BARGHAUSEN

TECHNICAL INFORMATION REPORT

Fortress- Puyallup

240 15th Street SE
Puyallup, Washington 98372

Prepared for:
CREF3 Puyallup, LLC
11611 San Vicente Blvd, 10th Floor
Los Angeles, CA 90049

7/27/2023

July 27, 2023
Our Job No. 22085

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Tab 1.0

1.0 PROJECT OVERVIEW

The proposed Fortress - Puyallup project is located on a 7.84-acre site located in the City of Puyallup, Washington. The project address is 240 15th Street SE, Puyallup, WA 98372 with the parcel numbers being 0420274126, 7845000161, and 7845000170. The site is located northwest of the intersection of 15th Street SE and East Pioneer Way. The current zoning of the project site is Limited Manufacturing (ML). Please see the enclosed Figure 1 - Vicinity Map for additional location information.

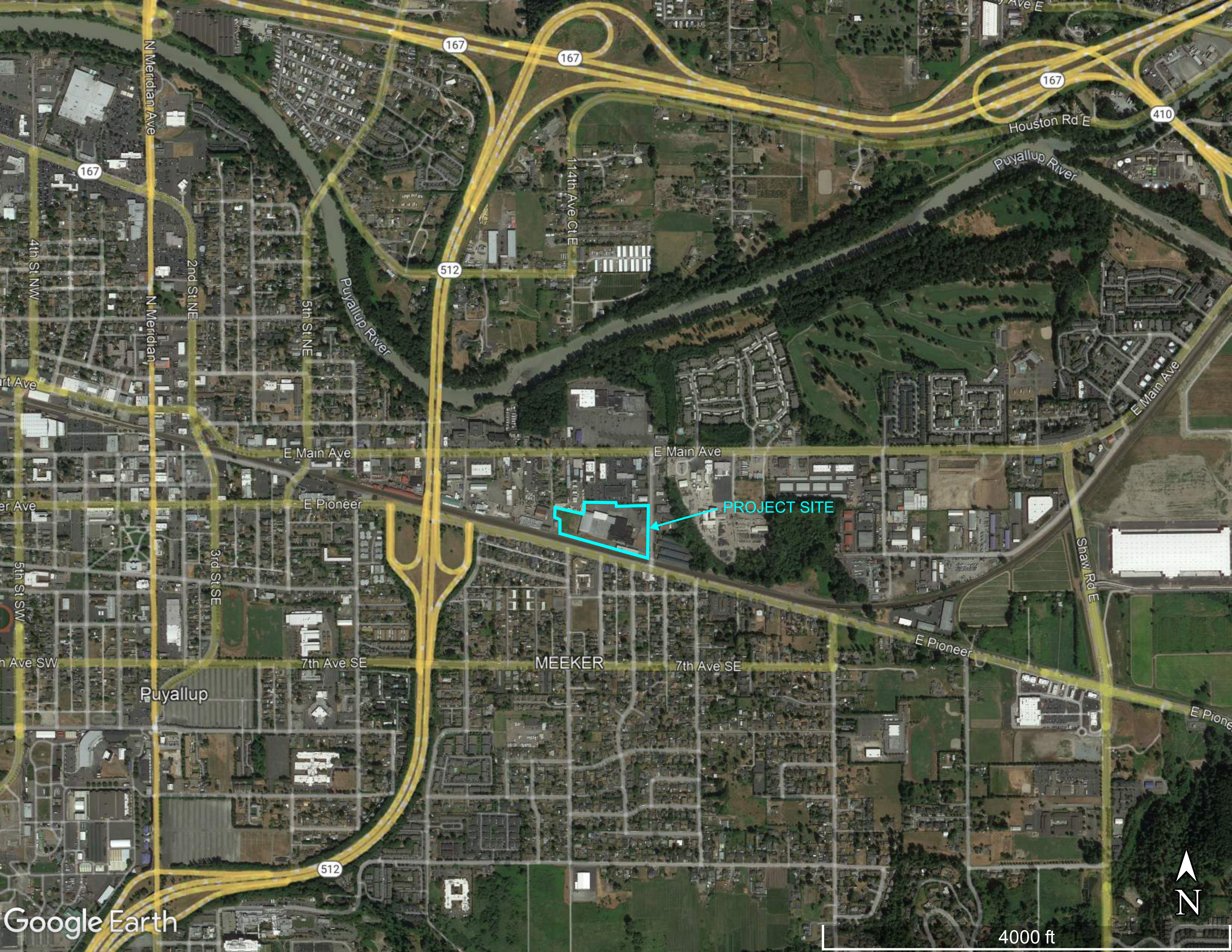
The existing site contains a cold storage warehouse that is in the process of demolition, a separate industrial building, and an office building. The majority of the site has been developed with buildings and pavement, though a small portion of the site is an undeveloped field. The property is not currently being used other than for demolition activity. There are three driveways serving the site off of 15th Street SE. The site is relatively flat and does not contain any steep slopes. The developed portion of the site drains to existing stormwater catch basins and piping, which discharge into the public stormwater systems in East Main Street and 15th Street SE, ultimately discharging to Deer Creek near the Puyallup River. See Figure 2 for a map of existing site conditions.

The site is not within a flood zone. See Figure 4 for a FEMA flood map. According to Puyallup GIS mapping, the project does not contain any wetlands or potential landslide hazards. The public stormwater system in 15th Street SE discharges to a wetland. See Figure 3 for a critical areas map.

The proposal for this development is to construct one warehouse building, new pavement, associate utilities, and landscaping. The developed runoff from the west portion of the site will be collected and conveyed to both water quality and detention vaults prior to discharge into the public stormwater system draining to East Main Street. The east part of the site will be collected and discharged through a water quality vault to the 15th Street SE system that drains to a wetland. This basin has been sized to match the existing conditions to match existing flows to the wetland. Stormwater treatment will be provided upstream of the detention vault by DOE-approved underground treatment vaults (Oldcastle Biopods).

This site has some incidental run-on from adjacent property that is accounted for by the proposed stormwater improvements.

