STORM DRAINAGE REPORT

Copperberry Condominiums

4002, 4010 and 4018 10th Street SE

Puyallup, WA

Prepared For:

Bill Riley Communities Family

1002 39th Avenue SW, Suite 104

Puyallup, WA 98373

Revised: June 10, 2023
Revised: April 8, 2023
Date: November 6, 2022

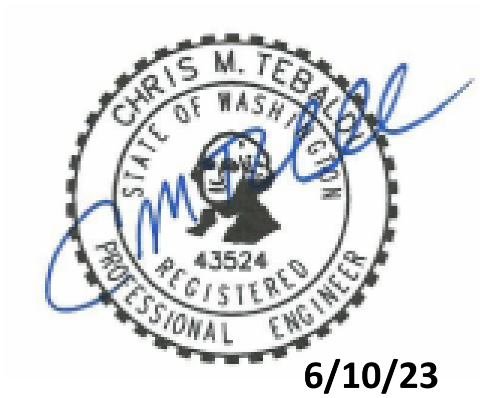
TEBALDI ENGINEERING, LLC

4625 – 126th Avenue East, Edgewood, WA 98372 (206) 450-5096

www.tebaldiengineering.com

ENGINEER'S CERTIFICATION

I hereby state that this Stormwater Site Plan for Copperberry Condominiums has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that the City of Puyallup does not and will not assume liability for the sufficiency, suitability or performance of drainage facilities prepared by me.



Chris M. Tebaldi, P.E.

6/10/23

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1.0 PROJECT OVERVIEW

The proposed project site is located within a portion of the NE ¼ of Section 10, Township 19 North, Range 4 East of the Willamette Meridian with a total project site area of 0.86 acres. More specifically, the site is located at 4002, 4010 and 4018 10th Street SE, Puyallup, WA on tax parcel numbers 4389000160, -0170 and -0180. See Figure 1.1-Vicinity Map in this section for the location of the proposed project site.

The proposed development includes two new six plex condominiums along with the associated driveway and utilities. The project will involve the removal and disturbance of existing on-site soils and vegetation, and installation of site improvements required for development. The site is gently sloped, with approximately 20 feet of topographic relief from east to west. The existing site contains one storm drainage conveyance line along the western boundary.

The project site consists of a single Threshold Discharge Area and intends to match the existing drainage patterns on site. Under this proposal, the project contains 0.54 acres of new impervious surface, which is subject to all minimum requirements as specified in the flow chart (Figure 1.2) of this report. As part of the drainage requirements, the project intends to infiltrate all runoff from the improvements associated with the development. This Stormwater Site Plan will serve to address the drainage requirements contained within the 2019 Department of Ecology Stormwater Management Manual for Western Washington and City of Puyallup requirements. Please see the remainder of this plan for the project's design intent for mitigating any adverse impacts as a result of on-site improvements.

Area Summary		
	Pre-Developed	**Developed**
Parcel Area	37,501 SF	37,501 SF
Project Area (clearing limits)	31,124 SF	31,124 SF
Pervious	31,124 SF	7,746 SF
Driveway (PGIS)	-	8,259 SF
North Building Roof	-	5,739 SF
South Building Roof	-	6,343 SF
Walk	-	3,307 SF
Total Impervious	0 SF	23,378 SF

A. ANALYSIS OF THE MINIMUM REQUIREMENTS

Minimum Requirement No. 1: Preparation of Stormwater Site Plan:
Response: The Stormwater Site Plan has been prepared pursuant to the City of Puyallup Stormwater Requirements and the 2019 Department of Ecology Surface Water Management Manual for Western Washington.

Minimum Requirement No. 2: Construction Stormwater Pollution Prevention:
Response: A Stormwater Pollution Prevention Plan (SWPPP) has been prepared pursuant to the 2019 Department of Ecology Surface Water Management Manual for Western Washington.

Minimum Requirement No. 3: Source Control of Pollution:
Response: The project will implement source control BMPs associated in accordance with the 2019 Department of Ecology Surface Water Management Manual for Western Washington. A maintenance and source control manual has been prepared as a part of this project.

Minimum Requirement No. 4: Preservation of Natural Drainage System and Outfalls:
Response: In the existing condition, stormwater generally sheet flows west to 9th Street Place SE. All runoff associated with the development is expected to be infiltrated and any bypass will be done such that the post-developed discharge off-site will be less than the pre-developed discharge.

Minimum Requirement No. 5: On-Site Stormwater Management:
Response: The proposed project is subject to City of Puyallup requirements which follow the 2019 Department of Ecology Surface Water Management Manual for Western Washington. The proposed project will meet the Low Impact Development Performance Standard.

Minimum Requirement No. 6: Runoff Treatment:
Response: The proposed project exceeds more than 5,000 square feet, therefore, water quality treatment will be required. Water quality requirements will be met in accordance with the stormwater manual.

Minimum Requirement No. 7: Flow Control:
Response: Flow control applies to the project. Flow control requirements will be met through the use of infiltration.

Minimum Requirement No. 8: Wetland Protection:
Response: The project does not discharge to any downstream wetlands.

Minimum Requirement No. 9: Operations and Maintenance:
Response: A maintenance and source control manual has been prepared that provides guidance on the requirements to maintain stormwater BMPs.

Minimum Requirement No. 10: Financial Liability
Response: All required financial guarantees/bonds will be provided for the proposed project.

TEBALDI ENGINEERING, LLC 4625 - 126TH AVENUE EAST EDGEWOOD, WA 98372	FOR: COPPERBERRY CONDOS	JOB #
	TITLE: VICINITY MAP	

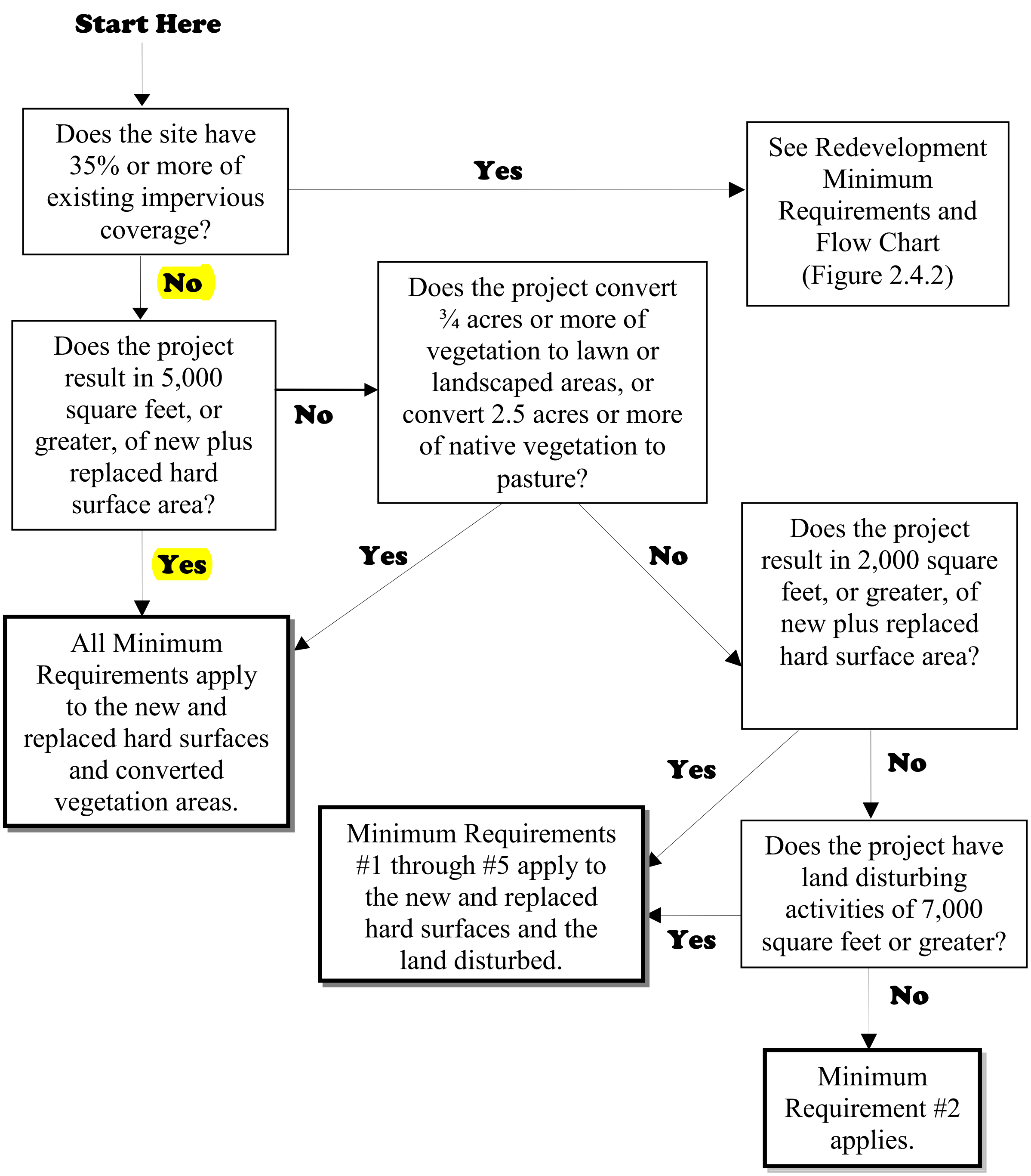


Figure 2.4.1 – Flow Chart for Determining Requirements for New Development

2.0 EXISTING CONDITIONS SUMMARY

The project site is located at 4002, 4010 and 4018 10th Street SE, Puyallup, WA. The site is abutted by commercial and multi-family developments to the north and south. The project is bound by 9th Street Place SE to the west and 10th Street SE to the east. The site is vacant and contains approximately 37,501 square feet of existing vegetation. The site generally slopes from east to west with slopes ranging from 0 to 30 percent.

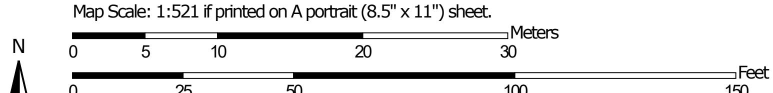
Stormwater runoff generally flows to the west across 9th Street Pl SE and continuing west through the apartment complex ultimately discharging to the existing wetland south of 39th Ave SE. There is no upstream flow contributing to the property as the eastern edge of the property is the sidewalk along the west side of 10th Street SE.

The site does not contain any on-site critical areas.

On-site native soils are classified as Kapowsin Gravelly Ashy Loam with 0 to 6 percent slopes per the NRCS soil survey. This soil is a hydrologic soil group B soil and suitable for infiltration. The soils report done for the subject property identified more sandy-gravelly soils during exploration that are suitable for infiltration. See section 3.0 of this report for additional information.

See Figure 2.1 - Soils Map.

Map Scale: 1:521 if printed on A portrait (8.5" x 11") sheet.



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 1:24,000.

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: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Jul 29, 2018—Jul 22, 2019

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
19B	Kapowsin gravelly ashy loam, 0 to 6 percent slopes	0.8	100.0%
Totals for Area of Interest		**0.8**	**100.0%**

3.0 INFILTRATION RATE / SOILS REPORT

A Geotechnical Soil Observation Report has been prepared by Leroy Surveyors and Engineers, Inc. dated March 5, 2021. On-site soils were identified to be coarse sand and gravel and well-draining. A design infiltration rate was determined by the geotechnical engineer using the grain size analysis method to be 6.5 inches/hr.

See Geotechnical Soil Observation Report included in Appendix B of this report.

4.0 WELLS AND SEPTIC SYSTEM

There are no wells or septic systems within the vicinity of the project.

5.0 FUEL TANKS

No existing in-use or abandoned fuel tanks were identified on or adjacent to the project site.

6.0 SUBBASIN DESCRIPTION

There is no upstream run-on tributary to the proposed project. The eastern property line is bound by an existing sidewalk for 10th Street SE that flows back into the storm drainage system for 10th Street SE.

The existing subbasin for the project consists of a single basin that discharges from the site via sheet flow to the west to the existing storm drainage system in 9th Street Place SE.

The downstream drainage path consists of the sheetflow leaving the site and flowing west across 9th Street Pl SE and continuing west through the apartment complex ultimately discharging to the existing wetland south of 39th Ave SE. A majority of the runoff created by the proposed development will be infiltrated on-site resulting in a reduction of downstream flows from the subject property.

7.0 FLOODPLAIN ANALYSIS

The project site resides in Panel 53053C0344E, effective March 7, 2017, of FEMA's National Flood Hazard Layer, and is designated Zone X at minimal risk for flood hazard. The site does not Reside in and is not near the 100-year flood plain.

See Figure 7.1 – FEMA floodplain map.

8.0 AESTHETIC CONSIDERATIONS FOR FACILITIES

There are no proposed above-ground or surface drainage facilities associated with the project. The storm drainage facilities are proposed to be located below ground and installed in accordance with City of Puyallup requirements.

9.0 FACILITY SIZING AND DOWNSTREAM ANALYSIS

A. EXISTING SITE HYDROLOGY

The project site is located at 4002, 4010 and 4018 10th Street SE, Puyallup, WA. The site is vacant and contains approximately 37,501 square feet of existing vegetation. The site generally slopes from east to west with slopes ranging from 0 to 30 percent.

Stormwater runoff generally flows to the west across 9th Street Pl SE and continuing west through the apartment complex ultimately discharging to the existing wetland south of 39th Ave SE. There is no upstream run-on tributary to the proposed project. The eastern property line is bounded by an existing sidewalk for 10th Street SE that flows back into the storm drainage system for 10th Street SE.

B. DEVELOPED SITE HYDROLOGY

The proposed development includes two new six plex condominiums along with the associated driveway and utilities. A majority of the runoff generated from the development will be collected and infiltrated on-site in an infiltration gallery. The gallery has been sized to meet the LID performance standard and flow control requirements. There will be some bypass of impervious sidewalk and some converted vegetation. See developed basin map in this section. The bypass of flows have been accounted for in the WWHM stormwater model. See stormwater runoff table below:

Area Summary		
	Pre-Developed	**Developed**
Parcel Area	37,501 SF	37,501 SF
Project Area (clearing limits)	31,124 SF	31,124 SF
Predeveloped forest	31,124 SF	-
Pervious (to trench)	-	2,035 SF
Driveway (PGIS)	-	8,259 SF
North Building Roof	-	5,739 SF
South Building Roof	-	6,343 SF
Walk (to trench)	-	1,859 SF
Total Impervious (to trench)	-	22,200 SF
Walk (bypass)	-	1,178 SF
Pervious (bypass)	-	5,711 SF

The general site topography and drainage patterns in the developed condition will maintain the natural drainage patterns present on site.

C. LOW IMPACT DEVELOPMENT FEATURES

Low impact development (LID) features are required for this project in accordance with the 2014 Ecology Stormwater Manual and Minimum Requirement No. 5. Compost amended topsoil is proposed for all disturbed soils that will be vegetated as a part of the project. The project proposed to meet the LID performance standard as the method of meeting minimum requirement No. 5.

