2020 SW 4th Avene Suite 300 Portland, OR 97201 United States T +1.503.235.5000 www.jacobs.com

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.

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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.

 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.



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- 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 around 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 Todd E. Cotten Date: 2023.08.04 12:44:50-07'00' Todd Cotten, PE, GE Geotechnical Engineer

Copies: File



August 4, 2023

Subject: Supplemental Geotechnical Information

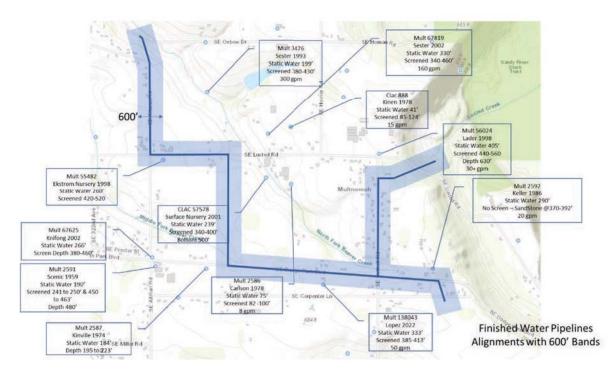


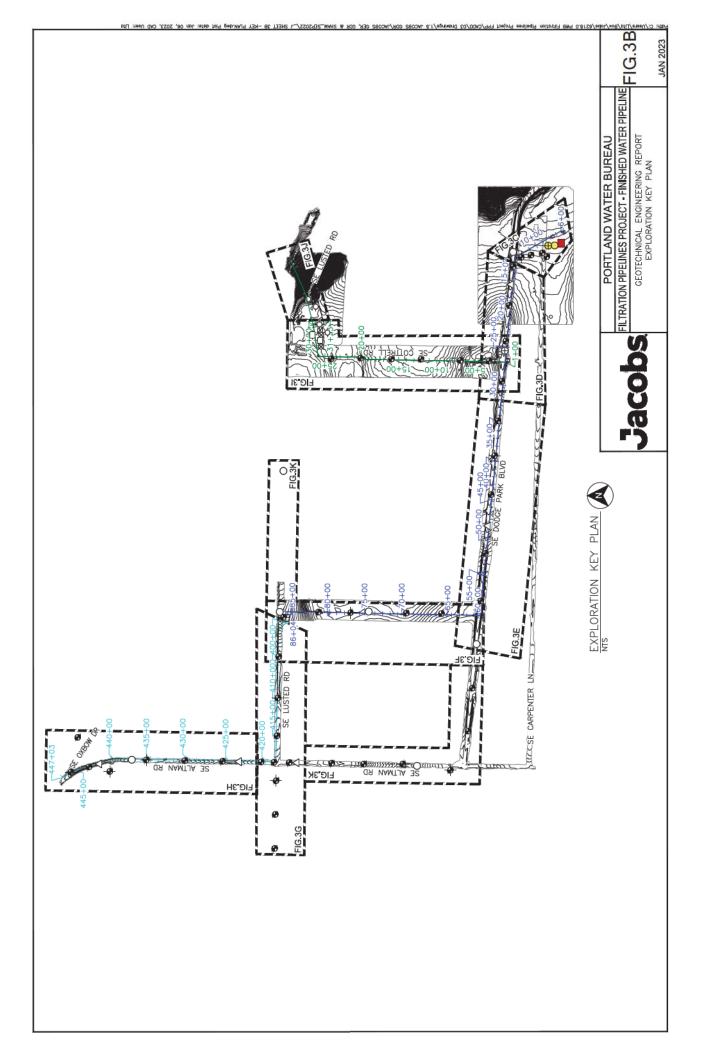
Figure 1. Water Wells in the Vicinity of the Finished Water Pipeline. Source: Oregon Water Resources Department, Well Report Query tool.

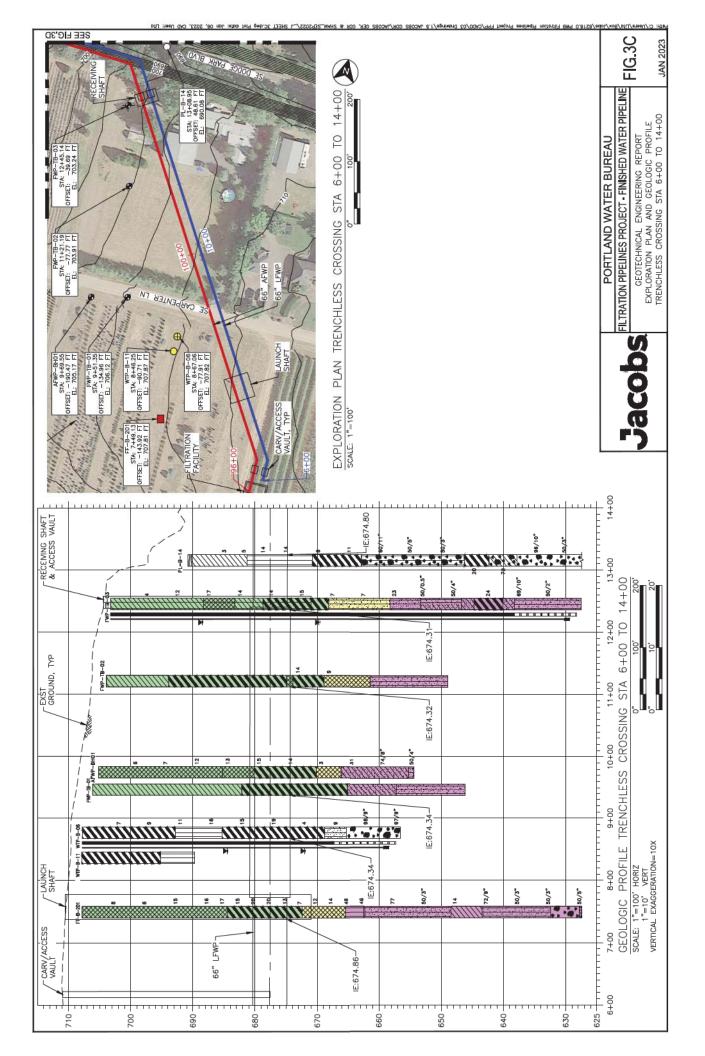


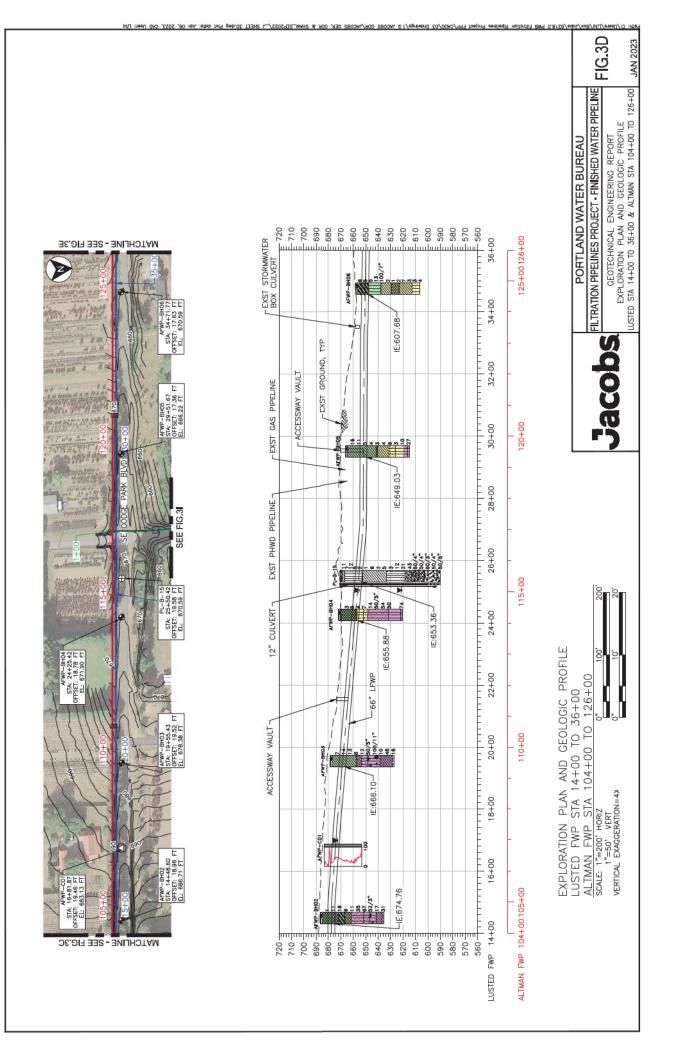
August 4, 2023 Subject: Supplemental Geotechnical Information

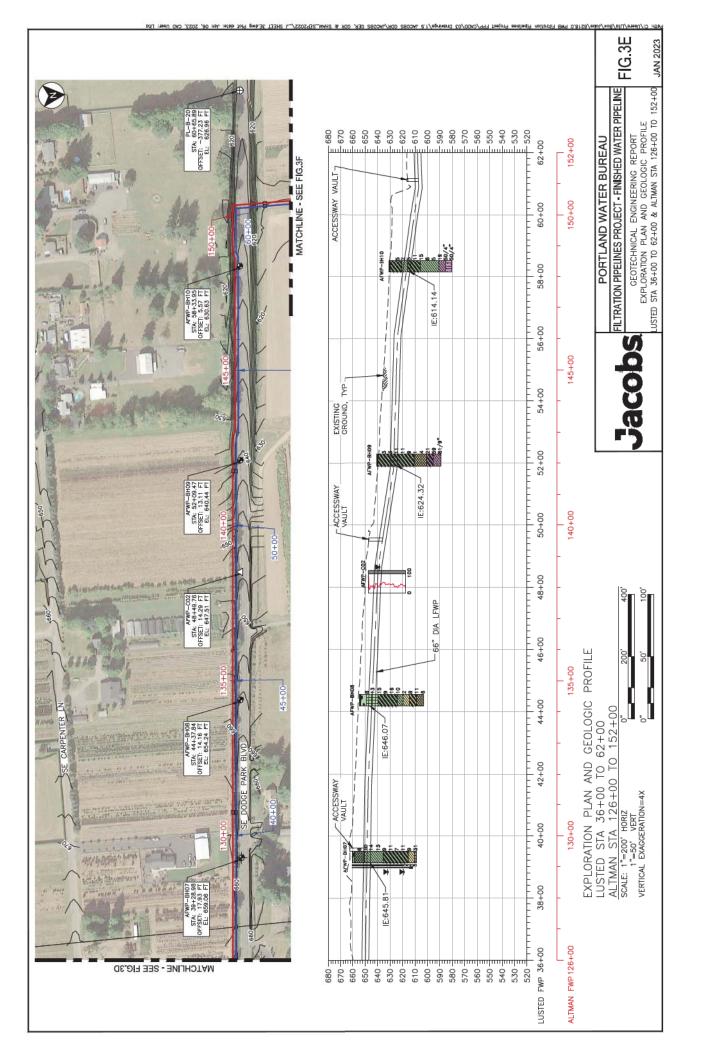
Appendix A: Field Exploration Mapping and Boring Logs

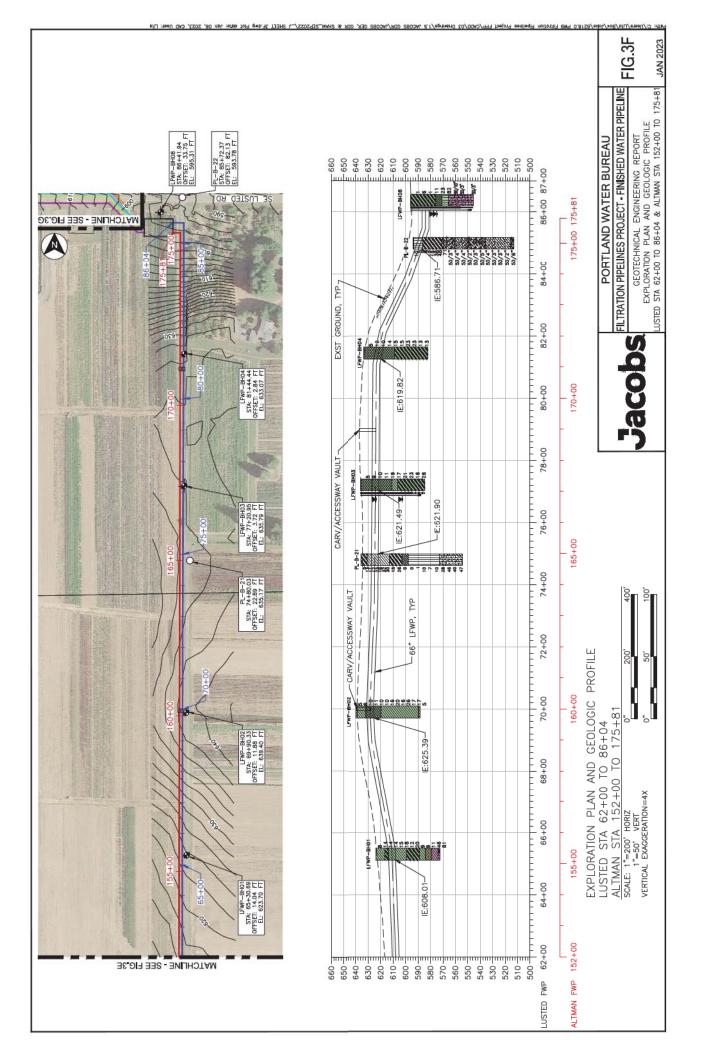
GENERAL NOTES: 1 AL EXPLORATION INVATION	1. ALL EXPLORATION LOCATIONS ARE APPROXIMALE. 2. HORIZONTAL DATUM: NADB3 STATE PLANE OREGON NORTH FIPS 3601,	INTERNATIONAL FEET, VERTICAL DATUM: PORTLAND VERTICAL DATUM, FEET.	POSITIVE OFFSET=RIGHT OF CENTERLINE, LOOKING UP STATION, NEGATIVE OFFSET=LEFT OF CENTERLINE, LOOKING UP STATION.		GEOTECHNICAL EXPLORATIONS ALONG THE ORIGINAL (NOW ABANDONED) ALTMAN FINISHED WATER PIPELINE ALIGNMENT AND LUSTED INTERTIE	OCCURRENT ALL AND A SINGLE TYPICAL PIPELINE, MULTIPLE		id¶ pmb	TECENIO	₹ x30N-1	- V	45 ~~24		WHS.	1994 - 1995 - 1994 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 - 1995 -	CPT LEGEND:	AFWP-CO1	CPT 10	(BLOWS/FT)			ENGI -	SEF TABLE AT RIGHT 0 100			BOTTOM OF BORING	4 n oŭŭ		and on	8129/4	PORTLAND WATER BUREAU	FILTRATION PIPELINES PROJECT - FINISHED WATER PIPELINE FIG 3 A	GEOTECHNICAL ENGINEERING REPORT FIGURE INDEX, LEGEND AND GENERAL NOTES
D SOIL CLASSIFICATION SYSTEM	0 M DZ400 ANU DZ407)	U		SILTY GRAVEL	CLAYEY GRAVEL		CITY SAND			ELASTIC SILT	NON-USCS SYMBOLS	SOIL GRAPHIC TYPICAL DESCRIPTION			KK BASALT	BORING LEGEND:	AFWP-BH01	, ,		MEASURED CROUNDWATER						VIBRATING WRE 31							Vacobs
UNITED		SYMBOL	GP	GM	00	Ъ	SC SM	WL	CL	CH						STRATIGRAPHIC LEGEND:	COLOR GEOLOGICAL UNITS	RESIDUAL SOIL OF THE	SPRINGWATER FORMATION	SENSITIVE SAPROUTE OF THE SPRINGWATER FORMATION	LESS WEATHERED SPRINGWATER FORMATION	UNWEATHERED SPRINGWATER					2020)		(RHINO 2020A)	WITH PIEZOMETER (RHINO 2020A)	(BHINO 2020B)	WITH PIEZOMETER (RHINO 2020B)	
FIGURE INDEX	ППСЕ	FIGURE INDEX, LEGEND AND GENERAL NOTES	EXPLORATION KEY PLAN		EXPLORATION PLAN AND GEOLOGIC PROFILE TRENCHLESS CROSSING STA 6+00 TO 14+00	EXPLORATION PLAN AND GEOLOGIC PROFILE LUSTED STA 14+00 TO 36+00 & ALTMAN STA 104+00 TO 126+00	ALTRATION PLAN NO 152-00 CONCIL ELUSTED STA 36+00 TO 62+00 &	EXPLORATION PLAN AND GEOLOGIC PROFILE LUSTED STA 62+00 TO 86+04 & ALTMAN STA 152+00 TO 175+81	EXPLORATION PLAN AND GEOLOGIC PROFILE C4 STA 400+00 T0 421+00,	UZ SIA ZUTTU IV ZZITIG & UJ SIA JUCTU IV SIA JUFIZA EXPLORATION PLAN AND GEOLOGIC PROFILE C4 STA 421+00 T0 447+03 & C2 ST2 221+19 T0 240+B6	EXPLORATION PLAN AND GEOLOGIC PROFILE CRTM STA 1+00 TO 31+23	EXPLORATION PLAN AND GEOLOGIC PROFILE CRTM VICINITY	EXPLORATION PLAN ORIGINAL ALTMAN ALIGNMENT BORINGS			AND SYMBOL KEY:	ALTMAN FWP	LUSTED FWP	CONDUT 2 FWP	CONDUIT 3 FWP	CONDUIT 4 FWP	ORIM De indefination destended profilments				X HISTORICAL JACOBS ASSOCIATES GEOTECHNICAL BOREHOLE (STANTEC 2019, 2020)	\diamond PREVIOUS LUSTED HILL TREATMENT PLANT CCIP GEOTECHNICAL BOREHOLE (STANTEC 2019, 2020)	FILTRATION FACILITY GEOTECHNICAL BOREHOLE (MJ 2021)			MINIORICAL FUNIARI FILS FOI (SIMPLEZ 2019, 2020) PRETIMINARY RITI RIN TREATMENT FI TRATIAN FAMILY PRAJECT REATECHNICAL ROBERIOLE (BHINO 2020R)		
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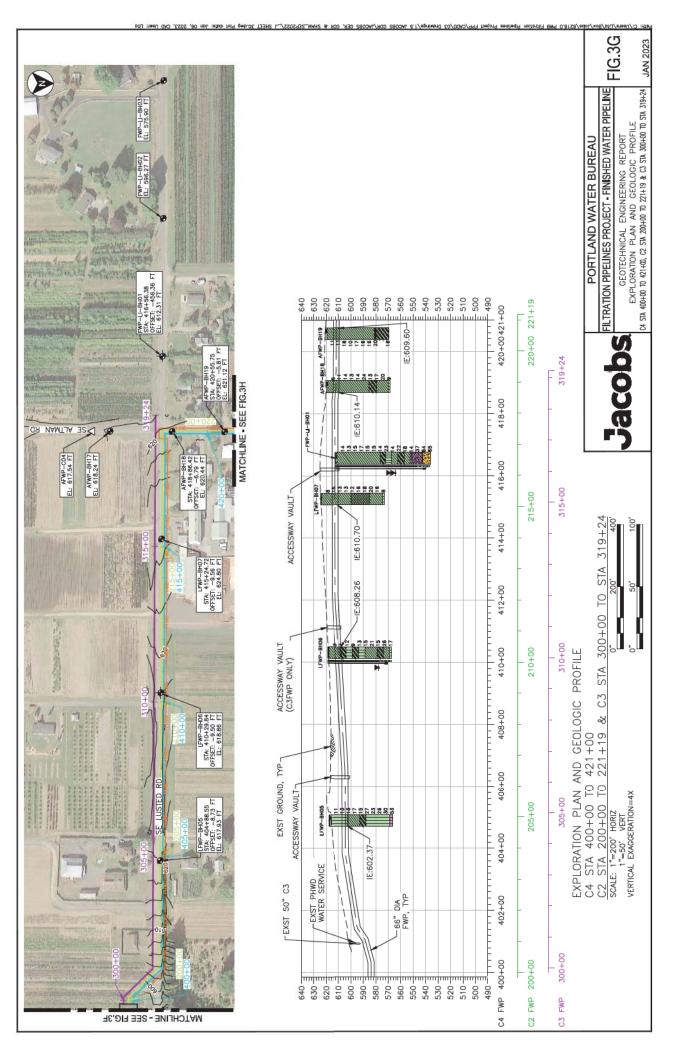


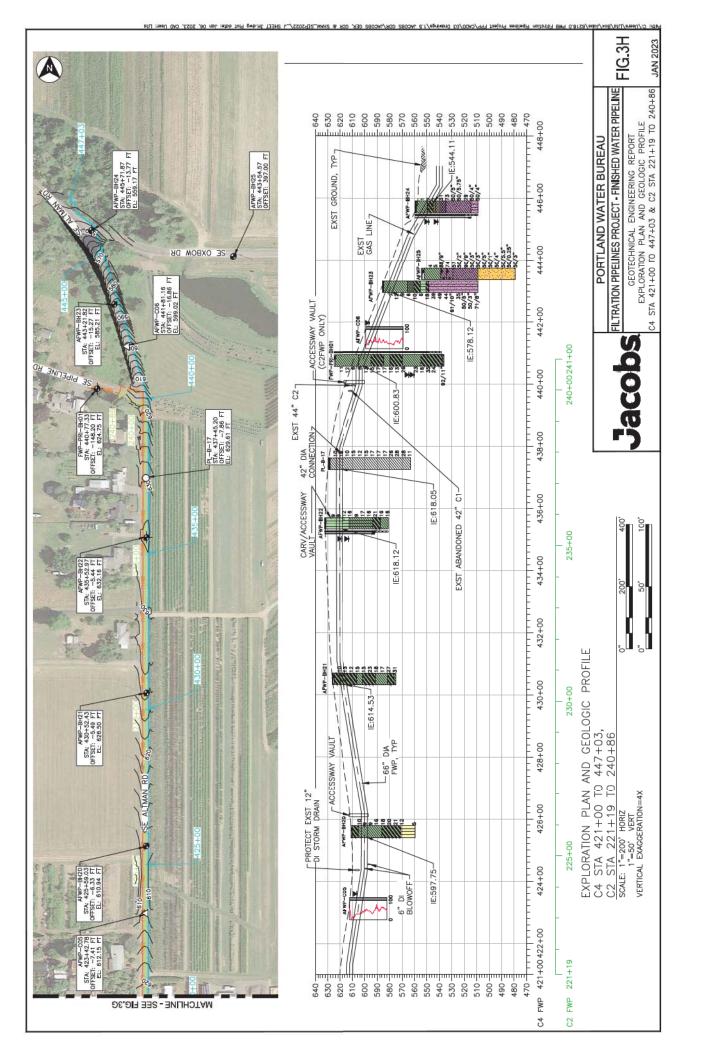


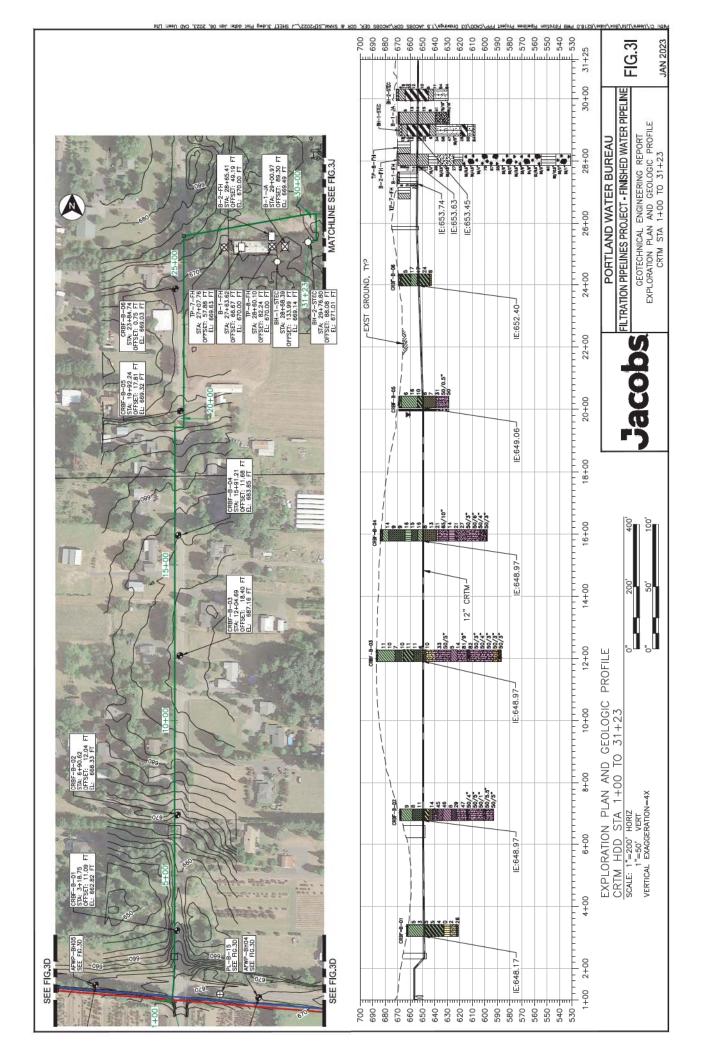


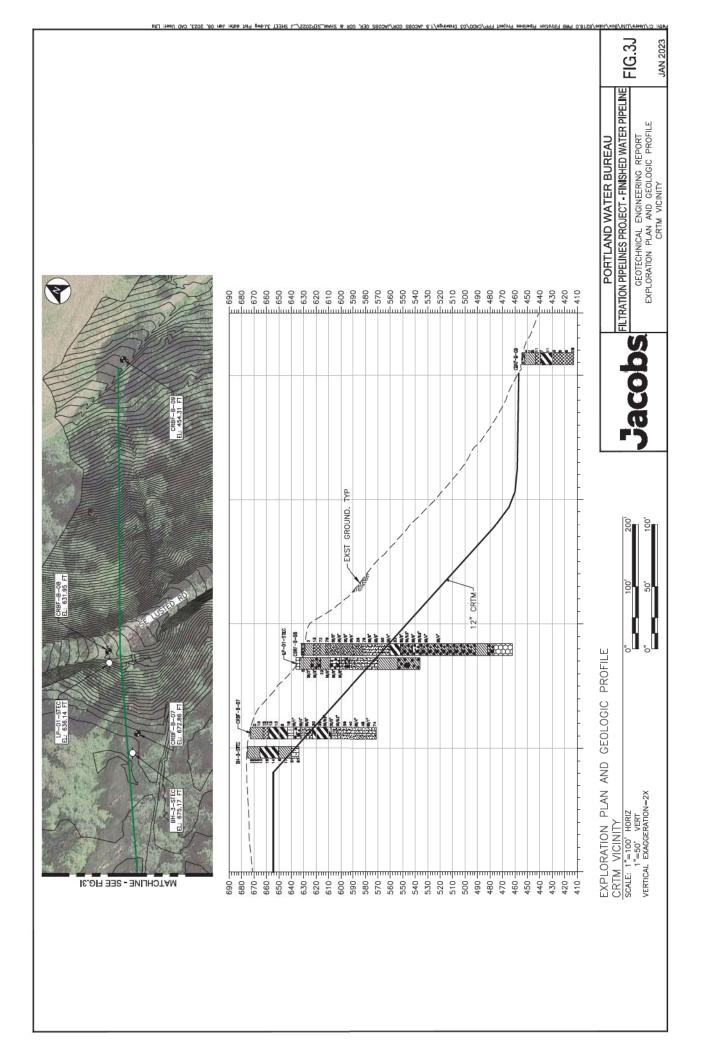


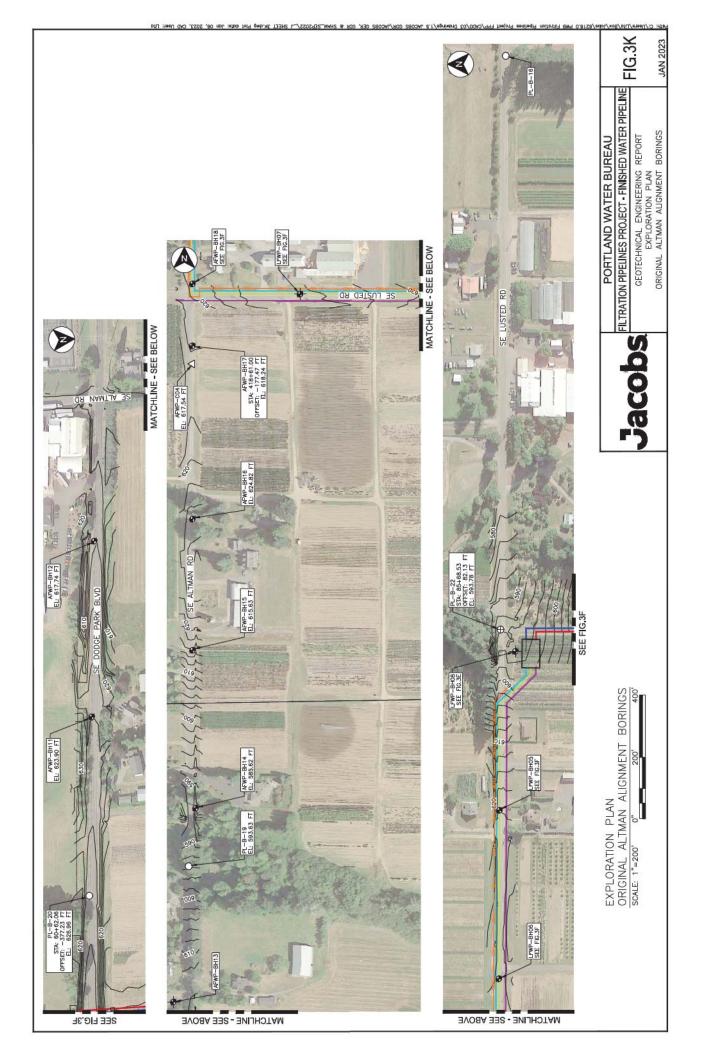












SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 704.91 ft

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

BORING NUMBER:

SHEET 1 OF 3

AFWP-BH01

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-Ib Auto Trip Hammer

WATER	DEPTH	: Not rec	orded			START : 4/14/21 09:10 END : 4/14	4/21 12:11 LOGGER : L. Bhaumik
DEPTH B	ELOW GR	OUND SU	IRFACE (ft)		OG	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	CLC		
		RECOVE	ERY (ft)		H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
				(,	*****		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.
-							
-						-	-
-							4 .
_							Class surrounding drill and ratio and from baring
5_	5.0						Clay surrounding drill rod retrieved from boring.
				2-2-4		ELASTIC SILT (MH) Slightly reddish-brown, moist, firm, medium	PP = 0.75, 1, 1.25 tsf
_		1.30	SS-1	(6)		plasticity, trace black to dark brown spots of fine to	
_	6.5					coarse sand and fine subangular gravel, trace organics consisting of very fine roots (Residual	
_						Soil of the Springwater Formation)	
_							
_						-	1
10	10.0					-	1
	10.0					Similar to SS-1 except slightly more	PP = 0.75, 1.25, 1 tsf
-		1.50	SS-2	3-3-4		reddish-brown.	- WC = 40.6% LL = 53, PL = 31, PI = 22
-	11.5			(7)		-	Silt surrounding drill rod retrieved from boring.
-	11.0					-	-
-						-	-
-							4 .
-							
-							4 .
-							4 .
							4 .
15	15.0					Similar to SS-1 except reddish-brown, stiff, trace	PP = 1.5, 1.75, 1 tsf
-		4.50		3-5-7		black Mn nodules, no trace organics	
-		1.50	SS-3	(12)			4 .
-	16.5					ST-4: 16.5 ft - 18.1 ft	ST-4:
_						31-4. 10.3 IL - 10.1 IL	- 16.5-17 ft: 200 psi -
-		1.60	ST-4				17-17.8 ft: 250 psi 17.8-18.1 ft: 600 psi
-	18.1						Recovery in Shelby tube = 2.2 ft
_							4
20							

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 704.91 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH01

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-Ib Auto Trip Hammer

WATER	DEPTH	· Not rec	orded			START : 4/14/21 09:10 END : 4/14	1/21 12:11 LOGGER : L. Bhaumik
10			RFACE (ft)		Ċ	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	PO		
		RECOVE	RY (ft)	TEST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-	20.0 21.5	1.50	SS-5	4-5-8 (13)		ELASTIC SILT (MH) Reddish-brown slightly mottled gravish-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	PP = 2, 2, 1.5 tsf WC = 32.5% LL = 55, PL = 31, PI = 24 -
- - - 25_	25.0					the Springwater Formation)	
-	26.5	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. - -
- - - 30_	30.0					-	28-30 ft: Driller reported stiffer soil.
-	31.5	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% -
- - - - 35_	35.0					- - - - - - - - - - - - - - - - - - -	
	36.5	1.50	SS-8	2-1-2 (3)		SANDY ELASTIC SIL1 (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%
- - 40							- 39 ft: Driller reported fine gravel, slight drill rig chatter. -

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 704.91 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH01

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-Ib Auto Trip Hammer

WATER	DEPTH	· Not rec	200000000			START : 4/14/21 09:10 END		4/21 12:11 LOGGER : L. Bhaumik
1	BELOW GR				U	SOIL DESCRIPTION		COMMENTS
	INTERV	AL (ft)		PENETRATION TEST RESULTS	P			
		RECOVE	RY (ft)	IEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL, COLOR	λ ,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY O CONSISTENCY, SOIL STRUCTURE, MINERALO		INSTRUMENTATION
-	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.
- - - 45_	45.0						-	
	46.2	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 san ±15% clay, trace coarse subangular gravel less than 1.5" in diameter, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	id, - S -	Recovery in split-spoon is 1.5 ft. Consists of cemented sand that disintegrates with finger pressure.
- - - 50	50.0					SILTY SAND WITH GRAVEL (SM)	-	Consists of cemented sand that disintegrates with
	50.8	0.80	SS-11	45-50/4" (50/4")		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 Formati Bottom of Boring at 50.8 ft below ground surfac	e - on)	Backfilled with: 0-1 ft: Bentonite chips 1-50.8 ft: Bentonite grout
55								

RUJECT 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-Ib Auto Trip Hamme

	DEPTH				_		1/21 13:45 LOGGER : L. Bhaumik
DEPTH E	1		RFACE (ft)	heart sectors and sectors and sectors	8	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft) TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
				(-7	\sim	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	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							- · · · · · · · · · · · · · · · · · · ·

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)

PROJECT NUMBER:

D3460500

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH02

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

	NUMBER OF STREET	: Not rec	24020000			START : 3/1/21 09:31 END : 3/1/	2 13:45 LOGGER : L. Bhaumik
1			RFACE (ft)		()	SOIL DESCRIPTION	COMMENTS
	INTERVA			PENETRATION	GRAPHIC LOG		
		RECOVE	RY (ft)	TEST RESULTS	¥	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
				6"-6"-6"	API	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	(N)	Б		
	20.0				****	ELASTIC SILT (MH)	PP = 1.25, 2, 0.25 tsf
		1.50	SS-4	2-3-3 (6)		Reddish-brown mottled gray, moist, firm, high plasticity, trace black Mn nodules (Sensitive	WC = 63.2% LL = 83, PL = 43, PI = 40
	21.5			(0)		Saprolite of the Springwater Formation)	1" zone of Mn nodules in the SS shoe.
-	21.5					-	21.5 ft: Switch to 3-7/8" melt-tooth bit.
-						-	-
						-	-
-						-	-
-						-	-
						-	-
-						-	-
25	<u>25.0</u>						
				2-4-7		SILTY SAND (SM) Light brown, wet, medium dense, fine to coarse	Fines = 39%, Sand = 52.3%, Gravel = 8.7%
		1.50	SS-5	(11)		sand, 12% clay, 27% silt, 9% fine to coarse	_
	26.5					subangular gravel (Less Weathered Springwater Formation)	
						· · · · · · · · · · · · · · · · · · ·	
						-	
-						-	28 ft: Driller reported rig clatter, switch to 4-7/8"
-						-	tricone bit. 28.5 ft: Driller reported rig clatter.
20	20.0					-	29-29.5 ft: Driller reported harder soil.
30	30.0					Similar to SS-5 except gravish brown, dense,	WC = 21.7%
		1.50	SS-6	12-14-21		24.5% fines, 11.7% fine to coarse subangular	- LL = NP, PL = NP, PI = NP -
		1.50	33-0	(35)		gravel	Fines = 24.5%, Sand = 63.8%, Gravel = 11.7%
-	31.5					-	-
-						-	32 ft: Driller reported rig clatter.
- 1						-	Jz II. Dilliei reported ng clatter.
						-	4
-						-	4
						-	
						-	1
35	35.0] _
						SILTY SAND WITH GRAVEL (SM) Grayish brown, moist, very dense, non plastic,	WC = 16.2% LL = 22, PL = NP, PI = NP
1]		1.50	SS-7	21-25-42 (67)		fine to coarse sand, ±40% fines, ±30% fine to	
	36.5			(07)		coarse subangular gravel (Less Weathered Springwater Formation)	1
						Springwater Formation	36.5 ft: Driller reported rig clatter.
						-	1 1
						-	1 1
						-	1 -
-						-	1 -
-						-	1 -
-						-	
40					11.11		

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)

PROJECT NUMBER:

D3460500

ELEVATION: 686.83 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH02

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	the second second	orded		6	START : 3/1/21 09:31 END : 3/1/	
DEPTH BELOW O				C	SOIL DESCRIPTION	COMMENTS
INTER	/AL (ft)		PENETRATION TEST RESULTS	PO		
	RECOV	ERY (ft)	IEST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
		TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LÓSS, 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.
4545.0	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
	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

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

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-Ib Auto Trip Hammer

WATER	DEPTH	: Not rec	orded			START : 3/2/21 09:36 END : 3/2	/21 13:40 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	OUND SU	RFACE (ft)	have been and a second second	OG	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	CLC		
		RECOVE	ERY (ft)		Ĭ	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS TESTS AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION
					((6 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
-					•	12 in: BASE GRAVEL	0-5 ft: Asphalt and gravel pieces in cuttings.
					• •	-	-
-					////		
						-	
-						-	-
-						-	-
-						-	-
-						-	-
-						-	-
5_	<u>5.0</u>						4 –
-				2-3-4		LEAN CLAY (CL) Brown, moist, firm, medium plasticity, ±5% fine	4 -
-		1.10	SS-1	(7)		sand, ±5% coarse subangular gravel, black Mn nodules (Residual Soil of the Springwater	-
-	6.5					Formation)	-
-						-	-
I -						-	-
1 -						-	-
10	10.0					-	-
···_						Similar to SS-1 except stiff, occasional black Mn	WC = 33%
		1.50	SS-2	4-6-8		nodules	LL = 50, PL = 26, PI = 24 -
	11.5			(14)		-	-
-	11.5					-	Driller reported stiffer soil after 11.5 ft.
						-	-
-						-	-
-						-	-
- 1						-	
-						-	- 1
-	15-					-	
15	15.0					Similar to SS-2 except reddish-brown iron oxide	Driller reported borehole collared up with clay
-		1.50	SS-3	3-6-7		staining, black Mn nodules	layer.
-		1.00	55-3	(13)		-	Driller reported trace rig chatter for 6" after 16.5 ft PP = 1.25, 1.5, 1.25 tsf
-	16.5					-	
- 1							
-							
I -						-	
1 -						-	
 _						-	
l -						-	Driller reported that he redrilled 0-5 ft of the borehole for progressing, a clay collar had formed
20							at that depth.

