Branch ENGINEERING inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

November 17, 2020

City of Harrisburg
PO Box 378
Harrisburg, Oregon 97446

RE: **GEOTECHNICAL INVESTIGATION**
WATER STORAGE RESERVOIR SITES
795 S. 2ND AVENUE & PEORIA ROAD
HARRISBURG, OREGON
Branch Engineering Inc Project No. 13-007

A Branch Engineering Inc. (BEI) geotechnical engineering staff conducted a subsurface investigation of both sites on September 2 and 3, 2020 to assess the subgrade soil conditions for construction of a water supply reservoir at each location.

Site and Project Description

South Site: The south site is located within the existing confines of the City's Public Works maintenance facility at 795 S. 2nd Avenue. The proposed location of the 0.5-million gallon above ground storage reservoir is in the southeast corner of the fenced parcel at latitude 44.266010° north and longitude 123.172650° west. The flat site is covered with compacted aggregate and two reservoir tanks are located just north of the location.

North Site: The north site is located directly west of address 23767 Peoria Road at the location of an existing City water pump station. The proposed reservoir site is south of the pump station building; however, BEI advanced borings on the north side as the final location did not seem to be set at the time of our site work. The area is a relatively flat, grass covered field at latitude 44.286210 north and longitude 123.175642 west. The proposed above ground storage reservoir size for this site is 1.5-million gallons.

Site Information Resources

The following site investigation activities were performed and literature was reviewed for pertinent site information.

- Five exploratory mud-rotary borings were advanced, two on the South Site and three on the North Site to a maximum depth of 51.5-feet below ground surface (BGS) at each site. The attached Figure-1 shows the approximate location of the borings at each site.

- Review of the Lane County Area Web Soil Survey, United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS).

- Review of the Geologic Mapping of the site area, United States Geological Survey (USGS) Geologic Map of Oregon, 1991, and Oregon Department of Geology and Mineral Industries (DOGAMI) Digital Geologic Map of the Southern Willamette Valley, Benton, Lane, Linn, Marion, and Polk Counties, Oregon, McClaughry, Wiley, Ferns, and Madin Open File Report (OFR) O-10-03, 2010

- Review of Oregon Department of Geology and Mineral Industries (DOGAMI) web hazard viewer.

- Review of nearby well logs obtained from the Oregon Water Resources Well Log Query

Site Geology

Geologic mapping of both sites is the same and is described as Pleistocene age lacustrine and fluvial sediments of gravels, sand, silt and clay that are unconsolidated to semi-consolidated by Walker and MacLeod, 1991. OFR O-10-03 maps the sites as Quaternary age Terrace and Fan deposits of unconsolidated to semi-consolidated gravels, sand, silt, and clay. The NRCS Web Soil Survey maps the South Site soil as Dayton Silt loam described as a silty and clayey alluvium found on terraces; the North Site is mapped as Willamette Silt loam described as silty alluvium found on terraces. The soil description and geologic description are consistent with our field observations. Well logs near each site show similar soil strata conditions to depths over 100-feet with increased clay zones at depth.

Site Soil Conditions

The subsurface soil conditions at each site are similar and are comprised of brown, damp to moist, medium stiff silt with clay to a depth of 10- to 11-feet BGS underlain by wet, dense rounded to sub-rounded gravels with sand to 44-feet BGS at the South Site and 50-feet BGS on the North site before encountering a grey to light brown sandstone.

Groundwater

Groundwater was measured at 14-feet BGS upon completion of drilling on the North Site and although a static level was not specifically measured due to hole caving at the South Site, the gravels became wet at about 20-feet BGS. The static water level in South Site City Well 15/4W-16H was measured at 22-feet BGS in August 1966. City Well number 87958 on the North Site had an upper static water level of 6-feet BGS in January 2007.

Excavations and Utility Trenching

Excavations for reservoir connections and plumbing are expected to be located within the upper 5-feet of each site and will encounter moist, silt soil that should stand near vertical to a depth of 4-feet. Groundwater is not expected to be encountered in these excavations; however, perched lenses can be expected during the mid to late wet season. The soils are classified as OSHA Type A. Equipment or materials should not be placed within 10-feet of an open trench.

Reservoir Foundation Subgrade Preparation

The following recommendations are for earthwork in the foundation areas. Earthwork shall be performed in general accordance with the standard of practice as generally described in Appendix J of the 2019 Oregon Structural Specialty Code and as specified in of this report. All areas intended to directly or laterally support structures shall be stripped of vegetation, organic soil, fill, and/or other deleterious material. These strippings shall either be removed from the site or used for foundation backfill.

The pad for the new water reservoir(s) shall be excavated to approximately 3-feet BGS to remove soft soil to expose suitable subgrade. After excavation to suitable subgrade, place a woven geotextile separation fabric on the subgrade and cover with structural backfill consisting of 1 ½" – (0) compacted aggregate shall be placed in lifts not exceeding 8-inches loose lift thickness and compacted to 95% relative compaction as determined by ASTM 1557 (modified Proctor). The aggregate thickness shall be a minimum of 24-inches thick and compaction testing by nuclear densometer (ASTM 6938) shall be performed to confirm compaction requirements are met. A

smaller diameter aggregate such as ¾" – (0) is acceptable for placement and compaction in the upper 6-inches of the structural fill if desired by the contractor. Excavation to subgrade and placement of structural fill shall extend horizontally a minimum distance 3-feet beyond the outside of the reservoir pad

Upon preparation of the reservoir pad(s) as described above, the allowable bearing capacity of the pad will be 2,500 psf with a modulus of subgrade reaction of 190 psi/in. The bearing capacity may be increased by 1/3 for short term loading, such as wind or seismic events.

