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August 4, 2023

Attention: Mr. Jesse Winterowd
Winterbrook Planning
610 SW Alder Street, Suite 810
Portland, Oregon 97205

Re: Portland Water Bureau Water Filtration Project
Land Use Permitting

Subject: Supplemental Geotechnical Information

Dear Jesse:

Jacobs Engineering was asked to provide additional information and responses to several comments documented in a memorandum prepared by True North Geotechnical dated June 28, 2023 (Exhibit E.21). This letter provides additional information for the Portland Water Bureau Finished Water Pipeline (FWP) related to the issues of expansive soils and potential water well impacts of the construction of the FWP.

Expansive Soils along the FWP

Jacobs Engineering performed an extensive geotechnical exploration program along the FWP project alignment. The explorations included completion of 36 geotechnical borings, four cone penetrometer test probes, installing and monitoring nine groundwater monitoring points, and excavating three test pits along the FWP alignment. The map showing the locations of the explorations relative to the FWP alignment, along with the geotechnical boring logs are included in Attachment A to this letter. The conclusion provided in Exhibit A.81 that "Based on the geotechnical investigations and evaluation performed for the project, the site is suitable for the intended development and the risks from the geologic and seismic hazards are low and can be mitigated with appropriate foundations and site developments." remains valid.

Fat Clay soils are present along much of the FWP alignment, but it is important to understand that all fat clay soil is not necessarily expansive. Fat clay soils can be inert to significant volume changes or they can be prone to large volume changes (expansion and shrinkage) if composed of expansive minerals and if subjected to changes in water content. Where present, the effects of expansive soils are typically limited to at-grade, light-weight structure foundations and slabs for which moisture contents of the soils fluctuate drastically between seasons and the loads on the foundations are not sufficient to counterbalance the swelling pressure from the expansive soil. When these conditions exist, it is common to over-excavate some or all of the fat clay beneath these structures and replace it with non-expansive soil or gravel.

To understand the potential impacts of expansive soils in a particular area it is to common practice to evaluate the past performance of similar facilities constructed in the same area and through similar soil conditions. When expansive soils are present in an area, it is common for the soils to have caused damage to roadways and other paved areas, as well as homes, warehouses, and other lightly loaded structures. Surveys of multiple existing structures along the FWP alignment, including several residential homes and outbuildings and the Lusted Hill Treatment Facility structures were conducted during the planning and design phases for the FWP project. These surveys did not identify damage to existing structures resulting from expansive soil issues. In addition, the existing Portland Water Bureau drinking water conduits running through these same fat clay soils have been in service for more than 100 years with no known systemic expansive soil issues.

The fat clay that is present along the FWP alignment is generally in a moist condition and the installation of the FWP is not expected to change the moisture condition. The presence of fat clay is not expected to have an impact on the buried finished water pipelines for the reasons set forth above and because the steel pipelines used for this project can withstand moderate deformations that could result from unexpected changes in soil moisture content. The only buildings associated with the FWP project are located at the FWP Intertie located south of SE Lusted Road. The Intertie Vault is the most significant structures at intertie location. The Intertie Vault structure will be excavated to depths below the expected limits of the fat clay layer that is present in the vicinity of the site.

Building codes and project specifications require that a Geotechnical Engineer observe the foundation conditions beneath the Intertie Vault structure and any other buildings associated with the project. If fat clay extends deeper than anticipated and it is observed beneath the intertie vault at the extent of the design excavation, or if it is present beneath other structures, the standard practice of requiring additional over-excavation of the fat-clay layer will be followed. For the proposed FWP structures and pipelines, we do not anticipate that expansive or contraction of fat clay soil would result in conditions that would result in damage or require future repairs.

Existing Water Wells

Regarding the existing water wells located along the FWP alignment indicated in Exhibit E.21, the following comments are provided. The majority of the FWP will be constructed in the public right of way along SE Dodge Park Boulevard, SE Cottrell Road, and SE Lusted Road, and SE Altman Road. Two segments of the FWP will be constructed within private property easements that will be negotiated with the property owners. There are no water wells within the FWP construction easement, or in the right of ways. The known water wells located in the vicinity of the FWP project are shown in Figure 1. Figure 1 also shows the completed depth of the wells and the noted depth to water according to Oregon Department of Water Resources (ODWR)records.

Three water wells are located within about 300 feet of the FWP. These include the following wells, which are shown relative the FWP in Figure 1.

1. Well Mult 55482: Located approximately 100 feet south of the FWP along SE Lusted Road. The report from this well indicates a depth to water of 260 feet and a completion depth of 480 feet.

2. Well Mult 2592: Located approximately 300 feet north of the eastern end of the FWP along SE Dodge Park Boulevard. The report from this well indicates a depth to water of 320 feet and a completion depth of 390 feet.
3. Well Mult 138043: Located approximately 300 feet south of the FWP along SE Dodge Park Boulevard. The report from this well indicates a depth to water of 385 feet and a completion depth of 415 feet.

The data in Figure 1 shows that most of the other water wells in the vicinity of the FWP are typically constructed to deep depths of 300 feet or more, similar to the three located closest to the FWP.

There are two wells, Well Mult 2586 and Well Clac 888, located in the project area that are screened at shallower depths of 100 feet and 124 feet, respectively. According to ODWR records, these shallower wells are located more than 1,400 feet away from the nearest pipeline installation. The two shallower wells in the area, although not as deep as the others, still pump water from much deeper levels as compared to the relatively shallow excavations, typically no deeper than about 20 feet, required for the construction of the FWP.

The majority of the FWP project will be constructed in soil using the open cut method and tradition construction equipment such as excavators, haul trucks, and compactors. These types of equipment typical produce very modest ground vibrations that dampen quickly with distance from the source. Published data for vibratory compactors, which would likely produce the largest ground vibrations of any of the types of construction equipment used for open cut construction, indicate that the ground would dampen to about 0.2 inches per second at distances of 30 to 40 feet away from the equipment. For comparison, these vibrations are much less than the limit of 0.5 inches per second that is commonly specified for blast induced ground vibrations to ensure sensitive structures, including residential homes with more easily damaged lathe and plaster walls, are not damaged.

Several segments of the FWP will be constructed using trenchless installation methods where the excavation will be completed below ground to open a hole for installation of the pipeline. At these locations the drilling work is being completed below ground so that any vibrations resulting from the work are quickly dampened by the overlying and surrounding soils. The segment of the FWP work from the Lusted Hill Treatment Facility (LHTF) down the hill to the Portland Water Bureau's existing SE Lusted Road Distribution Main will consist of a 12-inch diameter pipeline which will be constructed using horizontal directional drilling (HDD) methods. The HDD alignment will be close to the ground surface at the ends, but will be 40 feet, or more, below the ground over most of the alignment. The small cutting head that will be used to construct the HDD bore will not produce significant vibrations and any that are created will be dampened by the overlying ground such that surface vibrations will likely be imperceivable along most of the alignment. The other ground vibrations associated with the HDD installation will be associated with the work area where the HDD drill is set-up, which will be at the bottom of the hill in an area that is far from any existing structures or wells. The vibrations associated with this type of equipment will be similar to the vibrations associated with construction of the FWP using open cut methods. Given the anticipated ground vibrations associated with the equipment that will be used to construct the FWP, we do not anticipate that the work would result in damage to existing structures or wells along the FWP alignment.

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As noted above, private wells are offset from the construction work and the screened intervals on these wells are a minimum of approximately 80 to 100 feet below the invert of the constructed pipelines. In addition, the three wells located within 300 feet of the work area are screened at depths of at least 200 feet below the invert of the constructed pipeline. Construction vibrations are not expected to impact the performance of private wells because the distances and depth of the wells is too far from the construction work areas to result in damage. Similarly, construction of the FWP project is not anticipated to impact the pumping capacity or the water quality of the water wells located in the vicinity of the FWP work for the same reasons.

Yours sincerely,

Todd E. Cotten

Digitally signed by Todd E. Cotten
Date: 2023.08.04 12:44:50-07'00'

Todd Cotten, PE, GE
Geotechnical Engineer

Copies: File

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August 4, 2023
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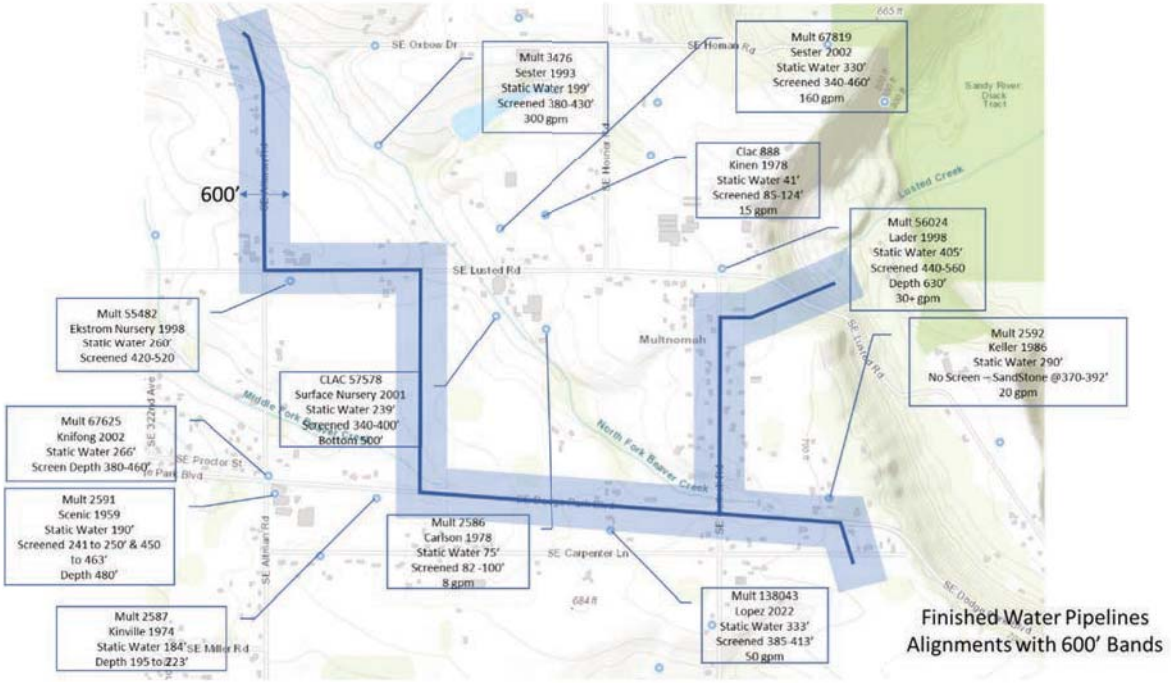


Figure 1. Water Wells in the Vicinity of the Finished Water Pipeline.
Source: Oregon Water Resources Department, Well Report Query tool.

Appendix A: Field Exploration Mapping and Boring Logs

FIGURE INDEX

FIG. #	TITLE
3A	FIGURE INDEX, LEGEND AND GENERAL NOTES
3B	EXPLORATION KEY PLAN
3C	EXPLORATION PLAN AND GEOLOGIC PROFILE TRENCHLESS CROSSING STA 6+00 TO 14+00
3D	EXPLORATION PLAN AND GEOLOGIC PROFILE LUSTED STA 14+00 TO 36+00 & ALTMAN STA 104+00 TO 126+00
3E	EXPLORATION PLAN AND GEOLOGIC PROFILE LUSTED STA 36+00 TO 62+00 & ALTMAN STA 126+00 TO 152+00
3F	EXPLORATION PLAN AND GEOLOGIC PROFILE LUSTED STA 62+00 TO 86+04 & ALTMAN STA 152+00 TO 175+81
3G	EXPLORATION PLAN AND GEOLOGIC PROFILE C4 STA 400+00 TO 421+00, C2 STA 200+00 TO 221+19 & C3 STA 300+00 TO STA 319+24
3H	EXPLORATION PLAN AND GEOLOGIC PROFILE C4 STA 421+00 TO 447+03 & C2 STA 221+19 TO 240+86
3I	EXPLORATION PLAN AND GEOLOGIC PROFILE CRTM STA 1+00 TO 31+23
3J	EXPLORATION PLAN AND GEOLOGIC PROFILE CRTM VICINITY
3K	EXPLORATION PLAN ORIGINAL ALTMAN ALIGNMENT BORINGS

UNITED SOIL CLASSIFICATION SYSTEM (ASTM D2488 AND D2487)

SYMBOL	SOIL GRAPHIC	TYPICAL DESCRIPTION
GP		POORLY GRADED GRAVEL
GM		SILTY GRAVEL
GC		CLAYEY GRAVEL
SP		POORLY GRADED SAND
SM		SILTY SAND
SC		CLAYEY SAND
ML		SILT
CL		LEAN CLAY
MH		ELASTIC SILT
CH		FAT CLAY

NON-USCS SYMBOLS

SOIL GRAPHIC	TYPICAL DESCRIPTION
	ASPHALT
	BASE GRAVEL
	BASALT

GENERAL NOTES:

1. ALL EXPLORATION LOCATIONS ARE APPROXIMATE.
2. HORIZONTAL DATUM: NAD83 STATE PLANE OREGON NORTH FIPS 3601, INTERNATIONAL FEET.
   VERTICAL DATUM: PORTLAND VERTICAL DATUM, FEET.
3. POSITIVE OFFSET=RIGHT OF CENTERLINE, LOOKING UP STATION, NEGATIVE OFFSET=LEFT OF CENTERLINE, LOOKING UP STATION.
4. PROFILE VIEWS ARE ONLY SHOWN ALONG THE CURRENT FINISHED WATER PIPELINE ALIGNMENTS. ONLY PLAN VIEWS ARE SHOWN FOR GEOTECHNICAL EXPLORATIONS ALONG THE ORIGINAL (NOW ABANDONED) ALTMAN FINISHED WATER PIPELINE ALIGNMENT AND LUSTED INTERTIE LOCATION.
5. PROFILE VIEWS ONLY INCLUDE A SINGLE TYPICAL PIPELINE. MULTIPLE PIPELINES OCCURRING ALONG THE FINISHED WATER ALIGNMENTS ARE NOT SHOWN.

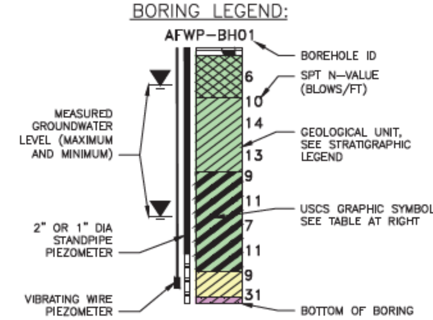
BORING AND SYMBOL KEY:

(red line)		ALTMAN FWP
(blue line)		LUSTED FWP
(light green line)		CONDUIT 2 FWP
(purple line)		CONDUIT 3 FWP
(cyan line)		CONDUIT 4 FWP
(green line)		CRTM
AFWP-BH01		FWP INVESTIGATION GEOTECHNICAL BOREHOLE
AFWP-BH07		FWP INVESTIGATION GEOTECHNICAL BOREHOLE WITH PIEZOMETER
AFWP-C01		FWP INVESTIGATION CPT
B-1-FH		HISTORICAL FUJITANI HILTS GEOTECHNICAL BOREHOLE (STANTEC 2019, 2020)
B-1-JA		HISTORICAL JACOBS ASSOCIATES GEOTECHNICAL BOREHOLE (STANTEC 2019, 2020)
BH-1-STEC		PREVIOUS LUSTED HILL TREATMENT PLANT CCIP GEOTECHNICAL BOREHOLE (STANTEC 2019, 2020)
FF-B-201		FILTRATION FACILITY GEOTECHNICAL BOREHOLE (MJ 2021)
PL-B14		PRELIMINARY BULL RUN TREATMENT FILTRATION PIPELINE PROJECT GEOTECHNICAL BOREHOLE (RHINO 2020A)
PL-B15		PRELIMINARY BULL RUN TREATMENT FILTRATION PIPELINE PROJECT GEOTECHNICAL BOREHOLE WITH PIEZOMETER (RHINO 2020A)
TP-7-FH		HISTORICAL FUJITANI HILTS TEST PIT (STANTEC 2019, 2020)
WTP-B11		PRELIMINARY BULL RUN TREATMENT FILTRATION FACILITY PROJECT GEOTECHNICAL BOREHOLE (RHINO 2020B)
WTP-B06		PRELIMINARY BULL RUN TREATMENT FILTRATION FACILITY PROJECT GEOTECHNICAL BOREHOLE WITH PIEZOMETER (RHINO 2020B)

STRATIGRAPHIC LEGEND:

COLOR	GEOLOGICAL UNITS
(green)	RESIDUAL SOIL OF THE SPRINGWATER FORMATION
(pale yellow)	SENSITIVE SAPROLITE OF THE SPRINGWATER FORMATION
(purple)	LESS WEATHERED SPRINGWATER FORMATION
(orange)	UNWEATHERED SPRINGWATER FORMATION

BORING LEGEND:



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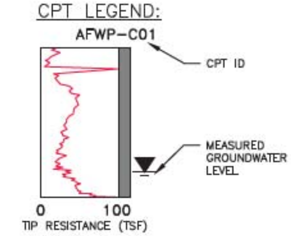

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE
GEOTECHNICAL ENGINEERING REPORT
FIGURE INDEX, LEGEND AND GENERAL NOTES

FIG.3A

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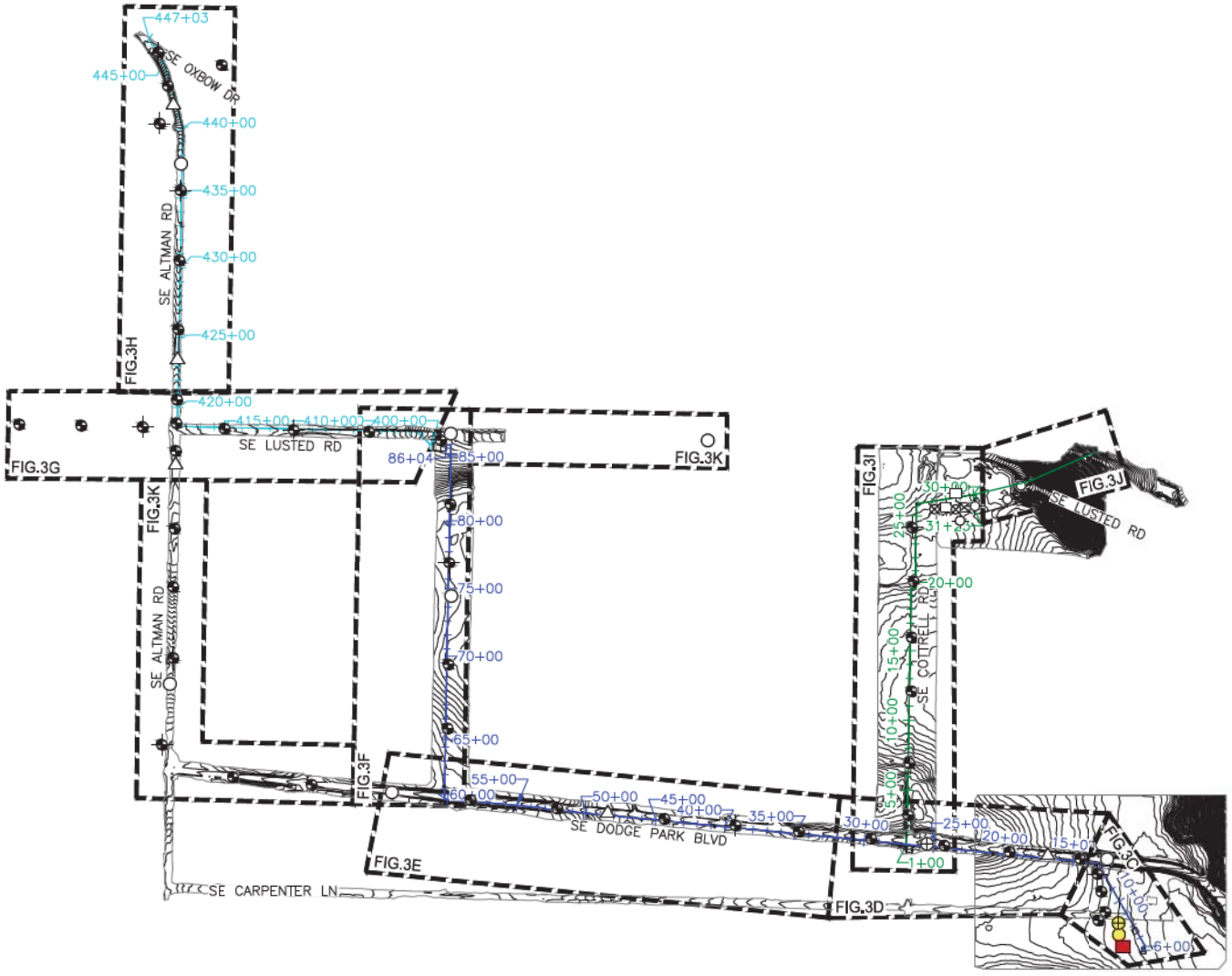

EXPLORATION KEY PLAN
NTS

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE

GEOTECHNICAL ENGINEERING REPORT
EXPLORATION KEY PLAN

FIG.3B

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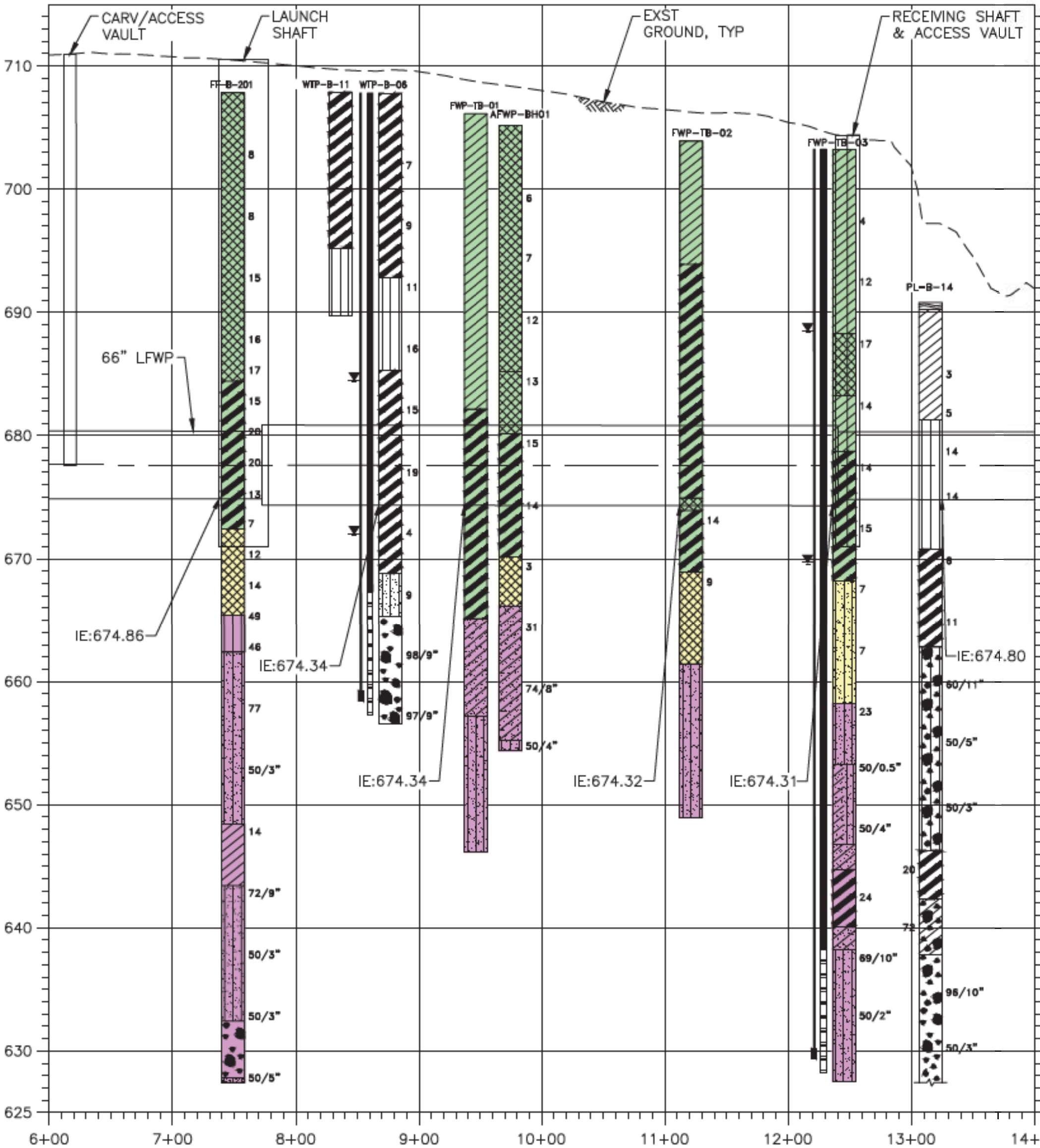
Path: C:\Users\DJH\Box\Jobs\62180 PWB Filtration Pipelines Project FPP\04\03 Drawings\1.5 JACOBS GDR\JACOBS GER, GDR & SHAM_SEP2022_7 SHEET 3B –KEY PLAN.dwg Plot date: Jan 06, 2023, CAD User: Lisa



GEOLOGIC PROFILE TRENCHLESS CROSSING STA 6+00 TO 14+00

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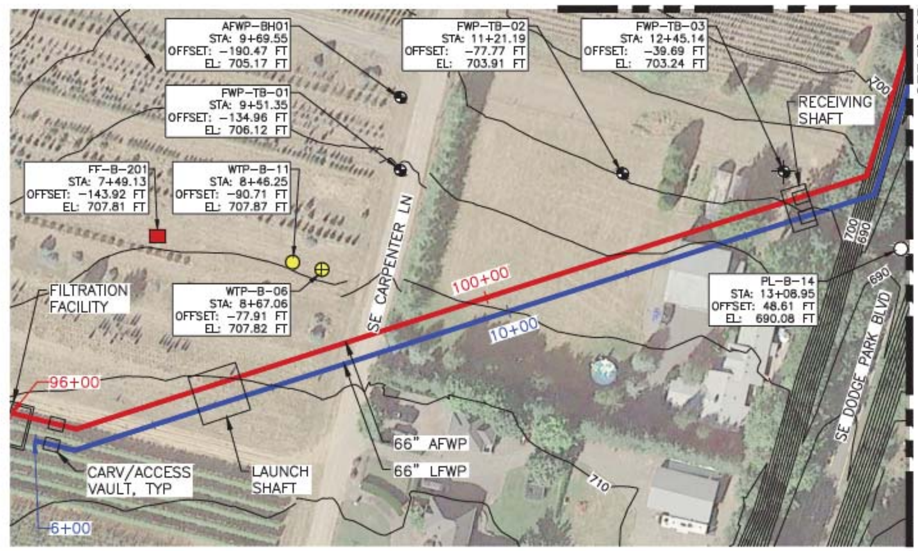

EXPLORATION PLAN TRENCHLESS CROSSING STA 6+00 TO 14+00

SCALE: 1"=100'

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE

GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN AND GEOLOGIC PROFILE
TRENCHLESS CROSSING STA 6+00 TO 14+00

FIG.3C

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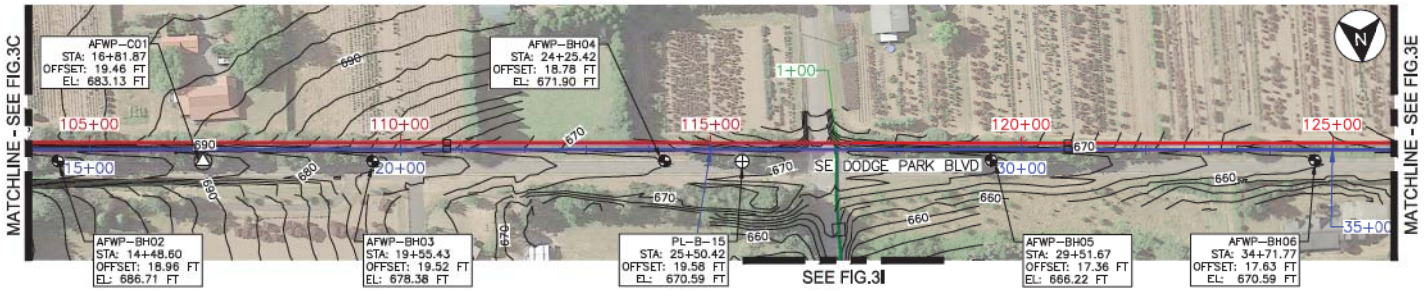

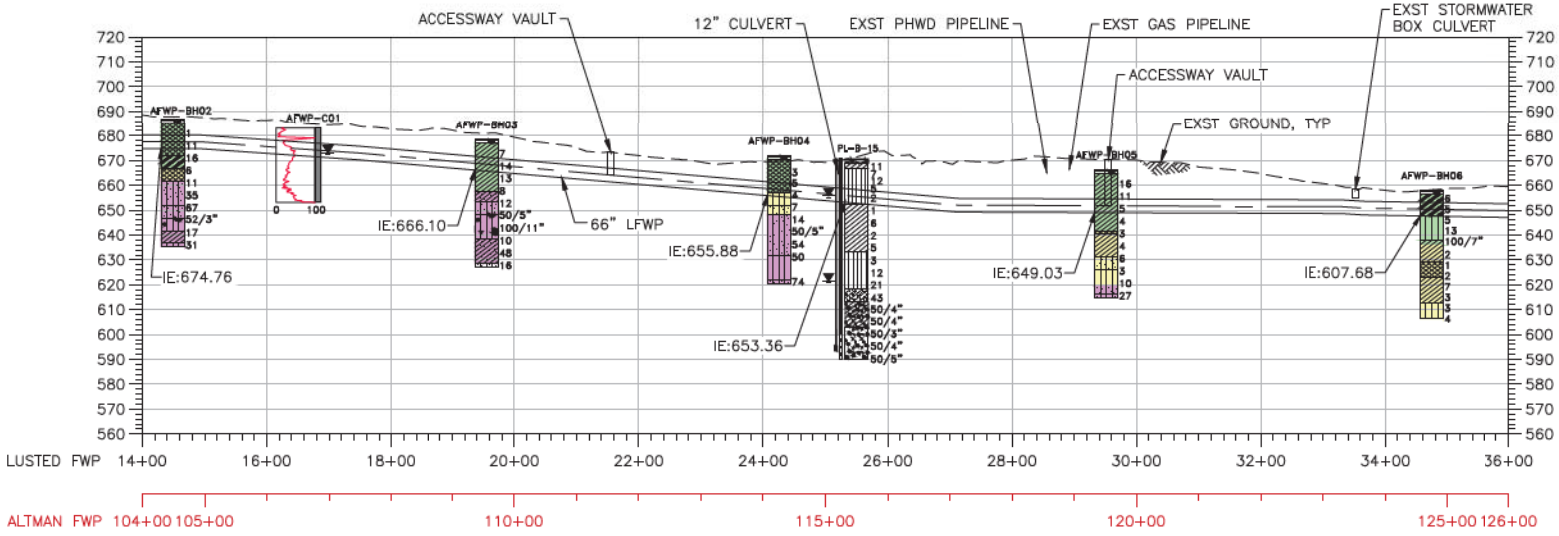

EXPLORATION PLAN AND GEOLOGIC PROFILE
LUSTED FWP STA 14+00 TO 36+00
ALTMAN FWP STA 104+00 TO 126+00

SCALE: 1"=200' HORIZ
1"=50' VERT
VERTICAL EXAGGERATION=4X

0" 100' 200'
0" 10' 20'

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE
GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN AND GEOLOGIC PROFILE
LUSTED STA 14+00 TO 36+00 & ALTMAN STA 104+00 TO 126+00

FIG.3D

JAN 2023

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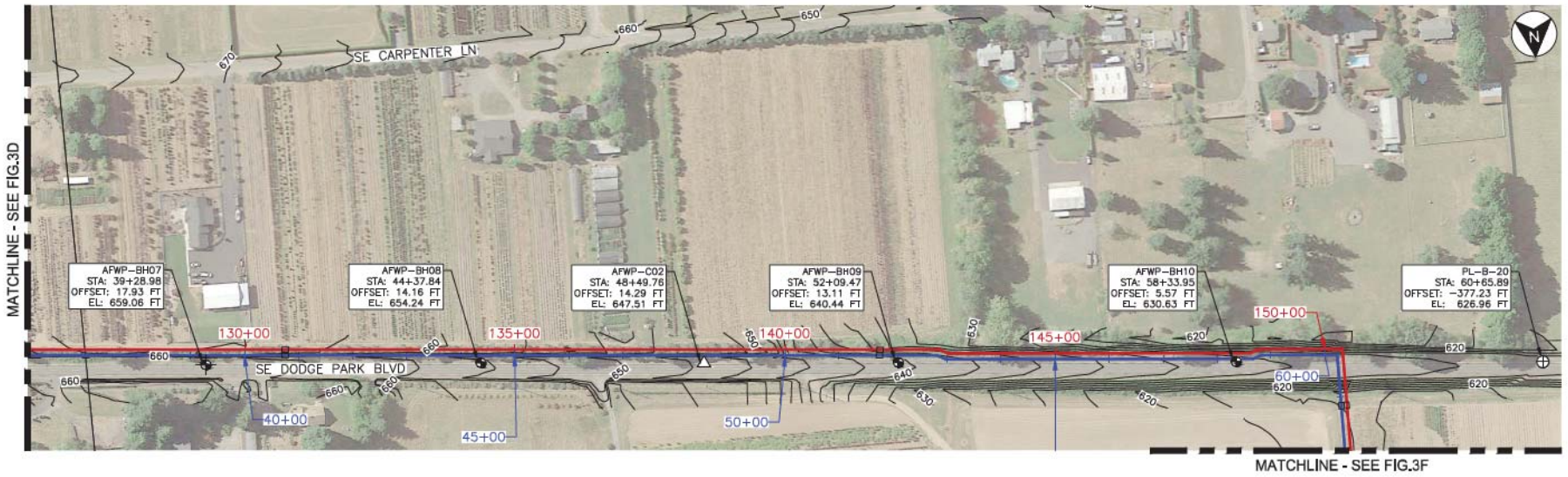

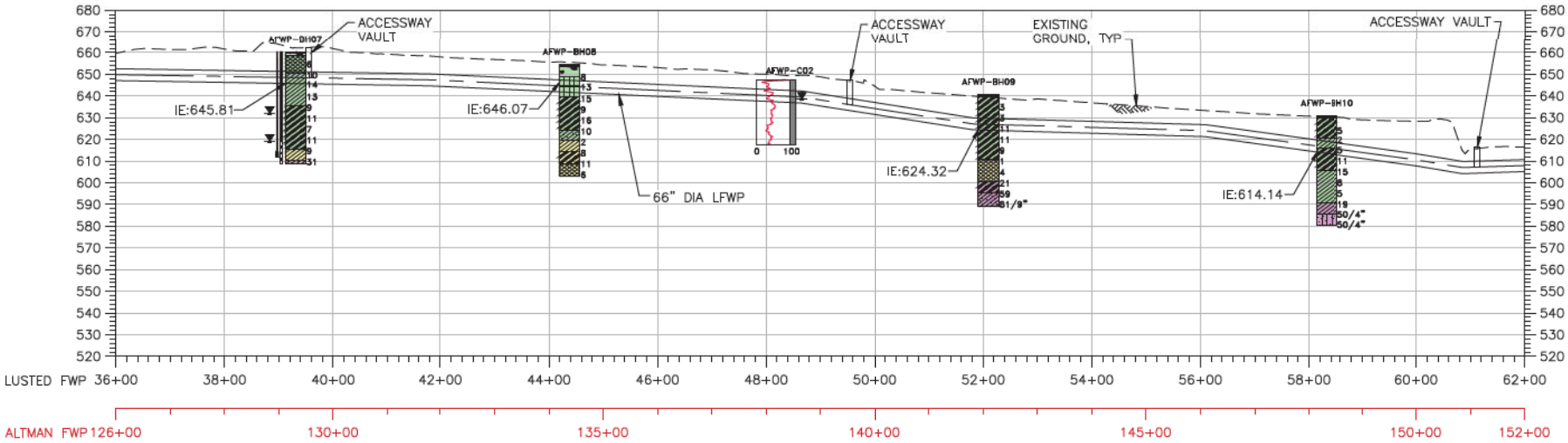

EXPLORATION PLAN AND GEOLOGIC PROFILE
LUSTED STA 36+00 TO 62+00
ALTMAN STA 126+00 TO 152+00

SCALE: 1"=200' HORIZ
1"=50' VERT
VERTICAL EXAGGERATION=4X

0" 200' 400'

0" 50' 100'

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE
GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN AND GEOLOGIC PROFILE
LUSTED STA 36+00 TO 62+00 & ALTMAN STA 126+00 TO 152+00

FIG.3E

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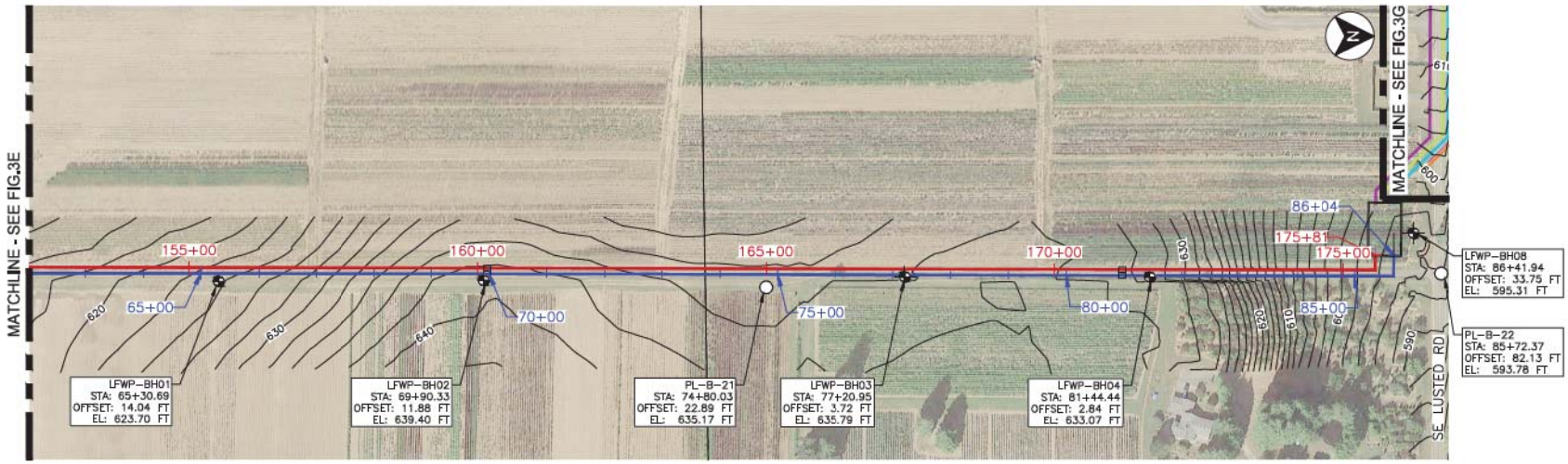

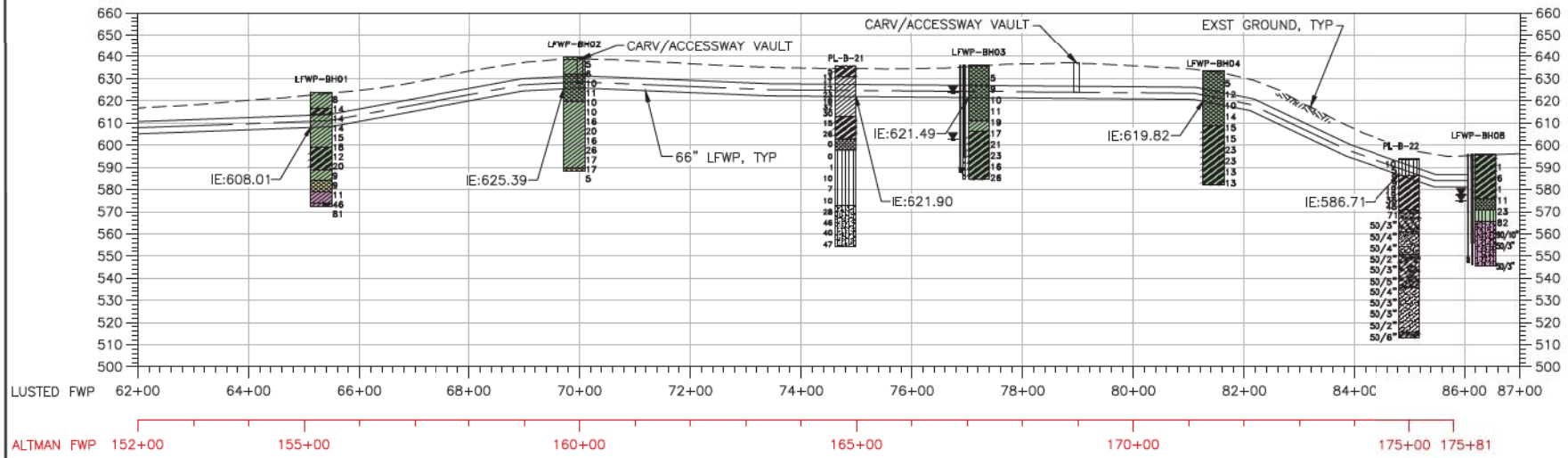

EXPLORATION PLAN AND GEOLOGIC PROFILE
LUSTED STA 62+00 TO 86+04
ALTMAN STA 152+00 TO 175+81

SCALE: 1"=200' HORIZ
1"=50' VERT
VERTICAL EXAGGERATION=4X

0" 200' 400'