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)

PROJECT NUMBER:

D3460500

ELEVATION: 678.50 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH03

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 rec	200000000		33	START : 3/2/21 09:36 END : 3/2/	21 13:40 LOGGER : L. Bhaumik
1			RFACE (ft)		C	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	P		
		RECOVE	RY (ft)	IEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-	20.0 21.5	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
- - - - - - - - - - - 25	25.0					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)	
-	26.5	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%
- - - - - 30	30.0						27 ft: Driller reported rig chatter
	30.9	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)	- 31.5 ft: 4-6" of rig chatter - -
	35.0					SILTY SAND WITH GRAVEL (SM)	34 ft: 4-6" of rig chatter
-	36.4	1.40	SS-7	13-50-50/5" (100/11")		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)	LL = NP, PL = NP, PI = NP Fines = 20.1%, Sand = 47.3%, Gravel = 32.6% - Driller reported stiffer soil after 37 ft, difficult drilling
- - - 40							Driller reported that soil becomes softer at 39 ft

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)

PROJECT NUMBER:

D3460500

ELEVATION: 678.50 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH03

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

Not reco	orded		5	START : 3/2/21 09:36	FND : 3/2/	21 13:40 LOGGER : L. Bhaumik
			C	SOIL DESCRIPTION		COMMENTS
AL (ft)	10000000000000000000000000000000000000	PENETRATION	P			- convertingen, different (1907)
	RY (ft)	IEST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL,	COLOR,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
[TYPE/ NUMBER	6"-6"-6" (N)	GRAF			INSTRUMENTATION
1.50	SS-8	3-4-6 (10)		CLAYEY SAND WITH GRAVEL(SC) Brown, moist, loose, ±15% coarse suba gravel, ±40% clay, some reddish-brown staining (Less Weathered Springwater	ngular - i iron oxide Formation) ⁻	
					- - - -	42 ft: Driller reported rig chatter
1.50	SS-9	14-18-30 (48)		subangular gravel, ±20% clay, fine to co sand, reddish-brown iron oxide staining	oarse - . gravel	
					- - - - -	Driller reported softer soil, smooth drilling, after 47 ft
1.10	SS-10	4-8-8 (16)		plasticity, 37% fine to coarse sand, trac trace reddish-brown iron oxide staining.	e gravel, trace	WC = 69.9% Fines = 63.2%
					d 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
	ROUND SUI AL (ft) RECOVE 1.50 1.50	RECOVERY (ft) TYPE/ NUMBER 1.50 SS-8 1.50 SS-9 1.50 SS-9	ROUND SURFACE (ft) AL (ft) PENETRATION RECOVERY (ft) PENETRATION 1.50 SS-8 3.4-6 1.50 SS-8 3.4-6 1.50 SS-8 3.4-6 1.50 SS-8 14-18-30 1.50 SS-9 14-18-30 (48) J J 1.50 SS-9 14-18-30 (48) J J	ROUND SURFACE (ft) PENETRATION TEST RESULTS OO UHU RECOVERY (ft) 6°-6°-6° (N) (N) 1.50 SS-8 3.4.6 (10) (N) (N) 1.50 SS-8 3.4.6 (10) (N) (N) 1.50 SS-9 14-18-30 (48) (A) (A) 1.50 SS-9 14-18-30 (48) (A) (A)	ROUND SURFACE (ft) PENETRATION TEST RESULTS O O O TEST RESULTS O O O O O O O O O O O O O O O O O O O	ROUND SURFACE (IT) AL (ft) PENETRATION TEST RESULTS OO UT SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 1.50 SS-8 3-4-6 (10) CLAYEY SAND WITH GRAVEL(SC) Brown, moist, loose, ±15% coarse subangular gravel, ±40% day, some reddish-brown iron oxide staining (Less Weathered Springwater Formation) 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) 1.10 SS-10 4-8-8 (16) SANDY SILT (ML) Light gray, moist, loces es and, trace gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Less Weathered Springwater Formation)

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

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-Ib Auto Trip Hammer

WATER	DEPTH	: Not rec	orded			START : 4/2/21 13:50 END : 4/5	/21 10:22 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	ROUND SU	RFACE (ft)	reaction and a contraction of	DG	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft) RECOVE	ERY (ft) TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
<u> </u>			NUMBER	(11)		6 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
-						12 in: BASE GRAVEL	
-	4.0					-	
5	6.0	1.60	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.
-	7.5	0.70	SS-2	WOH-1-2 (3)		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
- - - 10	10.0						
-	11.5	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
						-	
15 	15.0 16.5	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
						-	

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)

PROJECT NUMBER:

D3460500

ELEVATION: 671.94 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH04

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-Ib Auto Trip Hammer

END: 4/5/21 10:22 WATER DEPTH : Not recorded START : 4/2/21 13:50 LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION POG PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, RECOVERY (ft) MOISTURE CONTENT, RELATIVE DENSITY OR DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6 TYPE/ NUMBE (N) SILTY SAND (SM) Stop at 20 ft on 4/02/21 at 15:16 20.0 Gray, moist, loose, fine to coarse sand, ±38.3% Start on 4/05/21 at 8:55 2-2-5 1.50 SS-5 fines, 0.7% fine to coarse subrounded to WC = 72.2% (7) subangular gravel less than 1" in diameter, trace LL = NP, PL = NP, PI = NP215 Fines = 38.3%, Sand = 61%, Gravel = 0.7% reddish-brown iron oxide staining (Sensitive Saprolite of the Springwater Formation) Possibly pumaceous sand 24 ft: Driller reported fine gravel or cemented sand, slight rig clatter 25 25.0 SILTY SAND WITH GRAVEL (SM) Pumaceous sand Gray, moist, medium dense, fine to coarse sand, WC = 63.2% 2-6-8 SS-6 LL = 46, PL = NP, PI = NP 1 50 ±15% silt, ±20% fine to coarse subrounded to (14)subangular gravel less than 1.75" in diameter, Driller reported slightly stiffer layer 26.5-27.5 ft 26.5 trace reddish-brown iron oxide staining, trace clay (Less Weathered Springwater Formation) 30 30.0 CLAYEY SAND WITH GRAVEL (SC) WC = 22.5% 23-50/5' Gray to brown, moist, very dense, fine to coarse cemented sand, 25.8% fines, 21.9% fine to 0.90 SS-7 LL = 31, PL = 23, PI = 8 (50/5")30.9 Fines = 25.8%, Sand = 52.3%, Gravel = 21.9% Recovery in SS is 1 ft. Cemented sand, coarse subrounded gravel less than 1" diameter, reddish-brown iron oxide staining (Less disintegrates with finger pressure. Weathered Springwater Formation) 34 ft: Switch to 3-7/8" tricone bit because soil is stiff 35 35.0 CLAYEY SAND (SC) WC = 26% Reddish brown to yellowish brown to dark gray, LL = 36, PL = 23, PI = 13 34-32-22 1.10 SS-8 moist, very dense, fine to coarse cemented sand, Cemented sand, disintegrates with finger pressure. (54) ±20% fines, ±5% fine to coarse subrounded to 36.5 subangular gravel less than 1.25" in diameter, reddish-brown iron oxide staining (Less Weathered Springwater Formation) Driller reported soft soil layer, smooth drilling, at 39-40 ft. 40

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)

PROJECT NUMBER:

D3460500

ELEVATION: 671.94 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH04

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-Ib 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)		O	SOIL DESCRIPTION	COMMENTS
INTERVAL (ft) RECOVERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
TYPE/ NUMBER	6"-6"-6" (N)	GRAF	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
40.0 1.50 SS-9 41.5 - - -	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
- 45 - - - - -				Driller reported increase in amount of sand, mixture of sand and clay from 44-45 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	Driller reported cemented sand at 48 ft.
		<u>_</u>	less tals, 1.5" diameter (Less Weathered Springwater Formation) 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

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

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-Ib Auto Trip Hammer

WATER	DEPTH	: Not rec	orded			START : 3/17/21 12:10 END : 3/17	7/21 14:45 LOGGER : L. Bhaumik
DEPTH E	ELOW GR	OUND SU	RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
			NOMDER	(11)		6 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
					•	8 in: BASE GRAVEL	-
-					////		-
-						-	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					-	-
		4.50	00.4	3-7-9		LEAN CLAY WITH SAND (CL) Reddish brown, moist, very stiff, medium	PP = 1.75, 2, 1.5 tsf
-	6.5	1.50	SS-1	(16)		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)	-
-						-	-
						-	-
-						-	-
10	10.0						
-		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	10 ft: Switch to 4-7/8" drag bit at 10 ft PP = 2.5, 1.75, 1.75 tsf WC = 33.5%
	11.5			(11)		iron oxide staining, black Mn nodules, trace fine subangular gravel (Residual Soil of the	LL = 61, PL = 31, PI = 30
-						Springwater Formation)	-
						-	Driller reported rig chatter from 12.5-13 ft Driller reported stiffer soil after 12.5 ft
-						-	-
						-	-
15	15.0					LEAN CLAY (CL)	PP = 0, 0.25, 0.5 tsf
		1.50	SS-3	2-2-3 (5)		Brown mottled red, moist, firm, medium to high - plasticity, trace fine sand, trace reddish-brown iron oxide staining, black Mn nodules, trace fine to	
-	16.5					coarse subangular gravel (Residual Soil of the _ Springwater Formation)	-
							-
-						-	-
						-	-
						-	-
20					/////		

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)

PROJECT NUMBER:

D3460500

ELEVATION: 666.31 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH05

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-Ib Auto Trip Hammer

WATER	DEPTH	: Not rec	orded			START : 3/17/21 12:10 END : 3/1	7/21 14:45 LOGGER : L. Bhaumik			
DEPTH E	BELOW GR	OUND SU	RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS			
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND			
			TYPE/ NUMBER	6"-6"-6" (N)	GRAP	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION			
-	20.0 21.5	1.40	SS-4	2-2-2 (4)		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)				
							PP = 0, 0.25, 1.25 tsf Driller reported increase in sand after 22 ft			
25 	25.0 26.5	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	WC = 67.6% LL = 69, PL = 45, PI = 24			
- - - - - - - - - - - - - - - - - - -	30.0					nodules, possibly pumaceous sand (Sensitive Saprolit 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)				
-	31.5	1.50	SS-6	1-2-2 (4)		Similar to SS-5B except trace fine subrounded gravel	PP = 0.25, 0, 0 tsf -			
- - - - - 35	35.0									
-	36.5	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% 36.5-37.5 ft: Driller reported denser sand, drill rig chatter			
- - - - - 40										

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)

PROJECT NUMBER:

D3460500

ELEVATION: 666.31 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH05

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-Ib Auto Trip Hammer

1	DEPTH				_		7/21 14:45 LOGGER : L. Bhaumik		
DEPTHE	-		RFACE (ft)	heart sectors and sectors and sectors	00	SOIL DESCRIPTION	COMMENTS		
	INTERV/	AL (ft) RECOVE	TYPE/	PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
-	40.0	1.50	SS-8	(N) 1-1-2 (3)	0	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% 41-42 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			
- - - - 50	50.0						47-49 ft: Driller reported stiffer soil 49 ft: Driller reported gravel, drill rig chatter		
- - - - - - - - - - - - - - 55	51.5	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) Bottom of Boring at 51.5 ft below ground surface	WC = 55.7% LL = 50, PL = 37, PI = 13 Fines = 36.5% 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		
- - - - - - - - - - - - - - - - - - -									

D3460500	AFWP-BH06	SHEET	1	OF	3	
S	OIL BORING LOG	ì				

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-Ib Auto Trip Hammer

	R DEPTH					START : 3/3/21 09:38 END : 3/3	
DEPTH	BELOW GR	99000000000000000000000000000000000000	RFACE (ft)	Second Condenses. Contraction and a	00	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft) RECOVE	ERY (ft) TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
				()	$\left(\right)$	6 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
						12 in: BASE GRAVEL	Rig chatter when drilling through base gravel.
	2.5						Driller reported soft soil starting at 16-18" bgs
	4.0	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
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			(3)		-	
- 10_	10.0					- SILT (ML)	- - - PP = 0.75, 0.5, 0.25 tsf
	11.5	1.10	SS-3	2-2-3 (5)		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)	WC = 39.3% - LL = 45, PL = 30, PI = 15 10 ft: Switch to 3-7/8" tricone bit -
-	-					-	
15	15.0					-	-
	16.5	0.60	SS-4	4-6-7 (13)		Similar to SS-3 except stiff and no iron staining	
	-						17 ft: Driller reported drill rig chatter and stiffer soil for 3-4"
	-					- - -	
20							<u> </u>

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)

PROJECT NUMBER:

D3460500

ELEVATION: 660.15 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH06

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-Ib Auto Trip Hammer

1	DEPTH				_	START : 3/3/21 09:38 END : 3/3/	
DEPTHE	BELOW GR	Cardon Construction	RFACE (ft)	DENETDATION	8	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÀTION
	20.0 20.9	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	SS-5: last 0.6" and shoe contains disintegrated, black, possibly basalt gravel -
-						oxide staining (Residual Soil of the Springwater Formation) - - - - -	Driller reported harder soil, drill rig chatter from 20- 22 ft, softer soil after 22 ft.
25	25.0 26.5	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	-
-	28.5	0.50	ST-2			the Springwater Formation)	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
- - 30_	30.0	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	WC = 86.3% LL = 65, PL = 46, Pl = 19
	31.5	0.90	SS-8	WOH-WOH-2 (2)		Mn nodules (Sensitive Saprolite of the Springwater Formation)	-
- - - - 35_	35.0					-	
-	36.5	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	Pumaceous sand.
- - - - - 40						Formation)	

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

BORING NUMBER:

AFWP-BH06

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-Ib Auto Trip Hammer

WATER	DEPTH	- marine and a second	21/2012/01			START : 3/3/21 09:38 END :	V3/21 14:00 LOGGER : L. Bhaumik
1			RFACE (ft)		C	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	P		
		RECOVE	RY (ft)	IEST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOG	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-	40.0 41.5	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% -
- - - - 45	45.0						
-	46.5	1.50	SS-11	1-1-2 (3)		SANDY SILT (ML) Gravish 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.
- - - 50	50.0						
-	51.5	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%
- - - - 55						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
-							
- - - 60							

SHEET 3 OF 3

D3460500

PROJECT 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 bqs START : 3/4/21 09:12 END : 3/4/21 14:25 LOGGER : L. Bhaumik							
DEPTH BELOW GROUND SURFACE (ft)					U	SOIL DESCRIPTION	COMMENTS
	INTERVAL (ft)			PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	
	RECOVERY (ft)			DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND			
			TYPE/ NUMBER	6"-6"-6" (N)	GRAF	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
					(7 in: ASPHALT CONCRETE PAVEMENT	Make provision for piezometer monument:
						11 in: BASE GRAVEL	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.
	5.0					-	Driller reported that the base gravel is 3-4" in size, higher rig clatter. Advance borehole with 4-7/8" tricone bit.
	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
	10.0						
-	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	
-	13.0					Springwater Formation) Springwater Formation) 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 c the clay and elastic silt and enable quick piez	
-	14.2	1.20	ST-3				
- 15	15.7	1.50	SS-4	4-6-8 (14)			14" because very firm layer (possibly gravel) was encountered and further advancement might damage/bend ST.
-							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							

SOIL	BORING LOG	

SHEET 2 OF 3

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

BORING NUMBER:

AFWP-BH07

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

PROJECT NUMBER:

D3460500

WATER DEPTH : 28.3 to 40 feet bgs						START : 3/4/21 09:12	END : 3/4/2	21 14:25 LOGGER : L. Bhaumik		
DEPTH B	ELOW GR	OUND SU	RFACE (ft)		U	SOIL DESCRIPTION		COMMENTS		
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG					
		RECOVE	-DV (ft)	TEST RESULTS	₽	SOIL NAME, USCS GROUP SYMBOL,		DEPTH OF CASING, DRILLING RATE,		
		RECOVE			AP	MOISTURE CONTENT, RELATIVE DEI	NSITY OR	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
			TYPE/ NUMBER	6"-6"-6" (N)	R R	CONSISTENCY, SOIL STRUCTURE, MIN	NERALOGY	INSTROMENTATION		
	20.0		NOMDER	(14)		Similar to SS-4		PP = 0.75, 1.25, 1.75 tsf		
	20.0			4-6-7			-	Difficult to open SS	-	
		1.50	SS-5	(13)				WC = 32.4%		
	21.5			(/				LL = 51, PL = 30, PI = 21 Fines = 91.5%		
	21.0						-	Fines = 91.0%	-	
							-		-	
							_			
							-		-	
							-		-	
							_			
25	25.0									
					111	FAT CLAY (CH)	-	-	_	
-		1.50	SS-6	3-4-5		Brown mottled gray moist stiff medium	n to high –		-	
		1.50	55-6	(9)		plasticity, ±5% fine sand, ±5% fine bla subangular gravel, reddish-brown iron	CK ovido -		-	
	26.5					staining, black Mn nodules, brownish y	ellow -			
						spots/stains (Residual Soil of the Spring	gwater			
						Formation)	- 1		-	
							-		-	
							-		-	
							-			
-							-			
30	30.0						_			
						FAT CLAY (CH) Gray mottled yellowish brown and red,	moiet etiff	PP = 1.5, 1, 2 tsf Clay layer outside SS.		
		1.30	SS-7	2-5-6 (11)		±5% fine to coarse sand, ±5% fine suba	angular			
	04.5			(11)		gravel, high plasticity, reddish-brown in	on oxide			
	31.5					staining (Residual Soil of the Springwa	ter –		-	
						Formation)	-		-	
									_	
							1			
							-			
							-		-	
							-			
35	35.0									
						FAT CLAY (CH)		PP = 0.25, 0.25, 0.5 tsf	_	
		1.50	SS-8	2-2-5	\sim	Gray mottled red, moist, firm, ±5% fine	to coarse -	WC = 45.7%	-	
		1.50	55-6	(7)		sand, trace fine subangular gravel, high reddish-brown iron oxide staining, blac	n plasticity,	LL = 77 , PL = 27 , PI = 50 Driller reported that he is redrilling the top 5 ft of	-	
	36.5					nodules (Residual Soil of the Springwa	ter _	the borehole where the high plasticity soil has		
						Formation)		accumulated		
							-			
-							-			
							-			
							1			
							-		-	
40				ļ					_	

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH07

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

PROJECT NUMBER:

D3460500

1			40 feet bo	s		START : 3/4/21 09:12 END : 3/4	/21 14:25 LOGGER : L. Bhaumik
DEPTH E	-		RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	CLC		
		RECOVE	RY (ft)		H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
	40.0		NOMDER	(**)		FAT CLAY (CH)	PP = 1.75, 0.75, 0.75 tsf
-	41.5	1.50	SS-9	4-5-6 (11)		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)	
- - - 45	45.0						
-	46.5	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%
	50.0						
-	51.5	1.50	SS-11	3-9-22 (31)		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)	Inststalled VWP in 2" PVC standpipe piezometer.
-						Bottom of Boring at 51.5 ft below ground surface Geokon VWP 4500S (350 kPa), unvented, serial	Standpipe piezometer installed immediately after drilling. WVP installed on 06/24/2021.
- - 55_ -						no. 2111125 Geokon datalogger 8002-WP-2 LC-2, serial no. 2128641	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
60							1

D3460500	AFWP-BH08	SHEET	1	OF
	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)

PROJECT NUMBER:

ELEVATION: 654.41 ft

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

BORING NUMBER:

3

WATER	DEPTH	: Not rec	orded			START : 3/5/21 09:40 END : 3/5/	21 12:25 LOGGER : L. Bhaumik
DEPTH E	ELOW GR	OUND SU	RFACE (ft)	30000-2000-00-2000-2000-2000-2000-2000-	DG	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE		PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	R R	CONSISTENCT, SOIL STRUCTURE, MINERALOGT	INSTRUMENTATION
-					(()	6 in: ASPHALT CONCRETE PAVEMENT 6 in: BASE GRAVEL	Start drilling with 4-7/8" tricone bit. Rig chatter at base gravel layer. Smooth after 1 ft. Cuttings after 1 ft have sand.
	5.0						-
	<u>5.0</u> 6.5	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) SS-1B, 5.3-6.5 ft SILT (ML)	5 ft: Switch to 3-7/8" drag bit WC = 38.2% LL = 48, PL = 28, PI = 20
-	8.0					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)	- - ST-2
	9.6	1.60	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 WC = 33.2%
10 	11.1	1.50	SS-3	4-6-7 (13)		Black, moist, medium dense, ±20% clay, clay brown, subangular gravel, fine trace coarse subrounded gravel, ±5% fine sand (Residual Soil of the Springwater Formation)	LL = 46, PL = 31, PI = 15 su = 1800 psf
	15.0					SS-3B, 10.1-11.1 ft: Similar to SS-1B except stiff -	
-	16.5	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)	
						- - - - - -	

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)

PROJECT NUMBER:

D3460500

ELEVATION: 654.41 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH08

	DEPTH		2402000			START : 3/5/21 09:40	END : 3/5/2	21 12:25 LOGGER : L. Bhaumik
			IRFACE (ft)		()	SOIL DESCRIPTION	LIND . SIGI	COMMENTS
	INTERVA	Cardinal Contractor		PENETRATION TEST RESULTS	GRAPHIC LOG			
		RECOV	-DV (ft)	TEST RESULTS	₽	SOIL NAME, USCS GROUP SYMBOL, C	OLOR,	DEPTH OF CASING, DRILLING RATE,
		RECOVI		CII CII CII	API	MOISTURE CONTENT, RELATIVE DENS CONSISTENCY, SOIL STRUCTURE, MINE		DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	R	CONSISTENCT, SOIL STRUCTURE, MINE		
	20.0				///	LEAN CLAY (CL)		PP = 1.25, 1.5, 2 tsf
-		1.50	SS-5	3-4-5		Brown mottled gray, moist, stiff, medium p 13% fine sand, trace subrounded coarse	plasticity, - gravel	WC = 36.6% LL = 43, PL = 21, PI = 22
-		1.00		<mark>(</mark> 9)		reddish-brown iron oxide staining, black M	Min ¯	Fines = 86.9%
-	21.5					nodules (Residual Soil of the Springwater Formation)	r –	-
-						Formation	-	-
-							-	-
_	23.0						-	
							_	ST-6 recovery was 2.3 ft 23-24 ft: 150-200 psi -
		1.90	ST-6					24-24.9 ft = 500-700 psi
		1.50	51-0					25 ft: Driller reported slightly stiffer soil.
25	24.9						-	-
23_						Similar to SS-5 except very stiff, ±5 fine s	and	PP = 1.5, 2, 2 tsf
-		1.50	SS-7	5-6-10			-	-
	26.4			<mark>(1</mark> 6)			-	-
-	20.4						-	-
-							-	-
I -							_	_
							_	_
							-	-
30	30.0						-	-
50	50.0					CLAYEY SAND (SC)		·
-		1.10	SS-8	2-4-6		Brown, moist, loose, ±30% clay, trace	40	-
-		1.10	33-0	(10)		reddish-brown iron oxide staining, trace M nodules, fine to coarse sand (Residual So	vin pil of the	-
- 1	31.5					Springwater Formation)	-	-
-							-	-
_							_	_
							_	
					[]]])			
							_	
							-	1
35	35.0						-	1
35_	00.0					SANDY LEAN CLAY (CL)		WC = 84.6%
-		1.50	SS-9	1-1-1		Gravish brown, moist, soft, 33% sand, 33	% silt, -	Fines = 67.2%, Sand = 32.8%, Gravel = 0% -
-		1.50	33-3	(2)		trace reddish-brown iron oxide staining, b nodules, fine to coarse sand (Sensitive Sa	aprolite	-
-	36.5					of the Springwater Formation)		-
-							-	-
-							_	_
							_	
							_	
							-	1
40							-	-
40		I			////			

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)

PROJECT NUMBER:

D3460500

ELEVATION: 654.41 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH08

WATER DEPTH : Not reco				START : 3/5/21 09:40 END : 3/5/			
DEPTH BELOW GROUND SU			2	SOIL DESCRIPTION	COMMENTS		
INTERVAL (ft) RECOVE		ENETRATION EST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
	TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION		
40.0 - 1.50 - 41.5	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.		
45 45.0				-			
- 1.50 46.5	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) Crow moint effit medium to biob plasticiby ±15%			
				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)			
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	WC = 73% LL = 62, PL = 45, PI = 17		
				Springwater Formation) 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							
				-			
				-			

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

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

WATER						START : 3/5/21 14:50 END : 3/	8/21 12:50 LOGGER : L. Bhaumik		
DEPTH B	DEPTH BELOW GROUND SURFACE (ft)				g	SOIL DESCRIPTION	COMMENTS		
	INTERVA	RECOVERY (ft)		RECOVERY (ft)		PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER		ß				
					((7 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.		
						5 in: BASE GRAVEL			
							-		
							-		
							-		
							-		
5	5.0						1 -		
						FAT CLAY (CH) Brown, moist, soft, medium to high plasticity, ±5%	5 ft: Switch to 3-7/8" drag bit.		
		0.20	SS-1	2-2-1 (3)		fine sand, coarse subrounded gravel,			
	6.5					reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater			
						Formation)	-		
							-		
							-		
							-		
10	10.0						1 -		
						LEAN CLAY (CL) Brown, moist, soft, ±5% sand, trace subangular	WC = 37.4% - LL = 49, PL = 26, PI = 23		
		1.00	SS-2	WOH-1-2 (3)		fine to coarse gravel, medium plasticity,	- LL - 49, FL - 20, FI - 23		
	11.5					reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater	-		
						Formation)	-		
							-		
-									
-							1 -		
							1 -		
15	15.0						1		
				250		FAT CLAY (CH) Reddish brown, moist, stiff, ±5% fine sand,	PP = 0.75, 1.5, 1.75 tsf - Driller reported loss of drilling fluid		
		1.50	SS-3	2-5-6 (11)		medium to high plasticity, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of	-		
	16.5					the Springwater Formation)	4 -		
-									
							-		
							1 -		
							1 .		
20							1		

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)

PROJECT NUMBER:

D3460500

ELEVATION: 640.57 ft

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

BORING NUMBER: AFWP-BH09

SHEET 2 OF 3

WATER	DEPTH	: Not rec	orded			START : 3/5/21 14:50 END : 3/8/	21 12:50 LOGGER : L. Bhaumik
DEPTH E	ELOW GR	ROUND SU	RFACE (ft)		8	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
-	20.0 21.5	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	WC = 40.2% LL = 60, PL = 26, PI = 34
						Formation)	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	PP = 1, 1.5, 0.75 tsf SS coated with clay, drill bit plugged - Pump fixed, restart drilling. Driller reported he is
	26.5					the Springwater Formation)	using a "day breaker" mixed with the drilling fluid to help progress the borehole in the high plasticity day.
	31.5	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.
35	<u>35.0</u> <u>36.5</u>	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
- - 40							

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)

PROJECT NUMBER:

D3460500

ELEVATION: 640.57 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH09

	WATER DEPTH : Not recorded DEPTH BELOW GROUND SURFACE (ft)					START : 3/5/21 14:50 END : 3/8/	21 12:50 LOGGER : L. Bhaumik
DEPTH E		- and the second second	RFACE (ft)	DENETDATION	8	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft) RECOVE		PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STDUCTURE MINERAL OCX	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	ß	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
-	40.0 41.5	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 - - -
- - 45	45.0					SANDY ELASTIC SILT (MH)	
	46.5	1.20	SS-9	10-25-34 (59)		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)	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
- 50	50.0 51.0	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	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							

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

ELOW GR	enconstitution process	RFACE (ft)		C	SOIL DESCRIPTION	COMMENTS		
INTERVA			DEMISTRATION !	O I	Sole Beddrar Hold	COMMENTS		
	RECOVE	TYPE/	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
		TIONDER	(14)		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		
					-	Driller reported lost of circulation from 3-3.5 ft		
4.0					-	(approx 35 gal) -		
4.0	1.60	ST-1			-	ST-1 4-6 ft = 150 psi constant -		
6.0					-	-		
7.5	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			
10.0					-	Start on 3/9/21 at 10:15 with 3-7/8" drag bit		
11.5	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, Pl = 21 Fines = 91.3%		
15.0					-			
16.5	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 - -		
18.0					-	ST 5 receivery 2.1 ft, driller reported soil outtings		
	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		
	7.5 10.0 11.5 15.0	4.0 4.0 1.60 6.0 7.5 0.40 7.5 0.40 7.5 0.70 1.10 1.5.0 1.10 15.0 1.10 16.5 1.10	Image: Number of Num et al Numer of Num et al Number of Number of Number of Number of	Image: NUMBER 6"-6"-6" (N) NUMBER 6"-6"-6" (N) NUMBER 6"-6"-6" (N) Image: Number of State Image: Number of State 1.00 ST-1 1.60 ST-1 1.60 ST-1 1.60 SS-2 1.60 SS-3 1.00 SS-3 1.00 SS-3 1.10 SS-4 1.50 Image: Number of State 1.	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Industry (r) Tim ASPHALT CONCRETE PAVEMENT 5 in: BASE GRAVEL 5 in: BASE GRAVEL 4.0 1.60 ST-1 6.0		

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)

PROJECT NUMBER:

D3460500

ELEVATION: 630.78 ft

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

BORING NUMBER: AFWP-BH10

SHEET 2 OF 3

1	WATER DEPTH : Not recorded DEPTH BELOW GROUND SURFACE (ft)					START : 3/8/21 14:55 END : 3/9			
DEPTH I	1		RFACE (ft)	have been an account of	8	SOIL DESCRIPTION	COMMENTS		
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	MOISTURE CONTENT, RELATIVE DENSITY OR		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION		
-	20.0 21.5	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		
-						-			
25	25.0 26.5	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 bqs.		
-									
- 30	30.0	1.50	SS-8	344		Similar to SS-7 except firm			
-	31.5			(8)		-			
-						-			
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		
-						-			
- 40							Driller redrilling borehole due to formation of clay collar.		

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)

PROJECT NUMBER:

D3460500

ELEVATION: 630.78 ft

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

BORING NUMBER: AFWP-BH10

SHEET 3 OF 3

WATER DEPTH : Not recorded		1 14:08 LOGGER : L. Bhaumik		
DEPTH BELOW GROUND SURFACE (ft)	g	SOIL DESCRIPTION	COMMENTS	
RECOVERY (ft)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
	6"-6" 22 N) ᠑	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION	
	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.	
			43.5 ft: Driller reported trace gravel.	
4545.0				
45.7 0.70 SS-11 17-5 (50	50/4")/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)		
			47.5-49 ft: Driller reported stiffer soil, rig clatter, softer soil after 49 ft.	
50 <u>500</u> 50 <u>500</u> 50.2 0.20 SS-12 50			1	
0.20 00 12 00	//4" <u> </u> //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.	
60			-	

	SOIL BORING LOG				
D3460500	AFWP-BH11	SHEET	1	OF	
PROJECT NUMBER:	BORING NUMBER:				

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

3

WATER	DEPTH	: Not rec	orded			START : 3/15/21 09:20 END : 3/15	5/21 13:38 LOGGER : L. Bhaumik		
DEPTH E	ELOW GR	OUND SU	RFACE (ft)		OG	SOIL DESCRIPTION	COMMENTS		
	INTERVA	RECOVE	RY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	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	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.		