Periodic site observations by a geotechnical representative of BEI are recommended during the construction of the project; the specific phases of construction that should be observed are:

Table 1: Recommended Construction Observations

Recommended Construction Phases to be Observed by the Geotechnical Engineer	
At completion of subgrade excavation	Subgrade observation by the geotechnical engineer before fabric and aggregate placement.
Imported fill material	Observation of material or information on material type and source.
Placement or Compaction of fill material	Observation by geotechnical engineer or test results by qualified testing agency.

Drainage

As both proposed reservoir sites are flat, foundation drains are required provided that perimeter grades slope away from the reservoir pad so that surface water is not allowed to pond adjacent to foundations.

Site Seismic Classification

Based on the soil properties encountered in our site hand auger boring, on-site test pits and on-site well log information, Site Class D (Table 20.3-1 ASCE 7) is recommended for design of site structures. Site specific seismic spectral response design values generated by the USGS are attached for reference.

Conclusions

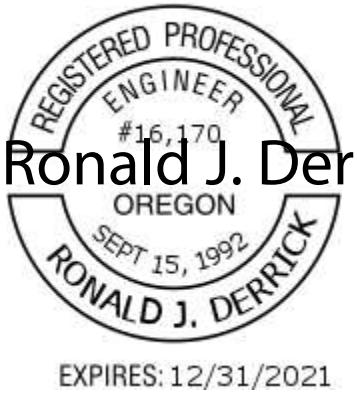
Based on our field observations, subsurface explorations, and data analyses, we conclude that the site is geologic and geotechnically suitable for the proposed development provided that the recommendations of this report are incorporated into the design and construction of the project. Our investigation did not reveal any specific site features or subsurface conditions that would impede the proposed building design or construction. Please contact our office with any questions.

Limitations

This report presents BEI's site observations, site research, site explorations, and recommendations for the proposed site development. The conclusions in this report are based on the conditions

described in this report and are intended for the exclusive use of the City of Harrisburg and their representatives for use in the site development design and construction. The analysis and general recommendations provided herein may not be suitable for structures or purposes other than those described herein. Services performed by the geotechnical engineer for this project have been conducted with the level of care and skill exercised by other current geotechnical professionals in this area under similar budget and time constraints. No warranty is herein expressed or implied. The conclusions in this report are based on the site conditions as they currently exist in the vicinity of the proposed home sites and it is assumed that the limited site locations that were physically investigated generally represent the subsurface conditions at the site. Should site development or site conditions change, or if a substantial amount of time goes by between our site investigation and site development, we reserve the right to review this report for its applicability. If you have any questions regarding the contents of this report, or if we can be of further assistance, please contact our office.

Sincerely,
Branch Engineering Inc.,



Ronald J. Derrick
Digitally signed by Ronald J. Derrick
Date: 2021.01.07 15:25:55 -08'00'

Ronald J. Derrick, P.E., G.E.
Principal Geotechnical Engineer

Attachments: Figure-1 Site Exploration Map
Appendix A - USCS Soils Key, Exploratory Boring Logs, Well Logs, Soil Survey
Appendix B – Geotechnical Specifications

N

NOTE: AERIAL IMAGE BY GOOGLE EARTH, 2020

WELLS 8 & 9 SITE *SCALE 1:80*

N

NOTE: AERIAL IMAGE BY GOOGLE EARTH, 2020

WELLS 4, 6, & 7 SITE *SCALE 1:80*

GRAPHIC SCALE
30 0 30 60
(IN FEET)

GRAPHIC SCALE
40 0 40 80
(IN FEET)

LEGEND

B-1 INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING

Branch ENGINEERING Inc
Since 1977

310 5th STREET, SPRINGFIELD, OREGON 97477

SCALE: VARIES BY SITE, SEE SPECIFIC SCALE BARS

SITE EXPLORATION MAP - NORTH & SOUTH WATER TREATMENT PLANT SITES

CITY OF HARRISBURG, OREGON

FIGURE-1

SEPTEMBER 2 & 3, 2020

PROJECT NO. 20-009C

APPENDIX A:

USCS Soils Key, Exploratory Boring Logs, Well Logs and Soil Survey

RELATIVE DENSITY - COARSE GRAINED SOILS

RELATIVE DENSITY	SPT N-VALUE	D&M SAMPLER (140 lbs hammer)	D&M SAMPLER (300 lbs hammer)
VERY LOOSE	< 4	< 11	< 4
LOOSE	4 - 10	11 - 26	4 - 10
MEDIUM DENSE	10 - 30	26 - 74	10 - 30
DENSE	30 - 50	74 - 120	30 - 47
VERY DENSE	> 50	> 120	> 47

USCS GRAIN SIZE

FINES		< #200 (.075 mm)
SAND	Fine	#200 - #40 (.425 mm)
	Medium	#40 - #10 (2 mm)
	Coarse	#10 - #4 (4.75 mm)
GRAVEL	Fine	#4 - 0.75 inch
	Coarse	0.75 - 3 inch
COBBLES		3 - 12 inches

CONSISTENCY - FINE GRAINED SOILS

CONSISTENCY	SPT N-VALUE	D&M SAMPLER (140 lbs hammer)	D&M SAMPLER (300 lbs hammer)	POCKET PEN. / UNCONFINED (TSF)	MANUAL PENETRATION TEST
VERY SOFT	< 2	< 3	< 2	< 0.25	Easy several inches by fist
SOFT	2 - 4	3 - 6	2 - 5	0.25 - 0.50	Easy several inches by thumb
MEDIUM STIFF	4 - 8	6 - 12	5 - 9	0.50 - 1.00	Moderate several inches by thumb
STIFF	8 - 15	12 - 25	9 - 19	1.00 - 2.00	Readily indented by thumb
VERY STIFF	15 - 30	25 - 65	19 - 31	2.00 - 4.00	Readily indented by thumbnail
HARD	> 30	> 65	> 31	> 4.00	Difficult by thumbnail

UNIFIED SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS: More than 50% retained on No. 200 sieve	GRAVELS: 50% or more *retained* on the No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS: 50% or more *passing* the No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines.
			SP	Poorly-graded sands and gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS: Less than 50% retained on No. 200 sieve	SILT AND CLAY	LIQUID LIMIT LESS THAN 50	ML	Inorganic silts, rock flour, clayey silts.
			CL	Inorganic clays of low to medium plasticity, lean clays.
			OL	Organic silt and organic silty clays of low plasticity.
		LIQUID LIMIT 50 OR GREATER	MH	Inorganic silts, clayey silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS			PT	Peat, muck, and other highly organic soil.

