SITE STORMWATER AND DOWNSTREAM ANALYSIS REPORT

Prepared For:

Lenity Architecture

3150 Kettle Ct SE

Salem, OR 97301

Project Location:

Bolton Terrace

1575 Burns Street

West Linn, OR 97068

Permit Number: CO -

Prepared By:

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J.O. 3132.0000.0

Updated August 2020

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APPENDICES

PROJECT OVERVIEW & DESCRIPTION

1.1 SIZE & LOCATION OF PROJECT

The proposed project is located on a primarily undeveloped 27,210 square feet lot at 1575 Burns Street in West Linn, Oregon. There is currently a 1,000 square foot house on the lot that will be removed prior to construction. Refer to the Civil Drawings for more detail.

1.2 BRIEF DESCRIPTION OF PROJECT SCOPE AND PROPOSED IMPROVEMENTS

The project scope is to develop the full 27,210 square foot lot. The new development will include two one new commercial building and associated parking and landscaping.

1.3 DESCRIPTION OF SIZE OF WATERSHED DRAINING TO THE SITE

The 27,210 square foot developed site will drain to an existing 12-inch stormwater pipe located in the southeast corner of the lot. This stormwater pipe then drains into the north fork of Cascade Springs Pond Creek. No other areas drain to the developed site.

1.4 DESCRIPTION OF THE EXISTING SITE CONDITIONS, TREES & NATIVE VEGETATION, CONSTRAINTS, SENSITIVE AREAS & WATERWAYS

The existing site is currently undeveloped with a 1,000 square feet single family home on the lot. There are multiple trees on the site and the ground is covered with grass. The westerly portion of the lot is relatively flat, while the eastern portion is moderately sloped descending to the east. Numerous small to large sized trees exist on site.

1.5 REGULATORY PERMITS REQUIRED

City of West Linn permits are required. No other permits are required for this project.

1.6 EMERGENCY STORM ESCAPE ROUTES

Please refer to the Developed Basin Map in Appendix A for emergency overflow routes.

METHODOLOGY

2.1 DEPTH TO GROUNDWATER

Per the Geotechnical Report in Appendix D, groundwater seepage was not encountered and is not expected during construction. See the Geotech Report in Appendix D for details.

2.2 MAXIMUM INFILTRATION AND VEGETATIVE TREATMENT

The proposed stormwater design will not provide detention for onsite runoff due topography constraints. Detention is not required because Cascade Springs Pond Creek has adequate downstream capacity. During the field visit conducted on April 14, 2020, it was determined that Cascade Springs Pond Creek will not see adverse effects due to the increase in stormwater runoff, created by the site, draining into the creek. See Appendix E for details on the field explorations. A Contech stormfilter will be designed to treat the water quality storm event because the site is extremely steep and infiltration is not feasible. See the Civil Drawings for more details.

2.3 SOIL INFORMATION

The pre-developed project site contains hydrologic soil group C soils. Refer to the Soils Report in Appendix B for more details.

2.4 HAZARDOUS MATERIAL

The owner is not aware of any hazardous material contamination onsite.

3.1 METHODS & SOFTWARE USED

HydroCAD modeling software was used to size the stormwater facilities. The Santa Barbara Unit Hydrograph Type 1A storm was used to model the required design storms. Per the City of West Linn Design Standards the design storms used were the 1.2 inch, 24-hour (water quality storm), half the 2-year, 24-hour and the 10-year, 24-hour storm events.

Table 1 | City of West Linn 24-hour Design Storms

	24-Hour Rainfall Depths for West Linn, OR							
Recurrence Interval, Years	2	5	10	25	50	100	500	WQ
24-Hour Depths, Inches	2.5	3.0	3.4	3.9	4.3	4.5	5.3	1.2

Source: City of West Linn Stormwater Management Plan

3.2 CURVE NUMBER AND TIME OF CONCENTRATION CALCULATIONS

Curve numbers were derived from the NRCS runoff curve numbers contained in TR-55 *Urban Hydrology for Small Watersheds* per the City of Gresham Standards. The developed impervious area and pervious areas were assigned curve numbers of 98 and 74 respectively. The impervious areas were assigned a curve number of 98 which corresponds to paved/parking areas. The pervious areas were assigned a curve number of 74 which corresponds to amended soil coverage with C-rated soils.

Time of concentration (Tc) for the pre-developed conditions was calculated to be 17.3 minutes using the sheet flow equation. See the Pre-Developed Basin Map in Appendix A for the flow path used and refer to the HydroCAD Summaries in Appendix C for calculations. A minimum time of concentration of 5 minutes is applied to the developed basin due to the minimum time-step used by the HydroCAD modeling software.

3.3 REVIEW OF RESOURCES & DRAINAGE BASIN

The entire 27,210 square foot lot will drain into Cascade Springs Pond Creek. There are five sub-basins within the Cascade Springs basin. The project site is located within the CS2N1 sub-basin per the West Linn Stormwater Management Plan. For more detail and resources refer to Appendix A.

3.4 INSPECTION OF AFFECTED AREA

No problem areas or areas of concern were notable during the review of resources. Additionally, there were no existing or potential areas where flooding, capacity problems, channel destruction, or significant destruction of aquatic habitat identified in the inspection.

3.5 TREATMENT & WATER QUALITY

The site was analyzed as one (1) basin for the predeveloped and developed stormwater calculations. General basin characteristics of both pre-developed and developed conditions are listed in Table 2. For more detail refer to the Basin Maps in Appendix A and the Civil Drawings.

Table 2 | Summary of Site Peak Flows

Basin ID	Source (Roof/Road/ Other)	Impervious Area (sq ft)	Pervious Area (sq ft)	Design Storms			CN	Tc
				WQ (cfs)	10 Year (cfs)	100 Year (cfs)		
PD	Native	-	27,570	-	0.17	0.30	74	17.3
DEV	Paved/ Landscape	19,920	7,650	0.12	0.40	0.56	98/79[2]	5.0

[1] PD = pre-developed site conditions (i.e., pre-developed release rates)
[2] The first curve number listed is for the impervious area in the basin (98), then for the pervious area (80)

Table 2 above depicts the runoff experience from developed site compared to that of the predeveloped site. The design storms analyzed were provided in the West Linn Stormwater Management Plan and consisted of the water quality, 10-year, and 100-year, 24-hour storm events.

A stormwater filtration planter is proposed to treat the water quality storm event and provide adequate capacity for the 100-year storm for the Developed Basin. Approximately 5,880 square feet of pervious area will not drain to the proposed filtration planter due to slope constraints. All the new impervious surfaces will drain to and be treated by the proposed filtration planter. Refer to Table 3 below for a summary of the filtration planter sizing.

Table 3 | Summary of Stormwater Flow-Through Planter Sizing

Facility ID[1]	Facility Elevations[2] (ft)		Facility Surface Area[2] (sf)		Required Drain Rock Surface Area (sf)	Depth of Drain Rock (in)
	Top	Bottom	Top	Bottom		
Planter	103.0	100.5	280	280	280	12

[1] The facility is a privately owned and maintained filtration planter.
[2] Top elevation is the top of the facility wall. Bottom elevation is the surface of the growing media.

The proposed Flow-Through Planter is designed to provide treatment for the water quality storm event and have capacity for the 100-year storm. Refer to Table 4 below for a summary of the release rates and water surface elevations within the planter during the water quality and 100-year storm events.

Table 4 | Summary of Facility Release Rate and Peak Water Surface Elevations

Facility ID	Infiltration Rate (in/hr)	WQ Storm		100-Year Storm	
		Release (cfs)	WSE[1] (ft)	Release (cfs)	WSE[1] (ft)
Planter	0.20	0.11	97.50	0.50	97.51

[1] WSE = Water Surface Elevation. See "Surface Test" printouts in Appendix C.

The HydroCAD modeled release rates and water surface elevations (WSE) shown in Table 4 assume free-flow though the filtration planter growing media. Release from the Flow-Through Planter can also be controlled by the filtration capacity of the growing media. To verify the entire WQ storm event is filtered through the growing media for treatment, the planter hydraulics were also modeled at the facility surface with an assumed filtration rate of 4 in/hr. The surface test was calculated using Darcy's Law of hydraulic conductivity with the groundwater elevation set 1.5 feet below the surface to represent the 1.5 feet (18 inches) of growing media thickness per COG Design Standards. See the HydroCAD analysis in Appendix F for surface test calculations.

Table 5 | Surface Filtration Test Summary – WQ Storm

Facility ID[1]	Facility Bottom Elevation (ft)	Max. Treatment Elevation[2]	WSE (ft)
Planter	100.50	101.50	100.68

[1] The facility is a privately owned and maintained rain garden
[2] Elevation at which water overtops the overflow orifice within the planter and is directed to flow control structure

3.6 CONVEYANCE SYSTEM & ANALYSIS OF DOWNSTREAM EFFECTS

Per City of West Linn Design Standards, this project is exempt from detention requirements due to adequate downstream capacity of conveyance system. However, a downstream analysis was conducted per the City of Gresham Standards to determine if Cascade Springs Pond Creek will have adequate capacity. The following table provides the COG design storm sizing criteria.

Table 6 | City of Gresham Conveyance Design Storm Sizing Criteria

Structure or Facility		Design Storm Recurrence Interval (years)
Storm sewers, ditches, and outfall pipes	Draining less than 250 acres	10
	Draining greater than 250 acres	50
Creek or stream Channels	Without designated floodplain	50
	With designated floodplain	100
Culverts and bridges		100

The downstream analysis was conducted using the 50-year, 24-hour design storm per COG Design Standards for a creek with drainage area less than 50 acres.

Peak flow rates for each sub-basin within the Cascade Springs basin were provided by the West Linn Stormwater Management Plan. Additionally, peak flow rates for the junction of sub-basins were also provided. The junction node CSJ2 was selected for this analysis. The peak flow of CSJ2 was combined with the added onsite runoff for the 50-year, 24-hour storm event to determine adequate downstream capacity. Based on inspection and mapping, the creek has 1,500 feet of length, 3:1 side slopes, a width varying 10-30 feet at the bottom, slope of 1.50%, a depth of 10-30 feet, and a Manning's number of 0.03 was used, corresponding to a typical open, earth channel, that is grassed and winding. See below for water depth in channel, calculated using Manning's Equation.

Table 7 | Summary of Cascade Springs Pond Creek During 50-year Storm

Basin ID	Drainage Area (acres)	50-Year (cfs)	Water Depth in Channel (ft)[a]
CSJ2	55.04	31.15	1.31
DEV	0.62	0.59	0.20
Total	55.56	31.74	1.32[a]

[a]Totals do not sum to the addition of the individual flows. This is due to the fact that the time of concentration per basin varies. The totals are the combination of the basin hydrographs. Refer to Link: OUT in Appendix D.

The calculations in Table 7 above display the added runoff to the Cascade Springs Pond Creek that will result from the developed project. The undetained developed 50-year event runoff peak for the site is 0.59 cfs. The developed runoff only contributes to approximately 2% of the total runoff conveyed by Cascade Springs Pond Creek. The peak water surface elevation will rise approximately a tenth of an inch with the added runoff from the developed site. Therefore, the conveyance system will provide adequate capacity for developed stormwater runoff and detention facilities are not required onsite.

3.7 SUMMARY

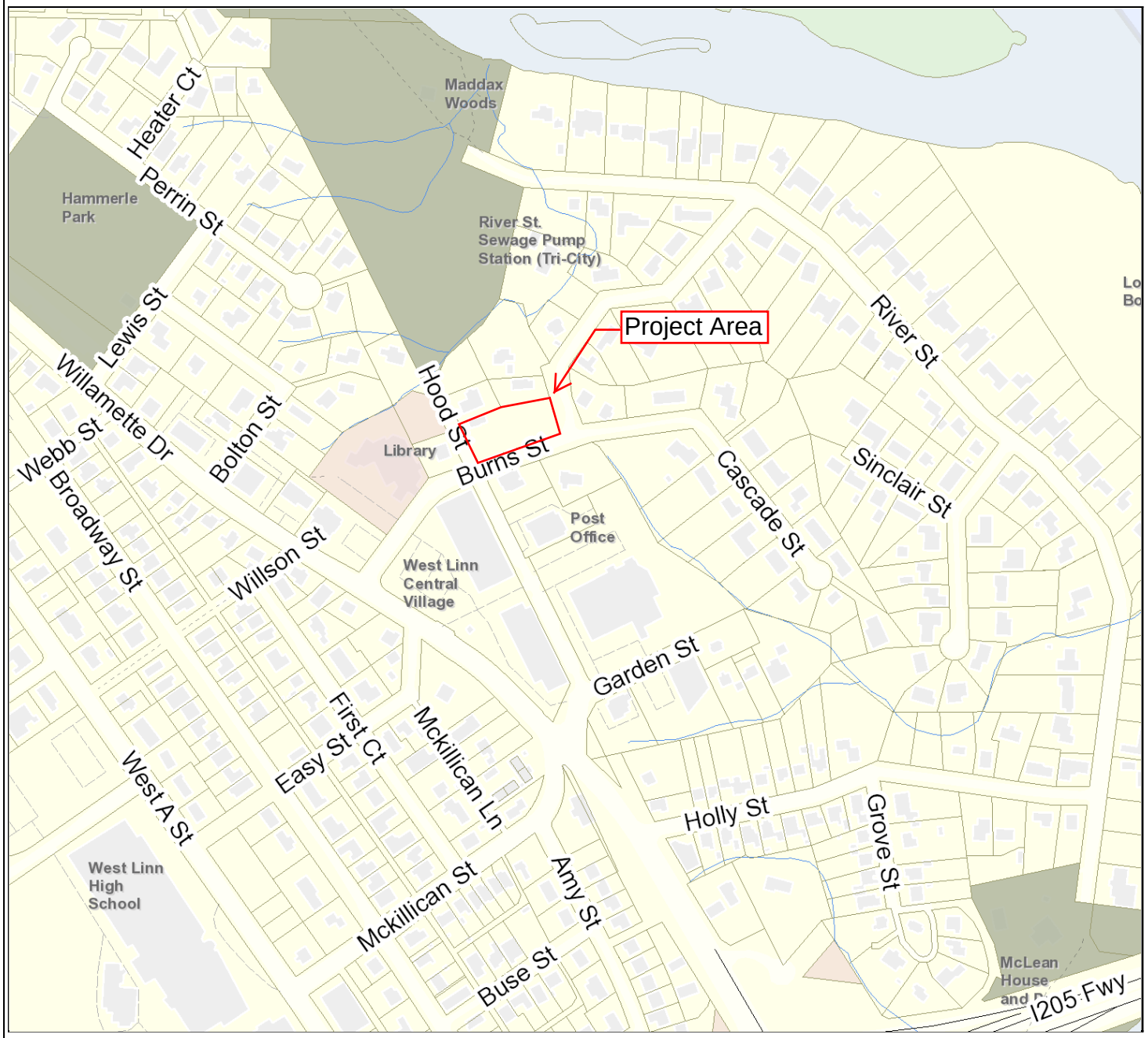
The treatment system consisting of a Flow-Through Planter has been designed to treat the water quality storm, and have capacity for the 100-year storm event. Detention was not required to be provided on site because Cascade Springs Pond Creek has adequate downstream capacity. Therefore, the project can meet the flow control and treatment requirements as set forth in the City of West Linn Stormwater Management Plan and the City of Gresham Stormwater Management Manual.

APPENDIX A

BASIN MAPS & RESOURCES

BASIN & AREA MAPS

Project Area Map



CITY OF West Linn

N W E S

Feet
0 200

Scale 1:4,800 - 1 in = 400 ft
Scale is based on 8-1/2 x 11 paper size

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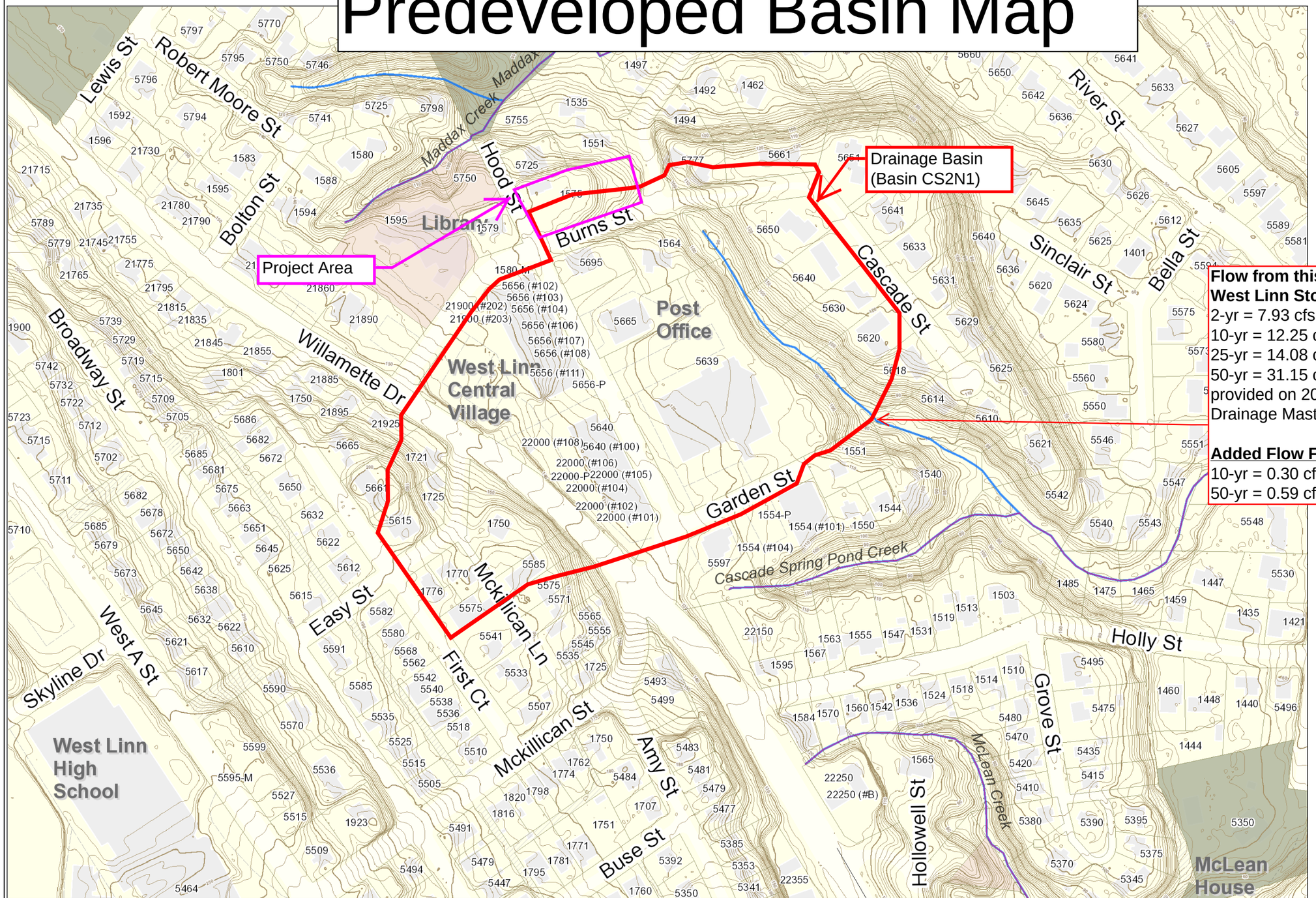
WEST LINN GIS