D. PERFORMANCE STANDARDS AND GOALS

The project is subject to requirements pertaining to Low Impact Development and Flow Control. The infiltration gallery has been designed to infiltration the full influent runoff file. The overall project has been designed to meet the LID performance standards which matches post-developed discharge durations to the pre-developed for the range of discharges between 8% of the 2-year storm and 50% of the 2-year storm. The project has also been designed to meet the flow control standard which matches post-developed discharge durations to the pre-developed for the range of discharges between 50% of the 2-year storm to the full 50-year storm. Water quality will be designed to comply with the requirements of the 2019 Department of Ecology Stormwater Management Manual for Western Washington.

E. FLOW CONTROL SYSTEM

Flow control facilities will be achieved through the use of an infiltration gallery. Runoff from the tributary surfaces will be collected in a series of catch basins and pipes and routed to the proposed infiltration gallery.

F. WATER QUALITY SYSTEM

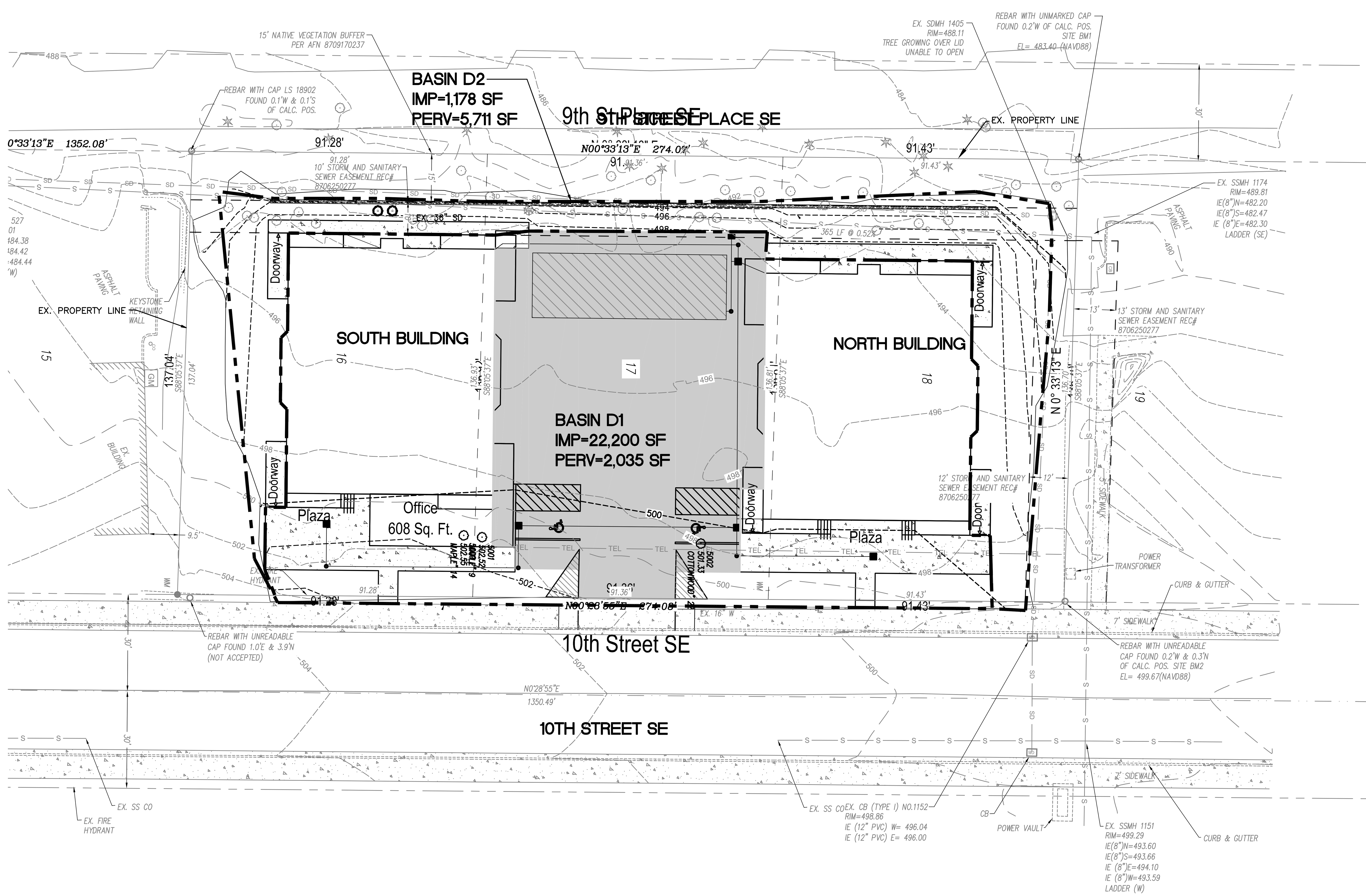
Water quality treatment will be provided for new pollution generating impervious surfaces. A Contech Stormfilter is proposed for water quality treatment. See sizing calculations in Appendix A.

G. CONVEYANCE SYSTEM ANALYSIS AND DESIGN

Conveyance sizing has been done to demonstrate that a 6-inch pipe can convey the 100-year design flow.

A PORTION OF SECTION 10, TOWNSHIP 19N, RANGE 4E, W.M., PIERCE COUNTY

POST-DEVELOPED BASIN MAP



LEGEND

EXISTING

- FOUND MONUMENT AS NOTED
- REBAR WITH CAP
- OTHER CORNERS FOUND
- FIRE HYDRANT
- WATER VALVE LID
- WATER MANHOLE
- WATER METER
- GAS METER
- TELEPHONE RISER
- STORM DRAIN MANHOLE
- SANITARY SEWER MANHOLE
- MONUMENTED CENTERLINE
- SUBJECT PARCEL BOUNDARY
- EXISTING EASEMENT LINE
- RIGHT OF WAY MARGIN
- ORANGE PAINT MARKS
- SANITARY SEWER LINE
- EXISTING CONTOUR LINE
- EXISTING EASEMENT LINE
- CONCRETE

PROPOSED

- FLOW PATH
- PROPOSED SPOT GRADE
- PROPOSED GRADING SLOPE
- PROPOSED DRIVEWAY
- PROPOSED CONTOUR LINE
- PROPOSED STORM DRAIN PIPE
- PROPOSED CATCH BASIN
- PROPOSED CLEANOUT
- PROPOSED SEWER LINE
- PROPOSED WATER METER
- PROPOSED WATER SERVICE

No.	Date	By	Ckd.	Appr.	Revision
3	7/6/22	CMT	CMT	CMT	REVISED PER CITY COMMENTS
2	4/7/22	CMT	CMT	CMT	REVISED PER CITY COMMENTS
1	8/20/21	CMT	CMT	CMT	SITE PLAN REVIEW

Title: POST DEVELOPED BASIN MAP
COPPERBERRY CONDOMINIUMS
4002, 4010, 4018 10TH STREET E
PUYALLUP, WA 98374

For: BRCF
1002 39TH AVENUE SW, SUITE 104
PUYALLUP, WA 98373
CONTACT: BILL RILEY (253) 881-3033

8/20/21

Scale: Horizontal 1"=20' Vertical N/A

Designed CMT
Drawn CMT
Checked CMT
Approved CMT
Date 8/20/21

TEBALDI ENGINEERING, LLC
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Job Number COPPER

Sheet 1 of 1

File:C:\Users\Chris Tebaldi\OneDrive – Linda Tebaldi\Documents\Tebaldi Engineering\Projects\Copperberry\Preliminary\Copperberry-Post.dwg Date/Time:4/10/2023 11:58 AM Scale:0.386863 CHRIS TEBALDI Xref: ----

APPENDIX A

WWHM2012

PROJECT REPORT

General Model Information

TRUST Project Name:	COPPERBERRY
Site Name:	Copperberry
Site Address:	
City:	
Report Date:	6/11/2023
Gage:	40 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2022/07/07
Version:	4.2.18

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data
Predeveloped Land Use

Predeveloped

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	0.87
Pervious Total	0.87
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.87

Mitigated Land Use

Developed D1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.05
Pervious Total	0.05
Impervious Land Use	acre
ROADS FLAT	0.19
ROOF TOPS FLAT	0.28
SIDEWALKS FLAT	0.04
Impervious Total	0.51
Basin Total	0.56

D2

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Mod	0.28
Pervious Total	0.28
Impervious Land Use	acre
SIDEWALKS FLAT	0.03
Impervious Total	0.03
Basin Total	0.31

Routing Elements
Predeveloped Routing

Mitigated Routing

StormTech 1

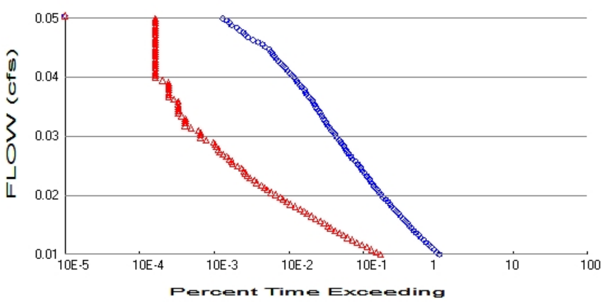
Chamber Model:	740	
Dimensions		
Max Row Length:	51.42	
Number of Chambers:	20	
Number of Endcaps:	6	
Top Stone Depth:	6	
Bottom Stone Depth:	6	
Infiltration On		
Infiltration rate:	6.5	
Infiltration safety factor:	1	
Total Volume Infiltrated (ac-ft.):		100.931
Total Volume Through Riser (ac-ft.):		0
Total Volume Through Facility (ac-ft.):		100.931
Percent Infiltrated:		100
Total Precip Applied to Facility:		0
Total Evap From Facility:		0
Discharge Structure		
Riser Height:	3.5 ft.	
Riser Diameter:	12 in.	
Element Flows To:		
Outlet 1	Outlet 2	

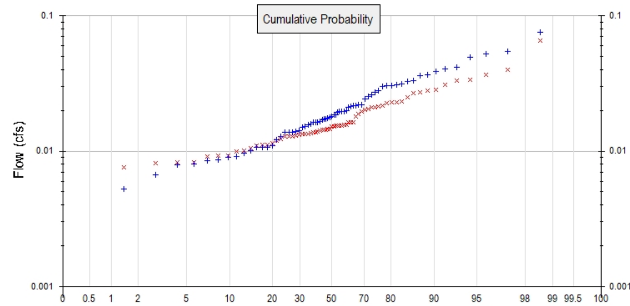
StormTech Hydraulic Table

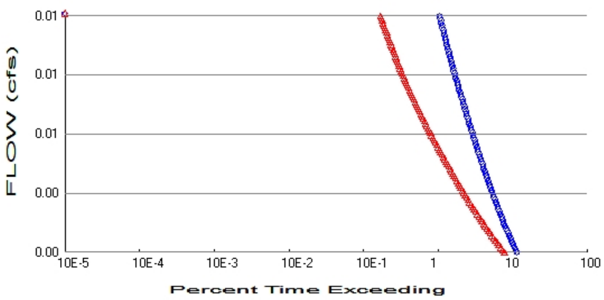
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.015	0.000	0.000	0.000
0.0833	0.015	0.000	0.000	0.101
0.1667	0.015	0.001	0.000	0.101
0.2500	0.015	0.001	0.000	0.101
0.3333	0.015	0.002	0.000	0.101
0.4167	0.015	0.002	0.000	0.101
0.5000	0.015	0.003	0.000	0.101
0.5833	0.015	0.004	0.000	0.101
0.6667	0.015	0.005	0.000	0.101
0.7500	0.015	0.006	0.000	0.101
0.8333	0.015	0.007	0.000	0.101
0.9167	0.015	0.008	0.000	0.101
1.0000	0.015	0.009	0.000	0.101
1.0833	0.015	0.010	0.000	0.101
1.1667	0.015	0.012	0.000	0.101
1.2500	0.015	0.013	0.000	0.101
1.3333	0.015	0.014	0.000	0.101
1.4167	0.015	0.015	0.000	0.101
1.5000	0.015	0.016	0.000	0.101
1.5833	0.015	0.017	0.000	0.101
1.6667	0.015	0.018	0.000	0.101
1.7500	0.015	0.019	0.000	0.101
1.8333	0.015	0.020	0.000	0.101
1.9167	0.015	0.021	0.000	0.101
2.0000	0.015	0.022	0.000	0.101
2.0833	0.015	0.023	0.000	0.101
2.1667	0.015	0.024	0.000	0.101
2.2500	0.015	0.024	0.000	0.101

2.3333	0.015	0.025	0.000	0.101
2.4167	0.015	0.026	0.000	0.101
2.5000	0.015	0.027	0.000	0.101
2.5833	0.015	0.028	0.000	0.101
2.6667	0.015	0.028	0.000	0.101
2.7500	0.015	0.029	0.000	0.101
2.8333	0.015	0.030	0.000	0.101
2.9167	0.015	0.030	0.000	0.101
3.0000	0.015	0.031	0.000	0.101
3.0833	0.015	0.031	0.000	0.101
3.1667	0.015	0.032	0.000	0.101
3.2500	0.015	0.032	0.000	0.101
3.3333	0.015	0.033	0.000	0.101
3.4167	0.015	0.033	0.000	0.101
3.5000	0.015	0.034	0.000	0.101

Analysis Results
POC 1







+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.87
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.33
Total Impervious Area: 0.54

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.01934
5 year	0.030623
10 year	0.037493
25 year	0.045299
50 year	0.050482
100 year	0.055161

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.015477
5 year	0.022662
10 year	0.028129
25 year	0.035884
50 year	0.042302
100 year	0.049292

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.016	0.013
1903	0.012	0.014
1904	0.024	0.033
1905	0.010	0.011
1906	0.005	0.008
1907	0.030	0.022
1908	0.022	0.013
1909	0.022	0.015
1910	0.030	0.022
1911	0.020	0.016
1912	0.076	0.066
1913	0.031	0.015
1914	0.008	0.037
1915	0.013	0.011
1916	0.020	0.015
1917	0.007	0.007
1918	0.021	0.013
1919	0.016	0.011
1920	0.020	0.014
1921	0.022	0.015
1922	0.022	0.023
1923	0.017	0.014
1924	0.008	0.016
1925	0.011	0.010
1926	0.020	0.015
1927	0.014	0.011
1928	0.015	0.013
1929	0.031	0.020
1930	0.019	0.016
1931	0.019	0.013
1932	0.014	0.013
1933	0.016	0.015
1934	0.040	0.027
1935	0.018	0.012
1936	0.017	0.014
1937	0.028	0.023
1938	0.016	0.013
1939	0.001	0.009
1940	0.018	0.016
1941	0.011	0.018
1942	0.027	0.020
1943	0.014	0.015
1944	0.030	0.031
1945	0.022	0.014
1946	0.014	0.016
1947	0.009	0.008
1948	0.042	0.023
1949	0.036	0.023
1950	0.011	0.009
1951	0.014	0.014
1952	0.055	0.040
1953	0.049	0.034
1954	0.017	0.013
1955	0.015	0.009
1956	0.008	0.008
1957	0.026	0.013

1958	0.052	0.028
1959	0.033	0.025
1960	0.010	0.010
1961	0.033	0.027
1962	0.018	0.014
1963	0.009	0.008
1964	0.009	0.028
1965	0.037	0.021
1966	0.011	0.011
1967	0.017	0.020
1968	0.017	0.012
1969	0.016	0.014
1970	0.025	0.019
1971	0.039	0.021