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)

PROJECT NUMBER:

D3460500

ELEVATION: 624.15 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH11

-	DEPTH					START : 3/15/21 09:20 END : 3/1	5/21 13:38 LOGGER : L. Bhaumik		
DEPTH E	BELOW GR	ROUND SU	IRFACE (ft)		0	SOIL DESCRIPTION	COMMENTS		
	INTERV/	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
			TYPE/ NUMBER	6"-6"-6" (N)	GR/	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION		
-	20.0 21.5	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	PP = 1.25, 2.5, 2 tsf WC = 33.1% LL = 51, PL = 25, PI = 26		
						the Springwater Formation)	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		
- - - - - 30	30.0					- - - - - -			
-	31.5	1.50	SS-6	5-9-12 (21)		Similar to SS-5	PP = 3.25, 4, 3 tsf		
- - - 35_	35.0					FAT CLAY WITH SAND (CH)	Pumaceous sand.		
-	36.5	1.50	SS-7	2-4-6 (10)		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)			
						-			
40							1		

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)

PROJECT NUMBER:

D3460500

ELEVATION: 624.15 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH11

	DEPTH	1 south losses	21072-210			START : 3/15/21 09:20	END : 3/15	a bernara	LOGGER : L. Bhaumik	
1			RFACE (ft)		(7)	SOIL DESCRIPTION	LIND . J/ IS	21 13.30	COMMENTS	
	INTERVA	servaries, conserva-		PENETRATION	GRAPHIC LOG					
	at Letter	RECOVE	DV (#)	TEST RESULTS	₽	SOIL NAME, USCS GROUP SYMBOL,	COLOR,	DEPTH C	OF CASING, DRILLING RATE,	
		RECOVE			APF	MOISTURE CONTENT, RELATIVE DEN CONSISTENCY, SOIL STRUCTURE, MIN	INSITY OR	DRILLIN	G FLUID LOSS, TESTS, AND INSTRUMENTATION	
			TYPE/ NUMBER	6"-6"-6" (N)	R	CONSISTENCE, SOIL STRUCTURE, MIN	IERALUG I		INSTRUMENTATION	
	40.0	1.30	SS-8	5-10-15 (25)		FAT CLAY (CH) Gray mottled greenish-brown, moist, ve medium to high plasticity, trace fine sar	id,			-
-	41.5					reddish-brown iron oxide staining, track nodules (Residual Soil of the Springwal Formation)	iblack Mn ter _ -			-
-						- - -			-	
- 45_	45.0					FAT CLAY WITH SAND (CH)	-	PP = 1, 2.25, 2 ts	sf	-
	46.5	1.30	SS-9	5-8-10 (18)		Brownish gray mottled brown, moist, ve medium to high plasticity, ±30% fine to sand, reddish-brown iron oxide staining Soil of the Springwater Formation)	coarse	.,,,		-
-							- - - -			
50	50.0			2.2.2		SANDY SILT (ML) Grayish brown with trace yellow parts, r	noist verv -	Top 2" of SS-10 : WC = 61.4%	similar to SS-9	_
	51.5	1.50	SS-10	3-2-2 (4)		loose, 31% fine to coarse sand, 27% cla reddish-brown iron oxide staining (Sens Saprolite of the Springwater Formation)	ay, sitive	Fines = 68.9%, S	Gand = 31.1%, Gravel = 0%	_
-						Bottom of Boring at 51.5 ft below groun		Backfilled with: 0-0.5 ft: Asphalt of conditions 0.5-1 ft: Gravel 1-4 ft: Bentonite of 4-50 ft: Bentonite	cold patch to match existing chips grout	-
-							-			-
55										
							-			-
							-			-
							-			-
-							-			-
60	1							L		

AFWP-BH12	SHEET	1	OF	3
	2			
		AFWP-BH12 SHEET		

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

WATER	DEPTH	: Not rec	orded			START : 4/2/21 08:45 END : 4/2	21 11:16 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	OUND SU	RFACE (ft)	heart sectors and sectors and sectors	OG	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	GR/	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
					(7 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
-						17 in: BASE GRAVEL	
	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	PP = 0, 0, 0 tsf 5 ft: Switch to 3-7/8" drag bit. WC = 39.1% LL = 41, PL = 23, PI = 18
						Formation)	
- - 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	PP = 0.75, 1, 0.75 tsf
-						nodules (Residual Soil of the Springwater Formation)	
15	15.0	1.50	SS-3	3-5-6 (11)		LEAN CLAY (CL) Gray mottled brown, moist, stiff, medium plasticity, trace fine to coarse sand, trace	PP = 1.5, 1.75, 1.5 tsf WC = 33.7% LL = 46, PL = 24, Pl = 22
-	16.5			,		reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	
- - - 20							

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)

PROJECT NUMBER:

D3460500

ELEVATION: 618.04 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH12

1	DEPTH					START : 4/2/21 08:45 END : 4/2			
DEPTH	BELOW GR	en and an	RFACE (ft)		8	SOIL DESCRIPTION	COMMENTS		
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION		
-	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		
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		
-									
- - 30	30.0					LEAN CLAY (CL)	PP = 1.5, 2.75, 1.75 tsf		
-	31.5	1.50	SS-6	5-7-8 (15)		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)			
-									
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		
						or the Springwater Formation,			
-						· · · · · · · · · · · · · · · · · · ·			
40							I		

	AFWP-BH12	SHEET	3
SOIL	BORING LO	G	

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

PROJECT NUMBER:

D3460500

ELEVATION: 618.04 ft

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

BORING NUMBER:

OF 3

WATER	DEPTH	: Not rec	orded			START : 4/2/21 08:45 END : 4/2/	21 11:16 LOGGER : L. Bhaumik
DEPTH B	COLORA DE CARE O		RFACE (ft)		8	SOIL DESCRIPTION	COMMENTS
	INTERVA			PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
		RECOVE	RY (ft)		H	MOISTURE CONTENT, RELATIVE DENSITY OR	DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GR/	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
-	40.0 41.5	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.
	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) Bottom of Boring at 51.5 ft below ground surface	42-50 ft: Slight rig clatter.
							0.5-1 ft: Gravel 1-3 ft: Bentonite chips 3-50 ft: Bentonite grout

SOIL		- 12				
D3460500	AFWP-BH13	SHEET	1	OF	3	
PROJECT NUMBER:	BORING NUMBER:					

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-Ib Auto Trip Hamm

WATER	DEPTH	: 46.6 to	> 50 feet	bgs		START : 4/13/21 09:38 END : 4/13	J/21 13:46 LOGGER : L. Bhaumik
1			IRFACE (ft)		U	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG		
	1	RECOVE	ERY (ft)	LOTALOULIO	H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/	6"-6"-6"	RAF	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
			NUMBER	(N)	÷	1.5 in: ASPHALT CONCRETE PAVEMENT	Make provision for piezometer monument:
-						10 in: BASE GRAVEL	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
-	4.0					-	installation of a VWP data logger. Advance borehole with 4-7/8" drag bit.
5		2.00	ST-1			- - -	ST-1 4-5 ft: 150 psi 5-6 ft: 250 psi -
	6.0 7.5	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	PP = 1.25, 2, 0.25 tsf - -
- - - 10	10.0					Spots of sand/gravel (Residual Soil of the Springwater Formation)	
-	11.5	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
-						-	
15 -	15.0 16.5	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.
						-	
20							

SOIL	BORING	IOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 613.15 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH13

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-Ib Auto Trip Hammed Content of the Content of

WATEF	DEPTH	: 46.6 to	> 50 feet	bqs		START : 4/13/21 09:38 END : 4/1	3/21 13:46 LOGGER : L. Bhaumik
DEPTH	BELOW GR	ROUND SU	RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG		
		RECOVE	ERY (ft)	LOTTLEOULIO	H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/	6"-6"-6"	RAF	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
			NUMBER		ΰ		
	20.0			57.10		FAT CLAY (CH) Brown mottled gray, moist, very stiff, medium to	PP = 2.5, 1.75, 1.75 tsf - Clay surrounding drill rod retrieved from borehole
		1.50	SS-5	5-7-10 (17)		high plasticity, trace fine to coarse sand, trace fine	Ciay surrounding unit four tenteved from borenoie
- I	21.5			()		to coarse subangular to subrounded gravel, less than 1.5 in diameter, trace reddish-brown iron	-
-	21.0					oxide staining, few dark brown to black spots of	-
-						sand and fine gravel, trace black Mn nodules	-
-						(Residual Soil of the Springwater Formation)	
-	23.0						- ST-6 -
-		1.40					- 23-23.5 ft: 250 psi -
		1.40	ST-6				23.5-24 ft: 300 psi
	24.4					LEAN CLAY (CL)	24-24.2: 500 psi = 24.2-24.4: 600 psi
25				4-6-8		Slightly reddish-brown mottled brown and gray,	ST-6 recovery in ST 1.6 ft
		1.50	SS-7	4-0-0 (14)		moist, stiff, medium plasticity, trace fine to coarse	PP = 2, 1.25, 1.75 tsf WC = 27.7%
	25.9					sand, trace fine subangular gravel, black Mn nodules, trace dark brown/black spots of sand	LL = 44, PL = 21, PI = 23
l -						and gravel, trace reddish-brown iron oxide	- Trace gray mottling -
-						staining (Residual Soil of the Springwater Formation)	-
-						1 official off	-
-							
-	-						
-	-						
.							
Ι.							
30	30.0						
						FAT CLAY (CH) Brown mottled gray, moist, very stiff, medium to	PP = 2, 2.5, 2 tsf
	1	1.50	SS-8	5-9-11 (20)		high plasticity, fine to coarse sand, trace sand,	-
	31.5			(20)		trace fine subangular gravel, trace black/dark	-
l -	01.0					brown pockets of sand and gravel, black Mn nodules, trace reddish-brown iron oxide staining	-
-						(Residual Soil of the Springwater Formation)	
-							
-	-						
-							
.	-						4 -
.							4 -
35	35.0						-
Ι.				E 40.45		FAT CLAY (CH) Dark gray mottled brown, moist, very stiff, medium	PP = 2.75, 2.25, 2.5 tsf - WC = 32.2%
		1.50	SS-9	5-10-15 (25)		plasticity, trace fine to coarse sand, trace	LL = 57, PL = 29, PI = 28
	36.5			()		reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	Clay surrounding drill rod retrieved from borehole The dark gray color is like steel
l ⁻							- The dain gray color is line Steel -
l ⁻	1						1 -
l -							1 -
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-							
-	-						
-	-						
40					///.		I

D3460500	AFWP-BH13	SHEET	3	OF	3
	SOIL BORING LOG	8			

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

PROJECT NUMBER:

ELEVATION: 613.15 ft

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

BORING NUMBER:

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-Ib Auto Trip Hamm

WATER DEPTH : 46.6 to > 50 feet bqs START: 4/13/21 09:38 END: 4/13/21 13:46 LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION POG PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) MOISTURE CONTENT, RELATIVE DENSITY OR DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6 TYPE/ NUMBE (N) FAT CLAY (CH) PP = 2.25, 2.25, 1.75 tsf 40.0 Brown mottled gravish-brown, moist, stiff, medium Clay surrounding drill rig retrieved from borehole 3-6-9 1.50 SS-10 to high plasticity, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the (15)415 Springwater Formation) 43 ft: Driller reported cemented sand or gravel 45_ 45.0 SANDY LEAN CLAY (CL) WC = 59.6% Grayish brown to dark brown, moist, medium Fines = 69.8% 5-8-9 1.40 SS-11 dense, 30% fine to coarse sand, reddish-brown The trace cemented sand pieces disintegrates with (17)iron oxide staining, trace pieces of dark gray finder pressure. 46.5 cemented sand (Less Weathered Springwater Formation) 50 50.0 CLAYEY SAND (SC) Brownish gray to gray, moist, medium dense, fine to coarse sand, $\pm 30\%$ clay, $\pm 5\%$ fine to coarse 6-8-11 1.30 SS-12 (19)subangular to subrounded gravel, trace 51.5 reddish-brown iron oxide staining (Less Weathered Springwater Formation) Installed VWP taped outside 1" PVC standpipe Bottom of Boring at 51.5 ft below ground surface piezometer Geokon VWP 4500s (350 KPa), unvented, serial 0-1.5 ft: 12" diameter, 12" deep monument set in no. 2111123 concrete, black dye added to concrete to match The finished water pipeline alignemnt existing conditions corresponding to this boring location was 1.5-38 ft: Bentonite chips abandoned, therefore, a Geokon datalogger was 38-50 ft: Sand not added. 40-50 ft: Screen 55 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 WWP Ro (1) 8895.047 (2) 8895.466 (3) 8896.589 (4) 8897.386 Average Ro = 8896.122 60

	AFWP-BH14	SHEET	1	OF	3
SOIL B	ORING LOG				

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

PROJECT NUMBER:

D3460500

ELEVATION: 585.62 ft

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

BORING NUMBER:

WATER	DEPTH	Not rec	orded			START : 3/16/21 09:22 END : 3/	7/21 15:30 LOGGER : L. Bhaumik
1			RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
-					•	0.5 in: ASPHALT CONCRETE PAVEMENT	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	<u>5.0</u> 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
- - - 15	15.0						Driller reported soft soil after 13.5 ft and the clay was starting to "collar up" the borehole, driller will re-dnll those locations.
-	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

	AFWP-BH14	SHEET	2	OF	3
SOIL B	ORING LOG				

BORING NUMBER: AFWP-BH14

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

PROJECT NUMBER:

D3460500

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-Ib Auto Trip Hammer

WATER	DEPTH	: Not rec	orded			START : 3/16/21 09:22 END : 3/17	7/21 15:30 LOGGER : L. Bhaumik
DEPTHE	BELOW GR	OUND SU	RFACE (ft)		8	SOIL DESCRIPTION	COMMENTS
	INTERVA	. /		PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME LISSS CROUP SYMPOL. COLOR.	DEPTH OF CASING, DRILLING RATE,
		RECOVE	RY (ft)		H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GR4	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	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
	21.3					-	
	26.5	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.
- - 30	30.0	1.50		3-6-9 (15)		SILTY SAND (SM) Gray, moist, medium dense, 44% medium – plasticity silt, fine to coarse sand, ±10% fine to	28 ft: Driller reported transition to sand with gravel, slight drill rig clatter.
	31.5			(13)		coarse subrounded gravel, reddish-brown iron oxide staining (Less Weathered Springwater Formation)	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
	33.0 - 35.7 -	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	seeping out of the side of the road embankment into a drainage ditch. 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.

	VP-BH14	SHEET	э	UF	3
SOIL BOR					

BORING NUMBER:

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

PROJECT NUMBER:

D3460500

ELEVATION: 585.62 ft

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

WATER DEPTH : Not recorded		START : 3/16/21 09:22 END : 3/17	/21 15:30 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)	g	SOIL DESCRIPTION	COMMENTS
INTERVAL (ft) PENETRATION TEST RESULT RECOVERY (ft)	PHIC LO	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
TYPE/ 6"-6"-6" NUMBER (N)	GR≬	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
RECOVERY (#) TEST RESULT RECOVERY (#) 6"-6"-6" TYPE/ 6"-6"-6" NUMBER (N) - - -	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			-

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

. DURING LUG

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

WATER DEPTH : Not recorded				_		0/21 15:05 LOGGER : L. Bhaumik	
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)				8	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			NUMBER		_		
-						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	6.0	1.90	ST-1				4.5-5.5 ft: 200 psi 5.5-6 ft: 250 psi 6 ft: Switch to 4-7/8" drag bit
-	7.5	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	PP = 1.25, 2.25, 2.25 tsf
- - - 10	10.0					the Springwater Formation)	
-	11.5	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
- - - - - - - - - - - - - -	15.0						
-	16.5	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	PP = 2, 1.25, 1.75 tsf
						Formation)	

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 615.77 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH15

WATER DEPTH : Not recorded						START : 3/10/21 10:15 END : 3/10	0/21 15:05 LOGGER : L. Bhaumik
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)				8	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
-	20.0 21.5	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)
	23.0					-	ST-6 recovery 2.3 ft
-	05.0	2.00	ST-6			-	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	PP = 1, 1, 1.25 tsf Drilling fluid seeping out from the edge of asphalt,
- - - - - - 30	30.0					nodules (Residual Soil of the Springwater Formation) - - - -	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
-	31.5	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	PP = 2.75, 2, 2 tsf
- - - - 35	35.0					nodules (Residual Soil of the Springwater Formation)	
-	36.5	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	PP = 0.25, 0.25, 1.5 tsf
- - - - - - - - - - - - - - -						Formation)	

	AFWP-BH15	SH
SO	L BORING LOG	•

SHEET 3 OF 3

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

PROJECT NUMBER:

D3460500

ELEVATION: 615.77 ft

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

BORING NUMBER:

WATER DEPTH : Not recorded					START : 3/10/21 10:15 END : 3/1	0/21 15:05 LOGGER : L. Bhaumik		
DEPTH BELOW GROUND SURFACE (ft)				8	SOIL DESCRIPTION	COMMENTS		
INTERVA				APHIC LO	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
		NUMBER		ß				
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 		
45.0			347		SANDY ELASTIC SILT (MH) Brown-red. moist. stiff. slight plasticity. ±35% fine			
46.5	1.50	SS-11	34-7 (11)		to coarse sand, trace fine subangular gravel, trace reddish-brown iron oxide staining, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation)	Pumaceous sand		
50.0	1.50	SS-12	5-5-6		Similar to SS-11 except ±40% fine to coarse sand, ±5% fine to coarse subangular to subrounded gravel			
51.5			(11)		3	-		
-					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		
-								
	BELOW GR INTERV/ 40.0 41.5 45.0 46.5	BELOW GROUND SU INTERVAL (ft) RECOVE 40.0 1.50 41.5 45.0 45.0 46.5 50.0 1.50	BELOW GROUND SURFACE (ft) INTERVAL (ft) TYPE/ NUMBER 40.0 1.50 SS-10 41.5 1.50 SS-10 45.0 50.0 SS-11 46.5 1.50 SS-11 50.0 1.50 SS-12	BELOW GROUND SURFACE (ft) PENETRATION TEST RESULTS INTERVAL (ft) TYPE/ NUMBER 6"-6"-6" (N) 40.0 1.50 SS-10 2-2-3 (5) 41.5 1.50 SS-10 2-2-3 (5) 41.5 1.50 SS-11 3-4-7 (11) 45.0 1.50 SS-11 3-4-7 (11) 46.5 1.50 SS-11 3-4-7 (11) 50.0 1.50 SS-12 5-5-6 (11)	BELOW GROUND SURFACE (ft) PENETRATION TEST RESULTS O O D TEST RESULTS 40.0 1.50 SS-10 2-2-3 (5) I 41.5 I	BELOW GROUND SURFACE (ft) PENETRATION TEST RESULTS SOIL DESCRIPTION INTERVAL (ft) PENETRATION TEST RESULTS O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		

S	OIL BORING LOO	2			
D3460500	AFWP-BH16	SHEET	1	OF	3
PROJECT NUMBER:	BORING NUMBER:				

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

DEPTHENCY GROUP VIEW (I) PENETRATION COMMENTS Immediate and the second	WATER	DEPTH	: Not rec	orded			START : 3/11/21 09:55 END : 3/1	1/21 14:38 LOGGER : L. Bhaumik
5 50 5 50 6 50 6 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 7/7 In BASE GRAVEL 9.0 88.1 3.2.5 (7) 10 100 10 150 10 150 15 150 15 150 15 150 150 88.4 3.3.5 (9) 15 150 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88	DEPTH E	BELOW GF	ROUND SU	IRFACE (ft)		U	SOIL DESCRIPTION	COMMENTS
5 50 5 50 6 50 6 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 7/7 In BASE GRAVEL 9.0 88.1 3.2.5 (7) 10 100 10 150 10 150 15 150 15 150 15 150 150 88.4 3.3.5 (9) 15 150 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88	0.0.55	INTERVA	AL (#)		PENETRATION	2		İ
5 50 5 50 6 50 6 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 7/7 In BASE GRAVEL 9.0 88.1 3.2.5 (7) 10 100 10 150 10 150 15 150 15 150 15 150 150 88.4 3.3.5 (9) 15 150 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88		a ticity			TEST RESULTS	0	SOIL NAME LISCS GROUP SYMBOL COLOR	DEPTH OF CASING DRILLING RATE
5 50 5 50 6 50 6 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 7/7 In BASE GRAVEL 9.0 88.1 3.2.5 (7) 10 100 10 150 10 150 15 150 15 150 15 150 150 88.4 3.3.5 (9) 15 150 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88			RECOVE	ERY (ft)		E	MOISTURE CONTENT, RELATIVE DENSITY OR	DRILLING FLUID LOSS, TESTS, AND
5 50 5 50 6 50 6 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 6.5 50 7/7 In BASE GRAVEL 9.0 88.1 3.2.5 (7) 10 100 10 150 10 150 15 150 15 150 15 150 150 88.4 3.3.5 (9) 15 150 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88.4 150 88				TYPE/	6"-6"-6"	₽	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				NUMBER	(N)	U		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $						• T		Start drilling with 4-7/8" tricone bit.
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	-					•	7.75 in: BASE GRAVEL	 Driller reported soft soil after 1 ft.
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $								
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $								Drilling fluid seeping out from cracks in asphalt, driller reported be will redrill the tep 5 ft of the
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		1						borehole where the clay "collars" the borehole
$\begin{array}{c c c c c c c c c c c c c c c c c c c $								
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	-							-
$\begin{array}{c c c c c c c c c c c c c c c c c c c $								
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10 10.0 10 10.0 10 10.0 11.50 ss.3 11.50 ss.4 11.50	J	5.0					LEAN CLAY WITH GRAVEL (CL)	PP = 2 25 1 5 1 tsf -
10 0.50 SS-1 (7) 8.0 - - 0.50 ST-2 10 0.50 ST-2 10 10.0 - 1.50 11.5 1.50 15 1.50 15. 1.50 15. 1.50 15. 1.50 16.5 - 16.5 - 16.5 - 16.5 - 16.5 - 15. 1.50 15. 1.50 15. 1.50 16.5 -<	-				325		Brown, moist, firm, medium to high plasticity,	
6.5			0.90	SS-1			±15% fine to coarse subangular gravel, ±5% fine	
8.0 -<		65			(**		sand, trace black Mn nodules, trace organics	
80 7.5 ft: Dniller reported very slight rig clatter possibly due to gravel. ST-2 10 10.0 10 10.0 11.5 SS-3 11.5 SS-3 11.5 SS-3 11.5 SS-3 15 15.0 15 15.0 16.5 SS-4 18.5 SSS 18.5 SS-4	-	0.0					consisting of roots (Residual Soli of the Springwater Formation)	1
80							Springwater romation	-
80	_							_
10 10.0 10.0 11.50 ST-2 8-10 ft. 150 pis constant 10 10.0 11.50 SS-3 2.2.3 Slighty-reddish brown, moist, firm, medium plasticity, ty2% fine sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation) WC = 37.1% UL = 49, PL = 24, PI = 25 15 15.0 11.5 Soil of the Springwater Formation) Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf WC = 36.1% UL = 44, PL = 26, PI = 18 WC = 36.1% PP = 1.75, 2, 1.25 tsf		80						
10 10	-	0.0						- due to gravel.
10 10.0 ST-2 Driller reported smooth and consistent run, drill cleans drilling fluid off with a spade 10 10.0 ISO ST-2 Driller reported smooth and consistent run, drill cleans drilling fluid off with a spade 10 10.0 ISO SS-3 2.2.3 (5) Slightly-reddish brown, moist, firm, medium plasticity, ±5% fire sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation) WC = 37.1% LL = 40, PL = 24, PI = 25 11.5 ISO SI of the Springwater Formation) EAN CLAY (CL) SI of the Springwater Formation) 15 15.0 SS 4 3.3.5 Singht reddish brown trace grayish-brown, moist, firm, medium plasticity, trace fire sand, trace fire subrounded gravel, trace redish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf 16.5 ISS 4 3.3.5 (8) Singht reddish brown trace grayish-brown, moist, firm, medium plasticity, trace fire sand, trace fire subrounded gravel, trace redish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf II.50 SS 4 3.3.6 III.50 SS 4 III.50 III.50 II.50 SS 4 SS 4 SS 4 III.50 III.50 III.50 III.	-							
10 10.0 Image: constraint of the spring water Formation Image: constraint of the spring water Formation Image: constraint of the spring water Formation 10 1.50 SS 4 3.3.5 (B) Image: constraint of the spring water Formation Image: constraint of the spring water Formation Image: constraint of the spring water Formation 15 15.0 Image: constraint of the spring water Formation 15 15.0 Image: constraint of the spring water Formation 16.5 1.50 SS 4 3.3.5 (B) Image: constraint of the spring water Formation	_		0.50	ST-2				 Driller reported smooth and consistent run, drill
15 150 SS-3 2-2-3 (5) Sightly-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. Dniller reported trace gravel 15 15.0 Image: Sightly-reddish brown, moist, Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf WC = 36.1% LL = 44, PL = 26, PI = 18 16.5 Image: Sightly-reddish brown trace gravish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf			0.00	0.2				cleans drilling fluid off with a spade
15 150 SS-3 2-2-3 (5) Sightly-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. Dniller reported trace gravel 15 15.0 Image: Sightly-reddish brown, moist, Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf WC = 36.1% LL = 44, PL = 26, PI = 18 16.5 Image: Sightly-reddish brown trace gravish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf	10	10.0						
15 150 SS-3 2.2.3 (5) Slightly-reddish brown, mosil, firm, medium plasticity, ±5% fine sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation) LL = 49, PL = 24, PI = 25 10.2 ft. Driller reported trace gravel 15 15.0 Image: Staining, trace black Mn nodules (Residual Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf 16.5 Image: Staining, trace black Mn nodules (Residual Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf 16.5 Image: Staining, trace black Mn nodules (Residual Soil of the Springwater Formation) PP = 1.75, 2, 1.25 tsf Image: Staining, trace black Mn nodules (Residual Soil of the Springwater Formation) Image: Staining, trace fine sand, trace fine sand, trace fine sand, trace fine subrounded gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	10	10.0					LEAN CLAY (CL)	- WC = 37.1%
1.50 SS-3 2.250 (5) plasticity, ±5% fine sand, trace reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater Formation) 10.2 ft: Dniller reported trace gravel 11.5 11.5 15.0 Image: staining, trace black Mn nodules (Residual Soil of the Springwater Formation) 10.2 ft: Dniller reported trace gravel 15 15.0 Image: staining, trace black Mn nodules (Residual Soil of the Springwater Formation) Image: staining, trace black Mn nodules (Residual Soil of the Springwater Formation) Image: staining, trace black Mn nodules (Residual Soil of the Springwater Formation) 15 15.0 Image: staining, trace black Mn nodules (Residual Soil of the Springwater Formation) Image: staining, trace black Mn nodules (Residual Soil of the Springwater Formation) 16.5 Image: staining, trace fine stain trace fine subrounded gravel, trace fine subr					223		Slightly-reddish brown, moist, firm, medium	
11.5 Interview Interview<			1.50	SS-3			plasticity, ±5% fine sand, trace reddish-brown iron	10.2 ft: Driller reported trace gravel
15 15.0 15 15.0 16.5 16.5 17.5 17.5 17.5 17.5 17.5 17.5 17.5 17.5 17.5 17.5 17.5 17.5 17.5 <		11.5			(0)		oxide staining, trace black Mn nodules (Residual]
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		11.5					Soli of the Springwater Formation)	-
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	-							-
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	_							
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								
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		1						1
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	-							1
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						////		4
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								
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	15	15.0						
1.50 SS-4 3-3-5 (8) 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) WC = 36.1% LL = 44, PL = 26, Pl = 18	10_	10.0					LEAN CLAY (CL)	PP = 1.75, 2, 1.25 tsf
16.5 (8) timm, medium plasticity, trace time sand, trace time subrounded gravel, trace reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	-				2.2.5		Slight reddish brown trace grayish-brown, moist,	- WC = 36.1%
16.5 Subrounded grave, race redist-brown non oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	_		1.50	SS-4				LL = 44, PL = 26, PI = 18
the Springwater Formation)		16.5						
	-						the Springwater Formation)	-
								4
	-					////		4
						////		
	-							1
20 -						////		-
20						////		4
	20					////		

	AFWP-BH16	SHEET
SOIL B	ORING LOO	G

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

START : 3/11/21 09:55

PROJECT NUMBER:

D3460500

ELEVATION : 625.10 ft

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

END: 3/11/21 14:38

BORING NUMBER:

2 OF 3

LOGGER : L. Bhaumik

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-Ib Auto Trip Hammer

WATER DEPTH : Not recorded DEPTH BELOW GROUND SURFACE (ft) U

1					1.000		COMMENTO
DEPTHE	and the second second	estanes contrac	RFACE (ft)	50005209000	00	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG		
		RECOVE	DV (A)	TEST RESULTS	₽	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
1		RECOVE	_rct (II)		Ъ,	MOISTURE CONTENT, RELATIVE DENSITY OR	DRILLING FLUID LOSS, TESTS, AND
1			TYPE/	6"-6"-6"	R	CONSISTENCY, SOIL STRUCTURE, MINERALOG	INSTRUMENTÁTION '
			TYPE/ NUMBER	(N)	Ū		
	20.0				////	Similar to SS-4 except more gray mottled spots,	PP = 1.25, 2, 2.5 tsf
I -		4.50		3-7-9	////	very stiff, more black Mn nodules	
1		1.50	SS-5	(16)	////]
I ⁻	21.5			(,	////		-
I -	21.0				////		-
I _					////		4
					////		
I -					////		
Ι.					////		4
					////		
I -					////		
I -					////		
					////		
I -					////		1 -
25	25.0				////		_ -
	7				////	LEAN CLAY (CL)	PP = 1.5, 1.5, 2.75 tsf
-		4.50	00.0	5-8-11	////	Brown mottled gray, moist, very stiff, medium plasticity, 6% fine to coarse sand, trace fine to	1 -
Ι.		1.50	SS-6	(19)	////	plasticity, 6% fine to coarse sand, trace fine to	4
	26.5			l `´	////	coarse subrounded gravel, reddish-brown iron	
I -	20.5				////	oxide staining (Residual Soil of the Springwater	1 -
-					////	Formation)	
1					////		
I -					////		1 -
Ι.					////		4
					////		
I -					////		1 -
I -					////		4
					////		
					////		1 -
30	30.0				////		
					////	Similar to SS-6 except black Mn nodules, no	PP = 1.5, 1, 1.5 tsf
I -		1.50	00.7	5-7-9	////	gravel	1 -
I -		1.00	SS-7	(16)	////		-
1	31.5				////		
I -	01.0				////		1 -
I -					////		-
1					////		
I -					////		1 -
I -					////		-
1					////		
I -					////		1 -
I -					////		-
1					////		
					////		1 -
35	35.0				////		
1					////	Similar to SS-6 except black Mn nodules, ±5%	WC = 36.2%
I -		1.50	SS-8	6-8-10	////	fine to coarse subrounded to subangular gravel,	- LL = 45, PL = 24, PI = 21
I -		1.30	55-8	(18)	////	trace reddish-brown iron oxide staining	Fines = 93.7%
1	36.5				////		Additional drilling fluid seeps out through asphalt,
I -	00.0				////		- driller made a small berm and is cleaning up
I _					////		4
					////		
I -					////		4
L _					////		
I 7					////		
I -					////		
I					////		
I -					////		1
I -					////		
40					////		
			-				

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 625.10 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH16

WATER DEPTH : Not recorded					2	START : 3/11/21 09:55 END : 3/1	1/21 14:38 LOGGER : L. Bhaumik		
DEPTH B	ELOW GR	OUND SU	RFACE (ft)		C	SOIL DESCRIPTION	COMMENTS		
	INTERVA	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
			TYPE/ NUMBER	6"-6"-6" (N)	GRAF	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION		
-	40.0	1.50	SS-9	5-8-10 (18)		ELASTIC SILT (MH) 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)	PP = 1.75, 2.25, 3 tsf - - - - -		
- - - 45	45.0					- - Similar to SS-9 except no gravel			
-	46.5	1.50	SS-10	7-12-16 (28)			WC = 35% LL = 50, PL = 30, PI = 20		
- - - 50	50.0								
	51.5	1.30	SS-11	7-11-19 (30)		Similar to SS-10			
-						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 - - -									

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

1	WATER DEPTH : Not recorded					START : 3/23/21 10:42 END : 3/2	3/21 14:20 LOGGER : L. Bhaumik		
DEPTHE	DEPTH BELOW GROUND SURFACE (ft)			the set to be an in the set of the set of the	8	SOIL DESCRIPTION	COMMENTS		
	INTERVA	AL (ft) RECOVE	TYPE/	PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
			NÜMBER			1/4 in: ASPHALT CONCRETE PAVEMENT 7.75 in: BASE GRAVEL	Start drilling with 4-7/8" tricone bit.		
5	<u>5.0</u> <u>6.5</u>	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	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 - - - - - - - - - - 20	15.0	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		

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 618.31 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH17

WATER DEPTH : Not recorded						START : 3/23/21_10:42 END : 3/23	3/21 14:20 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)					8	SOIL DESCRIPTION	COMMENTS
				PENETRATION TEST RESULTS	SOIL DESCRIPTION SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY		
1		RECOVE	ERY (ft)		H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
	20.0 21.5	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	PP = 0.5, 2, 2.25 tsf WC = 31.6% LL = 48, PL = 21, PI = 27 Fines = 95.6%
-						Soil of the Springwater Formation)	23 ft: Driller reported stiffer soil.
- - 25_	25.0						
-	26.5	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 - -
-							
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	PP = 2.75, 1.75, 2.5 tsf Clay surrounding drill rod attached to drill bit removed by driller
-	31.5					iron oxide staining (Residual Soil of the	
35	35.0						
	36.5	1.50	SS-7	4-6-7 (13)		plasticity, ±5% fine to coarse sand, black Mn nodules (Residual Soil of the Springwater Formation)	
						-	

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

BORING NUMBER:

AFWP-BH17

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 rec	orded		5		END : 3/23	3/21 14:20 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)					C	SOIL DESCRIPTION	LIND . 5/25	COMMENTS
10.00	INTERVAL (ft)			PENETRATION TEST RESULTS				
1	RECOVERY (ft)		ILST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DENSI	DLOR,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS TESTS AND	
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINEF	RALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-	40.0 41.5	1.50	SS-8	4-6-11 (17)		FAT CLAY (CH) Brown mottled gray, moist, very stiff, mediu plasticity, trace fine sand, trace fine suban gravel, trace reddish-brown iron oxide stain (Residual Soil of the Springwater Formatio	ning	PP = 2.75, 1, 2 tsf WC = 35% LL = 50, PL = 27, PI = 23 Similar to SS-6
- - - 45	45.0						- - - -	
	46.5	1.50	SS-9	4-8-12 (20)		Similar to SS-8 except no gravel, micaceo	us - - - -	PP = 3, 3.25, 2.75 tsf
- - - 50	50.0						-	
-	51.5	1.50	SS-10	5-7-10 (17)		Similar to SS-9	-	PP = 2.75, 3, 2.75 tsf
- - - - - - - 55						Bottom of Boring at 51.5 ft below ground s	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
							- - - - - -	
60							-	1

SHEET 3 OF 3

D3460500

PROJECT NUMBER:

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

	DEPTH					START : 4/6/21 09:08 END : 4/6/	21 12:23 LOGGER : L. Bhaumik
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)					SOIL DESCRIPTION	COMMENTS
	INTERVA	INTERVAL (ft) RECOVERY (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
					(\cdot)	3 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
					• 🛦	11 in: BASE GRAVEL	
							_
						-	_
						-	_
-						-	-
-						-	-
-						-	-
						-	-
5_	5.0					LEAN CLAY (CL)	SS-1 sample split in spoon, no PP
		1.50	SS-1	2-4-5		Brown, mottled gravish brown, moist, stiff, medium plasticity, trace fine to coarse sand, trace	WC = 33.8% LL = 47, PL = 22, PI = 25
	6.5			(9)		fine subangular to subrounded gravel, trace reddish-brown iron oxide staining, black Mn	,
	0.0					nodules (Residual Soil of the Springwater	-
						Formation)	
						-	_
						-	_
						-	_
-						-	-
10	10.0					Similar to SS-1 except additionally mottled slightly	PP = 2.25, 1.5, 1.75 tsf
-		1.50	SS-2	2-5-6		reddish brown and gray, subangular gravel only, - track black Mn nodules	Switch to 3-7/8" tricone bit -
-	11.5	1.00	002	(11)			-
-	11.5					-	-
						-	-
						-	
						_	
						-	-
						-	-
15	15.0					Similar to SS-1 except brown mottled grayish	SS-3 sample split in spoon, no PP
-		1.50	SS-3	4 -6-8		brown is gray to brown	
-	16.5	1.50	00-0	(14)		-	-
	10.5					-	-
						-	-
						-	
						-	
						-	
						-	-
20							l

	AFWP-BH18	SHE
SOIL B		G

BORING NUMBER:

SHEET 2 OF 3

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

PROJECT NUMBER:

D3460500

ELEVATION: 620.49 ft

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

WATER	DEPTH	- Not	recorded

WATER DEPTH : Not recorded						START : 4/6/21 09:08 END : 4/6/	21 12:23 LOGGER : L. Bhaumik
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)					SOIL DESCRIPTION	COMMENTS
	INTERVA	TERVAL (ft) PENETRATION TEST RESULTS			CLC	COLLNAME LICCO ODOUR COMPOL. COLLOR	DEPTH OF CASING DOULING DATE
	RECOVERY (ft)			GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
	20.0			(°7		Similar to SS-2	PP = 1.5, 1.75, 1.75 tsf
- 1		1.50	SS-4	3-5-8		-	-
-	21.5			<mark>(13)</mark>		-	-
-	21.5					-	-
-						-	-
-						-	-
-						-	-
-						-	-
-						-	1
25	25.0					-	-
	20.0					Similar to SS-1 except brown mottled gray,	PP = 0.5, 1.75, 1 tsf
-		1.50	SS-5	5-6-8		subangular gravel only, reddish-brown iron oxide - staining, track black Mn nodules	1
-	26.5			<mark>(14)</mark>		Staining, additionation of the state of the	-
	20.0					-	1
-						-	-
-						-	-
-						-	-
-						-	-
-						-	-
30	30.0					-	-
<u> </u>	00.0					LEAN CLAY WITH SAND (CL)	PP = 2.75, 3.75, 3 tsf
- 1		1.50	SS-6	7-11-13		Brown mottled gray and black, moist, very stiff, medium plasticity, 20% fine to coarse sand, trace	WC = 32% LL = 49, PL = 26, PI = 23
-	31.5			<mark>(24)</mark>		fine subangular to subrounded gravel, trace	Fines = 79.3%
-	01.0					reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater	1
- 1						Formation)	
l -						-	1 1
-						-	1 1
l -						-	1 1
-						-	1 1
35	35.0					-	1 1
						FAT CLAY (CH)	PP = 1, 1.25, 1.5 tsf
l -		1.50	SS-7	3-6-7 (13)		Grayish brown to dark gray mottled brown, moist, - stiff, medium to high plasticity, trace] 1
	36.5			(13)		reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater] 1
l -	_					Formation)] 1
l -						-] 1
					$\parallel \mid$	-]
						-	Driller reported slightly stiffer soil after 38 ft
I ⁻						-] 1
l -						-] 1
40						-]
-10							8

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 620.49 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH18

WATER	DEPTH	Not rec	orded			START : 4/6/21 09:08 END : 4/6	/21 12:23 LOGGER : L. Bhaumik
	BELOW GF				()	SOIL DESCRIPTION	COMMENTS
	INTERVAL (ft)			PENETRATION TEST RESULTS	PO		
1	RECOVERY (ft)		IEST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,	
1			TYPE/	6"-6"-6"	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			NUMBER	(N)	Ö		
-	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
- - - - - - - - - - - - - - - - - 	45.0					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)	
-	46.5	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
- - - - 50	50.0						
	51.5	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
- - - - 55_ - - -						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
- - - - 60							

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

WATER DEPTH : Not recorded						START : 4/5/21 13:00 END : 4/5/	21 15:49 LOGGER : L. Bhaumik
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)				g	SOIL DESCRIPTION	COMMENTS
	INTERVA	NTERVAL (ft) PENETRATION TEST RESULTS RECOVERY (ft)		GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
				()		3 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
-						15 in: BASE GRAVEL	
-						-	
- - 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	PP = 1.75, 1.75, 2 tsf 5 ft: Switch to 3-7/8" drag bit.
-						readisti-brown iron oxide staining, black with nodules (Residual Soil of the Springwater Formation)	
- - 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
-						Springwater Formation) -	
- - - 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							

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 621.39 ft

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

BORING NUMBER:

SHEET 2 OF 3

AFWP-BH19

	WATER DEPTH : Not recorded					START : 4/5/21 13:00	END : 4/5/				
DEPTH			UND SURFACE (ft) 0 SOIL DESCRIPTION					COMMENTS			
	INTERV/		PENETRATION TEST RESULTS		GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL MOISTURE CONTENT, RELATIVE DE	NSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION			
			TYPE/	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, M	NERALOGY	INSTRUMENTÁTION			
	20.0	1.50	SS-4	3-5-5 (10)		Similar to SS-2 except brown to brown gray and grayish brown, trace fine sub gravel, black Mn nodules	mottled angular - -	PP = 1, 0.75, 1.5 tsf			
- - - - - - - - - - - - - 	25.0						- - - -	-			
	26.5	1.50	SS-5	5-7-10 (17)		Similar to SS-2 except brown mottled stiff, trace fine subangular gravel, redo iron oxide staining, black Mn nodules	gray, very lish-brown _ _ _ _ _ _	PP = 2.25, 0.25, 0.75 tsf			
- - 30	30.0					LEAN CLAY (CL) Brown to brown mottled grayish brown	- 				
	31.5	1.50	SS-6	5-7-9 (16)		very stiff, medium plasticity, ±5% fine i sand, trace fine subangular gravel, tra reddish-brown iron oxide staining, gra gray (Residual Soil of the Springwater	io coarse ce vel is dark –	LL = 41, PL = 20, PI = 21			
	35.0							-			
-	36.5	1.50	SS-7	5-7-9 (16)		Similar to SS-6 except some gray mot addition to SS-6 colors, trace fine to co no gravel, trace black Mn nodules	ding in parse sand, - -	PP = 1.75, 2, 2.25 tsf			
-							- - -	-			
40								-			

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 621.39 ft

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

BORING NUMBER:

SHEET 3 OF 3

AFWP-BH19

WATER DEPTH : Not recorded		START : 4/5/21 13:00 END : 4/5/	5/21 15:49 LOGGER : L. Bhaumik		
DEPTH BELOW GROUND SURFACE (t)	SOIL DESCRIPTION	COMMENTS		
INTERVAL (ft) RECOVERY (ft)	TEST RESULTS	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
TYPE	6"-6"-6" R (N)		INSTRUMENTATION		
40.0 1.50 SS-8 41.5	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) SS-8B, 40.7-41.5 ft: LEAN CLAY (CL)	PP = 2.75, 3, 2.25 tsf		
- - - 45 - - - - - - - - - - - - - - - - - -		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.		
50 <u>50.0</u> - - - - - - - - - - - - -	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) Bottom of Boring at 51.5 ft below ground surface	WC = 41.3% LL = 60, PL = 37, PI = 23 Fines = 89.9% 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		