MOISTURE CONTENT

DRY: Absence of moisture, dusty, dry to the touch
DAMP: Some moisture but leaves no moisture on hand
MOIST: Leaves moisture on hand
WET: Visble free water, usually saturated

	PLASTICITY	DRY STRENGTH	DILATANCY	TOUGHNESS
ML	Non to Low	Non to Low	Slow to Rapid	Low, can't roll
CL	Low to Med.	Med. to High	None to Slow	Medium
MH	Med. to High	Low to Med.	None to Slow	Low to Med.
CH	Med. to High	High to V.High	None	High

STRUCTURE

STRATIFIED: Alternating layers of material or color > 6mm thick.
LAMINATED: Alternating layers < 6mm thick.
FISSURED: Breaks along definate fracture planes.
SLICKENSIDED: Striated, polished, or glossy fracture planes.
BLOCKY: Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
LENSES: Has small pockets of different soils, note thickness.
HOMOGENEOUS: Same color and appearance throughout.

LIST OF ABBREVIATION & EXPLANATIONS

SPT	Standard Penetration Test split barrel sampler
D&M	Dames and Moore sampler
LL	Atterberg Liquid Limit
PL	Atterberg Plastic Limit
PP	Pocket Penetrometer
VS	Vane Shear
G	Grab sample
MC	Moisture Content
MD	Moisture Density
UC	Unconfined Compressive Strength

EXPLORATORY KEY

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310 5th Street, Springfield OR 97477 | p: 541.746.0637 | www.branchengineering.com

Borehole ID: B-1

Sheet 1 of 2

Branch ENGINEERING INC. civil · transportation structural · geotechnical SURVEYING

Client:	City of Harrisburg	**Project Name:**	Harrisburg WTP Sites
Project Number:	20-009C	**Project Location:**	S. 2nd Street & Peoria Road
Date Started:	Sep 02 2020 **Completed:** Sep 02 2020	**Logged By:**	MWR **Checked By:** RJD
Drilling Contractor:	Western States	**Latitude:**	44.266052 **Longitude:** -123.172659 **Elevation:**
Drilling Method:	Mud Rotary	**Ground Water Levels**	
Equipment:	CME 75		
Hammer Type:	Automatic		
Notes:			

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
0		(GP) Angular open-graded quarry rock on ground surface					
1		(ML) Brown, dry, medium stiff Clayey Silt					
2			SPT				
3				67	3-4-8	1.50	
4							
5			SPT				
6		(ML) Brown, moist, Clayey Silt with trace fine grain sand, sand content increasing with depth		67	5-6-8	1.50	
7			SPT				
8				67	4-5-6	1.50	
9							
10			SPT				
11				67	4-11-31		
12		(GW) Brown-gray, dense, sandy rounded to sub-rounded Gravel, becomes wet at approximately 20-feet, routine caving during sampling with loss of drilling fluid at 30 to 35-feet					
13							
14							
15			SPT				
16				33	17-30-30		
17							
18							
19							
20			SPT				
21				33	17-23-26		
22							
23							
24							
25			SPT				
26				33	10-30-45		
27							
28							
29							
30			SPT				

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Borehole ID: B-1

Client: City of Harrisburg
Project Name: Harrisburg WTP Sites
Project Number: 20-009C
Project Location: S. 2nd Street & Peoria Road
Date Started: Sep 02 2020 **Completed:** Sep 02 2020
Logged By: MWR **Checked By:** RJD
Drilling Contractor: Western States
Latitude: 44.266052 **Longitude:** -123.172659 **Elevation:**
Drilling Method: Mud Rotary
Ground Water Levels
Equipment: CME 75
Hammer Type: Automatic
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
31		(GW) Brown-gray, dense, sandy rounded to sub-rounded Gravel, becomes wet at approximately 20-feet, routine caving during sampling with loss of drilling fluid at 30 to 35-feet		33	12-27-27		
32							
33							
34							
35			SPT				
36				33	14-15-19		
37							
38							
39							
40							
41							
42							
43							
44		Siltstone: Gray Siltstone, transition from gravel at approximately 44-feet, no sampling from 35-feet to 50-feet due to caving gravel					
45							
46							
47							
48							
49							
50			SPT				
51				33	15-21-28		
52							
53							
54							
55							
56							
57							
58							
59							
60							

Borehole ID: B-2

Sheet 1 of 1

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Client:	City of Harrisburg	**Project Name:**	Harrisburg WTP Sites
Project Number:	20-009C	**Project Location:**	S. 2nd Street & Peoria Road
Date Started:	Sep 02 2020 **Completed:** Sep 02 2020	**Logged By:**	MWR **Checked By:** RJD
Drilling Contractor:	Western States	**Latitude:**	44.266052 **Longitude:** -123.172659 **Elevation:**
Drilling Method:	Mud Rotary	**Ground Water Levels**	
Equipment:	CME 75		
Hammer Type:	Automatic		
Notes:			

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
0		(GP) Angular open-graded quarry rock on ground surface					
1		(ML) Brown, dry-damp, medium stiff Clayey Silt					
2			SPT				
3				67	2-3-4		
4							
5			SPT			1.50	
6				67	3-4-7		
7							
8		(ML-SC) Brown, moist, stiff Clayey Silt with trace fine-grain sand, sand content increases with depth, trace rounded gravel	SPT	67	6-7-7		
9							
10			SPT				
11				67	9-9-8		
12		(GW) Brown-gray, dense, sandy rounded to sub-rounded Gravel					
13							
14							
15			SPT				
16				67	29-46-50		
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