0" 50' 100'

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE
GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN AND GEOLOGIC PROFILE
LUSTED STA 62+00 TO 86+04 & ALTMAN STA 152+00 TO 175+81

FIG.3F

JAN 2023

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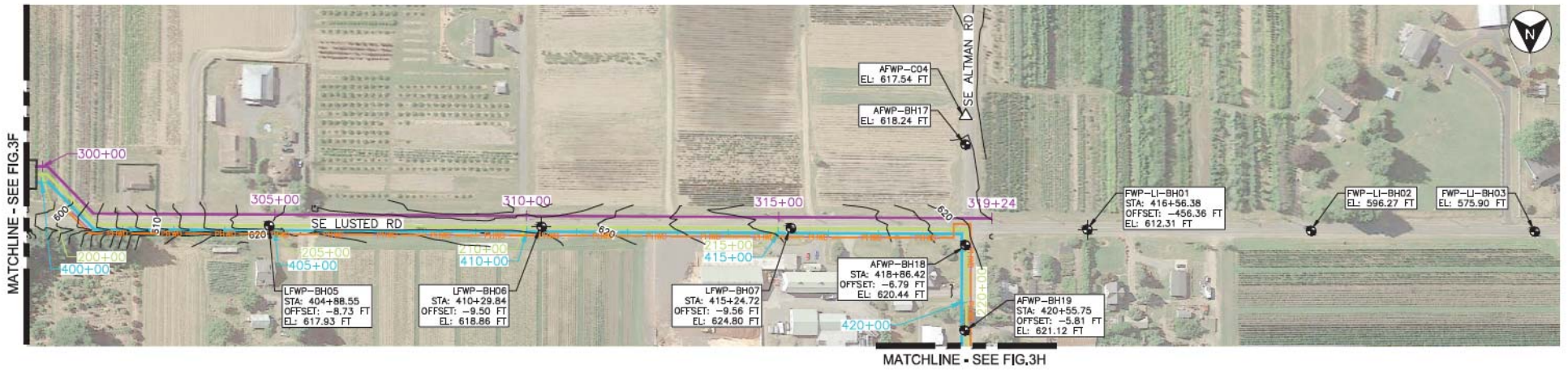

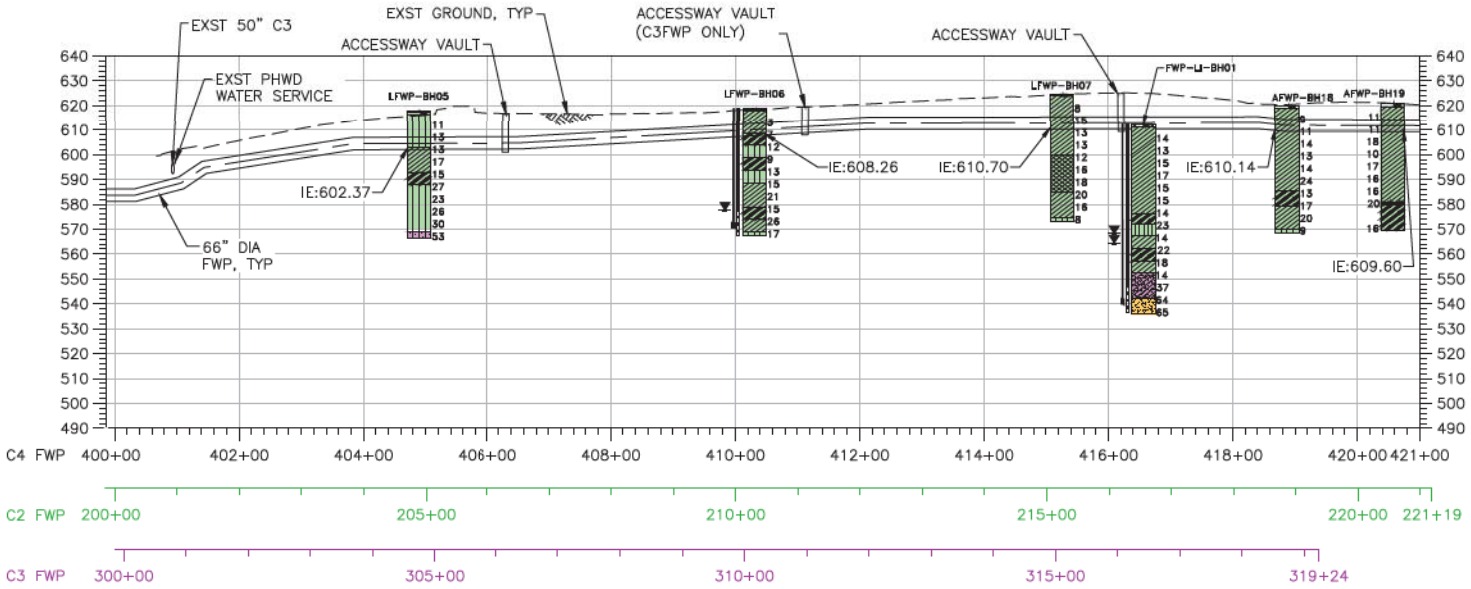

EXPLORATION PLAN AND GEOLOGIC PROFILE
C4 STA 400+00 TO 421+00
C2 STA 200+00 TO 221+19 & C3 STA 300+00 TO STA 319+24

SCALE: 1"=200' HORIZ
1"=50' VERT
VERTICAL EXAGGERATION=4X

0" 200' 400'
0" 50' 100'

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE
GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN AND GEOLOGIC PROFILE
C4 STA 400+00 TO 421+00, C2 STA 200+00 TO 221+19 & C3 STA 300+00 TO STA 319+24

FIG.3G
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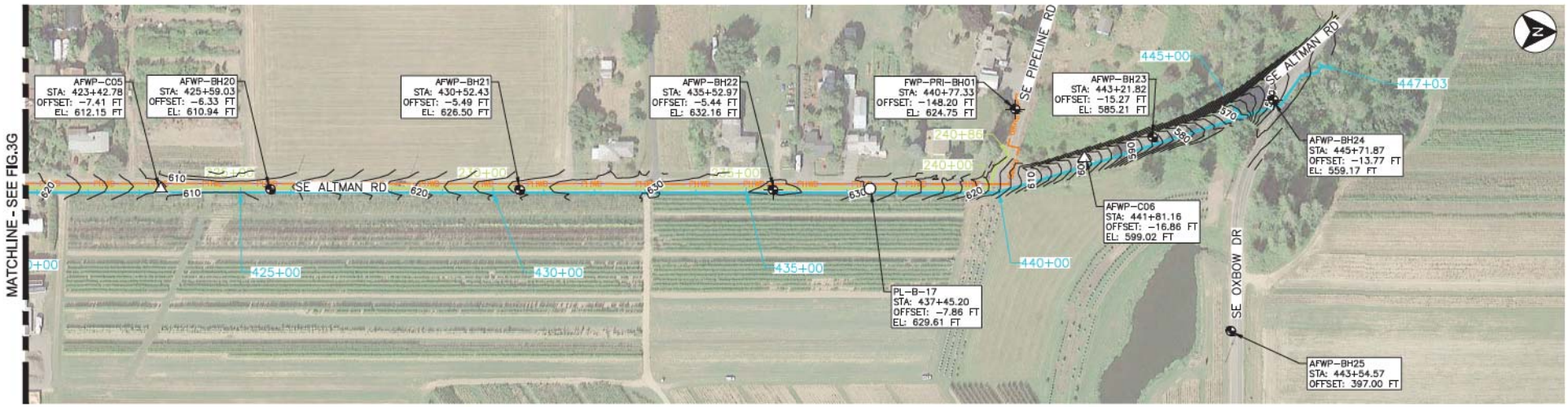

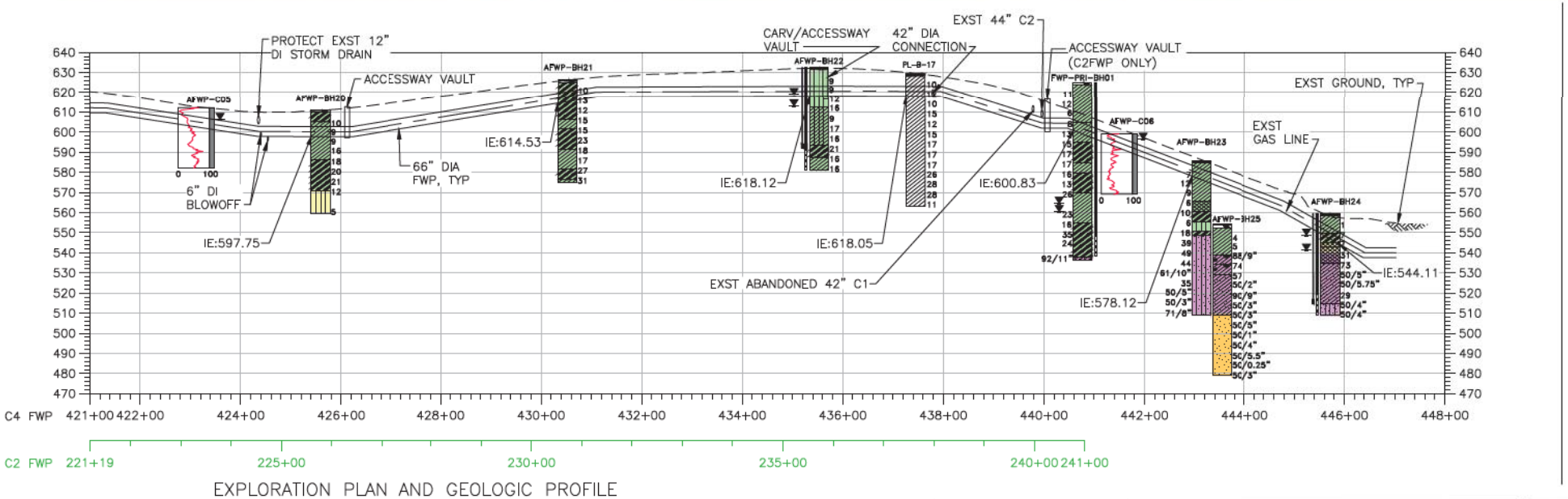

EXPLORATION PLAN AND GEOLOGIC PROFILE
C4 STA 421+00 TO 447+03,
C2 STA 221+19 TO 240+86

SCALE: 1"=200' HORIZ
1"=50' VERT
VERTICAL EXAGGERATION=4X

0" 200' 400'
0" 50' 100'

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE
GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN AND GEOLOGIC PROFILE
C4 STA 421+00 TO 447+03 & C2 STA 221+19 TO 240+86

FIG.3H

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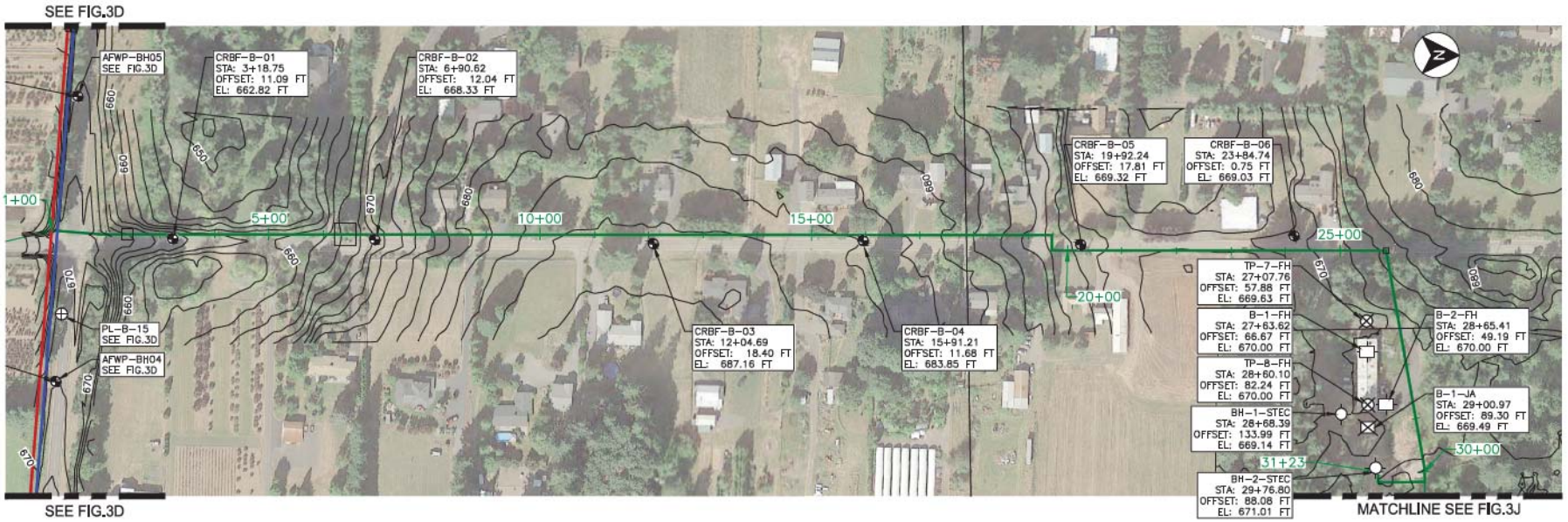

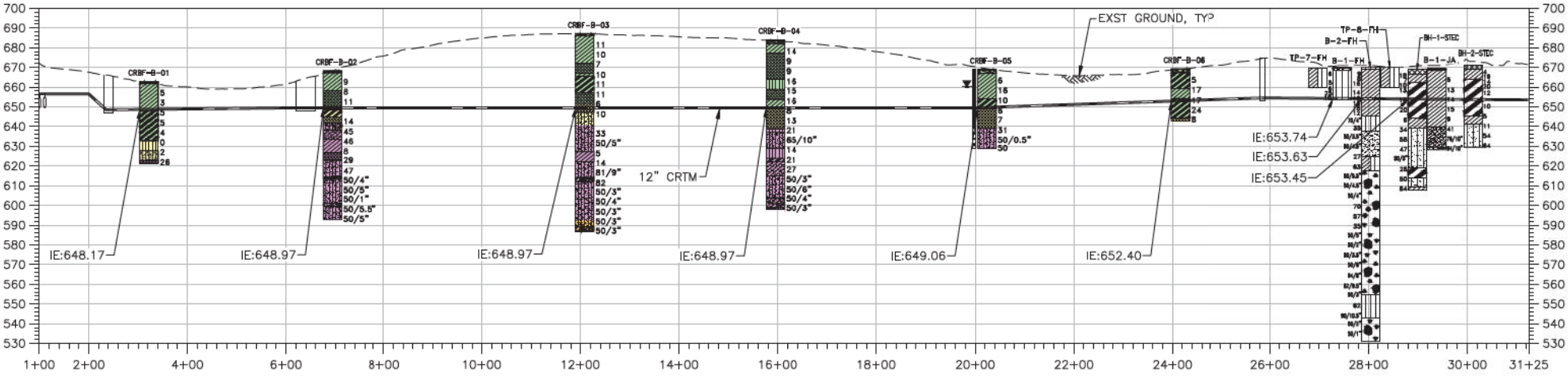

EXPLORATION PLAN AND GEOLOGIC PROFILE
CRTM HDD STA 1+00 TO 31+23

SCALE: 1"=200' HORIZ
1"=50' VERT
VERTICAL EXAGGERATION=4X

0" 200' 400'
0" 50' 100'

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FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE
GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN AND GEOLOGIC PROFILE
CRTM STA 1+00 TO 31+23

FIG.3I
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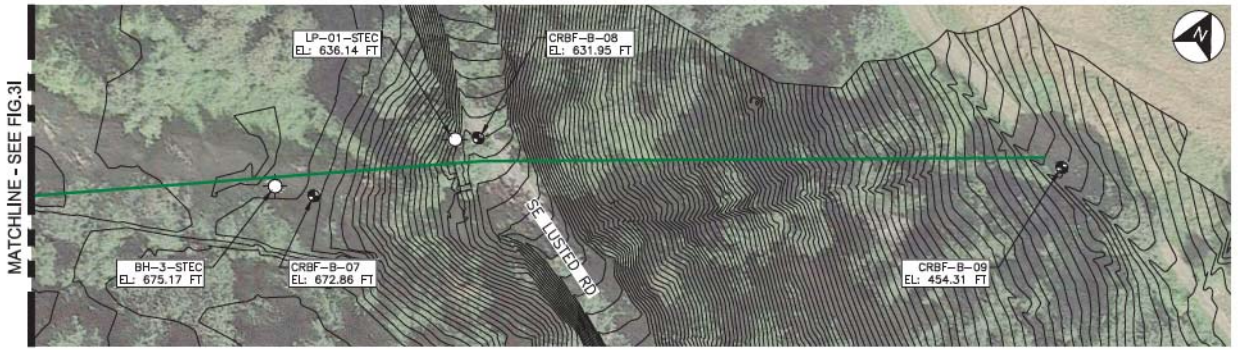

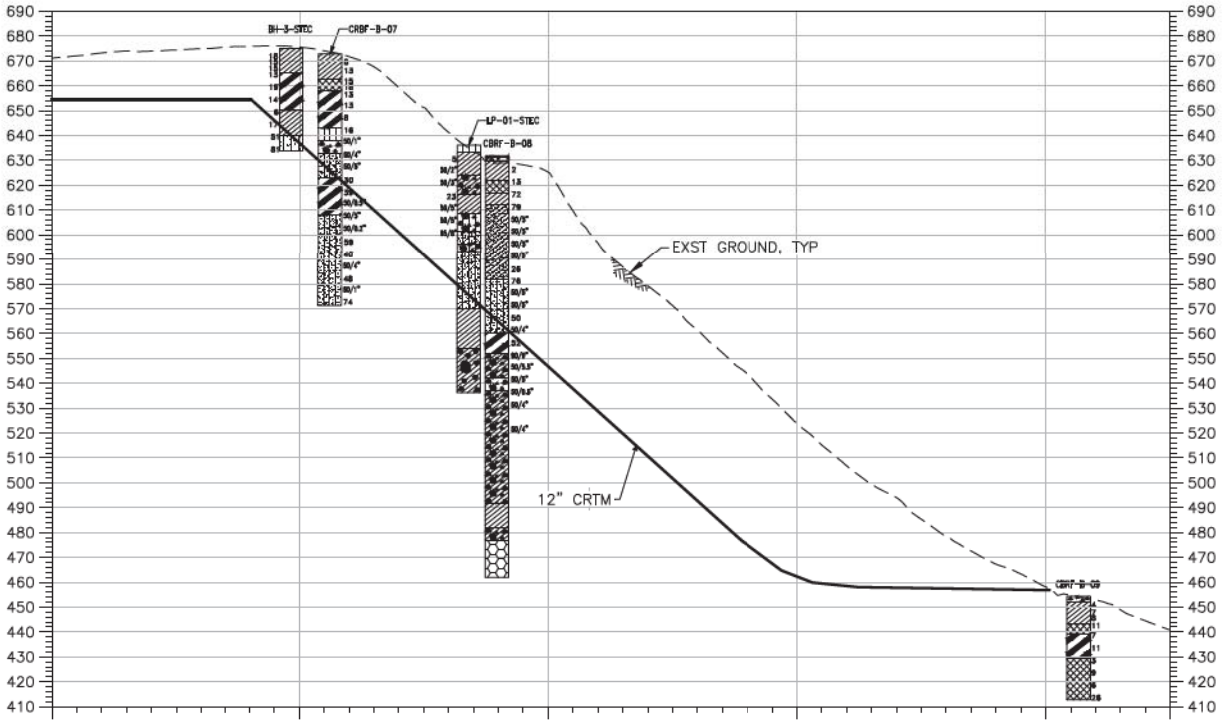

EXPLORATION PLAN AND GEOLOGIC PROFILE
CRTM VICINITY

SCALE: 1"=100' HORIZ
1"=50' VERT
VERTICAL EXAGGERATION=2X

0" 100' 200'

0" 50' 100'

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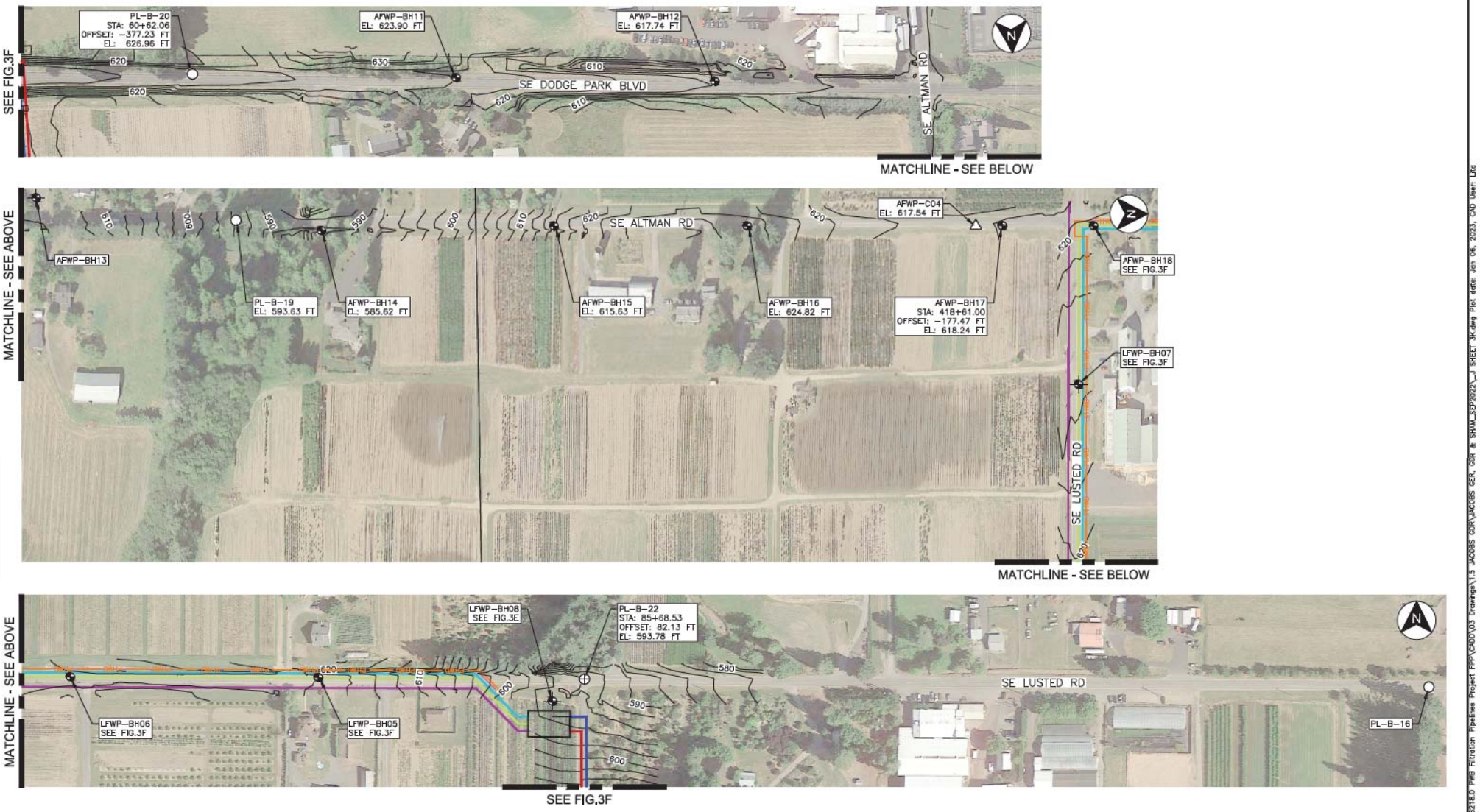
FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE

GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN AND GEOLOGIC PROFILE
CRTM VICINITY

FIG.3J

JAN 2023



EXPLORATION PLAN
ORIGINAL ALTMAN ALIGNMENT BORINGS
SCALE: 1"=200' 0" 200' 400'

Jacobs

PORTLAND WATER BUREAU
FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE
GEOTECHNICAL ENGINEERING REPORT
EXPLORATION PLAN
ORIGINAL ALTMAN ALIGNMENT BORINGS

FIG.3K
JAN 2023

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH01 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661475.87 N, 7740978.86 E)

ELEVATION : 704.91 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Drag Bit, 3-7/8" Drag Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/14/21 09:10 END : 4/14/21 12:11 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
							Ground surface conditions: Farm field, grass, and topsoil. Start drilling with 4-7/8" drag bit.
							Drilling fluid seeps through the grass. Add 6" diameter casing from 0-2 ft.
5	5.0						Clay surrounding drill rod retrieved from boring.
	6.5	1.30	SS-1	2-2-4 (6)		**ELASTIC SILT (MH)** Slightly reddish-brown, moist, firm, medium plasticity, trace black to dark brown spots of fine to coarse sand and fine subangular gravel, trace organics consisting of very fine roots (Residual Soil of the Springwater Formation)	PP = 0.75, 1, 1.25 tsf
10	10.0						
	11.5	1.50	SS-2	3-3-4 (7)		Similar to SS-1 except slightly more reddish-brown.	PP = 0.75, 1.25, 1 tsf WC = 40.6% LL = 53, PL = 31, PI = 22 Silt surrounding drill rod retrieved from boring.
15	15.0						
	16.5	1.50	SS-3	3-5-7 (12)		Similar to SS-1 except reddish-brown, stiff, trace black Mn nodules, no trace organics	PP = 1.5, 1.75, 1 tsf
	18.1	1.60	ST-4			ST-4: 16.5 ft - 18.1 ft	ST-4: 16.5-17 ft: 200 psi 17-17.8 ft: 250 psi 17.8-18.1 ft: 600 psi Recovery in Shelby tube = 2.2 ft
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH01 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661475.87 N, 7740978.86 E)

ELEVATION : 704.91 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Drag Bit, 3-7/8" Drag Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/14/21 09:10 END : 4/14/21 12:11 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-5	4-5-8 (13)		**ELASTIC SILT (MH)** Reddish-brown slightly mottled grayish-brown, moist, stiff, medium plasticity, trace fine to coarse sand, trace fine subangular to subrounded gravel, trace black to dark brown spots of sand and gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2, 2, 1.5 tsf WC = 32.5% LL = 55, PL = 31, PI = 24
	21.5						
25	25.0						
		1.50	SS-6	4-5-10 (15)		**FAT CLAY (CH)** Brown mottled gray to grayish-brown, moist, stiff, medium to high plasticity, trace fine to coarse sand, trace fine subangular gravel, trace black to dark brown pockets of sand and gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.5, 1.5, 1.5 tsf 25 ft: Switch to 3-7/8" drag bit.
	26.5						
							28-30 ft: Driller reported stiffer soil.
30	30.0						
		1.50	SS-7	4-6-8 (14)		**FAT CLAY (CH)** Gray mottled red and brown, moist, stiff, high plasticity, trace fine sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1.25, 1.75, 2.75 tsf WC = 41.5%
	31.5						
35	35.0						
		1.50	SS-8	2-1-2 (3)		**SANDY ELASTIC SILT (MH)** Gray mottled red to brown, gray, reddish-brown, yellowish-green and black, moist, soft, medium plasticity, 31% fine to coarse sand (Sensitive Saprolite of the Springwater Formation)	WC = 64% LL = 66, PL = 48, PI = 18 Fines = 69.2%
	36.5						
							39 ft: Driller reported fine gravel, slight drill rig chatter.
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH01 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661475.87 N, 7740978.86 E)

ELEVATION : 704.91 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Drag Bit, 3-7/8" Drag Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/14/21 09:10 END : 4/14/21 12:11 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40	40.0	1.50	SS-9	3-4-27 (31)		**CLAYEY SAND WITH GRAVEL (SC)** Light gray, moist, dense, fine to coarse sand, ±30% clay, ±15% fine to coarse subangular gravel less than 1.25" in diameter (Less Weathered Springwater Formation)	40 ft: Switch to 3-7/8" tricone bit.
	41.5						
45	45.0	1.20	SS-10	38-24-50/2" (74/8")		**CLAYEY SAND (SC)** Gray with trace greenish-gray and brown parts, moist, very dense, fine to coarse cemented sand, ±15% clay, trace coarse subangular gravel less than 1.5" in diameter, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	Recovery in split-spoon is 1.5 ft. Consists of cemented sand that disintegrates with finger pressure.
	46.2						
50	50.0	0.80	SS-11	45-50/4" (50/4")		**SILTY SAND WITH GRAVEL (SM)** Gray with some brown spots, moist, very dense, fine to coarse cemented sand, ±20% silt, trace clay, ±20% coarse subangular gravel less than 1.5" in diameter, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation) Bottom of Boring at 50.8 ft below ground surface	Consists of cemented sand that disintegrates with finger pressure. Backfilled with: 0-1 ft: Bentonite chips 1-50.8 ft: Bentonite grout
	50.8						
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH02 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661897.57 N, 7740838.79 E)

ELEVATION : 686.83 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 3-7/8" Melt-Tooth Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamme

WATER DEPTH : Not recorded START : 3/1/21 09:31 END : 3/1/21 13:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						6 in: **ASPHALT CONCRETE PAVEMENT**	Start drilling with 4-7/8" tricone bit.
						12 in: **BASE GRAVEL**	
							1.5-10 ft: Cuttings indicate elastic silt, brown, moist.
5	5.0						
	6.5	0.00	SS-1	WOH-WOH-1 (1)		No recovery	5 ft: Switch to 3-7/8" drag bit.
							8-9 ft: Driller reported stiffer soil with trace gravel.
10	10.0						
	11.5	1.50	SS-2	2-5-6 (11)		**ELASTIC SILT (MH)** Brown mottled gray, moist, stiff, medium plasticity, black Mn nodules (Residual Soil of the Springwater Formation)	WC = 33.5% LL = 50, PL = 29, PI = 21
15	15.0						
	16.5	1.50	SS-3	4-7-9 (16)		**FAT CLAY (CH)** Brown mottled gray, moist, very stiff, high plasticity (Residual Soil of the Springwater Formation)	PP = 3, 3, 2.25 tsf 1" zone of Mn nodules and reddish-brown iron oxide staining in the SS shoe. Driller reported that the borehole is collared up due to high plasticity soil.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH02 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661897.57 N, 7740838.79 E)

ELEVATION : 686.83 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 3-7/8" Melt-Tooth Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamme

WATER DEPTH : Not recorded START : 3/1/21 09:31 END : 3/1/21 13:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	2-3-3 (6)		**ELASTIC SILT (MH)** Reddish-brown mottled gray, moist, firm, high plasticity, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation)	PP = 1.25, 2, 0.25 tsf WC = 63.2% LL = 83, PL = 43, PI = 40 1" zone of Mn nodules in the SS shoe. 21.5 ft: Switch to 3-7/8" melt-tooth bit.
	21.5						
25	25.0						
		1.50	SS-5	2-4-7 (11)		**SILTY SAND (SM)** Light brown, wet, medium dense, fine to coarse sand, 12% clay, 27% silt, 9% fine to coarse subangular gravel (Less Weathered Springwater Formation)	Fines = 39%, Sand = 52.3%, Gravel = 8.7%
	26.5						
							28 ft: Driller reported rig clatter, switch to 4-7/8" tricone bit. 28.5 ft: Driller reported rig clatter. 29-29.5 ft: Driller reported harder soil.
30	30.0						
		1.50	SS-6	12-14-21 (35)		Similar to SS-5 except grayish brown, dense, 24.5% fines, 11.7% fine to coarse subangular gravel	WC = 21.7% LL = NP, PL = NP, PI = NP Fines = 24.5%, Sand = 63.8%, Gravel = 11.7%
	31.5						
							32 ft: Driller reported rig clatter.
35	35.0						
		1.50	SS-7	21-25-42 (67)		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, very dense, non plastic, fine to coarse sand, ±40% fines, ±30% fine to coarse subangular gravel (Less Weathered Springwater Formation)	WC = 16.2% LL = 22, PL = NP, PI = NP
	36.5						
							36.5 ft: Driller reported rig clatter.
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH02 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661897.57 N, 7740838.79 E)

ELEVATION : 686.83 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 3-7/8" Melt-Tooth Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamme

WATER DEPTH : Not recorded START : 3/1/21 09:31 END : 3/1/21 13:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0 40.8	0.80	SS-8	19-52/3" (52/3")		**SILTY GRAVEL (GM)** Grayish brown, moist, very dense, ±30% fine to coarse sand, ±40% silt, ±30% fine to coarse subangular gravel (Less Weathered Springwater Formation)	42 ft: Driller reported rig clatter, gravel content increases, stiffer soil to 43.5 ft. 43.5 ft: Driller reported softer soil.
45	45.0						
	46.5	1.50	SS-9	5-7-10 (17)		**LEAN CLAY (CL)** Gray mottled reddish brown, moist, very stiff, medium plasticity, reddish-brown iron oxide staining, occasional Mn nodules (Less Weathered Springwater Formation)	PP = 1, 0.5, 1.25 tsf WC = 34.6% LL = 42, PL = 25, PI = 17
50	50.0						
	51.5	1.50	SS-10	9-12-19 (31)		**SILT WITH SAND (ML)** Gray mottled brown, moist, hard, low plasticity, ±20% fine to coarse sand, trace gravel, reddish-brown iron oxide staining, black Mn nodules (Less Weathered Springwater Formation) Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-1 ft: Asphalt cold patch to match existing conditions and gravel 1-5 ft: Bentonite chips 5-51.5 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH03 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661947.66 N, 7740334.44 E)

ELEVATION : 678.50 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/2/21 09:36 END : 3/2/21 13:40 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						6 in: **ASPHALT CONCRETE PAVEMENT** 12 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit. 0-5 ft: Asphalt and gravel pieces in cuttings.
5	5.0						
	6.5	1.10	SS-1	2-3-4 (7)		**LEAN CLAY (CL)** Brown, moist, firm, medium plasticity, ±5% fine sand, ±5% coarse subangular gravel, black Mn nodules (Residual Soil of the Springwater Formation)	
10	10.0						
	11.5	1.50	SS-2	4-6-8 (14)		Similar to SS-1 except stiff, occasional black Mn nodules	WC = 33% LL = 50, PL = 26, PI = 24 Driller reported stiffer soil after 11.5 ft.
15	15.0						
	16.5	1.50	SS-3	3-6-7 (13)		Similar to SS-2 except reddish-brown iron oxide staining, black Mn nodules	Driller reported borehole collared up with clay layer. Driller reported trace rig chatter for 6" after 16.5 ft PP = 1.25, 1.5, 1.25 tsf
20							Driller reported that he redrilled 0-5 ft of the borehole for progressing, a clay collar had formed at that depth.

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH03 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661947.66 N, 7740334.44 E)

ELEVATION : 678.50 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/2/21 09:36 END : 3/2/21 13:40 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-4	2-4-4 (8)		SS-4A, 20-21 ft: **LEAN CLAY (CL)** Brown mottled gray, moist, firm, medium plasticity, ±5% fine sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	20 ft: switch to 3-7/8" tricone bit. WC = 33.6% LL = 44, PL = 23, PI = 21 PP = 2, 2, 0.75 tsf Driller reported sand and gravel below 22.5 ft
	21.5					SS-4B, 21-21.5 ft: **CLAYEY SAND (SC)** Brown, moist, loose, fine to coarse sand, fine to coarse subangular gravel, ±40% clay, ±10% gravel, reddish-brown iron oxide staining, black Mn nodules (Less Weathered Springwater Formation)	
25	25.0	1.50	SS-5	3-6-6 (12)		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, medium dense, 28% fines, 20% fine to coarse subangular gravel, trace reddish-brown iron oxide staining, black Mn nodules (Less Weathered Springwater Formation)	WC = 51% LL = 40, PL = NP, PI = NP Fines = 27.6%
	26.5						27 ft: Driller reported rig chatter
30	30.0	0.90	SS-6	18-50/5" (50/5")		**SILTY GRAVEL WITH SAND (GM)** Grayish brown, moist, very dense, ±30% fine to coarse sand, ±30% silt, fine to coarse subangular gravel, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
	30.9						31.5 ft: 4-6" of rig chatter
							34 ft: 4-6" of rig chatter
35	35.0	1.40	SS-7	13-50-50/5" (100/11")		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, very dense, ±20.1% fines, 32.6% fine to coarse subangular gravel, trace reddish-brown iron oxide staining, gravel pieces are gray (Less Weathered Springwater Formation)	WC = 15.2% LL = NP, PL = NP, PI = NP Fines = 20.1%, Sand = 47.3%, Gravel = 32.6%
	36.4						Driller reported stiffer soil after 37 ft, difficult drilling Driller reported that soil becomes softer at 39 ft
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH03 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661947.66 N, 7740334.44 E)

ELEVATION : 678.50 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/2/21 09:36 END : 3/2/21 13:40 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0					**CLAYEY SAND WITH GRAVEL(SC)**	
		1.50	SS-8	3-4-6 (10)		Brown, moist, loose, ±15% coarse subangular gravel, ±40% clay, some reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
	41.5						
							42 ft: Driller reported rig chatter
45	45.0						
		1.50	SS-9	14-18-30 (48)		Similar to SS-8 except brown, ±30% coarse to fine subangular gravel, ±20% clay, fine to coarse sand, reddish-brown iron oxide staining, gravel pieces are gray (Less Weathered Springwater Formation)	
	46.5						
							Driller reported softer soil, smooth drilling, after 47 ft
50	50.0						
		1.10	SS-10	4-8-8 (16)		**SANDY SILT (ML)** Light gray, moist, very stiff, medium to high plasticity, 37% fine to coarse sand, trace gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Less Weathered Springwater Formation)	WC = 69.9% Fines = 63.2%
	51.5					Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-1 ft: Asphalt cold patch to match existing conditions and gravel 1-6 ft: bentonite chips 6-51.5 ft: bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH04 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661992.87 N, 7739866.63 E)

ELEVATION : 671.94 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 13:50 END : 4/5/21 10:22 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						6 in: **ASPHALT CONCRETE PAVEMENT**	Start drilling with 4-7/8" tricone bit.
						12 in: **BASE GRAVEL**	
	4.0						
5		1.60	ST-1				ST-1 4-5 ft: 150 psi 5-6 ft: 250 psi 4 ft: Switch to 3-7/8" drag bit. Driller reported loss of circulation at 5 ft (approx 30 gal). Remix.
	6.0					**ELASTIC SILT (MH)** Brown, moist slightly mottled grayish brown, soft, medium plasticity, trace of sand, trace black Mn nodules (Residual Soil of the Springwater Formation)	SS-2 PP = 0, 0, 0 tsf
		0.70	SS-2	WOH-1-2 (3)			
	7.5						
10	10.0						
		1.20	SS-3	3-1-4 (5)		Similar to SS-2 except brown, firm, black Mn nodules	PP = 1.75, 1.75, 1.75 tsf WC = 38.1% LL = 53, PL = 29, PI = 24
	11.5						
15	15.0						
		1.50	SS-4	1-2-2 (4)		**SANDY SILT (ML)** Multicolored red, brown, yellow, reddish brown, grayish brown, moist, soft, 43% fine to coarse sand, 31% silt, 26% clay (Sensitive Saprolite of the Springwater Formation)	WC = 77.1% Fines = 57.5%, Sand = 42.5%, Gravel = 0% Pumaceous sand
	16.5						
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH04 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661992.87 N, 7739866.63 E)

ELEVATION : 671.94 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 13:50 END : 4/5/21 10:22 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-5	2-2-5 (7)		**SILTY SAND (SM)** Gray, moist, loose, fine to coarse sand, ±38.3% fines, 0.7% fine to coarse subrounded to subangular gravel less than 1" in diameter, trace reddish-brown iron oxide staining (Sensitive Saprolite of the Springwater Formation)	Stop at 20 ft on 4/02/21 at 15:16 Start on 4/05/21 at 8:55 WC = 72.2% LL = NP, PL = NP, PI = NP Fines = 38.3%, Sand = 61%, Gravel = 0.7% Possibly pumaceous sand
	21.5						
25	25.0						24 ft: Driller reported fine gravel or cemented sand, slight rig clatter
		1.50	SS-6	2-6-8 (14)		**SILTY SAND WITH GRAVEL (SM)** Gray, moist, medium dense, fine to coarse sand, ±15% silt, ±20% fine to coarse subrounded to subangular gravel less than 1.75" in diameter, trace reddish-brown iron oxide staining, trace clay (Less Weathered Springwater Formation)	Pumaceous sand WC = 63.2% LL = 46, PL = NP, PI = NP Driller reported slightly stiffer layer 26.5-27.5 ft
	26.5						
30	30.0						
	30.9	0.90	SS-7	23-50/5" (50/5")		**CLAYEY SAND WITH GRAVEL (SC)** Gray to brown, moist, very dense, fine to coarse cemented sand, 25.8% fines, 21.9% fine to coarse subrounded gravel less than 1" diameter, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	WC = 22.5% LL = 31, PL = 23, PI = 8 Fines = 25.8%, Sand = 52.3%, Gravel = 21.9% Recovery in SS is 1 ft. Cemented sand, disintegrates with finger pressure.
35	35.0						34 ft: Switch to 3-7/8" tricone bit because soil is stiff
	36.5	1.10	SS-8	34-32-22 (54)		**CLAYEY SAND (SC)** Reddish brown to yellowish brown to dark gray, moist, very dense, fine to coarse cemented sand, ±20% fines, ±5% fine to coarse subrounded to subangular gravel less than 1.25" in diameter, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	WC = 26% LL = 36, PL = 23, PI = 13 Cemented sand, disintegrates with finger pressure.
40							Driller reported soft soil layer, smooth drilling, at 39-40 ft.