Predeveloped Basin Map

City of West Linn



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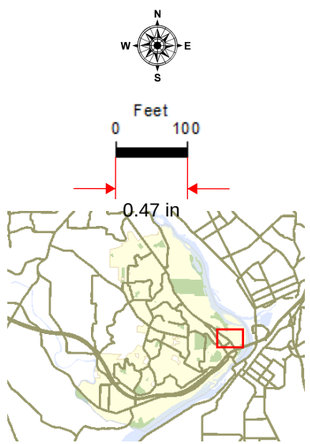
WEST LINN GIS

Developed Basin Map



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WEST LINN GIS

WETLAND, AND HABITAT INVENTORY

Wetland Inventory Map

CITY OF West Linn

Legend

Storm Lines

Storm Pipes

Storm Pipes County

Storm Pipes ODOT

Ditches and Creeks

Private Pipes

Wetland Inventory 2005 Goal 5

N

W E

S

Feet

0 200

Scale 1:4,800 - 1 in = 400 ft

Scale is based on 8-1/2 x 11 paper size

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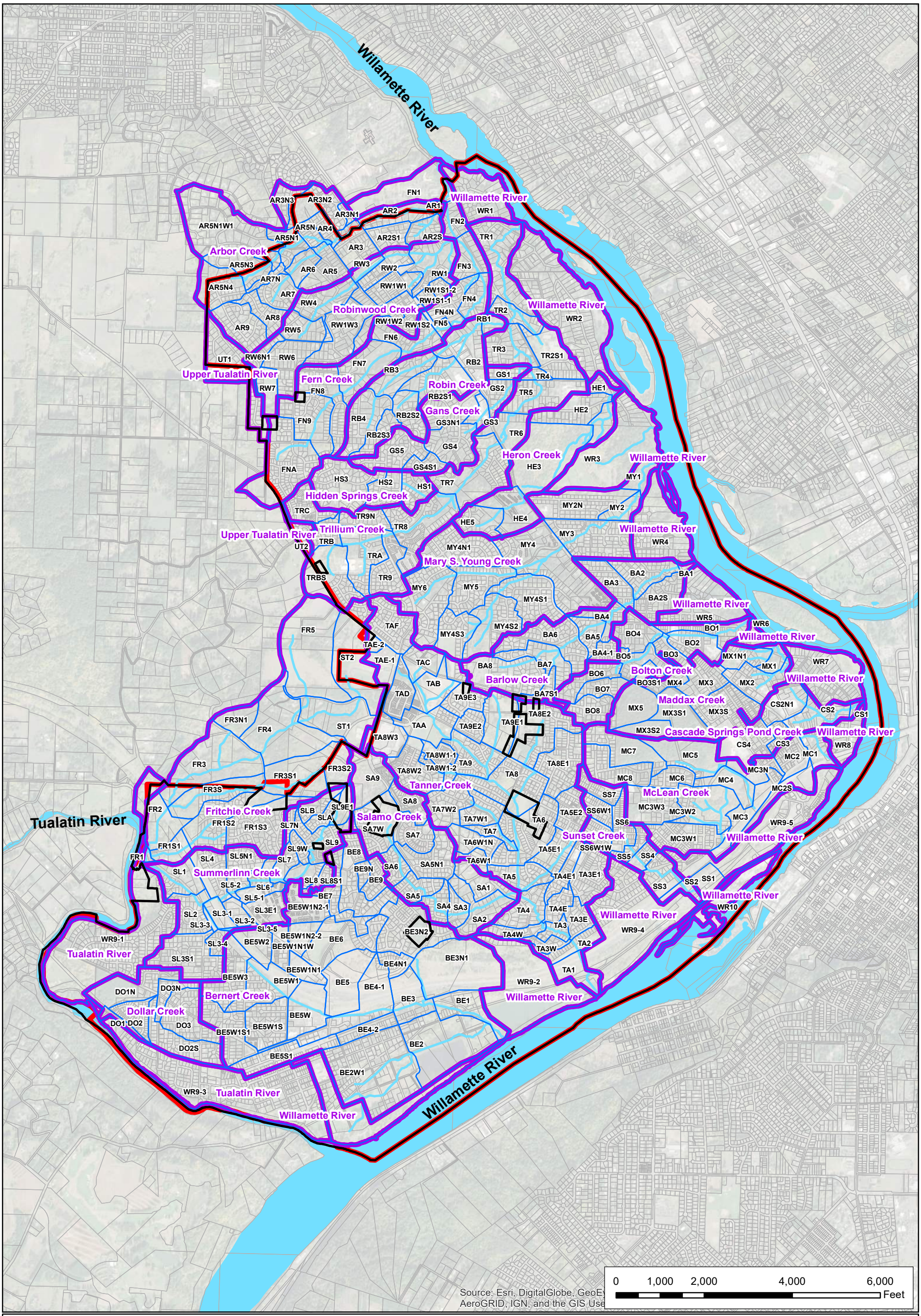
WEST LINN GIS

BASIN INFORMATION



1:24,000 scale

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CITY OF WEST LINN, OREGON

Storm Drainage and Sanitary Master Plan 2019

Figure B-1: Stormwater Subbasins

City Boundary
UGB
Subbasins
Watershed Boundaries
Streams

Data Source: City of West Linn GIS and Metro RLIS

Disclaimer: This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

Map Publication/Print Date: November 2018 Produced by Brown and Caldwell

10/7/2019

Legend

Hydraulic Modeling Location
- Detailed
- Capacity Check
- Hwy 43 Crossings
- Hydraulic Model Extent (Detailed Only)

Contributing Subbasins to Hydraulic Modeling Locations
- 13
- 47
- 56
- 59
- 60
- 63

- Stormwater Pipe
- Open Channel
- Streams
- Subbasins
- Watershed Boundaries
- City Limits
- UGB
- ODOT ROW
- Catch Basin
- Inlet
- Manhole
- Outfall

Mary S. Young Creek
Barlow Creek
Bolton Creek
Willamette River
Maddax Creek
Cascade Springs Pond Creek
Tanner Creek
McLean Creek
Summerlinn Creek
Salamo Creek
Sunset Creek
Bernert Creek
I205 FWY
I205 FWY RAMP
63
59
0 400 800 1,600 2,400 Feet

1:9,600 scale

N

CITY OF WEST LINN, OREGON

Storm Drainage and Sanitary Master Plan 2019

Figure B-4: Hydraulic Modeling Overview (South)

Data Source: City of West Linn GIS and Metro RLIS

Map Publication/Print Date: November 2018 Produced by Brown and Caldwell

10/7/2019

Attachment A. Table A-1: Hydrology Parameters and Model Results																	
Basin ID	Area (acres)	Width (ft)	Slope (ft/ft)	Existing Impervious Percentage	Future Impervious Percentage	Existing Land Use Maximum Flow (cfs)			Future Land Use Maximum Flow (cfs)			Future Land Use Absolute Increase in Maximum			Future Land Use Percent Increase in Maximum Flow		
						2-yr	10-yr	25-yr	2-yr	10-yr	25-yr	2-yr	10-yr	25-yr	2-yr	10-yr	25-yr
BE5W	21.46	862.53	0.03	56.19	56.19	9.37	15.47	17.78	9.37	15.47	17.78	0.00	0.00	0.00	0.00	0.00	0.00
BE5W1	23.58	631.68	0.06	32.24	32.24	7.82	15.52	18.21	7.82	15.52	18.21	0.00	0.00	0.00	0.00	0.01	0.00
BE5W1N1	7.87	423.89	0.05	84.69	84.69	4.29	6.16	7.02	4.29	6.16	7.02	0.00	0.00	0.00	0.00	0.00	0.00
BE5W1N1W	9.50	210.81	0.05	66.69	66.69	4.27	6.82	7.84	4.27	6.82	7.84	0.00	0.00	0.00	0.00	0.00	0.00
BE5W1N2-1	15.77	363.01	0.07	34.26	48.79	5.18	10.27	12.09	6.23	10.98	12.72	1.05	0.70	0.63	20.36	6.85	5.23
BE5W1N2-2	8.98	361.75	0.15	68.66	84.98	4.73	7.03	8.01	5.02	7.13	8.11	0.29	0.10	0.10	6.18	1.39	1.21
BE5W1S	21.41	550.38	0.04	31.82	31.95	6.44	13.34	15.87	6.45	13.35	15.88	0.01	0.01	0.01	0.22	0.09	0.06
BE5W1S1	22.68	464.81	0.02	31.11	31.67	5.77	12.42	15.20	5.83	12.48	15.26	0.06	0.06	0.06	1.06	0.50	0.39
BE5W2	11.96	526.59	0.02	43.29	43.29	4.61	8.29	9.61	4.61	8.29	9.61	0.00	0.00	0.00	0.00	0.00	0.00
BE5W3	21.99	632.15	0.06	30.71	30.71	7.27	14.49	17.00	7.27	14.49	17.00	0.00	0.00	0.00	0.00	0.00	0.00
BE6	28.38	505.71	0.13	21.24	48.79	7.75	17.42	20.79	11.48	19.97	23.08	3.73	2.54	2.29	48.17	14.60	11.01
BE7	15.60	291.98	0.08	29.67	30.21	4.57	9.64	11.50	4.61	9.68	11.53	0.04	0.04	0.03	0.94	0.36	0.28
BE8	25.60	534.32	0.10	28.95	28.96	8.04	16.52	19.48	8.04	16.52	19.48	0.00	0.00	0.00	0.01	0.00	0.01
BE9	8.75	313.98	0.09	29.73	29.73	3.26	6.05	7.04	3.26	6.05	7.04	0.00	0.00	0.00	0.00	0.00	0.00
BE9N	3.60	252.10	0.11	30.00	30.00	1.60	2.65	3.05	1.60	2.65	3.05	0.00	0.00	0.00	0.00	0.00	0.00
Bolton Creek																	
BO1	14.30	417.48	0.09	25.42	28.48	4.71	9.50	11.10	4.92	9.62	11.22	0.21	0.13	0.11	4.42	1.33	1.03
BO2	14.35	520.28	0.08	36.27	37.39	5.69	10.11	11.75	5.76	10.16	11.79	0.07	0.05	0.04	1.19	0.46	0.37
BO3	6.71	302.28	0.06	31.84	32.46	2.55	4.66	5.42	2.57	4.67	5.43	0.02	0.01	0.01	0.71	0.19	0.20
BO3S1	4.64	563.72	0.25	28.38	30.85	2.28	3.49	4.00	2.31	3.50	4.01	0.03	0.02	0.01	1.14	0.46	0.38
BO4	15.40	454.25	0.14	31.79	33.00	5.90	10.73	12.49	5.98	10.78	12.54	0.08	0.06	0.05	1.36	0.52	0.42
BO5	12.47	523.04	0.16	31.54	31.68	2.30	5.50	7.80	2.40	5.50	7.80	0.10	0.00	0.00	4.35	0.00	0.00
BO6	13.53	310.87	0.10	30.00	30.00	4.44	8.90	10.44	4.44	8.90	10.44	0.00	0.00	0.00	0.00	0.00	0.00
BO7	8.91	385.28	0.11	25.09	25.09	3.43	6.25	7.25	3.43	6.25	7.25	0.00	0.00	0.00	0.00	0.00	0.00
BO8	13.32	457.55	0.10	30.00	30.00	4.98	9.21	10.71	4.98	9.21	10.71	0.00	0.00	0.00	0.00	0.00	0.00
Cascade Springs Pond Creek																	
CS1	1.77	157.47	0.06	25.36	29.99	0.76	1.29	1.49	0.79	1.31	1.50	0.03	0.02	0.01	3.28	1.24	1.01
CS2	16.54	390.84	0.05	39.60	40.74	5.60	10.79	12.71	5.69	10.86	12.77	0.09	0.07	0.06	1.57	0.61	0.47
CS2N1	16.50	482.55	0.07	65.01	65.01	7.93	12.25	14.08	7.93	12.25	14.08	0.00	0.00	0.00	0.00	0.00	0.00
CS3	5.47	282.05	0.07	41.27	41.89	2.41	4.03	4.63	2.42	4.03	4.64	0.01	0.01	0.01	0.50	0.20	0.15
CS4	20.45	499.57	0.05	32.10	32.36	6.29	12.91	15.32	6.32	12.93	15.34	0.03	0.02	0.02	0.41	0.16	0.13
Dollar Creek																	
DO1	3.75	119.44	0.06	30.02	30.13	1.25	2.48	2.91	1.25	2.49	2.91	0.00	0.00	0.00	0.16	0.04	0.03
DO1N	24.53	508.68	0.04	18.07	29.91	5.20	12.97	16.05	6.71	14.42	17.40	1.51	1.45	1.35	29.07	11.15	8.40
DO2	10.85	368.67	0.02	34.97	34.97	3.30	6.72	8.01	3.30	6.72	8.01	0.00	0.00	0.00	0.00	0.00	0.00
DO2S	21.52	398.94	0.02	29.97	30.26	5.06	11.04	13.68	5.09	11.07	13.71	0.03	0.03	0.03	0.59	0.29	0.23
DO3	23.72	642.92	0.01	30.00	30.00	5.89	12.83	15.75	5.89	12.83	15.75	0.00	0.00	0.00	0.00	0.00	0.00
DO3N	8.00	209.29	0.02	29.94	30.00	2.13	4.59	5.57	2.13	4.60	5.57	0.00	0.00	0.00	0.09	0.07	0.04
Fern Creek																	
FN1	31.74	437.01	0.05	30.00	30.00	7.98	17.36	21.27	7.98	17.36	21.27	0.00	0.00	0.00	0.00	0.00	0.00
FN2	9.27	408.46	0.05	29.52	29.52	3.33	6.33	7.35	3.33	6.33	7.35	0.00	0.00	0.00	0.00	0.00	0.00
FN3	13.99	418.88	0.04	16.37	16.37	3.27	8.03	9.75	3.27	8.03	9.75	0.00	0.00	0.00	0.00	0.00	0.00
FN4	11.60	328.13	0.03	29.67	30.00	3.26	6.97	8.37	3.28	6.99	8.38	0.02	0.02	0.02	0.58	0.24	0.18
FN4N	13.46	372.26	0.05	38.80	38.80	4.85	9.11	10.62	4.85	9.11	10.62	0.00	0.00	0.00	0.00	0.00	0.00
FN5	3.66	169.57	0.03	82.17	82.17	1.91	2.75	3.14	1.91	2.75	3.14	0.00	0.00	0.00	0.00	0.00	0.00
FN6	18.67	520.42	0.08	30.34	33.15	6.39	12.51	14.60	6.64	12.66	14.74	0.25	0.15	0.14	3.90	1.22	0.94

APPENDIX B
NRCS SOIL REPORT

Hydrologic Soil Group—Clackamas County Area, Oregon
(Bolton Terrace Hydrologic Map)

Map Scale: 1:465 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 5 10 20 30

Feet: 0 20 40 80 120

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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: Clackamas County Area, Oregon
Survey Area Data: Version 15, Sep 10, 2019

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

Date(s) aerial images were photographed: Jul 26, 2014—Sep 5, 2014

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
91B	Woodburn silt loam, 3 to 8 percent slopes	C	0.6	100.0%
Totals for Area of Interest			**0.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soil Map—Clackamas County Area, Oregon
(Bolton Terrace Soil Map)

Map Scale: 1:465 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 20 40 80 120

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: Clackamas County Area, Oregon
Survey Area Data: Version 15, Sep 10, 2019

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

Date(s) aerial images were photographed: Jul 26, 2014—Sep 5, 2014

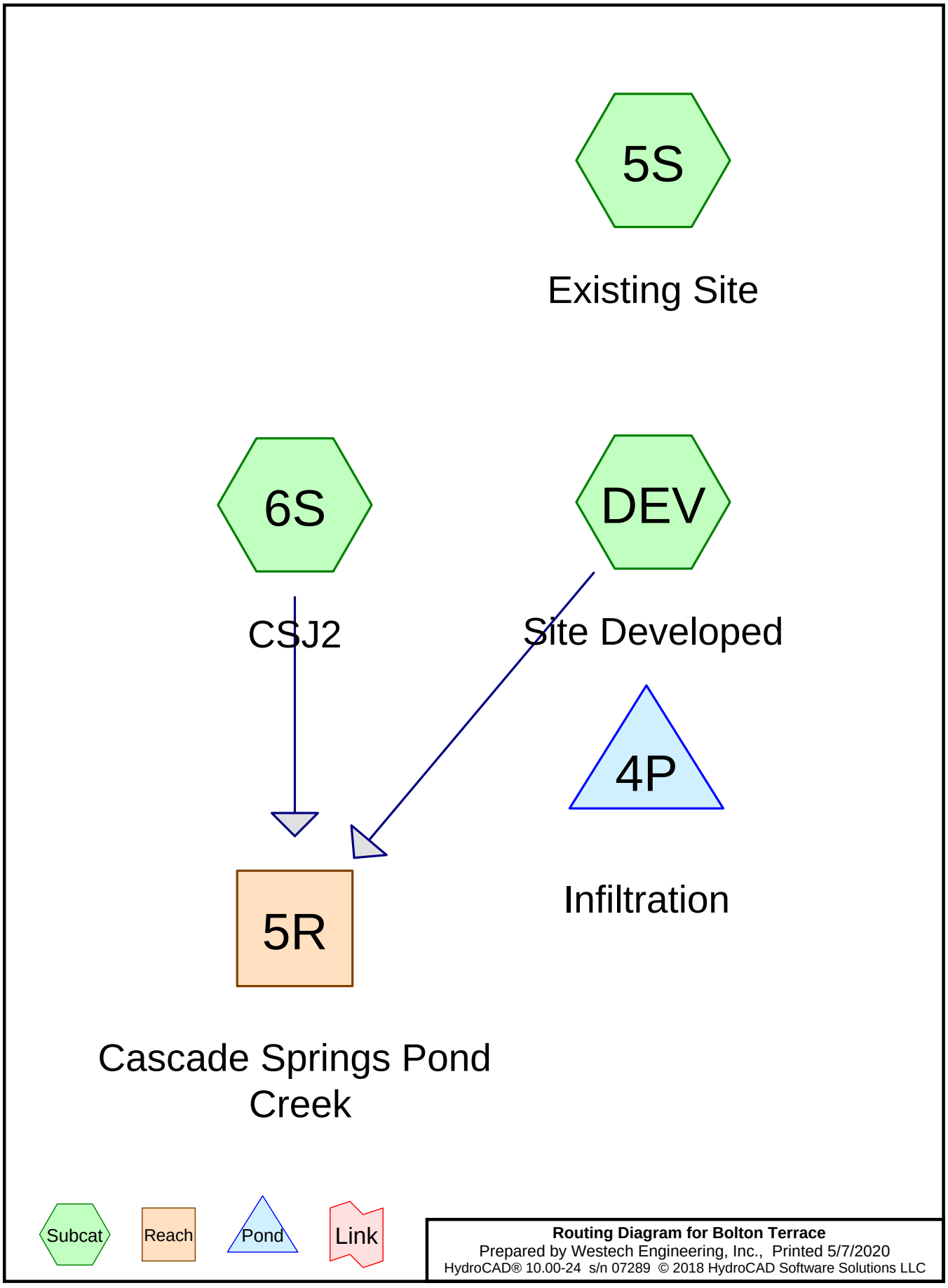
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
91B	Woodburn silt loam, 3 to 8 percent slopes	0.6	100.0%
Totals for Area of Interest		**0.6**	**100.0%**

