Oregon. Call 503-930-8202 or visit **www.northsantiam.org**.

Water Conservation

fact:

A leaky toilet could waste up to 200 gallons of water per day

Conservation Starts at Home

On average, one person uses over 100 gallons of water per day. Each water customer in the City of Salem can help conserve water by changing daily practices at home or work. Even a posting sign about water conservation tips is helpful. Some small changes include:

- Turn off the tap while brushing your teeth or washing your hands.
- Use a shower bucket. Instead of letting water run down the drain, collect it using a bucket and then water plants, or fill watering bucket for pets.
- Wash your cars on the lawn.
- Fix leaky toilets and faucets. Surprisingly, one drip per a second can add up to a lot in a day, and a year. This could be fixed and money can be saved.
- Landscape with plants, shrubs and trees that are suitable for this climate, and don't require excess watering during the summer. Remember, one inch per week.

The City of Salem can provide leaky toilet detection tablets and drip calculators. One can determine a leak by adding food coloring in the toilet tank. If the color shows up in the bowl without flushing, you have a leak. Good resources for native plants would include organizations and agencies like Marion Soil & Conservation District. For more information, go to **www.marionswcd.net**. To learn more about the tips listed above or about water conservation, visit the EPA Water Sense website at **www.epa.gov/WaterSense.**

City Offers Free Conservation Kits to Water Customers

Retrofitting existing fixtures can help reduce the amount of water you use every day and will help save money on your utility bill. The City offers free indoor and outdoor water conservation kits to its customers. To request a free water conservation kit, please call the Water Quality Hotline at 503-588-6323, or email us at **water@cityofsalem.net**.

One Inch Per Week Program

As much as 50 percent of water used outdoors is wasted from inefficient watering methods and systems. During the summer months, a high demand of water supply to customers comes at a period when water resources are already stressed due to hotter temperatures, drier conditions, and increased demand from vegetative growth. With this in mind, it is important to maintain a careful balance of your water needs, but to also keep in mind that the water used for drinking water comes from a river that is shared by other communities, wildlife, fish, and recreational users.

There are many uses for water during the summer months, including washing cars and walkways,

filling pools, and watering gardens, lawns and landscapes. There is an effective way to decrease outdoor water usage, thus saving money, water and energy. By giving your lawn only what it needs, you will potentially improve the durability of grass, reduce the need for chemical amendments like fertilizers, and decrease lawn mowing frequency. This will also improve local stream habitats for fish and wildlife, and improve water quality healthy for all downstream users on the Willamette River. Tips to efficiently improve your landscape include:

- Raise your lawn mower blade height to three inches. Longer grass blades retain more moisture, help keep weeds to a minimum, and encourage roots to grow deeper. Keep the mower blade sharp.
- Water deeply and infrequently. This encourages deep and strong root systems. Generally, landscapes need no more than **one inch per week**.
- Replace your irrigation system's clock timer controller with a weather-based irrigation controller, or a soil moisture sensor.
- Water early in the morning or late in the evening when temperatures are cool and the sun is low.
- Use mulch around vegetated areas. Mulch help retain moisture and keeps weeds out.
- Contact Oregon State University agriculture extension or other university extensions about fertilizer guides and applications. This will determine how much fertilizer is needed and reduce excess fertilizers from being used by unwanted vegetation like algae or weeds, or washing into nearby streams. It will also save costs. Remember, you can always add more.

Request a free One Inch per Week lawn watering gauge, provided by the City of Salem. To find out more information, call the Water Quality Hotline at 503-588-6323, or email water@cityofsalem.net.

By the Numbers

43.35
million gallons
peak daily water usage
August 20, 2016

22.20
million gallons
average daily winter demand
Jan.-Apr. and Oct.-Dec. 2016

32.40
million gallons
average daily summer demand
June-September 2016

9.520
billion gallons
total water produced
by the City of Salem in 2016

Salem Families Benefit from Low-Income Assistance Program

THE LOW-INCOME UTILITY ASSISTANCE PROGRAM, sponsored by the City of Salem, is dedicated to helping individuals and families facing financial difficulties to pay their City utility bills. The program is possible due to generous utility customers making voluntary, tax-deductible donations used exclusively for low-income assistance. These donations are matched by the City of Salem up to a $10,000 maximum per year.

In 2016, a total of **$14,670.74** was distributed to **157** families and individuals who would have otherwise faced possible water service disruption. Currently, the donation amounts received are not enough to keep up with the low-income requests for distribution.

If you would like to donate to the Low-Income Utility Assistance Program or if you are in need of low-income assistance for your City of Salem utility bill, please visit our website at **www.cityofsalem.net** or contact Customer Services Utility Billing at **503-588-6099** for more information.