PROJECT NUMBER:	BORING NUMBER:					
D3460500	AFWP-BH20	SHEET	1	OF	3	
	SOIL BORING LOG	2				

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

WATER	DEPTH	: Not rec	orded			START : 3/24/21 09:08 END	3/24/21 12:32 LOGGER : L. Bhaumik
DEPTHE			RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft) RECOVE	TYPE/	PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR MOISTURE CONTENT, RELATIVE DENSITY O CONSISTENCY, SOIL STRUCTURE, MINERALO	DRILLING FLUID LOSS, TESTS, AND
⊢			NUMBER	(N)	<u> </u>	3 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
-						6 in: BASE GRAVEL	
	4.0	100				ST-1, 4-5.9 ft: FAT CLAY (CH) Brown mottled gray, moist, stiff, medium to plasticity, reddish-brown iron oxide staining	
-	6.0	1.90	ST-1			(Residual Soil of the Springwater Formation)	
-	7.5	1.30	SS-2	3-4-6 (10)		LEAN CLAY (CL) Brown mottled gray, moist, stiff, medium plastici trace fine to coarse sand, trace fine subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater	5 ft: Switch to 4-7/8" drag bit. PP = 2, 1.5, 0.5 tsf Driller reported borehole "collared up" below base gravel and at 7 ft, he is redrilling the borehole
- - - 10	10.0					Formation)	
-	11.5	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
- - - - - - - - - - - -	15.0						
-	16.5	1.50	SS-4	4-4-5 (9)		Similar to SS-2 except gray mottled brown	PP = 2.25, 2.25, 1.25 tsf
-	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
	19.6	1.60	ST-5				Su = 2736 psf Recovery in Shelby tube is 1.9 ft
20					/////		

SOIL BORING LOG

SHEET 2 OF 3

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

PROJECT NUMBER:

D3460500

ELEVATION: 611.07 ft

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

BORING NUMBER: AFWP-BH20

	DEPTH					START : 3/24/21 09:08 END : 3/24	12:32 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	ROUND SU	RFACE (ft)		0	SOIL DESCRIPTION	COMMENTS
	INTERVAL (ft) PENETRATION TEST RESULTS			PENETRATION TEST RESULTS	CLC		
		RECOVE	ERY (ft)		Η̈́Ξ	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
	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					- - - FAT CLAY (CH)	
-	26.5	1.50	SS-7	5-8-10 (18)		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)	-
- - 30 -	30.0	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						-	

	AFWP-BH20	SHEET	3	OF	3
SOIL B	ORING LOG	ì			

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

PROJECT NUMBER:

D3460500

ELEVATION : 611.07 ft

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

BORING NUMBER:

AFWP-BH20

WATER DEPTH : Not recorded		START	3/24/21 09:08	END : 3/24	/21 12:32 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)	GROUND SURFACE (ft) O SOIL DESCRIPTION				COMMENTS
INTERVAL (ft) RECOVERY (ft)	PENETRATION TEST RESULTS	MOISTURE C	USCS GROUP SYMBOL, ONTENT, RELATIVE DEN	SITYOR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
TYPE/ NUMBER	6"-6"-6" 22 (N) 5	CONSISTENCY	, SOIL STRUCTURE, MIN	ERALOGY	INSTRUMENTÁTION
40.0 40.0 1.50 SS-10 41.5 - - - - - 45_ - - - - - - - - - - - - -	6"-6"-6" gr	SILT WITH S Brown with da moist, stiff, m trace fine sub iron oxide sta		parts, - sand,	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.
5050.0 1.50 ss-11 51.5	3-2-3 (5)	moist, firm, m sand, trace fir , iron oxide sta	ace dark bown and orange edium plasticity, 15% fine ne subangular gravel, redd ining, trace black Mn nodu	to coarse ish-brown les	WC = 50.6% LL = 48, PL = 32, Pl = 16 Fines = 85.2% Pumaceous sand Driller reported the top 5 ft of borehole had a clay
			prolite of the Springwater F ing at 51.5 ft below ground		"collar" which he redrilled. 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

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

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

WATER	DEPTH	: Not rec	orded			START : 3/12/21 09:15 END : 3/12	2/21 13:20 LOGGER : L. Bhaumik		
DEPTH E	BELOW GR	OUND SURFACE (ft) 0 SOIL DESCRIPTION				SOIL DESCRIPTION	COMMENTS		
	INTERVA	AL (ft) RECOVE	TYPE/	PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
			NUMBER	(N)	0	5 in: ASPHALT CONCRETE PAVEMENT	Driller reported using 6" tricone bit from 0-5 ft so		
-						13 in: BASE GRAVEL	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	PP = 2, 2.5, 2.25 tsf 		
- - - - 10	10.0					Springwater Formation)			
-	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 -		
- - - - - - - - - - - - - - - - - 	15.0					-	-		
-	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		

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

BORING NUMBER:

AFWP-BH21

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	2/21 13:20 LOGGER : L. Bhaumik				
DEPTHE	and the second	DW GROUND SURFACE (ft)			8	SOIL DESCRIPTION	COMMENTS			
	INTERVA	RECOVERY (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND			
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION			
-	20.0 21.5	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	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			
						Springwater Formation)				
25	<u>25.0</u> 26.5	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	PP = 1.75, 2.5, 2.5 tsf -			
						of the Springwater Formation)				
30	30.0 31.5	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				
- - - - 35	35.0					-				
-	36.5	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%			
- - - 40							Driller reported stiffer soil at 38 ft			

SHEET 2 OF 3

D3460500

PROJECT NUMBER:

	AFWP-BH21	SHEET
SOIL BO		G

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

PROJECT NUMBER:

D3460500

ELEVATION: 626.60 ft

60

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

BORING NUMBER:

3 OF 3

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) COMMENTS SOIL DESCRIPTION **GRAPHIC LOG** PENETRATION TEST RESULTS INTERVAL (ft) SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBE (N) Similar to SS-7 except fine to coarse sand, trace PP = 1.75, 1.75, 2 tsf 40.0 fine subangular gravel, no black Mn nodules Driller redrilling borehole due to formation of clay 6-7-10 1.50 SS-8 collar (17)415 45 45.0 FAT CLAY (CH) PP = 2, 4.25, 3.25 tsf Second leak of drilling fluid through cracks in Gray mottled brown, moist, very stiff, trace fine 6-13-14 1.50 SS-9 sand, medium plasticity, reddish-brown iron oxide asphalt pavement. Driller reported he will hose it (27) staining, trace black Mn nodules, micaceous down with water into the natural ditch on the east 46.5 (Residual Soil of the Springwater Formation) side of the road. Driller creates a drain with a spade (reaching the ditch) 50 50.0 LEAN CLAY (CL) Brown mottled gray, moist, hard, medium 9-13-18 1.50 SS-10 plasticity, 5% fine sand, trace fine to coarse (31)subangular gravel, trace reddish-brown iron oxide 51.5 staining, trace black Mn nodules, micaceous Backfilled with: (Residual Soil of the Springwater Formation) 0-0.5 ft: Asphalt cold patch to match existing Bottom of Boring at 51.5 ft below ground surface conditions 0.5-1 ft: Gravel 1-3 ft: Bentonite chips 3-51.5 ft: Bentonite grout 55

					1477.5	
D3460500	AFWP-BH22	SHEET	1	OF	3	
ROJECT NUMBER:	BORING NUMBER:					

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

1			19.3 feet	1 m			8/21 14:26 LOGGER : L. Bhaumik
DEPTHE	1		RFACE (ft)	3001.000000	00	SOIL DESCRIPTION	COMMENTS
	INTERV/	INTERVAL (ft) PENETRATION TEST RESULTS RECOVERY (ft) TYPE/ 6"-6"-6" NUMBER (N)			GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			NUMBER	(N)	0	5 in: ASPHALT CONCRETE PAVEMENT	Make provision for piezometer monument:
						7 in: BASE GRAVEL	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	6.0	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
-	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)	Recovery in Shelby tube is 1.8 ft 4 ft: Switch to 6" drag bit PP = 1.75, 1.25, 2 tsf -
- - - 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 Deservery in Schelbuchte is 2.2 ft
-	19.6	1.60	ST-5				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
20							cuttings possible on top of Shelby tube.

SOIL BORING LOG

SHEET 2 OF 3

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

PROJECT NUMBER:

D3460500

ELEVATION: 632.43 ft

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

BORING NUMBER:

AFWP-BH22

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	bqs		START : 3/18/21 09:08 END : 3/	18/21 14:26 LOGGER : L. Bhaumik
DEPTHE	1	services and a serve	RFACE (ft)	and a second to a second second	8	SOIL DESCRIPTION	COMMENTS
	INTERVA			PENETRATION TEST RESULTS	GRAPHIC LOG		DEPTH OF CASING, DRILLING RATE,
	RECOVERY (ft)				HH	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
		1.50	SS-6	5-7-9		LEAN CLAY (CL)	PP = 1.5, 2, 2.5 tsf
-	21.1	1.00		(16)		Reddish brown mottled gray, moist, very stiff, medium plasticity, ±5% fine to coarse sand, trace	- Driller reported smooth drilling throughout
-	21.1					fine subangular gravel, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of	1 -
-						the Springwater Formation)	1
⁻	1						-
- I	1						1
-							
]
25	25.0					_	-
 -				2-4-5		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%
-		1.50	SS-7	(9)			LL = 39, PL = 20, PI = 19
-	26.5						4 -
-							
-	-						
-							
-							
-							
-							
30	30.0					Similar to SS-6 except brown mottled gray, trace	PP = 1, 3.25, 1.25 tsf
-		1.50	SS-8	4-8-9		reddish-brown iron oxide staining, more black Mn nodules	
-	31.5			(17)		noulos	-
-	01.0						1 -
-							1 -
-							1
- I	1						-
]]
35	35.0						
 -				5-7-9		Similar to SS-6 except brown mottled gray, trace fine to coarse sand, trace reddish-brown iron	PP = 1.5, 2.5, 2.75 tsf
-		1.50	SS-9	5-7-9 (16)		oxide staining, more black Mn nodules	-
-	36.5						4
-							4 -
-							4 -
-							
-							
-							39 ft: Driller reported stiffer soil.
-							-
40							1

	AFWP-BH22	SHEET	3	OF	3
SOIL B	ORING LOG				

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

PROJECT NUMBER:

D3460500

ELEVATION: 632.43 ft

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

BORING NUMBER:

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	bas		START : 3/18/21 09:08	END: 3/18	3/21 14:26 LOGGER : L. Bhaumik
1			RFACE (ft)		U	SOIL DESCRIPTION		COMMENTS
	INTERV	AL (ft)		PENETRATION TEST RESULTS	2			
1		RECOVE	RY (ft)	ILST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, CO MOISTURE CONTENT, RELATIVE DENSIT	LOR,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY		INSTRUMENTATION
-	40.0 41.5	1.50	SS-10	5-9-12 (21)		FAT CLAY (CH) Gray mottled brown, moist, very stiff, mediu plasticity, trace fine sand, reddish-brown iro oxide staining (Residual Soil of the Springv Formation)	on	PP = 1.75, 3.5, 2.75 tsf WC = 29.2% LL = 51, PL = 23, PI = 28
- - 45	45.0					LEAN CLAY (CL)	- - -	- - - - - - - - - - - - - - - - - - -
	46.5	1.50	SS-11	4-7-9 (16)		Reddish to gravish brown, moist, very stiff, medium to high plasticity, trace fine sand, reddish-brown iron oxide staining, black Mr nodules (Residual Soil of the Springwater Formation)		
- 50 -	<u>50.0</u> 51.5	1.50	SS-12	4-7-9 (16)		Similar to SS-11 except trace fine subangu gravel	- .lar -	PP = 1.25, 1.75, 2 tsf
						Bottom of Boring at 51.5 ft below ground su	urface	Inststalled VWP in 2" PVC standpipe piezometer.
						Geokon VWP 4500S (350 kPa), unvented, no. 2111130 Geokon datalogger 8002-WP-2 LC-2, seria 2128640	-	Standpipe piezometer installed immediately after drilling. WVP installed on 06/24/2021.
- 55_ - - -							- - - - - -	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) 9007.733 (2) 9008.813
- - - 60							-	(4) 9008.993 Average Ro = 9008.212

D3460500	AFWP-BH23	SHEET	1	OF
	SOIL BORING LOG			

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

PROJECT NUMBER:

ELEVATION: 585.54 ft

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

BORING NUMBER:

4

WATER	DEPTH	- martine	200202000			START : 3/19/21 10:45 END : 3	22/21 12:24 LOGGER : L. Bhaumik
1			RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	P		
		RECOVE	RY (ft)	IEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
				6"-6"-6"	AP	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LÖSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER		В		
					(4 in: ASPHALT CONCRETE PAVEMENT	Driller reported smooth drilling after 10", likely
					•	6 in: BASE GRAVEL	 clay/silt. Clay in cuttings. Start drilling with 4-7/8" tricone bit.
-					////		
-							
							-
							-
	4.0						1 1
	4.0						- ST-1 -
-							- 4-4.5 ft: 150 psi
5_		2.00	ST-1		////		4.5-5 ft: 200 psi 5-5.5 ft: 250 psi
							_ 5.5-6 ft: 450 psi _
	6.0						5 ft: Switch to 4-7/8" drag bit
						LEAN CLAY (CL) Reddish brown mottled grayish brown, moist, firm,	PP = 1.25, 0.75, 1.5 tsf WC = 32.7%
		1.50	SS-2	3-3-4 (7)		medium plasticity, 12% fine to coarse sand, trace	LL = 41, PL = 22, PI = 19
	7.5			(7)		reddish-brown iron oxide staining, black Mn	Fines = 88.3%
	1.0					nodules (Residual Soil of the Springwater Formation)	-
-						1 officially	
-							
							-
							-
10	10.0						
						LEAN CLAY (CL)	PP = 1.75, 3, 2.5 tsf
		1.50	SS-3	3-6-6		Brown, slightly mottled grayish brown, moist, stiff, slight plasticity, 6% fine to coarse sand, trace fine	-
	11.5			(12)		subangular gravel, reddish-brown iron oxide	1 1
	11.5					staining, trace black Mn nodules (Residual Soil of the Springwater Formation)	-
							4 4
							4 4
							4 4
							4
]
15	15.0						1
						Similar to SS-3 except brown, trace	PP = 1.25, 1.25, 1.5 tsf
		1.50	SS-4	3-4-5		reddish-brown iron oxide staining, black Mn nodules	- WC = 28.4% LL = 34, PL = 21, PI = 13
	10.5			<mark>(</mark> 9)		CONDUCT	Fines = 94.3%
	16.5						Driller reported smooth drilling throughout
							4 4
							4 4
	18.0				////		4
							ST-5 - 18-19 ft: 150 psi -
1		0.00					19-19.5 ft: 200 psi
		2.00	ST-5				19.5-20 ft: 250 psi
							- Recovery in Shelby tube 2.2 ft
20					/////		

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 585.54 ft

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

BORING NUMBER:

SHEET 2 OF 4

AFWP-BH23

WATER	DEPTH	: Not rec	orded			START : 3/19/21 10:45 END : 3/2	2/21 12:24 LOGGER : L. Bhaumik		
1			RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS		
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	PO				
1		RECOVE	RY (ft)	ILOT NLOULIO	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION		
-	20.0 21.5	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		
- - - 25_	25.0								
-	26.5	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		
- - - - - 30	30.0								
-	31.5	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		
-	33.0						ST-9 33-34 ft: 250 psi		
- - 35_	35.0	2.00	ST-9				34-35 ft: 350 psi Recovery in Shelby tube 2.35 ft. Driller reported because of soil type, possibly some cuttings on top		
	36.5	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	PP = 1.75, 2.5, 3 tsf		
						nodules (Residual Soil of the Springwater Formation)	37-38 ft: Driller reported stiffer soil.		

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 585.54 ft

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

BORING NUMBER:

SHEET 3 OF 4

AFWP-BH23

WATER	DEPTH	: Not rec	orded			START : 3/19/21 10:45 END : 3	22/21 12:24 LOGGER : L. Bhaumik			
DEPTH E	ELOW GR	OUND SU	RFACE (ft)		G	SOIL DESCRIPTION		COMMENTS		
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	CLC					
		RECOVE	ERY (ft)		HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
			TYPE/	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	,	INSTRUMENTATION		
-	40.0	1.00	SS-11	(N) 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	Pumac	37.5% = 40.9% æous sand gravel in shoe includes black basalt.		
- - - - 45	41.5					(Less Weathered Springwater Formation)	 Rig cha Driller i progression 	after from 41.5 ft due to presence of gravel. reported that the drag bit is making ss,indicating that the gravel layer is thin and ts of smaller gravel pieces.		
P	46.5	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)	-	uous rig datter		
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 or	n 3/19/21 at 15:00 at 51.5 ft. /22/21 at 9:45, use 3-7/8" tricone bit.		
- - 55 - - - - - - - - - - -	55.0	1.30	SS-14	11-11-50/4" (61/10")	و و دوم و مرد و مرد و مرد br>مرد و مرد	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)	- Gravel - (gravel	Driller reported harder soil piece in shoe, SS bent, driller reported hard ly) soil from 56.25-57.5 ft		
60							1			

SOIL	BORING LOG	

BORING NUMBER:

SHEET 4 OF 4

LOGGER : L. Bhaumik

COMMENTS

DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION

AFWP-BH23

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

PROJECT NUMBER:

D3460500

ELEVATION: 585.54 ft

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

END: 3/22/21 12:24

WATER DEF	TH : Not I	ecorded			START : 3/19/21 10:45 END :			
DEPTH BELO	W GROUND	SURFACE (ft)	•	DOG	SOIL DESCRIPTION			
INT	ERVAL (ft)	OVERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LC	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR			
		TYPE/ NUMBEF	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY			
-	.0 1.5() SS-15	10-20-15 (35)		Similar to SS-14 except dense, ±30% gravel			
61	.5							
-								
-								
6565	.0		50/51	••••				

	60.0					Similar to SS-14 except dense, ±30% gravel	
		1.50	SS-15	10-20-15 (35)			
	61.5			(00)			_
1							-
-						1	-
-						1	-
-						- 63	3-65 ft: Driller reported stiffer soil (gravelly).
-							
-							-
-							-
65	65.0 65.4	0.40	SS-16	50/5"		Similar to SS-14 except gray, moist, very dense,	viller reported very stiff soil after SS-16
_	00.4	0.40	33-10	(50/5")		+40% fine to coarse sand fine to coarse –	
_						subangular to subrounded gravel, ±10% sitt, percent approximate because of small sample	_
_						size -	_
							_
						1	
1							_
-						1	-
70	70.0					1	-
<i>'</i> 0	70.3	0.30	SS-17	50/3"		SILTY SAND WITH GRAVEL (SM)	and and disintegrated gravel in return fluid, driller
-				(50/3")		Gravish brown, moist, very dense, ±40% fine to – re	ported consistent drilling from SS-16 to SS-17 0.25-70.75 ft: Drill rig clatter, driller reported stiffer
-					:	±15% silt, percent approximate because of small so	oil.
-						sample size (Less Weathered Springwater - Formation)	-
-						-	-
-						-	-
-						-	-
_							-
_						-	-
_						-	-
75	75.0						_
		1.20	SS-18	16-21-50/2"		SILTY SAND WITH GRAVEL (SM) Gravish brown, moist, very dense, ±40% fine to	_
	76.2	1.20	55-18	(71/8")		coarse subangular to subrounded gravel less than	_
	10.2				4.01	2", ±15% silt, fine to coarse sand, trace / reddish-brown iron oxide staining (Less / -	
7						Weathered Springwater Formation)	ackfilled with: -0.5 ft: Asphalt cold patch to match existing –
1						CO	onditions
1							.5-1 ft: Gravel -5 ft: Bentonite chips
1						5-	-76.5 ft: Bentonite grout
-						1	-
-						1	-
80						1	-
00							

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							/21 13:50 LOGGER : L. Bhaumik
1		OUND SU			C	SOIL DESCRIPTION	COMMENTS
a arces	INTERVA	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
						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_ -	<u>5.0</u> 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						ST-3 recovery 1.8 ft in tube, tube bent for the
-	14.3	1.30	ST-3			Bottom includes a 1/16" diameter root SANDY ELASTIC SILT (MH)	13-13.5 ft: 150 psi 13.5-14 ft: 250 psi 14-14.1 ft: 350 psi
15	15.8	1.20	SS-4	2-2-5 (7)		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	14.1-14.3 ft: 600 psi ST-3 bottom half of tube bent considerably SS-4: WC = 57%
						(Sensitive Saprolite of the Springwater Formation)	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

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

BORING NUMBER:

AFWP-BH24

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	bas		START : 4/7/21 08:55 END : 4	/7/21 13:50 LOGGER : L. Bhaumik
1			RFACE (ft)		C	SOIL DESCRIPTION	COMMENTS
	INTERVA	/AL (ft) PENETRATION C DEST RESULTS C					
		RECOVE	RY (ft)	IEST RESULTS	HOH	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/	6"-6"-6"	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION
	20.0		NUMBER	(N)	0	Similar to SS-4 except hard, ±10% gravel less	20 ft: Switch to 3-7/8" tricone bit
-	20.0	0.40	SS-5	6-7-24 (31)		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)	
- - - - 25	25.0						
-	26.5	1.50	SS-6	11-32-41 (73)		CLAYEY SAND (SC) Gravish 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.
 	30.0						
-	30.9	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	
- - 35 - - - - - -	<u>35.0</u>	0.20	<u>SS-8</u>	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 day, trace sand	
40							

SHEET 2 OF 3

D3460500

PROJECT NUMBER:

SOIL B	ORING	LOG	

SHEET 3 OF 3

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

PROJECT NUMBER:

D3460500

ELEVATION: 559.53 ft

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

BORING NUMBER:

AFWP-BH24

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 bqs START : 4/7/21 08:55 END: 4/7/21 13:50 LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION Pog PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) MOISTURE CONTENT, RELATIVE DENSITY OR DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBE (N) CLAYEY SAND (SC) SS-9 is lightly cemented, similar to SS-6 40.0 Yellowish-brown, moist, medium dense, fine to disintegrates easily with with finger pressure. 10-13-16 1.50 **SS-9** coarse sand, light cementation, 31% clay, trace WC = 56.4% (29)fine subangular gravel, trace reddish-brown iron Fines = 31.2% 415 oxide staining (Less Weathered Springwater Formation) 45_ 45.0 SILTY SAND (SM) 37-50/4" 0.80 SS-10 Grayish brown to yellowish brown, moist, very (50/4")45.8 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 ŀ11 0.30 50/4' Similar to SS-10 except ±10% gravel less than 50.3 SS-11 SS-11 1.5" diameter gravel piece in shoe. (50/4" 1.5" diameter Installed VWP taped outside 1" PVC standpipe piezometer Bottom of Boring at 50.3 ft below ground surface 0-1.25 ft: 12" diameter, 12" deep monument set in Geokon VWP 4500S (350 kPa), unvented, serial concrete, black dye added to concrete to match no. 2111122 existing conditions Geokon datalogger 8002-WP-2 LC-2, serial no. 1.25-38 ft: Bentonite chips 2107941 38-50 ft: Sand 40-50 ft: Screen Start Card # 1051378 Well # L141467 Base of VWP is at 44.9 ft below ground surface. Field WWP Ro 55 (1) 9072.554 (2)9092.526(3) 9072.090 (4) 9072 638 Average Ro = 9072.452 60

D3460500	AFWP-BH25	SHEET	1	OF	4	
	OIL 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

1	WATER DEPTH : Not recorded DEPTH BELOW GROUND SURFACE (ft)				_	START : 3/26/21 09:15 END : 3/20	6/21 15:50 LOGGER : L. Bhaumik	
DEPTH E	1		RFACE (ft)		8	SOIL DESCRIPTION	COMMENTS	
	INTERVA	AL (ft) RECOVE	TYPE/	PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
			NUMBER	(N)	(7 in: ASPHALT CONCRETE PAVEMENT	Driller reported that base gravel size increases with	
						17 in: BASE GRAVEL	depth Start drilling with 4-7/8" tricone bit.	
- - - - 5	4.0	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 7.5	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	-	
- - - 10	10.0					Formation)		
	11.5	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	
- - 15	15.0							
-	16.5	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)	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.	
- - - - 20						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)		

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 554.21 ft

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

BORING NUMBER: AFWP-BH25

SHEET 2 OF 4

-	WATER DEPTH : Not recorded DEPTH BELOW GROUND SURFACE (ft)				_	START : 3/26/21 09:15 END : 3/2	6/21 15:50 LOGGER : L. Bhaumik
DEPTHE	1	services and and a con-	IRFACE (ft)	Include American III - 2 Honorem America	8	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GR♪	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
-	20.0 21.5	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.
-						· · · · · · · · · · · · · · · · · · ·	24 ft: Driller reported very stiff soil. Alternating stiffer and softer layers.
25	25.0						
-	26.5	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	WC = 15.8% Fines = 22.1% Cemented sand, disintegrates with finger pressure.
-						dark gray brown yellow red pieces, trace reddish-brown iron oxide staining (Less Weathered Springwater Formation)	
- - - - - 30	30.0						
	<u>38.0</u> 	0.00	SS-7	50/2" (50/2")		No recovery	Only slough in SS
- 35_	35.0						
-	36.3	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.
40				ļ	////		

	AFWP-BH25	SHEET	3	OF	4
SC	IL BORING LOO	3			

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

PROJECT NUMBER:

D3460500

ELEVATION: 554.21 ft

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

BORING NUMBER:

	WATER DEPTH : Not recorded				_	START : 3/26/21 09:15 END	D : 3/26/21 15:50 LOGGER : L. Bhaumik
DEPTH	BELOW GF	ROUND SU	IRFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERV/	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOF MOISTURE CONTENT, RELATIVE DENSITY O	DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALC	OGY INSTRUMENTÁTION
-	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
45	45.0						- drilling.
-	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 san (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 - - - - - - - - - - - - -	<u>55.9</u>	0.00	<u>\$\$-12</u>	50/1" (50/1")		No recovery	- - - - - - - - - - - - - - - - - - -

SOIL	BORING LOG	

BORING NUMBER:

SHEET 4 OF 4

AFWP-BH25

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

PROJECT NUMBER:

D3460500

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

	CRBF-B-01	SHEET	1
SOIL	BORING LO	G	

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

PROJECT NUMBER:

D3460500

ELEVATION: 663.35 ft

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

BORING NUMBER:

OF 3

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-Ib Auto Trip Hammer

1	WATER DEPTH : Not recorded DEPTH BELOW GROUND SURFACE (ft)				_	START : 12/9/21 08:45 END : 12/	0/21 10:21 LOGGER : L. Bhaumik	
DEPTHE			RFACE (ft)	DENETDATION	8	SOIL DESCRIPTION	COMMENTS	
	INTERVA	AL (ft) RECOVE		PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
			TYPE/ NUMBER		В В			
-						4 in: ASPHALT CONCRETE PAVEMENT 8 in: BASE GRAVEL	Start drilling with 6" drag bit - -	
						-		
5	<u>5.0</u> 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	Switch to 4-7/8" drag bit	
- - - - - - - - - - - - - - - - - - -	10.0					the Springwater Formation)		
	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	
	15.0							
-	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							1	

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 663.35 ft

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

BORING NUMBER:

SHEET 2 OF 3

CRBF-B-01

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-Ib Auto Trip Hammer

WATER	WATER DEPTH : Not recorded				_	START : 12/9/21 08:45 END : 12/	9/21 10:21 LOGGER : L. Bhaumik	
DEPTH E		exected to base	IRFACE (ft)		8	SOIL DESCRIPTION	COMMENTS	
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
			TYPE/ NUMBER	6"-6"-6" (N)	GR/	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION	
-	20.0 21.5	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%	
- - - - 25_	25.0							
-	26.5	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	PP = 0, 0, 0.25, 0.25 tsf 1/4" thick twigs and seams of wood	
						less than 1" diameter, ± 15% organics consisting of wood and disintegrated wood (Residual Soil of the Springwater Formation)		
30	30.0 31.5	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	PP = 0, 0, 0 tsf WC = 61.9% LL = 50, PL = 31, PI = 19	
- - - - - - - - - - - - - - - - - 	35.0					Springwater Formation)		
-	36.5	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% 	
- - - 40								

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

BORING NUMBER:

CRBF-B-01

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-Ib Auto Trip Hammer

	RDEPTH				_	START : 12/9/21 08:45 END : 12/9	
DEPTH	BELOW GR	ROUND SU	RFACE (ft)		8	SOIL DESCRIPTION	COMMENTS
	INTERV/	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	PHIC LC	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
45_	40.0 41.5			PENETRATION TEST RESULTS 6"-6" (N) 2-7-19 (26)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 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) Bottom of Boring at 41.5 ft below ground surface	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION WC = 69.0% LL = 58, PL = 38, PI = 21 Fines = 86.1%, Sand = 13.9%, Gravel = 0% 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
						-	-
60							

SHEET 3 OF 3

D3460500

PROJECT NUMBER:

SOIL BORING LOG

BORING NUMBER:

SHEET 1 OF 4

CRBF-B-02

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

PROJECT NUMBER:

D3460500

ELEVATION: 668.49 ft

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

WATER					_	START : 11/17/21 11:54 END : 11/	18/21 14:14 LOGGER : L. Bhaumik
DEPTH B	terne and the states		RFACE (ft)	DENETRATION	00	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
	0.0				••	2 in: ASPHALT CONCRETE PAVEMENT	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	<u>5.0</u> 6.5	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)	WC = 31.8% Fines = 87.3%, Sand = 12.7%, Gravel = 0%
	10.0		S-3			S-3, 5-10 ft: Similar to SS-2 except pockets of gray black fine to coarse sand, trace reddish-brown iron oxide staining	
-	11.5	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	WC = 40.8% LL = 55, PL = 35, PI = 20 Fines = 82.9%, Sand = 17.1%, Gravel = 0%
- - - - - - - - - - - - - - - - - - -	15.0		S-5			Soil of the Springwater Formation) S-5, 10-15 ft: Similar to SS-4 except occasionally with more clay than silt	14-15 ft: Grab Sample GS-6 14.5 ft: Gray mottling in S-5
-	16.5	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	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
			S-8			Formation) S-8, 15-20 ft: Similar to SS-7 except trace reddish-brown iron oxide staining, one 4" diameter cobble	

SOIL BORING LOG

BORING NUMBER:

SHEET 2 OF 4

CRBF-B-02

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

PROJECT NUMBER:

D3460500

ELEVATION: 668.49 ft

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

WATER	NUM I A DOMESTIC	: Not rec	24/07/2012	1111		START : 11/17/21 11:54 END : 11/	18/21 14:14 LOGGER : L. Bhaumik
1			RFACE (ft)	i i	Ċ	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION	LOG		
		RECOVE	RY (ft)	TEST RESULTS	Ϋ́	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-	20.0	0.20	SS-9	WOH-WOH- WOH		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'
	25.0		S-10			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, 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	- - - - - - - - - - - - - - - - - - -
-	26.5	1.50	SS-12	6-3-11 (14)		(Sensitive Saprolite of the Springwater Formation) – 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
- - - - - - - - - - - - - - - - - - -	30.0		S-13	•		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)	Driller reported that he is not using any hydraulic pressure for drilling, there is 2" of hard soil then 28-30 ft: Grab Sample GS-14 WC = 31.2% Fines = 25.5%, Sand = 23.2%, Gravel and cobbles = 51.3%
-	31.5	1.50	SS-15	24-22-23 (45)		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	SS-15 broken gravel / cobble pieces in shoe. Shoe edge broken because of gravel/cobble
- - - - - - - - - - - - - - - - - - 	35.0		S-16			Springwater Formation) 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	- - - - - - - - - - - - - - - - - - -
-	36.5	1.50	SS-18	7-24-22 (46)		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 -
- - - - - - 40			S-19			S-19, 35-38.2: Similar to SS-18 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)	PP = 1, 0.75, 2.75 tsf - - -

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 668.49 ft

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

BORING NUMBER:

SHEET 3 OF 4

CRBF-B-02

WATER	DEPTH		200202000	La s	1.5		18/21 14:14 LOGGER : L. Bhaumik
1			RFACE (ft)		C	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION	PO		
		RECOVE	RY (ft)	TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/	6"-6"-6"	RAP	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			NUMBER		В В	,	
	40.0					LEAN CLAY (CL)	WC = 28.4%
		1.50	SS-20	WOH-3-5		Gray with some brown to orange brown mottling, moist, firm, medium plasticity, trace	LL = 35, PL = 20, PI = 15 -
-	41.5			<mark>(</mark> 8)		reddish-brown iron oxide staining, trace	-
-	41.5					subrounded to subangular gravel (Less \Weathered Springwater Formation)	Stop on 11/17/2021 at 41.5 ft bgs at 3:25 PM
-						S-21, 41.5-45 ft: ELASTIC SILT WITH	- Start on 11/18/2021 at 9:26 AM
-						COBBLES (MH)	S-21 contains 1 cobble less than 4" diameter.
- 1						Gray with brown to orange and rare red mottling, moist, stiff, medium plasticity, 10.1% fine to	gravel less than 1.5" diameter at 43.5-44.5 ft
- 1			S-21			coarse sand pockets, 1.6% fine to coarse	
						subangular to subrounded gravel less than 1.5" diameter, trace cobble less than 4" diameter,	43.5-44.5 ft: Grab Sample GS-22 WC = 41.1%
						gravel and cobble present at 43.5-44.5 ft (Less	LL = 54, PL = 30, PI = 24
45	45.0					Weathered Springwater Formation)	Fines = 88.3%, Sand = 10.1%, Gravel and cobbles
						SS-23A, 45-45.4 ft: ELASTIC SILT (MH)	
		0.50	SS-23	6-9-20		Gray mottled brown, moist, very stiff, midum to fingh plasticity, trace fine sand, trace fine	SS-23B: WC = 57.1%
-	46.5			(29)		subangular gravel (Less Weathered Springwater	Fines = 49.8%, Sand = 50.2%, Gravel = 0%
	40.5					Formation)	Gravel piece in shoe, basalt gravel
-						Gray, moist, medium dense, 49.8% fines, 50.2%	47-48 ft: Grab Sample GS-25
-						fine to coarse sand, trace subangular gravel (Less	- WC = 56.4% -
						Weathered Springwater Formation) S-24, 45-46.5 ft: Similar to SS-23A, B	LL = 77, PL = 40, PI = 37 Fines = 38.6%, Sand = 36.3%, Gravel = 25.1%
 -			S-24			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,	
50	50.0					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	
		1.50	SS-26	7-14-33		Springwater Formation) SILTY SAND WITH GRAVEL WITH COBBLES	1 1
	51.5			<mark>(</mark> 47)		(SM)	-
-	51.5					Gravish brown, moist, dense, fine to coarse sand,	S-27, 51.5-52.1 ft: Basalt cobbles, gray, fine
-						±20% fines, ±15% fine to coarse subrounded to subangular gravel less than 1.5" diameter (Less	grained, fresh, with a mechanical break, 5°, fresh,
-						Weathered Springwater Formation)	rough, hardness R5, clay surrounding Basalt
- 1						S-27, 50-51.5 ft: Similar to SS-26 S-27, 51.5-52.1 ft: Basalt cobbles	-
			S-27			S-27, 52.1-54 ft: Very dense, fine to coarse sand,	4
						±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%
55	55.0					S-27, 54-55 ft: CLAYEY GRAVEL WITH SAND	LL = 33, PL = 22, PI = 11
		0.83	SS-29	31-50/4"		AND COBBLES (GC) Grayish brown, moist, very dense, fine to coarse	Fines = 19.8%, Sand = 30.4%, Gravel and Cobbles = 49.8%
	55.8	0.05	33-29	(50/4")		sand, ±19.8% fines, ±30.4% fine to coarse sand,	S-30 did not complete fit in the sample box
1 7						fine to coarse subangular to subrounded gravel, 4" diameter cobble (Less Weathered Springwater	becasue it is a gravelly layer
						Formation)	-
					.: ::!·	SILTY SAND WITH GRAVEL (SM)	4 -
-						Grayish brown, moist, very dense, ±20% fines, ±15% fine to coarse subangular basalt gravel less	4 -
-			S-30			than 1.5" diameter, lightly cemented,	Cond is comparted disintegrates with factor
						disintegrated with finger pressure (Less Weathered Springwater Formation)	Sand is cemented, disintegrates with finger
						S-30, 55-59 ft; Similar to SS-29	
					.: : [:]: [:	S-30, 59-60 ft: Similar to SS-29 except 29.9%	59-60 ft: Grab Sample GS-31 Fines = 29.9%, Sand = 38%, Gravel = 32.1%
60						fines, 38% fine to coarse sand 59.8 ft: Increase in sand content	-20.070, -30.070 , -30.070 , -32.170
					بالقاب الملية		-

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 668.49 ft

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

BORING NUMBER:

SHEET 4 OF 4

CRBF-B-02

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-Ib Auto Trip Hammed Control of the second sec