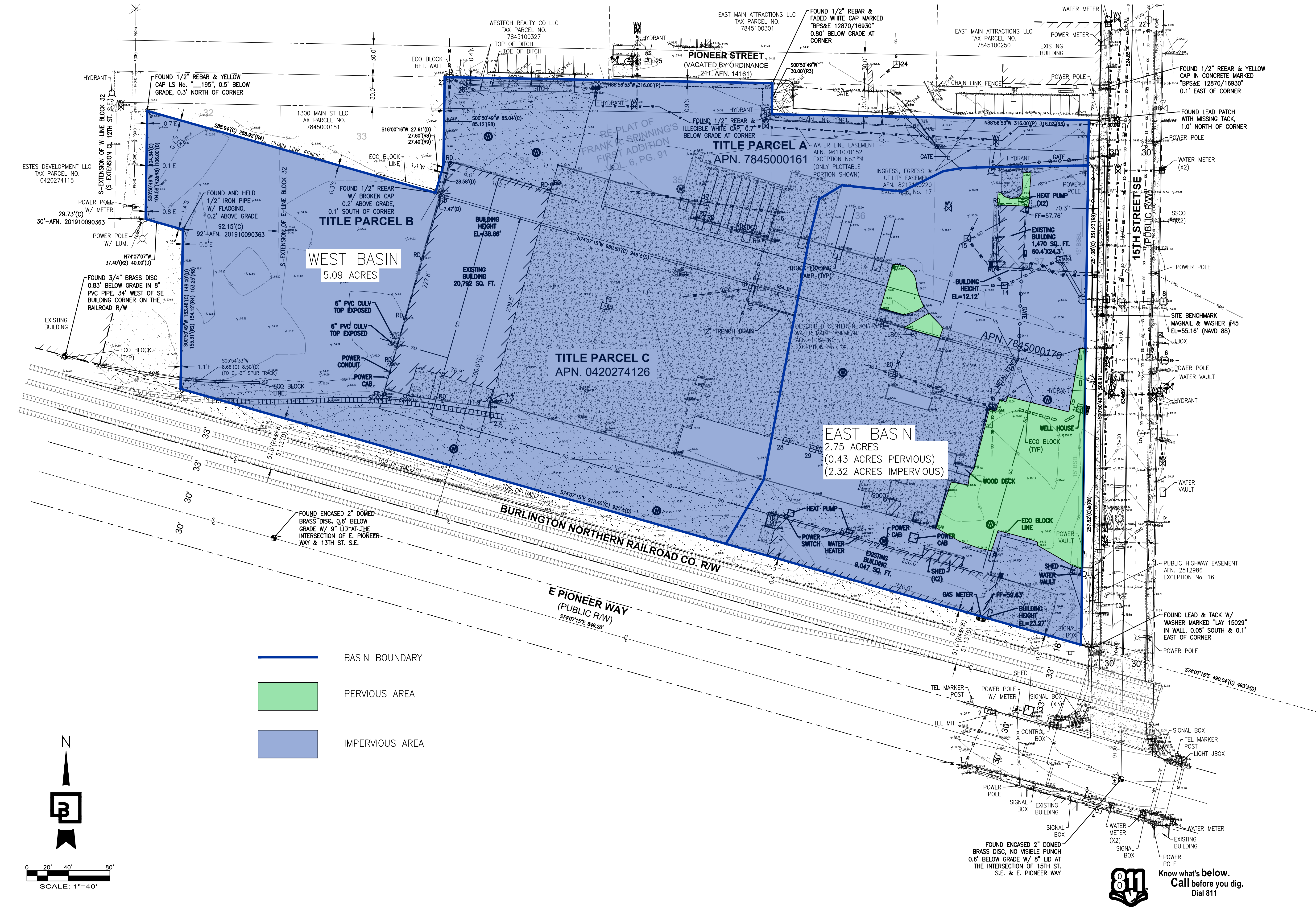
Figure 1
Vicinity Map



167
167
167
410
Houston Rd E
Puyallup River
N Meridian Ave
114th Ave Ct E
512
4th St NW
2nd St NE
5th St NE
Puyallup River
N Meridian
E Main Ave
E Main Ave
E Main Ave
E Pioneer
PROJECT SITE
Shaw Rd E
3rd St SE
5th St SW
7th Ave SE
MEEKER
7th Ave SE
E Pioneer
Puyallup
512
Google Earth
N
4000 ft

Figure 2
Existing Conditions Map

EXISTING CONDITION BASIN MAP EXHIBIT



BASIN BOUNDARY

PERVIOUS AREA

IMPERVIOUS AREA

Title: EXISTING CONDITION BASIN MAP EXHIBIT

FORTRESS - PUYALLUP

For: FORTRESS INVESTMENT GROUP
11611 SAN VICENTE BLVD
10TH FLOOR
LOS ANGELES, CA 90049

Scale: Horizontal 1"=40' Vertical N/A

Designed VMS Drawn VMS Checked KEH Approved KEH Date 10/04/22

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APPROXIMATE SITE BOUNDARY
EXISTING BUILDINGS UNDER DEMOLITION
15th St SE
15th St SE
E Pioneer
E Pioneer
E Pioneer
13th St SE
14th St SE
N
400 ft
Google Earth

Figure 3
Critical Areas Map

Show the existing wetland in which the project discharges too. [storm report, pg 11]