$14,670.74
was given to
157
low-income families

Stormwater Runoff vs. Wastewater: What's the Difference?

Salem has two separate drainage systems: one used to carry stormwater runoff, and the other to carry wastewater (sewage). Salem's wastewater system collects water used in homes, businesses, and schools and carries the water to a wastewater treatment facility where it is treated before the water is released into the Willamette River.

In some cities, the wastewater and stormwater systems are combined, but not in Salem. Salem's stormwater pipes are separate from the wastewater pipes. Unlike the sewer system, the stormwater system begins at the drains in the streets and leads directly to the nearest stream or to the Willamette River without treatment.

As stormwater runs off roofs, yards, and streets, it picks up pollutants on its path to the storm drain system, and eventually to the Willamette River. People fish, recreate, and use the Willamette as a source of drinking water. Fish and other aquatic animals depend on clean water as well. For these reasons, water pollution prevention is important! To learn more about what you can do to keep water clean, go to **www.cityofsalem.net/clean-streams**.

Want to Learn More?

US EPA

Safe Drinking Water Hotline

1-800-426-4791

www.epa.gov

Oregon Health Authority

Drinking Water Program

971-673-0405

http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater

(Salem's ID# 00731)

City of Salem Public Works Department

City of Salem Website

www.cityofsalem.net

Water Quality Hotline

503-588-6323

water@cityofsalem.net

Water Conservation Hotline

503-588-6323

water@cityofsalem.net

Water Outreach and Education Program

To arrange a classroom presentation, field trip, or community service project, call 503-588-6211

THE FEDERAL SAFE DRINKING WATER ACT requires this annual water quality report be made available to every customer to provide information regarding the quality of the community's drinking water. If you would like to receive a printed copy of this report, please call **503-588-6333**. If you have any questions or comments, please email **water@cityofsalem.net** or call the Water Quality Hotline at **503-588-6323**.

CITY OF Salem AT YOUR SERVICE
PUBLIC WORKS DEPARTMENT
1410 20TH STREET SE BLDG 2
SALEM OR 97302-1200

PWS – OR4100731

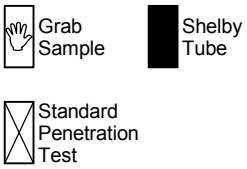
APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			**BEDROCK**	
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1	< 20	Weathered
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4	20 - 29	Firm
Medium Dense	10 - 29	Medium-Stiff	0.50 to 1.00	4 - 8	30 - 49	Medium Hard
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15	50 - 79	Hard
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30	>79	Very Hard
		Hard	> 4.00	> 30		

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

Exhibit: C-1

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

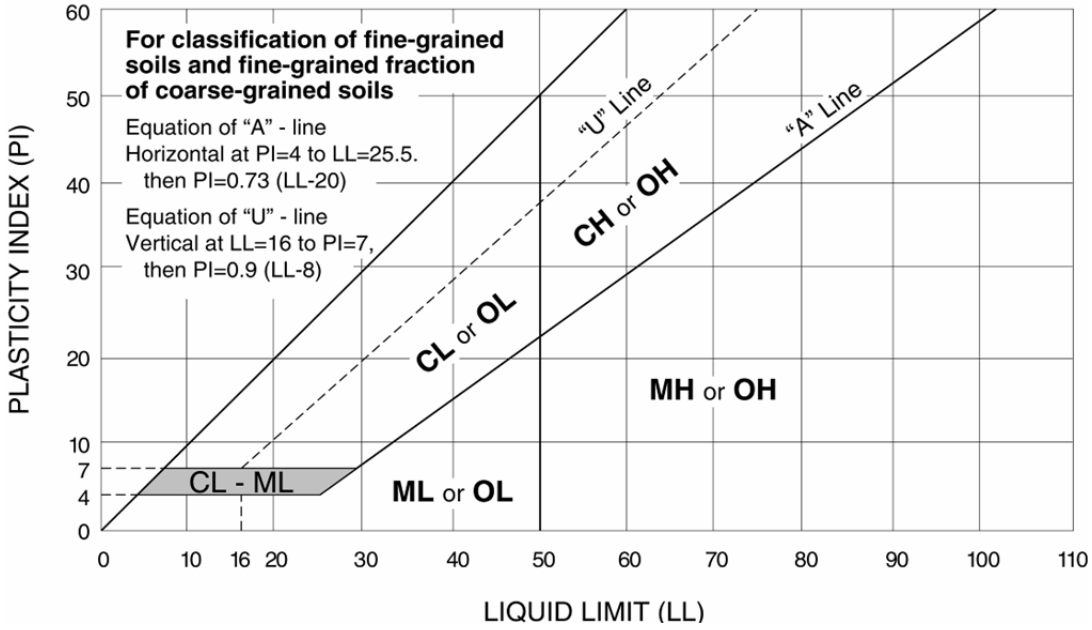
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Terracon