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0756	0.0656
2	0.0548	0.0398
3	0.0522	0.0368
4	0.0493	0.0337
5	0.0418	0.0333
6	0.0404	0.0310
7	0.0387	0.0284
8	0.0367	0.0279
9	0.0363	0.0273
10	0.0331	0.0269
11	0.0327	0.0249
12	0.0311	0.0234
13	0.0308	0.0229
14	0.0305	0.0228
15	0.0304	0.0227
16	0.0301	0.0216
17	0.0279	0.0215
18	0.0270	0.0210
19	0.0260	0.0209
20	0.0253	0.0205
21	0.0244	0.0202
22	0.0220	0.0197
23	0.0219	0.0188
24	0.0218	0.0179
25	0.0217	0.0164
26	0.0215	0.0163
27	0.0209	0.0163
28	0.0200	0.0157
29	0.0197	0.0156
30	0.0195	0.0154
31	0.0195	0.0154
32	0.0195	0.0154
33	0.0185	0.0153
34	0.0185	0.0152
35	0.0180	0.0151
36	0.0177	0.0147
37	0.0174	0.0145
38	0.0173	0.0143
39	0.0173	0.0143
40	0.0169	0.0143

41	0.0167	0.0142
42	0.0164	0.0139
43	0.0163	0.0138
44	0.0163	0.0137
45	0.0159	0.0135
46	0.0157	0.0133
47	0.0152	0.0133
48	0.0150	0.0133
49	0.0141	0.0131
50	0.0140	0.0130
51	0.0139	0.0129
52	0.0137	0.0129
53	0.0137	0.0128
54	0.0129	0.0124
55	0.0121	0.0119
56	0.0109	0.0114
57	0.0107	0.0111
58	0.0107	0.0111
59	0.0106	0.0110
60	0.0101	0.0106
61	0.0096	0.0100
62	0.0091	0.0099
63	0.0090	0.0093
64	0.0086	0.0092
65	0.0085	0.0092
66	0.0080	0.0083
67	0.0080	0.0082
68	0.0067	0.0082
69	0.0052	0.0076
70	0.0014	0.0065

LID Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0015	274972	189068	68	Pass
0.0016	265888	178339	67	Pass
0.0017	257049	168518	65	Pass
0.0018	248457	159361	64	Pass
0.0019	240355	150915	62	Pass
0.0020	232695	142985	61	Pass
0.0020	225329	135399	60	Pass
0.0021	218283	128402	58	Pass
0.0022	211507	121847	57	Pass
0.0023	205026	115586	56	Pass
0.0024	198814	109866	55	Pass
0.0024	192848	104465	54	Pass
0.0025	187153	99456	53	Pass
0.0026	181481	94571	52	Pass
0.0027	176203	89955	51	Pass
0.0028	171121	85683	50	Pass
0.0029	166235	81657	49	Pass
0.0029	161521	77753	48	Pass
0.0030	157028	74242	47	Pass
0.0031	152707	70903	46	Pass
0.0032	148509	67638	45	Pass
0.0033	144458	64594	44	Pass
0.0034	140579	61721	43	Pass
0.0034	136774	58922	43	Pass
0.0035	133091	56271	42	Pass
0.0036	129556	53791	41	Pass
0.0037	126168	51459	40	Pass
0.0038	122878	49225	40	Pass
0.0038	119711	47064	39	Pass
0.0039	116667	45125	38	Pass
0.0040	113720	43283	38	Pass
0.0041	110823	41516	37	Pass
0.0042	108074	39797	36	Pass
0.0043	105299	38128	36	Pass
0.0043	102697	36581	35	Pass
0.0044	100242	35083	34	Pass
0.0045	97811	33709	34	Pass
0.0046	95356	32383	33	Pass
0.0047	92999	31082	33	Pass
0.0047	90716	29854	32	Pass
0.0048	88482	28676	32	Pass
0.0049	86272	27522	31	Pass
0.0050	84186	26441	31	Pass
0.0051	82172	25410	30	Pass
0.0052	80208	24367	30	Pass
0.0052	78244	23412	29	Pass
0.0053	76427	22476	29	Pass
0.0054	74660	21590	28	Pass
0.0055	73015	20802	28	Pass
0.0056	71345	20004	28	Pass
0.0056	69750	19287	27	Pass
0.0057	68203	18511	27	Pass
0.0058	66705	17866	26	Pass

0.0059	65232	17215	26	Pass
0.0060	63759	16572	25	Pass
0.0061	62335	15978	25	Pass
0.0061	60985	15389	25	Pass
0.0062	59684	14858	24	Pass
0.0063	58358	14323	24	Pass
0.0064	57106	13837	24	Pass
0.0065	55878	13363	23	Pass
0.0066	54651	12909	23	Pass
0.0066	53448	12442	23	Pass
0.0067	52318	12047	23	Pass
0.0068	51189	11645	22	Pass
0.0069	50109	11244	22	Pass
0.0070	48979	10859	22	Pass
0.0070	47899	10508	21	Pass
0.0071	46868	10147	21	Pass
0.0072	45837	9793	21	Pass
0.0073	44904	9489	21	Pass
0.0074	43995	9150	20	Pass
0.0075	43087	8865	20	Pass
0.0075	42203	8576	20	Pass
0.0076	41295	8291	20	Pass
0.0077	40436	8048	19	Pass
0.0078	39576	7807	19	Pass
0.0079	38791	7581	19	Pass
0.0079	37980	7360	19	Pass
0.0080	37244	7164	19	Pass
0.0081	36483	6941	19	Pass
0.0082	35746	6747	18	Pass
0.0083	35059	6597	18	Pass
0.0084	34396	6425	18	Pass
0.0084	33709	6261	18	Pass
0.0085	33095	6067	18	Pass
0.0086	32432	5895	18	Pass
0.0087	31843	5740	18	Pass
0.0088	31278	5583	17	Pass
0.0088	30738	5411	17	Pass
0.0089	30173	5266	17	Pass
0.0090	29584	5136	17	Pass
0.0091	29068	5001	17	Pass
0.0092	28528	4868	17	Pass
0.0093	27988	4731	16	Pass
0.0093	27497	4591	16	Pass
0.0094	27006	4466	16	Pass
0.0095	26515	4355	16	Pass
0.0096	26024	4242	16	Pass
0.0097	25533	4132	16	Pass

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0097	25533	4132	16	Pass
0.0101	23461	3626	15	Pass
0.0105	21575	3140	14	Pass
0.0109	19818	2708	13	Pass
0.0113	18259	2329	12	Pass
0.0117	16825	1986	11	Pass
0.0121	15600	1729	11	Pass
0.0126	14409	1505	10	Pass
0.0130	13299	1313	9	Pass
0.0134	12359	1159	9	Pass
0.0138	11532	1006	8	Pass
0.0142	10761	892	8	Pass
0.0146	10056	809	8	Pass
0.0150	9408	725	7	Pass
0.0154	8772	644	7	Pass
0.0159	8212	557	6	Pass
0.0163	7655	489	6	Pass
0.0167	7135	429	6	Pass
0.0171	6683	391	5	Pass
0.0175	6288	346	5	Pass
0.0179	5917	297	5	Pass
0.0183	5563	258	4	Pass
0.0187	5202	228	4	Pass
0.0192	4824	205	4	Pass
0.0196	4488	188	4	Pass
0.0200	4198	163	3	Pass
0.0204	3955	141	3	Pass
0.0208	3717	126	3	Pass
0.0212	3491	115	3	Pass
0.0216	3302	105	3	Pass
0.0220	3135	90	2	Pass
0.0224	2993	84	2	Pass
0.0229	2855	73	2	Pass
0.0233	2688	68	2	Pass
0.0237	2521	64	2	Pass
0.0241	2392	61	2	Pass
0.0245	2260	57	2	Pass
0.0249	2136	50	2	Pass
0.0253	2037	43	2	Pass
0.0257	1900	42	2	Pass
0.0262	1765	39	2	Pass
0.0266	1656	36	2	Pass
0.0270	1555	32	2	Pass
0.0274	1479	29	1	Pass
0.0278	1405	28	1	Pass
0.0282	1345	26	1	Pass
0.0286	1283	25	1	Pass
0.0290	1217	24	1	Pass
0.0295	1152	19	1	Pass
0.0299	1083	16	1	Pass
0.0303	1024	16	1	Pass
0.0307	969	16	1	Pass
0.0311	905	15	1	Pass

0.0315	859	12	1	Pass
0.0319	813	10	1	Pass
0.0323	777	10	1	Pass
0.0328	740	10	1	Pass
0.0332	712	10	1	Pass
0.0336	680	9	1	Pass
0.0340	643	8	1	Pass
0.0344	614	8	1	Pass
0.0348	581	8	1	Pass
0.0352	556	8	1	Pass
0.0356	536	8	1	Pass
0.0361	514	8	1	Pass
0.0365	487	7	1	Pass
0.0369	453	6	1	Pass
0.0373	428	6	1	Pass
0.0377	410	6	1	Pass
0.0381	392	6	1	Pass
0.0385	364	6	1	Pass
0.0389	342	6	1	Pass
0.0394	324	6	1	Pass
0.0398	310	5	1	Pass
0.0402	288	4	1	Pass
0.0406	272	4	1	Pass
0.0410	254	4	1	Pass
0.0414	235	4	1	Pass
0.0418	219	4	1	Pass
0.0422	206	4	1	Pass
0.0426	192	4	2	Pass
0.0431	176	4	2	Pass
0.0435	166	4	2	Pass
0.0439	156	4	2	Pass
0.0443	148	4	2	Pass
0.0447	140	4	2	Pass
0.0451	133	4	3	Pass
0.0455	119	4	3	Pass
0.0459	108	4	3	Pass
0.0464	94	4	4	Pass
0.0468	81	4	4	Pass
0.0472	69	4	5	Pass
0.0476	64	4	6	Pass
0.0480	60	4	6	Pass
0.0484	53	4	7	Pass
0.0488	49	4	8	Pass
0.0492	42	4	9	Pass
0.0497	39	4	10	Pass
0.0501	36	4	11	Pass
0.0505	32	4	12	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
StormTech 1 POC	☐	91.85			☐	100.00			
Total Volume Infiltrated		91.85	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

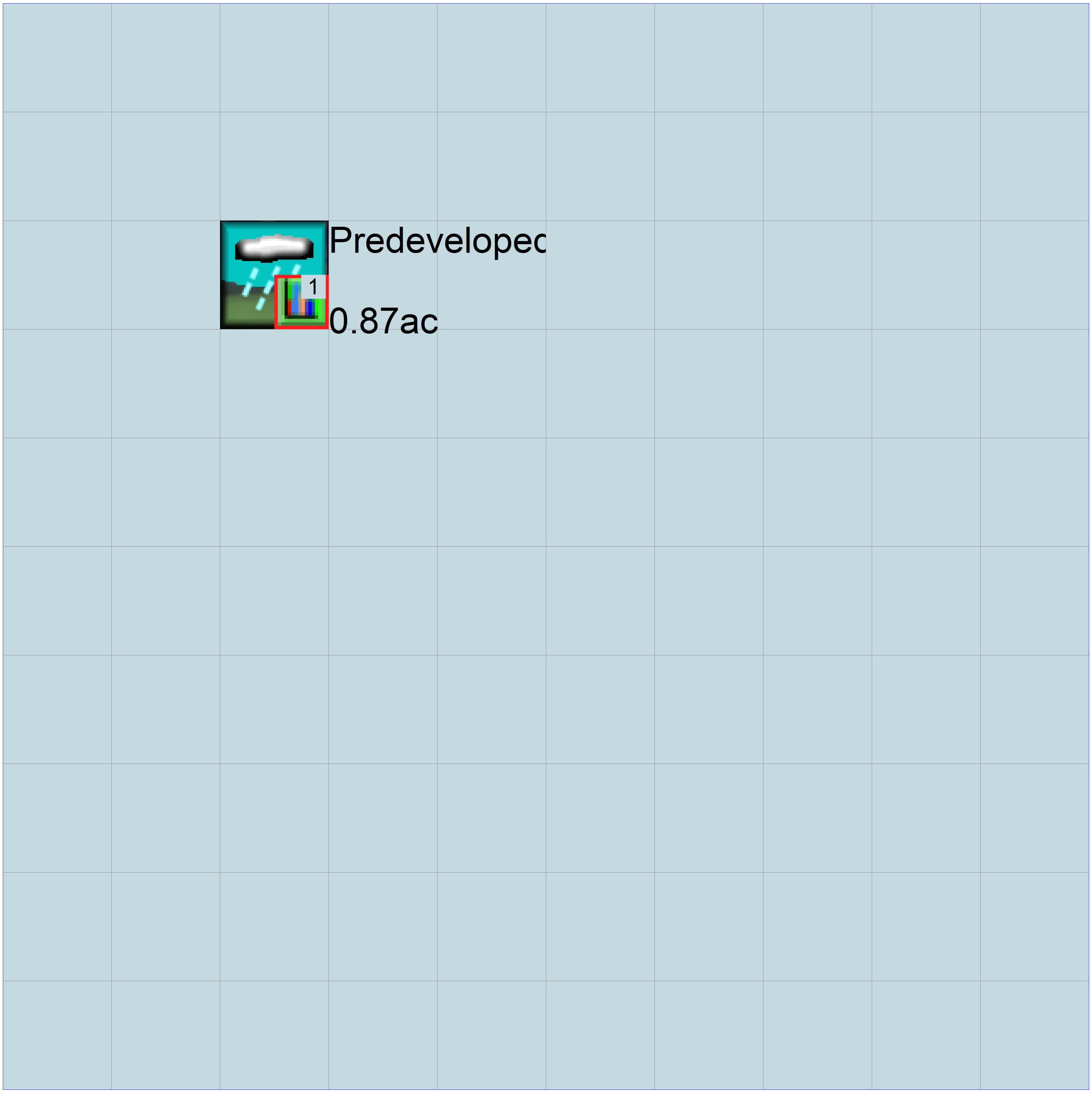
No PERLND changes have been made.