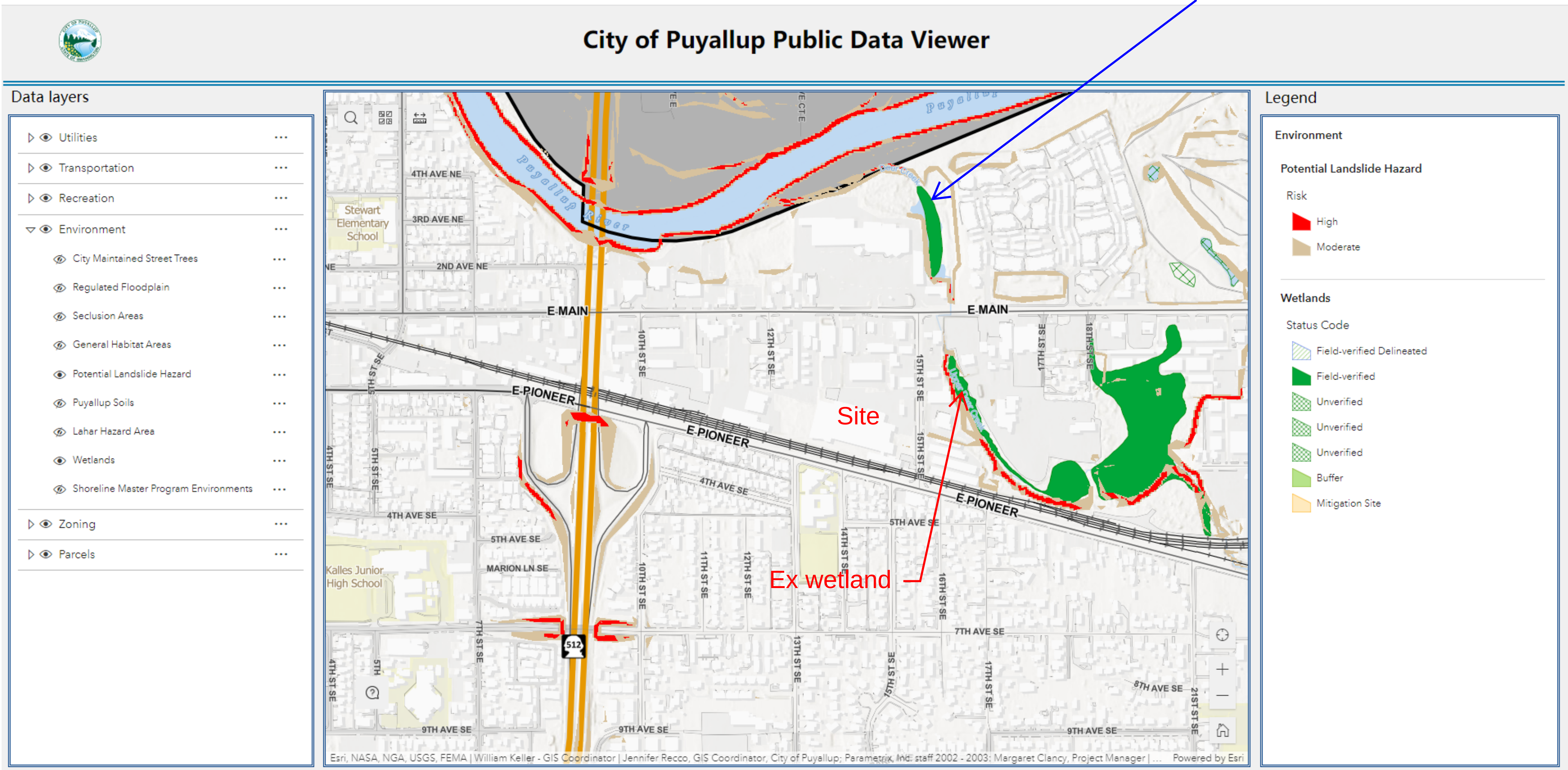


Figure 4
FEMA Flood Map

National Flood Hazard Layer FIRMette

FEMA

122°16'52"W 47°11'35"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

122°16'14"W 47°11'11"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/29/2022 at 5:18 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Tab 2.0

2.0 MINIMUM REQUIREMENTS SUMMARY

Per Figure 1-3.1 of the 2019 Department of Ecology Stormwater Management Manual for Western Washington (the Manual), minimum requirements #1 through #9 apply to this project. Minimum requirements (MRs) as listed in the Manual are listed in this section.

MR1 - Preparation of Stormwater Site Plans.

This report and the prepared construction drawings satisfy this requirement.

MR2 - Construction Stormwater Pollution Prevention Plan (SWPPP)

A CSWPPP was not submitted under a separate cover. Provide this document during the next submission. [drainage report, pg 15]

A SWPPP has been prepared and submitted to the City under a separate cover.

MR3 - Source Control of Pollution

Source Control BMPs will be selected in accordance with Volume IV of the Manual once the property has been leased and actual commercial activities are able to be identified. Good housekeeping measures will be used to keep the site clean and to reduce the chance that stormwater will come into contact with pollutants.

Identify source control BMP's within this section of MR 3 to be followed during construction. [drainage report, pg 15]

MR4 - Preservation of Natural Drainage Systems and Outfalls

In the existing condition the site discharges into the public stormwater systems in East Main Street and 15th Street SE, ultimately discharging to Deer Creek and then to the Puyallup River. These discharge locations will be maintained.

MR5 - On-Site Stormwater Management

To satisfy this Minimum Requirement, the BMPs given by List #2 are evaluated for feasibility. In accordance with the geotechnical report prepared for this project, infiltration of stormwater on the project site is not feasible. Dispersion BMPs are also infeasible due to the absence of available dispersion areas on the project site. Therefore, the project proposes to manage stormwater by implementing BMP T5.13 to all landscape areas and by conveying onsite runoff from the western portion of the site to the proposed stormwater treatment and detention facilities.

MR6 - Runoff Treatment

The use of OldCastle Biopods is proposed. These are proprietary underground treatment vaults that have received a General Use Level Designation (GULD) approval from the DOE. Sizing is provided with this report. See Section 4.4 and Figure 9.

MR7 - Flow Control

The project will meet the duration matching requirement. Flow control will be provided by the proposed detention vault. See Section 4.3 of this report for more information.

MR8 - Wetlands Protection

Some runoff from the project site enters the public stormwater system in 15th Street SE, which ultimately discharges to Deer Creek at a location where it is mapped as wetlands per City GIS. In order to protect this wetland, the flow to this discharge location will be maintained. The eastern portion of the site will continue to discharge to the wetland. This area is largely impervious in the existing condition so flows will be matched by discharging the eastern portion of the site without detention. See Section 4.5 for additional narrative.

MR9 - Operation and Maintenance

An operations and maintenance manual has be completed and submitted as a separate document.