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Borehole ID: B-3

Sheet 1 of 2

Client: City of Harrisburg
Project Name: Harrisburg WTP Sites
Project Number: 20-009C
Project Location: S. 2nd Street & Peoria Road
Date Started: Sep 03 2020 **Completed:** Sep 03 2020
Logged By: MWR **Checked By:** RJD
Drilling Contractor: Western States
Latitude: 44.286042 **Longitude:** -123.175553 **Elevation:**
Drilling Method: 8" HSA
Ground Water Levels
Equipment: CME 75
At time of drilling 14.00 on Sep 03 2020
Hammer Type: Automatic
Notes:

Depth	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)
1	(ML) Brown, stiff, dry Clayey Silt				
2					
3		SPT	67	4-5-6	
4					
5		SPT			
6	(ML) Brown-gray, stiff, damp Clayey Silt		67	7-11-15	2.00
7					
8		SPT	67	9-14-20	
9	(SM) Brown, moist, fine-grain Sand with silt				
10		SPT			
11	(GW) Brown-gray, dense, sandy rounded to sub-rounded Gravel		67	19-27-33	
12					
13					
14	▽				
15		SPT			
16			67	18-23-24	
17					
18					
19					
20		SPT			
21			67	11-14-15	
22					
23					
24					
25		SPT			
26			67	2-6-13	
27					
28					
29					
30		SPT			

SPT N-Value
PL MC LL
Fines Content

10 20 30 40 50 60 70 80 90

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Borehole ID: B-3

Client: City of Harrisburg
Project Name: Harrisburg WTP Sites
Project Number: 20-009C
Project Location: S. 2nd Street & Peoria Road
Date Started: Sep 03 2020 **Completed:** Sep 03 2020
Logged By: MWR **Checked By:** RJD
Drilling Contractor: Western States
Latitude: 44.286042 **Longitude:** -123.175553 **Elevation:**
Drilling Method: 8" HSA
Ground Water Levels
Equipment: CME 75
At time of drilling 14.00 on Sep 03 2020
Hammer Type: Automatic
Notes:

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)
31		(GW) Brown-gray, dense, sandy rounded to sub-rounded Gravel		67	27-28-32	
35			SPT	33	17-50	
40			SPT	67	19-15-12	
45			SPT	33	48-50	
50			SPT	100	15-11-16	
51		Siltstone: Transition to light brown Siltstone				

SPT N-Value
PL MC LL
Fines Content
10 20 30 40 50 60 70 80 90

Borehole ID: B-4

Sheet 1 of 1

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Client:	City of Harrisburg	**Project Name:**	Harrisburg WTP Sites
Project Number:	20-009C	**Project Location:**	S. 2nd Street & Peoria Road
Date Started:	Sep 03 2020 **Completed:** Sep 03 2020	**Logged By:**	MWR **Checked By:** RJD
Drilling Contractor:	Western States	**Latitude:**	44.286042 **Longitude:** -123.175553 **Elevation:**
Drilling Method:	8" HSA	**Ground Water Levels**	
Equipment:	CME 75	At time of drilling	15.00 on Sep 03 2020
Hammer Type:	Automatic		
Notes:			

Depth	Graphic	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)	SPT N-Value PL MC LL Fines Content (10 20 30 40 50 60 70 80 90)
1		(ML) Brown, dry, stiff Clayey Silt					
2			SPT				
3				67	3-5-6		
4							
5			SPT				
6				67	3-3-4	0.50	
7		(ML-SM) Brown, soft, moist Clayey Silt with fine-grain sand, becomes wet and soft					
8			SPT	100	2-2-3		
9							
10			SPT				
11				67	2-12-21		
12		(GW) Wet, dense Sandy Gravel					
13							
14							
15		▽	SPT				
16				67	6-13-19		
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							

Borehole ID: B-5

Sheet 1 of 1

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Client:	City of Harrisburg	**Project Name:**	Harrisburg WTP Sites
Project Number:	20-009C	**Project Location:**	S. 2nd Street & Peoria Road
Date Started:	Sep 03 2020 **Completed:** Sep 03 2020	**Logged By:**	MWR **Checked By:** RJD
Drilling Contractor:	Western States	**Latitude:**	44.286042 **Longitude:** -123.175553 **Elevation:**
Drilling Method:	8" HSA	**Ground Water Levels**	
Equipment:	CME 75	At time of drilling	15.00 on Sep 03 2020
Hammer Type:	Automatic		
Notes:			

Depth	Material Description	Sample	Recovery % RQD	Blow Counts (N Value)	Pocket Pen. (tsf)
1	(ML) Brown, dry, medium stiff Clayey Silt				
2					
3		SPT	67	3-3-4	
4					
5		SPT			
6	(ML-SM) Brown, moist Clayey Silt with trace fine grain sand, sand content and moisture increase with depth		100	2-4-5	1.00
7					
8		SPT	100	2-3-2	0.50
9					
10		SPT			
11	(GW) Wet, medium dense, Sandy Gravel		100	2-3-8	
12					
13					
14					
15	▽	SPT			
16			67	17-14-14	
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

SPT N-Value
PL MC LL
Fines Content

10 20 30 40 50 60 70 80 90

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

RECEIVED AUG 22 1966 STATE ENGINEER SALEM OREGON

LINN

WATER WELL REPORT 14186

STATE OF OREGON (Please type or print)

State Well No. 15/4W-16 H

State Permit No. G-3693

(1) OWNER:

Name City of Harrisburg

Address Harrisburg, Oregon

(2) LOCATION OF WELL:

County ~~Lane~~ Linn Driller's well number

¼ ¼ Section 16 T. 15S R. 4W W.M.