OPEN INFLORMENT START		DEPTU		21072-200						
MTERNAL (II) PENET INSULTS FRECOVERY (II) PENET INSULTS FRECOVERY (II) SOIL NAME, USSCS (ROOP SYMPOL, COLOR, MOSTURE CONTENT, RELATIVE CHASHY OR CONSISTURE, CONSTRUCTURE, IMMERALOCY DEPTH OF CASING, DRILLING RATE, DRILLING FLUD LOSS, TESTS, AND INSTRUMENTATION 0.00 0.02 SS-22 IS-007 (GOST) SILTY SAND WITH GRAVEL (SM) Graych brown, most, vary dense, fine to cares submydian formation in sand,	1				i	(7)				
RECOMENT (II) RESI (HESULE) Generation Color Note: USCS GROUP SYMBOL, COLOR, MULTING ENKITO'R CHARTYO R MOISTINGE CONTENT, RELATIVE ENKITO'R CHARTYO R MOISTINGE CONTENT, RELATIVE ENKITO'R CHARTYO R MOISTINGE CONTENT, SOLL STRUCTURE, MINERALOCY DEPTH OF CASINO, DRILLING RATE, DRILLING RATE,		-			PENETRATION	00	SOIL DESCRIPTION COMMENTS			
60.0 0.02 88-32 18-505* 60.0 0.02 88-32 18-505* 60.0 0.02 88-32 18-505* 61.0 0.02 88-32 18-505* 65 65.0 0.08 58-35 501* 65 65.0 0.08 58-35 501* 66 06.1 0.08 58-35 501* 67 0.08 58-35 501* 100* 66 66.0 0.08 58-35 501* 67 0.08 58-35 501* 100* 68 53.6 50* 100* 100* 100* 70 0.08 58-36 500* 100* 100* 100* 100* 70 70.5 0.46 58-38 500* 10		INTERV/		-DV (A)	TEST RESULTS	10	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,		
60.0 0.02 88-32 18-505* 60.0 0.02 88-32 18-505* 60.0 0.02 88-32 18-505* 61.0 0.02 88-32 18-505* 65 65.0 0.08 58-35 501* 65 65.0 0.08 58-35 501* 66 06.1 0.08 58-35 501* 67 0.08 58-35 501* 100* 66 66.0 0.08 58-35 501* 67 0.08 58-35 501* 100* 68 53.6 50* 100* 100* 100* 70 0.08 58-36 500* 100* 100* 100* 100* 70 70.5 0.46 58-38 500* 10			RECOVE			APF	MOISTURE CONTENT, RELATIVE DENSITY OR	DRILLING FLUID LOSS, TESTS, AND		
60.0 0.92 \$S.32 18:505" (4) BLTY SAND WTH GRAVEL (SM) Correct denses, fill to corress subargular to subargulare to subargular to subargular to subargulare to subargulare to su				TYPE/ NUMBER		GR	CONSISTENCY, SOIL STRUCTORE, MINERALOGY	INSTRUMENTATION		
65 65.0 0.08 (55.35) 50/4" 50/4" 65.0 65 65.0 0.08 (55.35) 50/4" 65.0 65.0 65 65.0 0.08 (55.35) 50/4" 65.0 65.0 65 65.0 0.08 (55.35) 50/4" 65.0 65.0 70 70.0 5.36 50/5" 50/4" 50.6 ft Grab Sample GS.37 70 70.0 5.36 50/5" 50/4" 50.6 ft Grab Sample GS.37 70 70.0 5.36 50/5" 50/4" 50.6 ft Grab Sample GS.37 70 70.0 5.36 50/5" 50/4" 50.6 ft Grab Sample GS.37 70 70.0 5.36 50/5" 50/6 ft Grab Sample GS.36 60/6 ft Grab Sample GS.37 70 70.0 5.36 50/5 ft 50/6 ft Grab Sample GS.37 65.9 ft Grab Sample GS.37 70 70.0 5.36 60/6 ft 50/5 ft 53/6 ft 53/6 ft 53/6 ft 70 70.0 0.40 88.38 60/6 ft 53/8 ft 53/8 ft 53/8 ft	-		0.92		18-50/5"		Grayish brown, moist, very dense, fine to coarse - sand, ±25% fine to coarse subangular to			
65.1 0.08 55.35 50/1" (50/1") 1 1 (50/1") (50/1") (50/1") 1 1 (50/1") (50/1") (50/1") 1 1 1 (50/1") (50/1") 1 2 3 (50/1") (50/1") 1 5 36 (50/1") (50/1") 1 5 36 (50/1") (50/1") 1 5 36 (50/1") (50/1") 1 5 36 (50/1") (50/1") 1 5 (50/1") (50/1") (50/1") 1 5 (50/1") (50/1") (50/1") 1 5 (50/1") (50/1") (50/1") 1 1 (50/1") (50/1") (50/1") 1 1 (50/1") (50/1") (50/1") 1 1 (50/1") (50/1") (50/1") 1 1 (50/1") (50/1") (50/1") 1 1 1 (50/1") (50/1") </td <td></td> <td></td> <td></td> <td>S-33</td> <td></td> <td></td> <td>cemented (Less Weathered Springwater - Formation) S-33, 60-64.9 ft: Similar to SS-32 except up to 3" - 62-63 ft: Grab Sample GS-34</td> <td>62-63 ft: Grab Sample GS-34</td>				S-33			cemented (Less Weathered Springwater - Formation) S-33, 60-64.9 ft: Similar to SS-32 except up to 3" - 62-63 ft: Grab Sample GS-34	62-63 ft: Grab Sample GS-34		
70 70.0 (50/1*) (50/1*) Fines = 29.8%, Sand = 45.7%, Gravel = 24.5% 70 70.0 S:36 S:36 S:36 Fines = 29.8%, Sand = 45.7%, Gravel = 24.5% 70 70.0 S:36 S:36 S:36 Fines = 29.8%, Sand = 45.7%, Gravel = 24.5% 70 70.0 S:36 S:36 S:36 S:36 Fines = 29.8%, Sand = 45.7%, Gravel = 24.5% 70 70.0 S:36 S:36 S:36 S:37 Fines = 29.8%, Sand = 45.7%, Gravel = 24.5% 70 70.0 S:36 S:36 S:37 Gravel at arc score s	65							_		
70 70.0 70 70.0 70 70.0 70 70.0 70 70.0 70 70.0 70 70.0 70.1 70.0 70.2 70.0 70.5 0.46 85.38 50/5.5" 70.5 0.46 85.39 50/5.5" 70.5 0.46 70.5 0.46 85.39 50/5.5" 70.5 0.46 85.39 50/5.5" 75 76.0 75 75.0 75.4 0.42 SS.40 50/5" 50/5" 75 76.0 75.4 0.42 SS.40 50/5" 50/5" 75 76.0 75.4 0.42 SS.40 50/5" 50/5" 75 76.0 75.4 0.42 SS.40 50/5" 50/5" 75.4 0.42 SS.40 50/5" 5		65.1	0.08	<u>SS-35</u>						
70 70.0 70 70.6 70.5 0.46 \$S:38 50/5.5" (50/5.5") 70.5 0.46 70.5 0.46 70.5 0.46 70.5 0.46 70.5 0.46 70.5 0.46 70.5 0.46 70.5 0.46 70.6 75.75.0 75.75.0 75.0 75.75.0 50/5" 75.75.0 50/5" 75.75.0 75.0 75.75.0 75.0 75.75.0 50/5" 75.75.0 75.0 75.75.0 75.0 75.75.0 75.0 75.75.0 75.0 75.75.0 50/5" 75.75.0 75.0 75.75.0 75.0 75.75.0 <td></td> <td></td> <td></td> <td>S-36</td> <td>(30/1)</td> <td></td> <td>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 S-36, 67.4-68.8 ft: POORLY GRADED GRAVEL</td> <td></td>				S-36	(30/1)		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 S-36, 67.4-68.8 ft: POORLY GRADED GRAVEL			
70.5 0.46 SS-38 50/5.5" 6 (50/5.5") (50/5.5") SILTY SAND WITH GRAVEL AND COBBLES 8 SJ, 68.8-70 IK Similar to SS-35 SILTY SAND WITH GRAVEL AND COBBLES 9 Dark gray, moist, very dense, ±12% fines, ±15% 1 S-39 9 Dark gray, moist, very dense, ±12% fines, ±15% 1 Giameter, cemented, disintegrated with finger 1 S-39 1 S-39 1 S-39 1 S-39 1 S-39 1 S-39, 70-73 ft. Similar to SS-38 except cobbles 1 S-39, 70-73 ft. Similar to SS-38 except tobbles 1 S-39, 70-73 ft. Similar to SS-38 except tobbles 1 S-39, 73-75 ft. Similar to SS-38 except tobbles 1 Giameter 1 S-39, 70-73 ft. Similar to SS-38 except tobbles 1 Giameter 1 S-39, 70-73 ft. Similar to SS-38 except tobbles 1 Giameter 1 Giameter 1 Giameter 1 Giameter 1 Giameter	70	70.0					Gray to dark gray, dry to moist, very dense, ±10% fines, ±30% fine to coarse sand, fine to coarse			
75 75.0 50.40 50.75" SS-30 SS		70.5	0.46	SS-38			diameter, mixture of cemented sand and sand			
75 75.0 required to disintegrate cemented parts, contains cobles up to 4" diameter 75.4 0.42 SS-40 50/5" (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 to cemented, disintegrates with finger pressure (Less Weathered Springwater Formation) Remove 6" casing from 0-75 ft 0.42 SS-40 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) 0.0.5 ft: Asphalt cold patch to match existing conditions				S-39			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			
75.4 0.42 SS-40 50/5" (50/5") 1111 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) 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 4.5 ft 46 Bentaria event	75	75.0					required to disintegrate cemented parts, contains			
 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) 			0.42	SS-40						
					(50/5")/	<u>ec i <u>p</u> i .</u>	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)	Backfilled with: 0-0.5 ft: Asphalt cold patch to match existing conditions 0.5-1.5 ft: Bentonite chips		
80	80									

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 687.52 ft

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

BORING NUMBER:

SHEET 1 OF 6

CRBF-B-03

1	DEPTH					START : 11/19/21 08:58 END : 11/2	22/21 12:55 LOGGER : L. Bhaumik
DEPTHE	BELOW GR	servaria, conserva-	RFACE (ft)	The second	00	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	RY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
	0.0		S-1			2.5 in: ASPHALT CONCRETE PAVEMENT 12.5 in: BASE GRAVEL 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)	6" diameter casing used
- - - 5_	5.0					-	
-	6.5	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)	
- - - - - - - - - - - - - - - - - 	10.0		S-3			S-3, 5-10 ft: Similar to SS-2 except trace fine subrounded gravel - - -	
-	11.5	1.50	SS-4	1-4-6 (10)		Similar to SS-2 except ±5% fine to coarse sand, trace organics consisting of roots	-
- - - - 15	15.0		S-5			S-5, 10-15 ft: Similar to SS-4 - - - -	
-	16.5	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
- - - - 20			S-7			S-7, 15-16.5 ft: Similar to SS-6 except medium to high plasticity	

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 687.52 ft

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

BORING NUMBER:

SHEET 2 OF 6

CRBF-B-03

WATER	DEPTH	: Not rec	orded			START : 11/19/21 08:58 END : 11/	22/21 12:55 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	OUND SU	RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
-	20.0 21.5	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%
	25.0		S-9			S-9, 20-216 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)	
	26.5	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	WC = 38.8% LL = 54, PL = 29, PI = 25 Fines = 91.8%, Sand = 8.2%, Gravel = 0%
- - - - - - - - - - - - - - - - - - -	30.0		S-11			Springwater Formation) 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	
-	31.5	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	WC = 37.8% LL = 50, PL = 31, PI = 19 Fines = 91.8%, Sand = 8%, Gravel = 0.2%
- - - - 35_	35.0		S-13			Formation) 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
	36.5	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	WC = 64.7% LL = 70, PL = 41, PI = 29
- - - - - - - -			S-15			(Sensitive Saprolite of the Springwater Formation) S-15, 35-40 ft: No recovery	

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 687.52 ft

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

BORING NUMBER:

SHEET 3 OF 6

CRBF-B-03

WATER	DEPTH	: Not rec	orded		-	START : 11/19/21 08:58 END : 11/	22/21 12:55 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	OUND SU	IRFACE (ft)		LOG	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE		PENETRATION TEST RESULTS	GRAPHIC LC	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	B		
-	40.0	1.50	SS-16	3-4-6 (10)		SILTY SAND WITH GRAVEL (SM) Light gravish 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%
- - - - - - - - - - - - - - - -	45.0		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
	50.0		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 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%
-	51.5	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% -
	55.0		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	
55	55.0	0.92	SS-23	25-50/5" (50/5")		SILTY SAND WITH GRAVEL AND COBBLES (SM)	
- - - - - - - - - - - - - - - - - 	55.9		S-24	(220)		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 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

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 687.52 ft

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

BORING NUMBER:

SHEET 4 OF 6

CRBF-B-03

	DEPTH		20070-2000			START : 11/19/21 08:58 END : 11/22/21 12:55 LOGGER : L. Bhaumik
1	BELOW GF				C	SOIL DESCRIPTION COMMENTS
	INTERV	AL (ft)		PENETRATION	PO	
	1	RECOVE	ERY (ft)	TEST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, MOISTURE CONTENT, RELATIVE DENSITY OR DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY INSTRUMENTATION
-	60.0 61.5	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
- - - - 65	65.0		S-27			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
-	66.5	1.50	SS-28	2-7-7 (14)		SILTY SAND WITH GRAVEL (SM) Gravish 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
	70.0		S-29			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 68-69 ft: Grab Sample GS-30 Fines = 37.5%, Sand = 31.3%, Gravel = 31.2%
-	71.3	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
	75.0		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,
-	76.5	1.50	SS-34	6-40-42 (82)		some parts disintegrated with pressure from putty knife, 4" diameter cobbles at 74, 74.6 ft (Less Weathered Springwater Formation) SILTY SAND WITH GRAVEL (SM) Grayish brown, moist, very dense, ±15% fines,
			S-35			±15% fine to coarse subangular to subrounded gravel less than 1.5" diameter, fine to coarse sand (Less Weathered Springwater Formation)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 AMGrayish 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 gray76.5-77 ft: Grab Sample GS-36 WC = 16.1% LI = 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

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 687.52 ft

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

BORING NUMBER:

SHEET 5 OF 6

CRBF-B-03

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-Ib Auto Trip Hammed Control of the second sec

WATER	DEPTU	· Not ros	20070-2000					
1			IRFACE (ft)		(1)	SOIL DESCRIPTION	/22/21 12:55 LOGGER : L. Bhaumik COMMENTS	
	INTERVA	CALLING CHILDREN		PENETRATION	PO	COL DECOMI HOM		
		RECOVE	ERY (ft)	TEST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,	
			TYPE/	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
-	80.0 80.8	0.75	SS-37	16-50/3" (50/3")		SILTY SAND WITH GRAVEL (SM) Gravish 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 - - -	<u>85.0</u> 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) S-41, 85-89 ft: Similar to SS-40 except trace	- 85.5-86.5 ft: Grab Sample GS-42	
- - - 90	90.0		S-41			reddish brown iron oxide staining 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 S-44	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) 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,	Gravel brown, some gray, vesicular basalt, cemented sand, disintegrated with finger pressure	
- - 95	95.0	0.75	SS-46	25-50/3"		trace reddish brown irox oxide staining, trace green staining SILTY SAND WITH COBBLES (SM)		
	95.8	0.75	S-46	(50/3")		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, 95-98 ft: Similar to SS-46 except 4" diameter cobble at 95.7 and 97.9 ft CLAYEY GRAVEL WITH SAND (GC)		
- - 100						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)	WC = 12.6% Fines = 25%, Sand = 23.2%, Gravel = 51.8%	

SOIL BORING LOG

BORING NUMBER:

CRBF-B-03

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 Hammed Control of Con

WATER DEPTH : Not recorded	2 2	START : 11/19/21 08:58 END : 11/2	22/21 12:55 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)	Ö	SOIL DESCRIPTION	COMMENTS
RECOVERY (ft)	PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
100.0 0.25 SS-49 - - - - - <t< td=""><td>6"-6"-6" (N) 50/3" (50/3")</td><td>CONSISTENCY, SOIL STRUCTURE, MINERALOGY 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</td><td>INSTRUMENTATION 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)</td></t<>	6"-6"-6" (N) 50/3" (50/3")	CONSISTENCY, SOIL STRUCTURE, MINERALOGY 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	INSTRUMENTATION 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)
- - 120		-	-

SHEET 6 OF 6

D3460500

PROJECT NUMBER:

SOIL	BORING LOG	

BORING NUMBER: CRBF-B-04

SHEET 1 OF 5

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

PROJECT NUMBER:

D3460500

ELEVATION: 683.86 ft

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

WATER DEPTH : Not recorded					_	START : 11/22/21 14:57 END : 11/2	23/21 14:25 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)					0	SOIL DESCRIPTION	COMMENTS
	INTERVAL (ft) RECOVERY (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
			TYPE/	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
-	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) 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)	
5	<u>5.0</u> 6.5	1.10	SS-2	4-7-7 (14)	Brown, moist, stiff, low to medium plasticity, trace – fine sand, trace fine subangular gravel, black Mn		
-	10.0		S-3				
10	10.0	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
- - - - - - - - -	15.0		S-5		S-5, 10-15 TE Similar to SS-4	S-5, 10-15 ft: Similar to SS-4	 Driller notes that S-5 was dropped and was later retrieved along with S-7
-	16.5	1.50	SS-6	3-4-5 (9)		Similar to SS-4 except trace reddish brown iron oxide staining	
- - - - 20			S-7			S-7, 15-20 ft: Similar to SS-6 - - - - - - -	

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 683.86 ft

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

BORING NUMBER:

SHEET 2 OF 5

CRBF-B-04

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 Hammed Control of Con

WATER	DEPTH	: Not rec	orded		0150	START : 11/22/21 14:57 END : 11/2	23/21 14:25 LOGGER : L. Bhaumik
1			RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)	ft) PENETRATION TEST RESULTS		GRAPHIC LOG		
		RECOVE	RY (ft)	IEST RESULTS	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/	6"-6"-6"	RAP	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			NUMBER	(Ň)	ß		
-	20.0 21.5	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	WC = 34.2% LL = 48, PL = 33, PI = 15 -
-			S-9			Springwater Formation) S-9, 20-25: Similar to SS-8 except slight gray mottling	- PP = 0.25, 0, 1.25, 0.5 tsf - -
25	25.0					-	-
-	26.5	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	WC = 34.7% LL = 51, PL = 30, PI = 21
- - - - - - - - - - - - - - - - - - -	30.0		S-11			Springwater Formation) S-11, 25-30 ft: Similar to SS-10 except fine subangular gravel layer at 29.7 ft - -	Stop on 11/22/2021 at 16:00 at 26.5 feet Start on 11/23/2021 at 8:45 AM - - - - - -
-	31.5	1.50	SS-12	2-7-9 (16)		LEAN CLAY WITH SAND (CL) Brown mottled gray with black spots of sand,	WC = 32.9% LL = 47, PL = 27, PI = 20 Fines = 79.5%, Sand = 20.3%, Gravel = 0.2%
-			S-13			nodules (Residual Soil of the Springwater Formation)	
						S-13, 34-35 ft: SANDY ELASTIC SILT (MH) Brown mottled gray, moist, firm, medium -	34-35 ft: Grab Sample GS-14 Fines = 62%, Sand = 38%, Gravel = 0%
35	35.0					plasticity, 38% fine to coarse sand, trace fine	_
-	36.5	1.50	SS-15	3-3-5 (8)		subangular gravel, trace reddish brown iron oxide staining, black Mn nodules (Sensitive Saprolite of the Springwater Formation) SS-15: SANDY ELASTIC SILT (MH) Brown mottled gray, moist, firm, medium	WC = 64.6% LL = 66, PL = 38, PI = 28 Fines = 59.6%, Sand = 40.4%, Gravel = 0%
- - - - - - - - - - - - - - - - - - -			S-16			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) 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 -

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 683.86 ft

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

BORING NUMBER:

SHEET 3 OF 5

CRBF-B-04

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-Ib Auto Trip Hammed Control of the second sec

WATER	DEPTH	: Not rec	orded			START : 11/22/21 14:57 END : 11/2	23/21 14:25 LOGGER : L. Bhaumik
DEPTH	BELOW GR	ROUND SU	RFACE (ft)	<u></u>	g	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG	CON NAME LIGOD ODCUD CLAIDSL COLOR	
		RECOVE	ERY (ft)		H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	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	-
- - - - - - - - - - - - - - - - - 	45.0		S-19			plasticity, ± 33% line to coarse sand, ± 13% line to coarse subrounded to subangular gravel less than 1.0" diameter, trace cobbles (Sensitive Saprolite of the Springwater Formation) S-19, 40-45 ft: Similar to SS-18 except up to 3" diameter gravel, one cobble at 44.8 ft	-
-	46.5	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"	45-46 ft: Grab Sample GS-22 WC = 31.7% LL = 42, PL = 35, PI = 7
	50.0		S-21			diameter (Less Weathered Springwater Formation) S-21, 45-46.8 ft: Similar to SS-20 except ±15% fine to coarse subrounded to subangular gravel less than 3" diameter 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	- 48-49 ft: Grab Sample GS-23 - -
	51.3	1.33	SS-24	20-15-50/4" (65/10")		CLAYEY SAND WITH GRAVEL AND - COBBLES (SC) - Grayish brown with rare pink and orange spots,	
-			S-25			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) 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	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%
55	55.0	1.50	SS-27	8-8-6 (14)		gravel less than 1.5" diameter, cemented, disintegrated with finger pressure (Less Weathered Springwater Formation) S-25, 54.7-55 ft. SILT (ML) Similar to SS-27	WC = 36% LL = 40, PL = 26, PI = 14
- - - - - - - - - - - - - 			S-28			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) S-28, 55-60 ft: No recovery	-

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 683.86 ft

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

BORING NUMBER:

SHEET 4 OF 5

CRBF-B-04

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-Ib Auto Trip Hammed Control of Con

WATER	DEPTH	: Not rec	orded			START : 11/22/21 14:57 END : 11/2	23/21 14:25 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	ROUND SU	RFACE (ft)	<u></u>	8	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	CLC		
		RECOVE	ERY (ft)		GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
	60.0 61.5	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	-
- - - - - 65	65.0		S-30			staining (Less Weathered Springwater Formation) S-30, 60-61.7 ft: Similar to SS-29 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% - -
-	66.5	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	WC = 35.2% Fines = 38.9%, Sand = 50.5%, Gravel = 10.6% -
-			S-33			iron-oxide staining, lightly cemented, disintegrated with finger pressure (Less Weathered Springwater Formation) S-33, 65-68.8 ft: Similar to SS-32, except zones with higher fines content, gravel less than 3" diameter	-
- 70	70.0	0.75	SS-35	40-50/3" (50/3")		S-33, 68.8-70 ft: Similar to SS-35 SILTY SAND WITH COBBLES (SM) Grayish brown, moist, very dense, 33.4% fines, -	S-36: Cemented, requires putty knife and hammer
	70.8		S-36	(30/3)		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: 70-75 ft. Similar to SS-35 except gravel less than 3" diameter, pink spots, one 4" diameter cobble 74.5-75 ft	-
	75.0					-	73-74 ft: Grab Sample GS-37 WC = 20.1% LL = 49, PL = 29, PI = 20 Fines = 33.4%, Sand = 54%, Gravel = 12.6%
	75.5	0.42	SS-38	50/6" (50/6")		SILTY SAND WITH GRAVEL AND COBBLES	
-			S-39	<u>(</u> סענ		(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) 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							-

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 683.86 ft

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

BORING NUMBER:

SHEET 5 OF 5

CRBF-B-04

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 Hammed Control of Con

WATER DEPTH : Not recorded		. START : 11/22/21 14:57 END : 11/	23/21 14:25 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)	U	SOIL DESCRIPTION	COMMENTS
INTERVAL (ft) RECOVERY (ft)	PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
TYPE/ NUMBER	(1)	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
85 85.0 0.33 SS-41 - 80.3 SS-41 - 80.5 SS-	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% - - - - - - - - - - - - - -
90 90	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
100			-

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

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-Ib Auto Trip Hammer

WATER	DEPTH	: 9 feet b	as			START : 12/8/21 08:46 END : 12/	/8/21 11:35 LOGGER : L. Bhaumik
1		OUND SU			C	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS 6"-6"-6"			
		RECOVE	RY (ft)	IEST RESULTS	Ê	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
		TLEOOT		01 01 01	API	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	R	CONSISTENCE, SOIL STRUCTURE, MINERALOUT	
				(-7		4 in: ASPHALT CONCRETE PAVEMENT	Start drilling through asphalt and base gravel with
-					•	20 in: BASE GRAVEL	4-1/4" auger -
-					• 👗		
					. •		
							2 ft: Switch to 4-7/8" tricone bit
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-							
I –							4 -
5	5.0						
						LEAN CLAY (CL)	WC = 35.4%
		1.20	SS-1	1-2-4		Slightly reddish brown, moist, firm, medium plasticity, trace fine sand, trace subangular gravel	- LL = 47, PL = 24, PI = 23 - 5 ft: Switch to 4-7/8" drag bit
-	6.5			(6)		less than 0.5" diameter, trace black Mn nodules	
-	C.0					(Residual Soil of the Springwater Formation)	
-							
-							
							-
-							
-	10.0						
10	10.0					LEAN CLAY (CL)	PP = 1.5, 1.5, 2 tsf
-		4.50		3-7-9		Slightly orangish to reddish brown with rare gray	
-		1.50	SS-2	(16)		mottling, moist, very stiff, medium to high plasticity, trace fine to coarse sand, trace black	-
	11.5					Mn nodules (Residual Soil of the Springwater	
						Formation)]
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15	15.0						
						FAT CLAY (CH) Orangish brown mottled gray to gray mottled	PP = 0.25, 0.25, 0.5 tsf WC = 43.1%
		1.50	SS-3	2-5-5 (10)		brown, moist, stiff, high plasticity, trace black fine	LL = 67, PL = 30, PI = 37
	16.5			(10)		to coarse sand, trace black Mn nodules, trace fine	Driller reported that a clay collar in the boring from
	10.0					gravel subrounded to subangular (Residual Soil of the Springwater Formation)	- 0-15 ft. Re-drill 0-15 ft with 6" drag bit. 15 ft: Switch to 6" drag bit.
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SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 669.23 ft

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

BORING NUMBER:

SHEET 2 OF 3

CRBF-B-05

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-Ib Auto Trip Hammer

WATER DEPTH : 9 feet bqs START: 12/8/21 08:46 END: 12/8/21 11:35 LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION **GRAPHIC LOG** PENETRATION TEST RESULTS INTERVAL (ft) SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) MOISTURE CONTENT, RELATIVE DENSITY OR DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBE (N) ELASTIC SILT (MH) PP = 0.5, 0, 0 tsf 20.0 Brown mottled gray with pink rare spots, moist, firm, high plasticity, ±15% fine to coarse sand, trace black Mn nodules (Sensitive Saprolite of the WC = 69.5% 1-3-3 1.50 SS-4 LL = 74, PL = 43, PI = 31 (6) 215 Springwater Formation) 25 25.0 SANDY ELASTIC SILT (MH) WC = 78.4% LL = 59, PL = 38, PI = 21 Light grayish brown with black spots, moist, firm, 2-3-4 1.50 SS-5 Fines = 53.4%, Sand = 46.1%, Gravel = 0.5% medium plasticity, 46% fine to coarse sand, 1% (7) fine to coarse subangular to subrounded gravel 26.5 less than 1.0" diameter, trace black Mn nodules (Sensitive Saprolite of the Springwater Formation) 30 30.0 SILTY SAND WITH GRAVEL (SM) WC = 26.0%Light gravish brown with with rare yellow seams and black spots, moist, dense, 30.7% fines, fine to Fines = 30.7%, Sand = 52.1%, Gravel = 17.2% 16-12-19 1.50 SS-6 30 ft: Switch to 4-7/8" drag bit (31)coarse sand, 17.2% fine to coarse subangular to 31.5 subrounded gravel less than 1.0" diameter, trace black Mn nodules, very lightly cemented (Less Weathered Springwater Formation) Sand easily disintegrates with finger pressure 30-35 ft: Occasional rig chatter 35 35 0 23-50/0.5 SILTY SAND (SM) 35 ft: Switch to 4-7/8" tricone bit 0.54 SS-7 35.5 (50/0.5")Grayish brown, lightly cemented, very dense, Disintegrates with finger pressure ±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) 40

	CRBF-B-05	SHEET	3	OF	3
SOIL B	ORING LOG				

BORING NUMBER:

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

PROJECT NUMBER:

D3460500

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-Ib Auto Trip Hammer

		: 9 feet b			_	START : 12/8/21 08:46 END :	12/8/21 11:35 LOGGER : L. Bhaumik
DEPTH E	EPTH BELOW GROUND SURFACE (ft)		8	SOIL DESCRIPTION	COMMENTS		
	INTERV	AL (ft) RECOVE	ERY (ft) TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOG'	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
<u> </u>	40.0	0.00	SS-8	50/<1/4"	1.1.1.1	No Recovery	Installed 1" PVC standpipe piezometer
				(50)		Bottom of Boring at 40.25 ft below ground surface	 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
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PROJECT NUMBER: BORING NUMBER: D3460500 CRBF-B-06 SHEET 1 OF 2		SOIL BORING LOG				
PROJECT NUMBER: BORING NUMBER:	D3460500	CRBF-B-06	SHEET	1	OF	2
	PROJECT NUMBER:	BORING NUMBER:				

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

	DEPTH		200220200			START : 12/28/21 14:23 END : 12/	8/21 15:30 LOGGER : L. Bhaumik
1			RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	P		a an ann angead distant priority. Bu
		RECOVE	RY (fft)	TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
		ALCOVIL		CII CII CII	API	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	ß	SCHOOLENGT, SOIL STRUCTORE, MINELVALOUT	
						4 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 3 7/8" drag/spade bit
					•	20 in: BASE GRAVEL	
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						-	1
						-	-
							-
						-	
5_	5.0						WC = 30.7%
				1-2-3		FAT CLAY (CH) Orangish-brown mottled gray, moist, firm, medium	WC = 30.7% LL = 55, PL = 25, PI = 30
		0.80	SS-1	(5)		plasticity, trace fine to coarse sand, ±10%	
	6.5			.,		subrounded to subangular gravel less than 1.0" diameter, trace reddish-brown iron oxide staining	
						(Residual Soil of the Springwater Formation)	
							1 -
						-	
						-	-
						-	-
						-	-
10	10.0						
						LEAN CLAY (CL)	PP = 0.5, 1.5, 1.5 tsf
		1.50	SS-2	5-7-10		Orangish-brown mottled gray, moist, very stiff, low to medium plasticity, ±10% fine to coarse sand,	-
-	11 E			(17)		trace reddish-brown iron oxide staining (Residual	-
	11.5					Soil of the Springwater Formation)	-
							4 -
							4 -
						-]
15	15.0					-	1
	10.0					FAT CLAY (CH)	WC = 32.5%
		1.50	SS-3	4-7-10		Orangish-brown mottled dark to light gray, moist,	LL = 53, PL = 27, PI = 26
		1.50	33-3	(17)		very stiff, medium plasticity, trace fine to coarse sand, trace reddish-brown iron oxide staining,	4 -
	16.5					black Mn nodules (Residual Soil of the	4 -
						Springwater Formation)	4 -
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-						-	-
20							

	CRBF-B-06	SHEET	2	OF	2
SOIL E	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

BORING NUMBER:

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

PROJECT NUMBER:

D3460500

WATER	DEPTH	: Not rec	orded		2	START : 12/28/21 14:23	END : 12/8	21 15:30 LOGGER : L. Bhaumik		
DEPTH E	BELOW GR	ROUND SU	IRFACE (ft)		C	SOIL DESCRIPTION		COMMENTS		
10.0125.5	INTERVA	AL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG			1		
		RECOVE		IEST RESULTS		SOIL NAME, USCS GROUP SYMBOL	COLOR,	DEPTH OF CASING, DRILLING RATE,		
		RECOVE			d l	MOISTURE CONTENT, RELATIVE DE	NSITY OR	DRILLING FLUID LOSS, TESTS, AND		
			TYPE/ NUMBER	6"-6"-6"	R R	CONSISTENCY, SOIL STRUCTURE, MI	NERALOGY	INSTRUMENTÁTION		
	00.0		NUMBER	(N)		Similar to SS-3 except medium to high	placticity	PP = 3.25, 1.75, 1.75 tsf		
I _	20.0			0 40 44		Similar to 55-5 except medium to high	piasucity	PP = 5.25, 1.75, 1.75 ISI		
		1.50	SS-4	6-10-14 (24)						
-	21.5			(27)			-			
- 1	21.0						-			
-							-			
I _							_			
-	1						-			
- 1							-			
-							-			
							_			
25	25.0									
						SANDY ELASTIC SILT (MH)		WC = 66.8%		
I -	1	1.50	SS-5	2-2-6		Light gray, dark brown, black, moist, fir plasticity, 44.3% fine to coarse sand, 0	m, medium –	LL = 64, PL = 40, PI = 24		
-		1.50	55-5	(8)		gravel, trace black Mn nodules (Sensiti	.8% TINE	Fines = 54.9%, Sand = 44.3%, Gravel = 0.8%		
I _	26.5				*****	Saprolite of the Springwater Formation) _			
						Bottom of Boring at 26.5 ft below groun	nd surface	Backfilled with:		
- 1						5 5	_	0-0.5 ft: Asphalt cold patch to match existing conditions		
-							-	0.5-1.5 ft: Concrete		
-							-	1.5-26.5 ft: Bentonite chips		
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D3460500	CRBF-B-07	SHEET	1	OF
PROJECT NUMBER:	BORING NUMBER:			

6

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : G

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

START : 8/15/22 09:20 WATER DEPTH : Not recorded END: 8/15/22 16:28 LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION 6 PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND SOIL NAME, USCS GROUP SYMBOL, COLOR, RECOVERY (ft) MOISTURE CONTENT, RELATIVE DENSITY OR INSTRUMENTATION CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBE (N) Start advancing borehole with 4-7/8" drag bit 2.5 LEAN CLAY (CL) PP = 0, 0, 0.25 tsf Orangish-brown, moist, firm, low to medium plasticity, $\pm 10\%$ fine to coarse sand, trace 1-3-5 1.50 SS-1 (8) organics roots, trace black Mn nodules, trace 4.0 reddish-brown iron oxide staining (Residual Soil ST-2 of the Springwater Formation) 4-5 ft: 400 psi 5-6 ft: 700 psi 5 ST-2 6.0 FAT CLAY (CH) PP = 0.5, 1.75. 0.5 tsf Orangish-brown, trace gray molting, stiff, ±5% WC = 35%4-6-7 1.50 SS-3 LL = 56, PL = 23, PI = 33 fine to coarse sand, trace subangular to (13)subrounded gravel (Residual Soil of the Springwater Formation) 7.5 ST-4 LEAN CLAY (CL) 7.5-8.5 ft: 500 psi Gray and tan, moist, stiff, medium plasticity, 8.5-9.5 ft: 800 psi ST-4 trace reddish-brown iron oxide staining WC = 29.8% (Residual Soil of the Springwater Formation) LL = 46, PL = 25, PI = 21 9.3 10 10.0 LEAN CLAY (CL) PP = 2.5, 2.5, 2 tsf Brown with trace gray mottling, moist, stiff, 4-6-9 1.50 SS-5 medium plasticity, ±5-15% fine to coarse sand, (15) trace subangular to subrounded gravel, trace 11.5 black Mn nodules, trace iron oxide staining (Residual Soil of the Springwater Formation) 12.5 Similar to SS-5 except very stiff, persistent gray PP = 1.75, 1.25, 1.5 tsf mottling, 12.9%, fine to coarse sand WC = 30.1% 6-8-10 1.50 SS-6 LL = 48, PL = 24, PI = 24 (18) Fines = 87.1%, Sand = 12.9%, Gravel = 0% 14.0 ST-7 14-15 ft: 650 psi ST-7 15-15.5 ft: 800 psi 15 15.5 FAT CLAY (CH) Orangish-brown, mottled gray, moist, stiff, medium to high plasticity, ±10% fine to coarse 4-5-8 PP = 1.5, 0.5, 1.5 tsf 1.50 SS-8 (13)Short clay collars retrieved from borehole sand, trace subangular to subrounded gravel, 17.0 black spots of sand and gravel, trace black Mn nodules, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)

S	OIL BORING LOO	3			
D3460500	CRBF-B-07			OF	6
PROJECT NUMBER:	BORING NUMBER:				

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.

WATER DEPTH		
WATER DEPTF	1. INOL RECORDED	

WATER	WATER DEPTH : Not recorded START : 8/15/22 09:20 END : 8/15/22 16:28 LOGGER : L. Bhaumik							
DEPTH B	ELOW GR	OUND SU	RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS	
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	CLC			
		RECOVE	ERY (ft)		H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION	
	20.0		NUMBER	(14)		Similar to SS-8 except trace red mottling in the	PP = 1, 1.75, 1.75 tsf	
-	20.0	4.50	SS-9	4-5-8		gray parts, ±5% sand -		
-		1.50	22-2	(13)		-	-	
-	21.5					-	-	
						-	-	
						-	-	
						-	-	
						-	-	
						-	-	
						-	-	
25	25.0					FAT CLAY WITH SAND (CH)	PP = 0, 0, 0 tsf (<0.25 tsf)	
				2-3-5		Gray and brown parts, moist, firm, medium to -	WC = 55.7%	
		1.50	SS-10	(8)		high plasticity, ±15% fine to coarse sand, trace subangular to subrounded gravel, trace black	LL = 72, PL = 33, PI = 39	
	26.5					Mn nodules, trace reddish-brown iron oxide	-	
						staining (Sensitive Saprolite of the Springwater Formation)	-	
						-	-	
						-	-	
						-	-	
						-	-	
						-	-	
30	30.0							
-				3-6-10		SANDY SILT WITH GRAVEL (ML) Gray, trace white and orange spots, moist, very -	PP = 0, 0, 0 tsf (<0.25 tsf)	
-		1.50	SS-11	(16)		stiff, ±35% fine to coarse sand, ±15% fine to coarse subangular to subrounded gravel <1.5"	-	
-	31.5					dia, trace iron oxide staining (Sensitive Saprolite _	-	
-						of the Springwater Formation)	-	
-						-	-	
						-	-	
						-		
						-		
						-		
35	35.0 35.2	0.20	SS-12	50/1		POORLY GRADED GRAVEL (GP)		
		0.20	00.12	(50/1")		Subangular gravel < 1" dia recovered two		
-						broken gravel pieces (Less Weathered	4 4	
-					••		4	
-					! • ●	-	Very slow drill rig progress. Drill rig chatter	
-						-		
					• •	-		
					` •	-	4 4	
						-	4 4	
					[. 🖌	-	4 4	
40					-			

SOIL BORING LOG

CRBF-B-07

BORING NUMBER:

SHEET 3 OF 6

EI 3 OF 6

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

PROJECT NUMBER:

D3460500

WATER DEPTH : Not recorded						START : 8/15/22 09:20	END: 8/15	/22 16:28 LOGGER : L. E	Bhaumik
1			RFACE (ft)		C	SOIL DESCRIPTION		COMMENTS	Chadmin
	INTERVAL (ft) PENETRATION TEST RESULTS				GRAPHIC LOG				
		RECOVE	RY (ft)	TEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL, O	OLOR,	DEPTH OF CASING, DRILLING	
			TYPE/	6"-6"-6"	ΔP	MOISTURE CONTENT, RELATIVE DENS CONSISTENCY, SOIL STRUCTURE, MINE		DRILLING FLUID LOSS, TEST INSTRUMENTATION	S, AND
			NUMBER	(N)	Ū	· · ·			
	40.0	0.80	SS-13	19-50/4 (50/4")		SILTY SAND WITH GRAVEL (SM) Gray, moist, very dense, fine to coarse	sand -		-
	40.8			(30/4)		lightly cemented, disintegrated with fing	er		_
						pressure, ±15% fines, ±20% fine to coa subangular to subrounded gravel less the	irse han 2 0"		_
						diameter (Less Weathered Springwater	r _		_
						Formation)			_
									_
]		_
									_
45	45.0								_
	45.4	0.40	SS-14	50/5 (50/5")		Similar to SS-13 except with reddish-bro oxide staining	own iron		
						oxide staining			_
									_
									_
]		
							1		-
							_		-
							-		-
50	50.0						_		-
						LEAN CLAY (CL) Gray mottled orangish brown, moist, ve	ny ctiff	Switch to 4-7/8" drag bit PP = 2.75, 1.75, 2.25 tsf	
		1.50	SS-15	9-12-18 (30)		low to medium plasticity, trace fine to co	oarse	WC = 29.8%	-
	51.5			(00)		sand, trace reddish-brown iron oxide sta (Less Weathered Springwater Formatio	aining [–]	LL = 40, PL = 24, PI = 16	-
						(2000 Would for a philig water Formatic	-		-
									-
							-		-
							-		-
							-		-
							-		-
55	55.0						-		-
						SANDY FAT CLAY (CH) Gray with rare pink and brown spots, ha	ard	Switch to 4-7/8" tricone bit	
1		1.50	SS-16	13-16-23 (39)		medium to high plasticity, ±40% fine to	coarse		-
	56.5			(00)		sand, trace fine to coarse subangular to subrounded gravel <1" diameter (Less) [–]		-
1						Weathered Springwater Formation)	-		-
1							-	Drill rig chatter	-
							-		-
							-		-
							-		-
							-		-
60							-		-

c	OIL BORING LO	2				
D3460500	CRBF-B-07	SHEET	4	OF	6	
PROJECT NUMBER:	BORING NUMBER:					

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.