Figure 5
Minimum Requirements Flowchart

Figure I-3.1: Flow Chart for Determining Requirements for New Development

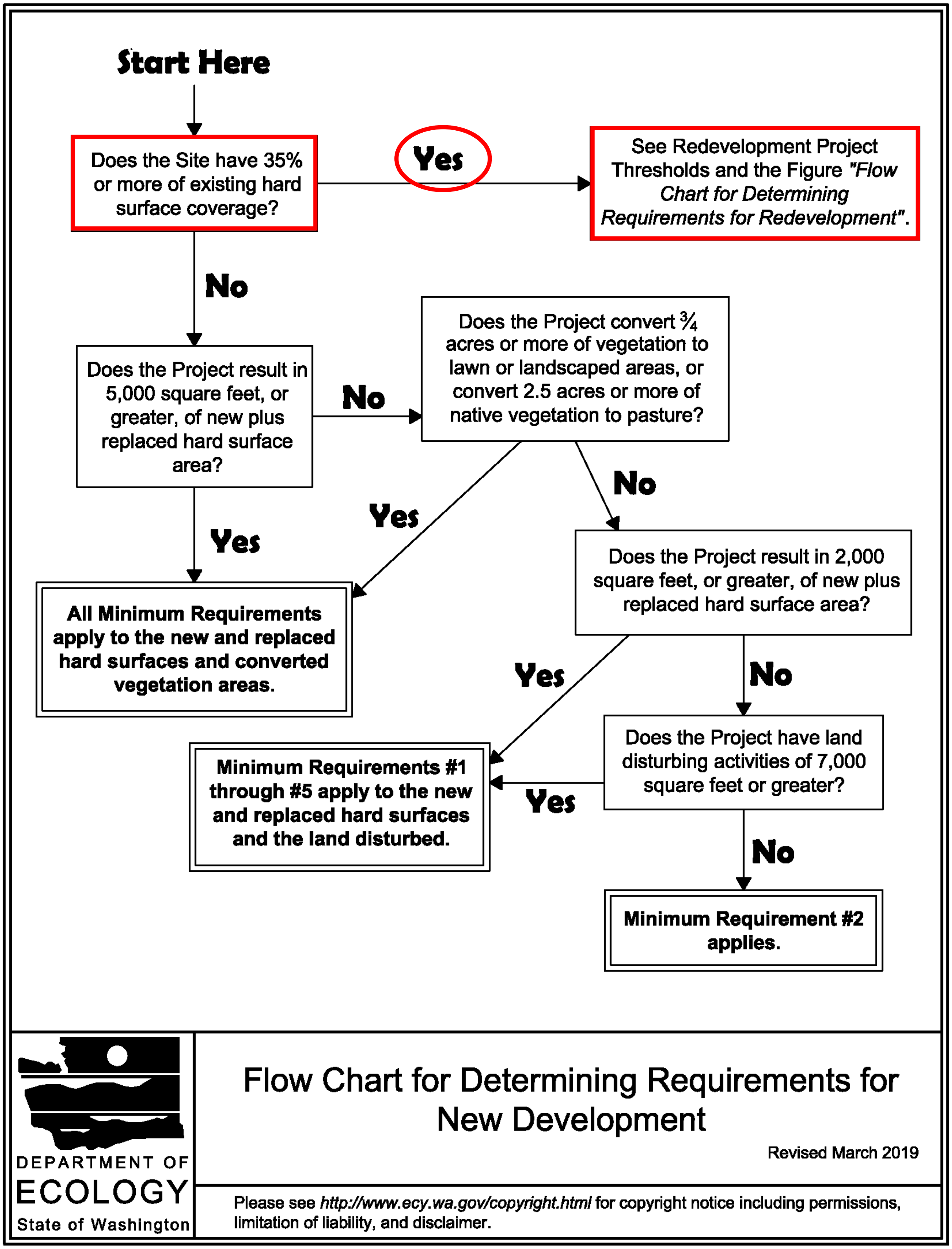


Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment

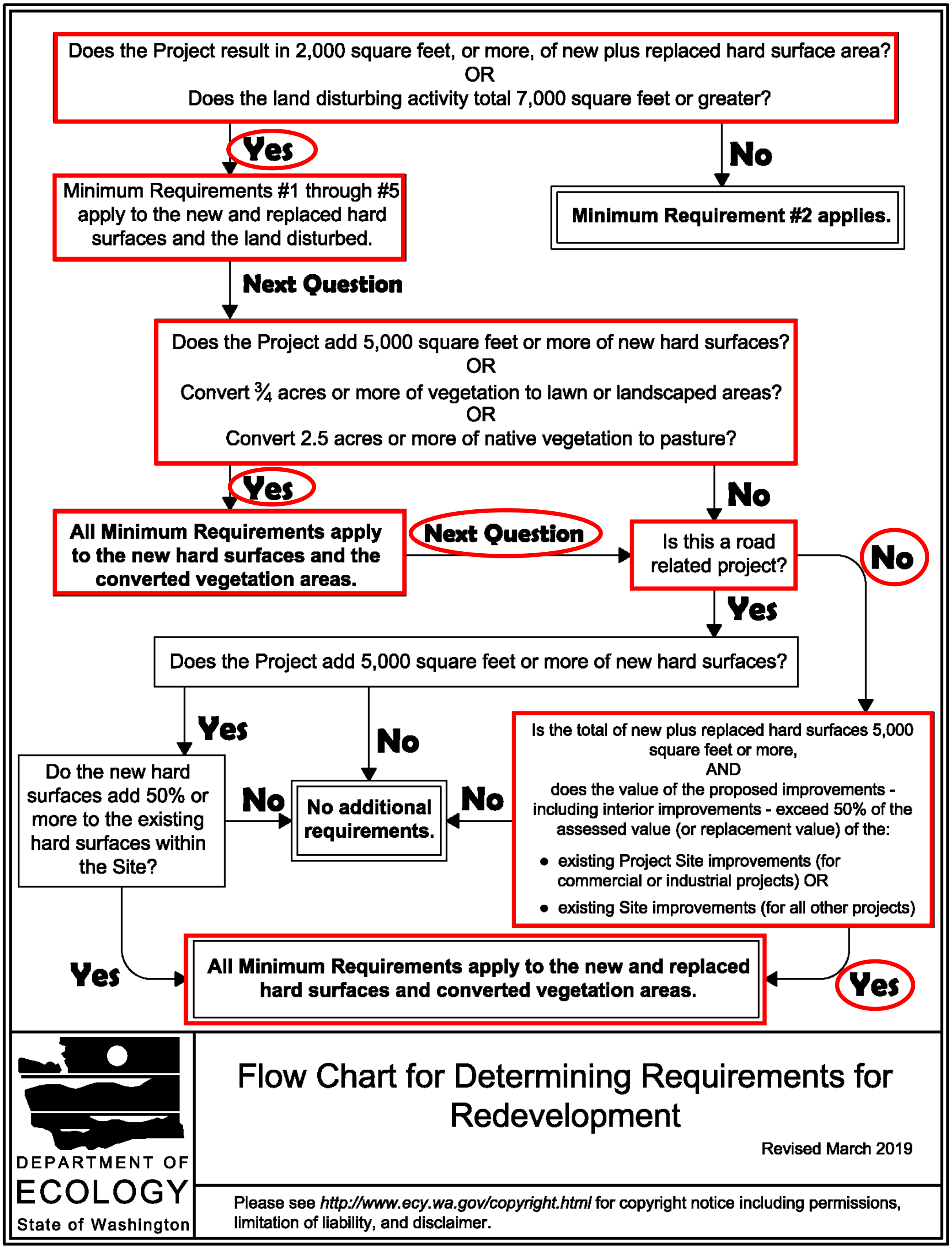


Figure III-1.1: Runoff Treatment BMP Selection Flow Chart

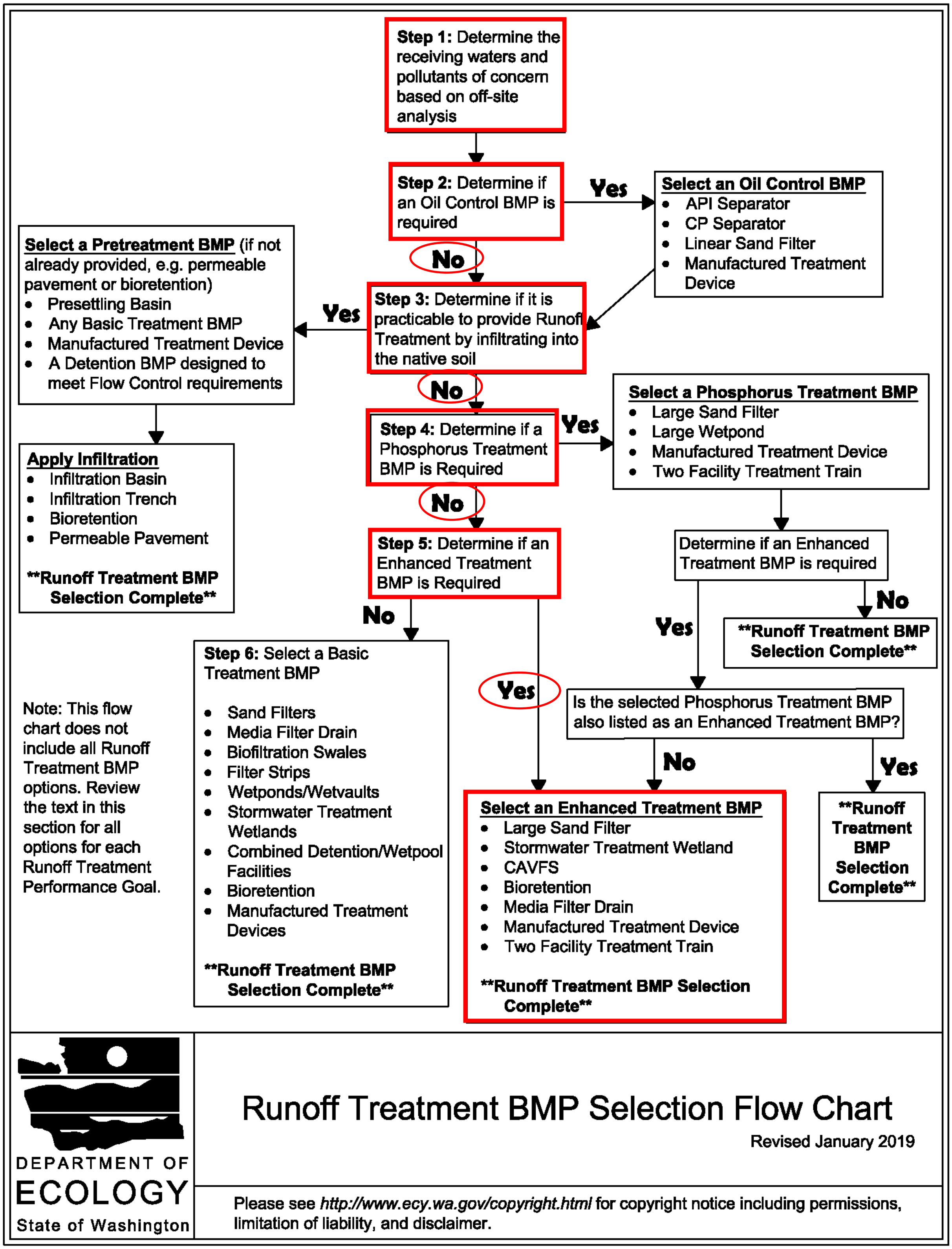
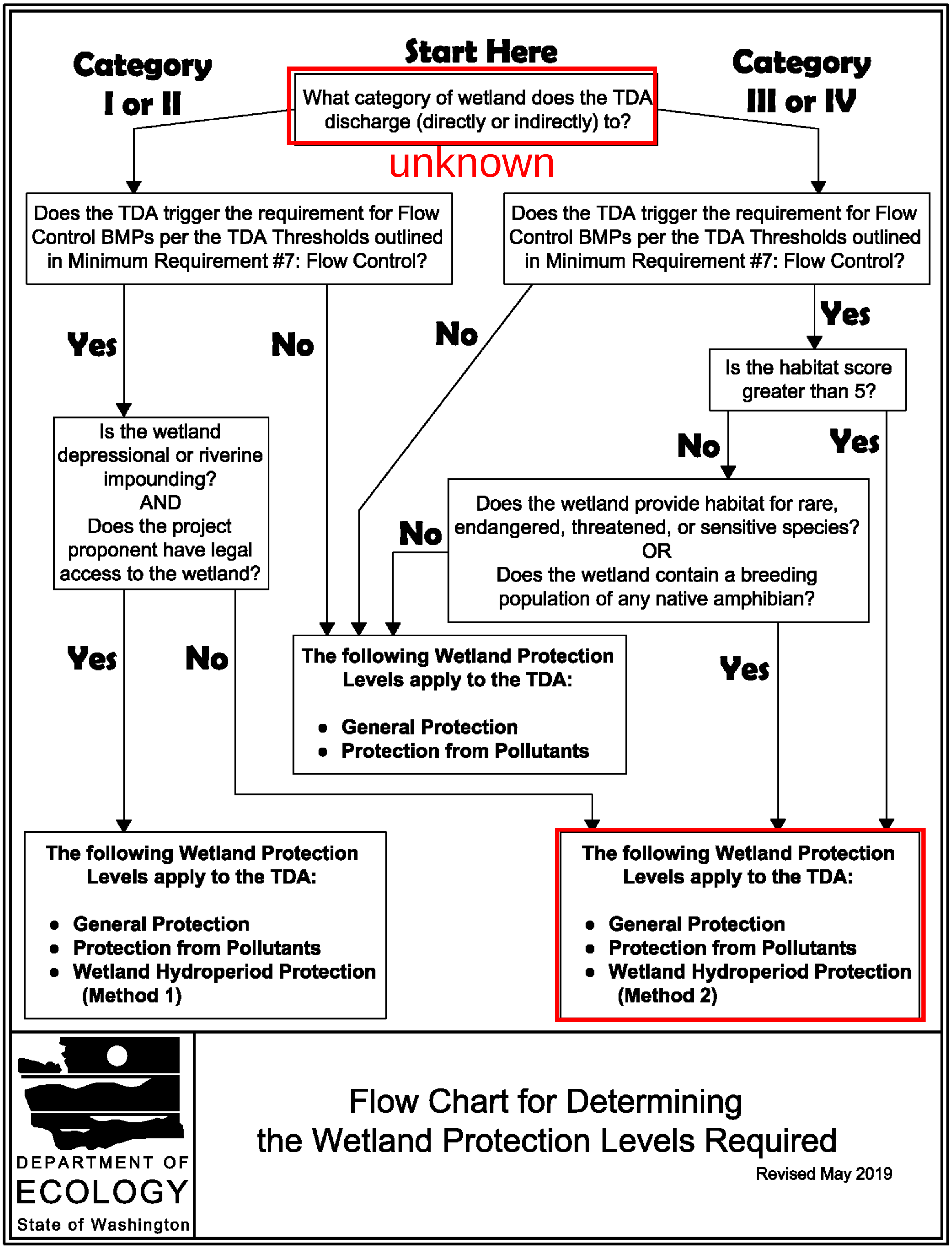