Bearing and distance from section or subdivision corner

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

If abandonment, describe material and procedure in Item 12.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☒

Irrigation ☐ Test Well ☐ Other ☐

(5) TYPE OF WELL:

Rotary ☐ Driven ☐

Cable ☒ Jetted ☐

Dug ☐ Bored ☐

(6) CASING INSTALLED:

Threaded ☐ Welded ☒

12 " Diam. from 0 ft. to 350 ft. Gage .330

" Diam. from ft. to ft. Gage

" Diam. from ft. to ft. Gage

(7) PERFORATIONS:

Perforated? ☒ Yes ☐ No

Type of perforator used Mills knife

Size of perforations ¼ in. by 2 in.

perforations from ft. to ft.

320 perforations from 110 ft. to 130 ft.

80 perforations from 335 ft. to 340 ft.

perforations from ft. to ft.

perforations from ft. to ft.

(8) SCREENS:

Well screen installed? ☐ Yes ☒ No

Manufacturer's Name

Type Model No.

Diam. Slot size Set from ft. to ft.

Diam. Slot size Set from ft. to ft.

(9) CONSTRUCTION:

Well seal—Material used in seal Bentonite

Depth of seal 20 ft. Was a packer used? clay

Diameter of well bore to bottom of seal 18 in.

Were any loose strata cemented off? ☐ Yes ☒ No Depth

Was a drive shoe used? ☒ Yes ☐ No

Was well gravel packed? ☐ Yes ☒ No Size of gravel:

Gravel placed from ft. to ft.

Did any strata contain unusable water? ☒ Yes ☐ No

Type of water? sulfur depth of strata 400'

Method of sealing strata off cement plug @ 346

(10) WATER LEVELS:

Static level 22 ft. below land surface Date 8/5/66

Artesian pressure lbs. per square inch Date

(11) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? ☒ Yes ☐ No If yes, by whom? WW Drilling

Yield: 300 gal./min. with 120 ft. drawdown after 27 hrs.

" " " "

" " " "

Bailer test gal./min. with ft. drawdown after hrs.

Artesian flow g.p.m. Date

Temperature of water 56 Was a chemical analysis made? ☐ Yes ☒ No

(12) WELL LOG:

Diameter of well below casing 12

Depth drilled 400 ft. Depth of completed well 346 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Gray white clay	0	10
Gray clay	10	14
Brown clay - pea gravel	14	47
Blue clay	47	65
Soft brown clay- very fine sand- water bearing	65	78
Soft blue clay	78	115
Black sand & gravel-(W B)	115	125
Blue clay	125	135
Gray green clay	135	150
Blue clay	150	178
Black sand very fine some water - static head 25'	178	190
Blue clay - very sticky	190	250
Very fine sand, blue clay some water, lots of wood	250	275
Dark gray clay - fine sand	275	290
Blue clay very sticky	290	335
Coarse black sand with buck shot gravel	335	337
Blue clay	337	400

Work started 6/29/66 19 Completed 8/6/66 19

Date well drilling machine moved off of well 8/6/66 19

(13) PUMP:

Manufacturer's Name

Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME W. W. Drilling and Pump Service (Person, firm or corporation) (Type or print)

Address 4157 Main St. Springfield, Ore.

Drilling Machine Operator's License No. 24

[Signed] Walt Wilson (By Lbs.) (Water Well Contractor)

Contractor's License No. 268 Date 8/8/66, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

REVISED 3-16-07

LINN 57656

LINN 57656
03-15-2007

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

WELL LABEL # L 87958

START CARD # 1000475

(1) LAND OWNER

Owner Well I.D.

First Name Last Name

Company City of Harrisburg

Address 354 Smith Street

City Harrisburg State OR Zip 97446

(2) TYPE OF WORK

☒ New Well ☐ Deepening ☐ Conversion
☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger ☐ Cable Mud
☐ Reverse Rotary ☐ Other

(4) PROPOSED USE

☐ Domestic ☐ Irrigation ☒ Community
☐ Industrial/ Commericial ☐ Livestock ☐ Dewatering
☐ Thermal ☐ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION

Special Standard ☐ (Attach copy)

Depth of Completed Well 236.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
12	0	236	Cement	0	184	196	S
			Bentonite	184	189	5	S
			Sand	189	236	401	S

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E

☐ Other

Backfill placed from 189 ft. to 191 ft. Material 20/40 sand

Filter pack from 191 ft. to 236 ft. Material sand Size 10/20

Explosives used: ☐ Yes Type Amount

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
●	○	8	☒	3	211	.250	●	○	☒	☐
●	○	8	☐	231	236	.250	●	○	☒	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐

Shoe ☐ Inside ☐ Outside ☐ Other Location of shoe(s)

Temp casing ☒ Yes Dia 12 From 1 To 236

(7) PERFORATIONS/SCREENS

Perforations Method

Screens Type Johnson Material 304 SS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size
Screen	Casing	8	211	231	.03		1,000	8

(8) WELL TESTS: Minimum testing time is 1 hour

○ Pump ○ Bailer ◉ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
400	218	236	1
400	182	200	1
275	132	150	1

Temperature 57 °F Lab analysis ☐ Yes By

Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County Linn Twp 15.00 S N/S Range 4.00 W E/W WM

Sec 9 NW 1/4 of the NE 1/4 Tax Lot 700

Tax Map Number Lot

Lat ° 0 ' " or DMS or DD

Long ° 0 ' " or DMS or DD

○ Street address of well ◉ Nearest address

Just north of 23690 Peoria Road Harrisburg, OR

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			☐	
Completed Well	03-12-2007		☐	18

Flowing Artesian? ☐ Dry Hole? ☐

WATER BEARING ZONES Depth water was first found

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
01-19-2007	9	90	75		☐	6
01-22-2007	120	155	300		☐	110
01-24-2007	214	231	400		☐	18
					☐	
					☐	