APPENDIX C

HYDROCAD SUMMARIES



Routing Diagram for Bolton Terrace
Prepared by Westech Engineering, Inc., Printed 5/7/2020

Summary for Subcatchment 5S: Existing Site

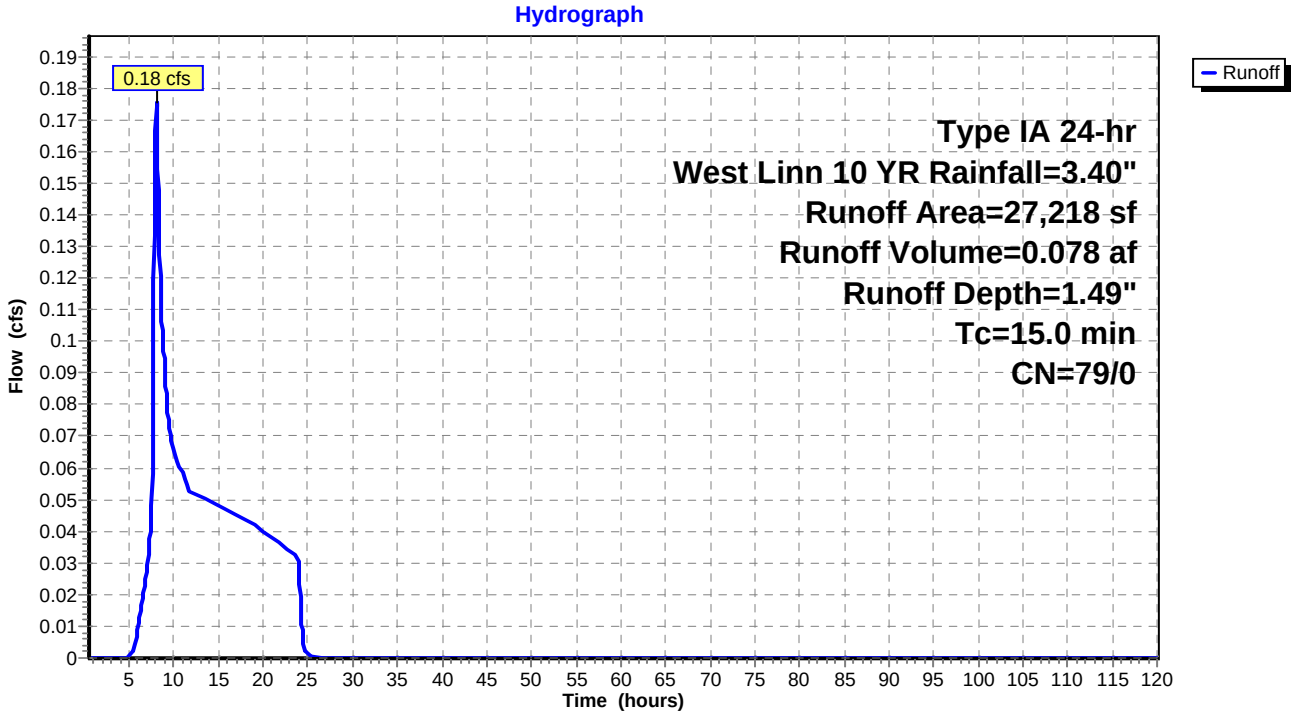
Runoff = 0.18 cfs @ 8.03 hrs, Volume= 0.078 af, Depth= 1.49"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn 10 YR Rainfall=3.40"

	Area (sf)	CN	Description
*	27,218	79	
	27,218		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry,**

Subcatchment 5S: Existing Site



Summary for Subcatchment 5S: Existing Site

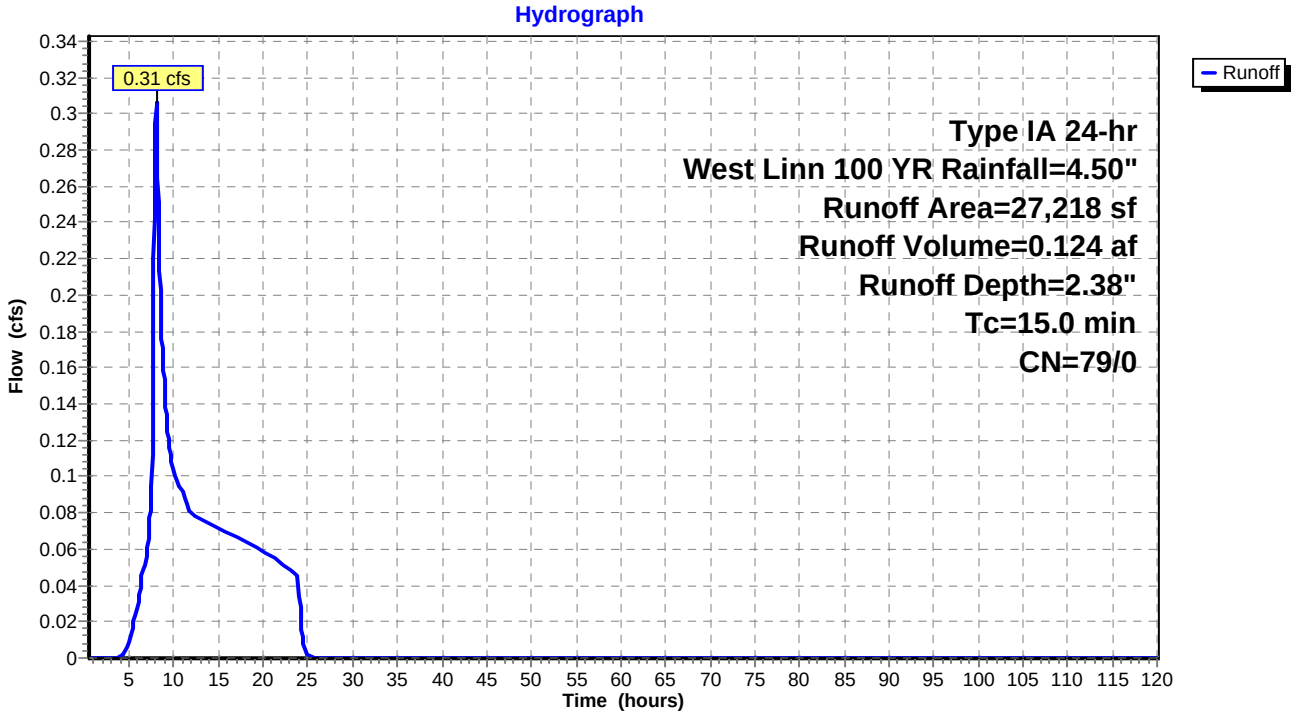
Runoff = 0.31 cfs @ 8.02 hrs, Volume= 0.124 af, Depth= 2.38"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn 100 YR Rainfall=4.50"

	Area (sf)	CN	Description
*	27,218	79	
	27,218		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry,**

Subcatchment 5S: Existing Site



Summary for Subcatchment 5S: Existing Site

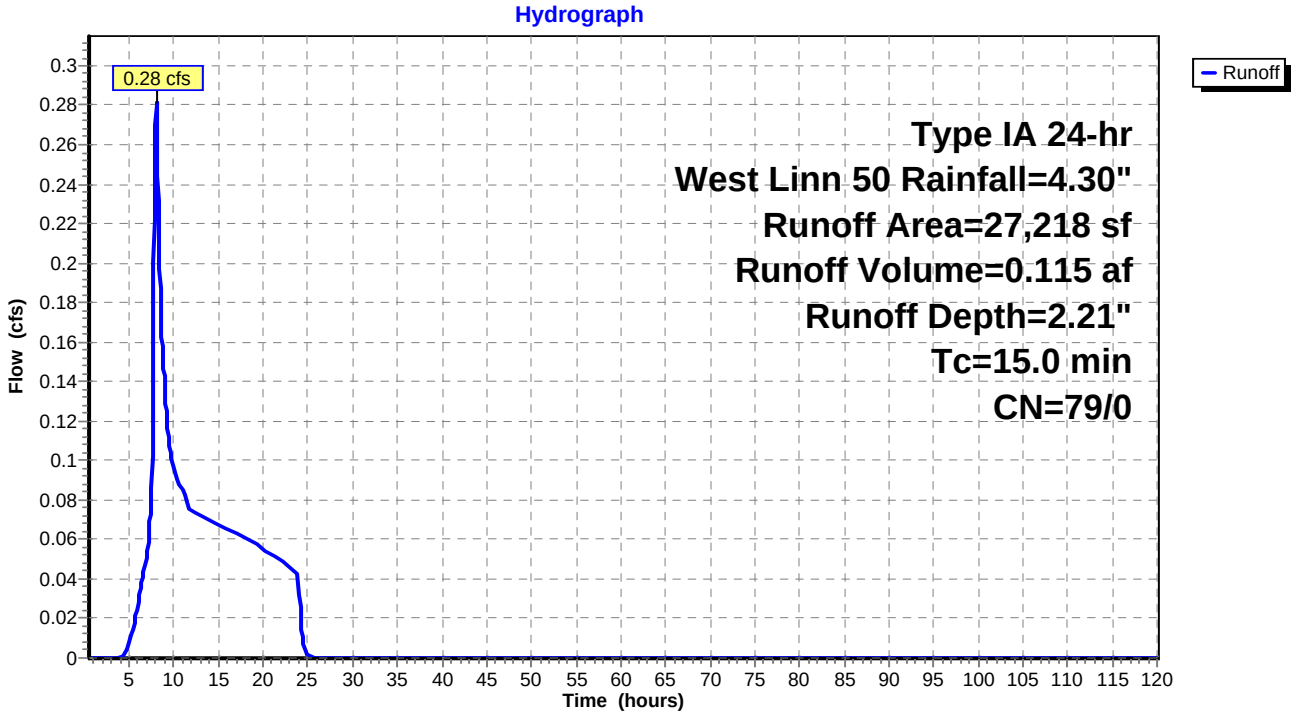
Runoff = 0.28 cfs @ 8.02 hrs, Volume= 0.115 af, Depth= 2.21"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn 50 Rainfall=4.30"

	Area (sf)	CN	Description
*	27,218	79	
	27,218		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry,**

Subcatchment 5S: Existing Site



Summary for Subcatchment 5S: Existing Site

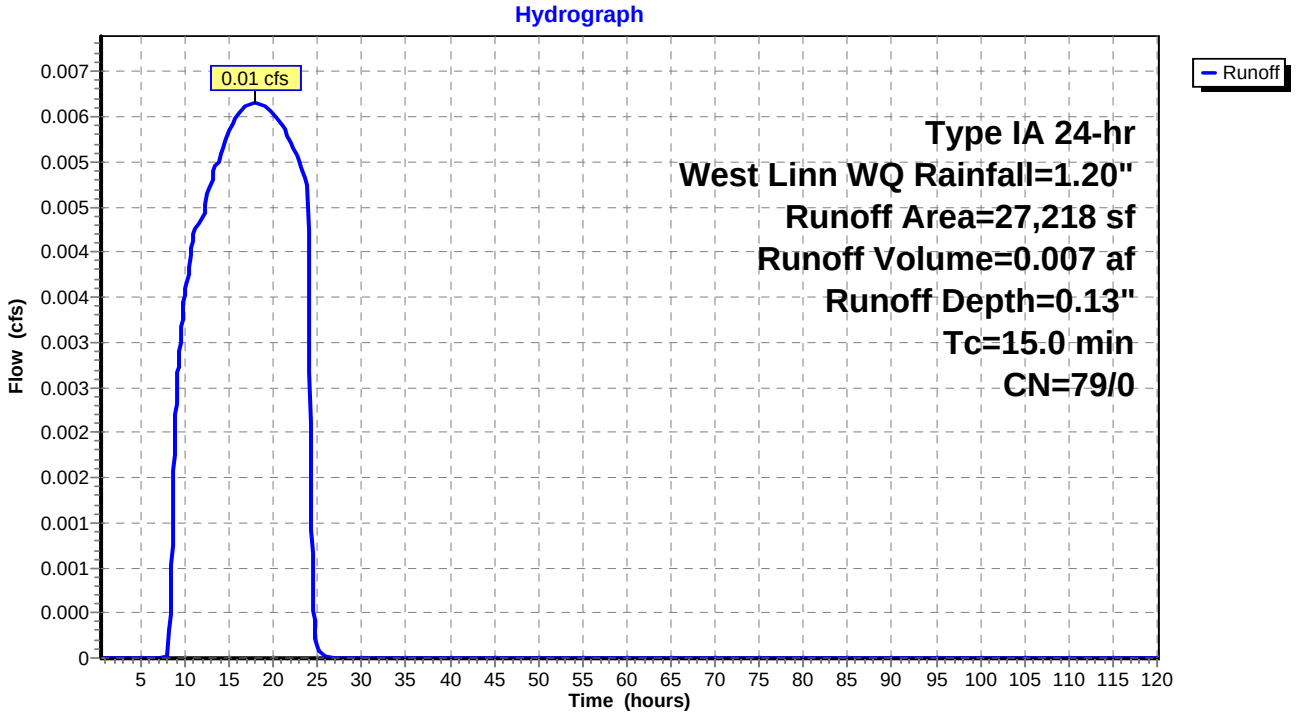
Runoff = 0.01 cfs @ 17.99 hrs, Volume= 0.007 af, Depth= 0.13"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn WQ Rainfall=1.20"

	Area (sf)	CN	Description
*	27,218	79	
	27,218		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					**Direct Entry,**

Subcatchment 5S: Existing Site



Summary for Subcatchment DEV: Site Developed

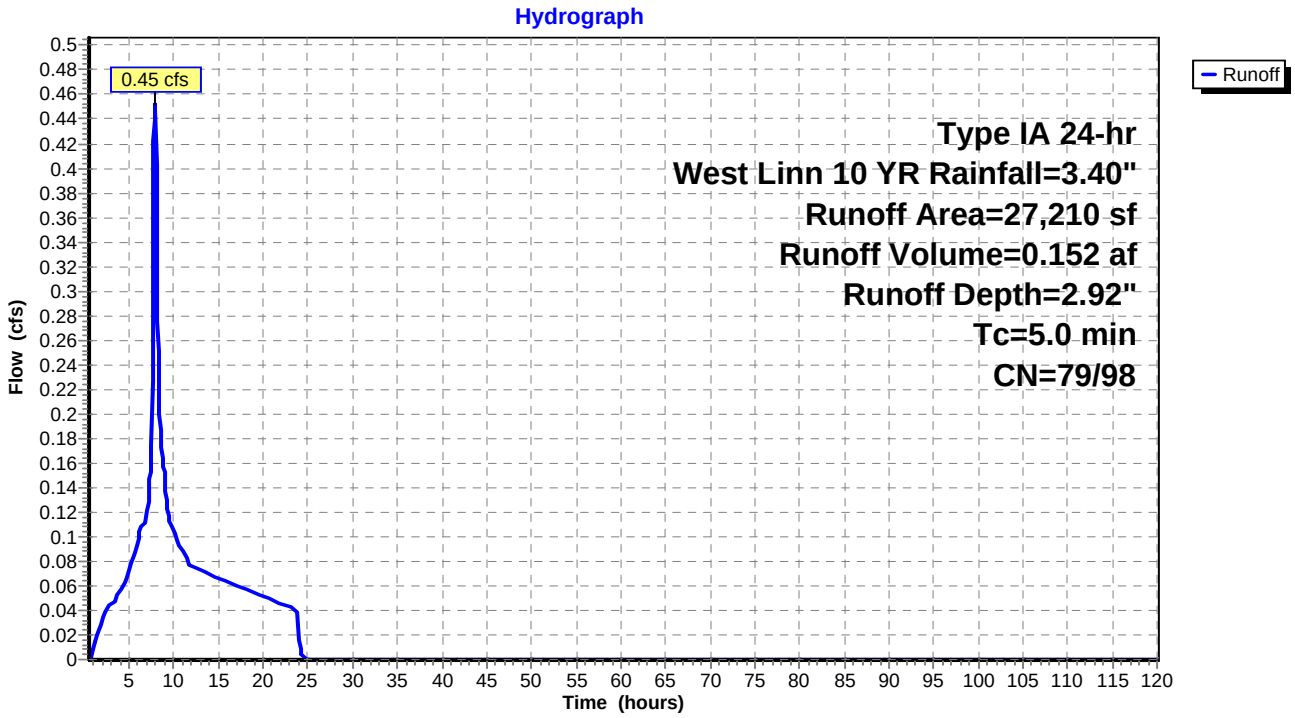
Runoff = 0.45 cfs @ 7.91 hrs, Volume= 0.152 af, Depth= 2.92"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn 10 YR Rainfall=3.40"

	Area (sf)	CN	Description
*	23,130	98	rooftop
	4,080	79	50-75% Grass cover, Fair, HSG C
	27,210	95	Weighted Average
	4,080		14.99% Pervious Area
	23,130		85.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment DEV: Site Developed