Figure I-3.5: Flow Chart for Determining Wetland Protection Level Requirements

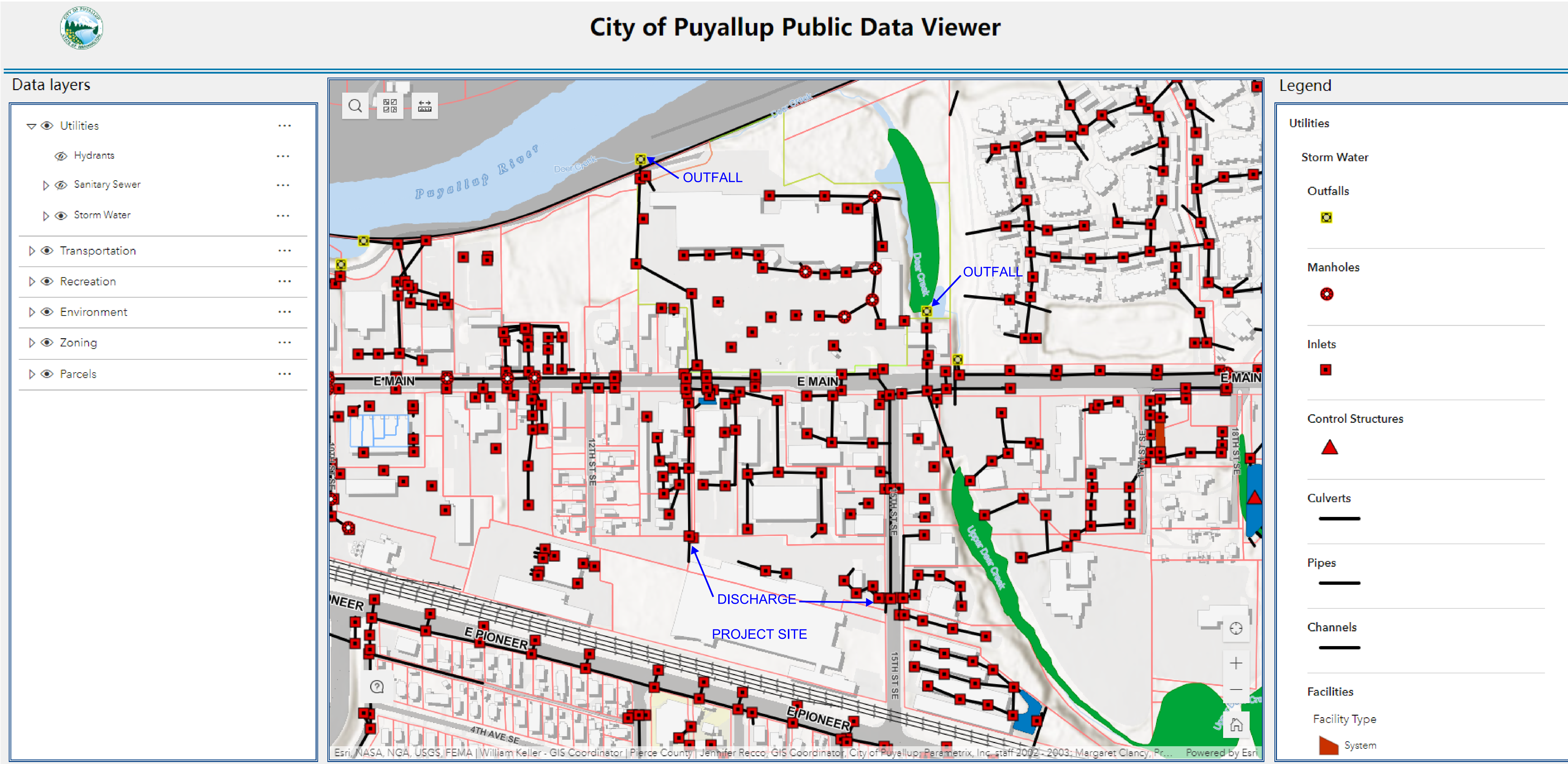


Tab 3.0

3.0 OFF-SITE ANALYSIS

The project site drains to existing stormwater catch basins and piping, which discharge into the public stormwater systems in East Main Street and 15th Street SE, ultimately discharging to Deer Creek near the Puyallup River. The outfall from the 15th Street SE system is location within an area classified as wetland per City of Puyallup GIS. See Figure 6. We are not aware of any known drainage issues with the existing downstream drainage systems.