(11) WELL LOG

Ground Elevation

Material	From	To
Crushed rock	0	1
Brown sandy clay	1	9
Brown sand and small gravels	9	38
Brown and gray sand and gravel	38	50
Brown sand and gravel	50	61
Brown sand (heaving)	61	90
Blue sandy clay	90	120
Black heaving sand	120	155
Blue claystone	155	214
Black heaving sand	214	231
Blue clay	231	236

RECEIVED
MAR 19 2007
WATER RESOURCES DEPT
SALEM OREGON

Date Started 01-15-2007 Completed 03-12-2007

(unbonded) Water Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number 1776 Date 03-15-2007

Electronically Filed
Signed DOUGLAS D TUCKER (E-filed)

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1541 Date 03-15-2007

Electronically Filed
Signed CASEY JONES JR (E-filed)

Contact Info (optional) Casey Jones Well Drilling 541-747-280

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version: 0.88

LINN 57656

WATER SUPPLY WELL REPORT - continuation page

WELL I.D. # L 0 87958

START CARD # 0 1000475

(5) BORE HOLE CONSTRUCTION

BORE HOLE

Dia	From	To

SEAL

Material	From	To	Amt	sacks/ lbs

FILTER PACK

From	To	Material	Size

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(7) PERFORATIONS/SCREENS

Perf/ Screen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
200	82	100	1

Water Quality Concerns

From	To	Description	Amount	Units

(10) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) WELL LOG

Material	From	To

RECEIVED

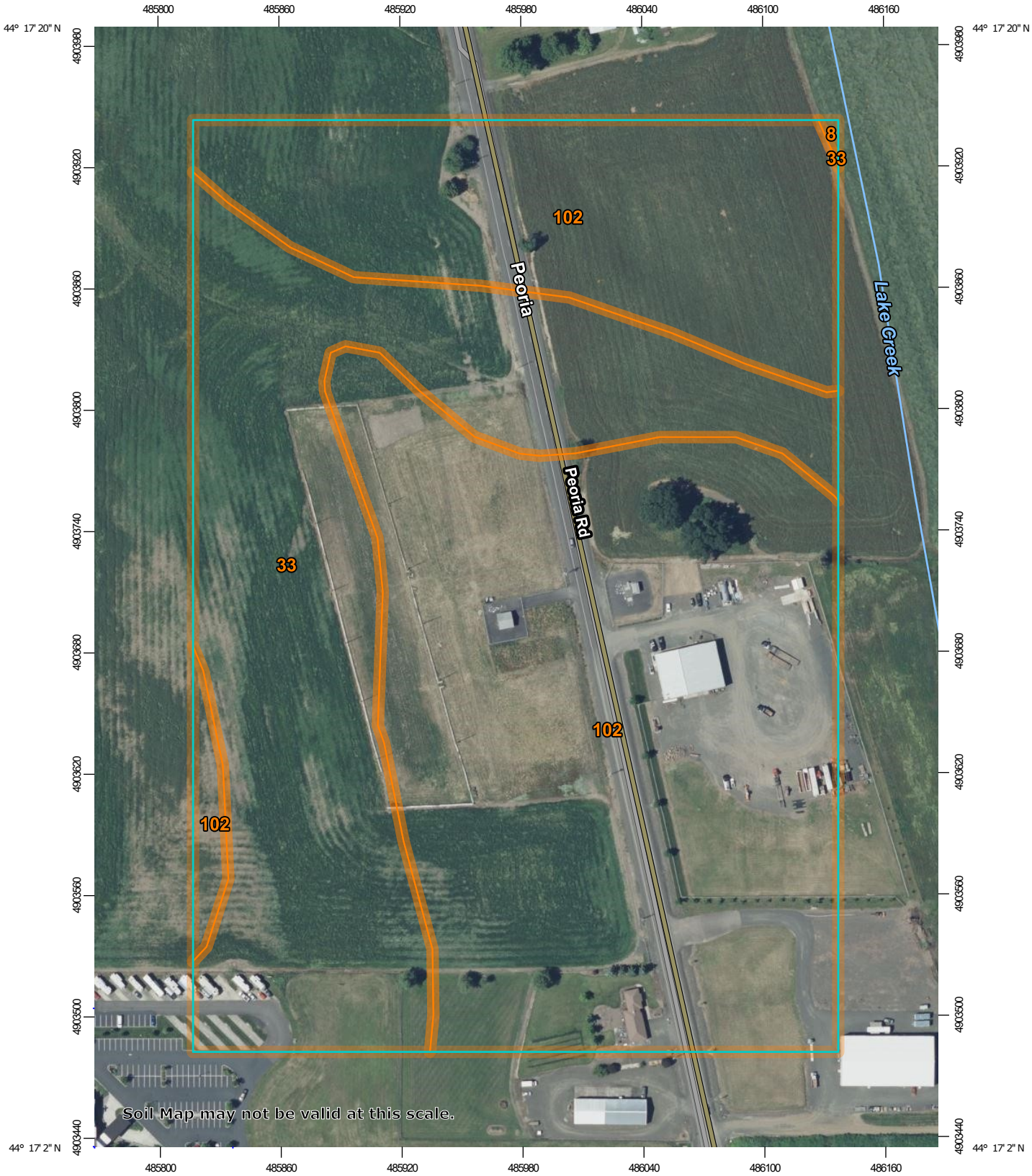
MAR 10 2007

WATER RESOURCES DEPT

SALEM, OREGON

Comments/Remarks

Soil Map—Linn County Area, Oregon
(North Site - Harrisburg Reservoir)



Map Scale: 1:2,700 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Linn County Area, Oregon
Survey Area Data: Version 15, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 23, 2020—May 28, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Bashaw silty clay	0.0	0.1%
33	Dayton silt loam	12.3	33.7%
102	Willamette silt loam	24.2	66.2%
Totals for Area of Interest		**36.6**	**100.0%**

Linn County Area, Oregon

102—Willamette silt loam

Map Unit Setting

National map unit symbol: 24vl
Elevation: 200 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Willamette and similar soils: 85 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Willamette