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH04 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (661992.87 N, 7739866.63 E)

ELEVATION : 671.94 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 13:50 END : 4/5/21 10:22 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
	1.50		SS-9	11-19-31 (50)		**SILT (ML)** Gray with some greenish brown stains, moist, hard, medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	PP = 4.25, 2.75, 4.25 tsf WC = 31.7% LL = 49, PL = 30, PI = 19
41.5							
45							Driller reported increase in amount of sand, mixture of sand and clay from 44-45 ft.
							Driller reported cemented sand at 48 ft.
50	50.0						
	1.50		SS-10	17-24-74 (98)		**SILTY SAND (SM)** Grayish brown to yellowish brown, fine to coarse cemented sand, moist, very dense, ±15% silt, trace clay, ±10% fine to coarse subangular gravel less than 1.5" diameter (Less Weathered Springwater Formation)	Cemented sand, disintegrates with finger pressure.
51.5						Bottom of Boring at 51.5 ft below ground surface	Bottom of borehole at 10:22 Backfilled with: 0-0.5 ft: asphalt 0.5-1 ft: gravel 1-5 ft: bentonite chips 5-51.5 ft: bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH05 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662042.89 N, 7739342.76 E)

ELEVATION : 666.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/17/21 12:10 END : 3/17/21 14:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						6 in: **ASPHALT CONCRETE PAVEMENT** 8 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
							Driller reported that the borehole has a clay collar from 1.5-5 ft, driller will redrill that section of the borehole.
5	5.0						
	6.5	1.50	SS-1	3-7-9 (16)		**LEAN CLAY WITH SAND (CL)** Reddish brown, moist, very stiff, medium plasticity, ±15% fine sand, trace reddish-brown iron oxide staining, black Mn nodules, trace fine to coarse subangular gravel (Residual Soil of the Springwater Formation)	PP = 1.75, 2, 1.5 tsf
10	10.0						
	11.5	1.50	SS-2	4-5-6 (11)		**FAT CLAY (CH)** Reddish brown mottled red, moist, stiff, medium plasticity, trace fine sand, trace reddish-brown iron oxide staining, black Mn nodules, trace fine subangular gravel (Residual Soil of the Springwater Formation)	10 ft: Switch to 4-7/8" drag bit at 10 ft PP = 2.5, 1.75, 1.75 tsf WC = 33.5% LL = 61, PL = 31, PI = 30
							Driller reported rig chatter from 12.5-13 ft Driller reported stiffer soil after 12.5 ft
15	15.0						
	16.5	1.50	SS-3	2-2-3 (5)		**LEAN CLAY (CL)** Brown mottled red, moist, firm, medium to high plasticity, trace fine sand, trace reddish-brown iron oxide staining, black Mn nodules, trace fine to coarse subangular gravel (Residual Soil of the Springwater Formation)	PP = 0, 0.25, 0.5 tsf
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH05 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662042.89 N, 7739342.76 E)

ELEVATION : 666.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/17/21 12:10 END : 3/17/21 14:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					**LEAN CLAY (CL)** Brown mottled gray, moist, soft, medium to high plasticity, ±5% fine to coarse sand, trace fine to coarse subangular gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)	
		1.40	SS-4	2-2-2 (4)			
	21.5						PP = 0, 0.25, 1.25 tsf Driller reported increase in sand after 22 ft
25	25.0						
		1.50	SS-5	1-1-2 (3)		SS-5A, 25-25.8 ft: **ELASTIC SILT WITH SAND (MH)** Brown, moist, soft, medium plasticity, ±15% fine to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, black Mn nodules, possibly pumaceous sand (Sensitive Saprolit	WC = 67.6% LL = 69, PL = 45, PI = 24
	26.5					SS-5B, 25.8-26.5 ft: **LEAN CLAY (CL)** Brown, moist, soft, medium to high plasticity, trace fine sand, trace reddish-brown iron oxide staining, black Mn nodules, trace fine subangular gravel (Sensitive Saprolite of the Springwater Formation)	
30	30.0						
		1.50	SS-6	1-2-2 (4)		Similar to SS-5B except trace fine subrounded gravel	PP = 0.25, 0, 0 tsf
	31.5						
35	35.0						
		1.50	SS-7	2-3-3 (6)		**SANDY ELASTIC SILT (MH)** Brown occasionally grayish, moist, loose, medium plasticity, 42.5% fine to coarse sand, trace reddish-brown iron oxide staining, possibly pumaceous sand (Sensitive Saprolite of the Springwater Formation)	WC = 71.1% LL = 61, PL = 37, PI = 24 Fines = 57.5%, Sand = 42.5%, Gravel = 0%
	36.5						36.5-37.5 ft: Driller reported denser sand, drill rig chatter
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH05 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662042.89 N, 7739342.76 E)

ELEVATION : 666.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/17/21 12:10 END : 3/17/21 14:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
	1.50		SS-8	1-1-2 (3)		**SANDY SILT (ML)** Gray golden brown and dark brown, moist, soft, 30% fine to coarse sand, ±5% fine to coarse subrounded to subangular gravel, trace reddish-brown iron oxide staining, possibly pumaceous sand (Sensitive Saprolite of the Springwater	WC = 79.5% Fines = 65.1%
41.5							41-42 ft: Driller reported denser sand
45 45.0							
	1.50		SS-9	2-2-8 (10)		Similar to SS-8 except loose, one 1.5" diameter gravel piece, trace golden brown and trace dark brown, grayish brown	
46.5							47-49 ft: Driller reported stiffer soil
50 50.0							49 ft: Driller reported gravel, drill rig chatter
	1.50		SS-10	3-7-20 (27)		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, medium dense, fine to coarse sand, 36.5% fines, trace clay, ±15% fine to coarse subrounded or subangular gravel (Less Weathered Springwater Formation)	WC = 55.7% LL = 50, PL = 37, PI = 13 Fines = 36.5%
51.5						Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: asphalt, cold patch to match existing conditions 0.5-1 ft: gravel 1-4 ft: bentonite chips 4-51.5 ft: bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH06 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662094.00 N, 7738825.18 E)

ELEVATION : 660.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/3/21 09:38 END : 3/3/21 14:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						6 in: **ASPHALT CONCRETE PAVEMENT**	Start drilling with 4-7/8" tricone bit. Rig chatter when drilling through base gravel.
						12 in: **BASE GRAVEL**	
	2.5						Driller reported soft soil starting at 16-18" bgs
		0.60	SS-1	3-2-4 (6)		**FAT CLAY (CH)** Brown, moist, firm, medium to high plasticity, ±5% fine to coarse subangular gravel, ±5% sand, black Mn nodules (Residual Soil of the Springwater Formation)	SS-1 bottom 2" fat clay (CH) without gravel
	4.0						
5		1.10	ST-1				ST-1 4-5 ft: 150 psi 5-6 ft: 200 psi Driller reported smooth ST sampling, no stops or drill rig clatter
	6.0						
		0.30	SS-2	2-2-3 (5)		Similar to SS-1	
	7.5						
10	10.0						
		1.10	SS-3	2-2-3 (5)		**SILT (ML)** Brown, moist, firm, medium plasticity, ±10% fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.75, 0.5, 0.25 tsf WC = 39.3% LL = 45, PL = 30, PI = 15 10 ft: Switch to 3-7/8" tricone bit
	11.5						
15	15.0						
		0.60	SS-4	4-6-7 (13)		Similar to SS-3 except stiff and no iron staining	
	16.5						17 ft: Driller reported drill rig chatter and stiffer soil for 3-4"
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH06 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662094.00 N, 7738825.18 E)

ELEVATION : 660.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/3/21 09:38 END : 3/3/21 14:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	0.90	SS-5	6-50-50/1" (100/7")		**LEAN CLAY WITH SAND (CL)** Brown, moist, mottled gray, hard, medium to high plasticity, ±20% fine to coarse sand, trace fine to coarse subangular gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	SS-5: last 0.6" and shoe contains disintegrated, black, possibly basalt gravel
	20.9						
							Driller reported harder soil, drill rig chatter from 20-22 ft, softer soil after 22 ft.
25	25.0						
		1.50	SS-6	1-1-1 (2)		**LEAN CLAY WITH SAND (CL)** Brown, moist, soft, medium plasticity, ±40% fine to coarse sand, trace fine to coarse subangular gravel, reddish-brown iron oxide staining, trace black Mn stains/nodules (Sensitive Saprolite of the Springwater Formation)	
	26.5						
		0.50	ST-2				ST-2 26.5-27.5 ft: 150 psi 27.5-28.5 ft: 200 psi 27.5 ft: Driller reported 2-3" of gravel.
	28.5						
		1.50	SS-7	WOH-WOH-1 (1)		**ELASTIC SILT WITH SAND (MH)** Brown, moist, very soft, medium plasticity, ±40% fine to coarse sand, trace small fine to coarse angular to subangular gravel, pebbles, reddish-brown iron oxide staining, black deposit Mn nodules (Sensitive Saprolite of the Springwater Formation) SS-8: Similar to SS-7 except trace black Mn nodules, and soft consistency	WC = 86.3% LL = 65, PL = 46, PI = 19
30	30.0						
		0.90	SS-8	WOH-WOH-2 (2)			
	31.5						
35	35.0						
		1.50	SS-9	WOH-2-5 (7)		**SANDY LEAN CLAY (CL)** Brown, moist, firm, ±35% fine to coarse sand, ±5% fine to coarse subangular to angular gravel, some reddish-brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation)	Pumaceous sand.
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH06 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662094.00 N, 7738825.18 E)

ELEVATION : 660.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/3/21 09:38 END : 3/3/21 14:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-10	WOH-1-2 (3)		Similar to SS-9 except soft, and no black Mn nodules, contains about 3" of pumaceous sand/breccia also possible	WC = 79.7% Fines = 60%
	41.5						
45	45.0	1.50	SS-11	1-1-2 (3)		**SANDY SILT (ML)** Grayish brown, yellow, moist, very loose, ±40-50% sand, ±20% clay, ±5% fine to coarse angular to subangular gravel, 2" layer of sand, trace reddish-brown iron oxide staining (Sensitive Saprolite of the Springwater Formation)	Pumaceous sand.
	46.5						
50	50.0	1.50	SS-12	1-1-3 (4)		**SANDY SILT (ML)** Grayish brown with trace red and yellow parts, moist, soft, ±37% sand, ±5% fine subangular gravel, pumaceous sand (Sensitive Saprolite of the Springwater Formation)	WC = 77.4% Fines = 58%
	51.5					Bottom of Boring at 51.5 ft below ground surface	Bottom of borehole at 14:00 Backfilled with: 0-1 ft: Gravel and asphalt patch 1-5 ft: Bentonite chips 5-51.5 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH07 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662138.99 N, 7738370.19 E)

ELEVATION : 659.24 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 28.3 to 40 feet bgs START : 3/4/21 09:12 END : 3/4/21 14:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						7 in: **ASPHALT CONCRETE PAVEMENT**	Make provision for piezometer monument: Core asphalt and base gravel with 14" core bit. Remove base gravel to approximately 0.8 ft below ground surface. Backfill with 3/8" bentonite chips, set the mud tub, drill the boring off-center to the cylinder drilled for the piezometer monumnet to accomodate future installation of a VWP data logger. Driller reported that the base gravel is 3-4" in size, higher rig clatter. Advance borehole with 4-7/8" tricone bit.
						11 in: **BASE GRAVEL**	
5	5.0						
	6.5	1.10	SS-1	2-3-3 (6)		**ELASTIC SILT (MH)** Brown, moist, firm, ±5% fine sand, medium plasticity, trace fine subangular gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	Top 1" consisted of fine to coarse angular to subangular gravel with ±10% clay, loose WC = 40.8% LL = 53, PL = 33, PI = 20
10	10.0						
	11.5	1.50	SS-2	3-4-6 (10)		**LEAN CLAY (CL)** Slightly reddish brown, moist, stiff, medium plasticity, ±10% fine to coarse sand, ±5% fine subangular gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	
	13.0						
	14.2	1.20	ST-3				ST-3 13-13.5 ft = 200 psi 13.5-14.2 ft = 600 psi to 750 psi Driller reported that he stopped advancing ST-3 at 14" because very firm layer (possibly gravel) was encountered and further advancement might damage/bend ST.
15	15.7	1.50	SS-4	4-6-8 (14)		**ELASTIC SILT (MH)** Brown and slightly reddish, moist, stiff, medium plasticity, ±5% fine sand, ±5% fine subangular gravel, black Mn nodules, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	Driller reported he is cleaning out borehole of all the clay and elastic silt to keep the borehole clean and enable quick piezometer installation, the high plasticity soil is thickening the drilling fluid.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH07 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662138.99 N, 7738370.19 E)

ELEVATION : 659.24 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 28.3 to 40 feet bgs START : 3/4/21 09:12 END : 3/4/21 14:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					Similar to SS-4	PP = 0.75, 1.25, 1.75 tsf Difficult to open SS WC = 32.4% LL = 51, PL = 30, PI = 21 Fines = 91.5%
		1.50	SS-5	4-6-7 (13)			
	21.5						
25	25.0						
		1.50	SS-6	3-4-5 (9)		**FAT CLAY (CH)** Brown mottled gray, moist, stiff, medium to high plasticity, ±5% fine sand, ±5% fine black subangular gravel, reddish-brown iron oxide staining, black Mn nodules, brownish yellow spots/stains (Residual Soil of the Springwater Formation)	
	26.5						
30	30.0						
		1.30	SS-7	2-5-6 (11)		**FAT CLAY (CH)** Gray mottled yellowish brown and red, moist, stiff, ±5% fine to coarse sand, ±5% fine subangular gravel, high plasticity, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1.5, 1, 2 tsf Clay layer outside SS.
	31.5						
35	35.0						
		1.50	SS-8	2-2-5 (7)		**FAT CLAY (CH)** Gray mottled red, moist, firm, ±5% fine to coarse sand, trace fine subangular gravel, high plasticity, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.25, 0.25, 0.5 tsf WC = 45.7% LL = 77, PL = 27, PI = 50 Driller reported that he is redrilling the top 5 ft of the borehole where the high plasticity soil has accumulated
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH07 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662138.99 N, 7738370.19 E)

ELEVATION : 659.24 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 28.3 to 40 feet bgs START : 3/4/21 09:12 END : 3/4/21 14:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-9	4-5-6 (11)		**FAT CLAY (CH)** Gray mottled yellowish brown, moist, stiff, ±5% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 0.75, 0.75 tsf
	41.5						
45	45.0	1.50	SS-10	2-2-7 (9)		**SANDY LEAN CLAY (CL)** Light gray and gray-green, moist, stiff, ±44% fine to coarse sand, ±5% fine to coarse angular gravel, reddish-brown iron oxide staining, some white and yellow spots (Sensitive Saprolite of the Springwater Formation)	Pumaceous sand WC = 63.1% Fines = 50.9%
	46.5						
50	50.0	1.50	SS-11	3-9-22 (31)		SS-11A, 50-50.2 ft: Similar to SS-10 SS-11B. 50.2-51.5 ft: **CLAYEY SAND WITH GRAVEL(SC)** Gray, moist, dense, ±30% coarse angular gravel, fine to coarse sand possibly pumaceous, ±15% clay, trace reddish brown iron stains (Less Weathered Springwater Formation)	
	51.5					Bottom of Boring at 51.5 ft below ground surface Geokon VWP 4500S (350 kPa), unvented, serial no. 2111125 Geokon datalogger 8002-WP-2 LC-2, serial no. 2128641	Inststalled VWP in 2" PVC standpipe piezometer. Standpipe piezometer installed immediately after drilling. VWP installed on 06/24/2021. 0-1 ft: 12" diameter, 12" deep monument set in concrete, black dye added to concrete to match existing conditions 1-38 ft: Bentonite chips 38-50 ft: Sand 40-50 ft: Screen Start Card # 1050981 Well # L139118 Base of VWP is at 48.3 ft below ground surface. Field VWP Ro (1) 9052.193 (2) 9052.604 (3) 9052.259 (4) 9052.993 Average Ro = 9052.512
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH08 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662184.87 N, 7737863.29 E)

ELEVATION : 654.41 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/5/21 09:40 END : 3/5/21 12:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						6 in: **ASPHALT CONCRETE PAVEMENT**	Start drilling with 4-7/8" tricone bit.
						6 in: **BASE GRAVEL**	Rig chatter at base gravel layer.
							Smooth after 1 ft. Cuttings after 1 ft have sand.
5	5.0						
		1.50	SS-1	2-3-5 (8)		SS-1A, 5-5.3 ft: **CLAYEY GRAVEL (GC)** Wet, loose, ±20% clay, ±5% fine sand, fine subangular to angular gravel (Residual Soil of the Springwater Formation)	5 ft: Switch to 3-7/8" drag bit WC = 38.2% LL = 48, PL = 28, PI = 20
	6.5					SS-1B, 5.3-6.5 ft **SILT (ML)** Brown, moist, firm, ±5% fine sand, medium plasticity, trace fine subangular to subrounded gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	
	8.0						
		1.60	ST-2				ST-2 8-9 ft = 250 psi 9-9.2 ft = 500 psi 9.2-9.58 ft = 700 psi Recovery in Shelby tube = 2.3 ft
	9.6						
10						SS-3A, 9.6-10.1 ft: **CLAYEY GRAVEL (GC)** Black, moist, medium dense, ±20% clay, clay brown, subangular gravel, fine trace coarse subrounded gravel, ±5% fine sand (Residual Soil of the Springwater Formation)	WC = 33.2% LL = 46, PL = 31, PI = 15 su = 1800 psf
		1.50	SS-3	4-6-7 (13)			
	11.1					SS-3B, 10.1-11.1 ft: Similar to SS-1B except stiff	
15	15.0						
		1.50	SS-4	4-7-8 (15)		**FAT CLAY (CH)** Brown and reddish brown, moist, stiff, ±5% fine sand, medium to high plasticity, trace subangular fine gravel, black Mn nodules (Residual Soil of the Springwater Formation)	
	16.5						
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH08 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662184.87 N, 7737863.29 E)

ELEVATION : 654.41 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/5/21 09:40 END : 3/5/21 12:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-5	3-4-5 (9)		**LEAN CLAY (CL)** Brown mottled gray, moist, stiff, medium plasticity, 13% fine sand, trace subrounded coarse gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.25, 1.5, 2 tsf WC = 36.6% LL = 43, PL = 21, PI = 22 Fines = 86.9%
	21.5						
	23.0	1.90	ST-6				ST-6 recovery was 2.3 ft 23-24 ft: 150-200 psi 24-24.9 ft = 500-700 psi 25 ft: Driller reported slightly stiffer soil.
25	24.9	1.50	SS-7	5-6-10 (16)		Similar to SS-5 except very stiff, ±5 fine sand	PP = 1.5, 2, 2 tsf
	26.4						
30	30.0	1.10	SS-8	2-4-6 (10)		**CLAYEY SAND (SC)** Brown, moist, loose, ±30% clay, trace reddish-brown iron oxide staining, trace Mn nodules, fine to coarse sand (Residual Soil of the Springwater Formation)	
	31.5						
35	35.0	1.50	SS-9	1-1-1 (2)		**SANDY LEAN CLAY (CL)** Grayish brown, moist, soft, 33% sand, 33% silt, trace reddish-brown iron oxide staining, black Mn nodules, fine to coarse sand (Sensitive Saprolite of the Springwater Formation)	WC = 84.6% Fines = 67.2%, Sand = 32.8%, Gravel = 0%
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH08 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662184.87 N, 7737863.29 E)

ELEVATION : 654.41 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/5/21 09:40 END : 3/5/21 12:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-10	1-4-4 (8)		**FAT CLAY (CH)** Gray, moist, firm, high plasticity, trace fine sand, reddish-brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation)	PP = 0.75, 0, 0.5 tsf Driller reported gray high plasticity soil.
	41.5						
45	45.0	1.50	SS-11	3-6-5 (11)		SS-11A, 45-45.6 ft: Similar to SS-10 except gray mottled slightly red and stiff SS-11B, 45.6-46.5 ft: **ELASTIC SILT WITH SAND (MH)** Gray, moist, stiff, medium to high plasticity, ±15% fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation)	
	46.5						
50	50.0	1.50	SS-12	1-1-5 (6)		**ELASTIC SILT WITH SAND (MH)** Gray, moist, firm, medium plasticity, ±20% fine to coarse sand, ±5% fine to coarse subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation)	WC = 73% LL = 62, PL = 45, PI = 17
	51.5					Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-2 ft: Bentonite chips 2-51.5 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH09 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662259.59 N, 7737095.12 E)

ELEVATION : 640.57 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/5/21 14:50 END : 3/8/21 12:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						7 in: **ASPHALT CONCRETE PAVEMENT**	Start drilling with 4-7/8" tricone bit.
						5 in: **BASE GRAVEL**	
5	5.0						
	6.5	0.20	SS-1	2-2-1 (3)		**FAT CLAY (CH)** Brown, moist, soft, medium to high plasticity, ±5% fine sand, coarse subrounded gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	5 ft: Switch to 3-7/8" drag bit.
10	10.0						
	11.5	1.00	SS-2	WOH-1-2 (3)		**LEAN CLAY (CL)** Brown, moist, soft, ±5% sand, trace subangular fine to coarse gravel, medium plasticity, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	WC = 37.4% LL = 49, PL = 26, PI = 23
15	15.0						
	16.5	1.50	SS-3	2-5-6 (11)		**FAT CLAY (CH)** Reddish brown, moist, stiff, ±5% fine sand, medium to high plasticity, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.75, 1.5, 1.75 tsf Driller reported loss of drilling fluid
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH09 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662259.59 N, 7737095.12 E)

ELEVATION : 640.57 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/5/21 14:50 END : 3/8/21 12:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	2-5-6 (11)		**FAT CLAY (CH)** Top 1" gray, then brown mottled gray, moist, stiff, ±5% fine sand, high plasticity, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	WC = 40.2% LL = 60, PL = 26, PI = 34
	21.5						Stop at 21.5 ft on 3/5/21 16:10 add 2x2 ft road plate over borehole which 15 ft (5 ft attached to plate 10 drill rod) Start on 3/8/21 at 9:15
25	25.0						
		1.50	SS-5	2-4-5 (9)		**FAT CLAY (CH)** Gray mottled brown, moist, stiff, trace fine sand, medium to high plasticity, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1, 1.5, 0.75 tsf SS coated with clay, drill bit plugged
	26.5						Pump fixed, restart drilling. Driller reported he is using a "clay breaker" mixed with the drilling fluid to help progress the borehole in the high plasticity clay.
30	30.0						
		1.50	SS-6	1-1-0 (1)		**ELASTIC SILT WITH SAND (MH)** Brown with occasional 1" white parts, moist, very soft, medium plasticity, 22% fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation)	WC = 77.4% LL = 68, PL = 44, PI = 24 Fines = 77.8% Pumaceous sand Driller using circulation from 6-15 ft, using easy mud, driller thinks it is ok to proceed without casing.
	31.5						
35	35.0						
		1.50	SS-7	1-1-3 (4)		**ELASTIC SILT WITH SAND (MH)** Grayish brown with few pink and white parts, moist, soft, ±35% fine to coarse sand, low to medium plasticity, trace reddish-brown iron oxide staining, black Mn nodules, trace subrounded fine to coarse gravel (Sensitive Saprolite of the Springwater Formation)	Pumaceous sand
	36.5						37.5-39 ft: Driller reported high plasticity soil layer.
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH09 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662259.59 N, 7737095.12 E)

ELEVATION : 640.57 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/5/21 14:50 END : 3/8/21 12:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-8	4-9-12 (21)		**FAT CLAY (CH)** Gray mottled brown, moist, very stiff, medium plasticity, trace fine sand, reddish-brown iron oxide staining, black Mn nodules (Less Weathered Springwater Formation)	PP = 2.5, 2.5, 2.75 tsf
	41.5						
45	45.0	1.20	SS-9	10-25-34 (59)		**SANDY ELASTIC SILT (MH)** Brown-gray, moist, very dense, slight plasticity, 38.3 % sand, 2.3% subangular fine to coarse gravel, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	WC = 38.9% LL = 50, PL = 36, PI = 14 Fines = 59.4%, Sand = 38.3%, Gravel = 2.3% Gravel pieces in shoe with sand and clay 46.5-47.5 ft: Driller reported softer soil. Likely gravel, sand, silt, and clay interbeds. Possibly pumaceous sand
	46.5						
50	50.0	1.00	SS-10	20-31-50/3" (81/9")		**CLAYEY SAND WITH GRAVEL (SC)** Brownish gray, moist, very dense, ±20% fine to coarse subrounded to subangular gravel, ±15% clay, trace reddish-brown iron oxide staining, possibly pumaceous sand (Less Weathered Springwater Formation) Bottom of Boring at 51.25 ft below ground surface	
	51.0						Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-50 ft: Bentonite chips Driller reported that due to loss of circulation during drilling, bentonite grout was not used to backfill the boring.
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH10 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662318.90 N, 7736475.09 E)

ELEVATION : 630.78 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/8/21 14:55 END : 3/9/21 14:08 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0						7 in: **ASPHALT CONCRETE PAVEMENT**	Start drilling with 4-7/8" tricone bit.
						5 in: **BASE GRAVEL**	1-4 ft: Driller reported clayey and silty soil with some gravel
	4.0						Driller reported lost of circulation from 3-3.5 ft (approx 35 gal)
5		1.60	ST-1				ST-1 4-6 ft = 150 psi constant
	6.0						
		0.40	SS-2	2-2-3 (5)		**FAT CLAY (CH)** Reddish brown, moist, firm, ±5% fine to coarse sand, trace subrounded gravel, trace reddish-brown iron oxide staining, medium to high plasticity, black Mn nodules (Residual Soil of the Springwater Formation)	
	7.5						Stop on 3/8/21 at 15:25 at 7.5 ft Start on 3/9/21 at 10:15 with 3-7/8" drag bit
10	10.0						
		0.70	SS-3	1-1-1 (2)		**LEAN CLAY (CL)** Reddish brown, moist, soft, medium plasticity, 9% fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	WC = 39.4% LL = 47, PL = 26, PI = 21 Fines = 91.3%
	11.5						
15	15.0						
		1.10	SS-4	1-2-3 (5)		**FAT CLAY (CH)** Gray mottled brownish green, moist, firm, trace of sand, medium to high plasticity, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0.25, 0.5, 1.25 tsf
	16.5						
	18.0						
		2.00	ST-5				ST-5 recovery 2.1 ft, driller reported soil cuttings from SS-4 present on the top of ST-5 18-19 ft: 150 psi 19-19.5 ft: 400 psi 19.5-20 ft: 500 psi
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH10 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662318.90 N, 7736475.09 E)

ELEVATION : 630.78 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/8/21 14:55 END : 3/9/21 14:08 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.10	SS-6	2-5-6 (11)		**FAT CLAY (CH)** Gray mottled red, moist, stiff, high plasticity, ±5% fine to coarse sand, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.5, 2, 2 tsf Driller reported loss of circulation about 380 gal, borehole collapsed due to clay, redrilling borehole WC = 41.3% LL = 70, PL = 23, PI = 47
	21.5						
25	25.0						
		1.50	SS-7	4-6-9 (15)		**LEAN CLAY (CL)** Gray, moist, stiff, medium plasticity, ±5% fine to coarse sand, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.25, 4.25, 3.5 tsf Loss of circulation, driller adding water and bentonite to mud tub, driller uncertain about where the loss is occuring, but estimates it to be from 1-10 ft bgs.
	26.5						
30	30.0						
		1.50	SS-8	3-4-4 (8)		Similar to SS-7 except firm	PP = 1.25, 1.75, 1.5 tsf
	31.5						
35	35.0						
		0.60	SS-9	1-2-3 (5)		Similar to SS-7 except firm	WC = 32.9% LL = 46, PL = 19, PI = 27
	36.5						
40							Driller redrilling borehole due to formation of clay collar.

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH10 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662318.90 N, 7736475.09 E)

ELEVATION : 630.78 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/8/21 14:55 END : 3/9/21 14:08 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
	40.0 – 41.5	1.50	SS-10	3-6-13 (19)		**SANDY LEAN CLAY (CL)** Gray green with brown, very stiff, low to medium plasticity, ±40% fine to coarse sand, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	PP = 2.25, 1.5, 1.75 tsf Bottom 2" has clayey sand. Driller reported loss of drilling fluid after about 40 ft.
41.5							
							43.5 ft: Driller reported trace gravel.
45							
45.0							
	45.0 – 45.7	0.70	SS-11	17-50/4" (50/4")		**SILTY SAND WITH GRAVEL (SM)** Gray green and gray, moist, very dense, ±15% fine to coarse subrounded to subangular gravel, ±20% silt, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
45.7							47.5-49 ft: Driller reported stiffer soil, rig clatter, softer soil after 49 ft.
50							
50.0							
50.2	50.2 – 50.3	0.20	SS-12	50/4" (50/4")		Similar to SS-11 except ±40% gravel, ±15% silt Bottom of Boring at 50.3 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 1-6 ft: Gravel 6-50.1 ft: Bentonite chips Driller reported that due to loss of circulation during drilling, bentonite grout was not used to backfill the boring.
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH11 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662429.72 N, 7735336.77 E)

ELEVATION : 624.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/15/21 09:20 END : 3/15/21 13:38 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						7 in: **ASPHALT CONCRETE PAVEMENT**	Start drilling with 4-7/8" tricone bit.
						5 in: **BASE GRAVEL**	
5	5.0						
	6.5	1.40	SS-1	3-4-5 (9)		**LEAN CLAY (CL)** Reddish brown, moist, stiff, trace fine to coarse sand, medium plasticity, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.25, 1.5, 2 tsf WC = 35.6% LL = 48, PL = 27, PI = 21 5 ft: Switch to 4-7/8" drag bit Driller reported that the borehole is collared from 0-5 ft due to clay, borehole redrilled to remove collar.
10	10.0						
	11.5	0.70	SS-2	7-7-9 (16)		Similar to SS-1 except very stiff	
15	15.0						
	16.5	1.50	SS-3	4-7-8 (15)		**LEAN CLAY (CL)** Brown mottled gray, moist, stiff, medium plasticity, 11% fine to coarse sand, trace subrounded to subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.5, 2.25, 2 tsf WC = 31.9% LL = 44, PL = 25, PI = 19 Fines = 89.3% 17.5 ft: Driller reported trace gravel.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH11 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662429.72 N, 7735336.77 E)

ELEVATION : 624.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/15/21 09:20 END : 3/15/21 13:38 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.40	SS-4	5-6-8 (14)		**FAT CLAY (CH)** Brown mottled gray, moist, stiff, medium plasticity, ±10% fine to coarse sand, trace fine to coarse subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.25, 2.5, 2 tsf WC = 33.1% LL = 51, PL = 25, PI = 26
	21.5						
							Driller reported he had to redrill borehole at 22.5-28 ft because of clay moving into/adhering to sides of borehole. Clay surrounding the drill rod.
25	25.0						
		1.50	SS-5	4-7-9 (16)		Similar to SS-4 except very stiff, ±5% fine to coarse sand, trace fine subangular gravel	PP = 2.75, 2.75, 2 tsf 10:40 clay collar comes up around the drill rod
	26.5						
30	30.0						
		1.50	SS-6	5-9-12 (21)		Similar to SS-5	PP = 3.25, 4, 3 tsf
	31.5						
35	35.0						
		1.50	SS-7	2-4-6 (10)		**FAT CLAY WITH SAND (CH)** Brown mottled gray, moist, stiff, medium plasticity, ±15% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	Pumaceous sand.
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH11 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662429.72 N, 7735336.77 E)

ELEVATION : 624.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/15/21 09:20 END : 3/15/21 13:38 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.30	SS-8	5-10-15 (25)		**FAT CLAY (CH)** Gray mottled greenish-brown, moist, very stiff, medium to high plasticity, trace fine sand, reddish-brown iron oxide staining, track black Mn nodules (Residual Soil of the Springwater Formation)	
	41.5						
45	45.0	1.30	SS-9	5-8-10 (18)		**FAT CLAY WITH SAND (CH)** Brownish gray mottled brown, moist, very stiff, medium to high plasticity, ±30% fine to coarse sand, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1, 2.25, 2 tsf
	46.5						
50	50.0	1.50	SS-10	3-2-2 (4)		**SANDY SILT (ML)** Grayish brown with trace yellow parts, moist, very loose, 31% fine to coarse sand, 27% clay, reddish-brown iron oxide staining (Sensitive Saprolite of the Springwater Formation)	Top 2" of SS-10 similar to SS-9 WC = 61.4% Fines = 68.9%, Sand = 31.1%, Gravel = 0%
	51.5					Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-4 ft: Bentonite chips 4-50 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH12 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662484.58 N, 7734774.18 E)

ELEVATION : 618.04 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 08:45 END : 4/2/21 11:16 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						7 in: **ASPHALT CONCRETE PAVEMENT** 17 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
5	5.0						
	6.5	1.10	SS-1	WOH-1-1 (2)		**LEAN CLAY WITH SAND (CL)** Brown, moist, soft, medium plasticity, ±15% fine to coarse sand, trace fine subangular to subrounded gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0, 0, 0 tsf 5 ft: Switch to 3-7/8" drag bit. WC = 39.1% LL = 41, PL = 23, PI = 18
10	10.0						
	11.5	1.50	SS-2	2-4-4 (8)		**LEAN CLAY (CL)** Brown slightly mottled grayish brown, moist, firm, medium to high plasticity, trace fine to coarse sand, trace fine subrounded gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.75, 1, 0.75 tsf
15	15.0						
	16.5	1.50	SS-3	3-5-6 (11)		**LEAN CLAY (CL)** Gray mottled brown, moist, stiff, medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.5, 1.75, 1.5 tsf WC = 33.7% LL = 46, PL = 24, PI = 22
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH12 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662484.58 N, 7734774.18 E)

ELEVATION : 618.04 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 08:45 END : 4/2/21 11:16 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	3-3-4 (7)		**LEAN CLAY (CL)** Brown mottled gray, moist, firm, medium plasticity, ±5% fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.75, 1.75, 1.25 tsf WC = 38.2% LL = 47, PL = 26, PI = 21
	21.5						
25	25.0						
		1.50	SS-5	2-2-5 (7)		Similar to SS-4 except brown mottled slightly gray, reddish-brown iron oxide staining, trace subrounded fine gravel	PP = 0.25, 0.75, 0.25 tsf
	26.5						
30	30.0						
		1.50	SS-6	5-7-8 (15)		**LEAN CLAY (CL)** Brown slightly mottled grayish brown, moist, stiff, medium to high plasticity, trace fine subangular gravel, trace fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.5, 2.75, 1.75 tsf
	31.5						
35	35.0						
		1.50	SS-7	3-4-7 (11)		**FAT CLAY (CH)** Gray, moist, stiff, medium plasticity, trace fine sand, trace fine subangular gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1.25, 0.75, 1.25 tsf WC = 37.4% LL = 54, PL = 27, PI = 27
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH12 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Dodge Park Boulevard, Gresham, OR (662484.58 N, 7734774.18 E)

ELEVATION : 618.04 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 08:45 END : 4/2/21 11:16 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
	1.50		SS-8	4-7-8 (15)		SS-8A, 40-40.4 ft: Similar to SS-7 except no gravel SS-8B, 40.4-41.5 ft: Similar to SS-7 except gray mottled brown, trace fine to coarse sand, reddish-brown iron oxide staining, no gravel	PP = 2.25, 2, 2.25 tsf 42 ft: Driller reported stiffer soil and higher hydraulic pressure indicative of high plasticity soil.
41.5							
							42-50 ft: Slight rig clatter.
45							
50							
50.0							
	1.50		SS-9	17-18-23 (41)		**SANDY LEAN CLAY (CL)** Gray and brown, moist, dense, ±34% fine to coarse sand, ±10% fine to coarse subrounded gravel less than 1.5" diameter, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	Driller reported transition to this stiffer layer was at 42 ft WC = 45% Fines = 56.3%
51.5						Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-3 ft: Bentonite chips 3-50 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH13 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Proctor Street, Gresham, OR (662716.08 N, 7734263.82 E)

ELEVATION : 613.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 7" Cookie Cutter bit, 4-7/8" and 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamme

WATER DEPTH : 46.6 to > 50 feet bgs START : 4/13/21 09:38 END : 4/13/21 13:46 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						1.5 in: **ASPHALT CONCRETE PAVEMENT** 10 in: **BASE GRAVEL**	Make provision for piezometer monument: Core asphalt and base gravel with 16" core bit. Remove base gravel to 0.8 ft below ground surface with a 7" "cookie cutter" bit. Backfill with 3/8" bentonite chips, set the mud tub, drill the boring off-center to the cylinder drilled for the piezometer monumnet to accomodate future installation of a VWP data logger. Advance borehole with 4-7/8" drag bit.
	4.0						
5		2.00	ST-1				ST-1 4-5 ft: 150 psi 5-6 ft: 250 psi
	6.0						
		1.30	SS-2	2-4-4 (8)		**LEAN CLAY (CL)** Slightly reddish-brown slightly mottled grayish brown, moist, firm, medium plasticity, trace fine to coarse sand, trace fine subangular to subrounded gravel, trace black Mn nodules, dark brown/black spots of sand/gravel (Residual Soil of the Springwater Formation)	PP = 1.25, 2, 0.25 tsf
	7.5						
10	10.0						
		1.50	SS-3	2-4-4 (8)		Similar to SS-2 except slightly reddish-brown mottled grayish brown, no gravel, trace reddish-brown iron oxide staining	PP = 0.75, 0.5, 2 tsf WC = 39.8% LL = 47, PL = 26, PI = 21
	11.5						
15	15.0						
		1.50	SS-4	5-5-8 (13)		Similar to SS-2 except brown slightly mottled grayish brown, stiff, no gravel, trace reddish-brown iron oxide staining, black Mn nodules, no dark brown/black spots	PP = 1.5, 1.25, 1.25 tsf (The top 0.85 ft of sample split while opening the SS, PP from the remaining part) Driller reported that he is redrilling 0-5 ft of borehole with 6" drag bit.
	16.5						
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH13 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Proctor Street, Gresham, OR (662716.08 N, 7734263.82 E)

ELEVATION : 613.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 7" Cookie Cutter bit, 4-7/8" and 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamme

WATER DEPTH : 46.6 to > 50 feet bgs START : 4/13/21 09:38 END : 4/13/21 13:46 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-5	5-7-10 (17)		**FAT CLAY (CH)** Brown mottled gray, moist, very stiff, medium to high plasticity, trace fine to coarse sand, trace fine to coarse subangular to subrounded gravel, less than 1.5 in diameter, trace reddish-brown iron oxide staining, few dark brown to black spots of sand and fine gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.5, 1.75, 1.75 tsf Clay surrounding drill rod retrieved from borehole
	21.5						
	23.0						
		1.40	ST-6				ST-6 23-23.5 ft: 250 psi 23.5-24 ft: 300 psi 24-24.2: 500 psi 24.2-24.4: 600 psi ST-6 recovery in ST 1.6 ft
	24.4						
25		1.50	SS-7	4-6-8 (14)		**LEAN CLAY (CL)** Slightly reddish-brown mottled brown and gray, moist, stiff, medium plasticity, trace fine to coarse sand, trace fine subangular gravel, black Mn nodules, trace dark brown/black spots of sand and gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2, 1.25, 1.75 tsf WC = 27.7% LL = 44, PL = 21, PI = 23 Trace gray mottling
	25.9						
30	30.0						
		1.50	SS-8	5-9-11 (20)		**FAT CLAY (CH)** Brown mottled gray, moist, very stiff, medium to high plasticity, fine to coarse sand, trace sand, trace fine subangular gravel, trace black/dark brown pockets of sand and gravel, black Mn nodules, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2, 2.5, 2 tsf
	31.5						
35	35.0						
		1.50	SS-9	5-10-15 (25)		**FAT CLAY (CH)** Dark gray mottled brown, moist, very stiff, medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2.75, 2.25, 2.5 tsf WC = 32.2% LL = 57, PL = 29, PI = 28 Clay surrounding drill rod retrieved from borehole The dark gray color is like steel
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH13 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Proctor Street, Gresham, OR (662716.08 N, 7734263.82 E)

ELEVATION : 613.15 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 7" Cookie Cutter bit, 4-7/8" and 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamme

WATER DEPTH : 46.6 to > 50 feet bgs START : 4/13/21 09:38 END : 4/13/21 13:46 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-10	3-6-9 (15)		**FAT CLAY (CH)** Brown mottled grayish-brown, moist, stiff, medium to high plasticity, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.25, 2.25, 1.75 tsf Clay surrounding drill rig retrieved from borehole
	41.5						
							43 ft: Driller reported cemented sand or gravel
45	45.0	1.40	SS-11	5-8-9 (17)		**SANDY LEAN CLAY (CL)** Grayish brown to dark brown, moist, medium dense, 30% fine to coarse sand, reddish-brown iron oxide staining, trace pieces of dark gray cemented sand (Less Weathered Springwater Formation)	WC = 59.6% Fines = 69.8% The trace cemented sand pieces disintegrates with finger pressure.
	46.5						
50	50.0	1.30	SS-12	6-8-11 (19)		**CLAYEY SAND (SC)** Brownish gray to gray, moist, medium dense, fine to coarse sand, ±30% clay, ±5% fine to coarse subangular to subrounded gravel, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
	51.5					Bottom of Boring at 51.5 ft below ground surface Geokon VWP 4500s (350 KPa), unvented, serial no. 2111123 The finished water pipeline alignemnt corresponding to this boring location was abandoned, therefore, a Geokon datalogger was not added.	Installed VWP taped outside 1" PVC standpipe piezometer 0-1.5 ft: 12" diameter, 12" deep monument set in concrete, black dye added to concrete to match existing conditions 1.5-38 ft: Bentonite chips 38-50 ft: Sand 40-50 ft: Screen Start Card # 1051471 Well # L142276 Base of VWP is at 4.8 ft from the bottom of the screen. Driller reported that he mistakenly marked 4.8 ft instead of 5 ft. Field VWP Ro (1) 8895.047 (2) 8895.466 (3) 8896.589 (4) 8897.386 Average Ro = 8896.122
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH14 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (663273.50 N, 7733595.81 E)

ELEVATION : 585.62 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 8" Auger, 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/16/21 09:22 END : 3/17/21 15:30 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						0.5 in: **ASPHALT CONCRETE PAVEMENT** 17.5 in: **BASE GRAVEL**	Core asphalt with 16" diameter core barrel for setting 12" diameter piezometer monument Start drilling with 6" tricone bit, drilling fluid seeping out through base gravel and exiting the borehole Removed base gravel with 8" auger to 1.3 ft (16" borehole) and filled with bentonite chips Start advancing borehole with 6" tricone bit
5	5.0						
	6.5	1.20	SS-1	WOR-WOH-1 (1)		**FAT CLAY (CH)** Gray, moist, very soft, high plasticity, ±5% fine to coarse sand, trace fine to coarse subrounded granite, trace organics consisting of fine roots, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 37.5% LL = 54, PL = 21, PI = 33 Switch to 4-7/8" drag bit
10	10.0						
	11.5	1.20	SS-2	2-4-8 (12)		**FAT CLAY (CH)** Gray slightly mottled brown to greenish-brown, moist, stiff, medium to high plasticity, trace fine sand, trace reddish-brown iron oxide staining, micaceous (Residual Soil of the Springwater Formation)	PP = 2.5, 1.75, 1.5 tsf WC = 34.8% LL = 61, PL = 26, PI = 35 Driller reported soft soil after 13.5 ft and the clay was starting to "collar up" the borehole, driller will re-drill those locations.
15	15.0						
	16.5	1.50	SS-3	2-2-3 (5)		**FAT CLAY (CH)** Gray, moist, firm, medium to high plasticity, trace fine sand, trace reddish-brown iron oxide staining, micaceous (Residual Soil of the Springwater Formation)	PP = 0, 0, 0.75 tsf SS-3 similar to SS-2 except gray and lesser amount of reddish-brown iron oxide staining, firm
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH14 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (663273.50 N, 7733595.81 E)

ELEVATION : 585.62 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 8" Auger, 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/16/21 09:22 END : 3/17/21 15:30 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-4	4-6-8 (14)		Similar to SS-2 except gray mottled brown or greenish brown, trace reddish-brown iron oxide staining	PP = 1.5, 1.75, 3.75 tsf After drilling to 20 ft, clay surrounding the drill rod adjacent to the drill bit was removed
	21.5						
25	25.0	1.50	SS-5	3-5-4 (9)		Similar to SS-2 except gray mottled brown to greenish-brown, ±5% fine to coarse sand	PP = 1.25, 0.75, 1.75 tsf Re-drill borehole from 0-30 ft with 6" tricone.
	26.5						
							28 ft: Driller reported transition to sand with gravel, slight drill rig clatter.
30	30.0	1.50	SS-6	3-6-9 (15)		**SILTY SAND (SM)** Gray, moist, medium dense, 44% medium plasticity silt, fine to coarse sand, ±10% fine to coarse subrounded gravel, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	WC = 63.7% Fines = 43.8% Pumaceous sand
	31.5						
							Driller reported rig clatter at 33.5 ft (gravel), smooth again at 34 ft Driller reported loss of 60 gallons of drilling fluid in the gravel encountered at 33.5 ft. Drilling fluid seeping out of the side of the road embankment into a drainage ditch.
35	35.0	0.70	SS-7	10-50/2" (50/2")		**SILTY SAND WITH GRAVEL (SM)** Gray, moist, very dense, ±20% medium plasticity silt, ±20% fine to coarse subrounded to subangular gravel, fine to coarse sand, trace reddish-brown iron oxide staining, gravel consists of basalt (Less Weathered Sprin Bottom of boring at 36.5 ft below ground surface	SS-7 similar to SS-6 except with more gravel, lesser amount of reddish-brown iron oxide staining 200 gal of drilling fluid loss due to seepage at side of road, driller mixed additional bentonite slurry. The cracks in the asphalt pavement are widening and the road heaving up due to accumulation of drilling fluid below the asphalt. Switch to 4-7/8" drag bit Seepage of drilling fluid increases, crack develops in soil on side of road, the soil started sliding slightly when putting foot over at that location. It was therefore decided to terminate the boroing at 36.5 ft.
	35.7						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH14 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (663273.50 N, 7733595.81 E)

ELEVATION : 585.62 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 8" Auger, 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/16/21 09:22 END : 3/17/21 15:30 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft) / RECOVERY (ft) / TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
45					Backfilled with: 0-5 in: Concrete, top 1" of concrete mixed with black dye to match existing conditions 5-7 in: Gravel 7 in-8 ft: Bentonite chips 8-36.5 ft: Bentonite grout
50					
55					
60					

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH15 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (663846.78 N, 7734345.40 E)

ELEVATION : 615.77 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/10/21 10:15 END : 3/10/21 15:05 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0						2 in: **ASPHALT CONCRETE PAVEMENT** 6 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit. Driller reported soft soil after 1 ft, containing brown fat clay with sand (cuttings) and also confirmed by driller
	4.0						
5		1.90	ST-1				ST-1 4-4.5 ft: 150 psi 4.5-5.5 ft: 200 psi 5.5-6 ft: 250 psi 6 ft: Switch to 4-7/8" drag bit
	6.0						
		1.30	SS-2	3-5-6 (11)		**LEAN CLAY (CL)** Reddish brown, moist, stiff, medium plasticity, 12% fine sand, trace subrounded to subangular fine to coarse gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.25, 2.25, 2.25 tsf
	7.5						
10	10.0						
		1.50	SS-3	4-6-6 (12)		Similar to SS-2 except brown mottled gray	PP = 2, 2.25, 1.25 tsf WC = 34.7% LL = 42, PL = 26, PI = 16 Fines = 88.4% Driller reported that he is redrilling the top 3 ft of the borehole
	11.5						
15	15.0						
		1.50	SS-4	4-5-8 (13)		**LEAN CLAY (CL)** Reddish brown to greenish brown, moist, stiff, medium to high plasticity, ±10% fine sand, ±5% subangular black fine to coarse gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2, 1.25, 1.75 tsf
	16.5						
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH15 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (663846.78 N, 7734345.40 E)

ELEVATION : 615.77 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/10/21 10:15 END : 3/10/21 15:05 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-5	4-6-8 (14)		**LEAN CLAY (CL)** Reddish brown mottled gray, moist, stiff, medium to high plasticity, ±10% fine to coarse sand, trace trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.5, 1.25, 1.5 tsf Driller reported he had to redrill the borehole 2 times (top 3 ft)
	21.5						
	23.0						
		2.00	ST-6				ST-6 recovery 2.3 ft Driller reported overpacked likely due to presence of clay
25	25.0						
		1.50	SS-7	4-7-8 (15)		**FAT CLAY (CH)** Brown mottled gray, moist, stiff, medium to high plasticity, ±5% fine to coarse sand, trace trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1, 1, 1.25 tsf Drilling fluid seeping out from the edge of asphalt, driller reported he will redrill the borehole and then see if the seepage reduces. Driller reported that the clay is squeezing in, driller refills mud tub, adds bentonite, redrills the borehole. Driller makes a small drain to route the drilling fluid seeping from the bottom of the pavement to the roadside ditch. Driller reported stiffer soil after 28 ft
	26.5						
30	30.0						
		1.50	SS-8	5-6-9 (15)		**FAT CLAY (CH)** Reddish brown mottled gray, moist, stiff, trace fine to coarse sand, trace fine to coarse subangular gravel, medium to high plasticity, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.75, 2, 2 tsf
	31.5						
35	35.0						
		1.50	SS-9	4-5-5 (10)		**LEAN CLAY (CL)** Brown mottled gray, moist, stiff, medium to high plasticity, ±10% fine to coarse sand, trace trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.25, 0.25, 1.5 tsf
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH15 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (663846.78 N, 7734345.40 E)

ELEVATION : 615.77 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/10/21 10:15 END : 3/10/21 15:05 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-10	2-2-3 (5)		**SILT (ML)** Brown, moist, firm, medium plasticity, ±5% fine to coarse sand, trace subangular fine gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0, 0, 0 tsf WC = 43.3% LL = 48, PL = 29, PI = 19
	41.5						
45	45.0	1.50	SS-11	3-4-7 (11)		**SANDY ELASTIC SILT (MH)** Brown-red, moist, stiff, slight plasticity, ±35% fine to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation)	WC = 57.7% LL = 52, PL = 45, PI = 7 Pumaceous sand
	46.5						
50	50.0	1.50	SS-12	5-5-6 (11)		Similar to SS-11 except ±40% fine to coarse sand, ±5% fine to coarse subangular to subrounded gravel	
	51.5					Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: asphalt cold patch to match existing conditions 0.5-1.5 ft: gravel 1.5-4.5 ft: bentonite chips 4.5-51.5 ft: grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH16 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (664269.84 N, 7734352.38 E)

ELEVATION : 625.10 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/11/21 09:55 END : 3/11/21 14:38 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						1/4 in: **ASPHALT CONCRETE PAVEMENT** 7.75 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit. Driller reported soft soil after 1 ft. Drilling fluid seeping out from cracks in asphalt, driller reported he will redrill the top 5 ft of the borehole where the clay "collars" the borehole.
5	5.0						
	6.5	0.90	SS-1	3-2-5 (7)		**LEAN CLAY WITH GRAVEL (CL)** Brown, moist, firm, medium to high plasticity, ±15% fine to coarse subangular gravel, ±5% fine sand, trace black Mn nodules, trace organics consisting of roots (Residual Soil of the Springwater Formation)	PP = 2.25, 1.5, 1 tsf 5 ft: Switch to 4-7/8" drag bit
	8.0						7.5 ft: Driller reported very slight rig clatter possibly due to gravel.
		0.50	ST-2				ST-2 8-10 ft: 150 psi constant Driller reported smooth and consistent run, drill cleans drilling fluid off with a spade
10	10.0						
	11.5	1.50	SS-3	2-2-3 (5)		**LEAN CLAY (CL)** Slightly-reddish brown, moist, firm, medium plasticity, ±5% fine sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 37.1% LL = 49, PL = 24, PI = 25 10.2 ft: Driller reported trace gravel
15	15.0						
	16.5	1.50	SS-4	3-3-5 (8)		**LEAN CLAY (CL)** Slight reddish brown trace grayish-brown, moist, firm, medium plasticity, trace fine sand, trace fine subrounded gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 2, 1.25 tsf WC = 36.1% LL = 44, PL = 26, PI = 18
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH16 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (664269.84 N, 7734352.38 E)

ELEVATION : 625.10 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/11/21 09:55 END : 3/11/21 14:38 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					Similar to SS-4 except more gray mottled spots, very stiff, more black Mn nodules	PP = 1.25, 2, 2.5 tsf
		1.50	SS-5	3-7-9 (16)			
	21.5						
25	25.0					**LEAN CLAY (CL)** Brown mottled gray, moist, very stiff, medium plasticity, 6% fine to coarse sand, trace fine to coarse subrounded gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1.5, 1.5, 2.75 tsf
		1.50	SS-6	5-8-11 (19)			
	26.5						
30	30.0					Similar to SS-6 except black Mn nodules, no gravel	PP = 1.5, 1, 1.5 tsf
		1.50	SS-7	5-7-9 (16)			
	31.5						
35	35.0					Similar to SS-6 except black Mn nodules, ±5% fine to coarse subrounded to subangular gravel, trace reddish-brown iron oxide staining	WC = 36.2% LL = 45, PL = 24, PI = 21 Fines = 93.7% Additional drilling fluid seeps out through asphalt, driller made a small berm and is cleaning up
		1.50	SS-8	6-8-10 (18)			
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH16 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (664269.84 N, 7734352.38 E)

ELEVATION : 625.10 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/11/21 09:55 END : 3/11/21 14:38 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0					**ELASTIC SILT (MH)**	PP = 1.75, 2.25, 3 tsf
		1.50	SS-9	5-8-10 (18)		Gray mottled brown, moist, very stiff, medium plasticity, trace subrounded to subangular fine to coarse gravel, trace fine sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	
	41.5						
45	45.0						
		1.50	SS-10	7-12-16 (28)		Similar to SS-9 except no gravel	PP = 3.5, 3.75, 3.5 tsf WC = 35% LL = 50, PL = 30, PI = 20
	46.5						
50	50.0						
		1.30	SS-11	7-11-19 (30)		Similar to SS-10	
	51.5						
						Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-5 ft: Bentonite chips 5-50 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH17 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (664826.22 N, 7734361.62 E)

ELEVATION : 618.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/23/21 10:42 END : 3/23/21 14:20 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						1/4 in: **ASPHALT CONCRETE PAVEMENT** 7.75 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
5	5.0						
	6.5	1.40	SS-1	3-4-6 (10)		**FAT CLAY (CH)** Grayish brown mottled brown, moist, stiff, medium to high plasticity, ±5% fine to coarse sand, ±5% fine to coarse subangular gravel, trace reddish-brown iron oxide staining, black Mn nodules, micaceous (Residual Soil of the Springwater Formation)	PP = 2, 2, 1.75 tsf 5 ft: Switch to 4-7/8" drag bit
10	10.0						
	11.5	1.50	SS-2	4-4-6 (10)		**FAT CLAY (CH)** Brown mottled gray, moist, stiff, medium plasticity, ±5% fine to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.25, 0.75, 1.25 tsf WC = 33.4% LL = 52, PL = 25, PI = 27
15	15.0						
	16.5	1.50	SS-3	3-5-7 (12)		**FAT CLAY (CH)** Grayish brown mottled brown, moist, stiff, medium to high plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 3, 2, 1.25 tsf Driller reported that the cuttings are stuck at the base gravel layer, driller re-drilled that section
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH17 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (664826.22 N, 7734361.62 E)

ELEVATION : 618.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/23/21 10:42 END : 3/23/21 14:20 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	4-6-6 (12)		**LEAN CLAY (CL)** Gray mottled brown, moist, stiff, medium plasticity, 4% fine to coarse sand, trace fine subrounded gravel, trace reddish-brown iron oxide staining, track black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.5, 2, 2.25 tsf WC = 31.6% LL = 48, PL = 21, PI = 27 Fines = 95.6%
	21.5						
							23 ft: Driller reported stiffer soil.
25	25.0						
		1.50	SS-5	5-7-7 (14)		**LEAN CLAY (CL)** Brown mottled gray, moist, soft, medium to high plasticity, ±10% fine to coarse sand, ±5% fine subangular gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2, 2.75, 2 tsf
	26.5						
30	30.0						
		1.50	SS-6	5-7-10 (17)		**FAT CLAY (CH)** Gray mottled brown, moist, very stiff, trace fine sand, trace fine subrounded to subangular gravel, medium to high plasticity, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2.75, 1.75, 2.5 tsf Clay surrounding drill rod attached to drill bit removed by driller
	31.5						
35	35.0						
		1.50	SS-7	4-6-7 (13)		**FAT CLAY (CH)** Brown mottled gray, moist, stiff, medium to high plasticity, ±5% fine to coarse sand, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.25, 2.25, 0.5 tsf
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH17 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (664826.22 N, 7734361.62 E)

ELEVATION : 618.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/23/21 10:42 END : 3/23/21 14:20 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0						
		1.50	SS-8	4-6-11 (17)		**FAT CLAY (CH)** Brown mottled gray, moist, very stiff, medium plasticity, trace fine sand, trace fine subangular gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2.75, 1, 2 tsf WC = 35% LL = 50, PL = 27, PI = 23 Similar to SS-6
	41.5						
45	45.0						
		1.50	SS-9	4-8-12 (20)		Similar to SS-8 except no gravel, micaceous	PP = 3, 3.25, 2.75 tsf
	46.5						
50	50.0						
		1.50	SS-10	5-7-10 (17)		Similar to SS-9	PP = 2.75, 3, 2.75 tsf
	51.5					Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-8 ft: Bentonite chips 8-50 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH18 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665025.52 N, 7734365.23 E)

ELEVATION : 620.49 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/6/21 09:08 END : 4/6/21 12:23 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						3 in: **ASPHALT CONCRETE PAVEMENT** 11 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
5	5.0						
	6.5	1.50	SS-1	2-4-5 (9)		**LEAN CLAY (CL)** Brown, mottled grayish brown, moist, stiff, medium plasticity, trace fine to coarse sand, trace fine subangular to subrounded gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	SS-1 sample split in spoon, no PP WC = 33.8% LL = 47, PL = 22, PI = 25
10	10.0						
	11.5	1.50	SS-2	2-5-6 (11)		Similar to SS-1 except additionally mottled slightly reddish brown and gray, subangular gravel only, track black Mn nodules	PP = 2.25, 1.5, 1.75 tsf Switch to 3-7/8" tricone bit
15	15.0						
	16.5	1.50	SS-3	4-6-8 (14)		Similar to SS-1 except brown mottled grayish brown is gray to brown	SS-3 sample split in spoon, no PP
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH18 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665025.52 N, 7734365.23 E)

ELEVATION : 620.49 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/6/21 09:08 END : 4/6/21 12:23 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-4	3-5-8 (13)		Similar to SS-2	PP = 1.5, 1.75, 1.75 tsf
	21.5						
25	25.0	1.50	SS-5	5-6-8 (14)		Similar to SS-1 except brown mottled gray, subangular gravel only, reddish-brown iron oxide staining, track black Mn nodules	PP = 0.5, 1.75, 1 tsf
	26.5						
30	30.0	1.50	SS-6	7-11-13 (24)		**LEAN CLAY WITH SAND (CL)** Brown mottled gray and black, moist, very stiff, medium plasticity, 20% fine to coarse sand, trace fine subangular to subrounded gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.75, 3.75, 3 tsf WC = 32% LL = 49, PL = 26, PI = 23 Fines = 79.3%
	31.5						
35	35.0	1.50	SS-7	3-6-7 (13)		**FAT CLAY (CH)** Grayish brown to dark gray mottled brown, moist, stiff, medium to high plasticity, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1, 1.25, 1.5 tsf
	36.5						
40							Driller reported slightly stiffer soil after 38 ft

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH18 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665025.52 N, 7734365.23 E)

ELEVATION : 620.49 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/6/21 09:08 END : 4/6/21 12:23 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40	40.0	1.50	SS-8	4-7-10 (17)		SS-8A, 40-40.8 ft: **FAT CLAY WITH SAND (CH)** Brown mottled reddish brown and grayish brown to gray, moist, very stiff, medium to high plasticity, ±15% fine to coarse sand, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 3.25, 3, 1.25 tsf
	41.5					SS-8B, 40.8-41.4 ft: **LEAN CLAY (CL)** Dark gray mottled brown, moist, very stiff, high plasticity, trace fine to coarse sand, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	
45	45.0	1.50	SS-9	7-9-11 (20)		Similar to SS-8B except ±5% fine to coarse sand, trace fine subangular gravel, trace black Mn nodules	PP = 3.25, 3.5, 2.5 tsf WC = 31.7% LL = 50, PL = 27, PI = 23
	46.5						
50	50.0	1.50	SS-10	3-3-6 (9)		**SILT (ML)** Brown mottled reddish brown and gray, moist, stiff, medium plasticity, trace fine sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	SS-10 sample split in spoon, no PP WC = 39.5% LL = 43, PL = 27, PI = 16
	51.5					Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-4 ft: Bentonite chips 5-50 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH19 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665194.81 N, 7734369.24 E)

ELEVATION : 621.39 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/5/21 13:00 END : 4/5/21 15:49 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						3 in: **ASPHALT CONCRETE PAVEMENT** 15 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
5	5.0						
	6.5	1.50	SS-1	4-5-6 (11)		**LEAN CLAY (CL)** Brown to reddish brown, moist, stiff, medium to high plasticity, ±10% fine to coarse sand, ±5% fine to coarse subangular to subrounded gravel, some gravel pieces 2" diameter, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 1.75, 2 tsf 5 ft: Switch to 3-7/8" drag bit.
10	10.0						
	11.5	1.50	SS-2	3-4-7 (11)		**LEAN CLAY (CL)** Slight reddish brown to brown mottled gray, moist, stiff, medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.75, 2.75, 1.75 tsf WC = 30.6% LL = 44, PL = 23, PI = 21
15	15.0						
	16.5	1.50	SS-3	4-8-10 (18)		Similar to SS-2 except very stiff, trace fine subangular gravel, ±5% fine to coarse sand, reddish-brown iron oxide staining	SS-3 sample split in spoon, no PP
							18-20 ft: Driller reported stiffer soil.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH19 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665194.81 N, 7734369.24 E)

ELEVATION : 621.39 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/5/21 13:00 END : 4/5/21 15:49 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-4	3-5-5 (10)		Similar to SS-2 except brown to brown mottled gray and grayish brown, trace fine subangular gravel, black Mn nodules	PP = 1, 0.75, 1.5 tsf
	21.5						
25	25.0	1.50	SS-5	5-7-10 (17)		Similar to SS-2 except brown mottled gray, very stiff, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules	PP = 2.25, 0.25, 0.75 tsf
	26.5						
30	30.0	1.50	SS-6	5-7-9 (16)		**LEAN CLAY (CL)** Brown to brown mottled grayish brown, moist, very stiff, medium plasticity, ±5% fine to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, gravel is dark gray (Residual Soil of the Springwater Formation)	PP = 2.75, 2.25, 3.5 tsf WC = 25.7% LL = 41, PL = 20, PI = 21
	31.5						
35	35.0	1.50	SS-7	5-7-9 (16)		Similar to SS-6 except some gray mottling in addition to SS-6 colors, trace fine to coarse sand, no gravel, trace black Mn nodules	PP = 1.75, 2, 2.25 tsf
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH19 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665194.81 N, 7734369.24 E)

ELEVATION : 621.39 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/5/21 13:00 END : 4/5/21 15:49 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
	1.50		SS-8	6-9-11 (20)		SS-8A, 40-40.7 ft: **FAT CLAY (CH)** Gray, moist, very stiff, high plasticity, trace brown mottling, trace fine sand (Residual Soil of the Springwater Formation)	PP = 2.75, 3, 2.25 tsf
41.5						SS-8B, 40.7-41.5 ft: **LEAN CLAY (CL)** Brown mottled gray, moist, very stiff, medium to high plasticity, trace fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	41.5-50 ft: Driller reported gray high plasticity soil.
45							
50	50.0						
	1.50		SS-9	6-8-8 (16)		**ELASTIC SILT (MH)** Gray and brown mottled gray with dark brown sand, moist, very stiff, medium plasticity, 10% fine to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 41.3% LL = 60, PL = 37, PI = 23 Fines = 89.9%
51.5						Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-3 ft: Bentonite chips 3-51.5 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH20 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665698.02 N, 7734377.76 E)

ELEVATION : 611.07 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/24/21 09:08 END : 3/24/21 12:32 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0						3 in: **ASPHALT CONCRETE PAVEMENT** 6 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
	4.0						
5		1.90	ST-1			ST-1, 4-5.9 ft: **FAT CLAY (CH)** Brown mottled gray, moist, stiff, medium to plasticity, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	ST-1 4-5 ft: 150 psi 5-6 ft: 200 psi WC = 30.3% LL = 51, PL = 26, PI = 25 su = 1296 psf 5 ft: Switch to 4-7/8" drag bit. PP = 2, 1.5, 0.5 tsf
	6.0						
		1.30	SS-2	3-4-6 (10)		**LEAN CLAY (CL)** Brown mottled gray, moist, stiff, medium plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	Driller reported borehole "collared up" below base gravel and at 7 ft, he is redrilling the borehole
	7.5						
10	10.0						
		1.50	SS-3	3-4-5 (9)		Similar to SS-2 except more black Mn nodules	PP = 2.25, 1.25, 1 tsf WC = 38.4% LL = 43, PL = 25, PI = 18
	11.5						
15	15.0						
		1.50	SS-4	4-4-5 (9)		Similar to SS-2 except gray mottled brown	PP = 2.25, 2.25, 1.25 tsf
	16.5						
	18.0						ST-5 18-18.5 ft: 150 psi 18.5-19 ft: 250 psi 19-19.6 ft: 550 psi, 19.6 ft: jumps to 650 psi WC = 32% LL = 46, PL = 25, PI = 21 su = 2736 psf Recovery in Shelby tube is 1.9 ft
		1.60	ST-5				
	19.6						
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH20 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665698.02 N, 7734377.76 E)

ELEVATION : 611.07 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/24/21 09:08 END : 3/24/21 12:32 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	21.1	1.50	SS-6	5-7-9 (16)		**LEAN CLAY WITH SAND (CL)** Brown mottled grayish brown and dark brown, moist, very stiff, medium plasticity, 17% fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2, 2.75, 0.75 ft WC = 33.4% Fines = 83.3% 19.6-20.6 ft: Driller reported rig chatter, slightly stiffer soil
25	25.0						
	26.5	1.50	SS-7	5-8-10 (18)		**FAT CLAY (CH)** Brown mottled gray, moist, very stiff, medium plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 3.25, 3.5, 2 tsf
30	30.0						
	31.5	1.30	SS-8	5-8-12 (20)		Similar to SS-7 except no gravel, more reddish-brown iron oxide staining, no black Mn nodules	PP = 3.5, 3.5, 3.25 tsf WC = 34.1% LL = 51, PL = 27, PI = 24
35	35.0						
	36.5	1.40	SS-9	4-9-12 (21)		Similar to SS-7 except ±5% fine to coarse sand, no black Mn nodules	PP = 2.5, 2.5, 1.75 tsf
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH20 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (665698.02 N, 7734377.76 E)

ELEVATION : 611.07 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/24/21 09:08 END : 3/24/21 12:32 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
	1.50		SS-10	4-6-6 (12)		**SILT WITH SAND (ML)** Brown with dark bown and trace orange parts, moist, stiff, medium plasticity, 15% fine sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation)	PP = 1.5, 1, 1 tsf Drilling fluid seeps through edge of asphalt, driller reported he poured grout into borehole so loss of drilling fluid is controlled 40-50 ft: Driller reported no change in drilling rate or soil.
41.5							
45							
50	50.0						
	1.50		SS-11	3-2-3 (5)		**SILT WITH SAND (ML)** Brown with trace dark bown and orange parts, moist, firm, medium plasticity, 15% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation)	WC = 50.6% LL = 48, PL = 32, PI = 16 Fines = 85.2% Pumaceous sand Driller reported the top 5 ft of borehole had a clay "collar" which he redrilled.
51.5						Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-4 ft: Bentonite chips 4-51.5 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH21 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (666191.32 N, 7734387.45 E)

ELEVATION : 626.60 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/12/21 09:15 END : 3/12/21 13:20 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						5 in: **ASPHALT CONCRETE PAVEMENT** 13 in: **BASE GRAVEL**	Driller reported using 6" tricone bit from 0-5 ft so that it helps mitigate the issue with the clay collaring the borehole at previous borings.
							Driller reported silt and clay in the top 1.5-5 ft, scattered gravel at 4 ft 1.5-5 ft gray clay and silt (based or cuttings).
5	5.0						
	6.5	1.30	SS-1	3-4-6 (10)		**FAT CLAY (CH)** Brown mottled gray, moist, stiff, medium plasticity, trace fine sand, might also contain some silt, trace reddish-brown iron oxide staining, trace black Mn nodules, micaceous (Residual Soil of the Springwater Formation)	PP = 2, 2.5, 2.25 tsf
10	10.0						
	11.5	1.50	SS-2	4-5-8 (13)		Similar to SS-1 except trace subangular fine gravel and more reddish-brown iron oxide staining	PP = 1.75, 2, 2.25 tsf WC = 31.5% LL = 51, PL = 23, PI = 28
15	15.0						
	16.5	1.50	SS-3	4-6-6 (12)		Similar to SS-1 except more reddish-brown iron oxide staining	PP = 1.5, 2.75, 1.5 tsf
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH21 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (666191.32 N, 7734387.45 E)

ELEVATION : 626.60 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/12/21 09:15 END : 3/12/21 13:20 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	4-7-8 (15)		**LEAN CLAY (CL)** Brown mottled gray, moist, stiff, medium plasticity, ±5% fine to coarse sand, may contain silt, reddish-brown iron oxide staining, black Mn nodules, micaceous (Residual Soil of the Springwater Formation)	PP = 2.25, 1.75, 2 tsf WC = 30.9% LL = 42, PL = 25, PI = 17 Drilling fluid seeps out from the edge of the asphalt, driller redrills the borehole
	21.5						
25	25.0						
		1.50	SS-5	4-7-8 (15)		**FAT CLAY (CH)** Gray mottled brown, moist, stiff, medium to high plasticity, trace fine to coarse sand, trace fine subrounded gravel, trace reddish-brown iron oxide staining, ±5% silt, micaceous (Residual Soil of the Springwater Formation)	PP = 1.75, 2.5, 2.5 tsf
	26.5						
30	30.0						
		1.50	SS-6	6-10-13 (23)		Similar to SS-5 except ±5% fine to coarse subrounded to subangular gravel, very stiff, black Mn nodules	
	31.5						
35	35.0						
		1.50	SS-7	7-7-11 (18)		**LEAN CLAY (CL)** Brown, moist, very stiff, medium plasticity, 5% fine sand, trace reddish-brown iron oxide staining, trace black Mn nodules, micaceous (Residual Soil of the Springwater Formation)	PP = 2.75, 3, 1.25 tsf WC = 25.9% LL = 38, PL = 18, PI = 20 Fines = 95.3%
	36.5						
							Driller reported stiffer soil at 38 ft
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH21 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (666191.32 N, 7734387.45 E)

ELEVATION : 626.60 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/12/21 09:15 END : 3/12/21 13:20 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-8	6-7-10 (17)		Similar to SS-7 except fine to coarse sand, trace fine subangular gravel, no black Mn nodules	PP = 1.75, 1.75, 2 tsf Driller redrilling borehole due to formation of clay collar.
	41.5						
45	45.0	1.50	SS-9	6-13-14 (27)		**FAT CLAY (CH)** Gray mottled brown, moist, very stiff, trace fine sand, medium plasticity, reddish-brown iron oxide staining, trace black Mn nodules, micaceous (Residual Soil of the Springwater Formation)	PP = 2, 4.25, 3.25 tsf Second leak of drilling fluid through cracks in asphalt pavement. Driller reported he will hose it down with water into the natural ditch on the east side of the road. Driller creates a drain with a spade (reaching the ditch)
	46.5						
50	50.0	1.50	SS-10	9-13-18 (31)		**LEAN CLAY (CL)** Brown mottled gray, moist, hard, medium plasticity, 5% fine sand, trace fine to coarse subangular gravel, trace reddish-brown iron oxide staining, trace black Mn nodules, micaceous (Residual Soil of the Springwater Formation)	
	51.5					Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-3 ft: Bentonite chips 3-51.5 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH22 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (666691.78 N, 7734396.49 E)

ELEVATION : 632.43 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Blt, 6" Tricone Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 13.4 to 19.3 feet bgs START : 3/18/21 09:08 END : 3/18/21 14:26 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						5 in: **ASPHALT CONCRETE PAVEMENT** 7 in: **BASE GRAVEL**	Make provision for piezometer monument: Core asphalt with 16" core bit. Dislodge base gravel to 1 ft below ground surface with 6" tricone bit bit. Remove base gravel with hand, then use iron rod to dislodge base gravel as required. Backfill with 3/8" bentonite chips, set the mud tub, drill the boring off-center to the cylinder drilled for the piezometer monumnet to accomodate future installation of a VWP data logger. Advance borehole with 6" tricone bit.
	4.0						
5		1.80	ST-1				ST-1 4-4.5 ft: 150 psi 4.5-5.5 ft: 200 psi 5.5-6 ft: 250 psi Driller reported 1" of soil missing from the bottom of ST Recovery in Shelby tube is 1.8 ft 4 ft: Switch to 6" drag bit PP = 1.75, 1.25, 2 tsf
	6.0						
	7.5	1.50	SS-2	2-4-5 (9)		**SILT WITH SAND (ML)** Reddish brown mottled grayish brown, moist, stiff, slight plasticity, ±15% fine to coarse sand, ±5% subangular fine to coarse gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	
10	10.0						
	11.5	1.50	SS-3	3-4-5 (9)		Similar to SS-2 except 17% fine to coarse sand, trace fine subrounded to subangular gravel, black Mn nodules	PP = 1.5, 1.5, 2 tsf WC = 34% LL = 39, PL = 26, PI = 13 Fines = 82.9%
							Driller reported collaring of borehole from 12-13 ft, the soil is squeezing in, driller is re-drilling the collared zones.
15	15.0						
	16.5	1.50	SS-4	4-5-7 (12)		Similar to SS-2 except trace fine to coarse sand, no gravel, black Mn nodules	PP = 2.5, 2.75, 2.25 tsf
	18.0						ST-5 18-18.5 ft: 150 psi 18.5-19 ft: 250 psi 19-19.5 ft: 450 psi 19.5-19.6 ft: 600 psi Recovery in Shelby tube is 2.2 ft Driller reported that the Shelby tube will be damaged or sample not properly recoverable if pushed with a pressure of 600 psi or greater. Driller cleaned the borehole, however, some cuttings possible on top of Shelby tube.
	19.6	1.60	ST-5				
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH22 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (666691.78 N, 7734396.49 E)

ELEVATION : 632.43 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 6" Tricone Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 13.4 to 19.3 feet bgs START : 3/18/21 09:08 END : 3/18/21 14:26 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	21.1	1.50	SS-6	5-7-9 (16)		**LEAN CLAY (CL)** Reddish brown mottled gray, moist, very stiff, medium plasticity, ±5% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.5, 2, 2.5 tsf Driller reported smooth drilling throughout.
25	25.0						
	26.5	1.50	SS-7	2-4-5 (9)		Similar to SS-6 except trace gray mottling, stiff, trace fine to coarse sand, more black Mn nodules	PP = 1.75, 1.75, 1.75 tsf WC = 28.4% LL = 39, PL = 20, PI = 19
30	30.0						
	31.5	1.50	SS-8	4-8-9 (17)		Similar to SS-6 except brown mottled gray, trace reddish-brown iron oxide staining, more black Mn nodules	PP = 1, 3.25, 1.25 tsf
35	35.0						
	36.5	1.50	SS-9	5-7-9 (16)		Similar to SS-6 except brown mottled gray, trace fine to coarse sand, trace reddish-brown iron oxide staining, more black Mn nodules	PP = 1.5, 2.5, 2.75 tsf
40							39 ft: Driller reported stiffer soil.

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH22 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (666691.78 N, 7734396.49 E)

ELEVATION : 632.43 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Blt, 6" Tricone Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 13.4 to 19.3 feet bgs START : 3/18/21 09:08 END : 3/18/21 14:26 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-10	5-9-12 (21)		**FAT CLAY (CH)** Gray mottled brown, moist, very stiff, medium plasticity, trace fine sand, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1.75, 3.5, 2.75 tsf WC = 29.2% LL = 51, PL = 23, PI = 28
	41.5						
45	45.0	1.50	SS-11	4-7-9 (16)		**LEAN CLAY (CL)** Reddish to grayish brown, moist, very stiff, medium to high plasticity, trace fine sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.5, 2, 1.75 tsf
	46.5						
50	50.0	1.50	SS-12	4-7-9 (16)		Similar to SS-11 except trace fine subangular gravel	PP = 1.25, 1.75, 2 tsf
	51.5					Bottom of Boring at 51.5 ft below ground surface Geokon VWP 4500S (350 kPa), unvented, serial no. 2111130 Geokon datalogger 8002-WP-2 LC-2, serial no. 2128640	Inststalled VWP in 2" PVC standpipe piezometer. Standpipe piezometer installed immediately after drilling. VWP installed on 06/24/2021. 0-1 ft: 12" diameter, 12" deep monument set in concrete, black dye added to concrete to match existing conditions 1-38 ft: Bentonite chips 38-50 ft: Sand 40-50 ft: Screen Start Card # 1051104, Well # L141456 Base of VWP is at 40.3 ft below ground surface. Field VWP Ro (1) 9007.308 (2) 9007.733 (3) 9008.813 (4) 9008.993 Average Ro = 9008.212
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH23 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (667443.42 N, 7734304.98 E)

ELEVATION : 585.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/19/21 10:45 END : 3/22/21 12:24 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						4 in: **ASPHALT CONCRETE PAVEMENT** 6 in: **BASE GRAVEL**	Driller reported smooth drilling after 10", likely clay/silt. Clay in cuttings. Start drilling with 4-7/8" tricone bit.
	4.0						
5		2.00	ST-1				ST-1 4-4.5 ft: 150 psi 4.5-5 ft: 200 psi 5-5.5 ft: 250 psi 5.5-6 ft: 450 psi 5 ft: Switch to 4-7/8" drag bit
	6.0						
		1.50	SS-2	3-3-4 (7)		**LEAN CLAY (CL)** Reddish brown mottled grayish brown, moist, firm, medium plasticity, 12% fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.25, 0.75, 1.5 tsf WC = 32.7% LL = 41, PL = 22, PI = 19 Fines = 88.3%
	7.5						
10	10.0						
		1.50	SS-3	3-6-6 (12)		**LEAN CLAY (CL)** Brown, slightly mottled grayish brown, moist, stiff, slight plasticity, 6% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 3, 2.5 tsf
	11.5						
15	15.0						
		1.50	SS-4	3-4-5 (9)		Similar to SS-3 except brown, trace reddish-brown iron oxide staining, black Mn nodules	PP = 1.25, 1.25, 1.5 tsf WC = 28.4% LL = 34, PL = 21, PI = 13 Fines = 94.3% Driller reported smooth drilling throughout
	16.5						
	18.0						
		2.00	ST-5				ST-5 18-19 ft: 150 psi 19-19.5 ft: 200 psi 19.5-20 ft: 250 psi Recovery in Shelby tube 2.2 ft.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH23 SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (667443.42 N, 7734304.98 E)

ELEVATION : 585.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/19/21 10:45 END : 3/22/21 12:24 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-6	2-3-3 (6)		**ELASTIC SILT (MH)** Brown, slightly mottled grayish brown, moist, firm, medium plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0, 1.25, 1 tsf WC = 44.1% LL = 54, PL = 30, PI = 24
	21.5						
25	25.0						
		1.50	SS-7	3-4-6 (10)		**FAT CLAY (CH)** Gray mottled brown, moist, stiff, trace fine to coarse sand, trace fine subangular gravel, medium to high plasticity, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2, 1.25, 1.75 tsf
	26.5						
30	30.0						
		1.50	SS-8	1-2-4 (6)		**SILT (ML)** Brown mottled grayish brown, moist, firm, medium plasticity, ±5% fine to coarse sand, ±5% fine subangular to subrounded gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.25, 0.25, 0.25 tsf WC = 38.9% LL = 45, PL = 27, PI = 18
	31.5						
	33.0						
		2.00	ST-9				ST-9 33-34 ft: 250 psi 34-35 ft: 350 psi Recovery in Shelby tube 2.35 ft. Driller reported because of soil type, possibly some cuttings on top
35	35.0						
		1.50	SS-10	4-8-10 (18)		**FAT CLAY (CH)** Brown mottled grayish brown, moist, very stiff, medium to high plasticity, trace fine to coarse sand, trace fine subrounded gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 2.5, 3 tsf
	36.5						37-38 ft: Driller reported stiffer soil.
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH23 SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (667443.42 N, 7734304.98 E)

ELEVATION : 585.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/19/21 10:45 END : 3/22/21 12:24 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.00	SS-11	4-11-28 (39)		**SILTY SAND WITH GRAVEL (SM)** Brown to very pale red, moist, dense, 41% silt, ±15% fine to coarse subrounded to subangular gravel, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	WC = 37.5% Fines = 40.9% Pumaceous sand SS-11 gravel in shoe includes black basalt. Rig chatter from 41.5 ft due to presence of gravel. Driller reported that the drag bit is making progress,indicating that the gravel layer is thin and consists of smaller gravel pieces.
	41.5						
45	45.0	1.50	SS-12	19-20-29 (49)		**SILTY SAND WITH GRAVEL (SM)** Gray, moist, dense, ±10% silt, ±40% fine to coarse subrounded to subangular gravel less than 1.75" in diameter, fine to coarse sand, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	Continuous rig clatter
	46.5						
50	50.0	1.40	SS-13	11-18-26 (44)		**SILTY SAND WITH GRAVEL (SM)** Gray, moist, dense, ±15% silt, ±30% fine to coarse subangular to subrounded gravel ,1.5" in diameter, fine to coarse sand, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	Stop on 3/19/21 at 15:00 at 51.5 ft. Start 3/22/21 at 9:45, use 3-7/8" tricone bit.
	51.5						
55	55.0	1.30	SS-14	11-11-50/4" (61/10")		**SILTY SAND WITH GRAVEL (SM)** Gray, moist, very dense, ±20% silt, ±20% fine to coarse subangular to subrounded gravel less than 2" diameter, fine to coarse sand (Less Weathered Springwater Formation)	54 ft: Driller reported harder soil Gravel piece in shoe, SS bent, driller reported hard (gravelly) soil from 56.25-57.5 ft
	56.3						
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH23 SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (667443.42 N, 7734304.98 E)