IMPLND Changes

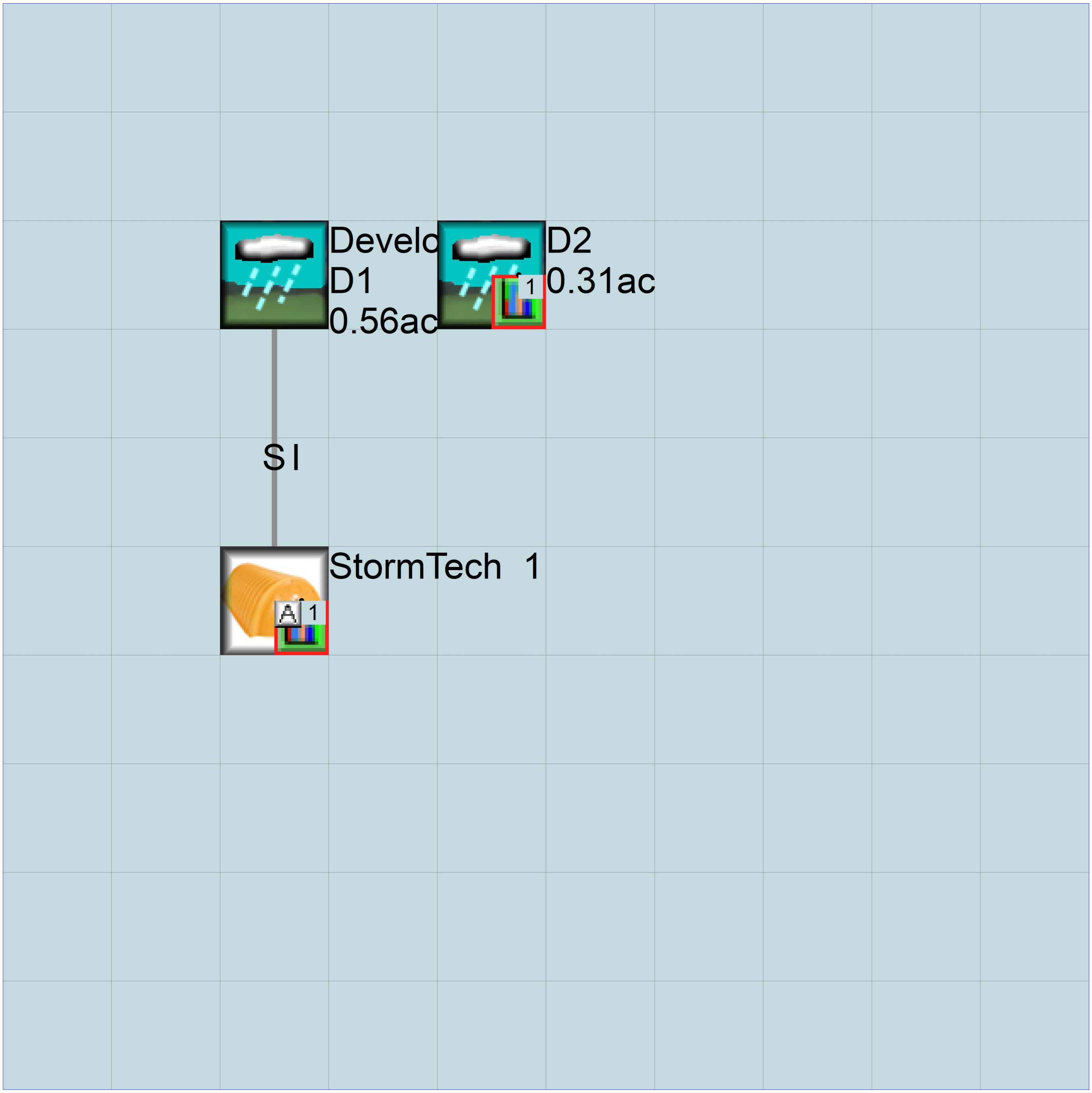
No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1901 10 01        END    2059 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   COPPERBERRY.wdm
MESSU      25   PreCOPPERBERRY.MES
           27   PreCOPPERBERRY.L61
           28   PreCOPPERBERRY.L62
           30   POCCOPPERBERRY1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Predeveloped                MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                            in  out           ***
   11      C, Forest, Mod          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11             0       4.5      0.08       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                 ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11           0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   11             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out            ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Predeveloped***
PERLND  11                        0.87     COPY   501     12
PERLND  11                        0.87     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                         in  out                             ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *        *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
```

```
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1901 10 01        END    2059 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   COPPERBERRY.wdm
MESSU      25   MitCOPPERBERRY.MES
           27   MitCOPPERBERRY.L61
           28   MitCOPPERBERRY.L62
           30   POCCOPPERBERRY1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       1
      IMPLND       4
      IMPLND       8
      PERLND      14
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        StormTech  1                MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   16     C, Lawn, Flat           1    1    1    1   27    0
   14     C, Pasture, Mod         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
```

```
   16         0    0    1    0    0    0    0    0    0    0    0    0
   14         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   14         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   16         0    0    0    0    0    0    0    0    0    0    0
   14         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   16              0       4.5      0.03       400      0.05       0.5     0.996
   14              0       4.5      0.06       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16              0         0         2         2         0         0         0
   14              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      0.25
   14           0.15       0.4       0.3         6       0.5       0.4
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   16              0         0         0         0       2.5         1         0
   14              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                       in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
```

```
    1         0    0    4    0    0    4    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Developed D1***
PERLND  16                        0.05     RCHRES   1      2
PERLND  16                        0.05     RCHRES   1      3
IMPLND   1                        0.19     RCHRES   1      5
IMPLND   4                        0.28     RCHRES   1      5
IMPLND   8                        0.04     RCHRES   1      5
D2***
PERLND  14                        0.28     COPY   501     12
PERLND  14                        0.28     COPY   601     12
PERLND  14                        0.28     COPY   501     13
PERLND  14                        0.28     COPY   601     13
IMPLND   8                        0.03     COPY   501     15
IMPLND   8                        0.03     COPY   601     15

******Routing******
PERLND  16                        0.05     COPY     1     12
IMPLND   1                        0.19     COPY     1     15
IMPLND   4                        0.28     COPY     1     15
IMPLND   8                        0.04     COPY     1     15
PERLND  16                        0.05     COPY     1     13
RCHRES   1                           1     COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                          in  out                            ***
    1     StormTech  1            2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1             1      0.01       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1             0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   42    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)    (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.015521  0.000000  0.000000  0.000000
  0.083333  0.015521  0.000518  0.000000  0.101726
  0.166667  0.015521  0.001036  0.000000  0.101726
  0.250000  0.015521  0.001556  0.000000  0.101726
  0.333333  0.015521  0.002074  0.000000  0.101726
  0.416667  0.015521  0.002593  0.000000  0.101726
  0.500000  0.015521  0.003111  0.000000  0.101726
  0.583333  0.015521  0.004237  0.000000  0.101726
  0.666667  0.015521  0.005360  0.000000  0.101726
  0.750000  0.015521  0.006477  0.000000  0.101726
  0.833333  0.015521  0.007588  0.000000  0.101726
  0.916667  0.015521  0.008692  0.000000  0.101726
  1.000000  0.015521  0.009790  0.000000  0.101726
  1.083333  0.015521  0.010879  0.000000  0.101726
```

```
  1.166667  0.015521  0.011959  0.000000  0.101726
  1.250000  0.015521  0.013030  0.000000  0.101726
  1.333333  0.015521  0.014092  0.000000  0.101726
  1.416667  0.015521  0.015142  0.000000  0.101726
  1.500000  0.015521  0.016181  0.000000  0.101726
  1.583333  0.015521  0.017209  0.000000  0.101726
  1.666667  0.015521  0.018223  0.000000  0.101726
  1.750000  0.015521  0.019223  0.000000  0.101726
  1.833333  0.015521  0.020209  0.000000  0.101726
  1.916667  0.015521  0.021179  0.000000  0.101726
  2.000000  0.015521  0.022132  0.000000  0.101726
  2.083333  0.015521  0.023069  0.000000  0.101726
  2.166667  0.015521  0.023987  0.000000  0.101726
  2.250000  0.015521  0.024878  0.000000  0.101726
  2.333333  0.015521  0.025744  0.000000  0.101726
  2.416667  0.015521  0.026587  0.000000  0.101726
  2.500000  0.015521  0.027400  0.000000  0.101726
  2.583333  0.015521  0.028179  0.000000  0.101726
  2.666667  0.015521  0.028917  0.000000  0.101726
  2.750000  0.015521  0.029601  0.000000  0.101726
  2.833333  0.015521  0.030196  0.000000  0.101726
  2.916667  0.015521  0.030758  0.000000  0.101726
  3.000000  0.015521  0.031291  0.000000  0.101726
  3.083333  0.015521  0.031809  0.000000  0.101726
  3.166667  0.015521  0.032327  0.000000  0.101726
  3.250000  0.015521  0.032847  0.000000  0.101726
  3.333333  0.015521  0.033365  0.000000  0.101726
  3.416667  0.015521  0.033884  0.000000  0.101726
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL      REPL
RCHRES   1 HYDR   RO     1 1        1      WDM   1004 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1005 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1        1      WDM   1006 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1007 STAG     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
```

```
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO        0.083333      COPY            INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO        0.083333      COPY            INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                  COPY            INPUT  MEAN
  END MASS-LINK   17

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

ERROR/WARNING ID: 341   6

DATE/TIME: 1952/ 1/10 8:45

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42 1453.4	1476.0	1536.2	

ERROR/WARNING ID: 341   5

DATE/TIME: 1952/ 1/10 8:45

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT	
0.0000E+00	1352.2	-4.951E+03	3.6613	3.6613		2

ERROR/WARNING ID: 341   6

DATE/TIME: 1952/ 1/10 9: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42 1453.4	1476.0	1617.8	

ERROR/WARNING ID: 341   5

DATE/TIME: 1952/ 1/10 9: 0

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT	
0.0000E+00	1352.2	-9.834E+03	7.2724	7.2724E+00		2

ERROR/WARNING ID: 341   6

DATE/TIME: 1952/ 1/10 9:15

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1692.2

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 9:15

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-1.429E+04	10.565	1.0565E+01	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1952/ 1/10 9:30

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1762.6

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 9:30

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-1.849E+04	13.677	1.3677E+01	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1952/ 1/10 9:45

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1830.6

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1952/ 1/10  9:45

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00 1352.2     -2.256E+04   16.686   1.6686E+01      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1952/ 1/10 10: 0

RCHRES:     1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1         V2         VOL
42 1.4534E+03 1476.0     1897.3
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1952/ 1/10 10: 0

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00 1352.2     -2.655E+04   19.637   1.9637E+01      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1952/ 1/10 10:15

RCHRES:     1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1         V2         VOL
42 1.4534E+03 1476.0     1911.1
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1952/ 1/10 10:15

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
```

Probably ftable was extrapolated. If extrapolation was small, no problem.
Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-2.738E+04	20.246	2.0246E+01	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1952/ 1/10 10:30

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1897.0

ERROR/WARNING ID: 341   5

DATE/TIME: 1952/ 1/10 10:30

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-2.654E+04	19.624	1.9624E+01	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1952/ 1/10 10:45

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1867.1

ERROR/WARNING ID: 341   5

DATE/TIME: 1952/ 1/10 10:45

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-2.474E+04	18.300	1.8300E+01	2

ERROR/WARNING ID: 341   6

DATE/TIME: 1952/ 1/10 11: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1827.4

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 11: 0

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-2.237E+04	16.546	1.6546E+01	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1952/ 1/10 11:15

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1777.6

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 11:15

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-1.939E+04	14.342	1.4342E+01	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1952/ 1/10 11:30

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS V1 V2 VOL
42 1.4534E+03 1476.0 1721.2

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 11:30

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A B C RDEP1 RDEP2 COUNT
0.0000E+00 1352.2 -1.602E+04 11.847 1.1847E+01 2

ERROR/WARNING ID: 341 6

DATE/TIME: 1952/ 1/10 11:45

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS V1 V2 VOL
42 1.4534E+03 1476.0 1660.4

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 11:45

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A B C RDEP1 RDEP2 COUNT
0.0000E+00 1352.2 -1.238E+04 9.1560 9.1560E+00 2

ERROR/WARNING ID: 341 6

DATE/TIME: 1952/ 1/10 12: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS V1 V2 VOL
42 1.4534E+03 1476.0 1596.5

ERROR/WARNING ID: 341 5

DATE/TIME: 1952/ 1/10 12: 0

RCHRES: 1

```
Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A           B           C      RDEP1      RDEP2  COUNT
0.0000E+00 1352.2     -8.558E+03    6.3292  6.3292E+00      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1952/ 1/10 12:15

RCHRES:     1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1          V2         VOL
42 1.4534E+03 1476.0     1531.5
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1952/ 1/10 12:15

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A           B           C      RDEP1      RDEP2  COUNT
0.0000E+00 1352.2     -4.673E+03    3.4556  3.4556E+00      2
```

```
ERROR/WARNING ID:   341   6

DATE/TIME: 1972/ 6/10 18:30

RCHRES:     1

The volume of water in this reach/mixed reservoir is greater than the value
in the "volume" column of the last row of RCHTAB().  To continue the
simulation the table has been extrapolated, based on information contained
in the last two rows.  This will usually result in some loss of accuracy.
If depth is being calculated it will also cause an error condition.
Relevant data are:

NROWS         V1          V2         VOL
42 1.4534E+03 1476.0     1487.5
```

```
ERROR/WARNING ID:   341   5

DATE/TIME: 1972/ 6/10 18:30

RCHRES:     1

Calculation of relative depth, using Newton's method of successive
approximations, converged to an invalid value (not in range 0.0 to 1.0).
Probably ftable was extrapolated.  If extrapolation was small, no problem.
Remedy; extend ftable.  Relevant data are:

A           B           C      RDEP1      RDEP2  COUNT
0.0000E+00 1352.2     -2.039E+03    1.5076  1.5076E+00      2
```

ERROR/WARNING ID: 341 6

DATE/TIME: 1972/ 6/10 18:45

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

```
NROWS         V1         V2        VOL
42 1.4534E+03 1476.0     1563.0
```

ERROR/WARNING ID: 341 5

DATE/TIME: 1972/ 6/10 18:45

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

```
A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00 1352.2     -6.555E+03    4.8477     4.8477       2
```

ERROR/WARNING ID: 341 6

DATE/TIME: 1972/ 6/10 19: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

```
NROWS         V1         V2        VOL
42 1453.4     1476.0     1627.6
```

ERROR/WARNING ID: 341 5

DATE/TIME: 1972/ 6/10 19: 0

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