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Silty alluvium derived from mixed materials

Typical profile

H1 - 0 to 24 inches: silt loam
H2 - 24 to 53 inches: silty clay loam
H3 - 53 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Concord

Percent of map unit: 3 percent

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

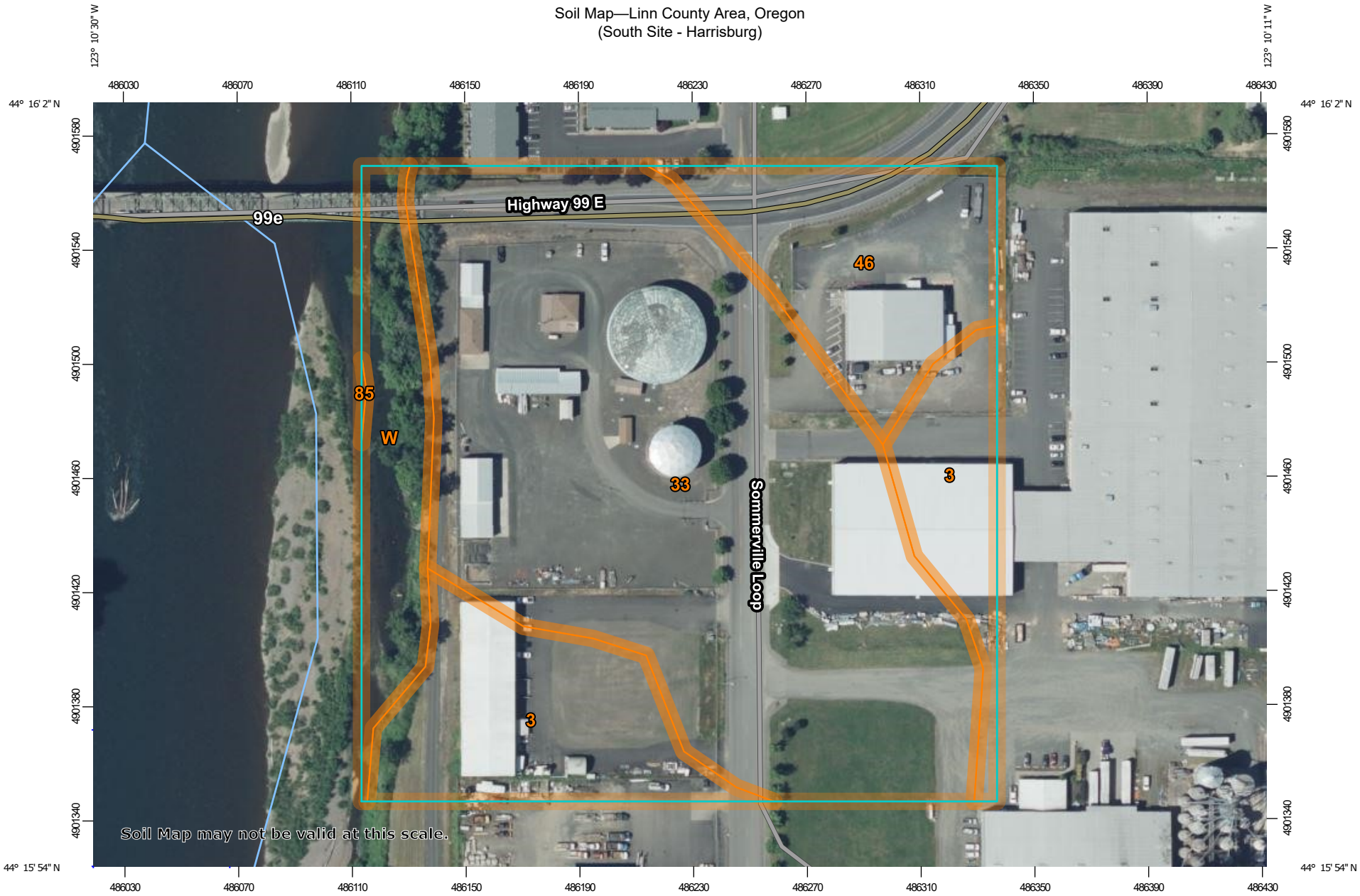
Dayton

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Linn County Area, Oregon
Survey Area Data: Version 15, Jun 11, 2020

Soil Map—Linn County Area, Oregon
(South Site - Harrisburg)



Map Scale: 1:1,890 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
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- Soil Map Unit Lines
- Soil Map Unit Points

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- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
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- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
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Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Linn County Area, Oregon
Survey Area Data: Version 15, Jun 11, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 23, 2020—May 28, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Amity silt loam	2.4	19.3%
33	Dayton silt loam	7.3	59.1%
46	Holcomb silt loam	1.6	13.1%
85	Riverwash	0.0	0.0%
W	Water	1.1	8.5%
Totals for Area of Interest		**12.4**	**100.0%**

Linn County Area, Oregon

33—Dayton silt loam

Map Unit Setting

National map unit symbol: 24x2
Elevation: 200 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Dayton and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dayton

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Parent material: Silty and clayey alluvium and lacustrine deposits

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 15 inches: silt loam
H3 - 15 to 40 inches: silty clay
H4 - 40 to 76 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 12 to 24 inches to abrupt textural change
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water capacity: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Forage suitability group: Poorly Drained (G002XY006OR)
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Concord

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Dayton, gravelly clay substratum

Percent of map unit: 2 percent
Landform: Terraces
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Linn County Area, Oregon
Survey Area Data: Version 15, Jun 11, 2020

APPENDIX B:

Recommended Earthwork Specifications

GEOTECHNICAL SPECIFICATIONS

General Earthwork

1. All areas where structural fills, fill slopes, structures, or roadways are to be constructed shall be stripped of organic topsoil and cleared of surface and subsurface deleterious material, including but limited to vegetation, roots, or other organic material, undocumented fill, construction debris, soft or unsuitable soils as directed by the Geotechnical Engineer of Record. These materials shall be removed from the site or stockpiled in a designated location for reuse in landscape areas if suitable for that purpose. Existing utilities and structures that are not to be used as part of the project design or by neighboring facilities, shall be removed or properly abandoned, and the associated debris removed from the site.