Figure 6
Downstream Drainage Map


City of Puyallup Public Data Viewer
Data layers
Utilities
Hydrants
Sanitary Sewer
Storm Water
Transportation
Recreation
Environment
Zoning
Parcels
Puyallup River
OUTFALL
OUTFALL
E MAIN
E MAIN
E MAIN
DISCHARGE
PROJECT SITE
E PIONEER
E PIONEER
12TH ST SE
15TH ST SE
4TH AVE SE
Esri, NASA, NGA, USGS, FEMA | William Keller - GIS Coordinator | Pierce County | Jennifer Recco, GIS Coordinator, City of Puyallup; Parametrix, Inc. staff 2002 - 2003; Margaret Clancy, Pr... Powered by Esri
Legend
Utilities
Storm Water
Outfalls
Manholes
Inlets
Control Structures
Culverts
Pipes
Channels
Facilities
Facility Type
System

Tab 4.0

Provide sizing calculations for both the west and east temporary sediment ponds. Also include calculation for the principal spillway, emergency overflow spillway, and dewatering orifice. [drainage report, pg 26]

4.0 FLOW CONTROL AND WATER QUALITY FACILITY ANALYSIS AND DESIGN

4.1 Existing Site Hydrology

For the purpose of flow control modeling, the predeveloped site condition for the west portion of the site (5.09 acres) is assumed to be forested. The meet the wetland protection guidelines, the eastern portion of the site (2.75 acres) is modeled as the current conditions which is mostly impervious. In accordance with soil characteristics described in the geotechnical report prepared for this project, existing site soils are modeled as Type C. The total area of the predeveloped basin is 7.84 acres. See Figure 7.

Basin ID	Existing Basin Area	
West Basin	5.09 ac	Forested
East Basin	2.75 acres	0.43 ac lawn 2.32 ac impervious

4.2 Developed Site Hydrology

The proposed development will convey runoff from the west portion of the site (5.31 acres) to the proposed detention vault using the proposed catch basins and gravity conveyance piping. The eastern portion of the site (2.52 acres) will discharge through a water quality unit prior to discharge. The pervious surface is modeled as pasture in accordance with BMP T5.13.

Basin ID	Basin Area	
West Basin	5.31 ac	4.59 ac impervious 0.72 ac pasture
East Basin	2.52 acres	2.10 ac impervious 0.42 ac pasture

4.3 Flow Control System

In accordance with the Manual the duration matching requirement that must be satisfied for flow control is: Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The proposed detention vault has been modeled using WWHM, a DOE approved continuous rainfall runoff modeling program, to ensure that this requirement is met. See Figure 7 for modeling inputs and outputs. The discharge to the wetland requires flows to match existing/current conditions. Flow control is not necessary for the discharge to the wetland in order to match existing flows.

4.4 Water Quality System

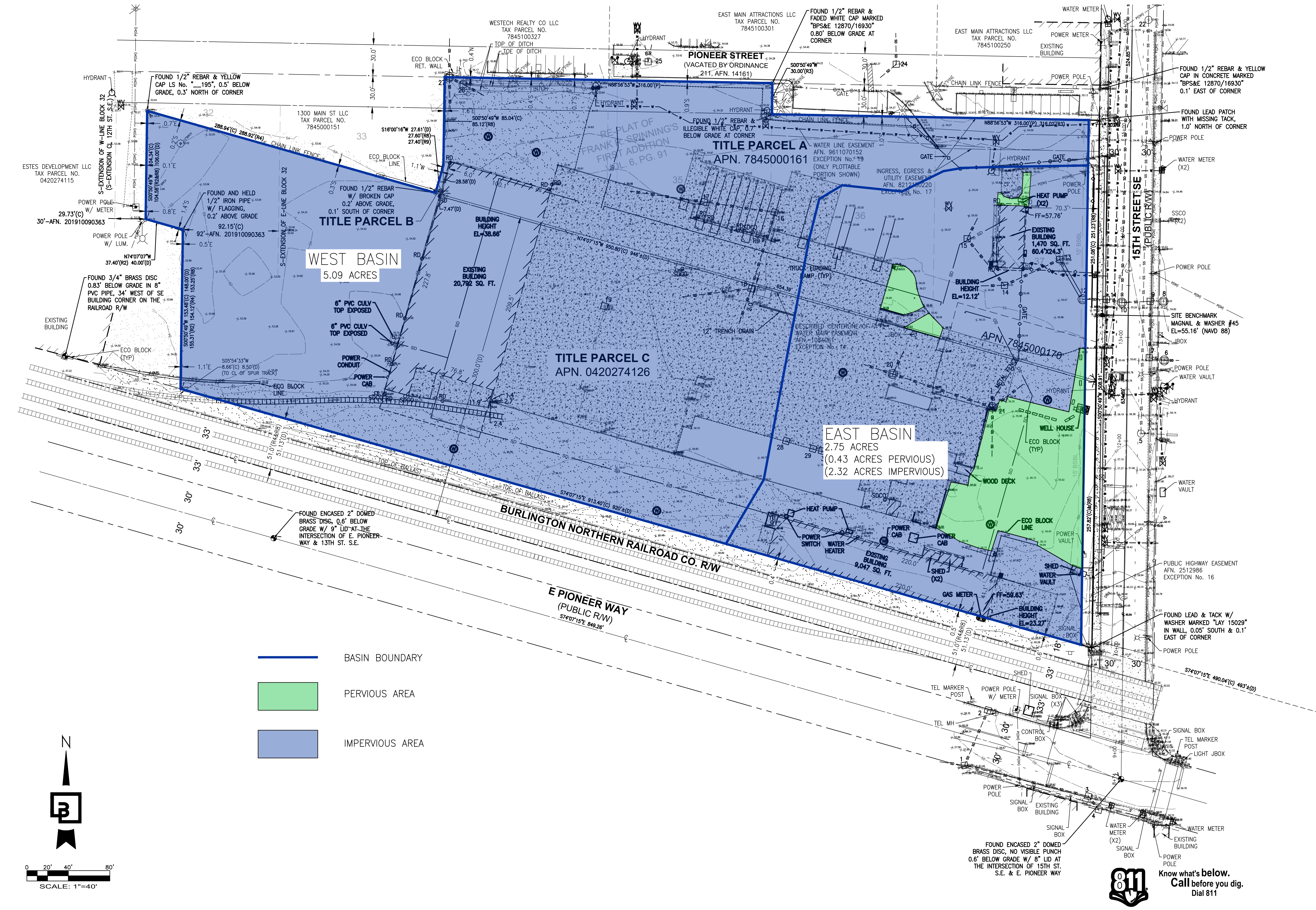
For commercial development, enhanced water quality treatment is required. OldCastle Bipods are proposed to provide the required treatment. These units have received a General Use Level Designation (GULD) approval from the DOE. Sizing is provided in Figure 9.