```
A          B          C      RDEP1      RDEP2  COUNT
0.0000E+00 1352.2     -1.042E+04    7.7067  7.7067E+00      2
```

ERROR/WARNING ID: 341 6

DATE/TIME: 1972/ 6/10 19:15

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1631.5

ERROR/WARNING ID: 341 5

DATE/TIME: 1972/ 6/10 19:15

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-1.065E+04	7.8780	7.8780E+00	2

ERROR/WARNING ID: 341 6

DATE/TIME: 1972/ 6/10 19:30

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
42	1.4534E+03	1476.0	1603.8

The count for the WARNING printed above has reached its maximum.

If the condition is encountered again the message will not be repeated.

ERROR/WARNING ID: 341 5

DATE/TIME: 1972/ 6/10 19:30

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
0.0000E+00	1352.2	-8.999E+03	6.6552	6.6552E+00	2

Disclaimer

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APPENDIX B

BRCF
1002 39th Ave SW, #104
Puyallup, WA. 98373
253-881-3046

March 5, 2021

Geotechnical Soil Observation Report
Parcel Nos. 4389000160, 0170, 0180
Site Address – 4002 10th St SE
LS&E Job No. 13298
Assessments Performed: 3/1/2021

Project Description

A geotechnical site and soil assessment is necessary for the proposed development of multi-family apartment buildings and the associated hard surfaces on the above referenced properties in order to make recommendations for site development and stormwater design plans. For this report we reviewed available published geological and soil information and made on site observations to gather additional in-situ information. Using a track-mounted excavator, we made several excavations throughout the sites and examined soil depth, texture, and gathered samples for grain-size analysis testing.

Information Sources

Soil identification and mapping for this assessment is supported by information from the Natural Resource Conservation Service (the Survey) and from the excavation and observations of test pits in representative locations on the site conducted for our review. Geologic information for this assessment is supported by information from the United States Geological Survey (USGS) *Draft* Geologic Map of the Puyallup 7.5 Minute Quadrangle, Washington. Our understanding of site geology is supported by the review of geologic mapping, published topographic and relief map layers from the Pierce County Geographical Information System (GIS), and site observations. Our opinions are based on our interpretation of the cumulative information and the contemporary conditions of the geologic setting.

Published Information Accuracy

It should be noted that the Survey, the USGS and/or DNR geologic maps, and the Pierce County GIS define general areas of soil deposits, geology, and landforms. Given the large areas to identify and limited sample points, the authors of the above sources had to infer boundaries, contacts, and other representations in some areas. Only through on-site reconnaissance can we further detail and adjust information from the maps as they relate to each site. They are not (from our experience) accurate on a lot by lot basis in all cases. In this case, the Survey does not agree with the in-situ conditions. There was another type of soil present. See 'Soil' section below for more explanation. The USGS unit identification agrees with the in-situ conditions. See 'Geology' section below.

Site Description

General

This proposed project site is located in the City of Puyallup and includes three contiguous parcels, each 0.29-acres according to the Pierce County Assessor-Treasurer Information Portal. Slopes are variable throughout the site. Significant fill has been placed at differing depths, creating modified contours that do not follow the natural, predeveloped ground surface. An approximate 6 to 8 percent slope descends generally from east to west through the uppermost, near-level portion of the site. Placement of the fill created a steeper slope of approximately 10 to 29 percent near the western parcel boundaries on all three sites. This slope increases from south to north. The site is undeveloped and has several large deciduous trees and a few conifers in the western, sloped section. A few trees exist in the eastern portion of the site; blackberries dominate the eastern portion of the site. The site is bounded on the north and south by medical office buildings on mostly cleared lots, to the west by 9th St Pl SE and homes on partially cleared lots, and to the east by 10th St SE and several apartment buildings. Figure 1 illustrates the test pit locations on the site, within the local terrain.

Figure 1: Test Pit (▲) Locations and Site Morphology

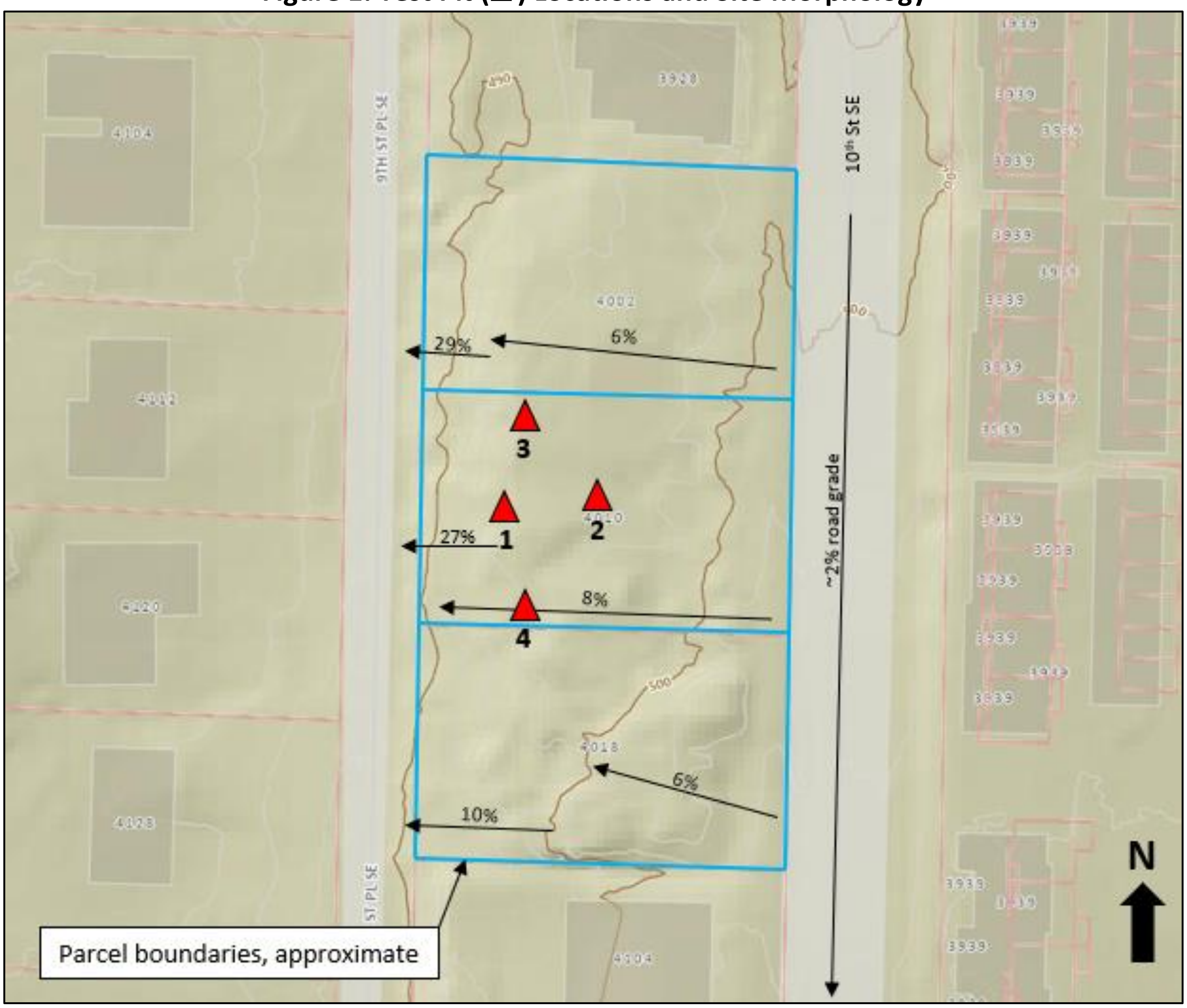
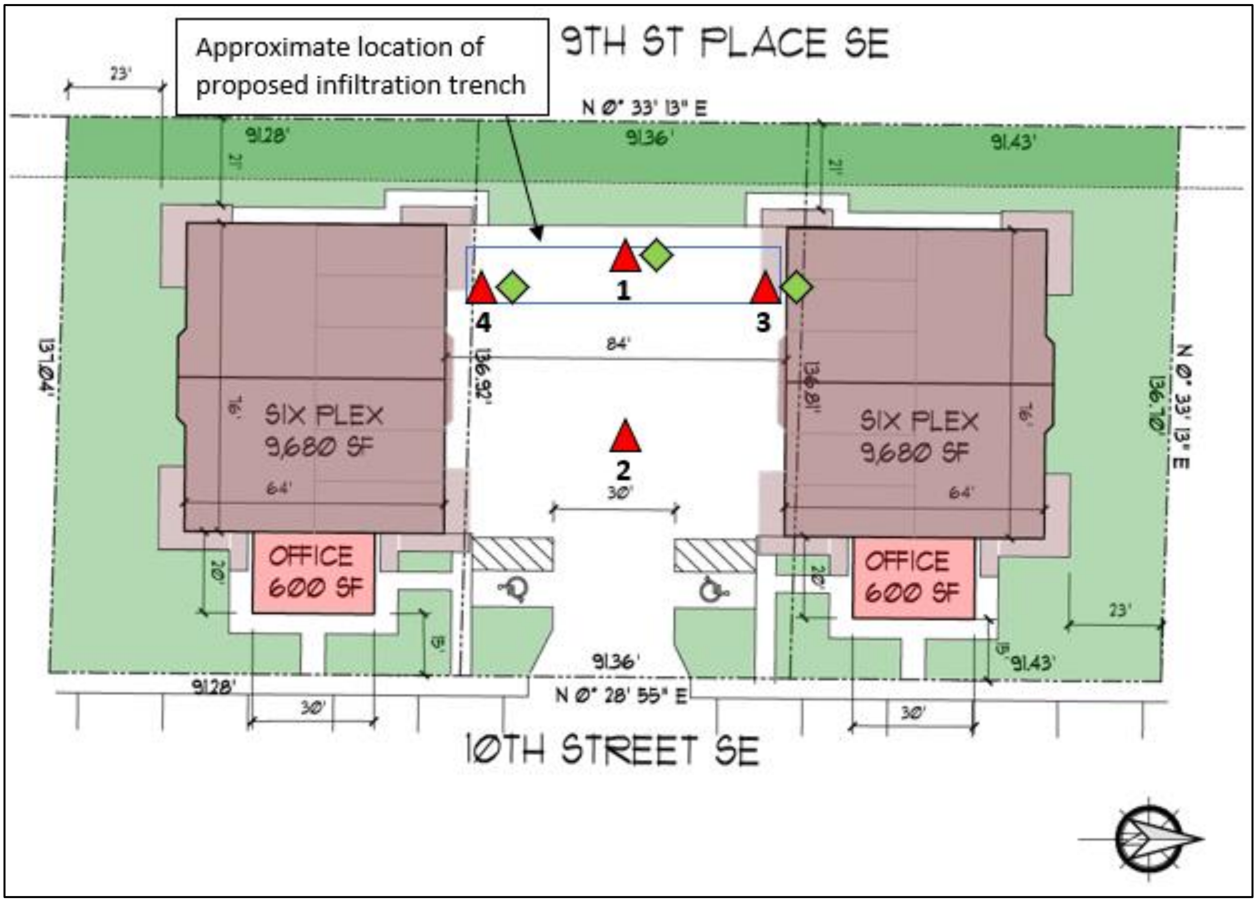


Figure 2: Test Pit (▲), Grain-size Sample (◆), & Proposed Stormwater Infiltration Trench Locations within Available Site Plan



Soil

As discussed in the 'Published Information Accuracy' section above; on-site reconnaissance is necessary to verify soil conditions on specific properties. Both the Survey and the geologic map describe materials of similar origin but disagree on the characteristics and location. Per the Survey, the type of soil throughout the site is the Kapowsin gravelly ashy loam. Indianola loamy sand and Everett very gravelly sandy loam is mapped just to the west and north of the project site. See Figure 3 below for site soil mapping.

Our in-situ examination of soil identifies a lodgment till layer within the lower horizon, approximately 24 inches below ground surface in test pit 2, and between 87 to 90 inches below ground surface (bgs) in the vicinity of test pits 1, 3, and 4. The soil series more descriptive of this lower soil horizon is Alderwood gravelly sandy loam. Another family of soils is present in the upper horizon. This soil is more indicative of the Everett soil series, found approximately 36 to 47 inches bgs in the vicinity of test pits 1, 3, and 4, extending to approximately 87 to 90 inches bgs before transitioning to Alderwood soil at depth. This upper in-situ soil texture is slightly coarser and classifies as a medium to coarse sand with gravel and cobbles rather than a gravelly ashy loam (till). A medium to coarse sand with gravel (or recessional outwash/outburst flood deposit) is consistent with the USGS findings. The soil found within the uppermost horizon is fill material. See soil logs attached.

Alderwood 1B – Alderwood gravelly sandy loam, 0 – 6 percent slopes
This nearly level to undulating soil is moderately well drained. It formed in glacial till and is one of the most extensive soils in the broad uplands of the central part of the county. The predominant vegetation in this soil is made up of hardwoods and conifers. The typical elevation range is from 200 to 800 feet. Granite boulders and stones are strewn across some slopes. Included with this soil in mapping in some areas are as much as 10 percent poorly drained Bellingham and Norma soils and very poorly drained Dupont soils; other areas area as much as 5 percent Everett soils.

In a typical profile, a thin mat of undecomposed needles and wood fragments overlies a 1 ½ inch very dark grayish brown gravely sandy loam surface layer. The subsoil and the upper part of the substratum, to a depth of 38 inches, are dark yellowish brown, brown, and dark grayish brown gravelly sandy loam. The lower part of the substratum, to a depth of more than 60 inches is weakly cemented, compact glacial till. A perched water table develops for short periods during the winter and spring rainy seasons. Permeability is very slow in the weakly cemented, compact part of the substratum. Commonly root growth is generally matted directly above this layer. The available water capacity is low. Surface runoff is very slow to slow, and the erosion hazard is slight.

Everett 13C – Everett gravelly sandy loam, 5 - 15 percent slopes
This rolling soil is somewhat excessively drained. It formed in gravelly glacial outwash under conifers. Elevation ranges from 200 to 700 feet. Areas range from five acres to more than 400 acres in size. Included with this soil in mapping are about eight percent Alderwood soils. Also included are some areas that are as much as five percent sandy Indianola soils and ten percent gravelly Neilton soils and less sloping Everett soils. In a typical profile the surface layer is very dark brown gravelly sandy loam about two inches thick. The subsoil, between depths of two and 19 inches, is dark yellowish brown gravelly sandy loam and dark brown very gravelly coarse sandy loam. The substratum, between depths of 19 and more than 60 inches, is clean, loose very gravelly sand. Permeability is rapid. The available water capacity is low. Surface runoff is slow, and the erosion hazard is low. The effective rooting depth is more than four feet.

The USGS geologic mapping, found below in 'Geology', concurs with our in-situ test pit observations, and should be the source utilized for this report. While the NRCS mapping identifies soils of similar *origin*, they are not similar in characteristics or location.

Figure 3: Site Position in NRCS Soil Mapping (Excerpt)

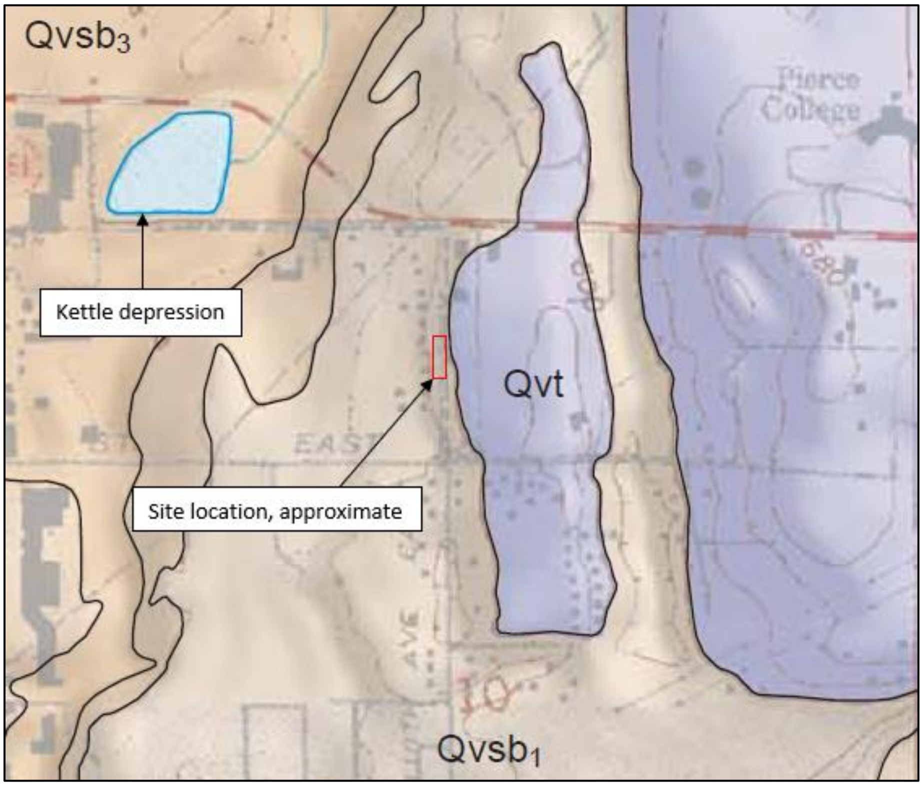
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