2. Upon completion of site stripping and clearing, the exposed soil and/or rock shall be observed by the Geotechnical Engineer of Record or a designated representative to assess the subgrade condition for the intended overlying use. Pits, depressions, or holes created by the removal of root wads, utilities, structures, or deleterious material shall be properly cleared of loose material, benched and backfilled with fill material approved by the Geotechnical Engineer of Record compacted to the project specifications.

3. In structural fill areas, the subgrade soil shall be scarified to a depth of 4-inches, if soil fill is used, moisture conditioned to within 2% of the materials optimum moisture for compaction, and blended with the first lift of fill material. The fill placement and compaction equipment shall be appropriate for fill material type, required degree of blending, and uncompacted lift thickness. Assuming proper equipment selection, the total uncompacted thickness of the scarified subgrade and first fill lift shall not exceed 8-inches, subsequent lifts of uncompacted fill shall not exceed 8-inches unless otherwise approved by the Geotechnical Engineer of Record. The uncompacted lift thickness shall be assessed based on the type of compaction equipment used and the results of initial compaction testing. Fine-grain soil fill is generally most effectively compacted using a kneading style compactor, such as a sheeps-foot roller; granular materials are more effectively compacted using a smooth, vibratory roller or impact style compactor.

4. All structural soil fill shall be well blended, moisture conditioned to within 2% of the material's optimum moisture content for compaction and compacted to at least 90% of the material's maximum dry density as determined by ASTM Method D-1557, or an equivalent method. Soil fill shall not contain more than 10% rock material and no solid material over 3-inches in diameter unless approved by the Geotechnical Engineer of Record. Rocks shall be evenly distributed throughout each lift of fill that they are contained within and shall not be clumped together in such a way that voids can occur.

5. All structural granular fill shall be well blended, moisture conditioned at or up to 3% above of the material's optimum moisture content for compaction and compacted to at least 90% of the material's maximum dry density as determined by ASTM Method D-1557, or an equivalent method. 95% relative compaction may be required for pavement base rock or in upper lifts of the granular structural fill where a sufficient thickness of the fill section allows for higher compaction percentages to be achieved. The granular fill shall not contain solid particles over 2-inches in diameter unless special density testing methods or proof-rolling is approved by the Geotechnical Engineer of Record. Granular fill is generally considered to be a crushed aggregate with a fracture surface of at least 70% and a maximum size not exceeding 1.5-inches in diameter, well-graded with less than 10%, by weight, passing the No. 200 Sieve.

6. Structural fill shall be field tested for compliance with project specifications for every 2-feet in vertical rise or 500 cy placed, whichever is less. In-place field density testing shall be performed by a competent individual, trained in the testing and placement of soil and aggregate fill placement, using either ASTM Method D-1556/4959/4944 (Sand Cone), D-6938 (Nuclear Densometer), or D-2937/4959/4944 (Drive Cylinder). Should the fill materials not be suitable for testing by the above methods, then observation of placement, compaction and proof-rolling with a loaded 10 cy dump-truck, or equivalent ground pressure equipment, by a trained individual may be used to assess and document the compliance with structural fill specifications.

Utility Excavations

1. Utility excavations are to be excavated to the design depth for bedding and placement and shall not be over-excavated. Trench widths shall only be of sufficient width to allow placement and proper construction of the utility and backfill of the trench.
2. Backfilling of a utility trench will be dependent on its location, use, depth, and utility line material type. Trenches that are required to meet structural fill specifications, such as those under or near buildings, or within pavement areas, shall have granular material strategically compacted to at least the spring-line of the utility conduit to mitigate pipeline movement and deformation. The initial lift thickness of backfill overlying the pipeline will be dependent on the pipeline material, type of backfill, and the compaction equipment, so as not to cause deflection or deformation of the pipeline. Trench backfill shall conform to the General Earthwork specifications for placement, compaction, and testing of structural fill.

Geotextiles

1. All geotextiles shall be resistant to ultraviolet degradation, and to biological and chemical environments normally found in soils. Geotextiles shall be stored so that they are not in direct sunlight or exposed to chemical products. The use of a geotextile shall be specified and shall meet the following specification for each use.

Subgrade/Aggregate Separation

Woven or nonwoven fabric conforming to the following physical properties:

• Minimum grab tensile strength	ASTM Method D-4632	180 lb
• Minimum puncture strength (CBR)	ASTM Method D-6241	371 lb
• Elongation	ASTM Method D-4632	15%
• Maximum apparent opening size	ASTM Method D-4751	No. 40
• Minimum permittivity	ASTM Method D-4491	0.05 s^{-1}

Drainage Filtration

Woven fabric conforming to the following physical properties:

• Minimum grab tensile strength	ASTM Method D-4632	110 lb
• Minimum puncture strength (CBR)	ASTM Method D-6241	220 lb
• Elongation	ASTM Method D-4632	50%
• Maximum apparent opening size	ASTM Method D-4751	No. 40
• Minimum permittivity	ASTM Method D-4491	0.5 s^{-1}

Geogrid Base Reinforcement

Extruded biaxially or triaxially oriented polypropylene conforming to the following physical properties:

• Peak tensile strength lb/ft	ASTM Method D-6637	925
• Tensile strength at 2% strain lb/ft	ASTM Method D-6637	300
• Tensile strength at 5% strain lb/ft	ASTM Method D-6637	600
• Flexural Rigidity	ASTM Method D-1388	250,000 mg-cm
• Effective Opening Size rock size	ASTM Method D-4751	1.5x