Summary for Subcatchment DEV: Site Developed

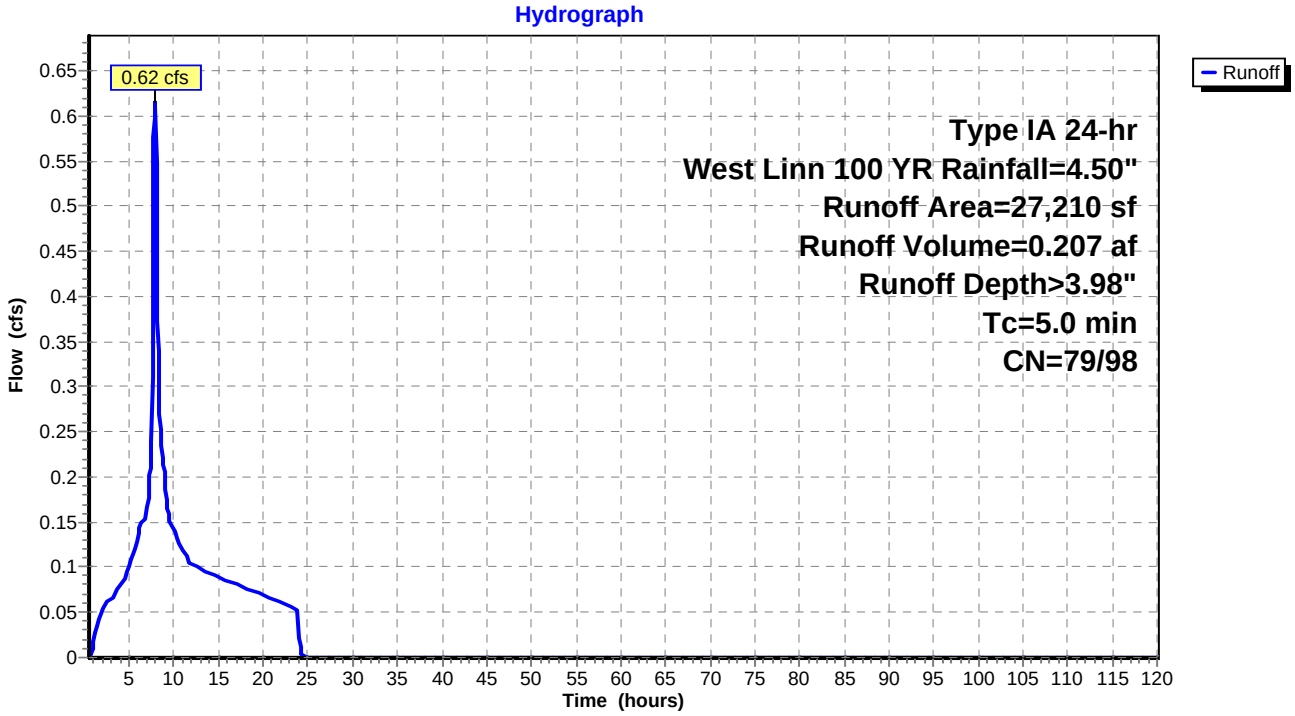
Runoff = 0.62 cfs @ 7.90 hrs, Volume= 0.207 af, Depth> 3.98"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn 100 YR Rainfall=4.50"

	Area (sf)	CN	Description
*	23,130	98	rooftop
	4,080	79	50-75% Grass cover, Fair, HSG C
	27,210	95	Weighted Average
	4,080		14.99% Pervious Area
	23,130		85.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment DEV: Site Developed



Summary for Subcatchment DEV: Site Developed

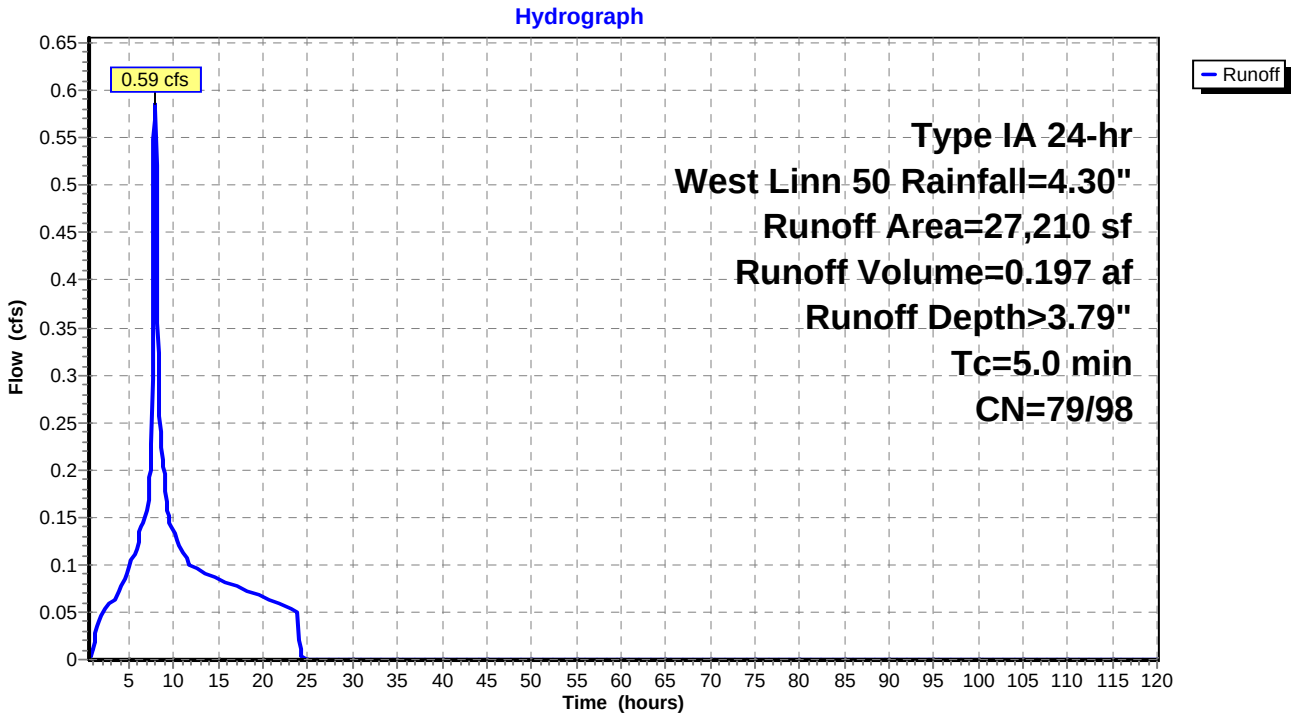
Runoff = 0.59 cfs @ 7.90 hrs, Volume= 0.197 af, Depth> 3.79"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn 50 Rainfall=4.30"

	Area (sf)	CN	Description
*	23,130	98	rooftop
	4,080	79	50-75% Grass cover, Fair, HSG C
	27,210	95	Weighted Average
	4,080		14.99% Pervious Area
	23,130		85.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment DEV: Site Developed



Summary for Subcatchment DEV: Site Developed

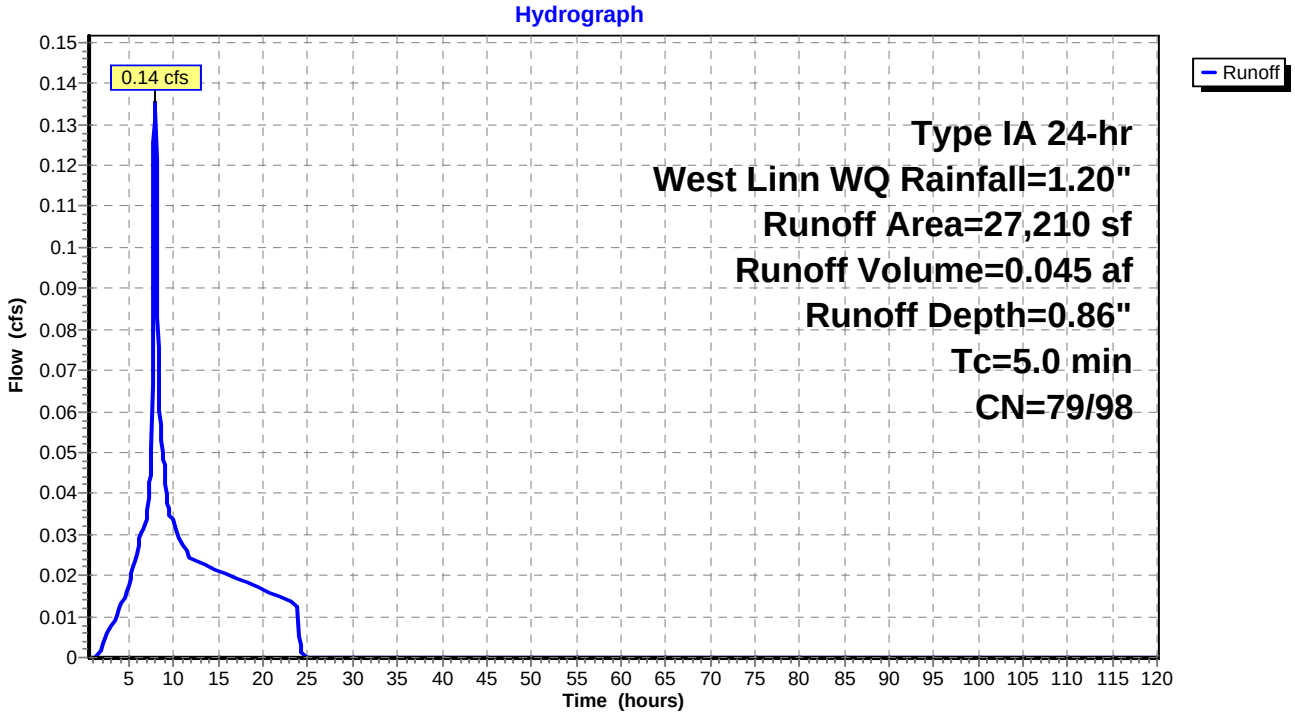
Runoff = 0.14 cfs @ 7.91 hrs, Volume= 0.045 af, Depth= 0.86"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn WQ Rainfall=1.20"

	Area (sf)	CN	Description
*	23,130	98	rooftop
	4,080	79	50-75% Grass cover, Fair, HSG C
	27,210	95	Weighted Average
	4,080		14.99% Pervious Area
	23,130		85.01% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment DEV: Site Developed



Summary for Subcatchment 6S: CSJ2

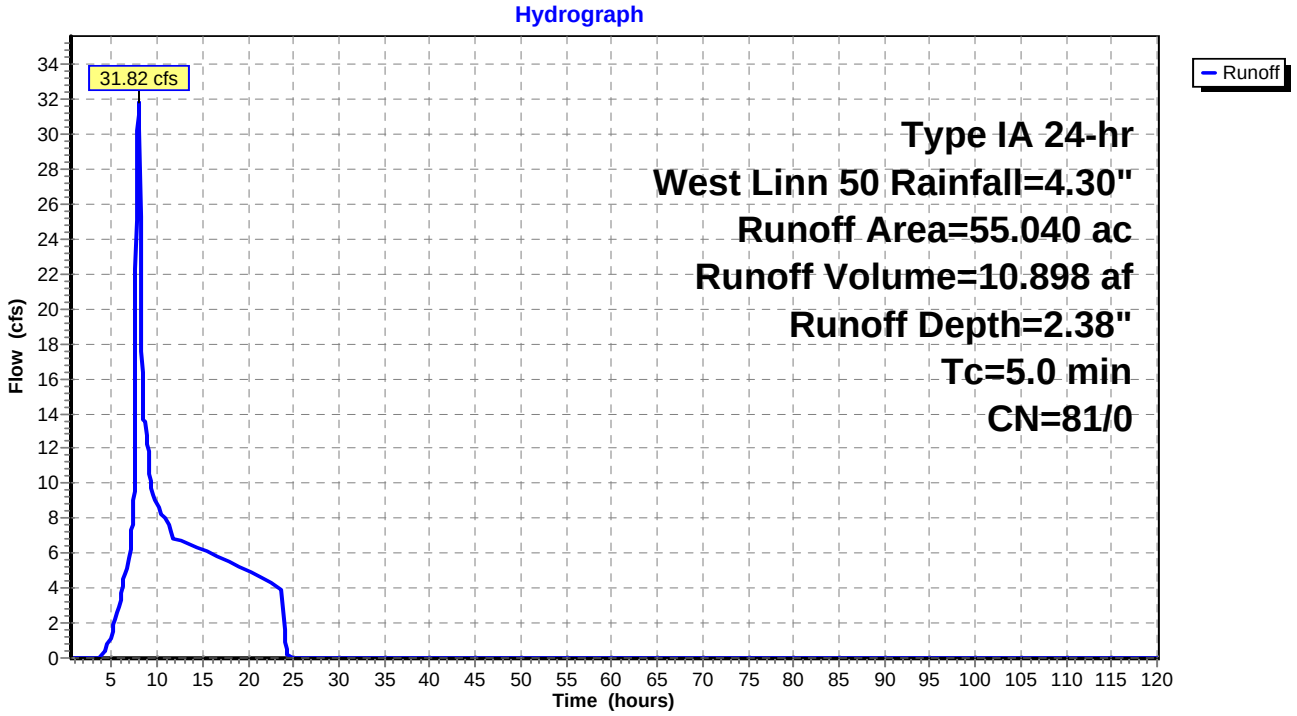
Runoff = 31.82 cfs @ 7.98 hrs, Volume= 10.898 af, Depth= 2.38"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn 50 Rainfall=4.30"

	Area (ac)	CN	Description
*	55.040	81	>75% Grass cover, Good, HSG D
	55.040		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 6S: CSJ2



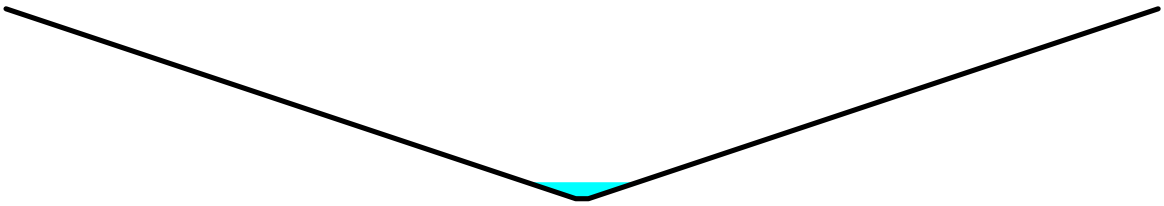
Summary for Reach 5R: Cascade Springs Pond Creek

Inflow Area = 55.040 ac, 0.00% Impervious, Inflow Depth = 2.38" for West Linn 50 event
Inflow = 31.82 cfs @ 7.98 hrs, Volume= 10.898 af
Outflow = 31.04 cfs @ 8.00 hrs, Volume= 10.898 af, Atten= 2%, Lag= 1.8 min

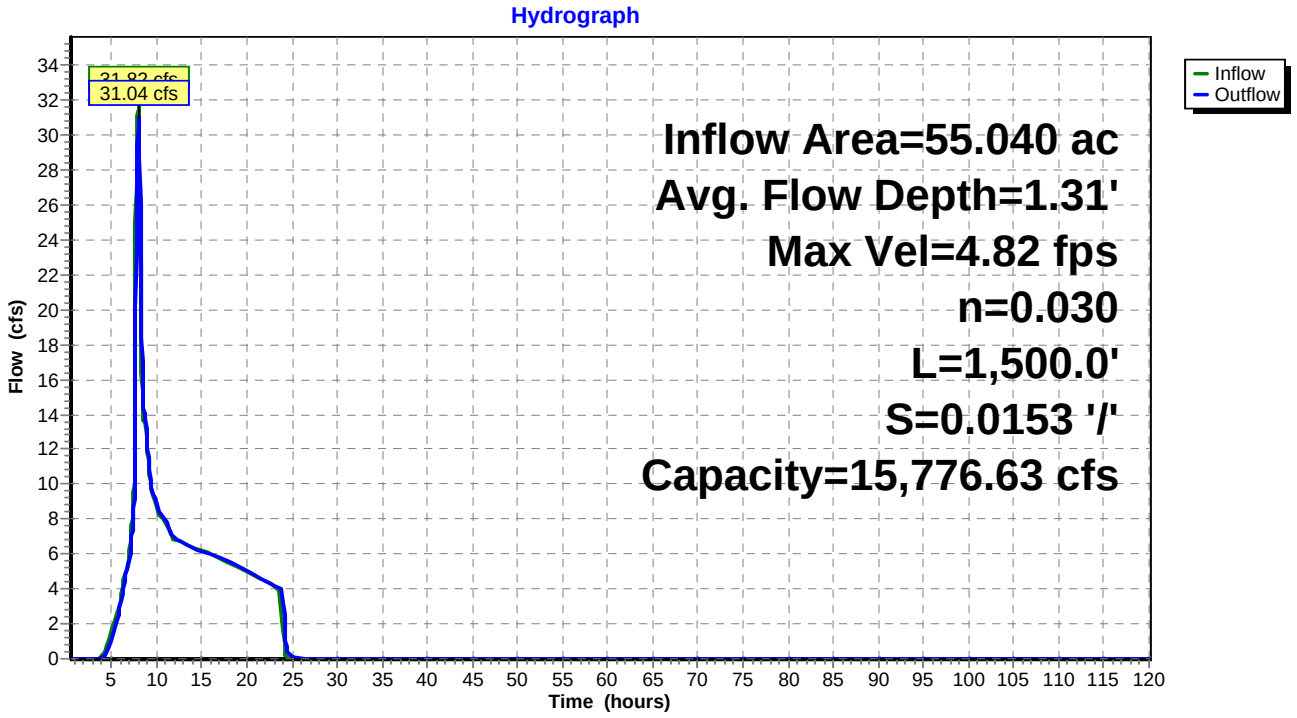
Routing by Stor-Ind method, Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.82 fps, Min. Travel Time= 5.2 min
Avg. Velocity = 2.94 fps, Avg. Travel Time= 8.5 min

Peak Storage= 9,660 cf @ 8.00 hrs
Average Depth at Peak Storage= 1.31'
Bank-Full Depth= 15.00' Flow Area= 690.0 sf, Capacity= 15,776.63 cfs

1.00' x 15.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 91.00'
Length= 1,500.0' Slope= 0.0153 '/'
Inlet Invert= 80.00', Outlet Invert= 57.00'



Reach 5R: Cascade Springs Pond Creek



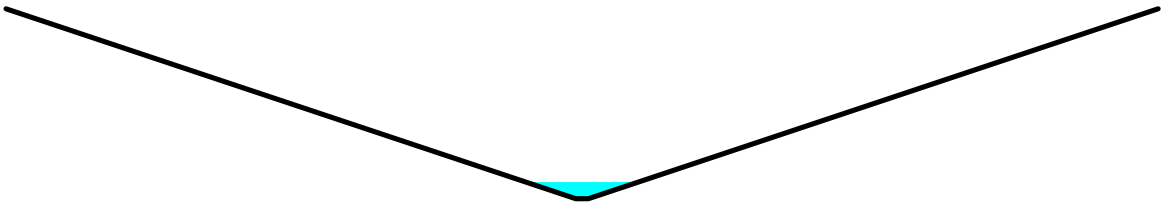
Summary for Reach 5R: Cascade Springs Pond Creek