ELEVATION : 585.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/19/21 10:45 END : 3/22/21 12:24 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0					Similar to SS-14 except dense, ±30% gravel	
		1.50	SS-15	10-20-15 (35)			
	61.5						
							63-65 ft: Driller reported stiffer soil (gravelly).
65	65.0						
	65.4	0.40	SS-16	50/5" (50/5")		Similar to SS-14 except gray, moist, very dense, ±40% fine to coarse sand, fine to coarse subangular to subrounded gravel, ±10% silt, percent approximate because of small sample size	Driller reported very stiff soil after SS-16
70	70.0						
	70.3	0.30	SS-17	50/3" (50/3")		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, very dense, ±40% fine to coarse subangular gravel, fine to coarse sand, ±15% silt, percent approximate because of small sample size (Less Weathered Springwater Formation)	Sand and disintegrated gravel in return fluid, driller reported consistent drilling from SS-16 to SS-17 70.25-70.75 ft: Drill rig clatter, driller reported stiffer soil.
75	75.0						
		1.20	SS-18	16-21-50/2" (71/8")		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, very dense, ±40% fine to coarse subangular to subrounded gravel less than 2", ±15% silt, fine to coarse sand, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
	76.2					Bottom of Boring at 76.2 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-5 ft: Bentonite chips 5-76.5 ft: Bentonite grout
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH24 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (667683.62 N, 7734235.49 E)

ELEVATION : 559.53 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 7" Cookie Cutter Bit, 3-7/8", 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sample

WATER DEPTH : 10.8 to 16.7 feet bgs START : 4/7/21 08:55 END : 4/7/21 13:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						5 in: **ASPHALT CONCRETE PAVEMENT** 9 in: **BASE GRAVEL**	Make provision for piezometer monument: Core asphalt with 16" core bit. Drill base gravel to 14" below ground surface with 7" "cookie cutter" bit & 6" tricone bit. Backfill with 3/8" bentonite chips, set the mud tub, drill the boring off-center to the cylinder drilled for the piezometer monumnet to accomodate future installation of a VWP data logger. Advance borehole with 4-7/8" tricone bit.
5	5.0						
	6.5	1.20	SS-1	WOH-WOH-1 (1)		**LEAN CLAY (CL)** Gray, moist, very soft, slight plasticity, trace fine subangular gravel, organics consisting of fine roots, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0, 0, 0.25 tsf WC = 34.8% LL = 34, PL = 23, PI = 11 5 ft: Switch to 4-7/8" drag bit.
10	10.0						
	11.5	1.50	SS-2	2-3-4 (7)		**FAT CLAY (CH)** Gray mottled slightly brown, moist, firm, medium to high plasticity, trace tine sand, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1, 0.75, 1 tsf
	13.0						
	14.3	1.30	ST-3			Bottom includes a 1/16" diameter root	ST-3 recovery 1.8 ft in tube, tube bent for the bottom ft 13-13.5 ft: 150 psi 13.5-14 ft: 250 psi 14-14.1 ft: 350 psi 14.1-14.3 ft: 600 psi ST-3 bottom half of tube bent considerably
15	15.8	1.20	SS-4	2-2-5 (7)		**SANDY ELASTIC SILT (MH)** Grayish brown with spots of red and pale yellow, moist, firm, medium plasticity, 41% fine to coarse sand, trace fine to coarse subrounded to subangular gravel less than 1" diameter (Sensitive Saprolite of the Springwater Formation)	SS-4: WC = 57% LL = 61, PL = 34, PI = 27 Fines = 58.5% Pumaceous sand, reddish brown 16.5 ft: Driller reported increase in resistance to drilling and drill rig chatter, possible due to presence of cemented sand or gravel Transition from Sensitive Saprolite of the Springwater Formation to Less Weathered Springwater Formation
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH24 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (667683.62 N, 7734235.49 E)

ELEVATION : 559.53 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 7" Cookie Cutter Bit, 3-7/8", 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sample

WATER DEPTH : 10.8 to 16.7 feet bgs START : 4/7/21 08:55 END : 4/7/21 13:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	0.40	SS-5	6-7-24 (31)		Similar to SS-4 except hard, ±10% gravel less than 1.25" in diameter, no reddish-brown iron oxide staining, no red spots (transition from Sensitive Saprolite of the Springwater Formation to Less Weathered Springwater Formation)	20 ft: Switch to 3-7/8" tricone bit
	21.5						
25	25.0	1.50	SS-6	11-32-41 (73)		**CLAYEY SAND (SC)** Grayish brown with trace yellow and red spots, moist, very dense, ±20% clay, trace silt, ±10% fine to coarse subrounded to subangular gravel less than 1" diameter, trace black Mn nodules (Less Weathered Springwater Formation)	Cemented sand, disintegrates with finger pressure.
	26.5						
30	30.0	0.90	SS-7	22-50/5" (50/5")		Similar to SS-6 except ±15% gravel up to 2" diameter, trace reddish-brown iron oxide staining	
	30.9						
35	35.0 35.2	0.20	SS-8	50/5.75" (50/5.75")		Very low recovery consisting of **POORLY GRADED GRAVEL (GP)**, gray, moist, very dense, fine to coarse subangular gravel less than 1.25" diameter, trace clay, trace sand	
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH24 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Altman Road, Gresham, OR (667683.62 N, 7734235.49 E)

ELEVATION : 559.53 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 16" Core Bit, 7" Cookie Cutter Bit, 3-7/8", 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sample

WATER DEPTH : 10.8 to 16.7 feet bgs START : 4/7/21 08:55 END : 4/7/21 13:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-9	10-13-16 (29)		**CLAYEY SAND (SC)** Yellowish-brown, moist, medium dense, fine to coarse sand, light cementation, 31% clay, trace fine subangular gravel, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	SS-9 is lightly cemented, similar to SS-6 disintegrates easily with with finger pressure. WC = 56.4% Fines = 31.2%
	41.5						
45	45.0						
	45.8	0.80	SS-10	37-50/4" (50/4")		**SILTY SAND (SM)** Grayish brown to yellowish brown, moist, very dense, fine to coarse cemented sand, ±15f% silt, trace clay, ±5% fine to coarse subangular gravel less than 1" diameter, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
50	50.0						
	50.3	0.30	SS-11	50/4" (50/4")		Similar to SS-10 except ±10% gravel less than 1.5" diameter	SS-11 1.5" diameter gravel piece in shoe.
						Bottom of Boring at 50.3 ft below ground surface	Installed VWP taped outside 1" PVC standpipe piezometer
						Geokon VWP 4500S (350 kPa), unvented, serial no. 2111122 Geokon datalogger 8002-WP-2 LC-2, serial no. 2107941	0-1.25 ft: 12" diameter, 12" deep monument set in concrete, black dye added to concrete to match existing conditions 1.25-38 ft: Bentonite chips 38-50 ft: Sand 40-50 ft: Screen Start Card # 1051378 Well # L141467
55							Base of VWP is at 44.9 ft below ground surface. Field VWP Ro (1) 9072.554 (2) 9092.526 (3) 9072.090 (4) 9072.638 Average Ro = 9072.452
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH25 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Oxbow Drive, Gresham, OR (667591.76 N, 7734691.03 E)

ELEVATION : 554.21 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/26/21 09:15 END : 3/26/21 15:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0						7 in: **ASPHALT CONCRETE PAVEMENT**	Driller reported that base gravel size increases with depth
						17 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
	4.0						
5		1.90	ST-1				ST-1 4-5 ft: 150 psi 5-6 ft: 200 psi Contains some slough at the top 0.3 ft, recovery reported discounting slough 5 ft: Switch to 4-7/8" drag bit.
	6.0						
		0.50	SS-2	WOH-2-2 (4)		**LEAN CLAY (CL)** Brown mottled grayish brown, moist, soft, trace fine to coarse sand, trace fine subrounded to subangular gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	
	7.5						
10	10.0						
		1.50	SS-3	2-2-3 (5)		**LEAN CLAY (CL)** Brown mottled gray, moist, firm, medium plasticity, trace fine sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.25, 0.75, 0.5 tsf WC = 32.7% LL = 47, PL = 21, PI = 26
	11.5						
15	15.0						
		1.30	SS-4	7-38-50/3" (88/9")		SS-4A, 15-15.3 ft: **LEAN CLAY WITH GRAVEL (CL)** Gray, firm to stiff, medium to high plasticity, ±5% fine to coarse sand, ±15% fine subangular gravel, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation) SS-4B, 15.3-16.25 ft: **CLAYEY GRAVEL WITH SAND (GC)** Dark gray to brown, moist, very dense, ±15% clay, fine to coarse subangular gravel, ±40% fine to coarse sand (Less Weathered Springwater Formation)	15 ft: Switch to 4-7/8" tricone bit. Rig chatter throughout after SS-4 16-17.5 ft: Driller reported stiff soil 17.5-18.5 ft: Driller reported softer soil, stiffer again after 18.5 ft.
	16.5						
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH25 SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Oxbow Drive, Gresham, OR (667591.76 N, 7734691.03 E)

ELEVATION : 554.21 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/26/21 09:15 END : 3/26/21 15:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-5	10-40-34 (74)		**CLAYEY GRAVEL WITH SAND (GC)** Dark gray to brown, moist, very dense, 20% clay, ±40% fine to coarse sand, fine to coarse dark gray subangular gravel less than 1.5" diameter (Less Weathered Springwater Formation)	WC = 16.3% Fines = 20.3% Cemented sand, disintegrates with finger pressure. Broken gravel in shoe of SS.
	21.5						
							24 ft: Driller reported very stiff soil. Alternating stiffer and softer layers.
25	25.0						
		1.50	SS-6	15-22-35 (57)		**CLAYEY SAND WITH GRAVEL (SC)** Grayish brown, moist, very dense, 22% clay, ±20% fine to coarse subrounded to subangular gravel less than 1.5" diameter, fine to coarse sand, gravel primarily dark gray but consists of dark gray brown yellow red pieces, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	WC = 15.8% Fines = 22.1% Cemented sand, disintegrates with finger pressure.
	26.5						
30	30.0						
	30.2	0.00	SS-7	50/2" (50/2")		No recovery	Only slough in SS
35	35.0						
		1.30	SS-8	25-40-50/3" (90/9")		Similar to SS-6 except primarily subangular gravel, ±30% gravel consists of dark gray and yellow pieces less than 1.5" diameter	Cemented sand, disintegrates with finger pressure.
	36.3						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH25 SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Oxbow Drive, Gresham, OR (667591.76 N, 7734691.03 E)

ELEVATION : 554.21 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/26/21 09:15 END : 3/26/21 15:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0 40.8	0.80	SS-9	28-50/3" (50/3")		Similar to SS-6 except trace clay, ±40% gravel	Driller reported consistent drilling since 15 ft.
							44-44.5 ft: Driller reported very stiff soil, very slow drilling.
45	45.0 45.3	0.30	SS-10	50/3" (50/3")		**POORLY GRADED SAND (SP)** Grayish-brown, moist, very dense, trace silt, ±10% fine to coarse subangular to subrounded gravel less than 1" diameter, fine to coarse sand (Unweathered Springwater Formation)	Recovery = 0.37 ft in SS SS-10 is a cemented sand, disintegrates with finger pressure. 45 ft: Switch to 3-7/8" tricone bit.
50	50.0 50.4	0.40	SS-11	50/5" (50/5")		Similar to SS-10	51-54 ft: Driller reported quicker drilling (softer zone)
55	55.0 55.1	0.00	SS-12	50/1" (50/1")		No recovery	57-58.5 ft: Driller reported softer zone (sand)
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	AFWP-BH25 SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Oxbow Drive, Gresham, OR (667591.76 N, 7734691.03 E)

ELEVATION : 554.21 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/26/21 09:15 END : 3/26/21 15:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0	0.30	SS-13	50/4" (50/4")		Similar to SS-10 except gravel less than 1.5" diameter, trace reddish-brown iron oxide staining	Recovery in SS is 0.5 ft
65	65.0						
		1.00	SS-14	28-50/5.5" (50/5.5")		Similar to SS-10 except trace reddish-brown iron oxide staining	Recovery in SS is 1.3 ft
	66.0						
70	70.0						
		0.00	SS-15	50/0.25" (50/0.25")		No recovery	
75	75.0						
	75.3	0.30	SS-16	50/3" (50/3")		Similar to SS-10 except ±40% gravel less than 1.5" diameter, trace reddish-brown iron oxide staining Bottom of Boring at 75.25 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-5 ft: Bentonite chips 5-75 ft: Bentonite grout
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-01 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (662191.16 N, 7739611.61 E)

ELEVATION : 663.35 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 12/9/21 08:45 END : 12/9/21 10:21 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						4 in: **ASPHALT CONCRETE PAVEMENT** 8 in: **BASE GRAVEL**	Start drilling with 6" drag bit
5	5.0						
	6.5	0.60	SS-1	1-1-4 (5)		**LEAN CLAY (CL)** Slightly orangish brown, moist, firm, low to medium plasticity, trace fine to coarse sand, trace fine subangular gravel, organics consisting of roots, trace black Mn nodules (Residual Soil of the Springwater Formation)	Switch to 4-7/8" drag bit
10	10.0						
	11.5	1.50	SS-2	WOH-1-2 (3)		**LEAN CLAY (CL)** Brown mottled slightly grayish brown, moist, soft, medium plasticity, trace fine to coarse sand, trace organics consisting of fine roots, trace black Mn nodules, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0, 0, 0 tsf WC = 44.2% LL = 46, PL = 25, PI = 21
15	15.0						
	16.5	1.50	SS-3	2-2-3 (5)		**FAT CLAY WITH SAND (CH)** Organish brown, mottled grayish brown, firm, high plasticity, 19.7% fine to coarse sand, trace subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0.75, 0.25, 0 tsf WC = 40.7% LL = 64, PL = 23, PI = 41 Fines = 80.3%, Sand = 19.7%, Gravel = 0%
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-01 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (662191.16 N, 7739611.61 E)

ELEVATION : 663.35 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 12/9/21 08:45 END : 12/9/21 10:21 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	1-2-3 (5)		**FAT CLAY (CH)** Gray mottled greenish brown with seams of orange mottling, moist, firm, high plasticity, 3.6% fine to coarse sand, trace black Mn nodules, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0.5, 0.25, 0.25 tsf WC = 43.2% LL = 59, PL = 23, PI = 36 Fines = 96.4%, Sand = 3.6%, Gravel = 0%
	21.5						
25	25.0						
		1.50	SS-5	WOH-2-2 (4)		**FAT CLAY (CH)** Dark gray with seams of brown and dark purple organics consisting of wood, moist, soft, medium to high plasticity, trace fine to coarse sand, trace fine to coarse subangular to subrounded gravel less than 1" diameter, ± 15% organics consisting of wood and disintegrated wood (Residual Soil of the Springwater Formation)	PP = 0, 0, 0.25, 0.25 tsf 1/4" thick twigs and seams of wood
	26.5						
30	30.0						
		1.50	SS-6	WOH-WOH-WOH		**SILT (ML)** Gray, very soft, medium plasticity, trace fine to coarse sand, trace fine subangular to subrounded gravel, reddish-brown iron oxide staining, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation)	PP = 0, 0, 0 tsf WC = 61.9% LL = 50, PL = 31, PI = 19
	31.5						
35	35.0						
		1.50	SS-7	1-1-1 (2)		**SANDY SILT (ML)** Gray with rare spots of green, pink, white, brown, moist, soft, 34.7% fine to coarse sand, 5% fine to coarse subangular gravel less than 1.5" diameter (Sensitive Saprolite of the Springwater Formation)	PP = 0, 0, 0.25 tsf Fines = 60.3%, Sand = 34.7%, Gravel = 5%
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-01 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (662191.16 N, 7739611.61 E)

ELEVATION : 663.35 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 12/9/21 08:45 END : 12/9/21 10:21 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
	1.50	1.50	SS-8	2-7-19 (26)		**ELASTIC SILT (MH)** Gray mottled green, moist, very stiff, medium plasticity, 13.9% fine to coarse sand, trace reddish-brown iron oxide staining, trace fine to coarse subangular to subrounded gravel less than 1.5" diameter (Less Weathered Springwater Formation)	WC = 69.0% LL = 58, PL = 38, PI = 21 Fines = 86.1%, Sand = 13.9%, Gravel = 0%
41.5						Bottom of Boring at 41.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1.5 ft: Concrete 1.5-40 ft: Bentonite chips
45							
50							
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-02 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (662580.80 N, 7739617.34 E)

ELEVATION : 668.49 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/17/21 11:54 END : 11/18/21 14:14 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0.0						2 in: **ASPHALT CONCRETE PAVEMENT** 10 in: **BASE GRAVEL**	6" casing used
			S-1			**LEAN CLAY (CL)** Reddish/orangish brown, moist, stiff, low plasticity, trace fine sand, trace fine subrounded gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)	
5 5.0							
	1.50	SS-2		3-4-5 (9)		**LEAN CLAY (CL)** Reddish/orangish brown, moist, stiff, low plasticity, 12.7% fine sand, trace fine subrounded gravel, trace black Mn nodules (Residual Soil of the Springwater Formation) S-3, 5-10 ft: Similar to SS-2 except pockets of gray black fine to coarse sand, trace reddish-brown iron oxide staining	WC = 31.8% Fines = 87.3%, Sand = 12.7%, Gravel = 0%
6.5			S-3				
10 10.0							
	1.50	SS-4		2-3-5 (8)		**ELASTIC SILT WITH SAND (MH)** Reddish/orangish brown, moist, firm, medium plasticity, 17.1% fine to coarse sand, trace reddish-brown iron oxide staining, trace black Mn nodules, pockets of black gray sand (Residual Soil of the Springwater Formation) S-5, 10-15 ft: Similar to SS-4 except occasionally with more clay than silt	WC = 40.8% LL = 55, PL = 35, PI = 20 Fines = 82.9%, Sand = 17.1%, Gravel = 0%
11.5			S-5				14-15 ft: Grab Sample GS-6 14.5 ft: Gray mottling in S-5
15 15.0							
	1.50	SS-7		3-5-6 (11)		**ELASTIC SILT WITH COBBLES (MH)** Brown, mottled gray rarely, moist, stiff, high plasticity, 12.5% fine to coarse sand, black pockets of fine to coarse sand, trace black Mn nodules (Residual Soil of the Springwater Formation) S-8, 15-20 ft: Similar to SS-7 except trace reddish-brown iron oxide staining, one 4" diameter cobble	WC = 40.0% LL = 67, PL = 37, PI = 30 Fines = 87.5%, Sand = 12.5%, Gravel = 0% SS-7 bottom 3" with increase gray mottling
16.5			S-8				
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-02 SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (662580.80 N, 7739617.34 E)

ELEVATION : 668.49 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/17/21 11:54 END : 11/18/21 14:14 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					**FAT CLAY WITH COBBLES (CH)** Brown, mottled gray, moist, very soft, high plasticity, 11.2% fine to coarse sand (Sensitive Saprolite of the Springwater Formation)	WC = 45.9% LL = 62, PL = 29, PI = 33 Fines = 88.8%, Sand = 11.2%, Gravel = 0% Low recovery, description of 0.2'
	21.5	0.20	SS-9	WOH-WOH-WOH		S-10, 20-23.5 ft: Similar to SS-9 except trace cobble, trace gravel less than 1.5" diameter, reddish-brown iron oxide staining	
			S-10				
						S-10, 23.5-25 ft: **SANDY ELASTIC SILT (MH)** Light gray with rare red, brown, black pockets, moist, stiff, slight plasticity, ±30% fine to coarse sand, trace gravel less than 1.5" diameter (Sensitive Saprolite of the Springwater Formation)	24-25 ft: Grab Sample GS-11
25	25.0					**SANDY ELASTIC SILT (MH)** Light gray with rare red, brown, black pockets, moist, stiff, slight plasticity, 36.1% fine to coarse sand, 0.5% gravel less than 1.5" diameter (Sensitive Saprolite of the Springwater Formation)	WC = 71.5% LL = 53, PL = 39, PI = 14 Fines = 63.4%, Sand = 36.1%, Gravel = 0.5% Gravels and cobbles in this layer likely not represented in SS-12
	26.5	1.50	SS-12	6-3-11 (14)			Driller reported that he is not using any hydraulic pressure for drilling, there is 2" of hard soil then
						S-13, 25-30 ft: **SILTY GRAVEL WITH COBBLES (GM)** Gray, moist, soft, medium plasticity, 23.2% fine to coarse sand, 51.3% subangular to subrounded gravel, few cobbles upto 4" diameter (Transition from Sensitive Saprolite of the Springwater Formation to Less Weathered Springwater Formation)	28-30 ft: Grab Sample GS-14 WC = 31.2% Fines = 25.5%, Sand = 23.2%, Gravel and cobbles = 51.3%
			S-13				
30	30.0					**CLAYEY SAND WITH GRAVEL (SC)** Light gray to gray, moist, dense, low to medium plasticity, fine to to coarse sand, ±40% fines, ±15% fine to coarse subrounded to subangular gravel less than 1.5" diameter (Less Weathered Springwater Formation)	SS-15 broken gravel / cobble pieces in shoe. Shoe edge broken because of gravel/cobble
	31.5	1.50	SS-15	24-22-23 (45)			
						S-16, 31.5-35 ft: Similar to SS-15 except dense to very dense, 28.3% fines, 16.4% fine to coarse subangular gravel less than 3" diameter	
			S-16				34-35 ft: Grab Sample GS-17 Fines = 28.3%, Sand = 55.3%, Gravel = 16.4%
35	35.0					**SANDY LEAN CLAY (CL)** Gray, moist, hard, ±30% fine to coarse sand, ±10% fine to coarse subangular gravel, lightly cemented, disintegrated easily with finger pressure (Less Weathered Springwater Formation)	WC = 17.7% LL = 29, PL = 19, PI = 10
	36.5	1.50	SS-18	7-24-22 (46)		S-19, 35-38.2: Similar to SS-18	
							PP = 1, 0.75, 2.75 tsf
			S-19			S-19, 38.2-40: **LEAN CLAY (CL)** Gray with some brown to orange brown mottling, moist, stiff, medium to high plasticity, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-02 SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (662580.80 N, 7739617.34 E)

ELEVATION : 668.49 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/17/21 11:54 END : 11/18/21 14:14 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-20	WOH-3-5 (8)		**LEAN CLAY (CL)** Gray with some brown to orange brown mottling, moist, firm, medium plasticity, trace reddish-brown iron oxide staining, trace subrounded to subangular gravel (Less Weathered Springwater Formation)	WC = 28.4% LL = 35, PL = 20, PI = 15
	41.5						Stop on 11/17/2021 at 41.5 ft bgs at 3:25 PM Start on 11/18/2021 at 9:26 AM
			S-21			S-21, 41.5-45 ft: **ELASTIC SILT WITH COBBLES (MH)** Gray with brown to orange and rare red mottling, moist, stiff, medium plasticity, 10.1% fine to coarse sand pockets, 1.6% fine to coarse subangular to subrounded gravel less than 1.5" diameter, trace cobble less than 4" diameter, gravel and cobble present at 43.5-44.5 ft (Less Weathered Springwater Formation)	S-21 contains 1 cobble less than 4" diameter, gravel less than 1.5" diameter at 43.5-44.5 ft 43.5-44.5 ft: Grab Sample GS-22 WC = 41.1% LL = 54, PL = 30, PI = 24 Fines = 88.3%, Sand = 10.1%, Gravel and cobbles = 1.6%
45	45.0						
		0.50	SS-23	6-9-20 (29)		SS-23A, 45-45.4 ft: **ELASTIC SILT (MH)** Gray mottled brown, moist, very stiff, midum to high plasticity, trace fine sand, trace fine subangular gravel (Less Weathered Springwater Formation)	SS-23B: WC = 57.1% Fines = 49.8%, Sand = 50.2%, Gravel = 0% Gravel piece in shoe, basalt gravel
	46.5					SS-23B, 45.4-46.5 ft: **SILTY SAND (SM)** Gray, moist, medium dense, 49.8% fines, 50.2% fine to coarse sand, trace subangular gravel (Less Weathered Springwater Formation)	
			S-24			S-24, 45-46.5 ft: Similar to SS-23A, B S-24, 46.5-50 ft: **SILTY SAND WITH GRAVEL AND COBBLES (SM)** Gray slightly mottled brown, moist, medium dense, 38.6% fines, 36.3% fine to coarse sand, 25.1% fine to coarse subrounded to subangular gravel less than 1" diameter, trace cobbles less than 4" diameter from 49-50 ft (Less Weathered Springwater Formation)	47-48 ft: Grab Sample GS-25 WC = 56.4% LL = 77, PL = 40, PI = 37 Fines = 38.6%, Sand = 36.3%, Gravel = 25.1%
50	50.0						
		1.50	SS-26	7-14-33 (47)		**SILTY SAND WITH GRAVEL WITH COBBLES (SM)** Grayish brown, moist, dense, fine to coarse sand, ±20% fines, ±15% fine to coarse subrounded to subangular gravel less than 1.5" diameter (Less Weathered Springwater Formation)	
	51.5						
			S-27			S-27, 50-51.5 ft: Similar to SS-26 S-27, 51.5-52.1 ft: Basalt cobbles	S-27, 51.5-52.1 ft: Basalt cobbles, gray, fine grained, fresh, with a mechanical break, 5°, fresh, rough, hardness R5, clay surrounding Basalt pieces
						S-27, 52.1-54 ft: Very dense, fine to coarse sand, ±20% fines, ±10% fine to coarse subangular basalt gravel less than 1.5" diameter, lightly cemented, disintegrated with finger pressure	54-55 ft: Grab Sample GS-28 WC = 11.4% LL = 33, PL = 22, PI = 11 Fines = 19.8%, Sand = 30.4%, Gravel and Cobbles = 49.8% S-30 did not complete fit in the sample box becasue it is a gravelly layer
55	55.0					S-27, 54-55 ft: **CLAYEY GRAVEL WITH SAND AND COBBLES (GC)** Grayish brown, moist, very dense, fine to coarse sand, ±19.8% fines, ±30.4% fine to coarse sand, fine to coarse subangular to subrounded gravel, 4" diameter cobble (Less Weathered Springwater Formation)	
	55.8	0.83	SS-29	31-50/4" (50/4")			
			S-30			**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, very dense, ±20% fines, ±15% fine to coarse subangular basalt gravel less than 1.5" diameter, lightly cemented, disintegrated with finger pressure (Less Weathered Springwater Formation) S-30, 55-59 ft: Similar to SS-29 S-30, 59-60 ft: Similar to SS-29 except 29.9% fines, 38% fine to coarse sand 59.8 ft: Increase in sand content	Sand is cemented, disintegrates with finger pressure 59-60 ft: Grab Sample GS-31 Fines = 29.9%, Sand = 38%, Gravel = 32.1%
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-02 SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (662580.80 N, 7739617.34 E)

ELEVATION : 668.49 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/17/21 11:54 END : 11/18/21 14:14 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0						
	60.9	0.92	SS-32	18-50/5" (50/5")		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, very dense, fine to coarse sand, ±25% fine to coarse subangular to subrounded gravel less than 1" diameter, lightly cemented (Less Weathered Springwater Formation) S-33, 60-64.9 ft: Similar to SS-32 except up to 3" diameter gravel	62-63 ft: Grab Sample GS-34
			S-33				
65	65.0						
	65.1	0.08	SS-35	50/1" (50/1")		**SILTY SAND WITH GRAVEL AND COBBLES (SM)** Gray to dark gray, moist, very dense, 29.8% fines, 24.5% fine to coarse subangular to subrounded gravel up to 3" diameter, fine to coarse sand, cemented sand mixed with sand, disintegrated with finger pressure, some gravel pieces with a green staining (Less Weathered Springwater Formation) S-36, 65-67.4 ft: Similar to SS-35 except 4" diameter cobble at 66.8 ft	65-66 ft: Grab Sample GS-37 Fines = 29.8%, Sand = 45.7%, Gravel = 24.5%
			S-36			S-36, 67.4-68.8 ft: **POORLY GRADED GRAVEL WITH SAND (GP)** Gray to dark gray, dry to moist, very dense, ±10% fines, ±30% fine to coarse sand, fine to coarse subangular to subrounded gravel less than 3" diameter, mixture of cemented sand and sand	
70	70.0						
	70.5	0.46	SS-38	50/5.5" (50/5.5")		S-36, 68.8-70 ft: Similar to SS-35 **SILTY SAND WITH GRAVEL AND COBBLES (SM)** Dark gray, moist, very dense, ±12% fines, ±15% fine subangular to subrounded gravel less than 1" diameter, cemented, disintegrated with finger pressure (Less Weathered Springwater Formation) S-39, 70-73 ft: Similar to SS-38 except cobbles present, one cobble less than 4" diameter at 70 ft S-39, 73-75 ft: Similar to SS-38 except ±15% fines, trace iron oxide staining, not cemented to cemented, putty knife with hammer blows required to disintegrate cemented parts, contains cobbles up to 4" diameter	
			S-39				
75	75.0						
	75.4	0.42	SS-40	50/5" (50/5")		**SILTY SAND (SM)** Dark gray, moist, very dense, fine to coarse sand, ±20-30% fines, ±5% fine subangular gravel, not cemented to cemented, disintegrates with finger pressure (Less Weathered Springwater Formation) Bottom of Boring at 75.4 ft below ground surface	Remove 6" casing from 0-75 ft Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1.5 ft: Bentonite chips 1.5-75.4 ft: Bentonite grout
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-03 SHEET 1 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663082.43 N, 7739628.58 E)

ELEVATION : 687.52 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/19/21 08:58 END : 11/22/21 12:55 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0.0						2.5 in: **ASPHALT CONCRETE PAVEMENT** 12.5 in: **BASE GRAVEL**	6" diameter casing used
			S-1			**LEAN CLAY (CL)** Slightly reddish brown, moist, stiff, low to medium plasticity, ±5% fine sand, trace black Mn nodules, trace organics consisting of roots (Residual Soil of the Springwater Formation)	
5 5.0							
	1.20	SS-2	2-4-7 (11)			**LEAN CLAY (CL)** Slightly reddish brown, moist, stiff, low to medium plasticity, ±5% fine sand, trace black Mn nodules (Residual Soil of the Springwater Formation)	
6.5							
		S-3				S-3, 5-10 ft: Similar to SS-2 except trace fine subrounded gravel	
10 10.0							
	1.50	SS-4	1-4-6 (10)			Similar to SS-2 except ±5% fine to coarse sand, trace organics consisting of roots	
11.5							
		S-5				S-5, 10-15 ft: Similar to SS-4	
15 15.0							
	1.50	SS-6	3-3-4 (7)			**ELASTIC SILT (MH)** Slightly reddish brown, moist, firm, medium plasticity, ±5-10% fine sand, trace black Mn nodules, trace organics consisting of roots (Residual Soil of the Springwater Formation)	WC = 36.1% LL = 54, PL = 33, PI = 21
16.5							
		S-7				S-7, 15-16.5 ft: Similar to SS-6 S-7, 16.5-20 ft: Similar to SS-6 except medium to high plasticity	
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-03 SHEET 2 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663082.43 N, 7739628.58 E)

ELEVATION : 687.52 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/19/21 08:58 END : 11/22/21 12:55 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-8	1-4-6 (10)		**LEAN CLAY (CL)** Slightly reddish brown, moist, stiff, low to medium plasticity, 6.7% fine sand, black pockets of sand, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 36.1% Fines = 93.3%, Sand = 6.7%, Gravel = 0%
	21.5						
			S-9			S-9, 20-21.6 ft: Similar to SS-8 S-9, 21.6-25 ft: **FAT CLAY (CH)** Brown with some gray and red mottling, moist, stiff, medium to high plasticity, ±10-15% fine to coarse black pockets of sand, trace fine subangular gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)	
25	25.0						
		1.50	SS-10	2-4-7 (11)		**FAT CLAY (CH)** Brown with some gray and red mottling, moist, stiff, medium plasticity, 8.2% fine to coarse black pockets of sand, trace fine subangular gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 38.8% LL = 54, PL = 29, PI = 25 Fines = 91.8%, Sand = 8.2%, Gravel = 0%
	26.5						
			S-11			S-11, 25-28.5 ft: Similar to SS-10 S-11, 28.5-30 ft: Similar to SS-10 except ±5% sand, increase in gray mottling	
30	30.0						
		1.50	SS-12	3-4-7 (11)		**ELASTIC SILT (MH)** Brown slightly mottled gray, moist, stiff, medium plasticity, 8% fine to coarse black sand pockets, 0.2% fine subangular gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 37.8% LL = 50, PL = 31, PI = 19 Fines = 91.8%, Sand = 8%, Gravel = 0.2%
	31.5						
			S-13			S-13, 31.5-35 ft: Similar to SS-12, interlayered elastic silt, elastic silt with sand, and sandy elastic silt	S-13: PP = 0.5, 0.25, 0.75 tsf
35	35.0						
		1.50	SS-14	3-2-4 (6)		**ELASTIC SILT (MH)** Brown slightly mottled gray, moist, firm, medium plasticity, 8% fine to coarse black sand pockets, 0.2% fine subangular gravel, trace black Mn nodules, bottom 4" contains ±40% sand (Sensitive Saprolite of the Springwater Formation)	WC = 64.7% LL = 70, PL = 41, PI = 29
	36.5						
			S-15			S-15, 35-40 ft: No recovery	
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-03 SHEET 3 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663082.43 N, 7739628.58 E)

ELEVATION : 687.52 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/19/21 08:58 END : 11/22/21 12:55 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0						
		1.50	SS-16	3-4-6 (10)		**SILTY SAND WITH GRAVEL (SM)** Light grayish brown to gray, moist, loose, 44% fines, 18.8% fine to coarse subrounded gravel less than 1.5" diameter (Sensitive Saprolite of the Springwater Formation) S-17, 40-45 ft: Similar to SS-16	WC = 62.7% LL = 59, PL = 44, PI = 15 Fines = 44.0%, Sand = 37.2%, Gravel = 18.8%
	41.5						
			S-17				S-17: Driller notes that the soil is flowing out of the sonic barrel and they could not recover any sample. Driller changed the bit diameter, still no recovery. Driller reported that the soil is flowing and heaving, drill rod sinking through without pressure. Soil similar to SS-16, and the "soupy" soil with cobbles encountered in CRBF-B-02
45	45.0						
			S-18			S-18, 45-46 ft: **SILTY SAND WITH GRAVEL (SM)** Light grayish brown, moist, loose, 38.3% fine to coarse sand, 43.5% fines, 18.2% fine to coarse subangular to subrounded gravel less than 1.5" diameter (Sensitive Saprolite of the Springwater Formation) S-18, 46-50 ft: **SILTY SAND WITH GRAVEL (SM)** Light gray-brown, moist, dense, fine to coarse sand, ±30% fines, ±15% fine to coarse subangular to subrounded gravel less than 3" diameter, lightly cemented (Less Weathered Springwater Formation) S-18, 49.2 ft: Increase in cementation	45 ft: No SPT, heaving of casing WC = 51.4% LL = 50, PL = 42, PI = 8 Fines = 43.5%, Sand = 38.3%, Gravel = 18.2%
50	50.0						
		1.50	SS-20	10-14-19 (33)		**SILTY SAND WITH GRAVEL (SM)** Light gray, brown, moist, dense, fine to coarse sand, 22.3% fines, 19.6% fine to coarse subangular to subrounded gravel less than 1.5" diameter, lightly cemented (Less Weathered Springwater Formation)	WC = 19.1% Fines = 22.3%, Sand = 58.1%, Gravel = 19.6%
	51.5						
			S-21			S-21, 51.5-55 ft: Similar to SS-20 except 21.1% fines, 50% sand, 28.9% fine to coarse subangular to subrounded gravel up to 3" diameter	53-54 ft: Grab Sample GS-22 Fines = 21.1%, Sand = 50%, Gravel = 28.9%
55	55.0						
		0.92	SS-23	25-50/5" (50/5")		**SILTY SAND WITH GRAVEL AND COBBLES (SM)** Grayish brown, moist, very dense, ±20% fines, ±15% fine to coarse subrounded to subangular gravel, fine to coarse sand, lightly cemented, disintegrates with the finger pressure (Less Weathered Springwater Formation) S-24, 55-57.5 ft: Similar to SS-23 S-24, 57.5-58 ft: Basalt cobbles	
	55.9						
			S-24			S-24, 58-60 ft: Similar to SS-23 exept brown, lightly cemented to cemented, disintegrates with the finger pressure to pressure with putty knife and hammer	S-24, 57.5-58 ft: 2 pieces of basalt cobble, gray, fine grained, fresh, red staining on the surface, less than 1 mm clay coating on the basalt pieces 58-59 ft: Grab Sample GS-25
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-03 SHEET 4 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663082.43 N, 7739628.58 E)

ELEVATION : 687.52 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/19/21 08:58 END : 11/22/21 12:55 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0	1.50	SS-26	2-2-3 (5)		**LEAN CLAY (CL)** Gray mottled brown, moist, firm, medium plasticity, 8% fine to coarse sand, 0.8% fine to coarse subrounded to subangular gravel less than 1" diameter (Less Weathered Springwater Formation) S-27, 60-61.5 ft: Similar to SS-26 except less than 2" diameter gravel S-27, 61.5-65 ft: Similar to SS-26 except ±15% fine to coarse sand	WC = 42.7% LL = 46, PL = 26, PI = 20 Fines = 90.5%, Sand = 8.7%, Gravel = 0.8%
	61.5		S-27				
65	65.0	1.50	SS-28	2-7-7 (14)		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, rare dark pink spot, moist, medium dense, ±40% fines, ±30% fine to coarse sand, ±30% fine to coarse subrounded to subangular gravel, reddish-brown iron oxide staining (Less Weathered Springwater Formation) S-29, 65-70 ft: Similar to SS-28, increase in cementation at 66.5 feet, disintegrates with pressure from putty knife and hammer	
	66.5		S-29				68-69 ft: Grab Sample GS-30 Fines = 37.5%, Sand = 31.3%, Gravel = 31.2%
70	70.0	1.25	SS-31	10-31-50/3" (81/9")		**SILTY SAND WITH GRAVEL AND COBBLES (SM)** Grayish brown, moist, very dense, ±40% fines, fine to coarse sand, ±15% fine to coarse subrounded to rounded gravels less than 1.5" diameter, reddish-brown iron oxide staining (Less Weathered Springwater Formation) S-32, 70-73 ft: Similar to SS-31 except 4" diameter cobble at 72ft	PP = 4.5 tsf Hammer and knife required to disintegrated soil increase in clay ~ 30%-40% clay
	71.3		S-32			S-32, 73-75 ft: **CLAYEY GRAVEL WITH SAND AND COBBLES (GC)** Gray, moist, very hard, 24.7% fines, 31.4% fine to coarse sand, gravels subrounded to subangular, ±10% subrounded 4" diameter cobbles, cemented, disintegrated with finger pressure, some parts disintegrated with pressure from putty knife, 4" diameter cobbles at 74, 74.6 ft (Less Weathered Springwater Formation)	73-75 ft: Grab Sample GS-33 WC = 9.6% LL = 30, PL = 20, PI = 10 Fines = 24.7%, Sand = 31.4%, Gravel and cobbles = 43.9%
75	75.0	1.50	SS-34	6-40-42 (82)			SS-34: Predominantly subrounded gravel
	76.5		S-35			**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, very dense, ±15% fines, ±15% fine to coarse subangular to subrounded gravel less than 1.5" diameter, fine to coarse sand (Less Weathered Springwater Formation) S-35, 76.5-77 ft: **SILTY SAND (SM)** Grayish brown, moist, very hard, 30.6% fines, 12.4% fine to coarse subangular to subrounded gravel less than 1.5" diameter, fine to coarse sand (Less Weathered Springwater Formation) S-35, 77-80 ft: Similar to S-35 from 76.5-77 ft except dark gray	76.5-77 ft: Grab Sample GS-36 WC = 16.1% LL = 31, PL = 26, PI = 5 Fines = 30.6%, Sand = 57%, Gravel = 12.4% Stop on 11/19/2021 at 76.5 feet at 15:30 PM Start on 11/22/2021 at 8:35 AM
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-03 SHEET 5 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663082.43 N, 7739628.58 E)