13B	Everett very gravelly sandy loam, 0 to 8 percent slopes	0.0	0.1%
18C	Indianola loamy sand, 5 to 15 percent slopes	2.4	5.1%
19B	Kapowsin gravelly ashy loam, 0 to 6 percent slopes	41.2	89.6%
20B	Kitsap silt loam, 2 to 8 percent slopes	2.4	5.2%
Totals for Area of Interest		**45.9**	**100.0%**

Geology and Morphology

The property is situated on the margin of a broad deposit of glacial outburst flood deposits that occurred during and at the end of the Vashon Stade of the Fraser glaciation period. The margin of this flood deposit contacts a large glacial till formation to the east of the site, emplaced during the Vashon advance of the Fraser glaciation period. This stratigraphic unit is a basal, or lodgment, till, deposited and compressed under advancing glaciation. It is structurally stable and erosionally resistant. Its deposition occurred during the most recent advance of the Fraser Glaciation period. This lowland deposit is common in western Washington.

As glacial Lake Puyallup, located at the base of the Cascade Range foothills, would fill with seasonal runoff, the valley glaciers (acting as a natural dam) would repeatedly fail releasing vast amounts of water that would erode the lowland formations and subsequently deposit new sediment as floodwater abated. This local landscape still includes Kettle depressions formed by portions of ice blocks that were trapped in place. Outwash deposits surrounded the ice blocks. Figure 4 below illustrates the site position in the regional geology.

Figure 4: USGS *Draft* Geologic Map of the Puyallup 7.5 Minute Quadrangle (Excerpt)



Geologic Map Unit Descriptions:

Qvs	Steilacoom Gravel of Walters and Kimmel (1968)—Sandy gravel and cobbles; clean to silty; poorly to well sorted; horizontally to cross bedded; loose to dense. Deposits vary from veneer of <1 to 15 m (3 to ~ 50 ft) thick. Deposited by multiple outburst floods from subsequently lower elevations of Glacial Lake Puyallup. Locally subdivided first by channel affiliation (Clover Creek or Bradley) and secondarily by relative age in descending series of deposits; higher number denotes younger (lower) deposit. Clover Creek channel (Bretz, 1913) begins in section 8, T19N, R4E. Bradley channel; herein named for Lake Bradley in section 3, T19N, R4E; begins in section 2, T19N, R4E. Numbering system contiguous w/adjacent Tacoma South quadrangle where multiple Clover Creek deposits are mapped (Troost, 2006). Mapable deposits consist of:	
	Qvs_{cc1}	Clover Creek deposit at elevation ~380 ft
	Qvs_{b4}	Bradley deposit at elevation ~400 ft
	Qvs_{b3}	Bradley deposit at elevation 420 – 440 ft
	Qvs_{b2}	Bradley deposit at elevation 440 – 460 ft
	Qvs_{b1}	Bradley deposit at elevation 460 – 480 ft

Qvt	Vashon till—diamict with silty sand matrix supporting gravel and lesser amounts of bullet-shaped cobbles and boulders more than 3 m (10 ft) in diameter; few erratics; matrix varies locally in relative proportions of silt and sand; locally weakly stratified and contains well sorted, stratified and/or deformed beds and lenses of sand, gravel, and silt; commonly near saturation giving rise to an impression of cementation; dense to very dense; glacially overridden. One to >18 meters (3 to >60 ft) thick, discontinuous within mapped areas. Sub-horizontal to vertical joints common. Clasts subangular to well-rounded; predominantly northern Cascades provenance. Gray where unoxidized, light yellowish gray and loose where oxidized. Weak soil commonly developed in the till, oxidation rarely extends more than about a meter into the deposit. Generally forms undulating, striated, drumlinized surface. Also found sporadically within areas mapped as unit Qvi. Forms variously gradational and abrupt contacts with underlying advance outwash

Soil Characteristics

Depth

The City of Puyallup requires the available soil depth above seasonal groundwater to be verified between December 21st and March 31st, as required by the Stormwater Management Manual for Western Washington. To perform this observation, we monitored the 4 test pits advanced for the purpose of infiltration testing for groundwater or seepage.

Table 1: Groundwater Monitoring Results

Date	Depth Below Ground TP-1	Depth Below Ground TP-2	Depth Below Ground TP-3	Depth Below Ground TP-4
3/1/2021	95 in. (dry) 88 in. (mott'd)	36 in. (dry) 24 in. (mott'd)	95 in. (dry) 87 in. (mott'd)	95 in. (dry) 90 in. (mott'd)

Based on the measured depths as per Table 1, approximately 7 feet of permeable native soil exists in the current setting above seasonal groundwater for design consideration. The location of TP-2 is not considered for placement of stormwater infiltration facilities. The depths observed are far greater than the potential influence of proposed infiltration facilities, and the level of precipitation has been at or greater than the normal expected amount for the region.

Findings

Based on these findings we have definitive understanding of soil depth and conditions throughout the site. As such, we can make infiltration trench design recommendations.

Infiltration Rates

Using the grain-size analysis method, test sites were selected in representative locations for the project design as shown in Figure 2. The depth at which soil samples were obtained for the grain-size analysis was established at the expected infiltrative soil horizon (which exists at approximately 60 inches below the existing ground surface). The soils in and around the proposed location of the stormwater infiltration trench are well-drained, medium to coarse sands with gravel that have not been consolidated by glacial advance.

Recommended Design Rate (Reference: 2015 Pierce County Stormwater Management & Site Development Manual, Appendix III-A, Method 3 – Soil Grain Size Analysis Method)

Estimated Initial Saturated Hydraulic Conductivity (K_{sat}):

$$\log_{10}(K_{sat}) = -1.57 + 1.90D_{10} + 0.015D_{60} - 0.013D_{90} - 2.08f_{fines}$$

Table 2: Soil Grain-size Analysis Method Results

SOIL SAMPLE	D10	D60	D90	fines	1.90D10	0.015D60	0.013D90	2.08fines	log10 (Ksat)	Ksat (cm/s)	Ksat (in/hr)
1	0.014	3.60	22.0	0.27	0.0266	0.054	0.286	0.5616	-2.3370	0.004603	6.52
2	0.024	3.00	24.0	0.21	0.0456	0.045	0.312	0.4368	-2.2282	0.005913	8.38
3	0.15	17.0	42.0	0.073	0.285	0.255	0.546	0.1518	-1.7278	0.018714	26.52

DESIGN INFILTRATION RATE

$KSAT_{(DESIGN)}$ = 6.52, use **6.50 in./hr**.

Soil Sample 1 gives the lowest, most conservative value for K_{sat} of the three samples taken. This is the value that will be used for design, rounding to a final design rate of 6.50 in./hr. It is our opinion that this is the most conservative approach to determining an infiltration design rate for a specific soil type. It is our experience is that actual infiltration rates far exceed this value.

Stormwater Design Recommendations

Given the coarse, sandy soil conditions in the vicinity of test pits 1, 3, and 4, infiltration trenches are feasible for stormwater control. **Infiltration rates of the in-situ soil is found to be 6.50 in./hr. using the grain-size analysis correction factors, shown above.** Correction factors for the grain-size analysis method are the most conservative of all common methods. This procedure and form of analysis is utilized and accepted in all jurisdictions we have assessed, and it is our experience that stormwater infiltration design values derived from this method are by far the most conservative.

Foundation Bearing Capacity

Test pits demonstrate that the subsurface conditions throughout the site are composed predominantly of 1-4’ of long-existing fine to medium sand with gravel fill placed directly upon native soils. There is a layer within this fill that includes organics, found at depths of approximately 2.5 to 4 feet bgs. Geologic maps and soil maps illustrate that the subsurface conditions throughout the sites are composed of medium to coarse sand with gravel, and at varying depth, this is overlaying a compact till layer. Sand is favorable for projects requiring average bearing capacity. The gravelly sand found throughout the project site is shown below as having a presumptive load-bearing value of 3000 psf. We recommend a conservative design value of 2000 psf bearing capacity per Figure 5. This is provided that the organic layer of fill identified in the attached soil logs is removed and replaced with well-drained structural fill. Organics within the foundation zone break down over time, accelerating settlement and possible failure of the foundation. The 2018 International Building Code (IBC) Chapter 18 provides expected capacities based on material classification. Please see Figure 5 below for an illustration of expected bearing capacity per the IBC.

Bearing surfaces should be medium dense or denser, undisturbed native soils which have been stripped of surficial organic soils, or on properly compacted structural fill which bears on undisturbed native soils which have been stripped of surficial organic soils. In general, before foundation concrete is placed, any localized zones of loose soils exposed across the footing subgrades should be compacted to a firm, unyielding condition, and any localized zones of soft, organic, or debris-laden soils should be over-excavated and replaced with suitable structural fill.