Exhibit C-2

APPENDIX D
GEOTECHNICAL INVESTIGATION SUMMARY CHECKLIST FOR COSTCO WHOLESALE PROJECTS

Geotechnical Investigation Summary Checklist for Costco Wholesale Projects

Geotechnical Investigation Summary Checklist

General Information

Costco Wholesale Real Estate Main Contact: Peter Kahn

Geotechnical Main Contact: James M. Schmidt, PE

Geotechnical Engineer of Record: Kristopher T. Hauck, PE

Project Location

CW #: 17-0460

Warehouse #:

Report Date: April 16, 2018

Consultant Project/Document Number: 49145137

Addendums (List):

Report Purpose: ☐ Preliminary ☐☐ Draft X Final ☐ Addendum/Revision

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
Pre-existing Conditions / Information				
Developer provided geotechnical report (describe):	☐	X		
Pre-existing development (describe)	☐	X	Previous grading onsite with fills on the order of up to 20 feet encountered in the borings.	4.1 and 4.2
Foundation type (describe):	X	☐	Spread footings	4.3
Performance Issues (describe):	☐	X		
Environmental Issues (describe)	☐	X	See Phase I ESA report	
Site Grading Records (stripping, compaction test results, field reports, etc.)	☐	X		
Typical Building Structural Design Criteria				
Other (describe): Fuel facility canopy				
Building size (describe): 160k Master Footprint				
Typical wall loading				
3,000 pounds per linear foot (1361 kilograms per 0.31 m) for Metal Buildings		☐		
4,500 pounds per linear foot (2041 kilograms per 0.31 m) CMU or pre-cast	X	☐		2.1
Typical column loading				
120,000 pounds (54430 kilograms) in non-snow regions	X	☐		2.1
150,000 pounds (68040 kilograms) in snow regions		☐		
Typical canopy loading: 50,000 pounds (22680 kilograms)	X	☐		2.1
Typical floor slab loading				

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
500 pounds per square foot (24 kPa), (psf, total)	X	☐		2.1
250 pounds per square foot (12kPa) (dead) at rack areas	X	☐		
150 pounds per square foot (7.2kPa) (dead) at non-rack areas	X	☐		
350 pounds per square foot (16.8kPa) (live)	X	☐		
Paving Design (twenty (20) year life)				
Heavy Duty paving shall accommodate thirty (30) trucks per day (Traffic Index of 7.0)	X	☐		4.7
Light Duty paving shall Accommodate 6,600 cars per day (Traffic Index of 5.0)	X	☐		4.7
Performance Grade (PG) binder oil identified for local climate conditions	X	☐		4.7
Site Grading Conditions/Assumptions				
Deviations to Typical Criteria (list / describe):	☐	X		
Design Finished Floor Elevation (FFE) (describe):	X	☐	EL 365 feet	2.1
Basis for FFE (assumed, per Civil) (describe):	X	☐	Green ink grading plan dated 3/16/2018 by DOWL.	2.1
Effects of change to assumed FFE (describe):	☐	X	None expected	
Maximum anticipated cuts (describe):	X	☐	12 feet or less	2.1
Maximum anticipated fills (describe):	X	☐	12 feet or less	2.1
Cross sections prepared for sites that are not essentially flat	X	☐		App A
Amount of import / export anticipated (describe):	☐	☐	Unknown	
Frost Depth (describe):	X	☐		4.3.1
Retaining walls				
Number of walls (describe):	X	☐	Near north and south sides of property	
Height / Length of walls (describe):	X	☐	About 7 to 33 feet (see civil)	
Wall construction / type (describe):	X	☐	Concrete/MSE	
Cut / fill transition in pad (describe):	X	☐	12 feet or less	2.1
Offsite Improvements (describe)	☐	X		
Fieldwork / Results				
Due Diligence Design Criteria				
Version (describe):	X	☐	2016 Costco Wholesale Development Requirements	
Followed Criteria?	X	☐		
Deviations to standard investigation (describe):	☐	X		
Groundwater				
Depth (describe):	X	☐	Elevation 343 feet at boring F-4	3.3
Perched	☐	X		
Expected seasonal fluctuation (describe):	X	☐	Unknown	3.4, 4.2.7, 4.4
Piezometers installed?	X	☐	Boring F-4 location	
Unusual / Challenging Soils conditions encountered				