ELEVATION : 687.52 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/19/21 08:58 END : 11/22/21 12:55 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	80.0						
	80.8	0.75	SS-37	16-50/3" (50/3")		**SILTY SAND WITH GRAVEL (SM)** Grayish brown, moist, very dense, ±15% fines, ±15% fine to coarse subangular to subrounded gravel less than 1.0" diameter, fine to coarse sand (Less Weathered Springwater Formation)	
			S-38			S-38, 80.75-85 ft: Similar to SS-37 except 24.8% fines, 30.9% gravel, trace iron-oxide staining, trace green staining	82-83 ft: Grab Sample GS-39 Fines = 24.8%, Sand = 44.3%, Gravel = 30.9%
85	85.0						
	85.3	0.33	SS-40	50/4" (50/4")		**SILTY SAND WITH GRAVEL (SM)** Dark gray, moist, very dense, ±15% fines, fine to coarse sand, ±15% fine to coarse subrounded to subangular gravel less than 1" diameter, cemented sand, disintegrates with finger pressure (Less Weathered Springwater Formation)	85.5-86.5 ft: Grab Sample GS-42
			S-41			S-41, 85-89 ft: Similar to SS-40 except trace reddish brown iron oxide staining	
90	90.0					S-41, 89-90 ft: **SILTY SAND WITH GRAVEL AND COBBLES (SM)** Similar to SS-40 except trace reddish brown iron oxide staining, 4.5" diameter basalt cobble, gray, fine grained, fresh, coated with fat clay (Less Weathered Springwater Formation)	
	90.8	0.75	SS-43	25-50/3" (50/3")		**SILTY SAND WITH GRAVEL AND COBBLES (SM)** Similar to SS-40 except ±15% fine to coarse subangular to subrounded gravel less than 1.5" diameter, trace cobbles (Less Weathered Springwater Formation)	Gravel brown, some gray, vesicular basalt, cemented sand, disintegrated with finger pressure
			S-44			S-44, 91.5-95 ft: Similar to SS-43 except increase in plasticity of fines at 92.5 ft, 33.4% fines, 15.7% fine to coarse subangular to subrounded gravel less than 3" diameter, two cobbles at 93.8 feet, trace reddish brown irox oxide staining, trace green staining	93-94 ft: Grab Sample GS-45 WC = 14.3% Fines = 33.4%, Sand = 50.9%, Gravel = 15.7% Similar to S-44 after 92.5 feet
95	95.0						
	95.8	0.75	SS-46	25-50/3" (50/3")		**SILTY SAND WITH COBBLES (SM)** Dark gray, moist, very dense, ±25% fines, trace fine to coarse subangular to subrounded gravel less than 0.5" diameter, fine to coarse sand, cemented, disintegrates with finger pressure, trace cobbles (Unweathered Springwater Formation)	
			S-47			S-47, 95-98 ft: Similar to SS-46 except 4" diameter cobble at 95.7 and 97.9 ft	
						CLAYEY GRAVEL WITH SAND (GC) Gray, moist, very dense, 25% fines, 23.2% fine to coarse sand, fine to coarse subrounded to subangular gravel up to 3" diameter (Unweathered Springwater Formation)	98-99 ft: Grab Sample GS-48 WC = 12.6% Fines = 25%, Sand = 23.2%, Gravel = 51.8%
100							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-03 SHEET 6 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663082.43 N, 7739628.58 E)

ELEVATION : 687.52 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/19/21 08:58 END : 11/22/21 12:55 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
100.0	0.25		SS-49	50/3" (50/3")	∴∵∴	**POORLY GRADED SAND (SP)** Dark gray, trace reddish and yellow grains, moist, very dense, ±5% fines, fine to coarse sand, trace fine subrounded gravel (Unweathered Springwater Formation) Bottom of Boring at 100.25 ft below ground surface	Remove 6" diameter casing from 0-100 ft Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-10 ft: Bentonite chips 10-100.25 ft: Bentonite grout (~100 gal of grout)
105							
110							
115							
120							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-04 SHEET 1 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663477.58 N, 7739637.07 E)

ELEVATION : 683.86 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/22/21 14:57 END : 11/23/21 14:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0.0						2 in: **ASPHALT CONCRETE PAVEMENT** 18 in: **BASE GRAVEL**	6" casing used
			S-1			S-1, 1.6-2.5 ft: Top soil S-1, 2.5-5 ft: **LEAN CLAY (CL)** Orangish to reddish brown, moist, stiff, low to medium platicity, trace fine sand, trace fine subangular gravel, black Mn nodules (Residual Soil of the Springwater Formation)	
5 5.0							
6.5	1.10	SS-2	4-7-7 (14)			**LEAN CLAY (CL)** Brown, moist, stiff, low to medium plasticity, trace fine sand, trace fine subangular gravel, black Mn nodules (Residual Soil of the Springwater Formation)	
			S-3			S-3, 6.5-10 ft: **ELASTIC SILT (MH)** Slightly orangish-brown, moist, stiff, medium plasticity, trace fine sand, trace black Mn nodules, trace organics consisting of fine roots (Residual Soil of the Springwater Formation)	
10 10.0							
11.5	1.40	SS-4	3-4-5 (9)			**ELASTIC SILT (MH)** Slightly orangish-brown, moist, stiff, medium plasticity, trace fine sand, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 38.6% LL = 55, PL = 35, PI = 20
			S-5			S-5, 10-15 ft: Similar to SS-4	Driller notes that S-5 was dropped and was later retrieved along with S-7
15 15.0							
16.5	1.50	SS-6	3-4-5 (9)			Similar to SS-4 except trace reddish brown iron oxide staining	
			S-7			S-7, 15-20 ft: Similar to SS-6	
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-04 SHEET 2 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663477.58 N, 7739637.07 E)

ELEVATION : 683.86 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/22/21 14:57 END : 11/23/21 14:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-8	2-6-10 (16)		**SILT (ML)** Slightly orangish-brown, moist, stiff, medium plasticity, trace fine sand, trace fine subangular gravel, trace reddish brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation) S-9, 20-25: Similar to SS-8 except slight gray mottling	WC = 34.2% LL = 48, PL = 33, PI = 15
	21.5						
			S-9				PP = 0.25, 0, 1.25, 0.5 tsf
25	25.0						
		1.50	SS-10	3-7-8 (15)		**ELASTIC SILT (MH)** Slightly orangish-brown slightly mottled gray, moist, stiff, medium plasticity, trace fine sand, trace fine subangular gravel, black Mn nodules, trace iron-oxide staining (Residual Soil of the Springwater Formation) S-11, 25-30 ft: Similar to SS-10 except fine subangular gravel layer at 29.7 ft	WC = 34.7% LL = 51, PL = 30, PI = 21
	26.5						Stop on 11/22/2021 at 16:00 at 26.5 feet Start on 11/23/2021 at 8:45 AM
			S-11				
30	30.0						
		1.50	SS-12	2-7-9 (16)		**LEAN CLAY WITH SAND (CL)** Brown mottled gray with black spots of sand, moist, very stiff, medium plasticity, 20.3% fine to coarse sand, 0.2% fine subangular gravel, trace reddish brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation) S-13, 31.5-34 ft: **LEAN CLAY (CL)** Gray mottled brown, moist, firm, medium to high plasticity, trace fine to coarse sand, trace reddish brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 32.9% LL = 47, PL = 27, PI = 20 Fines = 79.5%, Sand = 20.3%, Gravel = 0.2%
	31.5						
			S-13				
35	35.0					S-13, 34-35 ft: **SANDY ELASTIC SILT (MH)** Brown mottled gray, moist, firm, medium plasticity, 38% fine to coarse sand, trace fine subangular gravel, trace reddish brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation)	34-35 ft: Grab Sample GS-14 Fines = 62%, Sand = 38%, Gravel = 0%
		1.50	SS-15	3-3-5 (8)		SS-15: **SANDY ELASTIC SILT (MH)** Brown mottled gray, moist, firm, medium plasticity, 40.4% fine to coarse sand, trace fine subangular gravel, trace reddish brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation)	WC = 64.6% LL = 66, PL = 38, PI = 28 Fines = 59.6%, Sand = 40.4%, Gravel = 0%
	36.5						
			S-16			S-16, 35-39.7 ft: Similar to SS-15 except fine subangular to subrounded gravel S-16, 39.7 ft: Transition to SS-18 39.8 ft: One 4" diameter cobble, gravels less than 3" diameter	38-39 ft: Grab Sample GS-17
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-04 SHEET 3 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663477.58 N, 7739637.07 E)

ELEVATION : 683.86 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/22/21 14:57 END : 11/23/21 14:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-18	1-3-10 (13)		**SANDY ELASTIC SILT WITH GRAVEL AND COBBLES (MH)** Light grayish brown with rare brown, green and yellow spots, moist, stiff, medium to high plasticity, ± 35% fine to coarse sand, ±15% fine to coarse subrounded to subangular gravel less than 1.0" diameter, trace cobbles (Sensitive Saprolite of the Springwater Formation)	
	41.5		S-19			S-19, 40-45 ft: Similar to SS-18 except up to 3" diameter gravel, one cobble at 44.8 ft	
45	45.0	1.50	SS-20	6-6-15 (21)		**SANDY SILT WITH GRAVEL (ML)** Light grayish brown with rare brown, green and yellow spots, moist, very stiff, slight plasticity, ± 35% fine to coarse sand, ±15% fine to coarse subrounded to subangular gravel less than 1.5" diameter (Less Weathered Springwater Formation)	45-46 ft: Grab Sample GS-22 WC = 31.7% LL = 42, PL = 35, PI = 7
	46.5		S-21			S-21, 45-46.8 ft: Similar to SS-20 except ±15% fine to coarse subrounded to subangular gravel less than 3" diameter	48-49 ft: Grab Sample GS-23
50	50.0	1.33	SS-24	20-15-50/4" (65/10")		S-21, 46.8-50 ft: **CLAYEY SAND WITH GRAVEL (SC)** Gray to pink, moist, very dense, ±30% fines, ±15% fine to coarse subangular to subrounded gravel less than 3" diameter, cemented occassionally (Less Weathered Springwater Formation) **CLAYEY SAND WITH GRAVEL AND COBBLES (SC)** Grayish brown with rare pink and orange spots, moist, very dense, ±15% fines, ±15% fine to coarse subangular to subrounded gravels less than 1.5" diameter, cobbles, cemented, disintegrated with finger pressure (Less Weathered Springwater Formation)	PP = 3.5, 2.75, 3.75 tsf 52-53 ft: Grab Sample GS-26 WC = 17.4% LL = 37, PL = 23, PI = 14 Fines = 22.5%, Sand = 56.5%, Gravel = 21%
	51.3		S-25			S-25, 50 ft: One 4" diameter cobble S-25, 51.5-54.7 ft: **CLAYEY SAND WITH GRAVEL (SC)** Grayish brown with rare pink and orange spots to greenish yellow, moist, very hard, 22.5% fines, 21% fine to coarse subangular to subrounded gravel less than 1.5" diameter, cemented, disintegrated with finger pressure (Less Weathered Springwater Formation)	
55	55.0	1.50	SS-27	8-8-6 (14)		S-25, 54.7-55 ft: **SILT (ML)** Similar to SS-27 SS-27: **SILT (ML)** Greenish yellow and orangish brown, moist, stiff, slight plasticity, ± 5% fine to coarse sand, trace fine subangular gravel, trace black Mn nodules (Less Weathered Springwater Formation)	WC = 36% LL = 40, PL = 26, PI = 14
	56.5		S-28			S-28, 55-60 ft: No recovery	
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-04 SHEET 4 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663477.58 N, 7739637.07 E)

ELEVATION : 683.86 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/22/21 14:57 END : 11/23/21 14:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0	1.50	SS-29	6-7-14 (21)		**SANDY FAT CLAY (CH)** Greenish brown, moist, very stiff, low to medium plasticity, ±35-40% fine to coarse sand, trace fine to coarse subangular to subrounded gravel less than 0.5" diameter, reddish brown iron oxide staining (Less Weathered Springwater Formation)	
	61.5					S-30, 60-61.7 ft: Similar to SS-29	
			S-30			S-30, 61.7-65 ft: **CLAYEY SAND WITH COBBLES (SC)** Greenish brown, moist, dense, 34% fines, fine to coarse sand, 11% fine to coarse subangular to subrounded gravel less than 3" diameter, 19% cobbles upto 4" diameter, reddish brown iron oxide staining (Less Weathered Springwater Formation)	62-63 ft: Grab Sample GS-31 Fines = 34%, Sand = 36%, Gravel = 11%, Cobbles = 19%
65	65.0						
		1.50	SS-32	10-13-14 (27)		**CLAYEY SAND (SC)** Gray-brown, reddish brown, moist, medium dense, 38.9% fines, 10.6% fine to coarse subangular to subrounded gravel less than 1.5" diameter, fine to coarse sand, trace reddish brown iron-oxide staining, lightly cemented, disintegrated with finger pressure (Less Weathered Springwater Formation)	WC = 35.2% Fines = 38.9%, Sand = 50.5%, Gravel = 10.6%
	66.5						
			S-33			S-33, 65-68.8 ft: Similar to SS-32, except zones with higher fines content, gravel less than 3" diameter	68-69 ft: Grab Sample GS-34
						S-33, 68.8-70 ft: Similar to SS-35	
70	70.0						
	70.8	0.75	SS-35	40-50/3" (50/3")		**SILTY SAND WITH COBBLES (SM)** Grayish brown, moist, very dense, 33.4% fines, 12.6% fine to subrounded gravel less than 1" diameter, fine to coarse sand, cemented, disintegrates with finger pressure, trace cobbles (Less Weathered Springwater Formation)	S-36: Cemented, requires putty knife and hammer to disintegrate
			S-36			S-36: 70-75 ft: Similar to SS-35 except gravel less than 3" diameter, pink spots, one 4" diameter cobble 74.5-75 ft	73-74 ft: Grab Sample GS-37 WC = 20.1% LL = 49, PL = 29, PI = 20 Fines = 33.4%, Sand = 54%, Gravel = 12.6%
75	75.0						
	75.5	0.42	SS-38	50/6" (50/6")		**SILTY SAND WITH GRAVEL AND COBBLES (SM)** Gray and pink, moist, very dense, 23.5% fines, 29.2% fine to coarse subangular gravel less than 1.5" diameter, fine to coarse sand, cemented, disintegrates with finger pressure, trace cobbles (Less Weathered Springwater Formation)	76-77 ft: Grab Sample GS-40 Fines = 23.5%, Sand = 47.3%, Gravel = 29.2%
			S-39			S-39: 75-80 ft: Similar to SS-38 except predominantly gray, gravel less than 3" diameter, one 4" diameter cobble at 77.4 ft	
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-04 SHEET 5 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663477.58 N, 7739637.07 E)

ELEVATION : 683.86 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : Not recorded START : 11/22/21 14:57 END : 11/23/21 14:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
80.0							
80.3	0.33	SS-41	50/4" (50/4")		**CLAYEY GRAVEL WITH SAND AND COBBLES (GC)** Gray and pink, moist, very hard, 25.9% fines, 37% gravels and cobbles, fine to coarse subangular to subrounded gravels less than 3" diameter, 37.1% fine to coarse sand (Less Weathered Springwater Formation) S-42, 80-85 ft: Similar to SS-41 except 4" diameter cobbles at 80.7 and 85 ft	80-81 ft: Grab Sample GS-43 WC = 8.9% LL = 33, PL = 18, PI = 15 Fines = 25.9%, Sand = 37.1%, Gravel and Cobble = 37%
		S-42					
85 85.0							
85.8	0.75	SS-44	40-50/3" (50/3")			**SILTY SAND (SM)** Gray to brown, moist, very dense, ±30% fines, fine to coarse sand, trace fine to coarse subangular gravel less than 1" diameter, cemented, disintegrated with finger pressure (Less Weathered Springwater Formation) Bottom of Boring at 85.75 ft below ground surface	Remove 6" casing from 0-85 ft Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-8 ft: Bentonite chips 8-85.75 ft: Bentonite grout
90							
95							
100							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-05 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663877.35 N, 7739646.69 E)

ELEVATION : 669.23 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Tricone and Drag Bit, 10" Auger (4-1/4" I.D.), 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 9 feet bgs START : 12/8/21 08:46 END : 12/8/21 11:35 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						4 in: **ASPHALT CONCRETE PAVEMENT** 20 in: **BASE GRAVEL**	Start drilling through asphalt and base gravel with 4-1/4" auger
							2 ft: Switch to 4-7/8" tricone bit
5	5.0						
	6.5	1.20	SS-1	1-2-4 (6)		**LEAN CLAY (CL)** Slightly reddish brown, moist, firm, medium plasticity, trace fine sand, trace subangular gravel less than 0.5" diameter, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 35.4% LL = 47, PL = 24, PI = 23 5 ft: Switch to 4-7/8" drag bit
10	10.0						
	11.5	1.50	SS-2	3-7-9 (16)		**LEAN CLAY (CL)** Slightly orangish to reddish brown with rare gray mottling, moist, very stiff, medium to high plasticity, trace fine to coarse sand, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.5, 1.5, 2 tsf
15	15.0						
	16.5	1.50	SS-3	2-5-5 (10)		**FAT CLAY (CH)** Orangish brown mottled gray to gray mottled brown, moist, stiff, high plasticity, trace black fine to coarse sand, trace black Mn nodules, trace fine gravel subrounded to subangular (Residual Soil of the Springwater Formation)	PP = 0.25, 0.25, 0.5 tsf WC = 43.1% LL = 67, PL = 30, PI = 37 Driller reported that a clay collar in the boring from 0-15 ft. Re-drill 0-15 ft with 6" drag bit. 15 ft: Switch to 6" drag bit.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-05 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663877.35 N, 7739646.69 E)

ELEVATION : 669.23 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Tricone and Drag Bit, 10" Auger (4-1/4" I.D.), 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 9 feet bgs START : 12/8/21 08:46 END : 12/8/21 11:35 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	1-3-3 (6)		**ELASTIC SILT (MH)** Brown mottled gray with pink rare spots, moist, firm, high plasticity, ±15% fine to coarse sand, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation)	PP = 0.5, 0, 0 tsf WC = 69.5% LL = 74, PL = 43, PI = 31
	21.5						
25	25.0						
		1.50	SS-5	2-3-4 (7)		**SANDY ELASTIC SILT (MH)** Light grayish brown with black spots, moist, firm, medium plasticity, 46% fine to coarse sand, 1% fine to coarse subangular to subrounded gravel less than 1.0" diameter, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation)	WC = 78.4% LL = 59, PL = 38, PI = 21 Fines = 53.4%, Sand = 46.1%, Gravel = 0.5%
	26.5						
30	30.0						
		1.50	SS-6	16-12-19 (31)		**SILTY SAND WITH GRAVEL (SM)** Light grayish brown with with rare yellow seams and black spots, moist, dense, 30.7% fines, fine to coarse sand, 17.2% fine to coarse subangular to subrounded gravel less than 1.0" diameter, trace black Mn nodules, very lightly cemented (Less Weathered Springwater Formation)	WC = 26.0% Fines = 30.7%, Sand = 52.1%, Gravel = 17.2% 30 ft: Switch to 4-7/8" drag bit Sand easily disintegrates with finger pressure 30-35 ft: Occasional rig chatter
	31.5						
35	35.0						
	35.5	0.54	SS-7	23-50/0.5" (50/0.5")		**SILTY SAND (SM)** Grayish brown, lightly cemented, very dense, ±30% fines, ±10% fine to coarse subangular to subrounded gravel less than 1.5" diameter, gravel piece in shoe, fine to coarse sand (Less Weathered Springwater Formation)	35 ft: Switch to 4-7/8" tricone bit Disintegrates with finger pressure
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-05 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (663877.35 N, 7739646.69 E)

ELEVATION : 669.23 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Tricone and Drag Bit, 10" Auger (4-1/4" I.D.), 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 9 feet bgs START : 12/8/21 08:46 END : 12/8/21 11:35 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0	0.00		SS-8	50/<1/4" (50)		No Recovery Bottom of Boring at 40.25 ft below ground surface	Installed 1" PVC standpipe piezometer 0-1 ft: 8" diameter, 12" deep monument set in concrete 1-29 ft: Bentonite chips 29-40 ft: Sand 30-40 ft: Screen Start Card # 1054923 Well # L144782
45							
50							
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-06 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (664233.70 N, 7739653.08 E)

ELEVATION : 668.94 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 12/28/21 14:23 END : 12/8/21 15:30 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						4 in: **ASPHALT CONCRETE PAVEMENT** 20 in: **BASE GRAVEL**	Start drilling with 3 7/8" drag/spade bit
5	5.0						
	6.5	0.80	SS-1	1-2-3 (5)		**FAT CLAY (CH)** Orangish-brown mottled gray, moist, firm, medium plasticity, trace fine to coarse sand, ±10% subrounded to subangular gravel less than 1.0" diameter, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	WC = 30.7% LL = 55, PL = 25, PI = 30
10	10.0						
	11.5	1.50	SS-2	5-7-10 (17)		**LEAN CLAY (CL)** Orangish-brown mottled gray, moist, very stiff, low to medium plasticity, ±10% fine to coarse sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0.5, 1.5, 1.5 tsf
15	15.0						
	16.5	1.50	SS-3	4-7-10 (17)		**FAT CLAY (CH)** Orangish-brown mottled dark to light gray, moist, very stiff, medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	WC = 32.5% LL = 53, PL = 27, PI = 26
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-06 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Cottrell Road, Gresham, OR (664233.70 N, 7739653.08 E)

ELEVATION : 668.94 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 12/28/21 14:23 END : 12/8/21 15:30 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
20.0							
	1.50	SS-4	6-10-14 (24)			Similar to SS-3 except medium to high plasticity	PP = 3.25, 1.75, 1.75 tsf
21.5							
25 25.0							
	1.50	SS-5	2-2-6 (8)			**SANDY ELASTIC SILT (MH)** Light gray, dark brown, black, moist, firm, medium plasticity, 44.3% fine to coarse sand, 0.8% fine gravel, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation)	WC = 66.8% LL = 64, PL = 40, PI = 24 Fines = 54.9%, Sand = 44.3%, Gravel = 0.8%
26.5						Bottom of Boring at 26.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1.5 ft: Concrete 1.5-26.5 ft: Bentonite chips
30							
35							
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-07 SHEET 1 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664496.98 N, 7740359.62 E)

ELEVATION : 673.22 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : CME-550 Track #3, Mud Rotary, 4-7/8" Drag Bit, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/15/22 09:20 END : 8/15/22 16:28 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
							Start advancing borehole with 4-7/8" drag bit
	2.5						
	4.0	1.50	SS-1	1-3-5 (8)		**LEAN CLAY (CL)** Orangish-brown, moist, firm, low to medium plasticity, ±10% fine to coarse sand, trace organics roots, trace black Mn nodules, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0, 0, 0.25 tsf
5	6.0		ST-2				ST-2: 4-5 ft: 400 psi 5-6 ft: 700 psi
	7.5	1.50	SS-3	4-6-7 (13)		**FAT CLAY (CH)** Orangish-brown, trace gray molting, stiff, ±5% fine to coarse sand, trace subangular to subrounded gravel (Residual Soil of the Springwater Formation)	PP = 0.5, 1.75. 0.5 tsf WC = 35% LL = 56, PL = 23, PI = 33
	9.3		ST-4			**LEAN CLAY (CL)** Gray and tan, moist, stiff, medium plasticity, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	ST-4: 7.5-8.5 ft: 500 psi 8.5-9.5 ft: 800 psi WC = 29.8% LL = 46, PL = 25, PI = 21
10	10.0						
	11.5	1.50	SS-5	4-6-9 (15)		**LEAN CLAY (CL)** Brown with trace gray mottling, moist, stiff, medium plasticity, ±5-15% fine to coarse sand, trace subangular to subrounded gravel, trace black Mn nodules, trace iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2.5, 2.5, 2 tsf
	12.5						
	14.0	1.50	SS-6	6-8-10 (18)		Similar to SS-5 except very stiff, persistent gray mottling, 12.9%, fine to coarse sand	PP = 1.75, 1.25, 1.5 tsf WC = 30.1% LL = 48, PL = 24, PI = 24 Fines = 87.1%, Sand = 12.9%, Gravel = 0%
15	15.5		ST-7				ST-7: 14-15 ft: 650 psi 15-15.5 ft: 800 psi
	17.0	1.50	SS-8	4-5-8 (13)		**FAT CLAY (CH)** Orangish-brown, mottled gray, moist, stiff, medium to high plasticity, ±10% fine to coarse sand, trace subangular to subrounded gravel, black spots of sand and gravel, trace black Mn nodules, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1.5, 0.5, 1.5 tsf Short clay collars retrieved from borehole
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-07 SHEET 2 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664496.98 N, 7740359.62 E)

ELEVATION : 673.22 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : CME-550 Track #3, Mud Rotary, 4-7/8" Drag Bit, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/15/22 09:20 END : 8/15/22 16:28 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-9	4-5-8 (13)		Similar to SS-8 except trace red mottling in the gray parts, ±5% sand	PP = 1, 1.75, 1.75 tsf
	21.5						
25	25.0	1.50	SS-10	2-3-5 (8)		**FAT CLAY WITH SAND (CH)** Gray and brown parts, moist, firm, medium to high plasticity, ±15% fine to coarse sand, trace subangular to subrounded gravel, trace black Mn nodules, trace reddish-brown iron oxide staining (Sensitive Saprolite of the Springwater Formation)	PP = 0, 0, 0 tsf (<0.25 tsf) WC = 55.7% LL = 72, PL = 33, PI = 39
	26.5						
30	30.0	1.50	SS-11	3-6-10 (16)		**SANDY SILT WITH GRAVEL (ML)** Gray, trace white and orange spots, moist, very stiff, ±35% fine to coarse sand, ±15% fine to coarse subangular to subrounded gravel <1.5" dia, trace iron oxide staining (Sensitive Saprolite of the Springwater Formation)	PP = 0, 0, 0 tsf (<0.25 tsf)
	31.5						
35	35.0	0.20	SS-12	50/1 (50/1")		**POORLY GRADED GRAVEL (GP)** Subangular gravel < 1" dia recovered two broken gravel pieces (Less Weathered Springwater Formation)	Switch to 4-7/8" tricone bit Very slow drill rig progress. Drill rig chatter
	35.2						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-07 SHEET 3 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664496.98 N, 7740359.62 E)

ELEVATION : 673.22 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : CME-550 Track #3, Mud Rotary, 4-7/8" Drag Bit, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/15/22 09:20 END : 8/15/22 16:28 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0 40.8	0.80	SS-13	19-50/4 (50/4")		**SILTY SAND WITH GRAVEL (SM)** Gray, moist, very dense, fine to coarse sand, lightly cemented, disintegrated with finger pressure, ±15% fines, ±20% fine to coarse subangular to subrounded gravel less than 2.0" diameter (Less Weathered Springwater Formation)	
45	45.0 45.4	0.40	SS-14	50/5 (50/5")		Similar to SS-13 except with reddish-brown iron oxide staining	
50	50.0						
	51.5	1.50	SS-15	9-12-18 (30)		**LEAN CLAY (CL)** Gray mottled orangish brown, moist, very stiff, low to medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	Switch to 4-7/8" drag bit PP = 2.75, 1.75, 2.25 tsf WC = 29.8% LL = 40, PL = 24, PI = 16
55	55.0						
	56.5	1.50	SS-16	13-16-23 (39)		**SANDY FAT CLAY (CH)** Gray with rare pink and brown spots, hard, medium to high plasticity, ±40% fine to coarse sand, trace fine to coarse subangular to subrounded gravel <1" diameter (Less Weathered Springwater Formation)	Switch to 4-7/8" tricone bit Drill rig chatter
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-07 SHEET 4 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664496.98 N, 7740359.62 E)

ELEVATION : 673.22 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : CME-550 Track #3, Mud Rotary, 4-7/8" Drag Bit, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/15/22 09:20 END : 8/15/22 16:28 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0	0.00	SS-17	50/0.5 (50/0.5")		No Recovery	
65	65.0						
	65.4	0.40	SS-18	50/5 (50/5")		**SILTY SAND (SM)** Gray, moist, very dense, fine to coarse sand, very light cementation, easily disintegrated with finger pressure, ±40% fines, ±5% subangular to subrounded gravel, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
70	70.0		SS-19	50/0.2 (50/0.2")		No Recovery	Hammer bouncing off gravel/cobble
75	75.0						
	76.5	1.50	SS-20	19-30-29 (59)		**CLAYEY SAND WITH GRAVEL (SC)** Grayish brown, moist, very dense, lightly cemented, disintegrated with finger pressure, 24.6% fines, 17% subangular to subrounded gravel <1" diameter, reddish brown iron-oxide staining (Less Weathered Springwater Formation)	WC = 16.8% LL = 29, PL = 18, PI = 11 Fines = 24.6%, Sand = 58.4%, Gravel = 17%
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-07 SHEET 5 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664496.98 N, 7740359.62 E)

ELEVATION : 673.22 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : CME-550 Track #3, Mud Rotary, 4-7/8" Drag Bit, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

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DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	80.0						
		0.70	SS-21	27-21-19 (40)		**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)** Gray, moist, dense, lightly cemented sand, disintegrated with finger pressure, trace subangular to subrounded gravel <1.5" diameter, ±30-35% fines (Less Weathered Springwater Formation)	
	81.5						Heavy drill rig chatter
85	85.0						
		0.90	SS-22	10-50/4 (50/4")		Similar to SS-21 except ±10% fine to coarse subangular to subrounded gravel <2.5" diameter, very dense	
	85.9						
							Heavy drill rig chatter
90	90.0						
		1.50	SS-23	18-24-24 (48)		Similar to SS-21 except 31.4% subangular to subrounded gravel <1.5" diameter, 15.5% fines, very dense	WC = 14.4% LL = 24, PL = 20, PI = 4 Fines = 15.5%, Sand = 53.1%, Gravel = 31.4%
	91.5						
							Heavy drill rig chatter
95	95.0						
	95.6	0.60	SS-24	13-50/1 (50/1")		Similar to SS-23, except very dense	
100							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CRBF-B-07 SHEET 6 OF 6

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664496.98 N, 7740359.62 E)

ELEVATION : 673.22 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : CME-550 Track #3, Mud Rotary, 4-7/8" Drag Bit, 4-7/8" Tricone Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

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DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
100.0						Similar to SS-23, except very dense	
	0.90		SS-25	23-37-37 (74)			
101.5						Bottom of Boring at 101.5 ft below ground surface	Backfilled with: 0-15 ft: Bentonite chips 15-101.5 ft: Bentonite grout Place topsoil on top of borehole with spade to match existing condition
105							
110							
115							
120							

Jacobs

AH(3) CI MDW-) H4
JY2V: 7: :

- (HRMP MDW-) H4
C- HNU UG LS)) I 6 (N 5

L(RT - (HRMP T(P

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

ELEVATION : 631.89 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #13, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/17/22 09:10 END : 8/23/22 10:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0	0.0					6 in: **ELASETI C(MCH) I) AEF) W) MI** 1.5 ft: **PHEF) T - EL)**	
			S-1			S-1, 2-5ft: **T) EMCTEB OCT1** Brown, moist, soft, low to medium plasticity, trace fine to coarse sand, black Mn nodules, trace organics consisting of roots, trace reddish-brown iron oxide staining	
5	5.0	0.80	SS-2	1-1-1 (2)		Similar to S-1 S-3, 5-10 ft: Similar to S-1 except trace fine to coarse subrounded to subangular gravel < 2" diameter, micaceous, becomes stiffer at 9 ft	
	6.5		S-3				9-10 ft: Grab Sample GS-4
10	10.0	0.10	SS-5	8-5-8 (13)		S-6, 10-15ft: **) TELI RC LRTI OR S PHEF) T EMJ C(- - T) L 0WS1** Gray with orange mottling, moist, stiff, low to medium plasticity, trace fine to coarse sand, ±15% fine to coarse subgrounded to subrounded gravel <3", one 5" diameter basalt cobble at 12.5 feet, black Mn nodules, trace reddish-brown iron oxide staining	
	11.5		S-6				14-15 ft: Grab Sample GS-7 LL = 50.1, PL = 29.2, PI = 20.9
15	15.0	1.50	SS-8	6-24-48 (72)		**LEMJB T) EMCTEB OR S PHEF) T OCT1** Gray to brown, moist, hard, low plasticity, ±30-40% fine to coarse sand, ±15% fine to coarse subrounded to subangular gravel < 2" diameter, trace reddish-brown iron oxide staining S-9, 15-20ft: Similar to SS-8 except gravel < 3" diameter	
	16.5		S-9				18-19 ft: Grab Sample GS-10
20							

Jacobs

AH(3) CI MDW-) H4
JY2V: 7: :

- (HRMP MDW-) H4
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PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

ELEVATION : 631.89 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #13, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/17/22 09:10 END : 8/23/22 10:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.30	SS-11	3-29-50 (79)		**LRTI B CTEB) B LEMJ O RS PHEF) T EMJ C(- - T) L CLCLW1** Gray to brown, moist, very dense, fine to coarse sand, ±30-40% fines, ±15% fine to coarse subangular to subrounded gravel <2" diameter, trace iron-oxide staining, trace yellow spots	
	21.5		S-12			S-12, 21.5-25ft: Similar to SS-11 except gray, 27.1% fine to corase subangular to subrounded gravel < 3" diameter, 19.8% fines, lightly cemented, disintegrates with finger pressure, 5" basalt cobble at 24 ft	22-23 ft: Grab Sample GS-13 WC = 15.5% LL = 24.9, PL = 19.8, PI = 5.1 Fines = 19.8%, Sand = 53.1%, Gravel = 27.1%
25	25.0						
	25.9	0.90	SS-14	37-50/5" (50/5")		S-15, 25-30ft: **CTEB) B LEMJ O RS PHEF) T EMJ C(- - T) L CLC1** Gray, moist, ±20-30% fine to corase subangular to subrounded gravel < 3" diameter, ±30% fines, trace reddish-brown iron oxide staining, micaceous, lightly cemented, disintegrates with finger pressure, 0.8 ft long basalt cobble at 25 ft	
			S-15				27-28 ft: Grab Sample GS-16
30	30.0						
	30.9	0.60	SS-17	14-50/5" (50/5")		**CTEB) B LEMJ O RS PHEF) T CLC1** Brown, some gray parts, moist, very dense, ±20% fines, ±15% fine to coarse subangular to subrounded gravel < 2" diameter, some parts are lightly cemented, disintegrated with finger pressure, trace reddish-brown iron oxide staining	
			S-18			S-18, 30.9-32ft: Similar to SS-17 S-18, 30.9-32ft: Similar to SS-17 except gray, ±30% fines, ±30% fine to coarse subangular to subrounded gravel < 3" diameter, lightly cemented, disintegrated with finger pressure	
35	35.0						
	35.9	0.90	SS-19	4-50/5" (50/5")		S-20, 35-40ft: **CTEB) B LEMJ O RS PHEF) T EMJ C(- - T) L CLC1** Gray, moist, ±30% fines, ±15% fine to coarse subangular to subrounded gravel < 3" diameter, trace reddish-brown iron oxide staining, lightly cemented, disintegrates with finger pressure, 6" diameter cobble at 35 ft	
			S-20				
40							

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AH(3) CI MDW-) H4
JY2V: 7: :

- (HRMP MDW-) H4
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PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

ELEVATION : 631.89 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #13, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/17/22 09:10 END : 8/23/22 10:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0	40.0	0.00	SS-21	50/5" (50/5")		S-22, 40-45ft: **LRTI B LEMJ ORS PHEF) T EMJ C(- - T) L QLW1** Gray, moist, very dense, 19.2% fines, lightly cemented sand, disintegrated easily with finger pressure, 25.6% gravel, subrounded to subangular <2" diameter, trace iron-oxide staining, 5" diameter cobble at 40 ft	40.5-41.5 ft: Grab Sample GS-23 WC = 13.8% LL = 21.8, PL = 19.3, PI = 2.5 Fines = 19.2%, Sand = 55.2%, Gravel = 25.6%
40.4			S-22				
45 45.0						No Recovery in SS	45-46 ft: Grab Sample GS-26
	46.5	0.00	SS-24	3-9-17 (26)		S-25, 45-50ft: Similar to S-22, 4" diameter cobble at 46.5 ft	
			S-25				
50 50.0						**LRTI B CTEB) B LEMJ ORS PHEF) T EMJ C(- - T) L QLCULW1** Gray, trace spots of pink, yellow, and green, moist, very dense, fine to coarse lightly cemented sand, disintegrated with finger pressure, ±30% fines, ±15-20% fine to coarse subangular to subrounded gravel <1" diameter	
	51.5	1.50	SS-27	14-32-44 (76)		S-28, 51.5-54ft: Similar to SS-27 except cemented, disintegrates with pressure from putty knife, gravel < 3" diamter, 4" diameter cobble at 52 ft	53-54 ft: Grab Sample GS-29
			S-28			S-28, 54-55ft: Increase in gravel content to ±40%	
55 55.0							
	55.4	0.50	SS-30	50/5" (50/5")		S-31, 55-57ft: **CTEB) B LEMJ ORS PHEF) T QLC1** Gray, moist, very dense, ±30% fines, fine to coarse sand, ±30% fine to coarse subangular to subrounded gravel <3" diameter	Stop on 8/17/2022 at 3:55 PM at 55 feet Start on 8/18/2022 at 9:05 AM 56-57 ft: Grab Sample GS-32
			S-31			S-31, 57-60ft: **CTEB) B LEMJ ORS PHEF) T EMJ C(- - T) L QLC1** Gray, moist, very dense, ±15% fines, ±15% fine to corase subangular to subrounded gravel < 2.5" diameter, cemented, disintegrates with pressure from putty knife and hammer, 5" diameter cobble at 57 ft	58-59 ft: Grab Sample GS-33
60							

Jacobs

AH(3) CI MDW-) H4
JY2V: 7: :

- (HRMP MDW-) H4
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PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

ELEVATION : 631.89 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #13, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

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DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0 60.9	0.50	SS-34	5-50/5" (50/5")		S-35, 60-65ft: Similar to S-31 from 57-60ft	
							61-62 ft: Grab Sample GS-36
			S-35				
65	65.0						
	66.5	1.50	SS-37	9-18-32 (50)		S-38, 65-70ft: CTEB) B LEMJ OR S PHEF) T EMJ C(- - T) L CLC1 Gray, moist, dense, rare green, red, and orange spots, ±30% fines, fine to coarse sand, ±20% fine to coarse subangular to subrounded gravel <3" diameter, trace iron-oxide staining, trace organics consisting of roots, cemented, disintegrates with pressure from putty knife and hammer, 5" diameter cobbles at 65.8 and 69 ft	
							67-68 ft: Grab Sample GS-39
			S-38				
70	70.0						
	70.8	0.70	SS-40	14-50/4" (50/4")		S-41, 70-71.2ft: Similar to S-38	
						S-41, 71.2-75ft: NEI CTEB CS1 Dark green, moist, hard, medium to high plasticity, ±10% fine to coarse sand, trace fine to coarse subrounded to subangular gravel, trace reddish-brown iron oxide staining, trace white staining	PP > 4.5 tsf 72-73 ft: Grab Sample GS-42 LL = 51.6, PL = 24.3, PI = 27.3
			S-41				
75	75.0						
	76.5	1.50	SS-43	14-21-31 (52)		S-44, 75-80ft: Similar to S-41 from 71.2 to 75 ft except ±5% fine to coarse subangular to subrounded gravel <2.5" diameter	
			S-44				78-79 ft: Grab Sample GS-45
80							

Jacobs

AH(3) CI MDW-) H4
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	80.0	0.40	SS-46	14-40-50/3" (90/9")		S-47, 80-81ft: Similar to S-44	80-81 ft: Grab Sample GS-48
	81.3		S-47			S-47, 81-85ft: **CTEB) B PHEF) T OR S LEMJ EMJ C(- - T) L OPC1** Greenish gray, moist, very dense, ±15% fines, ±30% fine to coarse sand, fine to coarse subangular to subrounded gravel <3" diameter, trace reddish-brown iron oxide staining, occasionally cemented, disintegrates with pressure from putty knife, 6" diameter basalt cobble at 81 ft, 3.5" diameter basalt cobble at 82.5 ft	84-85 ft: Grab Sample GS-49
85	85.0						
	85.5	0.50	SS-50	50/5.5" (50/5.5")		S-51, 85-90ft: Similar to S-47 from 81-85 ft except ±30-40% fine to coarse sand, 5" diameter basalt cobble at 88 ft, 4" diameter basalt cobble at 89 ft	Sonic 85'-90': similar to SS-49
			S-51				88-89 ft: Grab Sample GS-52
90	90.0						
	90.4	0.40	SS-53	50/5" (50/5")		S-54, 90-95ft: Similar to S-51 except increase in the amount of cobbles, 4" diameter cobbles at 90 ft and 91.5 ft, several 3-5" diameter cobbles from 92.5-93.5 ft	91-92 ft: Grab Sample GS-55
			S-54				
95	95.0						
	95.1	0.10	SS-56	50/0.5" (50/0.5")		S-57, 95-100ft: Similar to S-54 except 3.5" diameter basalt cobble at 96 ft, 5" diameter basalt cobble at 97.6 ft	
			S-57				
100							

Jacobs

AH(3) CI MDW-) H4
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- (HRMP MDW-) H4
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PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

ELEVATION : 631.89 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #13, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

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DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	100.0 100.8	0.30	SS-58	22-50/4" (50/4")		S-59, 100-102.6ft: CTEB) B PHEF) T OR S LEMJ EMJ C(- - T) L OPC1 Grayish brown to gray, moist, very dense, gravels and cobbles in a "soupy" matrix, 25.3% fines, 37.6% fine to coarse sand, 37.1% fine to coarse subangular to subrounded gravel <3" diameter, 3-6" diameter cobbles S-59, 102.6-110 ft: Similar to above except ±20% fine to coarse sand, ±15 fines, no soupy consistency, 3-8" diameter basalt cobbles, trace reddish-brown iron oxide staining	Stop on 8/18/2022 at 4:25 PM at 100 feet Start on 8/19/2022 at 8:40 AM 101-102 ft: Grab Sample GS-60 WC = 17.4% LL = 28.7, PL = 17.9, PI = 10.8 Fines = 25.3%, Sand = 37.6%, Gravel = 37.1%
105			S-59				106-107 ft: Grab Sample GS-61 109-110 ft: Grab Sample GS-62
110	110.0 110.3	0.30	SS-63	50/4" (50/4")		S-64, 110-120ft: Similar to S-59 except 3-7" diameter cobbles	111-112 ft: Grab Sample GS-65
115			S-64				118-119 ft: Grab Sample GS-66
120							

Jacobs

AH(3) CI MDW-) H4
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- (HRMP MDW-) H4
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PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

ELEVATION : 631.89 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #13, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/17/22 09:10 END : 8/23/22 10:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
120.0	120.0 – 120.6	0.60	SS-67	26-50/1" (50/1")		S-68, 120-130ft: Similar to S-64 except gray, brown, rare red parts, ±30% fine to coarse sand, ±20% fines, 3-6" diameter cobbles	
							122-123 ft: Grab Sample GS-69
125			S-68				
							128-129 ft: Grab Sample GS-70
130	130.0 – 130.2	0.10	SS-71	50/2" (50/2")		S-72, 130-140ft: Similar to S-68 except ±25% fines	130.01-131 ft: Grab Sample GS-73
135			S-72				
							138-139 ft: Grab Sample GS-74
140							

Jacobs

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JY2V: 7: :

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PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

ELEVATION : 631.89 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #13, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/17/22 09:10 END : 8/23/22 10:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	140.0	0.10	SS-75	50/3" (50/3")		S-76, 140-140.5ft: Similar to S-72	Stop on 8/19/2022 at 4:05 PM at 140 feet Start on 8/22/2022 at 9:55 AM
	140.3					S-76, 140.5-145ft: **T) EMCTEB ORS PHEF) T EMJ C(- - T) L OCT1** Brown mottled gray, moist, stiff, medium to high plasticity, trace fine to coarse sand, ±5-10% fine to coarse subrounded to subangular gravel < 3" diameter, 3-4" diameter cobbles at 141.5 ft, black Mn nodules, reddish brown iron-oxide staining, occasionally cemented, disintegrates with finger pressure	142-143 ft: Grab Sample GS-77
145			S-76			S-76, 145-150ft: **PHEF) TT) B T) EMCTEB ORS C(- - T) L OCT1** Gray, moist, hard, ±30% fine to coarse subangular to subrounded gravel <3.0" diameter, 3-5" basalt cobbles present throughout	148-149 ft: Grab Sample GS-78
150	150.0						
	150.2	0.10	SS-79	50/2" (50/2")		S-80, 150-152.5ft: **CTEB) B PHEF) T ORS C(- - T) L OPC1** Gray, dry, very dense, ±30% fines, fine to coarse subangular to subrounded gravel <3.0" diameter, 3-4" basalt cobbles, iron-oxide stains on basalt pieces	Driller reported that borehole will be advanced with water from 150 ft, this will wash away the fines and sand around any basalt pieces
			S-80			S-80, 152.5-155 ft: **JRLRM) PHEI) J - ELETI** Basalt, fine grained, cobbles 3-6" diameter coated with lean clay, subrounded to subangular gravel < 3" diameter, iron-oxide stains on some basalt pieces	153-154 ft: Grab Sample GS-81
155	155.0					S-82, 155-160ft: **- ELETI** Grey, fine grained, fresh to slightly weathered, very to extremely hard rock (R5-R6), closely spaced joints, less than 1% vesicular with less than 1/4" diameter vesicles, pinprick vesicles throughout	156.4-156.9 ft: Grab Sample GS-84
			S-82				
160							

Jacobs

AH(3) CI MDW-) H4
JY2V: 7: :

- (HRMP MDW-) H4
C- HNJ UG LS)) I 5 (N 5

L(RT - (HRMP T(P

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

ELEVATION : 631.89 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc.