Figure 5: 2018 International Building Code (IBC) Excerpt

TABLE 1806.2
PRESUMPTIVE LOAD-BEARING VALUES

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction[a]	Cohesion (psf)[b]
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000 ← Use	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

On-Site Soils

We offer the following evaluation of these on-site soils in relation to potential use as structural fill.

Surficial organic soils: The duff and topsoil mantling most of the site are not suitable for use as structural fill under any circumstances due to their high organic content. Consequently, these materials can be used only for non-structural purposes such as landscaping areas.

Weathered and unweathered glacial till: Any present weathered and unweathered glacial till layers are sensitive to moisture content variations. These soils can be reused during dry conditions but will become increasingly difficult to reuse as conditions become wetter.

Permanent Slopes and Walls

All permanent cut slopes and fill slopes should be adequately inclined to minimize long-term raveling, sloughing, and erosion. We generally recommend no permanent slopes be steeper than 2H:1V. For all soil types, the use of flatter slopes, such as 2.5H:1V, would further reduce long-term erosion and facilitate revegetation. Fill slopes should consist of free-draining material placed on terraced cuts in native material, compacted to unyielding condition in 12 inch lifts. Landscape walls shall be no more than 4 feet in height, should have the bottom rock or block buried half its height in compacted fill or native soil, placed on a foundation of 4 inches of crushed rock, minimum, and have a surcharge of 4H:1V or less. As stated prior for bearing surfaces of foundations above, surfaces for foundation of landscape walls should be medium dense or denser, undisturbed native soils which have been stripped of surficial organic soils, or on properly compacted structural fill which bears on undisturbed native soils which have been stripped of surficial organic soils. In general, before crushed rock foundation is placed, any localized zones of loose soils exposed across the subgrades should be compacted to a firm, unyielding condition, and any localized zones of soft, organic, or debris-laden soils should be over-excavated and replaced with suitable structural fill.

Slope Protection

We recommend a hardy vegetative groundcover should be established as soon as feasible to protect the slopes from runoff water erosion. Alternatively, permanent slopes could be armored with quarry spalls or a geosynthetic erosion mat.

Lateral Resistance

Footings and structures that have been properly backfilled as recommended above will resist lateral movements by means of passive earth pressure and base friction. Passive earth pressures developed from compacted granular fill could be estimated using an equivalent fluid unit weight (using Hf Fill criteria) of 300 pcf. This value assumes that the structures extend at least 1.5 feet below the lowest adjacent exterior grade, are properly drained, and that the backfill around the structure is compacted in accordance with the recommendations for structural fill outlined herein. If footings are cast directly against native, undisturbed glacial till, passive earth pressure could be increased to an equivalent fluid unit weight of 450 pcf. Passive resistance against below-grade retaining walls or buried structures can be assumed to be equivalent to an equivalent fluid unit weight of 450 pcf. The above equivalent fluid unit weights include a factor of safety of 1.5 to limit lateral deflection. Also, cohesion of soil was neglected making these numbers inherently conservative. Active Earth Pressures are estimated at 30 pcf. We recommend an allowable base friction coefficient of 0.5 for use between cast-in-place concrete and undisturbed, dense, glacially overridden soil. An allowable base friction coefficient of 0.35 should be used for footings bearing on undisturbed sandy gravels and compacted structural fill.

Conclusions

Roof Runoff Control: Based on soil depth and texture, subsurface infiltration trenches are appropriate.

Construction Timing: Site construction on many properties with shallow soil, fine soil (moisture sensitivity), and shallow groundwater must be carefully considered and include geotechnical monitoring. Fortunately, this site has well-drained soils throughout the western half of the property. Inclement weather would have little to no impact on the native soils, provided the lower till layer is relatively undisturbed.

Geotechnical Oversight: For this or any similar design to be successfully implemented, we recommend coordination with LS&E to ensure compliance with design.

Recommended Additional Services

Please feel free to contact LS&E for consultation as needed during site development. A pre-construction meeting may be beneficial. Preparation of a letter summarizing all review comments (if required by Pierce County) may be necessary. LS&E is available to check all completed subgrades for footings before concrete is poured to verify their bearing capacity, as well as inspect all trenches prior to backfill. LS&E is available to oversee and inspect compaction of all fill and backfill. Preparation of a post-construction letter summarizing all field observations, inspections, and test results (if required by Pierce County) can be provided by LS&E in the future.

References

Debray, S. and Savage, W.Z., 2001, A Preliminary Finite-Element Analysis of a Shallow Landslide in the Alki Area of Seattle, Washington: U.S. Geological Survey Open File Report 01-0357, 5 p.

Koloski, J.W., Schwarz, S.D., and Tubbs, D.W., 1989, Engineering Geology in Washington, Volume 1, “Geotechnical Properties of Geologic Materials: Washington Division of Geology and Earth Resources Bulletin 78, 1989”, 9p.

Savage, W.Z., Morrissey, M.M., and Baum, R.L., 2000, Geotechnical Properties for Landslide-Prone Seattle-Area Glacial Deposits: U.S. Geological Survey Open File Report 00-228, 5p.

Shannon & Wilson, Inc., 2017, Geotechnical Report: 18th Avenue and Cherry Street Medical Office Building, Seattle, Washington, 59 p.

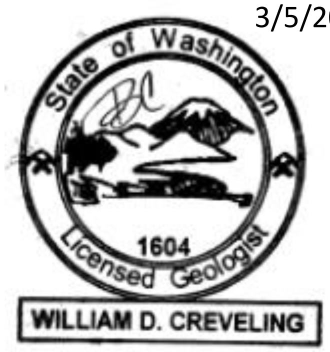
Closure

The information gathered for this report is standard practice and relevant for this type of project. The number and distribution of sampling locations is typical and reliable for obtaining an accurate understanding of the site. The conclusions and recommendations presented in this letter are based on our observations, interpretations, and assumptions regarding shallow subsurface conditions. However, if any variations in the site conditions are discovered later, please contact our office to review and if necessary, modify this report accordingly. We appreciate the opportunity to be of service on this project. If you have any questions regarding this letter or any aspects of the project, please feel free to contact our office.

Respectfully submitted,

LeRoy Surveyors & Engineers, Inc.

3/5/2021



3/5/2021

William Creveling, L.G.
Principal Geologist

Damon DeRosa, P.E.
Principal Engineer

Joshua Thompson, E.I.T.
Civil Engineering Technician

Attached: Graphic Soil Logs
Grain-size Laboratory Results

LEROY SURVEYORS & ENGINEERS, INC.

Surveying • Engineering • Geology • Septic Design • GPS • GIS Mapping

Client: BRCF

Job Number: 13298

Date Started: 3/1/2021

Date Completed: 3/1/2021

Excavation Contractor: Bob Goodman

Excavation Method: Excavator

Logged By: BC Checked By: BC

Notes:

Test Pit Number: TP-1

Project Name: BRCF 10th St SE

Ground Elevation: 496 Test Pit Size: 2' x 8'

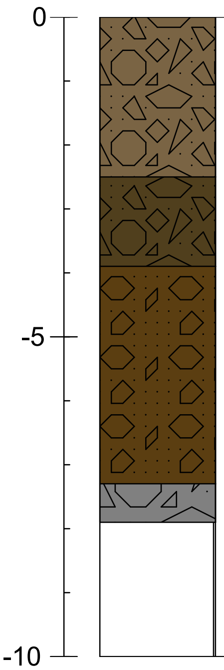
Ground Water Levels:

At Time of Excavation: None

At End of Excavation None

Static Water Depth: None

Depth	Graphic Log	USCS	Material Description
			Brown fine-med sand w/silt, gravel (FILL)
			Dark brown fine sand w/organics, gravel (FILL)
			Brown med-coarse SAND w/gravel, cobbles, loose, dry
			Gray fine-coarse sand w/gravel, dense, mottled, dry (TILL)



The depths on te test pit logs are based on an average of measurements across the test pit and should be considered accurate to +/- 0.5 ft.

Bottom of Test Pit at: 7.9

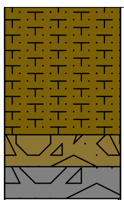
Ground Water/Seepage: None

Side Wall Caving: None

LEROY SURVEYORS & ENGINEERS, INC.
Surveying • Engineering • Geology • Septic Design • GPS • GIS Mapping

Client: BRCF
Job Number: 13298
Date Started: 3/1/2021
Date Completed: 3/1/2021
Excavation Contractor: Bob Goodman
Excavation Method: Excavator
Logged By: BC Checked By: BC
Notes:

Test Pit Number: TP-2
Project Name: BRCF 10th St SE
Ground Elevation: 498 Test Pit Size: 2' x 6'
Ground Water Levels:
At Time of Excavation: None
At End of Excavation None
Static Water Depth: None

Depth	Graphic Log	USCS	Material Description
0			Brown fine SAND w/gravel, silt
			Tan/gray fine SAND w/gravel, silt, mottled, dry
			Gray fine sand with silt, dense, mottled, dry (TILL)
-5			
-10			

The depths on te test pit logs are based on an average of measurements across the test pit and should be considered accurate to +/- 0.5 ft.

Bottom of Test Pit at: 3
Ground Water/Seepage: None
Side Wall Caving: None