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
Moisture-sensitive soils	X	☐		4.2.1
Undocumented fill	X	☐	SE and NE corner of building pad and NE corner of the site	4.1
Unsuitable soils (require removal)	☐	X		
Wet soils	☐	X		
Debris	☐	X		
Bedrock / potential non-rippable conditions	X	☐	Shallow rock in SW corner of site	4.2.4
Refusal	X	☐	Shallow rock in SW corner of site	4.2.4
Collapsible soils	☐	X		
Expansive soils	☐	X		
Compressible soils	☐	X		
Liquefaction	☐	X		
Sinkholes	☐	X		
Other (describe):	☐	X		
Potential Contamination Identified				
Soil	☐	X	See Phase I ESA	
Groundwater	☐	X	See Phase I ESA	
Restoration of Disturbed Areas				
Backfilled with soil	X	☐		
Backfilled with grout	☐	X		
Other (describe):	☐	X		
Topsoil samples collected / analyzed	X	☐		App B
Corrosivity testing performed/addressed	X	☐		App B
Culinary water quality testing performed	X	☐	City of Salem Public Works Department report	App B
Report				
Executive summary	X	☐		Ex Sum
Wet weather construction recommendations	X	☐		4.2.10
Pad winterization/pad recommendations	☐	X		
Frost protection recommendations	X	☐		4.3
Design Parameters				
Fill material parameters provided				
Structural fill (below foundations, slabs)	X	☐		4.2.2
Site grading fill (below pavements, flatwork)	X	☐		4.2.1, 4.5.2, 4.7.1
Select backfill (behind truck dock walls, foundations, grade beams, etc.)	X	☐		4.6
Trench backfill	X	☐		4.2.2
Drainage fill	☐	X		

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
Frost resistant fill	☐	X		
Slab base aggregate	X	☐	¾"-0 dense-graded aggregate base	4.5.1
Limits of debris / unsuitable removal provided	☐	X	NA	
Over-excavation / recompaction required				
Depth (describe):	X	☐	24"-36" remove and replace with select structural fill under footings 12" scarify, moisture condition, and recompact under pavements and floor slabs	4.3, 4.5, 4.7
Extent (include cross-section diagram)	X	☐		
Pad subgrade stabilization required (describe):	☐	X		
Surcharge				
Height (describe):	☐	X		
Lateral extent (describe):	☐	X		
Estimated duration (describe):	☐	X		
Shallow Foundations				
Pounds per square foot (kPa per m) allowable soil bearing pressure (describe):	X	☐	3,000 psf	4.3.1
Deep Foundations				
Type (describe):	☐	X		
Options and Value Engineering Matrix provided	☐	X		
Floor Slabs				
Unreinforced (>2500 pound per square foot) (>120 kPa)	X	☐		
Reinforced (describe why)	☐	X		
Subgrade modulus (pounds per square inch per inch (kPa / mm) (describe):	X	☐	150 pci	4.5.1
Base Material thickness:	X	☐	(minimum six (6) inch (152.4 mm)) (ODOT ¾"-o dense-graded aggregate base)	4.5.1
Seismic Conditions				
Governing Building Code (IBC, UBC, other)	X	☐	2014 Oregon Structural Specialty Code	
Geologic Hazard Identified	☐	X		
Proximity to earthquake fault zone(s)	☐	X		
Proximity to seismic hazard zone(s)	☐	X		
Potential for liquefaction	☐	X		
Potential for lateral spreading	☐	X		
Potential for seismic settlement	☐	X		
Potential for slope stability/landslides	☐	X		
Potential for ground shaking or geologic hazards	☐	X		
Retaining Walls	X	☐		4.6

Geotechnical Investigation Summary Checklist	Yes	No or NA	Describe / Comments	Report Section
Recommended Wall Types	☐	X		
Recommend Terracon Design	☐	☐	Unknown	
Lateral earth pressure design values				
Active:	X	☐		4.6
At-rest:	X	☐		4.6
Passive:	X	☐		4.6
Seismic:	X	☐		4.6
Backfill material, placement requirements	X	☐		4.6
Drainage requirements and cross-section drawing	X	☐		4.6
Finger Drains				
Required for frost	☐	X		
Recommended for long term maintenance and constructability	X	☐		4.7.2
Pavement				
Pavement subgrade stabilization required (describe):	☐	X		4.7.1
Asphalt mix design specified	X	☐		4.7.3
Heavy and light duty pavement sections specified	X	☐		4.7.3
Alternative pavement sections identified	X	☐	Rigid concrete	4.7.3
Specification for offsite pavement sections included	☐	X		
Data Gaps / Unknowns (describe):	X	☐	Subsurface information for planned retaining walls	4.12