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #13, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 8/17/22 09:10 END : 8/23/22 10:00 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
160	160.0					S-83, 160-161.5ft: Similar to S-82	
						S-83, 161.5-166.9ft: - **ELETI** Grey, fine grained, fresh to slightly weathered, very to extremely hard rock (R5-R6), closely spaced joints, ±30% vesicular with up to 3/4" diameter vesicles, pinprick vesicles throughout, some vesicles infilled with brown clay, some reddish brown iron-oxide staining	
165			S-83				165-165.8 ft: Grab Sample GS-85
						S-83, 166.9-170 ft: - **ELETI** Grey, fine grained, fresh to slightly weathered, very to extremely hard rock (R5-R6), closely spaced joints, less than 1% vesicular with less than 1/4" diameter vesicles, pinprick vesicles throughout	168.9-169.5 ft: Grab Sample GS-86
170	170.0					Bottom of Boring at 170 ft below ground surface	
175							
180							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CBRF-B-09 SHEET 1 OF 3

SOIL BORING LOG

7I : V3L8 ngI mmI - Jwaidaw- 7wet rwt, 7isjtua±Jwwvtf H dati 7wet rwt W LE86 D nAit, vdo b: I =" "2. 4CR50 Db. . 204P0R50 3T

3W8YE86 D n 2y2RyPra CI 6VW6DA L: D8I EL8: I nHt, ati- Fadat, Fswts-, tixdaw- 6uR

CI 6VW6DA B38Q: C EDC 3# N67B3D8 nLB3±yy0 8iduG<5bBI f I sadipb2± 9fSCidMgvab2± 9fS8iws-t gvabCS: RCRFemwgdiitmFdo emib120±moEl as 8iwzQdo o ti

H E83I C378Q nDsaitusiftf F8EI 8 n49I"9CC0Pf55 3DC n49I"9CC11n24 W AA3I nWRqvdI o vG

C378Q g3W H AI : NDC FNI JEL3 =raT	6D83I YEW=raT	I 3L: Y3I U=raT	8U739 DNBg3I	73D38I E86 D 83F8 I 3FNW8F "Sf"Sf"S =DT	AI E7Q6L WA	F: 6VC3FLI 6786 D	L: BB3D8F
						F: 6VDEB3bNFLF AI : N7 FUBg: V6L: W I b B: 6F8NI 3 L: D83D8bI 3WE86Y3 C3DF68U: I L: DF6F83DLUbF: 6VF8I NL8NI 3bB6D3I EW AU	C378Q: J LEF6DAbCI 6VW6DA I E83b CI 6VW6DA JVWGC W FFb83F8FbEDC 6DF8I NB3D8E86 D
						OranGRAVEL PAVEMENT AND BASE GRAVEL	Fadiadfxd-uwMksitvsmh hwav 2± 9fSaiwus-t kwa
	CRy						
	2FR0	1FR00	FF±1	O±OxO =2T		LEAN CLAY (CL) gish-bo swab, srabmsh as o t f wo end, awapb cy±10% rwt as usdi, t , d-f baidut rwt as usdi, t , I kd-M rdi Mdxt m(1RySf wdo t ai	77 / 0b0b0Ry a r
y	"FR0	CFR00	F8±O				F8±On 2±y ran500 e, w y±" ran5y0 e, w
	.Ry	1FR50	FF±5	O±5±2 =:T		Fwv wdi as FF±1 t)ut eanvio b-s Mdxt mbaidut rwt as usdi, t , d-f	77 / 1Ryb0Ryb0Ry a r
	PR0	0FR50	FF±2	5±5±y =4T		Fwv wdi as FF±5	
10	11R0	CR00	F8±y				F8±yn 2±y ran200 e, w y±" ranyy0 e, w
	1CRy	1Ry0	FF±"	5±y±" =I1T		ELASTIC SILT (MH) gish-hvav it f o sanwMbo swab, awbo t f wo as vWV end, awapbaidut rwt as usdi, t , d-f baidut siMd-w, us-, wavMsr rwt issa, baidut , I kd-M rdi as , I kisI-f t f Mdxt mbaidut krduG B--sf I rh,	77 / 5b0Ryb1RQy a r
1y	1yR0						
	1"Ry	1Ry0	FF±	O±5±2 =:T		FAT CLAY (CH) TO ELASTIC SILT (MH) gish-hvav it f o sanwMbo swabnvio bo t f wo as vWV end, awapbcy% rwt as usdi, t , d-f bcy% , I kd-M rdi as , I kisI-f t f Mdxt m(0RyS f wdo t ai ibkrduGB--sf I rh, baidut vis-±s) wt , adwwM	77 / 0RQyb0Ryb0Ry a r
	14R0						
	1PRP	0FR0	F8±4				F8±4n 14±1P ran500 e, w 1P±1PRP ran400 e, w
CO							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	CBRF-B-09 SHEET 2 OF 3

SOIL BORING LOG

7I : V3L8 ngI mmI - Jwaidaw- 7wetrwt, 7isjtua±Jwwvtf H dati 7wetrwt W LE86 DnAit, vdob: I =""2. 4CR50 Db. . 204P0R50 3T

3W8YE86 Dn2y2RyPra CI 6VW6DA L: D8I EL8: I nHt, ati- Fadat, Fswts-, tixdaw- 6uR

CI 6VW6DA B38Q: C EDC 3#N67B3D8 nLB3±yy0 8iduG<5bBI f I sadipb2± 94SCidMgwb2± 94S8iws-t gwbCS: RCRFemwgdiitmFdoemib120±moEl as 8ivzQdo o ti

H E83I C378QnDsaitusiftf F8EI 8 n49I"9QQ0Pr55 3DC n49I"9QQ11n24 W AA3I nWRqvdI ovG

C378Qg3W H AI : NDC FNI JEL3 =raT						
6D83I YEW=raT			73D38I E86 D 83F8 I 3FNW8F	AI E7Q6L WA	F: 6VC3FLI 6786 D	L: BB3D8F
I 3L: Y3I U=raT						
	8U739 DNBg3I	"S"S"S =DT			F: 6VDEB3bNFLF AI : N7 FUBg: VtL: W I b B: 6F8NI 3 L: D83D8bI 3WE86Y3 C3DF6BU: I L: DF6F83DLUbF: 6WF8I NL8NI 3bB6D3I EW AU	C378Q: J LEF6DAbCI 6VW6DA I E83b CI 6VW6DA JVWGC W FFb83F8FbEDC 6DF8I NB3D8E86 D
COR0	1Ry0	FF±P	"±"±y =11T		Fwwvdi as FF± t)ut ea, awrbcy±10% rwt as usdi, t , d-f	77 / 1RybCb0Ry a, r
O1Ry						
OyR0						
	1Ry0	FF±10	1±1±O =5T		**ELASTIC SILT (MH) TO FAT CLAY (CH)** Aidpbo swab, srabo t f wo as vwMv erd, awwapb aidut rwt , d-f baidut , I kd-M rndi as , I kisI -f t f Mdxt mbaidut wis-±s)wt , adwwM	77 / 0b0b0RQy
O'Ry						F8±11n O'Ry±O4Ry ran500 e, w
	OR0	F8±11				
O4Ry						
50R0						
	1Ry0	FF±1O	Oay±2 =PT		**ELASTIC SILT (MH)** Aidp hwv idit ewG, esa, bMtt - , esa, bo swab , awrbo t f wo as vwMv erd, awwapbcy±10% rwt as usdi, t , d-f bcy% rwt , I kd-M rndi as , I kisI -f t f Mdxt m(1R0Sf wlo t ai baidut krnduG B- -sf I rth, baidut it f f wv kish- wis-±s)wt , adwwM	77 / 0RybCRyb5Ry
51Ry						
5yR0						
	1Ry0	FF±15	1±1±y =" T		**ELASTIC SILT (MH)** Aidpbo swabrwo bo t f wo as vwMv erd, awwapb aidut rwt as usdi, t , d-f	77 / 0b0Ryb0 a, r
5"Ry						
20						

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PROJECT NUMBER:	BORING NUMBER:
D3460500	CBRF-B-09 SHEET 3 OF 3

SOIL BORING LOG

7I : V3L8 ngI mmI - Jwaidaw- 7wetrwt, 7isjtua±Jwwvtf H dati 7wetrwt W LE86 DnAit, vdob: I =""2. 4CR50 Db. . 204P0R50 3T

3W8YE86 Dn 2y2RyPra CI 6WWDA L: D8I EL8: I nHt, ati- Fadat, Fswts-, tixdaw- 6uR

CI 6WWDA B38Q: C EDC 3#N67B3D8 nLB3±yy0 8iduG<5bBI f I sadipb2± 94SCidMgwb2± 94S8iws-t gwbCS: RCRFenwgdiitmFdoemib120±woEl as 8iwzQdo o ti

H E83I C378QnDsaitusiftf F8EI 8 n49I"9CC0Pr55 3DC n49I"9CC11n24 W AA3I nWRqvdI ovG

C378Qg3W H AI : NDC FNI JEL3 =raT	6D83I YEW=raT	I 3L: Y3I U=raT	8U739 DNBg3I	73D38I E86 D 83F8 I 3FNW8F "S£"S£"S =DT	AI E7Q6L WA	F: 6WC3FLI 6786 D	L: BB3D8F
						F: 6WDEB3bNFLF AI : N7 FUBg: W6L: W I b B: 6F8NI 3 L: D83D8bI 3WE86Y3 C3DF8U: I L: DF6F83DLUbF: 6WF8I NL8NI 3bB6D3I EW AU	C378Q: J LEF6DAbCI 6WWDA I E83b CI 6WWDA JWWC W FFb83F8FbEDC 6DF8I NB3D8E86 D
2y	20R0	1Ry0	FF±12	"±P±1. =O'T		**ELASTIC SILT (MH)** Aidphwwidit itfbMtt- d-f ptmsh, esa,b oswabxtip, awbmsh as otfwo emd, awwpbaidut rwt, d-fbaidut, lkd-Mmdias, lkisl-ftf Mdxtm(1R0Sfwlo tdibaidut ws-±s)Wt, adwwM gsaso srgsiwMda21Ry raktmsh Msl-f, lirdut	77 / 1Ryb5b5Ry a r gduGwmf hwwkt-as-wi uvwe, riso 0±21Ry rtta
y0							
yy							
"0							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH01 SHEET 1 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664998.85 N, 7734123.18 E)

ELEVATION : 612.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 44 to 47.8 feet bgs START : 3/30/21 14:18 END : 4/1/21 11:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						2 in: **ASPHALT CONCRETE PAVEMENT** 12 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
	4.0						
5		2.00	ST-1				ST-1 4-4.5 ft: 150 psi 4.5-5.5 ft: 250 psi 5.5-6 ft: 450 psi 4 ft: Switch to 4-7/8" drag bit.
	6.0						
		1.50	SS-2	4-6-8 (14)		**LEAN CLAY (CL)** Brown mottled grayish brown, moist, stiff, medium to high plasticity, ±5% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 3.5, 2.75, 2.5 tsf
	7.5						
10	10.0						
		1.50	SS-3	4-6-7 (13)		**LEAN CLAY WITH SAND (CL)** Brown mottled grayish brown, moist, stiff, medium plasticity, ±15% fine to coarse sand, trace fine to coarse subangular gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0.75, 2.5, 2.75 tsf WC = 30.1% LL = 43, PL = 23, PI = 20 Drilling fluid seeps out on north side of road. Driller notes it is likely seeping through the thin asphalt, he will redrill the borehole tomorrow. Stop at 15:09 on 3/30/21 at 10 ft Start at 9:05 on 3/31/21 Driller reported he redrilled the top 10 ft of the borehole below the base gravel.
	11.5						
15	15.0						
		1.50	SS-4	4-7-8 (15)		**LEAN CLAY (CL)** Brown and mottled gray, moist, stiff, medium to high plasticity, ±5% fine to coarse sand, trace fine to coarse subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 3.25, 2.75, 2.75 tsf
	16.5						
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH01 SHEET 2 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664998.85 N, 7734123.18 E)

ELEVATION : 612.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 44 to 47.8 feet bgs START : 3/30/21 14:18 END : 4/1/21 11:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-5	5-7-10 (17)		**LEAN CLAY WITH SAND (CL)** Brown mottled gray, moist, very stiff, medium plasticity, ±15% fine to coarse sand, ±5% fine subangular gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1.25, 3, 1.75 tsf
	21.5						
	23.0						
		1.80	ST-6				ST-6 recovery 1.9 ft (in tube) 23-23.5 ft: 150 psi 23.5-24 ft: 250 psi 24-24.5 ft: 450 psi 24.5-24.75 ft: 650 psi
	24.8						
25		1.50	SS-7	4-7-8 (15)		**LEAN CLAY (CL)** Brown mottled grayish brown and gray, moist, stiff, medium to high plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.25, 2.25, 2 tsf
	26.3						
30	30.0						
		1.50	SS-8	4-6-9 (15)		**LEAN CLAY (CL)** Gray mottled brown, moist, soft, medium plasticity, trace fine to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2, 2, 1.25 tsf WC = 28.4% LL = 41, PL = 22, PI = 19 Driller reported he will redrill the clay collar formed at 1-20 ft in the borehole
	31.5						
35	35.0						Small seepage at same spot as 3/30/21. Driller reported he redrilled 1-3 ft of borehole very well, seepage controlled. Soil near seepage area is like a water bed, on application of pressure more drilling fluid seeps out.
		1.50	SS-9	3-5-9 (14)		SS-9A, 35-36 ft: **LEAN CLAY WITH SAND (CL)** Brown mottled gray, moist, stiff, medium to high plasticity, ±20% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1.5, 0, 2.5 tsf (2.5 tsf is from SS-9B, 1.5 tsf is from top 2" of SS-9A)
	36.5					SS-9B, 36-36.5 ft: **FAT CLAY (CH)** Dark gray slightly mottled brown, moist, stiff, high plasticity, trace fine sand, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH01 SHEET 3 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664998.85 N, 7734123.18 E)

ELEVATION : 612.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 44 to 47.8 feet bgs START : 3/30/21 14:18 END : 4/1/21 11:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0						
		1.50	SS-10	7-11-12 (23)		**SILT (ML)** Gray mottled brown, moist, very stiff, medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 3.25, 2.25, 2.75 tsf WC = 29.4% LL = 46, PL = 27, PI = 19 Driller reported he is redrill the borehole from 1-15 ft and 25-30 ft occasionally Driller reported stiffer soil after 40 ft
	41.5						
45	45.0						
		1.50	SS-11	3-6-8 (14)		**LEAN CLAY (CL)** Brown mottled grayish brown or gray, moist, stiff, medium plasticity, trace fine to coarse sand, black Mn nodules (Residual Soil of the Springwater Formation)	Sample split in SS, no PP Driller reported additional seepage, he will redrill the top 5 ft of borehole
	46.5						
50	50.0						
		1.50	SS-12	6-10-12 (22)		**FAT CLAY (CH)** Gray mottled brown, moist, very stiff, medium to high plasticity, trace fine to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2.75, 2.5, 2.25 tsf
	51.5						
55	55.0						
		1.50	SS-13	7-9-9 (18)		**LEAN CLAY (CL)** Grayish brown mottled brown, moist, very stiff, medium to high plasticity, ±20% silt, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	Sample split in SS, no PP 59 ft: Driller reported very stiff soil
	56.5						
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH01 SHEET 4 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664998.85 N, 7734123.18 E)

ELEVATION : 612.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 44 to 47.8 feet bgs START : 3/30/21 14:18 END : 4/1/21 11:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0						
		1.50	SS-14	5-5-9 (14)		**CLAYEY SAND (SC)** Grayish brown, moist, medium dense, fine to coarse sand, ±20% clay, trace ±10% silt, ±10-15% fine to coarse subrounded to subangular less than 1.5" diameter gravel, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	SS-14 shoe has gravel piece 1.5" diameter Switch to 3 7/8" tricone bit at 60 ft 60-65 ft: Driller reported intermittent drill rig chatter.
	61.5						
65	65.0						
		1.50	SS-15	17-14-23 (37)		**CLAYEY SAND WITH GRAVEL (SC)** Grayish brown, moist, dense, fine to coarse sand, ±15% fine to coarse subrounded to subangular less than 1.5" diameter gravel, ±15% clay, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	SS-15 last 1/4" SPT hammer bouncing off possible gravel encountered at that depth 65-70 ft: Driller reported intermittent drill clatter.
	66.5						
70	70.0						
		1.50	SS-16	16-30-34 (64)		**POORLY GRADED SAND WITH GRAVEL (SP)** Gray, moist, very dense, fine to coarse sand, trace clay, ±15% fine to coarse subrounded to subangular gravel less than 1.5" diameter (Unweathered Springwater Formation)	Cemented sand, disintegrates with finger pressure.
	71.5						Stop at 15:00 on 3/31/21 at 71.5 ft Start at 9:30 on 4/1/2021 Make provision for piezometer monument: Core asphalt with 16" core bit. Drill base gravel to 1 ft below ground surface with 7" "cookie cutter" bit & 6" tricone bit. Backfill with 3/8" bentonite chips, set the mud tub, drill the boring off-center to the cylinder drilled for the piezometer monumnet to accomodate future installation of a VWP data logger. Driller reported he will run the 4-7/8" tricone bit to 60 ft to make sure the borehole is clean and open, especially in the zones of high plasticity soil to ensure there are no issues when backfilling around the piezometer pipe with sand
75	75.0						
		1.50	SS-17	33-30-35 (65)		Similar to SS-16 except ±20% gravel less than 1.15" diameter, trace reddish-brown iron oxide staining	
	76.5						
						Bottom of Boring at 76.5 ft below ground surface Geokon VWP 4500S (750 kPa), unvented, serial no. 2110999 Geokon datalogger 8002-WP-2 LC-2, serial no. 2107940	
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH01 SHEET 5 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664998.85 N, 7734123.18 E)

ELEVATION : 612.31 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 3-7/8" and 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 44 to 47.8 feet bgs START : 3/30/21 14:18 END : 4/1/21 11:45 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft) / RECOVERY (ft) / TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
85					Installed VWP taped outside 1" PVC standpipe piezometer 0-1 ft: 12" diameter, 12" deep monument set in concrete, black dye added to concrete to match existing conditions 1-63 ft: Bentonite chips 63-75 ft: Sand 65-75 ft: Screen Start Card # 1051302 Well # L141460 Base of VWP is at 70.8 ft below ground surface. Field VWP Ro (1) 8730.943 (2) 8729.125 (3) 8731.106 (4) 8730.133 Average Ro = 8730.327
90					
95					
100					

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH02 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (665008.58 N, 7733679.22 E)

ELEVATION : 596.27 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/29/21 09:16 END : 3/29/21 10:35 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						2 in: **ASPHALT CONCRETE PAVEMENT** 8 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
5	5.0						
	6.5	1.50	SS-1	3-5-5 (10)		**LEAN CLAY (CL)** Brown mottled grayish brown, moist, stiff, medium plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish brown iron staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.5, 2, 2.25 tsf WC = 30.1% LL = 37, PL = 21, PI = 16 5 ft: Switch to 3-7/8" drag bit.
10	10.0						
	11.5	1.50	SS-2	3-5-6 (11)		Similar to SS-1 except brown mottled grayish brown to gray, ±5% fine to coarse sand, black Mn nodules	PP = 1, 1.25, 0.75 tsf
15	15.0						
	16.5	1.50	SS-3	4-5-7 (12)		Similar to SS-1 except brown mottled grayish brown to gray	PP = 2.5, 3, 2.25 tsf
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH02 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (665008.58 N, 7733679.22 E)

ELEVATION : 596.27 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/29/21 09:16 END : 3/29/21 10:35 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	4-6-6 (12)		**LEAN CLAY (CL)** Gray mottled brown, moist, stiff, medium plasticity, trace fine sand, reddish-brown iron oxide staining, track black Mn nodules (Residual Soil of the Springwater Formation)	PP = 0, 2.5, 2 tsf WC = 28% LL = 37, PL = 19, PI = 18
	21.5						
25	25.0						
		1.50	SS-5	5-8-11 (19)		**LEAN CLAY (CL)** Brown mottled gray, moist, very stiff, medium plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 3, 3, 2.25 tsf
	26.5					Bottom of Boring at 26.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-4 ft: Bentonite chips 4-25 ft: Bentonite grout
30							
35							
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH03 SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (665017.02 N, 7733236.11 E)

ELEVATION : 575.90 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/29/21 12:00 END : 3/29/21 13:51 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						2 in: **ASPHALT CONCRETE PAVEMENT** 9 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
	4.0						
5		2.00	ST-1				ST-1 4-5 ft: 150 psi 5-6 ft: 200 psi 4 ft: Switch to 3-7/8" drag bit. PP = 3.25, 3.25, 2.25 tsf
	6.0						
		1.20	SS-2	2-3-6 (9)		**FAT CLAY (CH)** Grayish brown mottled brown, moist, stiff, high plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	
	7.5						
10	10.0						
		1.50	SS-3	2-4-6 (10)		Similar to SS-2 except brown mottled gray, ±5% fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules	PP = 1.75, 2.5, 2 tsf WC = 31.1% LL = 56, PL = 23, PI = 33
	11.5						
							12 ft: Driller reported stiffer soil Driller reported he had to redrill 0-15 ft of the borehole
15	15.0						
		1.50	SS-4	3-6-7 (13)		Similar to SS-2 except brown mottled grayish brown, trace fine subangular gravel, reddish-brown iron oxide staining	Sample split in SS, no PP
	16.5						
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-LI-BH03 SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (665017.02 N, 7733236.11 E)

ELEVATION : 575.90 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 3-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/29/21 12:00 END : 3/29/21 13:51 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-5	3-3-5 (8)		Similar to SS-2 except brown mottled gray, firm, trace fine subangular gravel	PP = 1.75, 1.25, 1 tsf
	21.5						
25	25.0						
		1.50	SS-6	4-6-9 (15)		Similar to SS-2 except brown mottled grayish brown to gray, trace fine subangular gravel, reddish-brown iron oxide staining	PP = 1.25, 1.75, 0.75 tsf
	26.5						
						Bottom of Boring at 26.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: gravel 1-25 ft: bentonite chips
30							
35							
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-PRI-BH01 SHEET 1 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Pipeline Road, Gresham, OR (667173.02 N, 7734244.95 E)

ELEVATION : 624.75 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 14" Core Bit, 7" Cookie Cutter Bit, 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-l

WATER DEPTH : 60.1 to 64.2 feet bgs START : 4/8/21 09:22 END : 4/9/21 11:48 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						1/8-2 in: **ASPHALT CONCRETE PAVEMENT** 10-11.9 in: **BASE GRAVEL**	Core asphalt with 14" core bit, then remove base gravel with 7" "cookie cutter" bit at 1 ft, then backfill with bentonite chips (provision for 8" diameter piezometer monument) Advance borehole with 4-7/8" tricone bit
5	5.0						
	6.5	1.50	SS-1	3-5-6 (11)		**LEAN CLAY (CL)** Brown or grayish brown, moist, stiff, medium plasticity, ±5% fine to coarse sand, trace fine subangular to subrounded gravel less than 0.5" diameter, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 2.25, 2.25 tsf WC = 29.3% LL = 40, PL = 22, PI = 18 5 ft: Switch to 4-7/8" drag bit
10	10.0						
	11.5	1.50	SS-2	4-5-7 (12)		Similar to SS-1 except trace fine to coarse sand, no gravel, traced reddish-brown iron oxide staining, fewer black Mn nodules	PP = 2.75, 2.75, 2 tsf
	13.0						Drilling fluid seeps out from soil on south side of road. Driller redrills 0-10 ft of the borehole with a 6" tricone bit. Driller reported that a clay collar formed at the top of borehole is forcing drilling fluid out through the soil. Continue to advance borehole with 4-7/8" drag bit.
	14.5	0.30	ST-3			Bottom of ST-3 similar to SS-2	ST-3 13-13.5 ft: 150 psi 13.5-14 ft: 250 psi 14-14.25 ft: 250 psi 14.25-14.5 ft: 600 psi Driller reported ST not full because softer soil could not be recovered
15	16.0	1.50	SS-4	1-2-4 (6)		Similar to SS-1 except brown mottled gray, firm, ±10% fine to coarse sand, fine subangular gravel	PP = 1.75, 0.75, 0.75 tsf
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-PRI-BH01 SHEET 2 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Pipeline Road, Gresham, OR (667173.02 N, 7734244.95 E)

ELEVATION : 624.75 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 14" Core Bit, 7" Cookie Cutter Bit, 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-l

WATER DEPTH : 60.1 to 64.2 feet bgs START : 4/8/21 09:22 END : 4/9/21 11:48 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-5	3-3-5 (8)		**LEAN CLAY (CL)** Brown mottled grayish brown slightly mottled gray, moist, firm, medium plasticity, 7% fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1, 1, 0.75 tsf WC = 30.4% LL = 37, PL = 21, PI = 16 Fines = 93.3% Clay collar surrounding drill rod retrieved from borehole.
	21.5						
25	25.0						24.5 ft: Driller reported slight rig clatter
		1.50	SS-6	5-5-8 (13)		Similar to SS-5 except stiff, ±5% fine to coarse sand, trace fine subangular gravel less than 0.5" diameter, trace black Mn nodules	PP = 1, 1, 1.25 tsf
	26.5						
30	30.0						
		1.50	SS-7	5-6-9 (15)		**FAT CLAY (CH)** Gray mottled brown, moist, stiff, medium to high plasticity, trace fine to coarse sand, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0.75, 0.75, 2.25 tsf Driller reported he is re-drilling 10-15 ft of the borehole.
	31.5						
35	35.0						
		1.50	SS-8	6-7-10 (17)		Similar to SS-7 except very stiff, trace fine subrounded gravel, trace reddish-brown iron oxide staining, trace black Mn nodules	PP = 3, 1, 3, tsf
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-PRI-BH01 SHEET 3 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Pipeline Road, Gresham, OR (667173.02 N, 7734244.95 E)

ELEVATION : 624.75 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 14" Core Bit, 7" Cookie Cutter Bit, 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-l

WATER DEPTH : 60.1 to 64.2 feet bgs START : 4/8/21 09:22 END : 4/9/21 11:48 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-9	5-8-9 (17)		**SILT (ML)** Grayish brown mottled brown, moist, very stiff, medium plasticity, ±5-10% fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 2.5, 2.75 tsf WC = 34.5% LL = 46, PL = 27, PI = 19 Clay surrounding drill rod retrieved from borehole
	41.5						
45	45.0	1.50	SS-10	5-7-9 (16)		**FAT CLAY (CH)** Gray mottled brown, moist, very stiff, medium to high plasticity, ±5% fine to coarse sand, ±5% fine subangular gravel, 2" seam of black/very dark brown sand and gravel at 45.5ft, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2, 1.75, 3 tsf
	46.5						
50	50.0	1.50	SS-11	4-5-8 (13)		SS-11A, 50-50.3 ft: **FAT CLAY WITH SAND (CH)** Brown mottled grayish brown light gray dark brown, moist, stiff, medium to high plasticity, ±30% fine to coarse sand, trace fine subangular to subrounded gravel, gravel is black/very dark brown, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation) SS-11B, 50.3-51.5 ft: **FAT CLAY (CH)** Dark gray steel, moist, stiff, high plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	Driller reported slightly stiffer soil after SS-11
	51.5						
55	55.0	1.50	SS-12	9-12-14 (26)		**LEAN CLAY (CL)** Light gray to dark gray steel mottled brown, moist, very stiff, medium plasticity, ±5% fine to coarse sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 3.25, 4, 4 tsf WC = 31.8% LL = 43, PL = 25, PI = 18 Driller reported he is re-drilling 20-25 ft of the borehole
	56.5						
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-PRI-BH01 SHEET 4 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Pipeline Road, Gresham, OR (667173.02 N, 7734244.95 E)

ELEVATION : 624.75 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 14" Core Bit, 7" Cookie Cutter Bit, 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-l

WATER DEPTH : 60.1 to 64.2 feet bgs START : 4/8/21 09:22 END : 4/9/21 11:48 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
							Driller reported no change in soil from 55-60 ft
65	65.0						
	66.5	1.50	SS-13	6-9-14 (23)		Similar to SS-12 except trace fine to coarse sand, reddish brown iron staining	PP = 1.5, 2, 2.5 tsf Stop at 15:23 on 4/8/21 at 65 ft Start at 9:38 on 4/9/21 Driller reported drilling is consistent between 55-70 ft, however it is difficult to tell if the clay transitioned into a loose sand, cuttings have clay with some sand and fine gravel.
70	70.0						
	71.5	1.50	SS-14	4-7-9 (16)		**FAT CLAY (CH)** Gray mottled brown to grayish brown, moist, very stiff, medium to high plasticity, trace fine to coarse sand, trace fine subangular gravel, black Mn nodules, micaceous (Residual Soil of the Springwater Formation)	PP = 1.75, 1.5, 1.75 tsf WC = 34.3%
75	75.0						
	76.5	1.50	SS-15	8-15-20 (35)		Similar to SS-16 except hard, trace reddish brown iron staining	PP = 3.5, 3.25, 2.5 tsf Driller reported that the soil is stiffer at 75 ft, rig chatter and harder soil at 75 ft.
	78.0						
	79.5	1.50	SS-16	11-9-15 (24)		**FAT CLAY WITH SAND (CH)** Light gray brown, moist, very stiff, high plasticity, ±30-40% fine to coarse sand, ±20% fine to coarse subrounded gravel less than 1.5" diameter, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	WC = 42.6%
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-PRI-BH01 SHEET 5 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Pipeline Road, Gresham, OR (667173.02 N, 7734244.95 E)

ELEVATION : 624.75 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 14" Core Bit, 7" Cookie Cutter Bit, 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-l

WATER DEPTH : 60.1 to 64.2 feet bgs START : 4/8/21 09:22 END : 4/9/21 11:48 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
85							Driller reported stiffer soil (rig chatter) at 82.5 ft, then softer again.
							Driller reported that the soil is alternatingly stiff and soft.
							86-87 ft: Driller reported very stiff soil from 86-87 ft.
87.0							
	1.40		SS-17	10-42-50/5" (92/11")		**CLAYEY SAND (SC)** Gray, moist, very dense, fine to coarse cemented sand, ±15% clay, ±7.5% fine to coarse subrounded to subangular gravel less than 1.5" diameter, gravel is gray and trace light brown, trace reddish-brown iron oxide staining (Less Weathere	SS-17 recovery in sampler is 1.5 ft, lightly cemented, disintegrates easily with finger pressure.
88.4						Bottom of Boring at 88.4 ft below ground surface	
90							Installed 1" PVC standpipe piezometer 0-1 ft: 8" diameter, 12" deep monument set in concrete, black dye added to concrete to match existing conditions 1-57 ft: Bentonite chips 57-87 ft: Sand 65-85 ft: Screen Start Card # 1051379 Well # 141469
95							
100							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-01 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661468.20 N, 7741069.04 E)

ELEVATION : 706.57 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 11/17/21 08:20 END : 11/17/21 09:47 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0.0						**LEAN CLAY (CL)** Slightly reddish/orangish brown, moist, stiff to firm, low to medium plasticity, trace fine roots, ±5% fine to coarse sand, trace fine to coarse subangular gravel less than 2.0" diameter (Residual Soil of the Springwater Formation)	
5		5.00	S-1				
10	10.0					Similar to S-1 except only fine gravel	
15		10.00	S-2				
							18-20 ft: Grab Sample GS-3
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-01 SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661468.20 N, 7741069.04 E)

ELEVATION : 706.57 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 11/17/21 08:20 END : 11/17/21 09:47 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					S-4, 20-24 ft: Similar to S-2	
25		5.60	S-4			S-4, 24-30 ft: **FAT CLAY (CH)** Gray, mottled brown, moist, firm to stiff, high plasticity, trace fine sand, trace fine subangular gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	24-25 ft: Grab Sample GS-5 WC = 35.6% LL = 83, PL = 32, PI = 51
30	30.0					S-6, 30-38 ft: Similar to S-4 from 24-30 ft except occasional red mottling	
35		7.60	S-6				
40						S-6, 38-40 ft: **SANDY FAT CLAY (CH)** Brown, red mottled gray, moist, stiff to firm, high plasticity, 31.9% fine to coarse sand, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	38-40 ft: Grab Sample GS-7 WC = 51.4% LL = 105, PL = 31, PI = 74 Fines = 68.1%, Sand = 31.9%, Gravel = 0.0%

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-01 SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661468.20 N, 7741069.04 E)

ELEVATION : 706.57 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 11/17/21 08:20 END : 11/17/21 09:47 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0						S-8, 40-41 ft: Similar to S-6 from 38-40 ft except gray, medium to high plasticity, ±35% fine to coarse sand, ±10% fine to coarse subangular gravel (Residual Soil of the Springwater Formation)	
						S-8, 41-49 ft: **CLAYEY SAND WITH GRAVEL (SC)** Gray, moist, medium dense, 24.1% fines, fine to coarse sand, 28.1% fine to coarse subangular gravel less than 3" diameter (Less Weathered Springwater Formation)	
45		9.30	S-8				45-46 ft: Grab Sample GS-9 WC = 16.6% LL = 30, PL = 22, PI = 8 Fines = 24.1%, Sand = 47.8%, Gravel = 28.1% Drilller notes gravel at 45' bgs
						S-8, 49-50 ft: **SILTY SAND WITH GRAVEL (SM)** Gray, moist, very dense, 22.9% fines, 24.1% fine to coarse subangular gravel, pockets of cemented sand, disintegrates with finger pressure (Less Weathered Springwater Formation)	49-50 ft: Grab Sample GS-10
50	50.0					S-11, 50-58.5 ft: Similar to S-8 from 49-50 ft	50-51 ft: Grab Sample GS-12 WC = 16.1% Fines = 22.9%, Sand = 53.0%, Gravel = 24.1%
55		10.00	S-11				58.5-59.5 ft: Grab Sample GS-13
60	60.0						

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-01 SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661468.20 N, 7741069.04 E)

ELEVATION : 706.57 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 11/17/21 08:20 END : 11/17/21 09:47 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft) / RECOVERY (ft) / TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
				S-11, 58.5-60 ft: **SILTY SAND WITH GRAVEL (SM)** Gray with brown spots, moist, very dense, ±15% fines, ±20% gravel upto 3" diameter, basalt gravel, cemented sand, disintegrates with pressure from putty knifw and hammer (Less Weathered Springwater Formation)	Backfilled with: 0-2 ft: Bentonite chips and topsoil to match existing conditions 2-60 ft: Bentonite grout
				Bottom of Boring at 60 ft below ground surface	
65					
70					
75					
80					

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-02 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661655.46 N, 7741005.48 E)

ELEVATION : 703.56 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 11/15/21 09:20 END : 11/15/21 12:15 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0.0						**LEAN CLAY (CL)** Reddish / orangish brown, moist, firm to stiff, medium plasticity, trace reddish-brown iron oxide staining, black Mn nodules, ±5% fine to coarse sand, trace fine subangular gravel, trace organics consisting of fine roots (Residual Soil of the Springwater Formation)	Driller reported softer soil Low recovery
5		3.40	S-1				
							9-10 ft: Grab Sample GS-2
10	10.0					**FAT CLAY (CH)** Reddish/ orangish brown, moist, soft to firm, medium plasticity, trace reddish-brown iron oxide staining, black Mn nodules, ±5% fine to coarse sand, trace fine subangular gravel (Residual Soil of the Springwater Formation)	
15		4.50	S-3				
							19-20 ft: Grab Sample GS-4 WC = 29.7% LL = 51, PL = 28, PI = 23
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-02 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661655.46 N, 7741005.48 E)

ELEVATION : 703.56 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 11/15/21 09:20 END : 11/15/21 12:15 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					S-5, 20-29 ft: Similar to S-3	
25		5.00	S-5				
						S-5, 29-30 ft: **ELASTIC SILT (MH)** Brown, mottled gray, moist, stiff, medium to high plasticity, trace reddish-brown iron oxide staining, black Mn nodules, trace fine to coarse sand, trace fine subangular gravel (Residual Soil of the Springwater Formation)	29-30 ft: Grab Sample GS-6
30	30.0						
		1.50	SS-7	4-5-9 (14)			WC = 42.9% LL = 124, PL = 30, PI = 94
	31.5					**FAT CLAY (CH)** Gray, mottled brown to red, moist, stiff, high plasticity, ±5% fine to coarse sand, trace black Mn nodules (Residual Soil of the Springwater Formation) S-8, 30-35 ft: Similar to SS-7 except ±10% fine to coarse sand, black Mn nodules, seams of sand	
		2.50	S-8				
35	35.0						
		1.50	SS-9	2-2-7 (9)		**SANDY ELASTIC SILT (MH)** Dark brown with black and gray spots, moist, loose, 68.7% fines, 31.3% fine to coarse sand, trace fine subangular gravel, black Mn nodules (Sensitive Saprolite of the Springwater Formation) S-10, 35-42.5 ft: Similar to SS-9 except ±10% subrounded to subangular gravel up to 2.5" diameter, brown gravel pieces, some basalt gravel	WC = 60.4% Fines = 68.7%, Sand = 31.3%, Gravel = 0.0%
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-02 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661655.46 N, 7741005.48 E)

ELEVATION : 703.56 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 11/15/21 09:20 END : 11/15/21 12:15 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		10.00	S-10				
45	45.0					S-10, 42.5-45 ft: **SILTY SAND WITH GRAVEL (SM)** Gray, moist, loose, fine to coarse sand, 21.6% fines, 31.7% fine to coarse subangular to subrounded gravel up to 2.5" diameter, gray and brown gravel (Less Weathered Springwater Formation)	43-44 ft: Grab Sample GS-11 WC = 16.1% Fines = 21.6%, Sand = 46.7%, Gravel = 31.7%
						S-12, 45-55 ft: Similar to S-10 from 42.5-45 ft except gravel up to 3" diameter	45-46 ft: Grab Sample GS-13
50		10.00	S-12				
55	55.0					Bottom of Boring at 55 ft below ground surface	Driller reported borehole terminated at 54.5 ft, however, recovery in S-12 was 10 ft Backfilled with: 0-2 ft: Bentonite chips and topsoil to match existing conditions 2-55 ft: Bentonite grout
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-03 SHEET 1 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