LOGGER : L. Bhaumik

START : 8/15/22 09:20 END : 8/15/22 16:28

1	WATER	DEPTH	: Not	recorded	

DEPTH E	ELOW GR	OUND SU	RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft)		PENETRATION TEST RESULTS	CLO		
		RECOVE	ERY (ft)		H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/	6"-6"-6"	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
	60.0	0.00	NUMBER	(N) 50/0.5		No Recovery	
-	00.0	0.00		(50/0.5")			-
-						-	-
-						-	-
-						-	-
-						-	-
-						-	-
-						-	
-						-	
-						-	_
65	65.0			50.15			
-	65.4	0.40	SS-18	50/5 (50/5")		SILTY SAND (SM) Gray, moist, very dense, fine to coarse sand,	_
_				(00.07		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					-	
			<u>SS-19</u>	50/0.2 (50/0.2")		No Recovery	Hammer bouncing off gravel/cobble
-				(30/0.2)		-	
-						-	
						-	
-						-	
-						-	-
-						-	-
-						-	-
-						-	1
75	75.0					-	
					[]]]]	CLAYEY SAND WITH GRAVEL (SC)	WC = 16.8%
-		1.50	SS-20	19-30-29 (59)		Grayish brown, moist, very dense, lightly - cemented, disintegrated with finger pressure,	LL = 29, PL = 18, PI = 11 Fines = 24.6%, Sand = 58.4%, Gravel = 17%
-	76.5			(59)		24.6% fines, 17% subangular to subrounded gravel <1" diameter, reddish brown iron-oxide	-
-	10.0					staining (Less Weathered Springwater	1
-						Formation)	-
-						-	-
-						-	-
-						-	-
-						-	-
80						-	-
00					11141		•

CRBF-B-07

SOIL BORING LOG

BORING NUMBER:

SHEET 5 OF 6

ET 5 OF 6

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-Ib Auto Trip Hammer

PROJECT NUMBER:

D3460500

-	DEPTH :	A Providence of the Providence			ND : 8/15/2	12 16:28 LOGGER : L. Bhaumik		
1			RFACE (ft)		C	SOIL DESCRIPTION		COMMENTS
	DEPTH BELOW GROUND SURFACE (ft) INTERVAL (ft) RECOVERY (ft) TYPE/ NTPE/ (N)			PENETRATION	LO			
1				IEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL, COLO	DR,	DEPTH OF CASING, DRILLING RATE,
1				6"-6"-6"	AP	MOISTURE CONTENT, RELATIVE DENSITY (CONSISTENCY, SOIL STRUCTURE, MINERAL	OR OGY	DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	(N)	ъ			
	80.0					SILTY CLAYEY SAND WITH GRAVEL		
1 -		0.70	SS-21	27-21-19		(SC-SM) Gray, moist, dense, lightly cemented sand,	1	-
	81.5			(40)		disintegrated with finger pressure, trace	- 1	-
	01.5					subangular to subrounded gravel <1.5" diameter, ±30-35% fines (Less Weathered	- 1	-
- 1					<i>[]_</i> :-	Springwater Formation)		Heavy drill rig chatter
-								
- 1								-
- 1							-	-
I -							_	-
_								_
85	85.0							
		0.90	SS-22	10-50/4		Similar to SS-21 except ±10% fine to coarse subangular to subrounded gravel <2.5"	e	
1	85.9	0.00	00.22	(50/4")		diameter, very dense	1	-
-							1	-
-							- 1	-
							- 1	-
- 1							- 1	-
- 1								-
- 1							-	-
- 1								Hoovy drill rig chatter
- 1								Heavy drill rig chatter
90	90.0				<i>[]_</i> .			
I .				10 04 04		Similar to SS-21 except 31.4% subangular to subrounded gravel <1.5" diameter, 15.5% fir	to \ ines - I	WC = 14.4% LL = 24, PL = 20, PI = 4 -
		1.50	SS-23	18-24-24 (48)		very dense	F	Fines = 15.5%, Sand = 53.1%, Gravel = 31.4%
	91.5							
							1	
1 -					<u>//:</u> :		1	Heavy drill rig chatter
1 -							- 1	-
1 -							- 1	-
1 -								-
-								-
-								-
95	95.0	0.00		13-50/1		Similar to SS-23, except very dense		
-	<u>95.6</u>	0.60	SS-24	(50/1")	<i>[]</i>].	Similar to 00 20, 00000 1013 00150		-
- 1								-
- 1								-
I -								_
1 -								_
1								_
1 -							1	-
I -							1	-
100							- 1	-
100					$//_{i}$			

ELEVATION: 673.22 ft

PROJECT NUMBER: D3460500		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)

DRILLING CONTRACTOR : Western States Soil Conservation Inc.

	DEPTH :					START : 8/15/22 09:20 END : 8/15	5/22 16:28 LOGGER : L. Bhaumik		
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)		PTH BELOW GROUND SURFACE (ft) O SOIL DESCRIPTIO					SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	RY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION		
	100.0	0.90	SS-25	23-37-37 (74)		Similar to SS-23, except very dense	-		
	101.5			(+)		Bottom of Boring at 101.5 ft below ground	Backfilled with:		
-						surface -	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							1		

AH(3) CI MDW-) H4	-(HRMP MDW-)H4				
J Y2V: 7: :	 C-HNUUG	LS)) I	6	(N	5

L(RT-(HRMPT(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

-	N. S.	Not reco	Contraction of the		010020		END : 8/23/	I, 6" casing, 2" O.D. Split-Barrel Sampler, 140-lb Auto 1 V/22 10:00 LOGGER : L. Bhaumik	TIP TIG
		OUND SUF			C	SOIL DESCRIPTION	110:0/20	COMMENTS	
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	LO				-
		RECOVE	RY (ft)	TEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL, COLO	.OR,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
			TYPE/ NUMBER	6"-6"-6"	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY CONSISTENCY, SOIL STRUCTURE, MINERAL		INSTRUMENTATION	
	0.0		NUMBER	(N)	\sim	6 in: ELASETI C(MCH) I) AEF) W) M			_
	0.0				\frown	1.5 ft: PHEF) T - EL)			-
					•				-
					.				-
					, , , , , , , , , , , , , , , , , , , 	S-1, 2-5ft: T) EMCTEB 0CT1			-
			S-1			Brown, moist, soft, low to medium plasticity	у, -		-
						trace fine to coarse sand, black Mn nodule trace organics consisting of roots, trace	[,] s, -		-
						reddish-brown iron oxide staining			-
									-
									-
5_	5.0					Similar to S-1			_
		0.80	SS-2	1-1-1			- 4-		-
		0.00	33-2	(2)		S-3, 5-10 ft: Similar to S-1 except trace fine coarse subrounded to subangular gravel <	e to ≈ 2" ¯		-
-	6.5					diameter, micaceous, becomes stiffer at 9			-
									-
									-
			S-3						-
			3-3						-
								9-10 ft: Grab Sample GS-4	-
-									-
10	10.0					S-6, 10-15ft:) TELI R. LRI ORS PHEF)	т		-
		0.10	SS-5	8-5-8		EMÚ C(T) L OWS1 Gray with orange mottling, moist, stiff, low t			-
	44 E	0.10	000	(13)		medium plasticity, trace fine to coarse sand	d, -		-
	11.5					±15% fine to coarse subgrounded to subrounded gravel <3" one 5" diameter ba	asalt -		-
						subrounded gravel <3", one 5" diameter ba cobble at 12.5 feet, black Mn nodules, trace	e -		-
						reddish-brown iron oxide staining	- 1		-
			S-6						-
			-						-
							- 1	14-15 ft: Grab Sample GS-7	-
15	15.0						- 1	LL = 50.1, PL = 29.2, PI = 20.9	-
, [~] _					<i>711)</i>	LEMUBT) EMCTEBORS PHEF) T CCT1		1	-
		1.50	SS-8	6-24-48 (72)		Gray to brown, moist, hard, low plasticity, ±30-40% fine to coarse sand, ±15% fine to	, 1		-
	16.5			(12)		coarse subrounded to subangular gravel < diameter, trace reddish-brown iron oxide	: 2" 「		-
						staining	- 1		-
						S-9, 15-20ft: Similar to SS-8 except gravel	< 3"		-
						diameter			-
			S-9				1	18-19 ft: Grab Sample GS-10	
1							1		
							1		
20]		

- (HRMP MDW-)H4
C- HNU UG

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L(RT-(HRMPT(P

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline

DRILLING CONTRACTOR : Western States Soil Conservation Inc.

LOCATION : Gresham, OR (664596.96 N, 7740458.17 E)

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

AH(3) CIMDW-) H4 JY2V: 7::

WATER DEPTH : Not recorded

ELEVATION: 631.89 ft

WATER	DEPTH :	Not reco	orded			START : 8/17/22 09:10 END : 8/23	22 10:00 LOGGER : L. Bhaumik
DEPTH E	ELOW GR	OUND SU	RFACE (ft)		DOG	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	CLC		
		RECOVE	ERY (ft)		Ĕ	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
-	20.0 21.5	1.30	SS-11	3-29-50 (79)		LRTI B CTEB) B LEMU ORS PHEF) T EMU C(T) L (LCULWI Gray to brown, moist, very dense, fine to coarse sand, ±30-40% fines, ±15% fine to coarse subangular to subrounded gravel <2" diameter, trace in equip existing	
- - - - 25	25.0		S-12			trace iron-oxide staining, trace yellow spots 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%
	25.9	0.90	SS-14	37-50/5" (50/5")		S-15, 25-30ft: CTEB) B LEMJ OR S PHEF) T EMJ C(T) L CLC1 Gray, moist, ±20-30% fine to corase subangular	
- - - - - - 30	30.0		S-15			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	27-28 ft: Grab Sample GS-16
-	30.9	0.60	SS-17	14-50/5" (50/5")		CTEB) B LEMJ OR S PHEF) T 0.C1 Brown, some gray parts, moist, very dense, - ±20% fines, ±15% fine to coarse subangular to	
	35.0		S-18			subrounded gravel < 2" diameter, some parts are lightly cemented, disintegrated with finger pressure, trace reddish-brown iron oxide staining 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	
-	35.9	0.90	SS-19	4-50/5" (50/5")		S-20, 35-40ft: CTEB) B LEMJ OR S PHEF) T EMJ C(T) L CLC1 Gray, moist, ±30% fines, ±15% fine to coarse	
			S-20			subangular to subrounded gravel < 3" diameter, trace reddish-brown iron oxide staining, lightly cemented, disintegrates with finger pressure, 6" diameter cobble at 35 ft	

AH(3) CI MDW-) H4	- (HRMP MDW-) H4		
J Y2V: 7: :	C- HNU UG	LS)) I	

Y (N 5

LOGGER : L. Bhaumik

L(RT-(HRMPT(P

END: 8/23/22 10:00

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-Ib Auto Trip Hammer

START : 8/17/22 09:10

WATER	DEPTH :	Not recorded	
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DEPTH BELOW GROUND SURFACE (ft) INTERVAL (ft) RECOVERY (ft) TYPE/ NUMPERD (A) PENETRATION TST RESULTS O SOIL DESCRIPTION SOIL DESCRIPTION SOIL DESCRIPTION SOIL DESCRIPTION SOIL DESCRIPTION SOIL DESCRIPTION CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
DECOVERY (#) TEST RESULTS GECOVERY (#) SOIL NAME, USCS GROUP SYMBOL, COLOR,	
	DEPTH OF CASING, DRILLING RATE,
MOISTURE CONTENT, RELATIVE DENSITY OR TYPE/ 6"-6" & CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION
TYPE/ 6"-6" ⋛ CONSISTENCY, SOIL STRUCTURE, MINERALOGY NUMBER (N) 0	INOT COMENTATION
40.0 0.00 SS-21 50/5" [1+1- S-22, 40-45ft; LRT B LEMU OR S PHEF) T	
40.4 (50/5") EMU C(T) L 0LW1	0.5-41.5 ft: Grab Sample GS-23
Gray, moust, very dense, is. 2.76 miles, lightly	VC = 13.8% -
pressure, 25.6% gravel, subrounded to _ L	L = 21.8, PL = 19.3, PI = 2.5 ines = 19.2%, Sand = 55.2%, Gravel = 25.6%
- subangular <2" diameter, trace iron-oxide - staining, 5" diameter cobble at 40 ft -	nies – 19.2 %, Sand – 33.2 %, Graver – 23.0 %
S-22	1
	-
	-
	-
	-
45 No Recovery in SS 45	5-46 ft: Grab Sample GS-26
	5-10 II. Orab Sarripte 05-20 -
0.00 SS-24 (26) 1.11 S-25, 45-50tt: Similar to S-22, 4" diameter	_
46.5 (200) (
	-
	-
	1
- S-25	-
	-
	-
	-
	_
- 150 00 07 14-32-44 C(T) L CLCULW1 -	_
1.50 SS-27 (76) Gray, trace spots of pink, vellow, and green.	J
51.5 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	1
S-28, 51.5-54ft: Similar to SS-27 except	1
- Cemented, disintegrates with pressure from - 53	3-54 ft: Grab Sample GS-29
- cobble at 52 ft	
- S-28, 54-55ft: Increase in gravel content to -	-
- ±40% -	-
55 55.0 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	ton on 9/17/2022 at 2:55 DM at 55 foot
	otop on 8/17/2022 at 3:55 PM at 55 feet Start on 8/18/2022 at 9:05 AM -
Gray, moist, very dense, ±30% fines, fine to	
coarse sand, ±30% fine to coarse subangular to subrounded gravel <3" diameter	6-57 ft: Grab Sample GS-32
	-
S-31, 57-60ft: CTEB) B LENU OR S PHEF) T	1
- EMJ C(T) L 0_C1 - Gray, moist, very dense, ±15% fines, ±15% fine	1
to corase subangular to subrounded gravel < 58	8-59 ft: Grab Sample GS-33
2.5" diameter, cemented, disintegrates with pressure from putty knife and hammer, 5"	
diameter cobble at 57 ft	-
	F
60	

AH(3)CIMDW-)H4	- (HRMP MDW-)H4			
J Y2V: 7: :	C-HNUUG	LS)) I	2	(N

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LOGGER : L. Bhaumik

L(RT-(HRMPT(P

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

DRILLING CONTRACTOR : Western States Soil Conservation Inc.

END: 8/23/22 10:00

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

START: 8/17/22 09:10

WATER	DEPTH	· Not	recorded	

ELEVATION: 631.89 ft

DEPTH BELOW GROUND SURFACE (ft)			Ø	SOIL DESCRIPTION	COMMENTS		
	INTERVA	L (ft)		PENETRATION TEST RESULTS	DOL		
		RECOVE	RY (ft)	PHIC		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/	6"-6"-6"	₹ I	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
			NUMBER	(N)	O		
_	60.0	0.50	SS-34	5-50/5"		S-35, 60-65ft: Similar to S-31 from 57-60ft	-
_	60.9			(50/5")		_	_
							61-62 ft: Grab Sample GS-36
_						_	-
-			S-35			-	-
-			3-33			-	-
-						-	-
-						-	-
65	65.0					-	-
05	05.0					S-38, 65-70ft: CTEB) B LEMJ OR S PHEF) T	
-		1.50	SS-37	9-18-32		EMJ C(T) L 0LC1 Gray, moist, dense, rare green, red, and orange	-
-	00.5	1.00		(50)		spots, ±30% fines, fine to coarse sand, ±20%	-
-	66.5					fine to coarse subangular to subrounded gravel _ <3" diameter, trace iron-oxide staining, trace	-
-						organics consisting of roots, cemented,	67-68 ft: Grab Sample GS-39
-						disintegrates with pressure from putty knife and _ hammer, 5" diameter cobbles at 65.8 and 69 ft	-
-			S-38				-
-			3-30			-	-
-						-	-
-						-	-
70	70.0			44.50/4		S-41, 70-71.2ft: Similar to S-38	_
-	70.8	0.70	SS-40	14-50/4" (50/4")			-
-						-	-
-						S-41, 71.2-75ft: NEI CTEB 0CS1 Dark green, moist, hard, medium to high	PP > 4.5 tsf
-						plasticity, ±10% fine to coarse sand, trace fine to -	72-73 ft: Grab Sample GS-42
-						coarse subrounded to subangular gravel, trace reddish-brown iron oxide staining, trace white	LL = 51.6, PL = 24.3, PI = 27.3
_			S-41			staining _	-
_						-	-
_						-	-
_						-	-
75	75.0					S-44. 75-80ft: Similar to S-41 from 71.2 to 75 ft	_
_				14-21-31		except ±5% fine to coarse subangular to -	_
_		1.50	SS-43	(52)		subrounded gravel <2.5" diameter	_
_	76.5					_	_
_						_	_
_						_	
_						_	
			S-44			_	78-79 ft: Grab Sample GS-45
_							
					\langle / \rangle		
80							

AH(3) CIMDW-) H4	- (HRMP MDW-)H4		
J Y2V: 7: :	C-HNUUG LS)) I	7

END: 8/23/22 10:00

L(RT-(HRMPT(P

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LOGGER : L. Bhaumik

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-Ib Auto Trip Hammer

START : 8/17/22 09:10

WATER DEPTH : Not recorded	
	Г

DEPTH B	ELOW GR	OUND SUI	RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS
	INTERVA	L (ft) RECOVE	-RY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
		RECOVE	TYPE/ NUMBER	6"-6"-6" (N)	GRAPI	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION
-	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 -
- - - - - - - - - - - 85	81.3		S-47			S-47, 81-85ft: CTEB) B PHEF) T ORS LEMJ EMJ C(T) L (PC1 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 -
	85.5	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 - - -
- - - 90	90.0		S-51				88-89 ft: Grab Sample GS-52 - -
-	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 - -
- - - 95_	95.0					- - -	- - - -
	95.1	0.10	<u>SS-56</u>	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	
- - 100							-

- (HRMP MDW-)H4	
C-HNUUG	L

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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

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

WATER DEPTH . Not recorded

WATER	DEPTH -	NA PROVIDE LAND	and the second			START : 8/17/22 09:10 END : 8/23	3/22 10:00 LOGGER : L. Bhaumik
1			RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS
	INTERV	AL (ft)		PENETRATION TEST RESULTS	P		
		RECOVE	ERY (ft)	LOT NEGOLIG	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	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 (PC1 Grayish brown to gray, moist, very dense,	Stop on 8/18/2022 at 4:25 PM at 100 feet Start on 8/19/2022 at 8:40 AM -
- - - - - - - - - - - - - - - - - - -						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	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%
			S-59				
110	<u>110.0</u> 110.3	0.30	SS-63	50/4" (50/4")		S-64, 110-120ft: Similar to S-59 except 3-7"	
-				(30/4)		diameter cobbles	- 111-112 ft: Grab Sample GS-65
- - - 115_ -			S-64			-	
- - - - - - - - - - - - - - - - - - -							- 118-119 ft: Grab Sample GS-66 -

AH(3)CIMDW-)H4	- (HRMP_MDW-)H4				
J Y2V: 7::	C- HNU UG	LS)) I	9	(N	5

END: 8/23/22 10:00

LOGGER : L. Bhaumik

L(RT-(HRMPT(P

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

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-Ib Auto Trip Hammer

START : 8/17/22 09:10

WATER DEP	TH Not recorded	
VVAILIN DLI	III. NULICLUIUCU	

ELEVATION: 631.89 ft

DEDTU					324	START . 6/11/22 09.10	END . 0/23	
DEPTHE	ELOW GR		RFACE (III)	DENETRATION	8	SOIL DESCRIPTION		COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	L C			PERSONAL RECORDERED STOCK OF POPULATION AND INCOMENCES AND ADDRESS AND ADDRE
		RECOVE	-RY (ft)	LOTALOOLIO	l ₹	SOIL NAME, USCS GROUP SYMBOL, MOISTURE CONTENT, RELATIVE DEN	COLOR,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
I		1420012			AP	MOISTURE CONTENT, RELATIVE DEN	ISITY OR	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
1			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MIN	ENALUGY	
	400.0			(N) 26.50/4"		C CO 420 420th Cimiler to C C4 even	t grou	
	120.0 120.6	0.60	SS-67	26-50/1" (50/1")		S-68, 120-130ft: Similar to S-64 excep	organd -	
1 -	120.0					brown, rare red parts, ±30% fine to co ±20% fines, 3-6" diameter cobbles	arse sanu, -	
- 1							-	-
Ι.							_	
							-	122-123 ft: Grab Sample GS-69
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125								
120			0.00				—	1
I -			S-68				-	4 4
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1 7							_	
							-	128-129 ft: Grab Sample GS-70
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- 1							-	-
130	130.0	0.40	00.74	50/01				
	130.2	0.10	_SS-71_	50/2" (50/2")		S-72, 130-140ft: Similar to S-68 excep fines	ot ±25%	130.01-131 ft: Grab Sample GS-73
- I				(30/2)		lines	-	
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J Y2V: 7: :	C- HNU UG	LS)) I

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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

WATER DEPTH : Not recorded		START : 8/17/22 09:10 END : 8/23	3/22.10:00 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE	(ft) (D	SOIL DESCRIPTION	COMMENTS
INTERVAL (ft)	PENETRATION		
RECOVERY (ft	TEST RESULTS O	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
		MOISTURE CONTENT, RELATIVE DENSITY OR	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
TYP	E/ 6"-6" 23 BER (N) 5	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
140.0 0.10 SS-	5 50/3"	S-76, 140-140.5ft: Similar to S-72	Stop on 8/19/2022 at 4:05 PM at 140 feet
- 140.3 - - - - - - -	(50/3")	S-76, 140.5-145ft: T) EMCTEB OR S PHEF) T EMJ C(T) L CCT1 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	Start on 8/22/2022 at 9:55 AM
- - 145	5	S-76, 145-150ft: PHEF) TT) B T) EMCTEB ORS C(T) L 0CT1 - 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 <u>150.0</u> 150.2 0.10 SS-	9_1 50/2"	- S-80, 150-152.5ft: CTEB) B PHEF) T OR S	Driller reported that borehole will be advanced
	(50/2")	C(T) L CPC1 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	with water from 150 ft, this will wash away the fines and sand around any basalt pieces
		S-80, 152.5-155 ft: J R.RM) 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	
155 <u>155.0</u> - - - - - - - - - - - - - - - - - - -	2	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	
- - 160		-	

ELEVATION: 631.89 ft

180

AH(3)CIMDW-)H4	- (HRMP MDW-)H4			
J Y2V: 7::	C- HNU UG	LS)) I	5	(

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L(RT-(HRMPT(P

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

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-Ib Auto Trip Hammer

START : 8/17/22 09:10 END: 8/23/22 10:00 WATER DEPTH : Not recorded LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) SOIL DESCRIPTION COMMENTS 6 PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION SOIL NAME, USCS GROUP SYMBOL, COLOR, RECOVERY (ft) MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ (N) S-83, 160-161.5ft: Similar to S-82 160.0 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

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

SOIL BORING LOG

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3W8YE86 D n 2y2R/Pra

CI6WW6DAL: D8IEL8: InHt,ati-Fadat, Fswals-,tixdaws-6-uR

CI6WW10DA B38Q; CEDC3#N67B3D8 nLB3±yy08iduG<5bBIfIsadipb2±94SCidMgvab2±94S8iwus-tgvabC6; RCRFenovagdiitnFdoentib120±nbElas8iwu;Qdooti

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PROJECT NUMBER:	BORING NUMBER:					
D3460500	CBRF-B-09	SHEET	2	OF	3	
10						

SOIL BORING LOG

71: V3L8 ngl mml I - Jvanidaas- 7vetnwit, 7isjtua±Jwu,vtf H dati7vetnwit W LE86 D n Ait, vdo b: I = "2.40760 Db..204P0760 3T

3W8YE86 D n 2y2RyPra

CI6WW6DAL: D8IEL8: InHt,ati-Fadat, Fswals-,tixdaws-6-uR

WAA3I nWRqvdlovG

F8EI 8 n491"9000Pt55 3DC n491"90011r24

CI6WW10DA B38Q: CEDC3#N67B3D8 nLB3±yy08iduG<5bBIfIsadipb2±94SCidMgwab2±94S8iwus-tgwabC6: RCRFemwagdiitnFdoentib120±nbElas8iwa-Cdooti

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

SOIL BORING LOG

71: V3L8 ngl mnl I - Jwanidaws- 7 vet nwrt, 7 isjt ua±Jw wyvtf H dati7 vet nwrt W LE86 D nAit, vdo b: 1 = "2, 4050 Db., 204P0R50 3T

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

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

WATER	WATER DEPTH: 44 to 47.8 feet bgs					START : 3/30/21 14:18 END : 4/1	1/21 11:45 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	ROUND SU	RFACE (ft)		DG	SOIL DESCRIPTION	COMMENTS
	INTERV/	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
—						2 in: ASPHALT CONCRETE PAVEMENT	 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 7.5	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	PP = 3.5, 2.75, 2.5 tsf
	10.0					Formation)	
-	11.5	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	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
-						Formation)	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.
15	15.0						
-	16.5	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	PP = 3.25, 2.75, 2.75 tsf
	10.0					oxide staining, black Mn nodules (Residual Soil of the Springwater Formation)	

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 612.31 ft

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

BORING NUMBER:

SHEET 2 OF 5

FWP-LI-BH01

	NUMBER OF STREET	1-	7.8 feet bo	203			/21 11:45 LOGGER : L. Bhaumik
1			RFACE (ft)	3	C	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION	PO		
		RECOVE	RY (ft)	TEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/	6"-6"-6"	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			NUMBER	(N)	Ū		
	20.0			5740		LEAN CLAY WITH SAND (CL) Brown mottled gray, moist, very stiff, medium	PP = 1.25, 3, 1.75 tsf
		1.50 SS-5		5-7-10 (17)	5-7-10	plasticity, ±15% fine to coarse sand, ±5% fine	
	21.5					subangular gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater	
						Formation)	
	23.0						-
							ST-6 recovery 1.9 ft (in tube)
-		1.80	OTC				- 23-23.5 ft: 150 psi 23.5-24 ft: 250 psi
		1.00	ST-6				24-24.5 ft: 450 psi
-	24.8						- 24.5-24.75 ft: 650 psi -
25				470		LEAN CLAY (CL)	PP = 2.25, 2.25, 2 tsf
		1.50	SS-7	4-7-8 (15)		Brown mottled gravish brown and gray, moist, stiff, medium to high plasticity, trace fine to coarse	1 · · · ·
-	26.3			(/		suil, medium to high plasticity, trace line to coarse sand, trace fine subangular gravel, reddish-brown	
-						iron oxide staining, trace black Mn nodules	
-						(Residual Soil of the Springwater Formation)	-
-							-
							-
I -							-
							_
30	30.0						
						LEAN CLAY (CL) Gray mottled brown, moist, soft, medium	PP = 2, 2, 1.25 tsf WC = 28.4%
		1.50	SS-8	4-6-9 (15)		plasticity, trace fine to coarse sand, trace fine	LL = 41, PL = 22, PI = 19
	31.5			(10)		subangular gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater	Driller reported he will redrill the clay collar formed at 1-20 ft in the borehole
						Formation)	
							1 -
							1 -
							1 -
-							Small scepage at same spot as 3/30/21. Driller
	25.0						 reported he redrilled 1-3 ft of borehole very well, seepage controlled. Soil near seepage area is like
35	35.0					SS-9A, 35-36 ft: LEAN CLAY WITH SAND (CL)	a water bed, on application of pressure more
		1.50	00.0	3-5-9		Brown mottled gray, moist, stiff, medium to high	- drilling fluid seeps out. PP = 1.5, 0, 2.5 tsf
-		1.50	SS-9	(14)		plasticity, ±20% fine to coarse sand, trace fine \ subangular gravel, reddish-brown iron oxide /	(2.5 tsf is from SS-9B, 1.5 tsf is from top 2" of SS-
-	36.5			 		staining (Residual Soil of the Springwater) (ÀA)
-						\Formation) SS-9B, 36-36.5 ft: FAT CLAY (CH)	4 -
-						Dark gray slightly mottled brown, moist, stiff, high	4 -
						plasticity, trace fine sand, reddish-brown iron oxide staining (Residual Soil of the Springwater	4 -
-						Formation)	4 -
							-
							4 -
40							

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 612.31 ft

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

BORING NUMBER:

SHEET 3 OF 5

FWP-LI-BH01

WATER DEPTH : 44 to 47.8 feet bqs				s		START : 3/30/21 14:18 END : 4/1/	21 11:45 LOGGER : L. Bhaumik
DEPTH E	ELOW GR	OUND SU	RFACE (ft)	80-2223-33333-53	DG	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
-	40.0 41.5	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
- - - - 45_	45.0					-	-
-	46.5	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
- - - - 50	50.0					-	
-	<u>51.5</u>	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 - -
- - - - - - - - - -	55.0					-	-
	<u>56.5</u>	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	Sample split in SS, no PP - -
-						of the Springwater Formation)	
- 60							59 ft: Driller reported very stiff soil

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 612.31 ft

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

BORING NUMBER:

SHEET 4 OF 5

FWP-LI-BH01

WATER DEPTH : 44 to 47.8 feet bo	IS .	START : 3/30/21 14:18 END : 4/1/	21 11:45 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)	g	SOIL DESCRIPTION	COMMENTS
INTERVAL (ft) RECOVERY (ft)	PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
TYPE/ NUMBER	6"-6"-6" 80 (N)	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
60.0 - 1.50 SS-14 - 61.5	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	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.
		Weathered Springwater Formation)	
1.50 SS-15 66.5	17-14-23 (37)	CLAYEY SAND WITH GRAVEL (SC) Gravish 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	SS-15 last 1/4" SPT hammer bouncing off possible gravel encountered at that depth 65-70 ft: Driller reported intermittent drill clatter.
- - - - 70_70.0		Weathered Springwater Formation)	
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 (I worthcord Spirpayetar Competing)	Cemented sand, disintegrates with finger pressure.
75 75.0		(Unweathered Springwater Formation) -	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 monument to accomodate future installation of a VWP data logger. Driller reported he will run the 4-7/8" tricone bit to
- 1.50 ss-17 76.5	33-30-35 (65)	Similar to SS-16 except ±20% gravel less than 1.15" diameter, trace reddish-brown iron oxide staining	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
		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		-	-

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)

PROJECT NUMBER:

ELEVATION: 612.31 ft

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

BORING NUMBER:

WATER DEPTH : 44 to 47.8 feet bgs								
			RFACE (ft)	5	(7)	SOIL DESCRIPTION	LIND . 4/ 1/4	COMMENTS
	INTERV	and a second		PENETRATION TEST RESULTS	GRAPHIC LOG			
	INTERV/	100	- D) ((0)	TEST RESULTS	^o	SOIL NAME, USCS GROUP SYMBOL, COLOR,		DEPTH OF CASING, DRILLING RATE,
1		RECOVE	:RY (ft)		Ч	MOISTURE CONTENT, RELATIVE DENS	ITY OR	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6"	SR^	CONSISTENCY, SOIL STRUCTURE, MINER	RALOGY	INSTRUMENTATION
			NUMBER	(N)	0			Installed VWP taped outside 1" PVC standpipe
- 1							-	piezometer -
							_	0.1 ft: 12" diamater, 12" doop monument set in
								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
- I							_	Well # L141460
I .							_	Base of VWP is at 70.8 ft below ground surface.
1								Field VWP Ro
85							1	(1) 8730.943 (2) 8720 125
05_								(2) 8729.125 (3) 8731.106
1 -							-	(4) 8730.133
1 -							_	Àverage Ro = 8730.327
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100								

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

WATER DEPTH : Not recorded						START : 3/29/21 09:16 END : 3/29	9/21 10:35 LOGGER : L. Bhaumik
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)					SOIL DESCRIPTION	COMMENTS
	RECOVERY (ft)			PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
⊢			NUMBER	(N)	$\overline{}$	- 2 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
						8 in: BASE GRAVEL	
5	<u>5.0</u> <u>6.5</u>	1.50	SS-1	3-5-5 (10)		LEAN CLAY (CL) Brown mottled gravish 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	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							-

SOIL BORING LOG

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

PROJECT NUMBER:

D3460500

ELEVATION: 596.27 ft

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

BORING NUMBER:

SHEET 2 OF 2

FWP-LI-BH02

WATER DEPTH : Not recorded						START : 3/29/21 09:16 END : 3/2	9/21 10:35 LOGGER : L. Bhaumik
DEPTH	DEPTH BELOW GROUND SURFACE (ft)					SOIL DESCRIPTION	COMMENTS
	INTERVAL (ft) PENELIRATION TEST RESULTS RECOVERY (ft)			PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH C MOISTURE CONTENT, RELATIVE DENSITY OR DRILLING	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
-	20.0 21.5	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
-	-					-	
- 25_	25.0						
	26.5	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	PP = 3, 3, 2.25 tsf
- - - - - - - - - - - - - - - - - - -	26.5					subangular gravel, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation) 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
- - - - - - - - - - - - - - - - - - 	-						

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

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

WATER DEPTH : Not recorded						START : 3/29/21 12:00 END : 3/2	9/21 13:51 LOGGER : L. Bhaumik
DEPTH B	DEPTH BELOW GROUND SURFACE (ft)					SOIL DESCRIPTION	COMMENTS
	INTERVAL (ft) PENETRAT TEST RESU RECOVERY (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
						2 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.
						9 in: BASE GRAVEL	
]
							-
							-
	4.0						
-							
5_		2.00	ST-1			_	ST-1 -
-	6.0						- 4-5 ft: 150 psi - 5-6 ft: 200 psi
	0.0					FAT CLAY (CH)	4 ft: Switch to 3-7/8" drag bit. PP = 3.25, 3.25, 2.25 tsf
		1.20	SS-2	2-3-6 (9)		Grayish brown mottled brown, moist, stiff, high plasticity, trace fine to coarse sand, trace	- PP = 5.20, 5.20, 2.20 tsi -
	7.5			(3)		reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the Springwater]
						Formation)	
							-
							-
10	10.0					Similar to SS-2 except brown mottled gray, $\pm 5\%$	PP = 1.75, 2.5, 2 tsf
-		1.50	SS-3	2-4-6		fine to coarse sand, reddish-brown iron oxide staining, black Mn nodules	WC = 31.1% - LL = 56, PL = 23, PI = 33
-	11.5	1.00	000	(10)		staining, black with houses	LL = 30, FL = 23, FI = 33
-	11.5						-
							12 ft: Driller reported stiffer soil Driller reported he had to redrill 0-15 ft of the
							borehole
							4 -
-							4 -
15	15.0					Similar to SS-2 except brown mottled grayish	Sample split in SS, no PP
-		1.50	SS-4	3-6-7		brown, trace fine subangular gravel, reddish-brown iron oxide staining	-
	16.5		004	(13)		rounsi-brown non onde stanning	
	10.0						1 -
] -
							4 -
20					/////		I

	FWP-LI-BH03	SHEET	2
SOIL B		3	

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

PROJECT NUMBER:

D3460500

ELEVATION: 575.90 ft

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

BORING NUMBER:

OF 2

WATER DEPTH : Not recorded						START : 3/29/21 12:00 END : 3/2	29/21 13:51 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)					00	SOIL DESCRIPTION	COMMENTS
	INTERVAL (ft) RECOVERY (ft)		PENETRATION TEST RESULTS (ft)		SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION	
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	
-	20.0 21.5	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
-							
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 - - - - - - - - - - - - -
- 40							1

a a a a a a a a a a a a a a a a a a a	OIL BORING LOG					
D3460500	FWP-PRI-BH01	SHEET	1	OF	5	
PROJECT NUMBER:	BORING NUMBER:					