Inflow Area = 55.665 ac, 0.95% Impervious, Inflow Depth = 2.39" for West Linn 50 event
Inflow = 32.15 cfs @ 7.97 hrs, Volume= 11.095 af
Outflow = 31.62 cfs @ 8.00 hrs, Volume= 11.095 af, Atten= 2%, Lag= 1.8 min

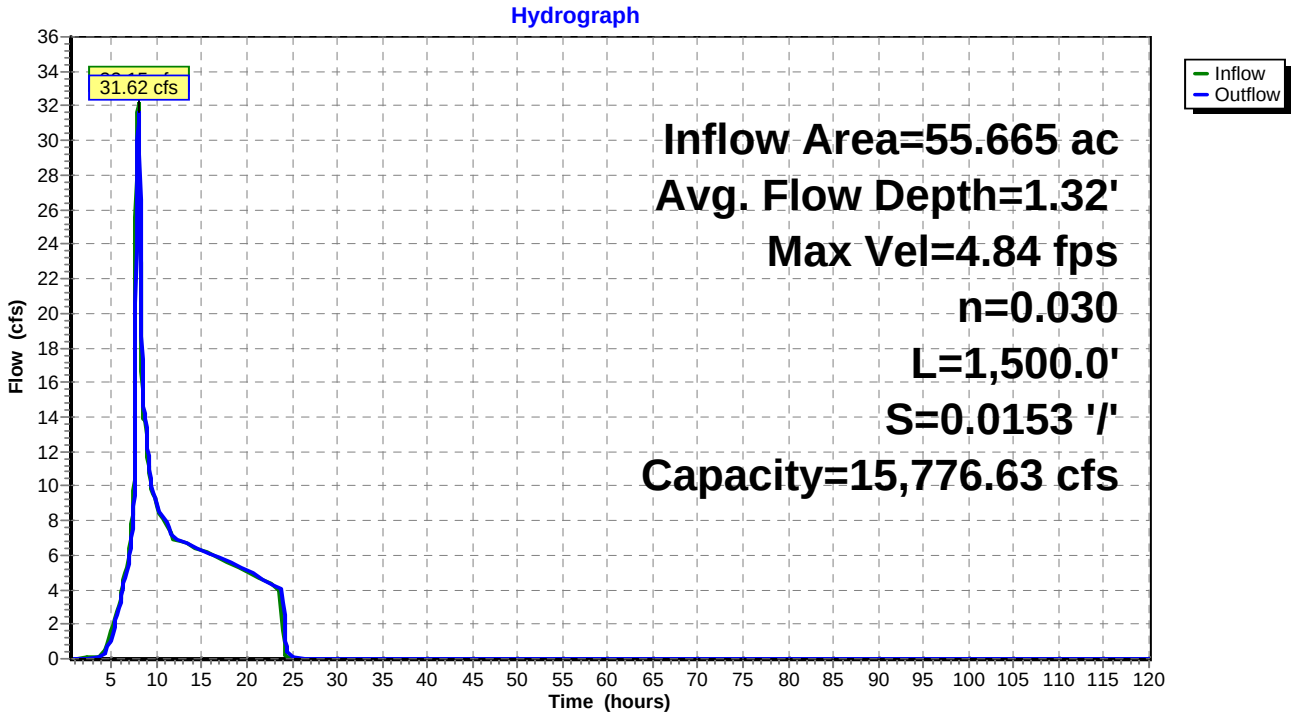
Routing by Stor-Ind method, Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.84 fps, Min. Travel Time= 5.2 min
Avg. Velocity = 2.76 fps, Avg. Travel Time= 9.1 min

Peak Storage= 9,797 cf @ 8.00 hrs
Average Depth at Peak Storage= 1.32'
Bank-Full Depth= 15.00' Flow Area= 690.0 sf, Capacity= 15,776.63 cfs

1.00' x 15.00' deep channel, n= 0.030 Earth, grassed & winding
Side Slope Z-value= 3.0 '/' Top Width= 91.00'
Length= 1,500.0' Slope= 0.0153 '/'
Inlet Invert= 80.00', Outlet Invert= 57.00'



Reach 5R: Cascade Springs Pond Creek



APPENDIX D

GEOTECHNICAL REPORT

REDMOND & ASSOCIATES

Geotechnical Investigation

Proposed Commercial Building Site

1575 Burns Street

West Linn (Clackamas County), Oregon

for

Mr. Rolf Olson

Project No. 943.001.G
May 20, 2005

REDMOND & ASSOCIATES

May 20, 2005

Mr. Rolf Olson
3453 Augusta National Drive South
Salem, Oregon 97302

Dear Mr. Olson:

Re: Geotechnical Investigation, Proposed Commercial Building Site, 1575 Burns Street, West Linn (Clackamas County), Oregon

INTRODUCTION

In accordance with the request of Mr. Rolf Olson, we have completed our Geotechnical Investigation at the above subject proposed commercial building site. The site, a rectangular shaped property, is located to the north of Burns Street and to the east of Hood Street in West Linn (Clackamas County), Oregon.

We understand that present plans are to develop the site by constructing a new commercial building. Although the project is still in the preliminary planning and design stages, we understand that the commercial structure will be a one- and/or two-story structure which will include a below grade parking level. Specific building materials are not presently known but are anticipated to include wood- and/or metal frame with concrete and/or masonry blocks walls. The planned commercial structure is anticipated to be supported on conventional continuous (strip) and/or individual spread (column) footings with a concrete slab-on-grade floor. Structural loading is anticipated to result in maximum dead plus live continuous footing and column footing loads on the order of about 2.0 to 4.0 kips per lineal foot (klf) and 50 to 100 kips, respectively. Other associated site improvements will include asphalt pavements for both automobile drive and parking areas, underground utility services and landscaping.

SITE DESCRIPTION

The proposed commercial site, located within Township 2 South, Range 2 East, and Section 30 of the Willamette Meridian, is presently unimproved and consists of existing open commercial lot.

Topographically, the westerly portion of the site is characterized as relatively flat-lying terrain while the easterly portion of the site is characterized as moderately sloping terrain descending down to the east with overall topographic relief across the entire estimated at about 10 to 15 feet and is estimated lie near to Elevation 180 feet.

Vegetation across most of the site consists of a moderate growth of grass, weeds, and brush as well as numerous small to large sized trees.

SCOPE OF WORK

The purpose of our geotechnical studies is to evaluate the overall site subsurface soil and ground water characteristics as well as any associated impacts or concerns with regard to the planned construction and development of the site. Specifically, our geotechnical investigation included the following scope of work items:

1. Site exploration by means of three (3) exploratory backhoe test pit excavations. The exploratory test pits were excavated at various locations across the site as shown on the Site Exploration Map, Figure No. 2 to depths ranging from about 8 to 11 feet beneath existing site grades. Detailed logs of the exploratory test pit excavations, presenting conditions encountered at each location explored, are presented on the Log of Test Pits, Figure No's. 5 and 6. Additionally, representative samples of the subsurface soils encountered at the site were collected at selected depths and/or intervals and returned to our laboratory for further examination and testing.

2. A laboratory testing program to assess the pertinent physical and engineering characteristics of the subsurface soils. The laboratory program consisted of tests to evaluate the natural (field) moisture content and dry density, Atterberg Limits, gradational properties and Direct Shear Strength tests. Results of the moisture content and dry density tests are shown on their respective test pit log, Figure No's. 5 and 6. Results of the Atterberg Limits, gradation and direct shear strength tests are shown graphically on Figure No's. 7 through 9.

3. Recommendations and our final written report presenting the results of our investigation. Our report includes recommendations for site preparation and grading including any overexcavation of unsuitable materials revealed by the explorations, placement and compaction of any required structural fill(s), suitability of the on-site soils for use as structural fill as well as criteria for import fill materials, and preparation of pavement and foundation areas.

4. Recommendations for foundation support and design including allowable contact bearing pressures for proportioning footings, minimum width and embedment depths, and estimates of foundation settlement as well as lateral earth pressures for below grade walls. Additionally, we have developed flexible pavement sections for automobile and/or truck traffic areas.

SUBSURFACE CONDITIONS

Our understanding of the subsurface conditions which underlie the site was developed by means of three (3) exploratory test pits excavated on April 23, 2005 with a rubber-tired excavator at the approximate locations shown on Figure No. 2. The test pits revealed that the site is underlain by native soil deposits comprised of lacustrine and fluvial sedimentary soil deposits of Pleistocene age. Specifically, the native soil materials were comprised of very moist to wet, medium stiff to stiff, clayey, sandy silt to the maximum depth explored of about 11.0 feet beneath existing site grades. These clayey, sandy silt subgrade soils are best characterized by relatively low to moderate strength and compressibility.

Ground water was not encountered at the site during our field exploration work and is not expected to be a factor during construction. However, topsoil materials were encountered at the site and consist of about 12 to 16 inches of organic, clayey and sandy silt. All soils encountered at the site were classified in accordance with the Unified Soil Classification System (USCS) which is outlined on Figure No. 4.

CONCLUSIONS AND RECOMMENDATIONS

From a geotechnical engineering and constructability standpoint, we are of the opinion that the site is suitable for the planned new commercial structure and its associated site improvements provided that the recommendations contained within this report are properly incorporated into the design and construction of the project.

The primary feature of concern at the site is the moisture sensitivity characteristics of the underlying clayey, sandy silt subgrade soil materials

In regards to the moisture sensitivity characteristics of the underlying clayey, sandy silt subgrade soils, we recommend that all foundation excavation and site grading work be performed during the drier summer months which is typically June through September.

The following sections of this report present specific recommendations for site preparation and grading as well as foundation design and construction for the commercial building project.

SITE PREPARATION

In general, we recommend that all planned structural improvement areas for the commercial building and pavements be stripped and cleared of any existing site improvements, vegetation, topsoil materials, and any deleterious materials present at the time of construction. In general, we envision that about 12 to 16 inches of topsoil stripping may be required to remove existing topsoil materials. Holes resulting from the removal of any buried obstructions, such as old foundation remnants and/or boulders, should be backfilled and compacted with structural fill materials. Areas resulting in deeper stripping and removals should be evaluated at the time of construction by the Geotechnical Engineer. The stripped and cleared materials should be properly disposed of as they are generally not considered suitable for use/reuse as structural fill.

Following the stripping and clearing operations, and prior to the placement of any required structural fills and/or structural improvements, the exposed subgrade soils within the planned building and pavement areas should be inspected by the Geotechnical Engineer and possibly proof-rolled with a half-loaded dump truck. Areas found to be soft or otherwise unsuitable for support of structural loads or improvements should be scarified and recompacted or overexcavated and replaced with structural fill. During wet or inclement weather conditions, proof-rolling as recommended above will not be appropriate.

The on-site native clayey, sandy silt subgrade soils are considered suitable for use/reuse as structural fill provided that they are free of organic materials, debris, and rock fragments in excess of 8 inches in dimension. If grading is conducted during wet weather, the use of the on-site clayey, sandy silt soils may be difficult and the use of an import granular fill material may be required. In general, we recommend that a free-draining (clean) granular fill (sand & gravel) containing no more than about 5 percent fines be used during wet weather grading. Representative samples of the material(s) to be used as structural fill should be submitted to our laboratory for approval and to determine the maximum dry density and optimum moisture content for compaction.

All required structural fill materials placed within the building and pavement (structural) areas should be moistened or dried as necessary to near (within 3 percent) optimum moisture conditions and compacted by mechanical means to a minimum of 92 percent of the maximum dry density as determined by the ASTM D-1557 (AASHTO T-180) test procedures. Fill materials should be placed in lifts (layers) such that when compacted do not exceed about 8 inches.

FOUNDATION SUPPORT

Based on the results of our investigation, it is our opinion that the proposed commercial building structure may be supported directly on the underlying native medium stiff to stiff, clayey, sandy silt subgrade soil deposits and/or by structural fill materials with conventional continuous and individual spread footings. As such, were foundations are constructed on approved native subgrade soils and/or properly placed and compacted structural fill materials, an allowable contact bearing pressure of about 2,500 pounds per square foot (psf) is recommended for design. However, where higher allowable contact bearing pressures are required, an allowable contact bearing pressure of 3,000 psf may be used for design where the foundations are supported by a minimum of at least 12 inches of compacted crushed aggregate base rock structural fill materials. These allowable contact bearing pressures are intended for dead loads and sustained live loads and may be increased by one-third for the total of all loads including short-term wind or seismic loads.

In general, continuous strip footings should have a minimum width of at least 16 inches and be embedded at least 18 inches below the lowest adjacent finish grade (includes frost protection). Individual column footings (if required) should be embedded at least 16 inches below grade and have a minimum width of about 24 inches.

Total and differential settlements of foundations constructed as recommended above and supported directly by approved native subgrade soils or on properly placed and compacted structural fill materials are expected to be well within tolerable limits for this type of structure and should generally be less than about 1-inch and 1/2-inch, respectively.

Allowable lateral frictional resistance between the base of the footings and the clayey, sandy silt or a gravel subgrade soil can be expressed as the applied vertical load multiplied by a coefficient of friction of 0.35 and 0.45, respectively. In addition, lateral loads may be resisted by passive pressures on footings poured "neat" against in-situ native soils or properly compacted structural fill materials. For passive earth pressure resistance we recommend that an equivalent fluid density of 300 pounds per cubic foot (pcf) be used for design.

FLOOR SLAB SUPPORT

In order to provide uniform subgrade reaction beneath concrete slab-on-grade floors, we recommend that the floor slabs be underlain by a minimum of 6 inches of free-draining (less than 5 percent passing the No. 200 sieve), well-graded, crushed rock. The crushed rock should provide a capillary break to prevent migration of moisture through the slab. Additional moisture protection can be provided by using a 6-mil visqueen vapor barrier covered with a 1-inch protective layer of sand on the top and bottom. The base course materials should be compacted to at least 95 percent of the maximum dry density obtainable by the ASTM D-1557 (AASHTO T-180) test procedures.

BELOW GRADE/RETAINING WALLS

Below grade walls should be designed to resist lateral earth pressures imposed by native soils and/or granular backfill materials as well as any adjacent surcharge loads. For walls which are fully restrained from rotation at the top and supporting level backfill, we recommend that at-rest earth pressures be computed on the basis of an equivalent fluid density of 50 pcf and 60 pcf for granular backfill or sandy silt soil backfill materials, respectively. However, for walls which are free to rotate at the top and retaining level backfill, we recommend that active earth pressures be computed on the basis of an equivalent fluid density of 30 pcf and 40 pcf for granular backfill and sandy silt soil backfill materials, respectively. The above recommended lateral earth pressure values assume that the wall(s) will adequately drained to prevent the buildup of hydrostatic pressures. Where wall drainage will not be present and/or where adjacent surcharge loading and/or sloping ground conditions are present, the above recommended lateral earth pressure values will be higher.

Non structural backfill materials behind retaining walls should be compacted to at least 85 percent of the maximum dry density as determined by the ASTM D-1557 (AASHTO T-180) test procedures. Where structural backfill materials are required, the degree of compaction should be at least 90 percent of the maximum dry density. However, special care should be taken to avoid overcompaction near the wall(s) which could result in higher lateral earth pressures than those indicated herein. In an area within about three (3) to five (5) feet behind walls, we recommend the use of light hand operated compaction equipment.

EXCAVATIONS

Temporary excavations within native subgrade soils of up to four (4) feet in depth are expected to remain fairly stable at near vertical inclinations. Excavations to depths of between four (4) feet to ten (10) feet should be properly braced and shored or backcut to inclinations of at least 1 to 1 (Horizontal to Vertical). Where excavations are planned to exceed ten (10) feet, this office should be consulted. Additionally, at present levels, we do not anticipate that ground water will not be a factor during construction.

PAVEMENTS

Flexible pavement design for the project was determined on the basis of projected traffic volume and loading conditions relative to assumed subgrade soil strength characteristics. Based on an assumed subgrade "R"-value of 35 (CBR = 4.0) and utilizing the Oregon State Highway Flexible Pavement Design Procedures, we recommend that the asphaltic concrete pavement sections for automobile parking and drive area use at the site consist of the following:

	Asphaltic Concrete Thickness (inches)	**Crushed Base Rock Thickness (inches)**
Automobile Parking Areas	2.5	8.0
Automobile Drive Areas	3.0	9.0

Note: Where heavy vehicle traffic is anticipated, we recommend that the main access drive area pavement section be increased by adding 1.0 inches of asphalt and 3.0 inches of aggregate base rock. Additionally, for wet and/or winter time construction, we recommend that a minimum of at least 12 inches of aggregate base rock be used in all pavement areas.

The above recommended pavement section(s) assume that the subgrade will be prepared as recommended herein, that the exposed subgrade soils will be properly protected from rain and construction traffic, and that the subgrade is firm and unyielding at the time of paving. Additionally, it assumes that the subgrade is graded to prevent any ponding of water which may tend to accumulate in the base course. Further, the above recommended flexible pavement section(s) assumes a design life of about 20 years.

Pavement base course materials should consist of well-graded 1 1/2-inch and/or 3/4-inch minus crushed base rock having less than 5 percent fine materials passing the No. 200 sieve. The base course and asphaltic concrete materials should conform to the requirements set forth in the latest edition of the Oregon Department of Transportation, Standard Specifications of Highway Construction. The base course materials should be compacted to at least 95 percent of the maximum dry density as determined by the ASTM D-1557 (AASHTO T-180) test procedures. The asphaltic concrete materials should be compacted to at least 91 percent of the theoretical maximum density as determined by the ASTM D-2041 (Rice Gravity) test method.

SEISMIC DESIGN CONSIDERATIONS

Subgrade acceleration coefficients for the project were obtained from the seismic hazard/design mapping project performed by Geomatrix Consultants. Geomatrix mapping indicates that a peak ground acceleration on bedrock soils in the area of the site are 0.19g with a return period of about 500 years. The UBC seismic zone factor (Z) for the subject site is 0.30. Additionally, the IBC soil profile for the subject site to estimate the site class is recommended at D.

USE OF REPORT

This report is intended for the exclusive use of the addressee and their representatives to use to design the proposed commercial building structure and its associated site improvements described herein and to prepare any construction documents. The data, analyses, and recommendations may not be appropriate for other structures or purposes. We recommend that parties contemplating other structures or purposes contact our office. In the absence of our written approval, we make no representation and assume no responsibility to other parties regarding this report.