ELEVATION : 703.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : 15 to 33.8 feet bgs START : 11/15/21 12:30 END : 11/16/21 12:32 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0	0.0		S-1			S-1, 0-5 ft: **LEAN CLAY (CL)** Slightly reddish to orangish brown, moist, soft, low to medium plasticity, trace fine to coarse sand, trace fine subangular gravel, trace black Mn nodules, trace organics consisting of fine roots (Residual Soil of the Springwater Formation)	Sonic drill with 6" casing and 4" sonic core
5	5.0	1.37	SS-2	1-2-2 (4)		**LEAN CLAY (CL)** Slightly reddish to orangish brown, moist, soft, medium plasticity, ± 5% fine to coarse sand, trace fine subangular gravel, trace black Mn nodules, trace organics consisting of fine roots (Residual Soil of the Springwater Formation)	WC = 38.3% LL = 49, PL = 26, PI = 23
	6.5		S-3			S-3, 5-10 ft: Similar to SS-2	
10	10.0	1.50	SS-4	3-6-6 (12)		Similar to SS-2 except stiff, black Mn nodules, no organics	
	11.5		S-5			S-5, 10-15 ft: Similar to SS-4	
15	15.0	1.50	SS-6	4-7-10 (17)		**ELASTIC SILT (MH)** Slightly reddish/orangish brown, moist, very stiff, medium plasticity, ± 5% fine to coarse sand, trace fine subangular gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)	WC = 34.1% LL = 50, PL = 30, PI = 20
	16.5		S-7			S-7, 10-15 ft: Similar to SS-6	
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-03 SHEET 2 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

ELEVATION : 703.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : 15 to 33.8 feet bgs START : 11/15/21 12:30 END : 11/16/21 12:32 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0	1.50	SS-8	3-5-9 (14)		**LEAN CLAY (CL)** Slightly reddish to orangish brown, moist, stiff, low to medium plasticity, ± 5% fine to coarse sand, trace fine subangular gravel, trace black Mn nodules (Residual Soil of the Springwater Formation) S-9, 20-24.5 ft: Similar to SS-8	
	21.5		S-9				
25	25.0	1.50	SS-10	2-6-8 (14)		S-9, 24.5-25 ft: Similar to SS-10 **FAT CLAY (CH)** Gray mottled brown, moist, stiff, high plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation) S-11, 25-30 ft: Similar to SS-10 except from 28.6-29.3 ft with ±10% fine to coarse sand	WC = 37.2% LL = 58, PL = 26, PI = 32
	26.5		S-11				
30	30.0	1.50	SS-12	4-6-9 (15)		**FAT CLAY (CH)** Gray mottled brown interlayered with gray mottled red, moist, stiff, medium to high plasticity, ±5% fine to coarse sand, trace black Mn nodules (Residual Soil of the Springwater Formation) S-13, 30-35 ft: Similar to SS-12	
	31.5		S-13				
35	35.0	1.50	SS-14	3-2-5 (7)		**SILTY SAND (SM)** Brown, black, light gray, moist, loose, fine to coarse sand, 46.8% fines, trace reddish-brown iron oxide staining (Sensitive Saprolite of the Springwater Formation) S-15, 35-40 ft: No recovery	WC = 71.7% Fines = 46.8%, Sand = 53.2%, Gravel = 0.0%
	36.5		S-15				
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-03 SHEET 3 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

ELEVATION : 703.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : 15 to 33.8 feet bgs START : 11/15/21 12:30 END : 11/16/21 12:32 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0						
		1.50	SS-16	0-2-5 (7)		**SILTY SAND (SM)** Light gray and light brown, moist, loose, fine to coarse sand, ±35% fines, trace fine subangular gravel less than 0.75" diameter, trace reddish-brown iron oxide staining (Sensitive Saprolite of the Springwater Formation)	
	41.5						Stop on 11/15/21 at at 41.5 ft bgs 4:05 PM Start on 11/16/21 at 8:35 AM S-17: Full recovery but in bucket
			S-17			S-17, 40-45 ft: Similar to SS-16 except some sandy elastic silt (MH) from 40-43 ft, trace organics consisting of fine roots	43-44 ft: Grab Sample GS-18
45	45.0						
		1.50	SS-19	9-8-15 (23)		**SILTY SAND (SM)** Light gray, light brown, white and reddish brown seams, moist, medium dense, 39.6% fines, 5.7% fine to coarse subangular gravel up to 1.5" diameter, trace reddish-brown iron oxide staining (Transition from Sensitive Saprolite of the Springwater Formation to Less Weathered Springwater Formation)	WC = 44.4% Fines = 39.6%, Sand = 54.7%, Gravel = 5.7%
	46.5						
			S-20			S-20, 45-47 ft: Similar to SS-19 except trace organics consisting of fine roots S-20, 47-48.5 ft: Similar to SS-19 except color is predominantly brown	48.5-49 ft: Grab Sample GS-21
50	50.0					S-20, 48.5-50 ft: **SILTY SAND WITH GRAVEL (SM)** Similar to SS-19 except brown, ±20% fine to coarse subangular gravel (Less Weathered Springwater Formation)	
	50.5	1.50	SS-22	20-50/0.5" (50/0.5")		**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)** Light gray, light brown, white and reddish brown seams, moist, very dense, 29.6% fines, 46.1% very lightly cemented sand, 24.3% fine to coarse subangular gravel less than 1.5" diameter, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	51-52 ft: Grab Sample GS-24 WC = 29.6% LL = 28, PL = 21, PI = 7 Fines = 29.6%, Sand = 46.1%, Gravel = 24.3%
			S-23			S-23, 50-55 ft: Similar to SS-22	
55	55.0						
	55.3	0.33	SS-25	50/4" (50/4")		**SILTY CLAYEY SAND WITH GRAVEL (SC-SM)** Gray with light brown seams, moist, very dense, ±20% fines, ±20-30% fine to coarse subangular gravel less than 1.5" diameter, very lightly cemented sand, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	56.5-57.5 ft: Grab Sample GS-27 WC = 20.3% LL = 33, PL = 17, PI = 16 Fines = 41.6%, Sand = 30.9%, Gravel = 27.5%
			S-26			S-26, 55-56.5 ft: Similar to SS-25 S-26, 56.5-58.5 ft: **CLAYEY SAND WITH GRAVEL (SC)** Gray, moist, dense, 41.6% fines, 27.5% fine to coarse subangular gravel less than 2" diameter (Less Weathered Springwater Formation)	58.2-59.5 ft: Grab Sample GS-28
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-03 SHEET 4 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

ELEVATION : 703.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : 15 to 33.8 feet bgs START : 11/15/21 12:30 END : 11/16/21 12:32 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
60.0							
	1.50		SS-29	5-12-12 (24)		S-26, 58.5-60 ft: **FAT CLAY (CH)** Gray mottled brown, moist, firm, medium to high plasticity, ±10% fine to coarse sand, ± 5%, fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Less Weathered Springwater Formation)	WC = 34.4% LL = 52, PL = 27, PI = 25 S-30: Not retreived at first attempt, on second attempt sample split in middle because of shoe Driller reported that the sample expanded
61.5							
			S-30			SS-29: **FAT CLAY (CH)** Gray mottled orangish brown, moist, very stiff, medium plasticity, ±10% fine to coarse sand, trace fine subangular gravel less than 0.5" diameter, trace reddish-brown iron oxide staining, trace black Mn nodules (Less Weathered Springwater Formation) S-30, 60-63.2 ft: Similar to SS-29	
65 65.0						S-30, 63.2-65 ft: **CLAYEY SAND WITH GRAVEL (SC)** Gray with rare brown seams/pockets, moist, dense, ±30% fines, ±15% fine to coarse subangular gravel, some basalt gravel (Less Weathered Springwater Formation)	WC = 39.7% Fines = 42.4%, Sand = 46.9%, Gravel = 10.7%
	1.33		SS-31	12-19-50/4" (69/10")			
66.3						**SILTY SAND (SM)** Light gray, brown with dark brown and black spots, moist, very dense, fine to coarse sand, 42.4% fines, 10.7% fine to coarse subangular gravel, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
			S-32			S-32, 65-70 ft: Similar to SS-31 except up to 3" diameter gray gravel pieces	
70 70.0							
70.7	0.67		SS-33	15-50/2" (50/2")		**SILTY SAND WITH GRAVEL (SM)** Gray with rare reddish brown spots, moist, very dense, fine to coarse sand, ±15% fines, ±20% fine to coarse subangular gravel, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
			S-34			S-34, 70-75 ft: Similar to SS-33	
75 75.0							
75.8	0.75		SS-35			Similar to SS-33 except brown and gray, ±15% fine to coarse subangular gravel	
						Bottom of Boring at 75.75 ft below ground surface	Installed VWP in 2" PVC standpipe piezometer
						Geokon VWP 4500S (350 kPa), unvented, serial no. 2146341 Geokon datalogger 8002-WP-2 LC-2, serial no. 2130266	Standpipe piezometer installed immediately after drilling VWP installed on 12/08/2021 0-1 ft: 12" diameter, 12" deep monument set in concrete 1-63 ft: Bentonite chips 63-75 ft: Sand 65-75 ft: Screen
80							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	FWP-TB-03 SHEET 5 OF 5

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

ELEVATION : 703.54 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

DRILLING METHOD AND EQUIPMENT : GeoProbe 8150LS, Rotosonic, SV5 Sonic Head, Track #10, 4" I.D. core barrel, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hamm

WATER DEPTH : 15 to 33.8 feet bgs START : 11/15/21 12:30 END : 11/16/21 12:32 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft) / RECOVERY (ft) / TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
85					Start Card # 1054725 Well # L142298 Base of VWP is at 73.9 ft below ground surface. Field VWP Ro (1) 9011.844 (2) 9012.433 (3) 9012.203 (4) 9012.120 Average Ro = 9012.15
90					
95					
100					

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH01 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (662832.22 N, 7736310.27 E)

ELEVATION : 623.85 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Tyler Stigall

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 09:00 END : 4/2/21 12:45 LOGGER : J. Fissel

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
							Ground surface conditions: Farm field, and topsoil.
	2.5						
	4.0	1.50	SS-1	2-2-6 (8)		**LEAN CLAY (CL)** Brown mottled red-brown, moist, becomes wetter at 3.5 ft, firm, medium plasticity (Residual Soil of the Springwater Formation)	
5	5.0						
	6.5	1.50	SS-2	2-6-8 (14)		Similar to SS-1 except includes dark brown inclusions, moist	
	7.5						
	9.0	1.50	SS-3	5-6-8 (14)		**FAT CLAY (CH)** Brown, moist, stiff, medium plasticity, 9% sand, some gray high plasticity clay regions (Residual Soil of the Springwater Formation)	WC = 30.3% LL = 50, PL = 25, PI = 25
10	10.0						
	11.5	1.50	SS-4	5-7-7 (14)		**LEAN CLAY (CL)** Brown, moist, stiff, medium high plasticity, some gray fat clay regions, trace black medium sand (Residual Soil of the Springwater Formation)	
	12.5						
	14.0	1.50	SS-5	6-6-9 (15)		Similar to SS-4	
15	15.0						
	16.5	1.50	SS-6	7-8-10 (18)		Similar to SS-4	
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH01 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (662832.22 N, 7736310.27 E)

ELEVATION : 623.85 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Tyler Stigall

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 09:00 END : 4/2/21 12:45 LOGGER : J. Fissel

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					**LEAN CLAY (CL)** Brown, moist, stiff, trace black medium sand, medium to high plasticity (Residual Soil of the Springwater Formation)	
	21.5	1.50	SS-7	5-6-6 (12)			
25	25.0						
	26.5	1.50	SS-8	5-8-12 (20)		**FAT CLAY (CH)** Brown and gray, moist, very stiff, high plasticity (Residual Soil of the Springwater Formation)	WC = 30.9% LL = 62, PL = 27, PI = 35
30	30.0						
	31.5	1.50	SS-9	3-4-5 (9)		**FAT CLAY (CH)** Brown and gray, moist, stiff, trace black coarse sand, high plasticity (Residual Soil of the Springwater Formation)	
35	35.0						
	36.5	1.50	SS-10	4-4-5 (9)		**LEAN CLAY (CL)** Brown red-brown gray and purple, moist, stiff, trace fine to medium sand, some black inclusions (Residual Soil of the Springwater Formation)	
40							39 ft: Driller reported gravel

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH01 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (662832.22 N, 7736310.27 E)

ELEVATION : 623.85 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Tyler Stigall

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/2/21 09:00 END : 4/2/21 12:45 LOGGER : J. Fissel

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-11	7-5-6 (11)		**ELASTIC SILT WITH SAND (MH)** Gray, moist, stiff, medium plasticity, sand, trace fine subangular gravel (Sensitive Saprolite of the Springwater Formation)	WC = 59.8% LL = 60, PL = 43, PI = 17
	41.5						
45	45.0						
		1.50	SS-12	5-3-43 (46)		**LEAN CLAY WITH SAND (CL)** Gray and olive-brown, moist, very dense, trace fine subrounded gravel, medium sand (Less Weathered Springwater Formation)	WC = 35.3%
	46.5						
50	50.0						
		0.50	SS-13	20-40-41 (81)		**CLAYEY GRAVEL WITH SAND (GC)** Gray, moist, very dense, fine subangular gravel, medium to coarse sand (Less Weathered Springwater Formation)	
	51.5					Bottom of Boring at 51.5 ft below ground surface	Backfilled with bentonite chips to surface
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH02 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (663291.82 N, 7736316.14 E)

ELEVATION : 639.71 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/5/21 09:10 END : 4/5/21 12:10 LOGGER : K. Elliott

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
							Ground surface conditions: Farm field, and topsoil.
	2.5						
	4.0	1.00	SS-1	0-2-3 (5)		**LEAN CLAY (CL)** slightly red-brown, moist, medium stiff, medium plasticity (Residual Soil of the Springwater Formation)	
5	5.0						
	6.5	1.00	SS-2	2-3-3 (6)		Similar to SS-1	
	7.5						
	9.0	1.50	SS-3	2-4-6 (10)		**ELASTIC SILT (MH)** Red-brown, moist, stiff, medium plasticity (Residual Soil of the Springwater Formation)	WC = 33.3% LL = 51, PL = 32, PI = 19
10	10.0						
	11.5	1.50	SS-4	3-5-6 (11)		Similar to SS-3	
	12.5						
	14.0	1.50	SS-5	3-4-6 (10)		Similar to SS-3	
15	15.0						
	16.5	1.50	SS-6	4-4-6 (10)		Similar to SS-3 except slight light to dark brown mottling	
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH02 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (663291.82 N, 7736316.14 E)

ELEVATION : 639.71 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/5/21 09:10 END : 4/5/21 12:10 LOGGER : K. Elliott

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-7	4-6-10 (16)		**LEAN CLAY (CL)** Red-brown with trace black mottles, moist, very stiff, medium to high plasticity (Residual Soil of the Springwater Formation)	
	21.5						
25	25.0						
		1.50	SS-8	3-9-11 (20)		**LEAN CLAY (CL)** Orange-brown-light gray to slightly blue-gray and black mottled, moist, very stiff, medium plasticity (Residual Soil of the Springwater Formation)	WC = 29.8% LL = 41, PL = 24, PI = 17
	26.5						
30	30.0						
		1.50	SS-9	4-6-10 (16)		**LEAN CLAY (CL)** Orange brown with blue gray mottles, moist, very stiff, medium to high plasticity (Residual Soil of the Springwater Formation)	
	31.5						
35	35.0						
		1.50	SS-10	7-10-16 (26)		Similar to SS-9 except with track black mottles, completely decomposed sand or fine gravel	
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH02 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (663291.82 N, 7736316.14 E)

ELEVATION : 639.71 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/5/21 09:10 END : 4/5/21 12:10 LOGGER : K. Elliott

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0						**LEAN CLAY (CL)** Orange brown and blue gray mottled, moist, very stiff (Residual Soil of the Springwater Formation)	
	1.50		SS-11	5-8-9 (17)			
41.5							
45 45.0							
	1.50		SS-12	6-7-10 (17)		**LEAN CLAY (CL)** Orange brown and black mottled with trace decomposed sand and trace fine gravel, very stiff (Residual Soil of the Springwater Formation)	
46.5							
50 50.0							
	1.50		SS-13	4-2-3 (5)		**ELASTIC SILT (MH)** Orange brown gray mottled, moist, medium stiff, slight plasticity, with completely decomposed sand and gravel, trace highly weathered gravel clast (Sensitive Saprolite of the Springwater Formation)	WC = 58.1% LL = 53, PL = 42, PI = 11
51.5						Bottom of Boring at 51.5 ft below ground surface	Backfilled with bentonite chips to surface
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH03 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (664023.07 N, 7736321.90 E)

ELEVATION : 636.02 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 12.3 to 33.5 feet bgs START : 4/6/21 09:00 END : 4/6/21 12:30 LOGGER : M. Azevedo

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						2 in: **BASE GRAVEL**	0-25 ft: Orange-brown clay / silt collaring around drill rod for cuttings (partially sticking to drill rod, but easy to peel off)
5	5.0						
	6.5	1.50	SS-1	2-2-3 (5)		**ELASTIC SILT (MH)** Orange-brown, wet, firm, medium plasticity, trace less than 1/8" iron/Mn nodules (Residual Soil of the Springwater Formation)	WC = 35.2% LL = 50, PL = 30, PI = 20
10	10.0						
	11.5	1.50	SS-2	2-4-5 (9)		Similar to SS-1 except stiff	
15	15.0						
	16.5	1.50	SS-3	4-4-6 (10)		Similar to SS-1 except stiff	
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH03 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (664023.07 N, 7736321.90 E)

ELEVATION : 636.02 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 12.3 to 33.5 feet bgs START : 4/6/21 09:00 END : 4/6/21 12:30 LOGGER : M. Azevedo

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					Similar to SS-1 except stiff, more trace Mn than above	
		1.50	SS-4	4-4-7 (11)			
	21.5						
25	25.0						
		1.50	SS-5	6-7-12 (19)		**LEAN CLAY (CL)** Orange-brown and mottled gray, moist, very stiff, medium plasticity, 11% sand, trace 1/8-1/2" iron/Mn nodules (Residual Soil of the Springwater Formation)	WC = 27.1% LL = 45, PL = 24, PI = 21 Fines = 88.9%
	26.5						
30	30.0						
		1.50	SS-6	4-6-11 (17)		**FAT CLAY (CH)** Orange-brown and mottled gray, moist, very stiff, high plasticity (Residual Soil of the Springwater Formation)	5 ft clay collar above drill bit when pull out rods at 25 ft, 30 ft, 35 ft. Clay appears to have high plasticity.
	31.5						
35	35.0						
		1.50	SS-7	6-9-12 (21)		**FAT CLAY (CH)** Orange-brown and mottled gray, moist, very stiff, high plasticity, ±5% iron/Mn nodules (Residual Soil of the Springwater Formation)	36-36.5 ±20% iron nodules
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH03 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (664023.07 N, 7736321.90 E)

ELEVATION : 636.02 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 12.3 to 33.5 feet bgs START : 4/6/21 09:00 END : 4/6/21 12:30 LOGGER : M. Azevedo

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-8	8-9-14 (23)		Similar to SS-7 except trace iron/Mn nodules	4 ft clay collar above drill bit when pull out rods at 40 ft, 45 ft
	41.5						
45	45.0	1.50	SS-9	4-6-10 (16)		**FAT CLAY (CH)** Gray mottled orange-brown with Mn veining, moist, very stiff, high plasticity (Residual Soil of the Springwater Formation)	
	46.5						
50	50.0	1.50	SS-10	9-11-15 (26)		**FAT CLAY (CH)** Gray mottled orange-brown, moist, very stiff, high plasticity (Residual Soil of the Springwater Formation)	6 ft clay collar at 50 ft one 1" diameter rounded basalt gravel in shoe
	51.5					Bottom of Boring at 51.5 ft below ground surface Geokon VWP 4500S (350 kPa), unvented, serial no. 2111124 Geokon datalogger 8002-WP-2 LC-2, serial no. 2128644	Inststalled VWP in 2" PVC standpipe piezometer. Standpipe piezometer installed immediately after drilling. VWP installed on 06/25/2021. 0-1.5 ft: 12" diameter, 12" deep monument set in concrete 1.5-30 ft: Dentonite chips 38-50 ft: Sand 40-50 ft: Screen Start Card # 1051306 well # L141466 Base of VWP is at 48.5 ft below ground surface. Field VWP Ro (1) 8969.972 (2) 8969.743 (3) 8969.580 (4) 8970.704 Average Ro = 8969.999
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH04 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (664445.89 N, 7736328.38 E)

ELEVATION : 633.62 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/7/21 09:08 END : 4/7/21 11:50 LOGGER : M. Azevedo

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						2 in: **BASE GRAVEL**	
5	5.0						
	6.5	1.50	SS-1	2-2-3 (5)		**ELASTIC SILT (MH)** Orange brown, moist, firm, medium plasticity, trace <1/8" iron/Mn nodules (Residual Soil of the Springwater Formation)	Cuttings not colaring around drill rod, but are coming out as large clumps of clay
10	10.0						
	11.5	1.50	SS-2	3-5-7 (12)		Similar to SS-1 except stiff	WC = 40% LL = 54, PL = 33, PI = 21
15	15.0						
	16.5	1.50	SS-3	3-4-6 (10)		Similar to SS-1 except stiff	
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH04 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (664445.89 N, 7736328.38 E)

ELEVATION : 633.62 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/7/21 09:08 END : 4/7/21 11:50 LOGGER : M. Azevedo

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	4-6-8 (14)		Similar to SS-1 except stiff and some trace Mn veining, more than above	Clay collaring around drill rod 15-20 ft
	21.5						
25	25.0						
		1.50	SS-5	4-7-8 (15)		**FAT CLAY (CH)** Orange brown with minor gray mottling, moist, stiff, medium to high plasticity, trace less than 1/4" iron/Mn nodules (Residual Soil of the Springwater Formation)	
	26.5						
30	30.0						
		1.50	SS-6	4-7-8 (15)		**FAT CLAY (CH)** Orange brown and mottled gray, moist, stiff, high plasticity (Residual Soil of the Springwater Formation)	WC = 35.8% LL = 61, PL = 30, PI = 31
	31.5						
35	35.0						
		1.50	SS-7	6-11-12 (23)		**FAT CLAY (CH)** Orange brown and mottled gray, moist, very stiff, high plasticity, trace iron/Mn nodules (Residual Soil of the Springwater Formation)	
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH04 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Private property, Gresham, OR (664445.89 N, 7736328.38 E)

ELEVATION : 633.62 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Sam Moreno

DRILLING METHOD AND EQUIPMENT : CME-850 Track #7, Mud Rotary, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/7/21 09:08 END : 4/7/21 11:50 LOGGER : M. Azevedo

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40	40.0 – 41.5	1.50	SS-8	7-10-13 (23)		**FAT CLAY (CH)** Orange brown and mottled gray, moist, very stiff, high plasticity, ±5% less than 0.5" iron/Mn nodules and iron/Mn veining (Residual Soil of the Springwater Formation)	
45	45.0 – 46.5	1.50	SS-9	4-6-7 (13)		**FAT CLAY (CH)** Orange brown, moist, stiff, medium to high plasticity, trace Mn veining (Residual Soil of the Springwater Formation)	
50	50.0 – 51.5	1.50	SS-10	5-5-8 (13)		**FAT CLAY (CH)** Orange brown, moist, stiff, medium to high plasticity, trace iron nodules and Mn veining (Residual Soil of the Springwater Formation)	
						Bottom of Boring at 51.5 ft below ground surface	Backfilled with bentonite grout and capped with base gravel to match existing conditions
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH05 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664965.13 N, 7735746.88 E)

ELEVATION : 618.17 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Kevin Delgado

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/12/21 08:58 END : 4/12/21 12:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						5 in: **ASPHALT CONCRETE PAVEMENT** 7 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
5	5.0						
	6.5	1.40	SS-1	3-5-6 (11)		**SILT (ML)** Brown slightly mottled grayish brown, moist, stiff, slight plasticity, ±5% fine to coarse sand, trace fine to coarse subrounded to subangular gravel 1.5 " diameter, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.75, 2.25, 1.25 tsf 5 ft: Switch to 4-7/8" drag bit.
10	10.0						
	11.5	1.50	SS-2	3-6-7 (13)		Similar to SS-1 except only fine subangular gravel, trace reddish brown iron stains	PP = 2.5 tsf from top 0.3 ft of sample (remaining part of sample split in SS, no PP) WC = 36.3% LL = 40, PL = 27, PI = 13
15	15.0						
	16.5	1.50	SS-3	3-6-7 (13)		**LEAN CLAY (CL)** Brown slightly mottled grayish brown, moist, stiff, medium to high plasticity, trace fine to coarse sand, trace fine subrounded gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 1.5, 1.5 tsf Driller reported will redrill the borehole from 0-10 ft with the 6" tricone bit. The clay has "collared up" the borehole and is lifting the mud tub, causing drilling fluid to lean onto the road.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH05 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664965.13 N, 7735746.88 E)

ELEVATION : 618.17 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Kevin Delgado

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/12/21 08:58 END : 4/12/21 12:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	3-7-10 (17)		**LEAN CLAY (CL)** Brown mottled gray, moist, very stiff, medium plasticity, ±10% fine to coarse sand, ±5% fine to coarse black subangular to subrounded gravel less than 1" diameter, trace reddish-brown iron oxide staining, trace black Mn nodules, black/very dark brown pockets of sand and gravel (Residual Soil of the Springwater Formation)	PP = 3.25, 3.75, 2.5 tsf WC = 33.8% LL = 46, PL = 23, PI = 23 Clay collar surrounding drilling rod retrieved from borehole
	21.5						
25	25.0						
		1.50	SS-5	5-6-9 (15)		**FAT CLAY (CH)** Gray mottled brown, moist, soft, medium to high plasticity, ±5% fine to coarse sand, ±5% fine to coarse subangular gravel less than 1.25" diameter, black or very dark brown pockets of sand and gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2, 1.5, 2 tsf
	26.5						
30	30.0						
		1.50	SS-6	5-11-16 (27)		**SILT (ML)** Dark gray steel mottled brown, moist, very stiff, medium plasticity, 6% fine to coarse sand, 1% fine subangular gravel, black/very dark brown pockets of sand and gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 3, 3.75, 3.5 tsf WC = 31.6% LL = 46, PL = 27, PI = 19 Fines = 93%, Sand = 6.2%, gravel = 0.8%
	31.5						
35	35.0						
		1.50	SS-7	4-8-15 (23)		Similar to SS-6 except dark gray steel, trace slightly mottled brown, no sand, no gravel	PP = 3.5, 2.75, 1 tsf
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH05 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664965.13 N, 7735746.88 E)

ELEVATION : 618.17 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Kevin Delgado

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" and 6" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 4/12/21 08:58 END : 4/12/21 12:25 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0						Similar to SS-6 except dark steel and light gray slightly mottled brown, no gravel, track black Mn nodules, no pockets of gravel	PP = 3.25, 3.25, 3 tsf
	1.50		SS-8	6-10-16 (26)			
41.5							
45 45.0							
	1.50		SS-9	8-14-16 (30)		Similar to SS-6 except no pockets of sand and gravel, trace fine to coarse sand, trace fine subangular gravel	PP = 3.75, 3.25, 3.5 tsf
46.5							
50 50.0							49 ft: Driller reported gravel, slight rig chatter
	1.50		SS-10	8-20-33 (53)		**SILTY SAND (SM)** Brown, 2" gray at the top, moist, very lightly cemented, very dense, ±15% silt, trace clay, fine to coarse sand, trace fine to coarse subrounded to subangular gravel less than 1.5" diameter (Less Weathered Springwater Formation)	Lightly cemented sand, disintegrates easily with finger pressure.
51.5						Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1 ft: Gravel 1-5 ft: Bentonite chips 5-51.5 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH06 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664975.94 N, 7735205.70 E)

ELEVATION : 619.21 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 6" Tricone Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 41.6 to > 50 feet bgs START : 3/24/21 15:00 END : 3/25/21 13:36 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						3.5 in: **ASPHALT CONCRETE PAVEMENT** 11.5 in: **BASE GRAVEL**	
5	5.0						
	6.5	0.80	SS-1	1-1-2 (3)		**LEAN CLAY (CL)** Gray mottled brown, moist, soft, medium to high plasticity, trace fine sand, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 1, 1, 0.5 tsf Some silt possible, ±5-10%
	8.0						
		2.00	ST-2				ST-2 recovery 2.15 ft, some cuttings at top 8-9 ft: 150 psi 9-10 ft: 250 psi
10	10.0						
	11.5	1.50	SS-3	2-3-4 (7)		**FAT CLAY (CH)** Brown slightly mottled dark grayish brown, moist, firm, medium to high plasticity, trace fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1, 0.5, 1.25 tsf Stop on 3/24/21 at 15:50 at 10 ft Start on 3/25/21 at 8:30 Make provision for piezometer monument: Core asphalt with 16" core bit. Drill base gravel to 1 ft below ground surface with 7" "cookie cutter" bit. Backfill with 3/8" bentonite chips, set the mud tub, drill the boring off-center to the cylinder drilled for the piezometer monumnet to accomodate future installation of a VWP data logger.
15	15.0						
	16.5	1.50	SS-4	4-6-6 (12)		**SILT (ML)** Brown mottled gray, moist, stiff, medium plasticity, trace of sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.5, 1.5, 1.75 tsf WC = 29.5% LL = 39, PL = 23, PI = 16 15 ft: Switch to 6" drag bit.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH06 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664975.94 N, 7735205.70 E)

ELEVATION : 619.21 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 6" Tricone Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 41.6 to > 50 feet bgs START : 3/24/21 15:00 END : 3/25/21 13:36 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0					**FAT CLAY (CH)**	PP = 2.25, 2.25, 2.75 tsf
		1.30	SS-5	3-3-6 (9)		Brown mottled gray, moist, stiff, medium to high plasticity, trace fine sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	
	21.5						
	23.0						
							ST-6
		2.00	ST-6				23-23.5 ft: 150 psi
							23.5-24 ft: 300 psi
							24-24.5 ft: 450 psi
							24-5-25 ft: 550 psi
25	25.0						Driller reported he is reaming out / redrilling borehole repeatedly from 0-10 ft
		1.50	SS-7	2-5-8 (13)		**SILT (ML)** Gray mottled brown, moist, stiff, medium plasticity, trace fine sand, trace of subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 1.5, 2.5 tsf WC = 31.8% LL = 45, PL = 28, PI = 17
	26.5						
30	30.0					SS-8A, 30-30.5 ft: Similar to SS-7	PP = 0.75, 1.25, 3.5 tsf
		1.50	SS-8	4-7-8 (15)		SS-8B, 30.5-31.5 ft: **LEAN CLAY WITH SAND (CL)** Brown slightly mottled gray, moist, stiff, medium plasticity, ±30% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	
	31.5						
35	35.0						
		1.50	SS-9	7-10-11 (21)		**LEAN CLAY (CL)** Brown mottled grayish brown, moist, very stiff, medium to high plasticity, ±10% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 3, 3.25, 3.5 tsf
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH06 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664975.94 N, 7735205.70 E)

ELEVATION : 619.21 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 6" Tricone Bit, 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 41.6 to > 50 feet bgs START : 3/24/21 15:00 END : 3/25/21 13:36 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	40.0	1.50	SS-10	3-7-8 (15)		**FAT CLAY (CH)** Gray mottled brown, moist, stiff, medium to high plasticity, ±5% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1, 1, 2 tsf
	41.5						
45	45.0	1.40	SS-11	6-10-16 (26)		**LEAN CLAY (CL)** Brown mottled gray, moist, very stiff, medium to high plasticity, ±10% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 3.5, 3.5, 2 tsf
	46.5						
50	50.0	1.50	SS-12	8-9-8 (17)		**SILT WITH SAND (ML)** Brown slightly mottled gray, moist, very stiff, slight plasticity, 25% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1, 2, 3 tsf WC = 42.3% LL = 44, PL = 30, PI = 14 Fines = 74.7%, Sand = 25.0%, Gravel = 0.3%
	51.5					Bottom of Boring at 51.5 ft below ground surface Geokon VWP 4500S (350 kPa), unvented, serial no. 2116126 Geokon datalogger 8002-WP-2 LC-2, serial no. 2128643	Inststalled VWP in 2" PVC standpipe piezometer. Standpipe piezometer installed immediately after drilling. VWP installed on 06/24/2021. 0-1.5 ft: 12" diameter, 12" deep monument set in concrete, Black dye added to concrete to match existing conditions 1.5-2 ft: base gravel 2-38 ft: Bentonite chips 38-50 ft: Sand 40-50 ft: Screen Start Card # 1051203 Well # L141457 Base of VWP is at 48.3 ft below ground surface. Field VWP Ro (1) 9111.705 (2) 9111.870 (3) 9112.589 (4) 9112.938 Average Ro = 9112.276
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH07 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664985.76 N, 7734711.06 E)

ELEVATION : 624.99 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/30/21 09:12 END : 3/30/21 12:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
						2.5 in: **ASPHALT CONCRETE PAVEMENT** 7.5 in: **BASE GRAVEL**	Start drilling with 4-7/8" tricone bit.
5	5.0						
	6.5	1.50	SS-1	3-3-5 (8)		**LEAN CLAY (CL)** Brown slightly mottled grayish brown, moist, firm, medium to high plasticity, trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1, 1.25, 1.25 tsf 5 ft: Switch to 4-7/8" drag bit.
10	10.0						
	11.5	1.50	SS-2	4-6-9 (15)		**LEAN CLAY (CL)** Brown mottled gray, moist, stiff, medium plasticity, ±5% fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.75, 1.25, 2.25 tsf WC = 33.7% LL = 44, PL = 25, PI = 19
15	15.0						
	16.5	1.50	SS-3	4-6-7 (13)		Similar to SS-2 except color is brown, trace fine to coarse sand	PP = 1.5, 1.25, 1.25 tsf
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH07 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664985.76 N, 7734711.06 E)

ELEVATION : 624.99 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/30/21 09:12 END : 3/30/21 12:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	20.0						
		1.50	SS-4	4-5-8 (13)		**LEAN CLAY (CL)** Light brown mottled grayish brown to gray, moist, stiff, medium to high plasticity, ±5% fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 1.25, 1.25, 1.25 tsf
	21.5						
25	25.0						
		1.50	SS-5	3-5-7 (12)		**ELASTIC SILT (MH)** Gray mottled light brown or brown, moist, stiff, medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0.75, 1.25, 1 tsf Driller reported he will redrill 0-10 ft of borehole to remove clay collar formed at that location
	26.5						
30	30.0						
		1.50	SS-6	4-7-9 (16)		Similar to SS-5 except very stiff, trace fine subrounded gravel	PP = 2.5, 2, 2.25 tsf WC = 36.6% LL = 56, PL = 31, PI = 25
	31.5						
35	35.0						
		1.50	SS-7	5-7-11 (18)		Similar to SS-5 except color brown mottled grayish brown, very soft, ±5-10% fine to coarse sand	PP = 1, 2.25, 1.75 tsf
	36.5						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH07 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664985.76 N, 7734711.06 E)

ELEVATION : 624.99 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Shane Sprauge

DRILLING METHOD AND EQUIPMENT : CME-75 Truck #9, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : Not recorded START : 3/30/21 09:12 END : 3/30/21 12:50 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
	40.0 – 41.5	1.50	SS-8	6-9-11 (20)		**LEAN CLAY (CL)** Brown mottled light brown, moist, very soft, medium to high plasticity, ±5% fine to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	PP = 2.75, 1.5, 2.75 tsf Driller reported he will ream out / redrill 1-5 ft of borehole to remove clay collar
45	45.0 – 46.5	1.50	SS-9	5-7-9 (16)		Similar to SS-8 except some gray mottling, trace fine to coarse sand, reddish brown iron staining	PP = 1, 2.25, 1.75 tsf
50	50.0 – 51.5	0.70	SS-10	3-4-4 (8)		**SILT (ML)** Brown, moist, firm, slight plasticity, trace fine to coarse sand, ±5% fine to coarse subangular to subrounded gravel less than 1.5" diameter, reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0.5, 0.75, 0 tsf WC = 38.8% LL = 37, PL = 26, PI = 11
						Bottom of Boring at 51.5 ft below ground surface	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1.5 ft: Gravel 1-5 ft: Bentonite chips 5-50.7 ft: Bentonite grout
55							
60							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH08 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664904.92 N, 7736258.26 E)

ELEVATION : 595.79 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dustin Helmig

DRILLING METHOD AND EQUIPMENT : CME-55 Track #2, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" and 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 18.4 to 20.9 feet bgs START : 9/2/21 08:55 END : 9/2/21 12:10 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
							Ground surface conditions: Farm field, grass, and topsoil consisting of clay and trace sand. Vacuum excavate to 4 ft bgs. Clear of utilities. Start drilling with 4-7/8" drag bit.
5	5.0						
	6.5	1.30	SS-1	WOH-0-1 (1)		**FAT CLAY (CH)** Gray mottled slight orangish-brown, moist, very soft, medium plasticity, trace fine sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0, 0.5, 0.75 tsf WC = 37.3% LL = 52, PL = 23, PI = 29
10	10.0						
	11.5	1.50	SS-2	1-3-3 (6)		Similar to SS-1 except reddish brown, firm, more reddish-brown iron oxide staining, black Mn nodules	PP = 0.5, 0.75, 1.5 tsf
15	15.0						
	16.5	1.50	SS-3	WOH-1-0 (1)		**FAT CLAY (CH)** Gray mottled brown to greenish brown, moist, very soft, high plasticity, 6.5% fine sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0, 0.5, 0.75 tsf WC = 43.7% LL = 64, PL = 24, PI = 40 Fines = 93.5%, Sand = 6.5%, Gravel = 0% Clay collar from 0-12 ft bgs retreived from borehole.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH08 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664904.92 N, 7736258.26 E)

ELEVATION : 595.79 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dustin Helmig

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	20.0						
		1.50	SS-4	2-5-6 (11)		**ELASTIC SILT (MH)** Gray, moist, stiff, medium plasticity, trace fine subrounded gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2.5, 2.5, 1 tsf WC = 44%
	21.5						
							23 ft: Use 6" drag bit to re-drill borehole from 0-15 ft bgs, borehole collared up due to plastic soils. Switch back to 4-7/8" drag bit.
25	25.0						
		1.50	SS-5	4-5-18 (23)		**SANDY SILT (ML)** Gray, moist, very stiff, slight plasticity, ±40% fine to coarse sand, ±5% fine to coarse subrounded to subangular gravel less than 1.25" in diameter (Residual Soil of the Springwater Formation)	WC = 46.4% LL = 48, PL = 44, PI = 4 Top 1" of SS-5 includes soil similar to SS-4 Pumaceous sand 25 ft: Switch to 4-7/8" tricone bit
	26.5						
30	30.0						
		1.50	SS-6	15-42-40 (82)		**SILTY SAND WITH GRAVEL (SM)** Gray with trace red and dark green spots, moist, very dense, ±20% silt, fine to coarse sand, ±15% fine to coarse subangular gravel less than 1.5" in diameter (Less Weathered Springwater Formation)	Lightly cemented sand, disintegrates easily with finger pressure.
	31.5						
35	35.0						
		1.33	SS-7	34-40-50/4" (90/10")		**SILTY SAND (SM)** Similar to SS-6 except 12.2% fine to coarse subangular to subrounded gravel (Less Weathered Springwater Formation)	WC = 20.8% LL = 32, PL = 28, PI = 4 Fines = 29.7%, Sand = 58.1%, Gravel = 12.2% Recovery in SS = 1.5 ft Drill rig chatter after 36 ft
	36.3						
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH08 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664904.92 N, 7736258.26 E)

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WATER DEPTH : 18.4 to 20.9 feet bgs START : 9/2/21 08:55 END : 9/2/21 12:10 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
40.8	0.75	SS-8		24-50/3" (50/3")		Similar to SS-7 except ±10% fine to coarse subangular to subrounded gravel	Recovery in SS = 1.3 ft 40-50 ft: Driller reported similar soil.
45							
50	50.0						
	50.3	0.25	SS-10	50/3" (50/3")		Similar to SS-7 except no greater than 0.25" diameter gravel pieces Bottom of Boring at 50.25 ft below ground surface Geokon VWP 4500S (350 kPa), unvented, serial no. 2146339 Geokon datalogger 8002-WP-2 LC-2, serial no. 2128642	Installed 2" dia standpipe piezometer for future installation of VWP Standpipe piezometer installed immediately after drilling VWP installed on 12/21/2021. 0-1 ft: 12" diameter, 12" deep monument set in concrete 1.5-2 ft: Base gravel 1-37.5 ft: Bentonite chips 37.5-50 ft: Sand 40-50 ft: Screen Start Card # 1053657 Well # L142289 Base of VWP is at 48.45 ft below ground surface. Field VWP Ro (1) 8962.688 (2) 8962.688 (3) 8962.771 (4) 8964.232 Average Ro = 8963.095
55							
60							