LEROY SURVEYORS & ENGINEERS, INC.

Surveying • Engineering • Geology • Septic Design • GPS • GIS Mapping

Client: BRCF

Job Number: 13298

Date Started: 3/1/2021

Date Completed: 3/1/2021

Excavation Contractor: Bob Goodman

Excavation Method: Excavator

Logged By: BC Checked By: BC

Notes:

Test Pit Number: TP-3

Project Name: BRCF 10th St SE

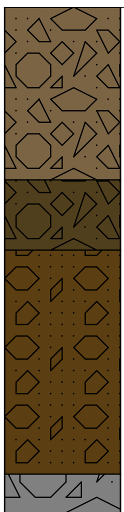
Ground Elevation: 496 Test Pit Size: 2' x 8'

Ground Water Levels:

At Time of Excavation: None

At End of Excavation None

Static Water Depth: None



Depth	Graphic Log	USCS	Material Description
0			Brown fine-med sand w/silt, gravel (FILL)
			Dark brown fine sand w/organics, gravel (FILL)
-5			Brown med-coarse SAND w/gravel, cobbles, loose, dry
			Gray fine-coarse sand w/gravel, dense, mottled, dry (TILL)
-10			

The depths on te test pit logs are based on an average of measurements across the test pit and should be considered accurate to +/- 0.5 ft.

Bottom of Test Pit at: 7.9

Ground Water/Seepage: None

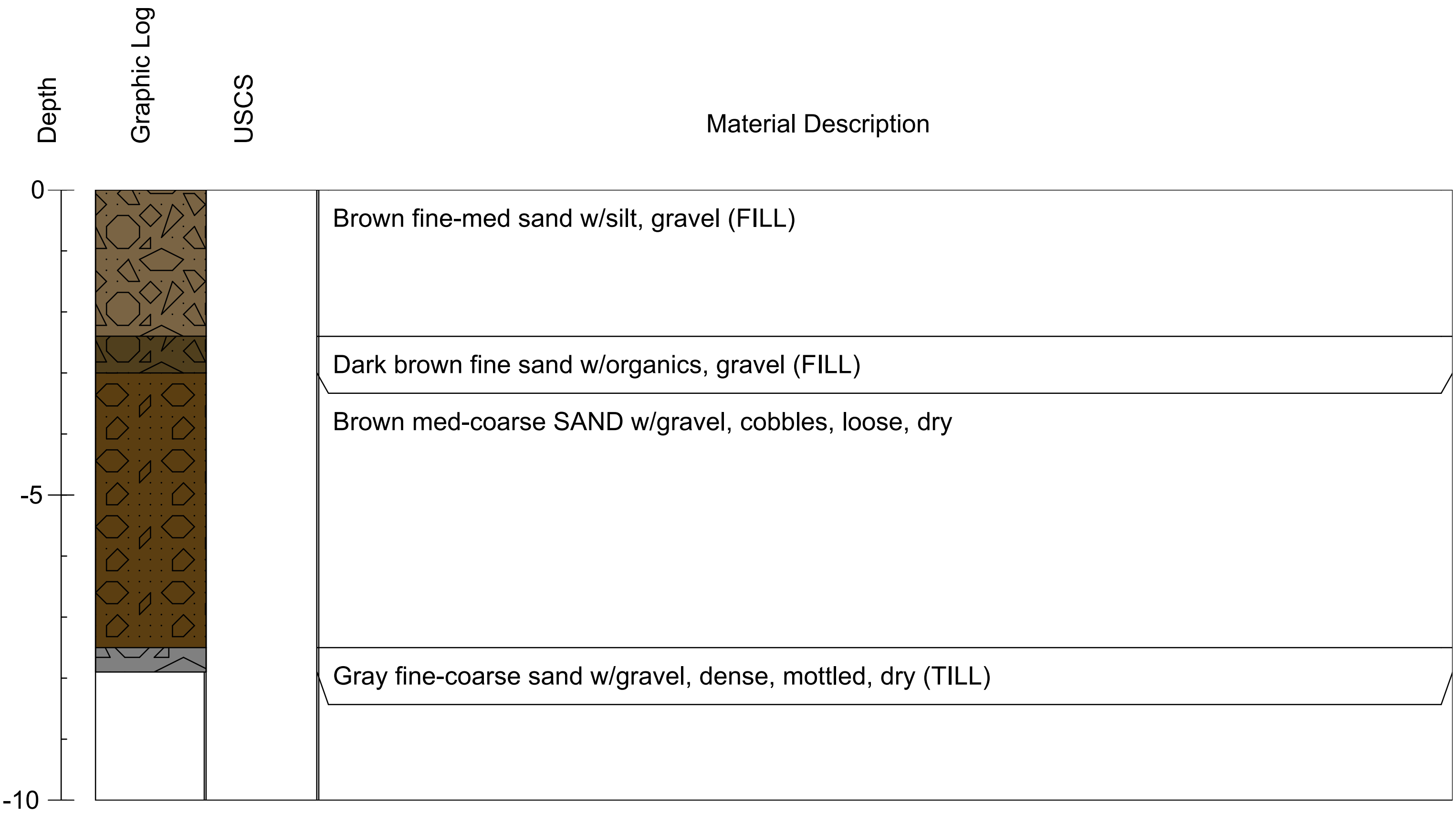
Side Wall Caving: None

LEROY SURVEYORS & ENGINEERS, INC.

Surveying • Engineering • Geology • Septic Design • GPS • GIS Mapping

Client: BRCF
Job Number: 13298
Date Started: 3/1/2021
Date Completed: 3/1/2021
Excavation Contractor: Bob Goodman
Excavation Method: Excavator
Logged By: BC Checked By: BC
Notes:

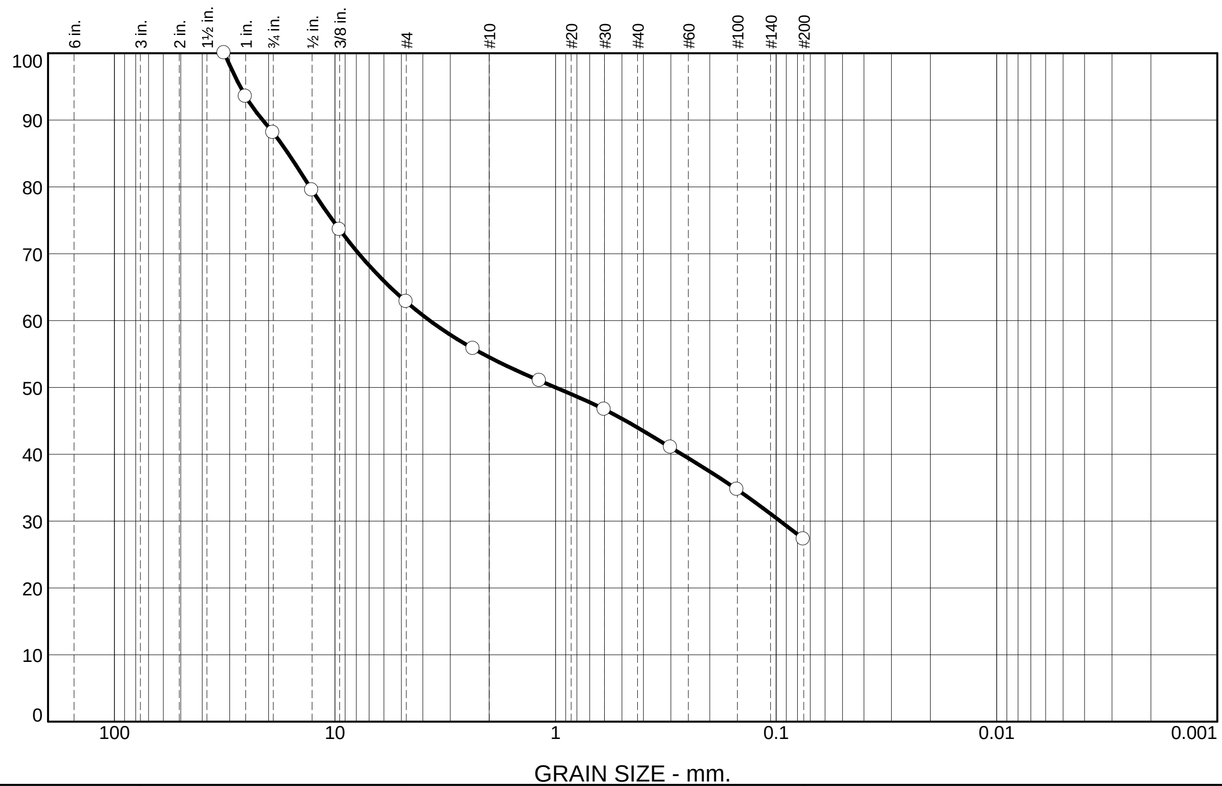
Test Pit Number: TP-4
Project Name: BRCF 10th St SE
Ground Elevation: 496 Test Pit Size: 2' x 8'
Ground Water Levels:
At Time of Excavation: None
At End of Excavation None
Static Water Depth: None



The depths on te test pit logs are based on an average of measurements across the test pit and should be considered accurate to +/- 0.5 ft.

Bottom of Test Pit at: 7.9
Ground Water/Seepage: None
Side Wall Caving: None

Particle Size Distribution Report ASTM C117/C136



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	12	25	8	11	17	27	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/4"	100		
1"	94		
3/4"	88		
1/2"	80		
3/8"	74		
#4	63		
#8	56		
#16	51		
#30	47		
#50	41		
#100	35		
#200	27		

* (no specification provided)

Material Description

Light Brown Gravelly Sandy Silt
SL #1

Atterberg Limits

PL= LL= PI=

Classification

USCS= AASHTO=

Remarks

Report: 01

Sampled By: Client

Source of Sample: Native
Sample Number: 21-247

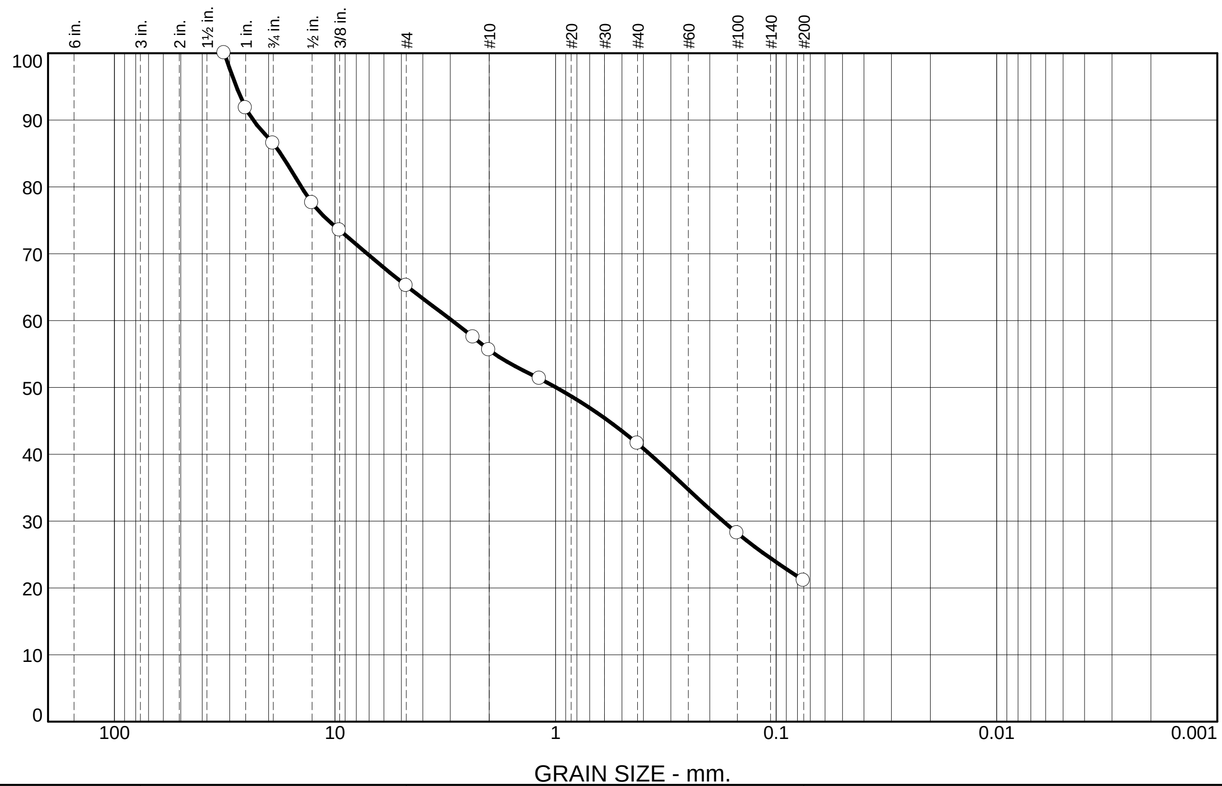
Date: 03-01-21

Construction Testing Laboratories
400 Valley Ave. NE, Suite #102
Puyallup WA, 98372 Tel. (253) 383-8778

Client: Copperberry, LLC
Project: Copperberry Condominiums
Project No: 9027 **Figure**

Tested By: M Armstrong **Checked By:** C Pedersen

Particle Size Distribution Report ASTM C117/C136



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	14	21	9	14	21	22	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1 1/4"	100		
1"	92		
3/4"	86		
1/2"	78		
3/8"	74		
#4	65		
#8	58		
#10	56		
#16	51		
#40	42		
#100	28		
#200	21		

* (no specification provided)

Material Description

Light Brown Gravelly Sandy Silt
SL #3

Atterberg Limits

PL= LL= PI=

Classification

USCS= AASHTO=

Remarks

Report: 02

Sampled By: Client

Source of Sample: Native
Sample Number: 21-248

Date: 03-01-21

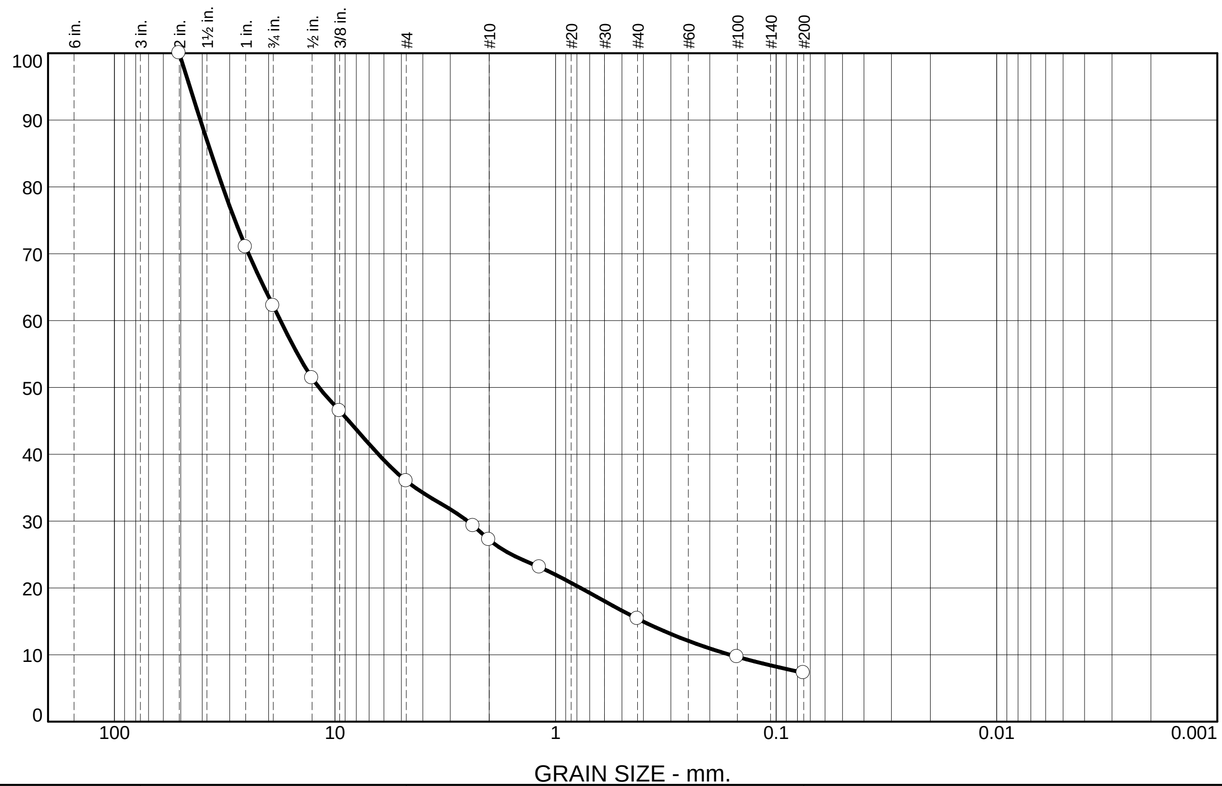
Construction Testing Laboratories
400 Valley Ave. NE, Suite #102
Puyallup WA, 98372 Tel. (253) 383-8778

Client: Copperberry, LLC
Project: Copperberry Condominiums
Project No: 9027 **Figure**

Report shall not be reproduced except in full without the written approval of the Laboratory. Report pertains only to the material tested.

Tested By: M Armstrong **Checked By:** C Pedersen

Particle Size Distribution Report ASTM C117/C136



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% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	38	26	9	12	8	7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100		
1"	71		
3/4"	62		
1/2"	51		
3/8"	46		
#4	36		
#8	29		
#10	27		
#16	23		
#40	15		
#100	10		
#200	7.3		

* (no specification provided)

Material Description

Light Grey/Brown Gravelly Sand
SL #4

Atterberg Limits

PL= LL= PI=

Classification

USCS= AASHTO=

Remarks

Report: 03

Sampled By: Client

Source of Sample: Native
Sample Number: 21-249

Date: 03-01-21

Construction Testing Laboratories
400 Valley Ave. NE, Suite #102
Puyallup WA, 98372 Tel. (253) 383-8778

Client: Copperberry, LLC
Project: Copperberry Condominiums
Project No: 9027 **Figure**

Tested By: M Armstrong **Checked By:** C Pedersen

APPENDIX C

Pipe Conveyance Capacity

Capacity of 6-inch pipe at 1%

Flow (cfs)	Q=VA	0.52243
Velocity (fps)	$V=(k/n)(A/P)^{2/3}S^{1/2}$	2.660714
	k=	1.49
Manning's n	n=	0.014
X-Sec Area (sf)	$A=pi*r^2$	0.19635
Pipe Radius (ft)	r=	0.25
Wetted Perim.	P=2*pi*r	1.570796
Slope (ft/ft)	S=slope	0.01

Capacity of 4-inch pipe at 1%

Flow (cfs)	Q=VA	0.175311
Velocity (fps)	$V=(k/n)(A/P)^{2/3}S^{1/2}$	2.025087
	k=	1.49
Manning's n	n=	0.014
X-Sec Area (sf)	$A=pi*r^2$	0.08657
Pipe Radius (ft)	r=	0.166
Wetted Perim.	P=2*pi*r	1.043009
Slope (ft/ft)	S=slope	0.01

Capacity of 6-inch pipe at 2%

Flow (cfs)	Q=VA	0.738828
Velocity (fps)	$V=(k/n)(A/P)^{2/3}S^{1/2}$	3.762818
	k=	1.49
Manning's n	n=	0.014
X-Sec Area (sf)	$A=pi*r^2$	0.19635
Pipe Radius (ft)	r=	0.25
Wetted Perim.	P=2*pi*r	1.570796
Slope (ft/ft)	S=slope	0.02

Capacity of 4-inch pipe at 2%

Flow (cfs)	Q=VA	0.247927
Velocity (fps)	$V=(k/n)(A/P)^{2/3}S^{1/2}$	2.863905
	k=	1.49
Manning's n	n=	0.014
X-Sec Area (sf)	$A=pi*r^2$	0.08657
Pipe Radius (ft)	r=	0.166
Wetted Perim.	P=2*pi*r	1.043009
Slope (ft/ft)	S=slope	0.02

WWHM2012

PROJECT REPORT

Conveyance Calculations

General Model Information

Project Name:	default[2]
Site Name:	
Site Address:	
City:	
Report Date:	9/24/2021
Gage:	52 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

Assume worst case
WWHM rainfall

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year
Low Flow Threshold for POC2:	50 Percent of the 2 Year
High Flow Threshold for POC2:	50 Year
Low Flow Threshold for POC3:	50 Percent of the 2 Year
High Flow Threshold for POC3:	50 Year

5,000 SF

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS MOD	0.12
Impervious Total	0.12
Basin Total	0.12

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

10,000 SF

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS MOD	0.23
Impervious Total	0.23
Basin Total	0.23

Element Flows To:

Surface	Interflow	Groundwater

15,000 SF

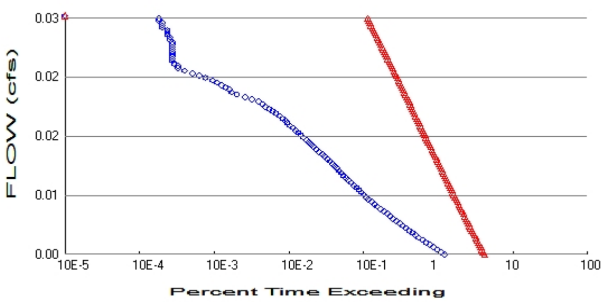
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS MOD	0.35
Impervious Total	0.35
Basin Total	0.35

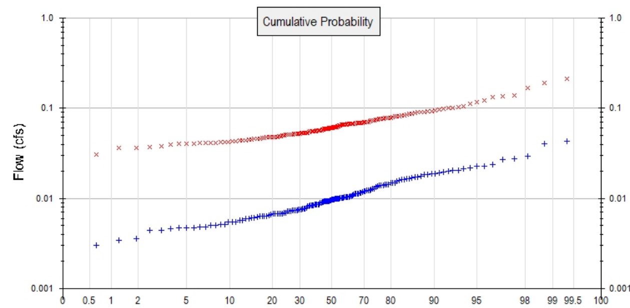
Element Flows To:

Surface	Interflow	Groundwater

Analysis Results

POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.23
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.12

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.009603
5 year	0.014655
10 year	0.01845
25 year	0.023756
50 year	0.028081
100 year	0.032727

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.060376
5 year	0.081552
10 year	0.097655
25 year	0.120514
50 year	0.139469
100 year	0.160167

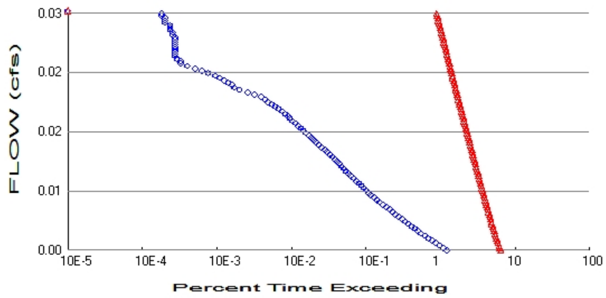
100 year peak flow

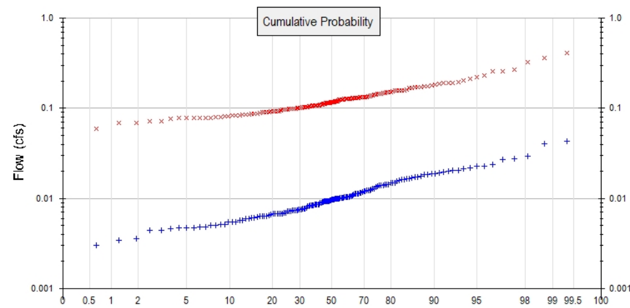
Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.007	0.068
1903	0.007	0.073
1904	0.019	0.083
1905	0.007	0.047
1906	0.003	0.047
1907	0.014	0.054
1908	0.010	0.046
1909	0.009	0.058
1910	0.013	0.056
1911	0.010	0.062

POC 2





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #2
Total Pervious Area: 0.23
Total Impervious Area: 0

Mitigated Landuse Totals for POC #2
Total Pervious Area: 0
Total Impervious Area: 0.23

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #2

Return Period	**Flow(cfs)**
2 year	0.009603
5 year	0.014655
10 year	0.01845
25 year	0.023756
50 year	0.028081
100 year	0.032727

Flow Frequency Return Periods for Mitigated. POC #2

Return Period	**Flow(cfs)**
2 year	0.11572
5 year	0.156308
10 year	0.187173
25 year	0.230986
50 year	0.267316
100 year	0.306987

100 year peak flow

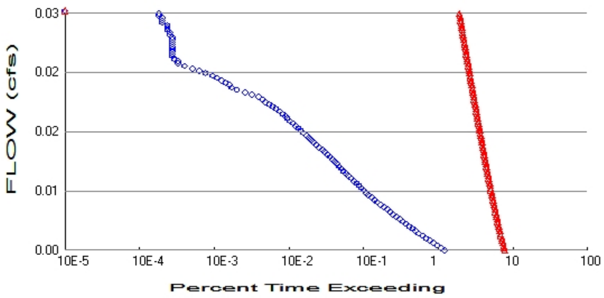
Annual Peaks

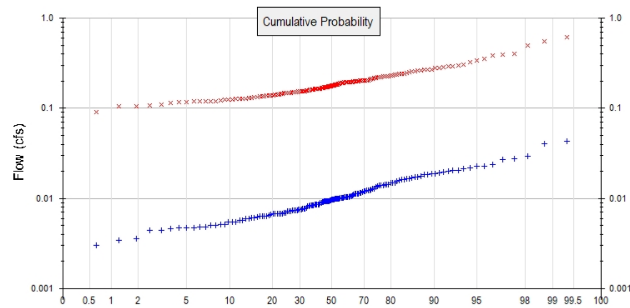
Annual Peaks for Predeveloped and Mitigated. POC #2

Year	**Predeveloped**	**Mitigated**
1902	0.007	0.130
1903	0.007	0.140
1904	0.019	0.159
1905	0.007	0.091
1906	0.003	0.090
1907	0.014	0.103
1908	0.010	0.088
1909	0.009	0.110
1910	0.013	0.107
1911	0.010	0.119
1912	0.040	0.202

15,000 SF Tributary Area - POC 1

POC 3





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #3
Total Pervious Area: 0.23
Total Impervious Area: 0

Mitigated Landuse Totals for POC #3
Total Pervious Area: 0
Total Impervious Area: 0.35

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #3

Return Period	**Flow(cfs)**
2 year	0.009603
5 year	0.014655
10 year	0.01845
25 year	0.023756
50 year	0.028081
100 year	0.032727

Flow Frequency Return Periods for Mitigated. POC #3

Return Period	**Flow(cfs)**
2 year	0.176096
5 year	0.23786
10 year	0.284828
25 year	0.3515
50 year	0.406786
100 year	0.467154

100-year peak flow

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #3

Year	**Predeveloped**	**Mitigated**
1902	0.007	0.198
1903	0.007	0.213
1904	0.019	0.242
1905	0.007	0.138
1906	0.003	0.137
1907	0.014	0.157
1908	0.010	0.134
1909	0.009	0.168
1910	0.013	0.164
1911	0.010	0.181
1912	0.040	0.308

Mitigated Schematic