LEVEL OF CARE

Services performed by the Geotechnical Engineer for this project have been conducted with that level of care and skill ordinarily exercised by members of the profession currently practicing in the area under similar budget and time restraints. No warranty, either expressed or implied, is made.

CONSTRUCTION MONITORING AND TESTING

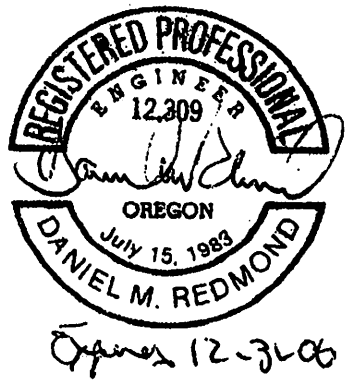
We recommend that **Redmond & Associates** be retained to provide construction monitoring and testing services during all earthwork operations. The purpose of our monitoring services would be to confirm that the site conditions which are encountered are as anticipated, provide field recommendations as necessary based on the actual conditions encountered, and document the activities of the contractor and assess his/her compliance with the project specifications and recommendations.

It is important that we meet with the grading contractor prior to any site grading work to establish a plan that will minimize costly overexcavation and site preparation work. Of primary importance will be observations made during the site preparation, structural fill placement, footing excavation and preparation, and construction of all below grade retaining walls.

We will be pleased to provide such additional assistance or information as you may require in the balance of the design phase of this project and to aid in construction control or solution of unforeseen conditions which may arise during the construction period.

Sincerely,

Daniel M. Redmond, P.E.
President/Principal Geotechnical Engineer



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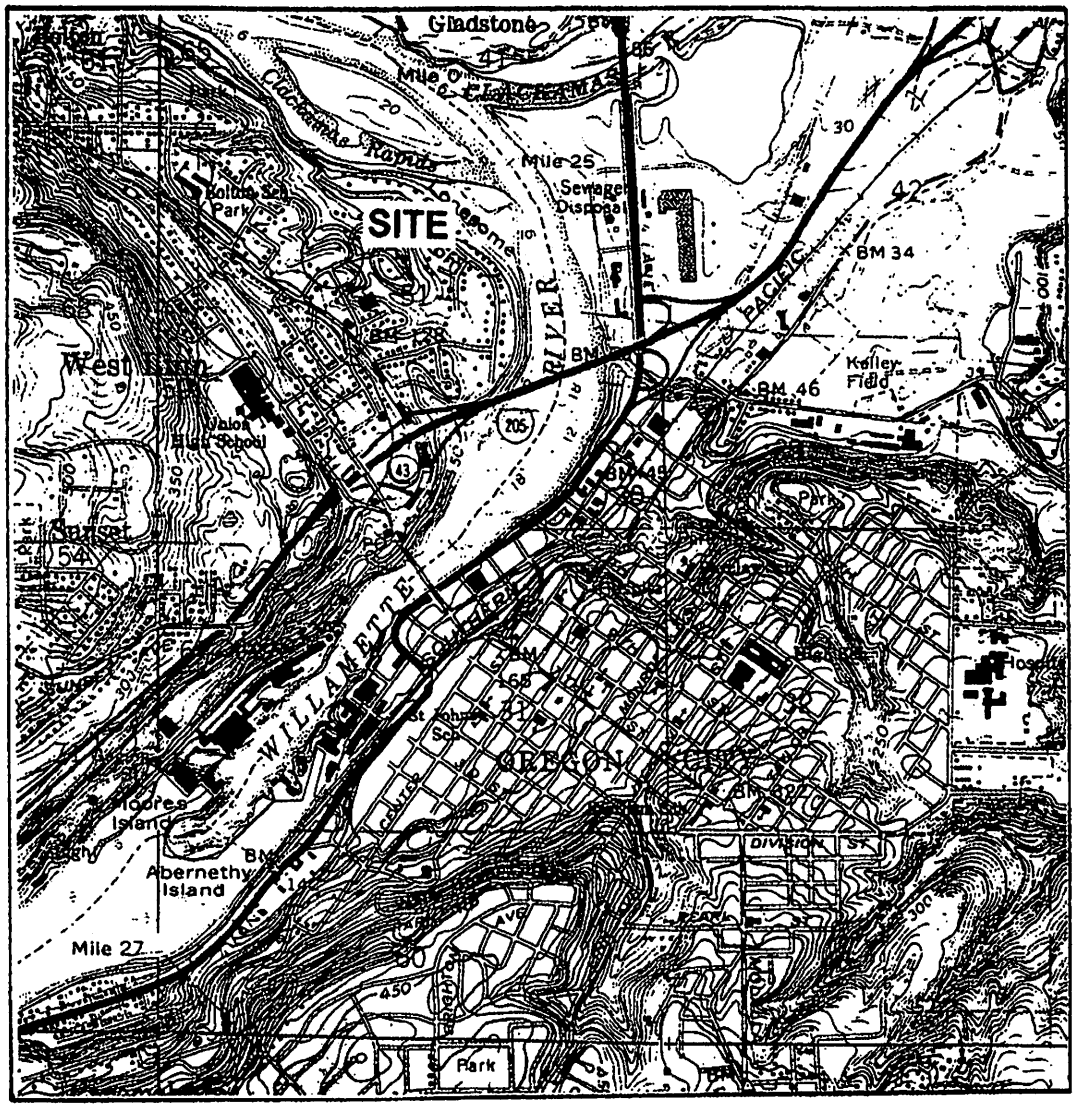


OREGON CITY QUADRANGLE
OREGON—CLACKAMAS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 OREGON CITY 15' QUADRANGLE

SCALE 1:24 000

1 0 1 MILE

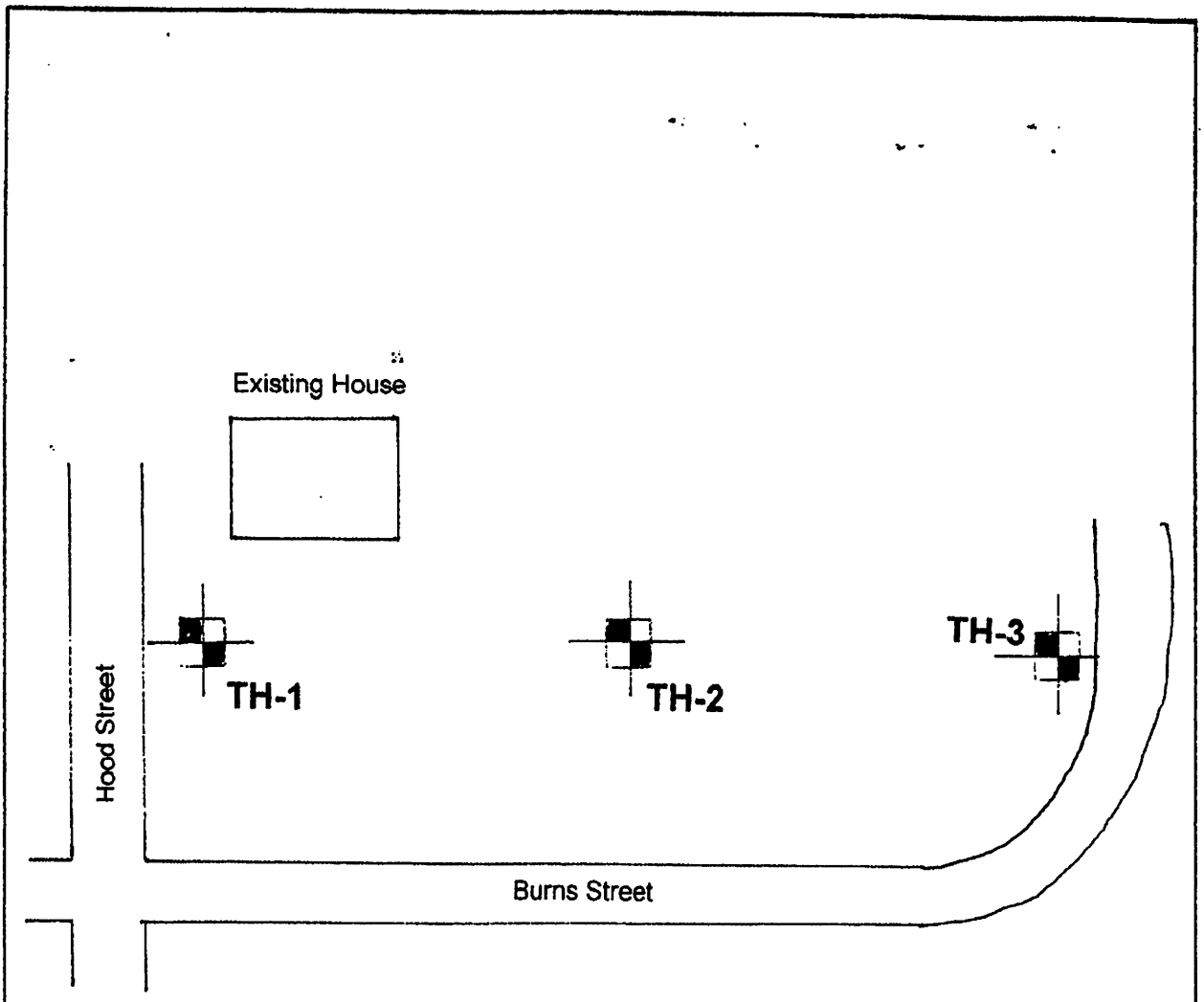
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

SITE VICINITY MAP

Project No. 943.001.G	1575 BURNS STREET	Figure No. 1

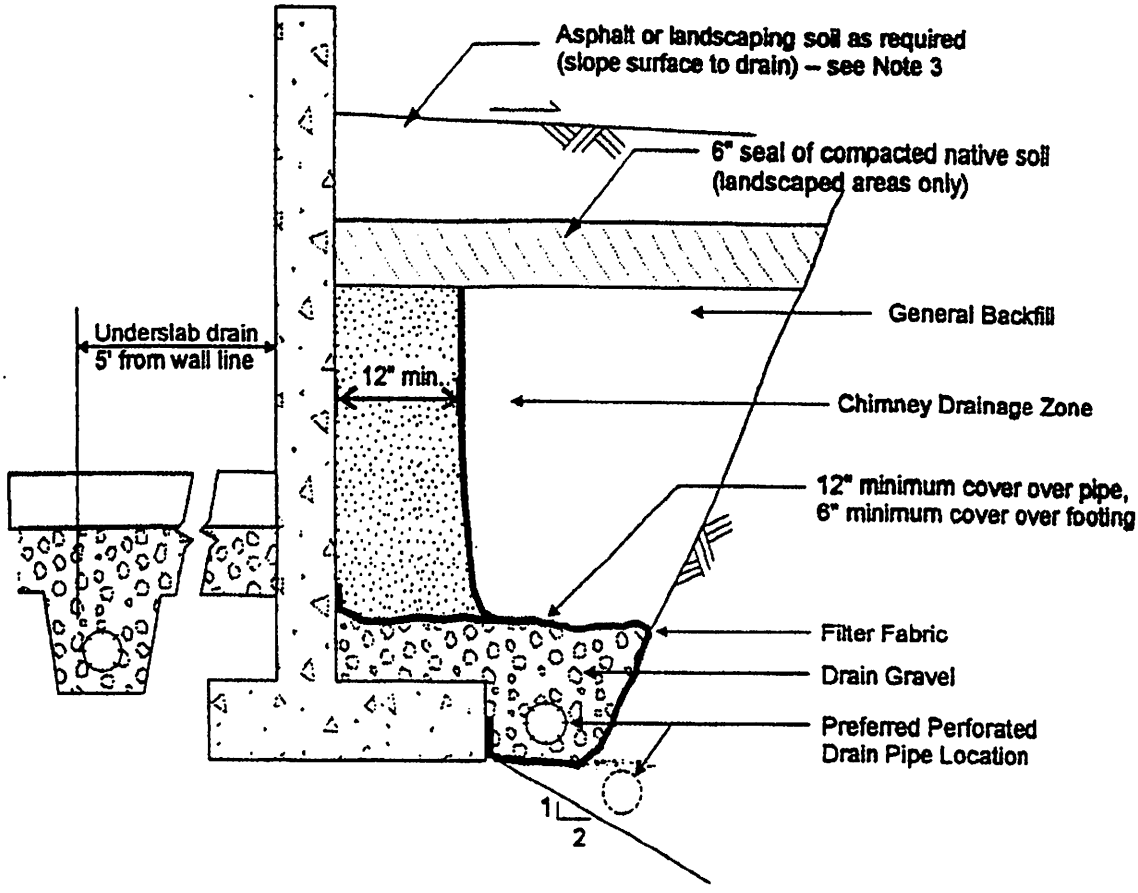


Legend

TH-3 Indicates approximate location of exploratory test hole

SITE EXPLORATION MAP

Project No. 943.001.G	1575 BURNS STREET	Figure No. 2



SCHEMATIC - NOT TO SCALE

NOTES:

1. Filter Fabric to be non-woven geotextile (Amoco 4545, Mirafi 140N, or equivalent)
2. Lay perforated drain pipe on minimum 0.5% gradient, widening excavation as required. Maintain pipe above 2:1 slope, as shown.
3. All-granular backfill is recommended for support of slabs, pavements, etc. (see text for structural fill).
4. Drain gravel to be clean, washed ¾" to 1½" gravel.
5. General backfill to be on-site gravels, or ¾"-0 or 1½"-0 crushed rock compacted to 92% Modified Proctor (AASHTO T-180).
6. Chimney drainage zone to be 12" wide (minimum) zone of clean washed, medium to coarse sand or drain gravel if protected with filter fabric. Alternatively, prefabricated drainage structures (Miradrain 6000 or similar) may be used.

FOOTING/RETAINING WALL DRAIN

Project No. 943.001.G	1575 BURNS STREET	Figure No. 3

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS — MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.
		GRAVEL WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
	SANDS — MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures, non-plastic fines.
			SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS — MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT IS LESS THAN 50%		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS — LIQUID LIMIT IS GREATER THAN 50%		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

DEFINITION OF TERMS

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENINGS				
200	40	10	4	3/4"	3"	12"		
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS	
	FINE	MEDIUM	COARSE	FINE	COARSE			

GRAIN SIZES

SANDS, GRAVELS AND NON-PLASTIC SILTS	BLOWS/FOOT†
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

RELATIVE DENSITY

CLAYS AND PLASTIC SILTS	STRENGTH‡	BLOWS/FOOT†
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32

CONSISTENCY

†Number of blows of 140 pound hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).

‡Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

REDMOND & ASSOCIATES
P.O. Box 301545 • Portland, OR 97230

KEY TO EXPLORATORY TEST PIT LOGS
Unified Soil Classification System (ASTM D-2487)

1575 BURNS STREET COMMERCIAL SITE
WEST LINN, OREGON

PROJECT NO.	DATE	Figure
943.001.G	May 20, 2005	4

BACKHOE COMPANY: Kavik, Inc. BUCKET SIZE: 24 inches DATE: 4/23/05

DEPTH (FEET)	BAG SAMPLE	DENSITY TEST	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION
						TEST PIT NO. TH-1 ELEVATION
0					ML	Dark brown, very moist to wet, soft, organic, sandy and clayey SILT (Topsoil)
	x			24.4	ML	Medium brown to olive-brown, very moist, medium stiff to stiff, clayey, sandy SILT
5	x			27.2		
10						Total Depth - 9.0 feet No ground water encountered
15						
						TEST PIT NO. TH-2 ELEVATION
0					ML	Dark brown, very moist to wet, soft, organic, sandy and clayey SILT (Topsoil)
	x			26.1	ML	Medium brown to olive-brown, very moist, medium stiff to stiff, clayey, sandy SILT
5	x			28.3		
10						Total Depth = 11.0 feet No ground water encountered
15						

LOG OF TEST PITS

PROJECT NO. 943.001.G | 1575 BURNS STREET COMMERCIAL SITE | FIGURE NO. 5

BACKHOE COMPANY: Kavik, Inc. BUCKET SIZE: 24 inches DATE: 4/23/05

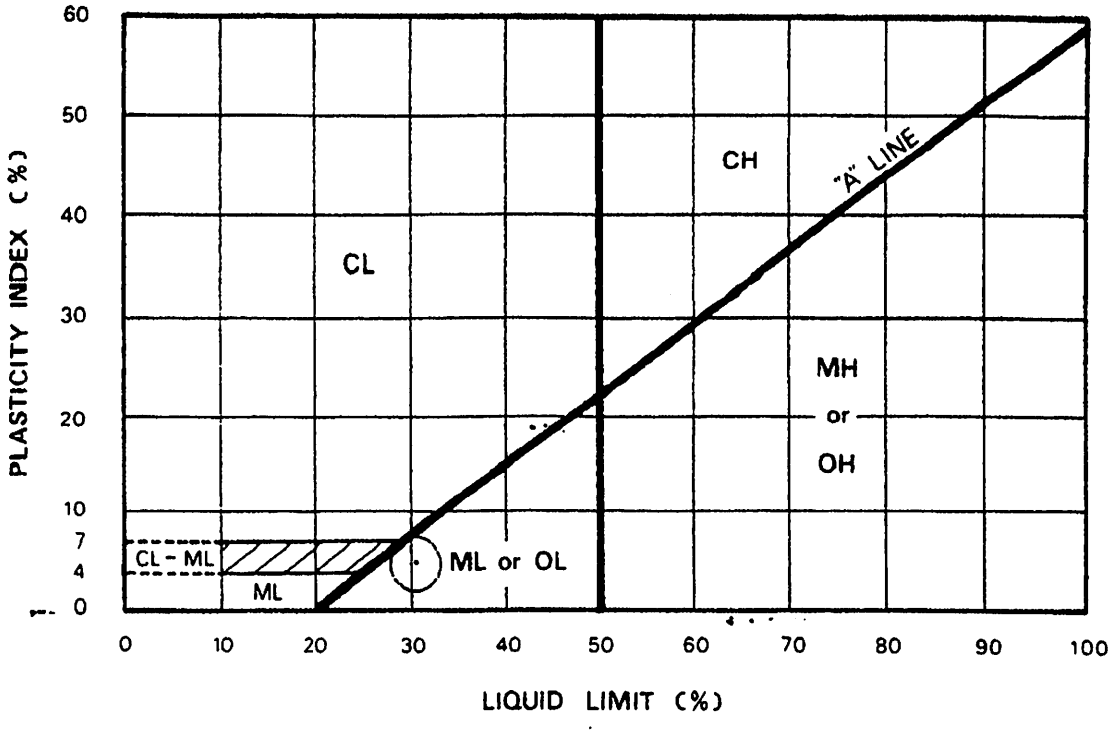
DEPTH (FEET)	BAG SAMPLE	DENSITY TEST	DRY DENSITY (pcf)	MOISTURE CONTENT (%)	SOIL CLASS. (U.S.C.S.)	SOIL DESCRIPTION
						TEST PIT NO. TH-3 ELEVATION
0					ML	Dark brown, very moist to wet, soft, organic, sandy and clayey SILT (Topsoil)
	X			35.5	ML	Gray-brown, wet, soft to medium stiff, sandy, clayey SILT
5	x			32.6	ML	Medium brown to olive-brown, very moist to wet, medium stiff to stiff, clayey, sandy SILT
10						Total Depth = 8.0 feet No ground water encountered
15						