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-

WATER DEPTH : 60.1 to 64.2 feet bqs START : 4/8/21 09:22 END: 4/9/21 11:48 LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION Pog PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBEI (N) 1/8-2 in: ASPHALT CONCRETE PAVEMENT Core asphalt with 14" core bit, then remove base gravel with 7" "cookie cutter" bit at 1 ft, then backfill 10-11.9 in: BASE GRAVEL with bentonite chips (provision for 8" diameter piezometer monument) Advance borehole with 4-7/8" tricone bit 5 5.0 LEAN CLAY (CL) PP = 1.75, 2.25, 2.25 tsf Brown or grayish brown, moist, stiff, medium plasticity, ±5% fine to coarse sand, trace fine WC = 29.3% 3-5-6 1.50 SS-1 LL = 40, PL = 22, PI = 18(11)subangular to subrounded gravel less than 0.5" 5 ft: Switch to 4-7/8" drag bit 6.5 diameter, reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater Formation) 10 10.0 Similar to SS-1 except trace fine to coarse sand, PP = 2.75, 2.75, 2 tsf no gravel, traced reddish-brown iron oxide 4-5-7 1.50 SS-2 staining, fewer black Mn nodules (12) Drilling fluid seeps out from soil on south side of 11.5 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. 13.0 Bottom of ST-3 similar to SS-2 ST-3 13-13.5 ft: 150 psi 0.30 ST-3 13.5-14 ft: 250 psi 14-14.25 ft: 250 psi 14.5 14.25-14.5 ft: 600 psi Similar to SS-1 except brown mottled gray, firm, Driller reported ST not full because softer soil could 15 ±10% fine to coarse sand, fine subangular gravel not be recovered 1-2-4 1.50 SS-4 PP = 1.75, 0.75, 0.75 tsf (6)16.0

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Pipeline Road, Gresham, OR (667173.02 N, 7734244.95 E)

PROJECT NUMBER:

D3460500

ELEVATION: 624.75 ft

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

BORING NUMBER:

FWP-PRI-BH01

SHEET 2 OF 5

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-

END: 4/9/21 11:48 WATER DEPTH : 60.1 to 64.2 feet bqs START : 4/8/21 09:22 LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION **GRAPHIC LOG** PENETRATION TEST RESULTS INTERVAL (ft) SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBEI (N) PP = 1, 1, 0.75 tsf WC = 30.4% LEAN CLAY (CL) 20.0 Brown mottled grayish brown slightly mottled 3-3-5 1.50 SS-5 gray, moist, firm, medium plasticity, 7% fine to LL = 37, PL = 21, PI = 16 (8) coarse sand, trace reddish-brown iron oxide Fines = 93.3% 215 staining, black Mn nodules (Residual Soil of the Clay collar surrounding drill rod retrieved from Springwater Formation) borehole 24.5 ft: Driller reported slight rig clatter 25_ 25.0 Similar to SS-5 except stiff, ±5% fine to coarse PP = 1, 1, 1.25 tsf sand, trace fine subangular gravel less than 0.5" 5-5-8 1.50 SS-6 diameter, trace black Mn nodules (13)26.5 30 30.0 FAT CLAY (CH) PP = 0.75, 0.75, 2.25 tsf Driller reported he is re-drilling 10-15 ft of the Gray mottled brown, moist, stiff, medium to high 5-6-9 1.50 SS-7 plasticity, trace fine to coarse sand, reddish-brown borehole (15) iron oxide staining (Residual Soil of the 31.5 Springwater Formation) 35 35.0 Similar to SS-7 except very stiff, trace fine PP = 3, 1, 3, tsf subrounded gravel, trace reddish-brown iron 6-7-10 1.50 SS-8 oxide staining, trace black Mn nodules (17) 36.5 40

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Pipeline Road, Gresham, OR (667173.02 N, 7734244.95 E)

PROJECT NUMBER:

D3460500

ELEVATION: 624.75 ft

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

BORING NUMBER:

FWP-PRI-BH01

SHEET 3 OF 5

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-

WATER	DEPTH	: 60 1 to	64.2 feet	bas		START : 4/8/21 09:22 END : 4/9/	/21 11:48 LOGGER : L. Bhaumik
1			RFACE (ft)	Jogo .	C	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	SOL		
		RECOVE	RY (ft)	LOT NEOULIO	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
-	40.0 41.5	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
- - - - 45_	45.0					-	
-	46.5	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	PP = 2, 1.75, 3 tsf
- - - - - 50	50.0					Springwater Formation)	
-	51.5	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	Driller reported slightly stiffer soil after SS-11
	-					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)	
55	55.0						
-	56.5	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
60							11

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-

END : 4/9/21 11:48 WATER DEPTH : 60.1 to 64.2 feet bqs START : 4/8/21 09:22 LOGGER : L. Bhaumik DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION GRAPHIC LOG PENETRATION TEST RESULTS INTERVAL (ft) SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBEI (N) Driller reported no change in soil from 55-60 ft 65 65.0 PP = 1.5, 2, 2.5 tsf Stop at 15:23 on 4/8/21 at 65 ft Similar to SS-12 except trace fine to coarse sand, reddish brown iron staining 6-9-14 SS-13 1.50 Start at 9:38 on 4/9/21 (23)Driller reported drilling is consistent between 55-70 66.5 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 FAT CLAY (CH) PP = 1.75, 1.5, 1.75 tsf Gray mottled brown to grayish brown, moist, very WC = 34.3% 4-7-9 1.50 SS-14 stiff, medium to high plasticity, trace fine to coarse (16) sand, trace fine subangular gravel, black Mn 71.5 nodules, micaceous (Residual Soil of the Springwater Formation) 75 75.0 Similar to SS-16 except hard, trace reddish brown PP = 3.5, 3.25, 2.5 tsf iron staining Driller reported that the soil is stiffer at 75 ft, rig 8-15-20 1.50 SS-15 chatter and harder soil at 75 ft. (35)76.5 78.0 FAT CLAY WITH SAND (CH) WC = 42.6% Light gray brown, moist, very stiff, high plasticity, $\pm 30.40\%$ fine to coarse sand, $\pm 20\%$ fine to coarse subrounded gravel less than 1.5" diameter, roddieb begin with the strength of th 11-9-15 1.50 SS-16 (24) 79.5 reddish-brown iron oxide staining (Residual Soil of the Springwater Formation) 80

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-

WATER	DEPTH	: 60.1 to	64.2 feet	bgs	12	START : 4/8/21 09:22 END : 4	4/9/21	1 11:48 LOGGER : L. Bhaumik
DEPTH B	ELOW GR	OUND SU	RFACE (ft)		C	SOIL DESCRIPTION		COMMENTS
	INTERV	L (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR		DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOG	Ý	INSTRUMENTÁTION
	<u>87.0</u> 88.4	1.40	SS-17			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 Bottom of Boring at 88.4 ft below ground surface		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. SS-17 recovery in sampler is 1.5 ft, lightly cemented, disintegrates easily with finger pressure. Installed 1" PVC standpipe piezometer 0-1 ft: 8" diameter, 12" deep monument set in
90 - - - - - - - - - - - - -						bottom of boning at 00.4 it bolow ground surface		concrete, black dye added to concrete to match existing conditions 1-57 ft: Sentonite chips 57-87 ft: Sand 65-85 ft: Screen Start Card # 1051379 Well # 141469
95 - - - - - - - - - - - - - - - - - -								 - - - - - - - - - - - - -

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661468.20 N, 7741069.04 E)

PROJECT NUMBER:

D3460500

ELEVATION: 706.57 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

BORING NUMBER:

SHEET 1 OF 4

FWP-TB-01

WATER						START : 11/17/21 08:20 END : 11/	17/21 09:47 LOGGER : L. Bhaumik
DEPTH B	ELOW GR	OUND SU	RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE		PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	<mark>(N)</mark>	Ū		
- - - - - - - - - - - - - - - - - - -	0.0	5.00	8-1			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)	
- - - - - - - - - - - - - - - - - - -		10.00	8-2			Similar to S-1 except only fine gravel	18-20 ft: Grab Sample GS-3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661468.20 N, 7741069.04 E)

PROJECT NUMBER:

D3460500

ELEVATION: 706.57 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

BORING NUMBER:

SHEET 2 OF 4

FWP-TB-01

WATER							17/21 09:47 LOGGER : L. Bhaumik
DEPTH E		energen an oralle	RFACE (ft)	newspectrum and an end of the second	8	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft) TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-	20.0		TOMOL	(1)		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
- - - - - - - - - - - - - - - - - - -	30.0					S-6, 30-38 ft: Similar to S-4 from 24-30 ft except occasional red mottling	
- - - - 35_		7.60	S-6				
- - - - - - - - - - - - - - - - - - -						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%

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661468.20 N, 7741069.04 E)

PROJECT NUMBER:

D3460500

ELEVATION: 706.57 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

BORING NUMBER:

SHEET 3 OF 4

FWP-TB-01

WATER DEPT		The second second		0.00	START : 11/17/21 08:20 END : 11/	17/21 09:47 LOGGER : L. Bhaumik
DEPTH BELOW			i i	(7)	SOIL DESCRIPTION	COMMENTS
	RVAL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG		
	RECOVE	-RY (ft)	TEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
		TYPE/	6"-6"-6"	RAP	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
		NUMBER		Ю	,,, _,, _	
40.0 - - - - - - 45 - - - - - - - - - - - - - - - - - -	9.30	S-8	((*)		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)	45-46 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
50 50.0					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	49-50 ft: Grab Sample GS-10
	10.00	S-11			sand, disintegrates with inger pressure (Less Weathered Springwater Formation) 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%

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Carpenter Lane, Gresham, OR (661468.20 N, 7741069.04 E)

PROJECT NUMBER:

D3460500

ELEVATION: 706.57 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

BORING NUMBER:

SHEET 4 OF 4

FWP-TB-01

WATER DEPTH : Not recorded	<u></u>		START : 11/17/21 08:20 END : 11/1	17/21 09:47 LOGGER : L. Bhaumik		
DEPTH BELOW GROUND SURFACE (ft)	and the second		SOIL DESCRIPTION	COMMENTS		
RECOVERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
TYPE/ NUMBER -	6"-6"	GRU	CONSISTENCY, SOIL STRUCTURE, MINERALOGY 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 puty knifw and hammer (Less Weathered Springwater Formation) Bottom of Boring at 60 ft below ground surface	INSTRUMENTATION Backfilled with: 0-2 ft: Bentonite chips and topsoil to match existing conditions 2-60 ft: Bentonite grout		

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661655.46 N, 7741005.48 E)

PROJECT NUMBER:

D3460500

ELEVATION: 703.56 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

BORING NUMBER:

SHEET 1 OF 3

FWP-TB-02

	ATER DEPTH : Not recorded					START : 11/15/21 09:20 END : 11/	15/21 12:15 LOGGER : L. Bhaumik		
DEPTH E	and the second second	the second se		DW GROUND SURFACE (ft)				SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft) TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
	0.0	3.40	S-1			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)	Priller reported softer soil Low recovery		
		4.50	S-3			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)	19-20 ft: Grab Sample GS-4 WC = 29.7% LL = 51, PL = 28, PI = 23		

SOIL	BORING L	OG

BORING NUMBER:

SHEET 2 OF 3

FWP-TB-02

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661655.46 N, 7741005.48 E)

PROJECT NUMBER:

D3460500

ELEVATION: 703.56 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

WATER DEPTH :	Not recorded		START : 11/15/21 09:20 END : 11/15/21 12:15 LOGGER : L. Bhaumik
DEPTH BELOW GRO	OUND SURFACE (1	t) C	SOIL DESCRIPTION COMMENTS
INTERVAL	RECOVERY (ft)	D PENETRATION TEST RESULTS 6"-6"-6" R (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
	5.00 S-5		S-5, 20-29 ft: Similar to S-3
30 <u>30.0</u> - - 31.5	1.50 SS-7	4-5-9 (14)	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) FAT CLAY (CH) Gray, mottled brown to red, moist, stiff, high
- - - 35	2.50 S-8		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
	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

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661655.46 N, 7741005.48 E)

PROJECT NUMBER:

D3460500

ELEVATION: 703.56 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Joe Bohach, Alex McCan

BORING NUMBER:

SHEET 3 OF 3

FWP-TB-02

WATER					_		15/21 12:15 LOGGER : L. Bhaumik
DEPTH B	a sole description of a	enconserve and the	RFACE (ft)	NEWS ANY	00	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE		PENETRATION TEST RESULTS 6"-6"-6"	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	0-0-0 (N)	В		
-		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%
45 50	45.0	10.00	S-12		و با مالا کار از مالا با مالا این کار با این اور این کار این اور این این میکند. میکن اور این میکن میکن این می موجه بالای میکن میکن میکن میکن میکن میکن این میکن میکن میکن این میکن میکن میکن میکن میکن میکن میکن می	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
- - - 55	55.0					Bottom of Boring at 55 ft below ground surface	Driller reported borehole terminated at 54.5 ft,
						Example For the second se	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

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

PROJECT NUMBER:

D3460500

ELEVATION: 703.54 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

BORING NUMBER:

SHEET 1 OF 5

FWP-TB-03

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-Ib Auto Trip Hammed Control of the second sec

DEPTH BELOW GROUND SURFACE (f) PENETRATION TSTRESULTS SOIL DESCRIPTION COMMENTS INTERVAL (f) PENETRATION TSTRESULTS 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1.200	DEPTH			20.5	5	START : 11/15/21 12:30 END : 11/	6/21 12:32	LOGGER : L. Bhaumik	
Implementation Prestruction 0 Prestruction 1 Prestructin 1	1					C		0121 12:02		
0.0 Status 1,97 Status 1,97 Status		INTERVA	AL (ft)	PENETRATION C		P				
0.0 Status 1,97 Status 1,97 Status				RY (ft)	TEST RESULTS	Ę	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF (CASING, DRILLING RATE,	
0.0 Status 1,97 Status 1,97 Status					C!! C!! C!!	API		DRILLING F	LUID LOSS, TESTS, AND TRUMENTATION	
10 100 1.37 SS-2 1-2-2 (4) 1-2-2 (4) Singhty reddish to crangish forwn, moist, soft, trace fine subangular gravel, trace black Min rodules, trace organics consisting of fine roots (Residual Soil of the Springwater Formation) WC = 38.3% LL = 49, PL = 26, PI = 23 0 1.37 SS-2 1-2-2 (4) Singhty reddish to crangish brown, moist, soft, medium plasticity, ±5% fine to coarse sand, trace fine subangular gravel, trace black Min nodules, trace organics consisting of fine roots (Residual Soil of the Springwater Formation) WC = 38.3% LL = 49, PL = 26, PI = 23 10 10.0 1.50 SS-4 3-6.6 (12) Similar to SS-2 except stift, black Min nodules, no organics Image: stable stift, black Min nodules, no organics 11.5 1.50 SS-4 3-6.6 (12) S.5, 10-15 ft: Similar to SS-4 Image: stable stift, black Min nodules, no organics Image: stable stift, black Min nodules, no organics				NUMBER		В	CONSISTENCE, SOLE STRUCTURE, MINERALOOT			
to medium plasticity, trace fine to corses sand, trace fine subangular gravel, trace black Mn nodules, trace organics consisting of fine roots (Residual Soil of the Springwaler Formation) 5 50 50 50 50 50 50 50 50 50 50		0.0				////		Sonic drill with 6" ca	sing and 4" sonic core	
10 10.0 10.0 11.50 SS 4 3.6.6 (12) S.5, 10.15 ft. Similar to SS-4							Slightly reddish to orangish brown, moist, soft, low -			
10 10.0 10.0 11.5 Ss4 3.6.6 (12) Similar to SS-2 except stiff, black Mn nodules, no organics $Ss4 Ss4	- 1						trace fine subangular gravel, trace black Mn			
$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 5 & 5 & 0 & 1 \\ \hline & 5 & 5 & 0 & 1 \\ \hline & 5 & 5 & 0 & 1 \\ \hline & 5 & 5 & 0 & 1 \\ \hline & 5 & 5 & 0 & 1 \\ \hline & 6 & 5 & 1 \\ \hline & 6 & 5 & 1 \\ \hline & 1 & 1 & 1 $	- 1						nodules, trace organics consisting of fine roots			
$\begin{bmatrix} 5 & 5.0 & & & \\ 5 & 5.0 & & & \\ \hline & 5 & 5.0 & & \\ \hline & 1.37 & SS-2 & 1.2.2 \\ \hline & 6.5 & & \\ \hline & 6.5 $	- 1						(Residual Soil of the Springwater Formation)			
$\begin{bmatrix} 5 & 5.0 & & & \\ 5 & 5.0 & & & \\ \hline & 5 & 5.0 & & \\ \hline & 1.37 & SS-2 & 1.2.2 \\ \hline & 6.5 & & \\ \hline & 6.5 $				S-1			-			
Image: Lean CLAY (CL) WC = 38.3% Singhty 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 Sol of the Springwater Formation) S-3, 5-10 ft: Similar to SS-2 WC = 38.3% 10 10.0 Similar to SS-2 Similar to SS-2 except stiff, black Mn nodules, no organics MC = 38.3% 11.5 1.50 SS-4 3.6.6 Similar to SS-2 except stiff, black Mn nodules, no organics Similar to SS-2 11.5 1.50 SS-4 3.6.6 S.5, 10-15 ft: Similar to SS-4 Similar to SS-4				0.						
Image: Lean CLAY (CL) WC = 38.3% Singhty 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 Sol of the Springwater Formation) S-3, 5-10 ft: Similar to SS-2 WC = 38.3% 10 10.0 Similar to SS-2 Similar to SS-2 except stiff, black Mn nodules, no organics MC = 38.3% 11.5 1.50 SS-4 3.6.6 Similar to SS-2 except stiff, black Mn nodules, no organics Similar to SS-2 11.5 1.50 SS-4 3.6.6 S.5, 10-15 ft: Similar to SS-4 Similar to SS-4										
Image: Lean CLAY (CL) WC = 38.3% Singhty 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 Sol of the Springwater Formation) S-3, 5-10 ft: Similar to SS-2 WC = 38.3% 10 10.0 Similar to SS-2 Similar to SS-2 except stiff, black Mn nodules, no organics MC = 38.3% 11.5 1.50 SS-4 3.6.6 Similar to SS-2 except stiff, black Mn nodules, no organics Similar to SS-2 11.5 1.50 SS-4 3.6.6 S.5, 10-15 ft: Similar to SS-4 Similar to SS-4	- T	1								
Image: Lean CLAY (CL) WC = 38.3% Singhty 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 Sol of the Springwater Formation) S-3, 5-10 ft: Similar to SS-2 WC = 38.3% 10 10.0 Similar to SS-2 Similar to SS-2 except stiff, black Mn nodules, no organics MC = 38.3% 11.5 1.50 SS-4 3.6.6 Similar to SS-2 except stiff, black Mn nodules, no organics Similar to SS-2 11.5 1.50 SS-4 3.6.6 S.5, 10-15 ft: Similar to SS-4 Similar to SS-4	l -						-			
Image: Lean CLAY (CL) WC = 38.3% Singhty 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 Sol of the Springwater Formation) S-3, 5-10 ft: Similar to SS-2 WC = 38.3% 10 10.0 Similar to SS-2 Similar to SS-2 except stiff, black Mn nodules, no organics MC = 38.3% 11.5 1.50 SS-4 3.6.6 Similar to SS-2 except stiff, black Mn nodules, no organics Similar to SS-2 11.5 1.50 SS-4 3.6.6 S.5, 10-15 ft: Similar to SS-4 Similar to SS-4		5.0					-			
1.37 SS-2 1.2.2 (4) Slightly reddish to rangish brown, moist, soft, medium plasticity, ±5% fine to coarse sand, trace fine subangular grave, trace black Mn nodules, trace organics consisting of fine roots (Residual Soil of the Springwater Formation) LL = 49, PL = 26, Pl = 23 10 10.0 S.3 S.3 Similar to SS-2 S.3 10 10.0 S.3 Similar to SS-2 except stiff, black Mn nodules, no organics Similar to SS-2 except stiff, black Mn nodules, no organics S.5, 10-15 ft. Similar to SS-4	°-	5.0					LEAN CLAY (CL)	WC = 38,3%		
1.57 SS-2 (4) medium plasticity, ±3% fine to coarse sand, trace fine subangular gravel, trace black Mn nodules, trace organics consisting of fine roots (Residual Soil of the Springwater Formation) 10 10.0 S-3 10 10.0 SS-4 11.50 SS-4 3-6-6 (12) 11.50 SS-4 3-6-6 (12) 11.50 SS-4 3-6-6 (12)	I -		1 97	00.0	1-2-2		Slightly reddish to orangish brown, moist, soft.		= 23	
6.5	- 1		1.31	55-2			medium plasticity, ± 5% fine to coarse sand, trace fine subangular gravel, trace black Mn nodules			
10 10.0 10 10.0 10 10.0 10 1.50 11.5 <	 -	6.5					trace organics consisting of fine roots (Residual			
10 10.0 10 10.0 10 10.0 10 1.50 11.5							Soil of the Springwater Formation)			
10 10.0 - <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>3-3, 3-10 II. 311111di 1033-2</td> <td></td> <td></td>							3-3, 3-10 II. 311111di 1033-2			
10 10.0 - <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>										
11.5 11.5 11.5 Similar to SS-2 except stiff, black Mn nodules, no organics S-5, 10-15 ft: Similar to SS-4	l -			S-3			-			
1.50 ss-4 3-6-6 (12) Similar to SS-2 except stiff, black Mn nodules, no organics 11.5 S-5, 10-15 ft: Similar to SS-4	l -						-			
1.50 ss-4 3-6-6 (12) Similar to SS-2 except stiff, black Mn nodules, no organics 11.5 S-5, 10-15 ft: Similar to SS-4							-			
1.50 ss-4 3-6-6 (12) Similar to SS-2 except stiff, black Mn nodules, no organics 11.5 S-5, 10-15 ft: Similar to SS-4	- 1						-			
1.50 ss-4 3-6-6 (12) organics 11.5 S-5, 10-15 ft: Similar to SS-4	10	10.0					Similar to SS 2 except stiff black Mp podulos, po			
S-5, 10-15 ft: Similar to SS-4	- 1				3.6.6					
S-5, 10-15 ft: Similar to SS-4			1.50	SS-4			-			
		11.5								
							S-5, 10-15 ft: Similar to SS-4			
	- I	1					-			
	l -						-			
	I -	1		S-5						
							-			
							-			
	- 1									
	15	15.0						$W_{\rm C} = 24.49$		
- 4.7-10 ELASTIC SILT (MH) WC = 34.1% Slightly reddish/orangish brown, moist, very stiff, - LL = 50, PL = 30, Pl = 20	I -				4 7 40		Slightly reddish/orangish brown, moist, very stiff		= 20	
1.50 SS-6 (17) medium plasticity, ± 5% fine to coarse sand, trace	I .		1.50	SS-6			medium plasticity, ± 5% fine to coarse sand, trace			
16.5 fine subangular gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)		16.5					tine subangular gravel, trace black Mn nodules (Residual Soil of the Springwater Formation)			
S-7, 10-15 ft: Similar to SS-6	I .						S-7, 10-15 ft: Similar to SS-6			
	1 -	1								
	I -						-			
				Q 7			-			
				3-1						
	- 1						-			
	 -									
20	20									

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

PROJECT NUMBER:

D3460500

ELEVATION: 703.54 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

BORING NUMBER:

SHEET 2 OF 5

FWP-TB-03

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-Ib Auto Trip Hammed Control of Con

1			3.8 feet be			START : 11/15/21 12:30 END : 11/	16/21 12:32 LOGGER : L. Bhaumik
DEPTH	BELOW GR	ROUND SU	JRFACE (ft)	the set to be an in the set of the set of the	g	SOIL DESCRIPTION	COMMENTS
	INTERVAL (ft) PENETRATION TEST RESULTS		GRAPHIC LOG				
		RECOVE	ERY (ft)		H	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/	6"-6"-6"	RAF	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
			NUMBER	(N)	Ū		
-	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	
-	-		S-9			nodules (Residual Soil of the Springwater Formation) S-9, 20-24.5 ft: Similar to SS-8	
-						S-9, 24.5-25 ft: Similar to SS-10	
25	25.0	1.50	SS-10	2-6-8 (14)		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	WC = 37.2% LL = 58, PL = 26, PI = 32
- - - - - - - - - - - - - - - - 	30.0		S-11			Springwater Formation) S-11, 25-30 ft: Similar to SS-10 except from 28.6-29.3 ft with ±10% fine to coarse sand	
-	31.5	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)	
- - - - - - - - - - - - - - - - - 	35.0		S-13			Š-13, 30-35 ft: Similar to SŠ-12 - - - - -	
-	36.5	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)	WC = 71.7% Fines = 46.8%, Sand = 53.2%, Gravel = 0.0%
- - - - - - - - - - - -			S-15			S-15, 35-40 ft: No recovery	

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

PROJECT NUMBER:

D3460500

ELEVATION: 703.54 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

BORING NUMBER:

SHEET 3 OF 5

FWP-TB-03

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-Ib Auto Trip Hammed Control of Con

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 COMMENTS SOIL DESCRIPTION POG PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) MOISTURE CONTENT, RELATIVE DENSITY OR DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBE (N) SILTY SAND (SM) 40.0 Light gray and light brown, moist, loose, fine to coarse sand, ±35% fines, trace fine subangular 0-2-5 1.50 **SS-16** (7) gravel less than 0.75" diameter, trace 415 reddish-brown iron oxide staining (Sensitive Stop on 11/15/21 at at 41.5 ft bgs 4:05 PM Saprolite of the Springwater Formation) S-17, 40-45 ft: Similar to SS-16 except some Start on 11/16/21 at 8:35 AM sandy elastic silt (MH) from 40-43 ft, trace S-17: Full recovery but in bucket organics consisting of fine roots 43-44 ft: Grab Sample GS-18 S-17 45 45.0 SILTY SAND (SM) WC = 44.4%Light gray, light brown, white and reddish brown Fines = 39.6%, Sand = 54.7%, Gravel = 5.7% 9-8-15 1 50 SS-19 seams, moist, medium dense, 39.6% fines, 5.7% (23)fine to coarse subangular gravel up to 1.5' 46.5 diameter, trace reddish-brown iron oxide staining (Transition from Sensitive Saprolite of the Springwater Formation to Less Weathered Springwater Formation) 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 S-20 predominantly brown 48.5-49 ft: Grab Sample GS-21 S-20, 48.5-50 ft: SILTY SAND WITH GRAVEL (SM) Similar to SS-19 except brown, ±20% fine to 50 50.0 coarse subangular gravel (Less Weathered 20-50/0.5 Springwater Formation) SS-22 1 50 50.5 (50/0.5")SILTY CLAYEY SAND WITH GRAVEL (SC-SM) Light gray, light brown, white and reddish brown 51-52 ft: Grab Sample GS-24 seams, moist, very dense, 29.6% fines, 46.1% very lightly cemented sand, 24.3% fine to coarse WC = 29.6%LL = 28. PL = 21. PI = 7 subangular gravel less than 1.5" diameter, trace Fines = 29.6%, Sand = 46.1%, Gravel = 24.3% reddish-brown iron oxide staining (Less Weathered Springwater Formation) S-23 S-23, 50-55 ft: Similar to SS-22 55 55.0 50/4 55.3 0.33 SS-25 SILTY CLAYEY SAND WITH GRAVEL (SC-SM) (50/4") 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) S-26, 55-56.5 ft: Similar to SS-25 56.5-57.5 ft: Grab Sample GS-27 WC = 20.3% LL = 33, PL = 17, PI = 16 S-26, 56.5-58.5 ft: CLAYEY SAND WITH Fines = 41.6%, Sand = 30.9%, Gravel = 27.5% S-26 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

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : Water Bureau property, Gresham, OR (661781.98 N, 7740995.03 E)

PROJECT NUMBER:

D3460500

ELEVATION: 703.54 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dan, Alex McCan

BORING NUMBER:

SHEET 4 OF 5

FWP-TB-03

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-Ib Auto Trip Hammed Control of Con

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) COMMENTS SOIL DESCRIPTION LOG PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, RECOVERY (ft) MOISTURE CONTENT, RELATIVE DENSITY OR DRILLING FLUID LÓSS, TESTS, AND INSTRUMENTATION CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBEI (N) S-26, 58.5-60 ft: FAT CLAY (CH) 60.0 WC = 34.4% Gray mottled brown, moist, firm, medium to high LL = 52, PL = 27, PI = 255-12-12 1.50 **SS-29** plasticity, ±10% fine to coarse sand, ±5%, fine S-30: Not retreived at first attempt, on second (24)subangular gravel, reddish-brown iron oxide attempt sample split in middle because of shoe 615 staining, black Mn nodules (Less Weathered Driller reported that the sample expanded Springwater Formation) SS-29: FAT CLAY (CH) Gray mottled orangish brown, moist, very stiff, medium plasticity, $\pm 10\%$ fine to coarse sand, trace fine subangular gravel less than 0.5" S-30 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 S-30, 63.2-65 ft: CLAYEY SAND WITH 65 65.0 GRAVEL (SC) WC = 397% Gray with rare brown seams/pockets, moist, 12-19-50/4" Fines = 42.4%, Sand = 46.9%, Gravel = 10.7% dense, ±30% fines, ±15% fine to coarse 1.33 **SS-31** (69/10") subangular gravel, some basalt gravel (Less 66.3 Weathered Springwater Formation) 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 S-32 (Less Weathered Springwater Formation) S-32, 65-70 ft: Similar to SS-31 except up to 3" diameter gray gravel pieces 70 70.0 15-50/2 SILTY SAND WITH GRAVEL (SM) **SS-33** 067 Gray with rare reddish brown spots, moist, very (50/2") 70.7 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, 70-75 ft: Similar to SS-33 S-34 75 75.0 Similar to SS-33 except brown and gray, ±15% 0.75 SS-35 fine to coarse subangular gravel 75.8 Bottom of Boring at 75.75 ft below ground surface Installed VWP in 2" PVC standpipe piezometer Geokon VWP 4500S (350 kPa), unvented, serial Standpipe piezometer installed immediately after drilling VWP installed on 12/08/2021 no. 2146341 Geokon datalogger 8002-WP-2 LC-2, serial no. 2130266 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

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-Ib Auto Trip Hammed Control of Con

WATER DEPTH : 15 to 33.8 feet bqs		START : 11/15/21 12:30 END : 11/	16/21 12:32 LOGGER : L. Bhaumik
DEPTH BELOW GROUND SURFACE (ft)	OG	SOIL DESCRIPTION	COMMENTS
INTERVAL (ft) PENETRA TEST RESI RECOVERY (ft) TYPE/ 6"-6"-6	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
NUMBER (N)	ß		
	GR		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

SC	DIL BORING LOO	2			
D3460500	LFWP-BH01	SHEET	1	OF	3
PROJECT NUMBER:	BORING NUMBER:				

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 Stigal

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

	R DEPTH					START : 4/2/21 09:00 END : 4/2/3	21 12:45 LOGGER : J. Fissel	
DEPTH	BELOW GR	ROUND SU	RFACE (ft)	arean - marine	g	SOIL DESCRIPTION	COMMENTS	
	INTERVA	AL (ft)		PENETRATION TEST RESULTS O				
		RECOVE	ERY (ft)		HIG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND	
			TYPE/	6"-6"-6"	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION	
			NUMBER	(N)	7777		Ground surface conditions: Farm field, and topsoil.	
·	-					-		
· ·	-					-	-	
- I	-					-	-	
.	-					-	-	
· ·	2.5						-	
.				2-2-6		LEAN CLAY (CL) Brown mottled red-brown, moist, becomes wetter -	-	
I .		1.50	SS-1	(8)		at 3.5 ft, firm, medium plasticity (Residual Soil of the Springwater Formation)	-	
.	4.0					ule Springwaler Formalion)	_	
						_	_	
5_	5.0						_	
.				260		Similar to SS-1 except includes dark brown inclusions, moist		
		1.50	SS-2	2-6-8 (14)		indusions, most		
I .	6.5			. ,		_		
	7.5							
						FAT CLAY (CH) Brown, moist, stiff, medium plasticity, 9% sand, -	WC = 30.3% LL = 50, PL = 25, PI = 25	
	1	1.50	SS-3	5-6-8 (14)		some grav high plasticity clay regions (Residual	LL – 30, FL – 23, FI – 23	
	9.0			(,		Soil of the Springwater Formation)	_	
·						-	-	
10	10.0					-	-	
··						LEAN CLAY (CL)		
I .	1	1.50	SS-4	5-7-7 (14)		Brown, moist, stiff, medium high plasticity, some - gray fat clay regions, trace black medium sand	-	
· ·	11.5			(14)		(Residual Soil of the Springwater Formation)	-	
·						-	-	
l .	12.5					-	-	
I '						Similar to SS-4	-	
·	1	1.50	SS-5	6-6-9		1	-	
I '	14.0			(15)		1	-	
· ·							-	
15	15.0					1	-	
^{``_}						Similar to SS-4	_	
· ·	1	1.50	SS-6	7-8-10		1	-	
· ·	16.5			(18)			-	
·	10.0					1	-	
· ·						-	-	
· ·	1						-	
· ·						-	-	
·						-	-	
·						-	-	
						-	-	
20	1				(////			

	LFWP-BH01	SHEET	2	OF	3
SOIL E	BORING LOG				

BORING NUMBER:

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 Stigal

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

PROJECT NUMBER:

	DEPTH			111.00		START : 4/2/21 09:00 END : 4/2	LOGGER : J. Fissel
DEPTH E	-	enconserve and the	RFACE (ft)		8	SOIL DESCRIPTION	COMMENTS
	INTERVA			PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	
		RECOVE	RY (ft)		H	MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GR♪	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
-	20.0 21.5	1.50	SS-7	5-6-6 (12)		LEAN CLAY (CL) Brown, moist, stiff, trace black medium sand, medium to high plasticity (Residual Soil of the Springwater Formation)	
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

SOIL BORING LOG

BORING NUMBER:

LFWP-BH01

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 Stigal

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

	DEPTH			111 111 1		START : 4/2/21 09:00	END : 4/2/2		GER : J. Fissel
			RFACE (ft)		C	SOIL DESCRIPTION	LIND . T(Z).	COMME	
	INTERVA	AL (ft)		PENETRATION TEST RESULTS					
		RECOVE	RY (ft)	IEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL,	COLOR,	DEPTH OF CASING	DRILLING RATE,
				6"-6"-6"	βAP	MOISTURE CONTENT, RELATIVE DE	NSITY OR NERALOGY	DRILLING FLUID LC INSTRUME	NTATION
			TYPE/ NUMBER	(N)	G				
-	40.0	1.50	SS-11	7-5-6 (11)		ELASTIC SILT WITH SAND (MH) Gray, moist, stiff, medium plasticity, sar fine subangular gravel (Sensitive Sapro Springwater Formation)	nd, trace - lite of the _	WC = 59.8% LL = 60, PL = 43, PI = 17	-
	41.5						- - - - -		- - - -
45 - -	45.0 46.5	1.50	SS-12	5-3-43 (46)		LEAN CLAY WITH SAND (CL) Gray and olive-brown, moist, very dens fine subrounded gravel, medium sand (Weathered Springwater Formation)	e, trace - Less _ -	WC = 35.3%	
- - - - 50	50.0						- - - - -		-
-	51.5	0.50	SS-13	20-40-41 (81)		CLAYEY GRAVEL WITH SAND (GC) Gray, moist, very dense, fine subangula medium to coarse sand (Less Weather Springwater Formation)	ar gravel, - ed _		-
						Bottom of Boring at 51.5 ft below groun	d surface - - - - -	Backfilled with bentonite chip	os to surface - - - - -
							- - - - - - - - - - - - - -		
- 60							_		-

SHEET 3 OF 3

D3460500

PROJECT NUMBER:

S	OIL BORING LOG				
D3460500	LFWP-BH02 S			OF	3
PROJECT NUMBER:	BORING NUMBER:				

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

	DEPTH		1.000			START : 4/5/21 09:10 END : 4/5/	
1			RFACE (ft)		()	SOIL DESCRIPTION	COMMENTS
	INTERVA	- second and a second		PENETRATION TEST RESULTS	ro		A de suer respected filter in de Alexandre - and
		RECOVE	RY (ft)	IEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
				6"-6"-6"	RAP	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	(Ň)	ß		
_							Ground surface conditions: Farm field, and topsoil.
						-	
	2.5					-	
						LEAN CLAY (CL)	
		1.00	SS-1	0-2-3 (5)		slightly red-brown, moist, medium stiff, medium - plasticity (Residual Soil of the Springwater	-
	4.0			(3)		Formation)	-
	1.0					-	-
5	5.0					-	1 1
1 1	0.0					Similar to SS-1	1 -
		1.00	SS-2	2-3-3		-	1 1
	6.5		_	<mark>(6)</mark>		-	1 1
-	0.0					-	-
-	75					-	-
	7.5					ELASTIC SILT (MH)	WC = 33.3%
-		1.50	SS-3	2-4-6		Red-brown, moist, stiff, medium plasticity - (Residual Soil of the Springwater Formation)	LL = 51, PL = 32, PI = 19 -
-		1.50	55-5	(10)		(Residual Soli of the Springwater Formation)	-
-	9.0					-	-
-						-	-
10	10.0					Similar to SS-3	
		4.50		3-5-6			-
-		1.50	SS-4	(11)		-	-
- 1	11.5					-	-
- 1						-	-
-	12.5					Similar to SS-3	
-		1.55		3-4-6			
-		1.50	SS-5	(10)		-	
-	14.0					-	
-						-	-
15	15.0					Cimilar to CC 2 avaant clickt light to dark broom	
				4-4-6		Similar to SS-3 except slight light to dark brown mottling	
		1.50	SS-6	4-4-0 (10)			
	16.5					-	
						-	
						-	
						-	
						_	
]
]
20							

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

BORING NUMBER:

SHEET 2 OF 3

LFWP-BH02

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

PROJECT NUMBER:

WATER DEPTH : Not recorded		START : 4/5/21 09:10 END : 4/5	J21 12:10 LOGGER : K. Elliott
DEPTH BELOW GROUND SURFACE (ft)		SOIL DESCRIPTION	COMMENTS
INTERVAL (ft) PENETI TEST RECOVERY (ft)	PHI	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
TYPE/ 6"-6 NUMBER (N	GR (CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
20.0 1.50 SS-7 4-6 21.5	10	LEAN CLAY (CL) Red-brown with trace black mottles, moist, very stiff, medium to high plasticity (Residual Soil of the Springwater Formation)	
25 25.0			
2.5 2.5.0 1.50 SS-8 3-9 (2 26.5	.11))	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
30 <u>30.0</u> - 1.50 ss-9 4.6 (1		LEAN CLAY (CL) Orange brown with blue gray mottles, moist, very stiff, medium to high plasticity (Residual Soil of the Springwater Formation)	
35 <u>35.0</u> - 1.50 SS-10 - 7-10	-16	Similar to SS-9 except with track black mottles, completely decomposed sand or fine gravel	
(2	5)		
40			-

SOIL BORING LOG

BORING NUMBER:

SHEET 3 OF 3

LFWP-BH02

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-Ib Auto Trip Hammer

PROJECT NUMBER:

WATER DEPTH : Not recorded		START : 4/5/21 09:10 END : 4/5	5/21 12:10 LOGGER : K. Elliott		
DEPTH BELOW GROUND SURFACE (ft)	S S	SOIL DESCRIPTION	COMMENTS		
INTERVAL (ft) PENETRAT TEST RESU RECOVERY (ft)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STUDY DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
TYPE/ 6"-6"-6" NUMBER (N)	GR	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION		
40.0 1.50 SS-11 5-8-9 (17) 41.5		LEAN CLAY (CL) Orange brown and blue gray mottled, moist, very stiff (Residual Soil of the Springwater Formation)			
		-			
45 <u>45.0</u> - 1.50 SS-12 - 46.5		LEAN CLAY (CL) Orange brown and black mottled with trace decomposed sand and trace fine gravel, very stiff (Residual Soil of the Springwater Formation)			
		-			
50 <u>50.0</u> - 1.50 ss-13 - (5)		ELASTIC SILT (MH) Orange brown gray mottled, moist, medium stiff, slight plasticity, with completely decomposed sand and gravel, trace highly weathered gravel	WC = 58.1% LL = 53, PL = 42, PI = 11		
		clast (Sensitive Saprolite of the Springwater Formation) Bottom of Boring at 51.5 ft below ground surface	Backfilled with bentonite chips to surface		
55		- - -			

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

DEPTH MELOW GROUND SUBJECT (0) PINTENDING (0) Solit Auxel USCS GROUP SYNBOL, COLOR, MORTINE CONTERY, (0) DEPTH of CASING, DIBLING PATE, DISTINGE CONTERY, (0) DEPTH of CASING, DIBLING PATE, DISTINGE CONTERY, (0) 5 5.0	WATER	DEPTH	: 12.3 to	33.5 feet	bqs		START : 4/6/21 09:00 END : 4/6	/21 12:30 LOGGER : M. Azevedo
5 5.0 2.1 BASE CRAVEL 0.25 ft: Change brown clay / sitt collining eround clining for collining (partially slicking to drall rod, but easy to peel off) 5 5.0 5.0 1.50 SS:1 2.2.3 6.5 1.50 SS:1 2.2.3 Charge brown, clay / sitt collining eround clining eround clini	DEPTH B	and the second second	energies and the	RFACE (ft)	heard prevents of provide states of	DG	SOIL DESCRIPTION	COMMENTS
5 5.0 2.1 BASE CRAVEL 0.25 ft: Change brown clay / sitt collining eround clining for collining (partially slicking to drall rod, but easy to peel off) 5 5.0 5.0 1.50 SS:1 2.2.3 6.5 1.50 SS:1 2.2.3 Charge brown, clay / sitt collining eround clining eround clini		RECOVERY (ft)		CLC				
5 5.0 2.1 BASE CRAVEL 0.25 ft: Change brown clay / sitt collining eround clining for collining (partially slicking to drall rod, but easy to peel off) 5 5.0 5.0 1.50 SS:1 2.2.3 6.5 1.50 SS:1 2.2.3 Charge brown, clay / sitt collining eround clining eround clini				H	SUIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
5 5.0 2.1 BASE CRAVEL 0.25 ft: Change brown clay / sitt collining eround clining for collining (partially slicking to drall rod, but easy to peel off) 5 5.0 5.0 1.50 SS:1 2.2.3 6.5 1.50 SS:1 2.2.3 Charge brown, clay / sitt collining eround clining eround clini				TYPE/	6"-6"-6"	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION
5 5.0				NUMBER	(11)		- 2 in: BASE GRAVEL	0-25 ft: Orange-brown clay / silt collaring around
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	-							 drill rod for cuttings (partially sticking to drill rod.
$\begin{bmatrix} 1 & 1.50 & \text{ss-1} & 2.2.3 \\ 6.5 & 0 & 0 & 0 \\ \hline 0.5 & 0 & 0 \\$	-							but easy to peer on)
$\begin{bmatrix} 1 & 1.50 & \text{ss-1} & 2.2.3 \\ 6.5 & 0 & 0 & 0 \\ \hline 0.5 & 0 & 0 \\$								-
$\begin{bmatrix} 1 & 1.50 & \text{ss-1} & 2.2.3 \\ 6.5 & 0 & 0 & 0 \\ \hline 0.5 & 0 & 0 \\$								-
$\begin{bmatrix} 1 & 1.50 & \text{ss-1} & 2.2.3 \\ 6.5 & 0 & 0 & 0 \\ \hline 0.5 & 0 & 0 \\$	-							-
$\begin{bmatrix} 1 & 1.50 & \text{ss-1} & 2.2.3 \\ 6.5 & 0 & 0 & 0 \\ \hline 0.5 & 0 & 0 \\$								-
$\begin{bmatrix} 1 & 1.50 & \text{ss-1} & 2.2.3 \\ 6.5 & 0 & 0 & 0 \\ \hline 0.5 & 0 & 0 \\$								-
$\begin{bmatrix} 1 & 1.50 & \text{ss-1} & 2.2.3 \\ 6.5 & 0 & 0 & 0 \\ \hline 0.5 & 0 & 0 \\$								-
$\begin{bmatrix} 1 & 1.50 & \text{ss-1} & 2.2.3 \\ 6.5 & 0 & 0 & 0 \\ \hline 0.5 & 0 & 0 \\$								-
150 SS-1 2-2-3 (5) Corange-brown, wet, firm, medium plasticity, traceless than houses (Residual Soil of the Springwater Formation) LL = 50, PL = 30, PI = 20 10 10.0 10.0 10.0 10.0 10.0 11.5 1.50 SS-2 2-4-5 (9) Similar to SS-1 except stiff 1 15 15.0 15.0 Ss-3 4-4.6 (10) Similar to SS-1 except stiff 1	5_	5.0						
- -					222		ELASTIC SILT (MH) Orange-brown, wet, firm, medium plasticity, trace	WC = 35.2% LL = 50, PL = 30, PI = 20
6.5 Image: Springwater Formation) 10 10.0 10 150 11.5 1.50 11.5 1.50 11.5 1.50 11.5 1.50 11.5 1.50 11.5 1.50 11.5 1.50 11.5 1.50 11.5 1.50 15.0 1.50 15.0 1.50 15.0 1.50 15.0 1.50 15.0 1.50 15.0 1.50 15.0 1.50			1.50	SS-1	(5)		less than 1/8" iron/Mn nodules (Residual Soil of	4
Similar to SS-1 except stiff		<u>6.5</u>					ule spilligwater romauon)	4 -
Similar to SS-1 except stiff								-
Similar to SS-1 except stiff								
Similar to SS-1 except stiff								-
Similar to SS-1 except stiff								-
Similar to SS-1 except stiff								
Similar to SS-1 except stiff								
150 SS-2 24-5 (9) 11.5 11.5 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0 15.0	10	10.0					_	
11.5 (9) 11.5					245		Similar to SS-1 except stiff	
11.5 - -			1.50	SS-2	2-4-5 (9)			-
Similar to SS-1 except stiff		11.5						-
Similar to SS-1 except stiff								
Similar to SS-1 except stiff								
Similar to SS-1 except stiff								
Similar to SS-1 except stiff								
Similar to SS-1 except stiff								
Similar to SS-1 except stiff								4 -
1.50 SS-3 4-4-6 (10)	15	15.0					C: 1 + CO 4 + -//7	4 –
- (10)					146		Similar to SS-1 except stiff	4 -
00000			1.50	SS-3	4-4-0 (10)			4 -
		16.5						4 -
								4 -
								4 -
								4 -
20	20							

50	DIL BORING LOO	2			
D3460500	LFWP-BH03	SHEET	2	OF	3
PROJECT NUMBER:	BORING NUMBER:				

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

			33.5 feet	0000		START : 4/6/21 09:00	END : 4/6/	
1	BELOW GR				C	SOIL DESCRIPTION	LIND . 1707.	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	P			The court income of Decision Balances
		RECOVE	RY (ft)	TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL,	COLOR,	DEPTH OF CASING, DRILLING RATE,
		12001		6"-6"-6"	AP	MOISTURE CONTENT, RELATIVE DEN CONSISTENCY, SOIL STRUCTURE, MIN	ISITY OR	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER		В			
	20.0				****	Similar to SS-1 except stiff, more trace I	Mn than	
		1.50	SS-4	4-4-7		above	-	-
-	015			(11)			-	-
-	21.5						-	-
-							-	-
-							-	-
- 1							-	-
							-	-
 -							_	-
							_	_
25	25.0							
						LEAN CLAY (CL) Orange-brown and mottled gray, moist,	VOD/ ctiff	WC = 27.1% LL = 45, PL = 24, PI = 21
		1.50	SS-5	6-7-12 (19)		medium plasticity 11% sand trace 1/8-	1/2"	LL = 45, PL = 24, PI = 21 Fines = 88.9%
	26.5			(13)		iron/Mn nodules (Residual Soil of the S Formation)	pringwater	-
	20.0					Formauon)	-	-
-							-	-
							-	-
-							-	-
-							-	-
-							-	-
- 1							-	-
30	30.0							
				4-6-11		FAT CLAY (CH) Orange-brown and mottled gray, moist,	verv stiff.	5 ft clay collar above drill bit when pull out rods at 25 ft, 30 ft, 35 ft.
		1.50	SS-6	(17)		high plasticity (Residual Soil of the Spri	ngwater	Clay appears to have high plasticity.
	31.5					Formation)	_	
	1						-	-
							-	-
							-	-
							-	-
35	35.0						-	-
- 55_	30.0					FAT CLAY (CH)		36-36.5 ±20% iron nodules
		1.50	SS-7	6-9-12		Orange-brown and mottled gray, moist, high plasticity, ±5% iron/Mn nodules (R	very stiff, -	-
-		1.50	33-1	(21)		high plasticity, ±5% iron/Mn nodules (R Soil of the Springwater Formation)	esiquai	-
-	36.5						-	-
-					//		-	-
-					$\langle \rangle \rangle$		-	-
							-	-
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							_	
40							-	-
	•							

C	OIL BORING LOG				
D3460500	LFWP-BH03	SHEET	3	OF	3
PROJECT NUMBER:	BURING NUMBER:				

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-Ib Auto Trip Hammer

P

END: 4/6/21 12:30 WATER DEPTH : 12.3 to 33.5 feet bqs START : 4/6/21 09:00 LOGGER : M. Azevedo DEPTH BELOW GROUND SURFACE (ft) COMMENTS SOIL DESCRIPTION LOG PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBEI (N) Similar to SS-7 except trace iron/Mn nodules 4 ft clay collar above drill bit when pull out rods at 40.0 40 ft, 45 ft 8-9-14 1.50 SS-8 (23)415 45_ 45.0 FAT CLAY (CH) Gray mottled orange-brown with Mn veining, 4-6-10 1.50 SS-9 moist, very stiff, high plasticity (Residual Soil of (16) the Springwater Formation) 46.5 50 50.0 FAT CLAY (CH) 6 ft clay collar at 50 ft Gray mottled orange-brown, moist, very stiff, high one 1" diameter rounded basalt gravel in shoe 9-11-15 1.50 SS-10 plasticity (Residual Soil of the Springwater (26)Formation) 51.5 Bottom of Boring at 51.5 ft below ground surface Inststalled VWP in 2" PVC standpipe piezometer. Geokon VWP 4500S (350 kPa), unvented, serial Standpipe piezometer installed immediately after drilling. no. 2111124 Geokon datalogger 8002-WP-2 LC-2, serial no. WP installed on 06/25/2021. 2128644 0-1.5 ft: 12" diameter, 12" deep monument set in concrete 1.5-38 ft: Bentonite chips 38-50 ft: Sand 55 40-50 ft: Screen Start Card # 1051306 well # L141466 Base of VWP is at 48.5 ft below ground surface. Field WVP Ro (1) 8969.972 (2) 8969.743 (3) 8969.580 (4) 8970.704 Average Ro = 8969.999 60

	LFWP-BH04	SHEET	1
0.011 0			
SOIL B	ORING LOC	ć	

BORING NUMBER:

OF 3

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-Ib Auto Trip Hammer

PROJECT NUMBER:

DEPTH BELOW GROUND SURFACE (ft) PENETRATION COMMENTS INTERVAL (ft) PENETRATION TESTRESULTS SOIL DESCRIPTION COMMENTS SOIL DAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY DEPTH OF CASING, DRILLING FAU DRILLING FLUID LOSS, TESTS, A INSTRUMENTATION DEPTH OF CASING, DRILLING FAU DRILLING FLUID LOSS, TESTS, A INSTRUMENTATION - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -	vedo
5 5.0 1.50 SS-1 2.2.3 (5) 2 in: BASE GRAVEL	
5 5.0 1.50 SS-1 2.2.3 (5) 2 in: BASE GRAVEL	TE
5 5.0 1.50 SS-1 2.2.3 (5) 2 in: BASE GRAVEL	ND
5 5.0 5 5.0 1.50 SS-1 2-2-3 (5) Springwater Expression)	
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 a coming out as large clumps of clay	
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 a coming out as large clumps of clay	_
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 a coming out as large clumps of clay	-
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 a coming out as large clumps of clay	-
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 a coming out as large clumps of clay	-
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 a coming out as large clumps of clay	-
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 a coming out as large clumps of clay	-
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 a coming out as large clumps of clay	-
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 a coming out as large clumps of clay	-
- 1.50 SS-1 2-2-3 (5) Crange brown, moist, firm, medium plasticity, trace <1/8" iron/Mn nodules (Residual Soil of the Springwater Formation)	re
Springwater Formation)	-
	-
	-
	-
	-
	-
	-
	-
10 10.0 Similar to SS-1 except stiff WC = 40%	_
- 1 ± 54, PL = 33, PI = 21	-
	-
	-
	-
	-
	-
	-
	-
15 15.0 Similar to SS 1 avaant stiff	_
Similar to SS-1 except stiff	-
$\begin{bmatrix} 1.50 & \text{ss-3} & \frac{3.4.6}{(10)} \end{bmatrix}$	-
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SOIL	BORING	LOG

BORING NUMBER:

LFWP-BH04

SHEET 2 OF 3

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-Ib Auto Trip Hammer

PROJECT NUMBER:

WATER	DEPTH	: Not rec	orded		22	START : 4/7/21 09:08	END : 4/7/2	21 11:50 LOGGER : M. Azevedo
			RFACE (ft)		U	SOIL DESCRIPTION		COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG			
		RECOVE	DV (#)	TEST RESULTS	₽	SOIL NAME, USCS GROUP SYMBOL,	COLOR,	DEPTH OF CASING, DRILLING RATE,
		RECOVE			d	MOISTURE CONTENT, RELATIVE DE	NSITY OR	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	R	CONSISTENCY, SOIL STRUCTURE, MI	NERALOGY	INSTRUMENTATION
	20.0		NUMBER	(1)		Similar to SS-1 except stiff and some tr	aco Mn	Clay collaring around drill rod 15-20 ft
	20.0			4-6-8		veining, more than above		Citay containing around unin rou 13-20 h
		1.50	SS-4	(14)		5,		
	21.5							
	21.0						-	-
							-	
							-	-
							_	
							-	-
							-	· · · ·
- 1							-	-
25	25.0							_
						FAT CLAY (CH)	moist	
		1.50	SS-5	4-7-8 (15)		Orange brown with minor gray mottling stiff, medium to high plasticity, trace less	s than 1/4"	
-	00 F			(15)		iron/Mn nodules (Residual Soil of the S	pringwater	-
	26.5					Formation)	-	-
- 1							-	
							_	
							-	-
							-	-
- 1							-	
							_	
30	30.0							
						FAT CLAY (CH)		WC = 35.8%
		1.50	SS-6	4-7-8		Orange brown and mottled gray, moist, plasticity (Residual Soil of the Springwa	stiff, high -	LL = 61, PL = 30, PI = 31
				(15)		Formation)		
	31.5					,	-	
							_	
							-	-
							-	· · · ·
-							-	-
							-	
							_	
35	35.0							
						FAT CLAY (CH)		-
		1.50	SS-7	6-11-12		Orange brown and mottled gray, moist, high plasticity, trace iron/Mn nodules (F	very stiff, -	· · · ·
- 1		1.50	33-1	(23)		Soil of the Springwater Formation)	Kesiduai –	-
	36.5					con or the opininghator ronnation,	-	
							-	
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					$\langle \rangle \rangle$		-	
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40								
				-				-

	LFWP-BH04	SHE
SOIL B		G

BORING NUMBER:

SHEET 3 OF 3

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-Ib Auto Trip Hammer

PROJECT NUMBER:

WATER	DEPTH		21072-210			START : 4/7/21 09:08	END : 4/7/			
			RFACE (ft)		C	SOIL DESCRIPTION		COMMENTS		
	INTERV/	AL (ft)		PENETRATION TEST RESULTS	P				_	
		RECOVE	RY (ft)	IEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL,	COLOR,	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	MOISTURE CONTENT, RELATIVE DE CONSISTENCY, SOIL STRUCTURE, MI		INSTRUMENTATION		
-	40.0 41.5	1.50	SS-8	7-10-13 (23)		FAT CLAY (CH) Orange brown and mottled gray, moist, high plasticity, ±5% less than 0.5" iron/ nodules and iron/Mn veining (Residual Springwater Formation)	Mn	-	-	
- - - 45_	45.0						- - - -	- - - -	-	
-	46.5	1.50	SS-9	4-6-7 (13)		FAT CLAY (CH) Orange brown, moist, stiff, medium to h plasticity, trace Mn veining (Residual S Springwater Formation)	igh - oil of the - - -	-	-	
- - - 50	50.0					FAT CLAY (CH)	- - - -	-	-	
-	51.5	1.50	SS-10	5-5-8 (13)		Orange brown, moist, stiff, medium to h plasticity, trace iron nodules and Mn ve (Residual Soil of the Springwater Form	ining	-	-	
						Bottom of Boring at 51.5 ft below groun	d surface - - - - -	Backfilled with bentonite grout and capped with base gravel to match existing conditions	-	
55 - - -							- - - -	- - - -		
- - - 60							- - - -	-	-	

PROJECT NUMBER: BORING NUMBER: D3460500 LFWP-BH05 SHEET 1 OF 3	S					
PROJECT NUMBER: BORING NUMBER:	D3460500	LFWP-BH05	SHEET	1	OF	3
	PROJECT NUMBER:	BORING NUMBER:				

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

1	ATER DEPTH : Not recorded EPTH BELOW GROUND SURFACE (ft)					START : 4/12/21 08:58 END : 4/1	2/21 12:25 LOGGER : L. Bhaumik		
DEPTH E	1		RFACE (ft)	PENETRATION	90	SOIL DESCRIPTION	COMMENTS		
	INTERVA	AL (#) RECOVE	RY (ft) TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION		
			NOMBER	(1)		5 in: ASPHALT CONCRETE PAVEMENT	Start drilling with 4-7/8" tricone bit.		
-					•	7 in: BASE GRAVEL	1 -		
-					• •		-		
							1		
_									
-							-		
-							-		
5_	5.0					SILT (ML)	PP = 2.75, 2.25, 1.25 tsf		
-		1.40	SS-1	3-5-6		Brown slightly mottled grayish brown, moist, stiff, slight plasticity, ±5% fine to coarse sand, trace	5 ft: Switch to 4-7/8" drag bit.		
	6.5	1.10		(11)		fine to coarse subrounded to subangular gravel	-		
-	0.0					1.5 " diameter, reddish-brown iron oxide staining, trace black Mn nodules (Residual Soil of the	1 -		
						Springwater Formation)	1		
_							-		
-							-		
10	10.0					Similar to SS-1 except only fine subangular	PP = 2.5 tsf from top 0.3 ft of sample (remaining		
-		1.50	1.50 SS-2	3-6-7		gravel, trace reddish brown iron stains	part of sample split in SS, no PP)		
-	44.5	1.50	33- 2	(13)			WC = 36.3% LL = 40, PL = 27, PI = 13		
-	11.5						-		
-							-		
							1 -		
]		
-							4 -		
15	15.0					LEAN CLAY (CL)	PP = 1.75, 1.5, 1.5 tsf		
		1.50	SS-3	3-6-7		Brown slightly mottled grayish brown, moist, stiff, medium to high plasticity, trace fine to coarse	Driller reported will redrill the borehole from 0-10 ft - with the 6" tricone bit.		
	16.5	1.00	55-5	(13)		sand, trace fine subrounded gravel, trace	The clay has "collared up" the borehole and is		
	10.0					reddish-brown iron oxide staining, black Mn nodules (Residual Soil of the Springwater	 lifting the mud tub, causing drilling fluid to lean – onto the road. 		
						Formation)] 1		
]		
							1		
							4		
-							4 -		
20					////				

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664965.13 N, 7735746.88 E)

PROJECT NUMBER:

D3460500

ELEVATION: 618.17 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Kevin Delgado

BORING NUMBER:

SHEET 2 OF 3

LFWP-BH05

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-Ib Auto Trip Hammer

WATER	DEPTH	Not rec	orded		6	START : 4/12/21 08:58 END : 4/1	2/21 12:25 LOGGER : L. Bhaumik			
1			RFACE (ft)		U	SOIL DESCRIPTION	COMMENTS			
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	2					
		RECOVE	RY (ft)	LOT NEOULIO	HIC	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND			
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION			
	20.0		TOMEL	(14)		LEAN CLAY (CL)	PP = 3.25, 3.75, 2.5 tsf			
		1.50	SS-4	3-7-10		Brown mottled gray, moist, very stiff, medium plasticity, ±10% fine to coarse sand, ±5% fine to	WC = 33.8% - LL = 46, PL = 23, PI = 23			
	01 E	1.00		(17)		coarse black subangular to subrounded gravel	Clay collar surrounding drilling rod retrieved from			
	21.5					less than 1" diameter, trace reddish-brown iron oxide staining, trace black Mn nodules, black/very	borehole _			
						dark brown pockets of sand and gravel (Residual	-			
						Soil of the Springwater Formation)				
						· · · ·	-			
							-			
						· · · · ·	-			
-	05.0					· · · · · · · · · · · · · · · · · · ·				
25	25.0					FAT CLAY (CH)	PP = 2, 1.5, 2 tsf			
		1.50	SS-5	5-6-9		Gray mottled brown, moist, soft, medium to high plasticity, ±5% fine to coarse sand, ±5% fine to				
	00.5	1.00	000	(15)		coarse subangular gravel less than 1.25"	-			
	26.5					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)	-			
						· · · · ·				
							-			
	20.0					· · · · ·	-			
30	30.0					SILT (ML)	PP = 3, 3.75, 3.5 tsf			
		1.50 SS-6	5-11-16		Dark gray steel mottled brown, moist, very stiff, medium plasticity, 6% fine to coarse sand, 1%	- WC = 31.6% LL = 46, PL = 27, PI = 19				
	21 E		(27)			fine subangular gravel, black/very dark brown	Fines = 93%, Sand = 6.2%, gravel = 0.8%			
	31.5					pockets of sand and gravel, trace reddish-brown iron oxide staining (Residual Soil of the				
						Springwater Formation)	-			
							-			
							-			
						· · · · · · · · · · · · · · · · · · ·	-			
							-			
35	35.0						1			
						Similar to SS-6 except dark gray steel, trace slightly mottled brown, no sand, no gravel	PP = 3.5, 2.75, 1 tsf			
1		1.50	SS-7	4-8-15 (23)		Singhuy mouled brown, no Sand, no graver]			
1	36.5			(20)] -			
1]			
							4 -			
40										

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664965.13 N, 7735746.88 E)

PROJECT NUMBER:

D3460500

ELEVATION: 618.17 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Kevin Delgado

BORING NUMBER:

SHEET 3 OF 3

LFWP-BH05

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-Ib Auto Trip Hammer

WATER DEPTH : Not recorded		START : 4/12/21 08:58 END : 4/12	
DEPTH BELOW GROUND SURFACE (ft)	S S	SOIL DESCRIPTION	COMMENTS
RECOVERY (ft)	BETRATION T RESULTS 6"-6"-6" (N)	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0	(10-16 (26)	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 - - -
	3-14-16	Similar to SS-6 except no pockets of sand and gravel, trace fine to coarse sand, trace fine	
	(30)	Subangular gravel	
50		SILTY SAND (SM)	49 ft: Driller reported gravel, slight rig chatter
	-20-33 (53)	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	finger pressure.
- - - - 55_		Weathered Springwater Formation) 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
		- - - - - -	
		- - -	

D3460500	LFWP-BH06	SHEET	1	OF	3	
s	OIL BORING LOG	ì				

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-Ib Auto Trip Hammer

WATER	DEPTH	: 41.6 to	> 50 feet	bqs		START : 3/24/21 15:00 END : 3/2	25/21 13:36 LOGGER : L. Bhaumik		
DEPTH E	BELOW GR	OUND SU	RFACE (ft)	Service and the contract of the service of the serv	00	SOIL DESCRIPTION	COMMENTS		
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND		
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION		
			TIOMDEN	(1)		3.5 in: ASPHALT CONCRETE PAVEMENT			
-						11.5 in: BASE GRAVEL	-		
					<i>`////</i>				
-							-		
-							-		
-							-		
-							1 -		
							1 -		
							1		
5	5.0						-		
						LEAN CLAY (CL) Gray mottled brown, moist, soft, medium to high	PP = 1, 1, 0.5 tsf Some silt possible, ±5-10%		
		0.80	SS-1	1-1-2 (3)		plasticity, trace fine sand, reddish-brown iron	- Some silt possible, ±3-10% -		
	6.5			(0)		oxide staining (Residual Soil of the Springwater Formation)]		
	8.0								
							ST-2 recovery 2.15 ft, some cuttings at top - 8-9 ft: 150 psi		
		2.00	ST-2				9-10 ft: 250 psi		
		2.00							
10	10.0								
				2-3-4		FAT CLAY (CH) Brown slightly mottled dark grayish brown, moist,	PP = 1, 0.5, 1.25 tsf - Stop on 3/24/21 at 15:50 at 10 ft -		
-		1.50	SS-3	(7)		firm, medium to high plasticity, trace fine to coarse sand, reddish-brown iron oxide staining, black Mn	Start on 3/25/21 at 8:30 Make provision for piezometer monument:		
	11.5					nodules (Residual Soil of the Springwater	 Core asphalt with 16" core bit. 		
-						Formation)	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		
							4 -		
15	15.0						4 -		
13	13.0					SILT (ML)	PP = 2.5, 1.5, 1.75 tsf		
		1.50	SS-4	4-6-6		Brown mottled gray, moist, stiff, medium plasticity, trace of sand, reddish-brown iron oxide staining,	- WC = 29.5% LL = 39, PL = 23, PI = 16		
	16.5			(12)		black Mn nodules (Residual Soil of the Springwater Formation)	15 ft: Switch to 6" drag bit.		
						Springwater Formation)	1 1		
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] [
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]		
20									

	BORING LOG				
D3460500	LFWP-BH06	SHEET	2	OF	3
PROJECT NUMBER:	BORING NUMBER:				

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-Ib Auto Trip Hammer

WATER	DEPTH	: 41.6 to	> 50 feet	bqs		START : 3/24/21 15:00 END : 3/25	5/21 13:36 LOGGER : L. Bhaumik
DEPTH E	BELOW GR	ROUND SU	RFACE (ft)		Ð	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft)		PENETRATION TEST RESULTS	CLC		
		RECOVE	RY (ft)		Ĭ	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND
			TYPE/ NUMBER	6"-6"-6" (N)	GRAPHIC LOG	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
	20.0	1.30	SS-5	3-3-6 (9)		FAT CLAY (CH) 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)	PP = 2.25, 2.25, 2.75 tsf - -
-	23.0					-	- - ST-6
- - 25_	25.0	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 Driller reported he is reaming out / redrilling borehole repeatedly from 0-10 ft
-	26.5	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
- - - - 30						-	-
						SS-8A, 30-30.5 ft: Similar to SS-7	PP = 0.75, 1.25, 3.5 tsf
- I	1	1.50	SS-8	4-7-8 (15)		SS-8B, 30.5-31.5 ft: LEAN CLAY WITH SAND	-
I -	31.5			(13)		 (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)	-
 -						-	_
35	35.0						
-	36.5	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	PP = 3, 3.25, 3.5 tsf - -
-						Springwater Formation)	-
- - 40						-	

	LFWP-BH06	SHEET	3	OF	3
SOIL B		3			

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664975.94 N, 7735205.70 E)

PROJECT NUMBER:

D3460500

ELEVATION : 619.21 ft

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

BORING NUMBER:

LFWP-BH06

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

WATER	DEPTH	: 41.6 to	> 50 feet	bqs		START : 3/24/21 15:00 END : 3/25	5/21 13:36 LOGGER : L. Bhaumik
DEPTH E	ELOW GR	OUND SU	RFACE (ft)		g	SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	ERY (ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/	6"-6"-6" (N)	GRAP	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-	40.0 41.5	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
- - - - - 45_	45.0					-	
-	46.5	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
	50.0					-	
-	51.5	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, Pl = 14 Fines = 74.7%, Sand = 25.0%, Gravel = 0.3% Inststalled VWP in 2" PVC standpipe piezometer.
-						Bottom of Boring at 51.5 ft below ground surface Geokon VWP 4500S (350 kPa), unvented, serial no. 2116126	Standpipe piezometer installed immediately after drilling. VWP installed on 06/24/2021.
- - 55_ - -						Geokon datalogger 8002-WP-2 LC-2, serial no. 2128643 - - 	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

SOILE						
D3460500	LFWP-BH07	SHEET	1	OF	3	
PROJECT NUMBER:	BORING NUMBER:					

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-Ib Auto Trip Hammer

WATER DEPTH : Not recorded DEPTH BELOW GROUND SURFACE (ft)						START : 3/30/21 09:12 END : 3/30				
DEPTH B	1		RFACE (ft)	head presents in province and	8	SOIL DESCRIPTION	COMMENTS			
	INTERVA	AL (ft) RECOVE		PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSIDERATION CONTRACTION AMOUNT OF A	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION			
			TYPE/ NUMBER	6"-6"-6" (N)	GR	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION			
						2.5 in: ASPHALT CONCRETE PAVEMENT 7.5 in: Base Gravel	Start drilling with 4-7/8" tricone bit.			
-	5.0					-				
5	<u>5.0</u> 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	PP = 1, 1.25, 1.25 tsf 5 ft: Switch to 4-7/8" drag bit.			
- - - - 10	10.0					Soil of the Springwater Formation)				
-	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	1 <u>5.0</u>					Similar to SS-2 except color is brown, trace fine to	PP = 1.5, 1.25, 1.25 tsf			
-	16.5	1.50	SS-3	4-6-7 (13)		coarse sand				
						-				

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

BORING NUMBER:

LFWP-BH07

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-Ib Auto Trip Hammer

WATER DEPTH : Not recorded						START : 3/30/21 09:12 END : 3/3				
DEPTH	DEPTH BELOW GROUND SURFACE (ft)					SOIL DESCRIPTION	COMMENTS			
	INTERVA		DV (8)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR,	DEPTH OF CASING, DRILLING RATE,			
		RECOVE	ERY (ft)	6"-6"-6"	APH	MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION			
	00.0		NUMBER		5					
	20.0	1.50	SS-4	4-5-8 (13)		LEAN CLAY (CL) Light brown mottled gravish 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	PP = 1.25, 1.25, 1.25 tsf 			
-						(Residual Soil of the Springwater Formation)				
25	25.0									
	26.5	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			
-										
-						-	-			
30	30.0 31.5	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			
-						-				
35	35.0									
.	36.5	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 -			
						-				

SHEET 2 OF 3

D3460500

PROJECT NUMBER:

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664985.76 N, 7734711.06 E)

PROJECT NUMBER:

D3460500

ELEVATION: 624.99 ft

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

BORING NUMBER:

SHEET 3 OF 3

LFWP-BH07

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-Ib Auto Trip Hammer

WATER DEPTH : Not recorded						START : 3/30/21 09:12 END : 3/3	0/21 12:50 LOGGER : L. Bhaumik
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)					SOIL DESCRIPTION	COMMENTS
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTATION
-	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	PP = 2.75, 1.5, 2.75 tsf Driller reported he will ream out / redrill 1-5 ft of borehole to remove clay collar
- - - - - - - - - - - - - - - - - 	45.0					Formation)	
-	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	PP = 0.5, 0.75, 0 tsf WC = 38.8% LL = 37, PL = 26, PI = 11
-						\of the Springwater Formation) / 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							-

PROJECT NUMBER:		BORING NUMBER:				
D3460500		LFWP-BH08	SHEET	1	OF	3
	SOIL B	ORING 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	bas		START : 9/2/21 08:55	END : 9/2/	21 12:10 LOGGER : L. Bhaumik
			IRFACE (ft)		U	SOIL DESCRIPTION	LND . 5/2/	COMMENTS
	INTERV	AL (ft)		PENETRATION TEST RESULTS	GRAPHIC LOG			
		RECOVE	ERY (ft)	TEST RESULTS	HC	SOIL NAME, USCS GROUP SYMBOL, C	OLOR,	DEPTH OF CASING, DRILLING RATE,
			TYPE/	6"-6"-6"	ζAΡ	MOISTURE CONTENT, RELATIVE DENS CONSISTENCY, SOIL STRUCTURE, MINE	RALOGY	DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
			NUMBER		ច			
							- - -	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					FAT CLAY (CH)	- - - -	- - - PP = 0, 0.5, 0.75 tsf
	6.5	1.30	SS-1	WOH-0-1 (1)		Gray mottled slight orangish-brown, mois soft, medium plasticity, trace fine sand, tr reddish-brown iron oxide staining (Reside of the Springwater Formation)	ace	WC = 37.3% LL = 52, PL = 23, PI = 29
10	10.0	1.50	SS-2	1-3-3		Similar to SS-1 except reddish brown, firr reddish-brown iron oxide staining, black l nodules	m, more Mn -	PP = 0.5, 0.75, 1.5 tsf
-	11 5			<mark>(6)</mark>		noudles	-	-
	11.5						- - - -	-
15	15.0							
-	16.5	1.50	SS-3	WOH-1-0 (1)		FAT CLAY (CH) Gray mottled brown to greenish brown, m very soft, high plasticity, 6.5% fine sand, reddish-brown iron oxide staining (Reside of the Springwater Formation)	trace	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
20							_	-

SOIL	BORING	LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664904.92 N, 7736258.26 E)

PROJECT NUMBER:

D3460500

ELEVATION: 595.79 ft

DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dustin Helmig

BORING NUMBER:

SHEET 2 OF 3

LFWP-BH08

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 bqs						START : 9/2/21 08:55 END : 9/2/				
DEPTH E	DEPTH BELOW GROUND SURFACE (ft)					SOIL DESCRIPTION	COMMENTS			
	INTERVA	AL (ft) RECOVE	E <mark>RY (</mark> ft)	PENETRATION TEST RESULTS	GRAPHIC LOG	SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR	DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND			
			TYPE/ NUMBER	6"-6"-6" (N)	GRA	CONSISTENCY, SOIL STRUCTURE, MINERALOGY	INSTRUMENTÁTION			
-	20.0 21.5	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%			
-							23 ft: Use 6" drag bit to re-drill borehole from 0-15 ft bgs, borehole collared up due to plastic soils.			
	25.0						Switch back to 4-7/8" drag bit.			
-	26.5	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, Pl = 4 Top 1" of SS-5 includes soil similar to SS-4 Pumaceous sand 25 ft: Switch to 4-7/8" tricone bit			
-										
- 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	Lightly cemented sand, disintegrates easily with finger pressure.			
	31.5					diameter (Less Weathered Springwater - Formation) - - -				
35	35.0			34-40-50/4"						
-	36.3	1.33	SS-7	(90/10")		subangular to subrounded gravel (Less Weathered Springwater Formation)	Fines = 29.7%, Sand = 58.1%, Gravel = 12.2% Recovery in SS = 1.5 ft Drill rig chatter after 36 ft			
-										
40							-			

9	OIL BORING LOG					
D3460500	LFWP-BH08	SHEET	3	OF	3	_
PROJECT NUMBER:	BORING NUMBER:					

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-Ib 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) COMMENTS SOIL DESCRIPTION LOG PENETRATION TEST RESULTS INTERVAL (ft) GRAPHIC SOIL NAME, USCS GROUP SYMBOL, COLOR, DEPTH OF CASING, DRILLING RATE, **RECOVERY** (ft) DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY 6"-6"-6" TYPE/ NUMBE (N) 24-50/3 Similar to SS-7 except ±10% fine to coarse Recovery in SS = 1.3 ft 40.0 0.75 SS-8 subangular to subrounded gravel 40-50 ft: Driller reported similar soil. (50/3")40.8 45_ 50 50.0 : .:. 50.3 0.25 SS-10 Similar to SS-7 except no greater than 0.25" 50/3" Installed 2" dia standpipe piezometer for future (50/3")diameter gravel pieces installation of VWP Bottom of Boring at 50.25 ft below ground surface Standpipe piezometer installed immediately after Geokon VWP 4500S (350 kPa), unvented, serial drilling no. 2146339 VWP installed on 12/21/2021. Geokon datalogger 8002-WP-2 LC-2, serial no. 2128642 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 55 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 60