TEST PIT NO. ELEVATION

0
5
10
15

LOG OF TEST PITS

PROJECT NO. 943.001.G | 1575 BURNS STREET COMMERCIAL SITE | FIGURE NO. 6



KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	NATURAL WATER CONTENT %	LIQUID LIMIT %	PLASTICITY INDEX %	PASSING NO. 200 SIEVE %	LIQUIDITY INDEX	UNIFIED SOIL CLASSIFICATION SYMBOL
⊙	TH-2	3.0	28.3	30.6	5.5	76.0		ML

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PLASTICITY CHART AND DATA

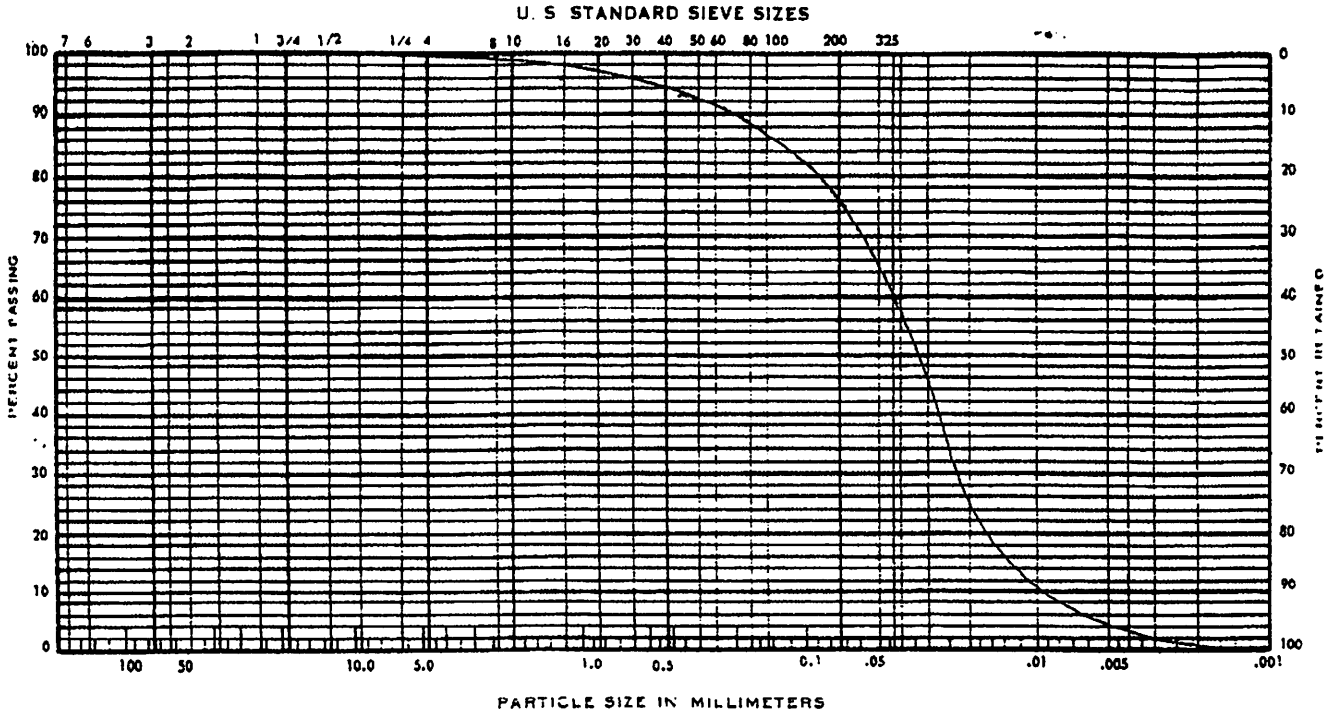
1575 BURNS STREET COMMERCIAL SITE
West Linn, Oregon

PROJECT NO.	DATE
943.001.G	May 20, 2005

Figure 7

UNIFIED SOIL CLASSIFICATION SYSTEM

(ASTM D 422-72)



COBBLES	GRAVEL		SAND			SILT AND CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

KEY SYMBOL	BORING NO.	SAMPLE DEPTH (feet)	ELEV (feet)	UNIFIED SOIL CLASSIFICATION SYMBOL	SAMPLE DESCRIPTION
——	TH-1	3.0		ML	Medium brown to olive-brown, clayey, sandy SILT

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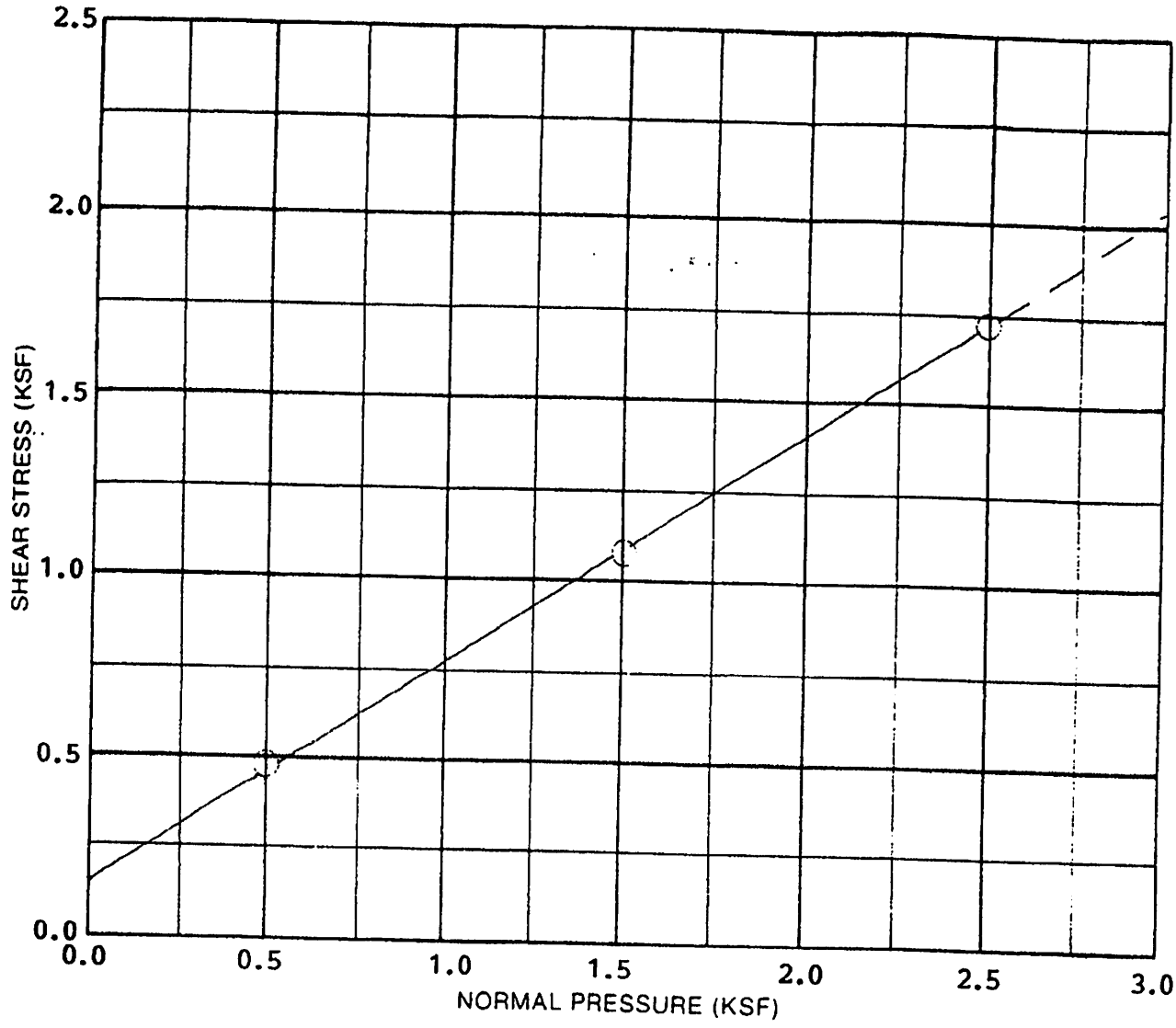
GRADATION TEST DATA

1575 BURNS STREET COMMERCIAL SITE
West Linn, Oregon

PROJECT NO.	DATE	FIGURE
943.001.G	May 20, 2005	8



SAMPLE DATA	
DESCRIPTION:	Medium to olive-brown, clayey, sandy SILT
BORING NO.:	TH-2
DEPTH (ft.): 3.0'	ELEVATION (ft):
TEST RESULTS	
APPARENT COHESION (C):	150 psf
APPARENT ANGLE OF INTERNAL FRICTION (Φ):	32°

TEST DATA				
TEST NUMBER	1	2	3	4
NORMAL PRESSURE (KSF)	0.5	1.5	2.5	
SHEAR STRENGTH (KSF)	0.48	1.09	1.74	
INITIAL H_2O CONTENT (%)	26.0	26.0	26.0	
FINAL H_2O CONTENT (%)	25.9	24.2	22.1	
INITIAL DRY DENSITY (PCF)	91.1	91.1	91.1	
FINAL DRY DENSITY (PCF)	91.6	93.1	95.4	
STRAIN RATE:	0.02 inches per minute			

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P.O. Box 301545 • Portland, OR 97294

DIRECT SHEAR TEST DATA

1575 BURNS STREET COMMERCIAL SITE
West Linn, Oregon

PROJECT NO.	DATE	
943.001.G	May 20, 2005	Figure 9

APPENDIX E

FIELD VISIT EXPLORATIONS

Field Visit Notes:

A field visit for the Bolton Terrace project located at 1575 Burns Street in West Linn, OR 97068 was conducted on April 14th, 2020. The purpose of this visit was to determine if the north fork of Cascade Springs Pond Creek had adequate downstream capacity for the added runoff produced from the developed project site.

During the field visit it was observed that at the mouth of the creek, located near the southeast corner of the project site, the creek had a width of over 30 feet and depth of 10-15 feet. The observed slope at this area was 1.50%.

It was observed, that the creek increases in width and depth further downstream. The next measurement observed was 300 feet downstream. At this point, the creek was greater than 40 feet in depth and greater than 50 feet in width at the widest point. The slope at this point was 1.65%. The width at the bottom of the creek was on average 15 feet in diameter.

These characteristics continue until 1900 feet downstream. The creek decreases to 10 feet in width and approximately 6 feet in depth. The creek then flows through a 30-inch diameter concrete pipe, flowing under River Street and into a 25-foot depth and 30-foot wide creek on the other side. This creek then flows into the Willamette River.

Through field observations, it is determined that Cascade Springs Pond Creek will have more than enough downstream capacity to convey the 0.20 feet of added runoff depth produced by the proposed developed site.

Field Visit Pictures:

Picture 1:

From mouth of creek looking southeast

Picture 2:

From mouth of creek looking northwest

Picture 3:

From project site looking southeast

Picture 4:

300 ft downstream looking northwest

Picture 5:

300 ft downstream looking southeast

Picture 6:

1900 ft downstream looking west

Picture 7:

1900 ft downstream looking east

Picture 8:

1920ft downstream looking east

APPENDIX F

WATER QUALITY TREATMENT

Predeveloped WQ Basin Map

LEGEND

- FOUND MONUMENT
- STORM DRAIN MANHOLE
- CATCH BASIN
- CULVERT
- SANITARY SEWER MANHOLE
- CLEANOUT
- WATER METER
- WATER VALVE
- FIRE HYDRANT
- IRRIGATION CONTROL BOX
- ELECTRICAL BOX
- POWER METER
- ELECTRICAL TRANSFORMER
- LIGHT POLE
- UTILITY POLE
- GUY WIRE
- COMMUNICATION RISER
- COMMUNICATION BOX
- GAS METER
- GAS VALVE
- SIGN
- MAILBOX
- GAS LINE MARKER
- CONCRETE
- GRAVEL
- DECIDUOUS TREE & TRUNK SIZE
- EVERGREEN TREE & TRUNK SIZE

- SEWER LINE UNDERGROUND
- STORM LINE UNDERGROUND
- WATERLINE UNDERGROUND
- GAS LINE UNDERGROUND
- COMMUNICATION LINE UNDERGROUND
- ELECTRICAL LINE UNDERGROUND
- OVERHEAD POWER LINE
- FENCE LINE

AC	ASPHALT
CONC	CONCRETE
E.O.P.	EDGE OF PAVEMENT
HCR	HANDICAP RAMP
FF	FINISH FLOOR
IR	IRON ROD
IP	IRON PIPE
W/YPC	WITH YELLOW PLASTIC CAP
DOC. NO.	DOCUMENT NUMBER
SF	SQUARE FEET

SLOPE/DRAINAGE LEGEND

SLOPES ON SITE GREATER THAN 25% (TYPE II)
AREA=0.25 Ac (40% OF SITE)

DIRECTION OF DRAINAGE FLOW

0 10 20 40 (feet)

Flow Path:
Length = 250 FT
Slope = 12.4 %
Tc = 17.3 min.

PROPERTY AREA:
27,571 SQ. FT.
(0.63 Ac.)

OWNER: BOLTON COMMONS, LLC
KIM WRIGHT
ADDRESS:
1554 GARDEN ST. STE 104
WEST LINN, OR 97068

KUNRATH/MILLER
DOC. NO. 2012-018184

DOUBLEDAY
DOC. NO. 2012-033279

EXISTING HOUSE
FF=132.10'
FF BASEMENT=123.75'

EXISTING 6' PUE

BURNS STREET — 56.46' R.O.W.

WOOD STREET — 40' R.O.W.

CASCADE STREET — 50' R.O.W.

22.34' ℄–E/P

63.36' R.O.W.

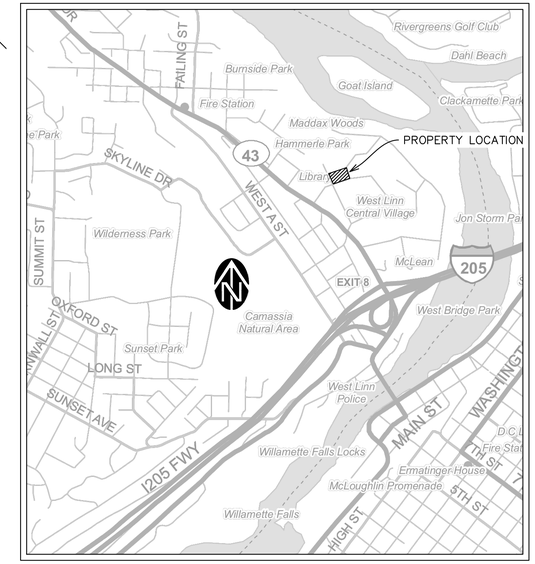
15.92' E/P–E/P

31.72' CURB–CURB

37.27' CURB–CURB

27.94' CURB–C

VICINITY MAP



SITE ANALYSIS TABLE

POTENTIAL ITEMS	FOUND ON SITE? (Y/N)	
POTENTIAL NATURAL HAZARD AREAS	YES	NO
FLOODPLAIN AREAS		X
WATER RESOURCE AREAS		X
LANDSLIDE AREAS	X	
LANDSLIDE VULNERABLE AREAS		X
RESOURCE AREAS	YES	NO
WETLANDS		X
RIPARIAN CORRIDORS		X
STREAMS, INTERMITTENT STREAMS, OR EPHEMERAL STREAMS		X
HABITAT CONSERVATION AREAS		X
LARGE ROCK OUTCROPPINGS		X

NO.	DATE	DESCRIPTION	BY
1		REVISIONS	

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

DSN. JW
DRN. RS
CKD. JW
DATE: 05/2020

REVIEW
REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 12, 2005
WILLIAM A. WELLS
RENEWS: 6/30/2020

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com

LENITY ARCHITECTURE
ADVANCE DENTAL ARTS

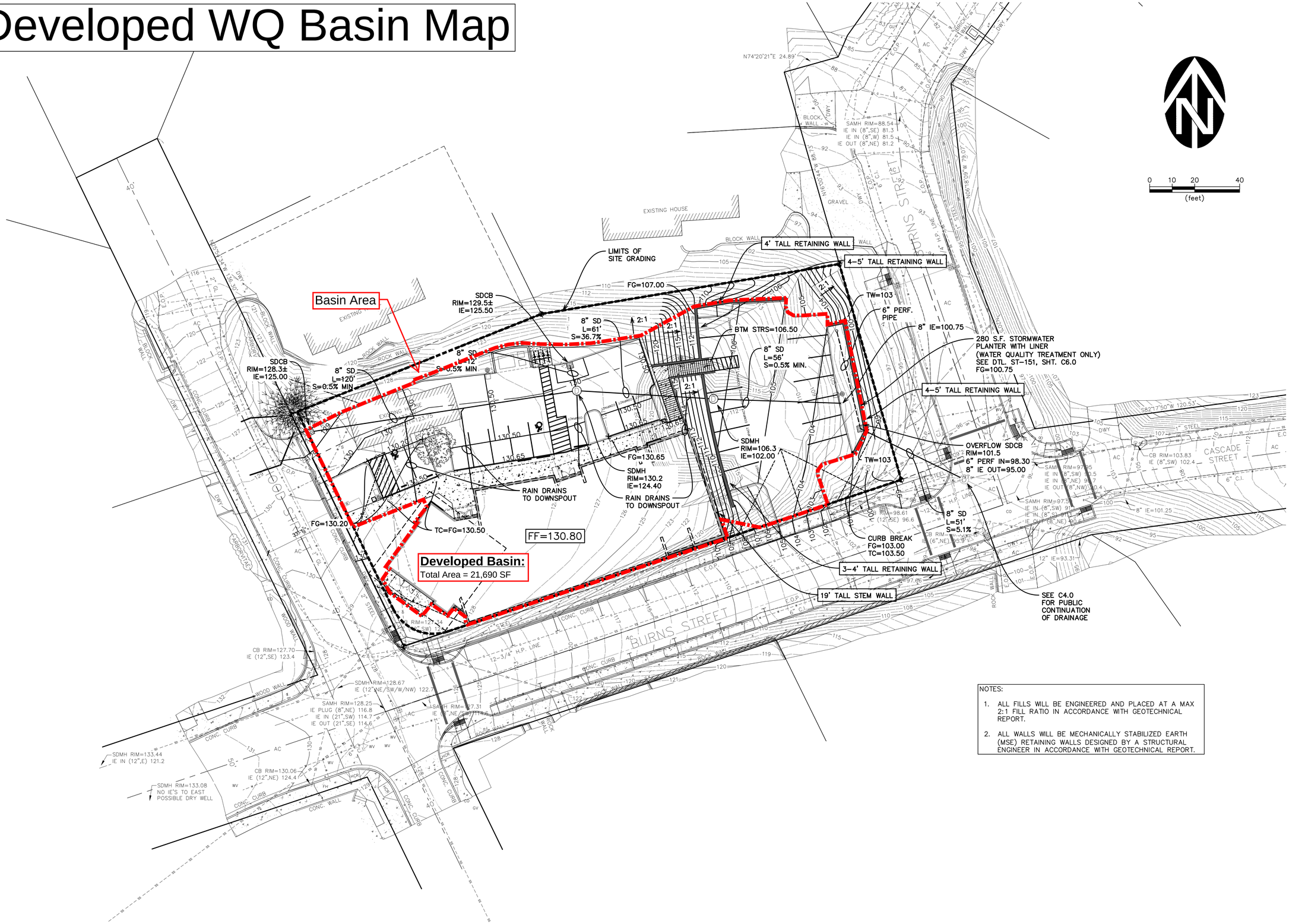
SITE ANALYSIS PLAN

DRAWING
C1.0

JOB NUMBER
3132.0000.0

7/30/2020 5:25:57 PM
C:\Users\Cyndia\Desktop\WE Projects\Bolton Terrace 3132.0000.0\Civil\Photos\SITE ANALYSIS.dwg, (C1.0 tab)

Developed WQ Basin Map



NOTES:

1. ALL FILLS WILL BE ENGINEERED AND PLACED AT A MAX 2:1 FILL RATIO IN ACCORDANCE WITH GEOTECHNICAL REPORT.
2. ALL WALLS WILL BE MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALLS DESIGNED BY A STRUCTURAL ENGINEER IN ACCORDANCE WITH GEOTECHNICAL REPORT.

NO.	DATE	DESCRIPTION	BY
1		REVISIONS	

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING 1"
IF NOT ONE INCH, ADJUST SCALES ACCORDINGLY

DSN. JW
DRN. RS
CKD. JW
DATE: 05/2020

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 12, 2005
WILLIAM V. WELLS
RENEWS: 6/30/2020
REVIEW

WESTECH ENGINEERING, INC.
CONSULTING ENGINEERS AND PLANNERS
3841 Fairview Industrial Dr. S.E., Suite 100, Salem, OR 97302
Phone: (503) 585-2474 Fax: (503) 585-3986
E-mail: westech@westech-eng.com

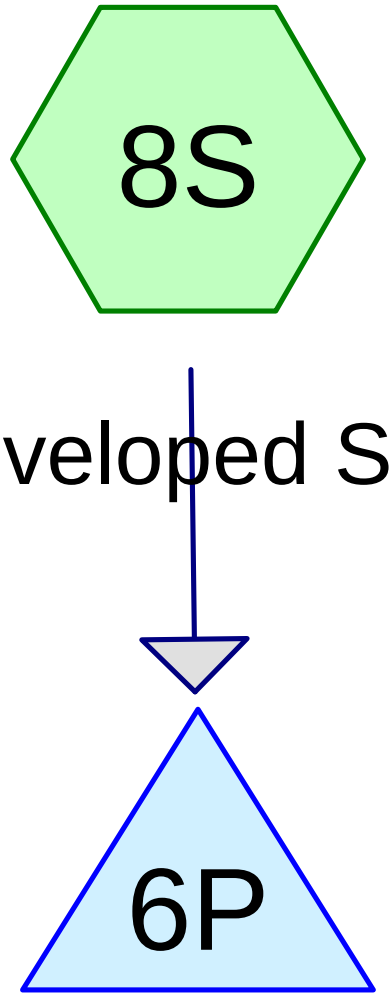
LENITY ARCHITECTURE
ADVANCE DENTAL ARTS

PRELIMINARY GRADING & DRAINAGE PLAN

DRAWING
C2.0

JOB NUMBER
3132.0000.0

8/5/2020 11:20:58 AM
C:\Users\ryoho\Desktop\WE Projects\Belton Terrace 3132.0000.0\Civil\Plots\GRADING & DRAINAGE.dwg, (C2.0 tab)



Filtration Planter (12" Drain Rock)

Subcat Reach Pond Link

Routing Diagram for Bolton Terrace
Prepared by Westech Engineering, Inc., Printed 8/3/2020

Summary for Subcatchment 8S: Developed Site

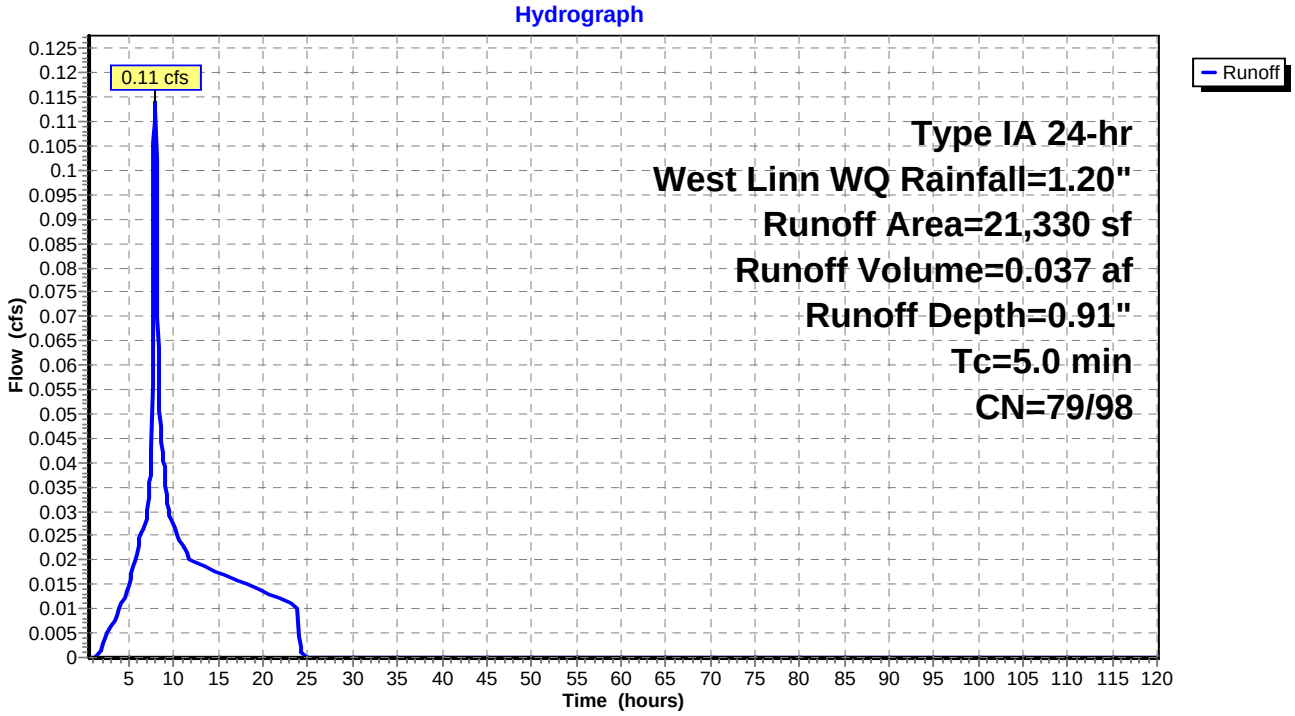
Runoff = 0.11 cfs @ 7.91 hrs, Volume= 0.037 af, Depth= 0.91"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn WQ Rainfall=1.20"

	Area (sf)	CN	Description
*	19,470	98	rooftop
	1,860	79	50-75% Grass cover, Fair, HSG C
	21,330	96	Weighted Average
	1,860		8.72% Pervious Area
	19,470		91.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Developed Site



Summary for Pond 6P: Filtration Planter (12" Drain Rock)

Inflow Area = 0.490 ac, 91.28% Impervious, Inflow Depth = 0.91" for West Linn WQ event
Inflow = 0.11 cfs @ 7.91 hrs, Volume= 0.037 af
Outflow = 0.11 cfs @ 7.91 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 7.91 hrs, Volume= 0.000 af
Primary = 0.11 cfs @ 7.91 hrs, Volume= 0.037 af

Routing by Stor-Ind method, Time Span= 0.50-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 97.50' @ 7.91 hrs Surf.Area= 280 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (708.0 - 707.9)

Volume	Invert	Avail.Storage	Storage Description
#1	97.50'	392 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

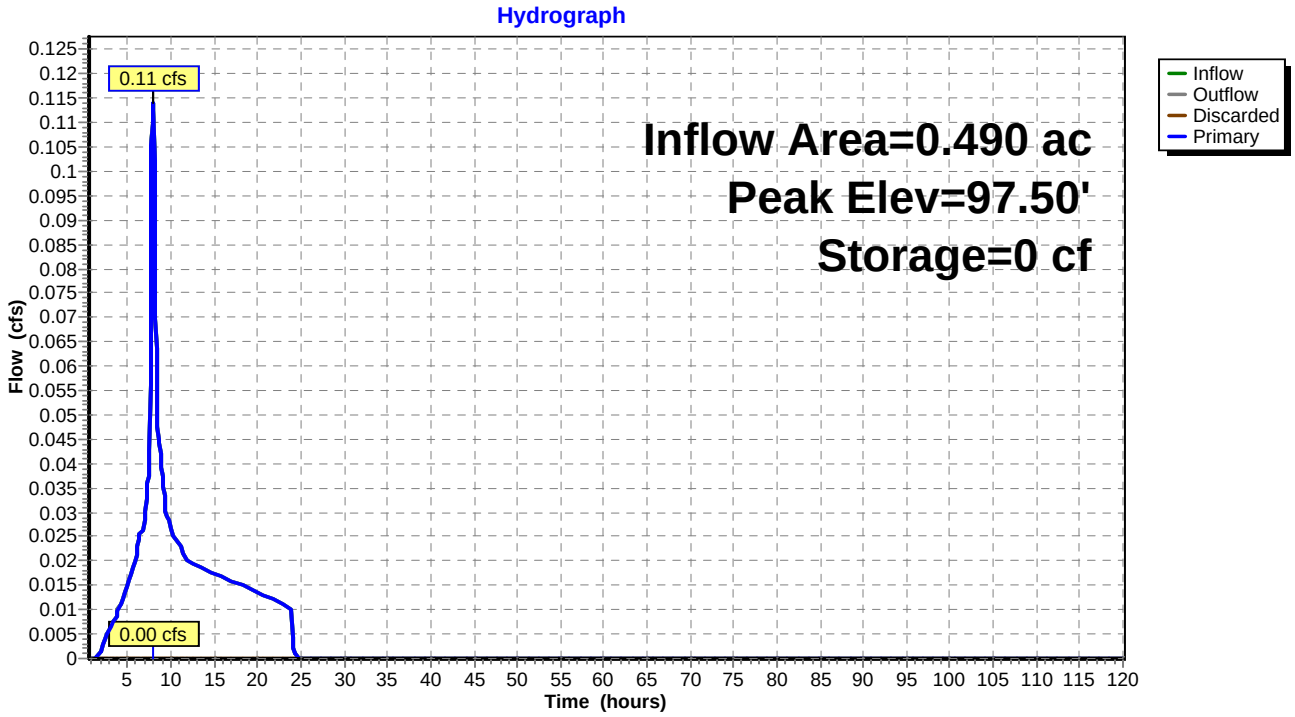
Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
97.50	280	0.0	0	0
98.50	280	40.0	112	112
100.00	280	0.1	0	112
101.00	280	100.0	280	392

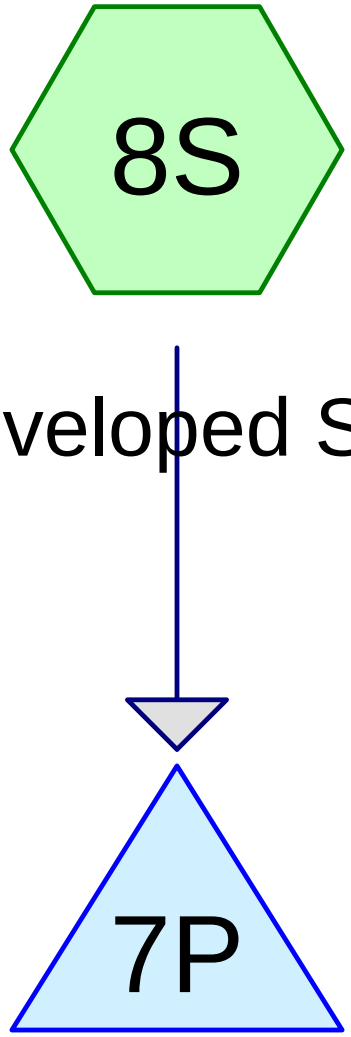
Device	Routing	Invert	Outlet Devices
#1	Discarded	97.50'	**0.200 in/hr Exfiltration over Surface area**
#2	Primary	95.00'	**8.0" Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.00 cfs @ 7.91 hrs HW=97.50' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=2.47 cfs @ 7.91 hrs HW=97.50' (Free Discharge)
↑—**2=Orifice/Grate** (Orifice Controls 2.47 cfs @ 7.09 fps)

Pond 6P: Filtration Planter (12" Drain Rock)





Filtration Planter
(Surface Test)

Subcat Reach Pond Link

Routing Diagram for Bolton Terrace
Prepared by Westech Engineering, Inc., Printed 8/3/2020

Summary for Subcatchment 8S: Developed Site

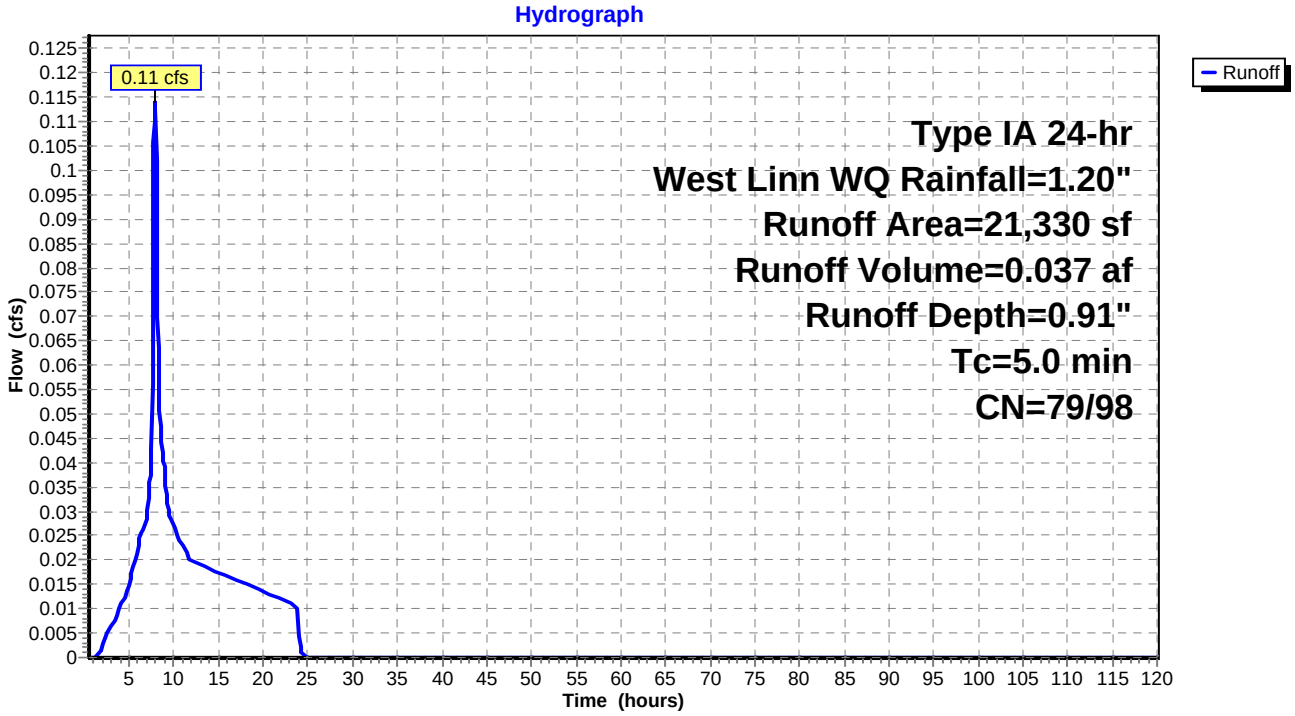
Runoff = 0.11 cfs @ 7.91 hrs, Volume= 0.037 af, Depth= 0.91"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.50-120.00 hrs, dt= 0.05 hrs
Type IA 24-hr West Linn WQ Rainfall=1.20"

	Area (sf)	CN	Description
*	19,470	98	rooftop
	1,860	79	50-75% Grass cover, Fair, HSG C
	21,330	96	Weighted Average
	1,860		8.72% Pervious Area
	19,470		91.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: Developed Site



Summary for Pond 7P: Filtration Planter (Surface Test)

Inflow Area = 0.490 ac, 91.28% Impervious, Inflow Depth = 0.91" for West Linn WQ event
Inflow = 0.11 cfs @ 7.91 hrs, Volume= 0.037 af
Outflow = 0.04 cfs @ 8.78 hrs, Volume= 0.037 af, Atten= 63%, Lag= 51.8 min
Discarded = 0.04 cfs @ 8.78 hrs, Volume= 0.037 af

Routing by Stor-Ind method, Time Span= 0.50-120.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 100.68' @ 8.78 hrs Surf.Area= 280 sf Storage= 189 cf

Plug-Flow detention time= 26.4 min calculated for 0.037 af (100% of inflow)
Center-of-Mass det. time= 26.4 min (734.3 - 707.9)

Volume	Invert	Avail.Storage	Storage Description
#1	100.00'	560 cf	**Custom Stage Data (Conic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
100.00	280	0.0	0	0	280
102.00	280	100.0	560	560	399

Device	Routing	Invert	Outlet Devices
#1	Discarded	100.00'	**4.000 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 98.50'

Discarded OutFlow Max=0.04 cfs @ 8.78 hrs HW=100.68' (Free Discharge)
↑**1=Exfiltration** (Controls 0.04 cfs)

Pond 7P: Filtration Planter (Surface Test)