4.5 Wetland Protection

The discharge to Deer Creek for the eastern basin is shown as a wetland per the Puyallup critical areas map. It is assumed that the wetland requires General Protection, Protection from Pollutants and Wetland Hydroperiod Protection (Method 2). The discharge from the east basin will be discharged through a enhanced treatment water quality unit prior to discharge to protect the wetland from pollutants. The basin to the wetland was sized to match the existing conditions of the site, which is mostly impervious. Per I-3.4.8 MR8: Wetlands Protection from the DOE Stormwater Management Manual for Western Washington, when the flow control and wetlands protections requirements cannot bot be met, the wetlands protection is the overriding concern. In order to match current discharge conditions to the wetland, flow control matching forested conditions is not possible or flows to the wetland would be overly reduced. See East Basin - Wetland recharge in Figure 8 to see flow durations are being matched for the basin that flows to the wetland.

Figure 7
Flow Control
Calculations

EXISTING CONDITION BASIN MAP EXHIBIT



Title: EXISTING CONDITION BASIN MAP EXHIBIT

FORTRESS - PUYALLUP

For: FORTRESS INVESTMENT GROUP
11611 SAN VICENTE BLVD
10TH FLOOR
LOS ANGELES, CA 90049

No.	Date	By	Ckd.	Appr.	Revision

Scale: Horizontal 1"=40' Vertical N/A

Designed VMS
Drawn VMS
Checked KEH
Approved KEH
Date 10/04/22

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Job Number 22085

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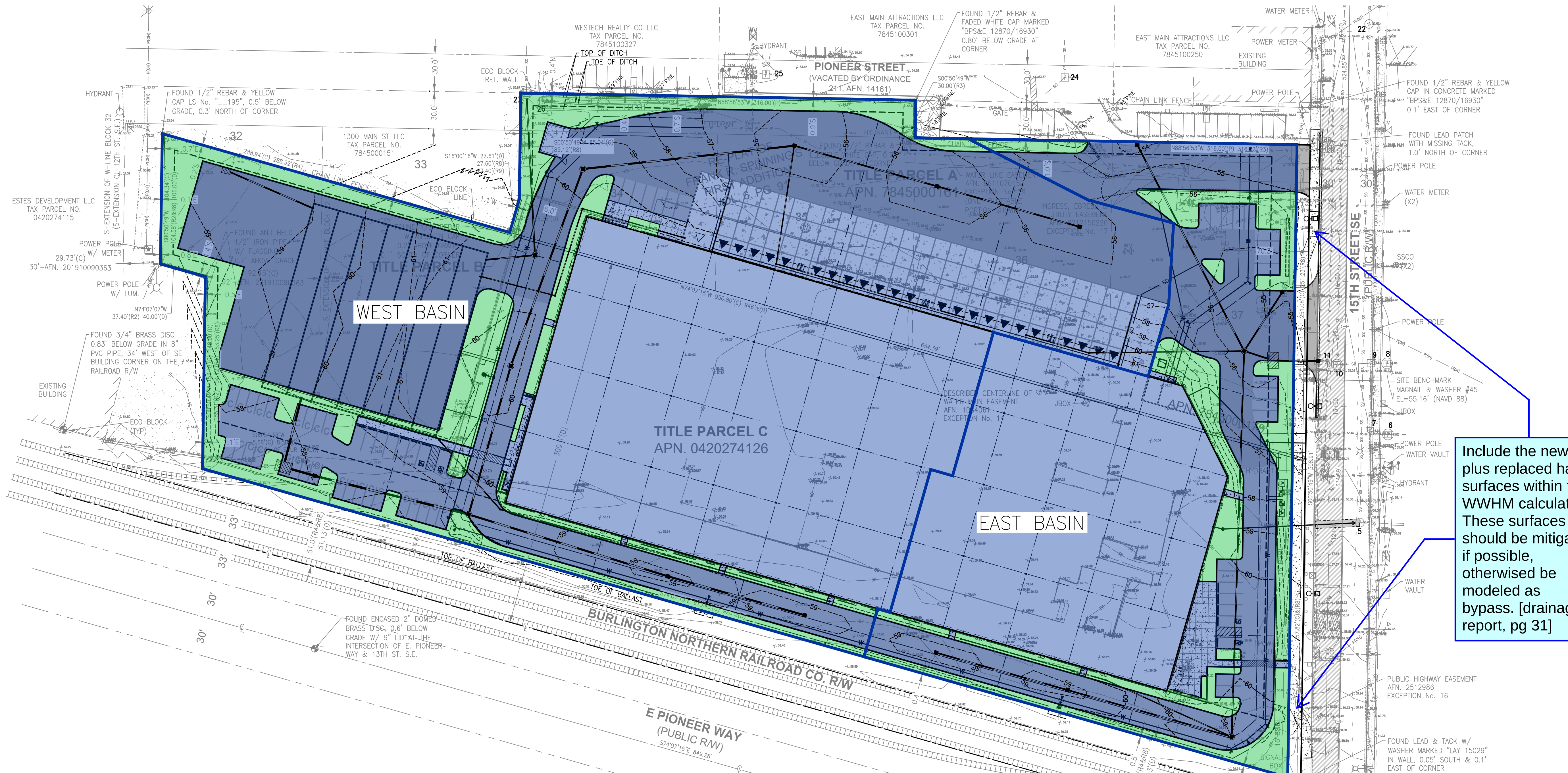
PROPOSED CONDITION BASIN MAP EXHIBIT



Include the new plus replaced hard surfaces within the WWHM calculation. These surfaces should be mitigated if possible, otherwise be modeled as bypass. [drainage report, pg 31]

BASIN BOUNDARY

PERVIOUS AREA

IMPERVIOUS AREA

SURFACE COVERAGE	WEST BASIN ACREAGE	EAST BASIN ACREAGE
TOTAL AREA	5.31	2.52
IMPERVIOUS AREA	4.59	2.10
PERVIOUS AREA	0.72	0.42

Know what's below. Call before you dig. Dial 811

Title: PROPOSED CONDITION BASIN MAP EXHIBIT

FORTRESS - PUYALLUP

For: CREF3 PUYALLUP OWNER LLC
11611 SAN VICENTE BLVD
10TH FLOOR
LOS ANGELES, CA 90049

Scale: Horizontal 1"=40' Vertical N/A

Designed VMS
Drawn VMS
Checked KEH
Approved KEH
Date 10/04/22

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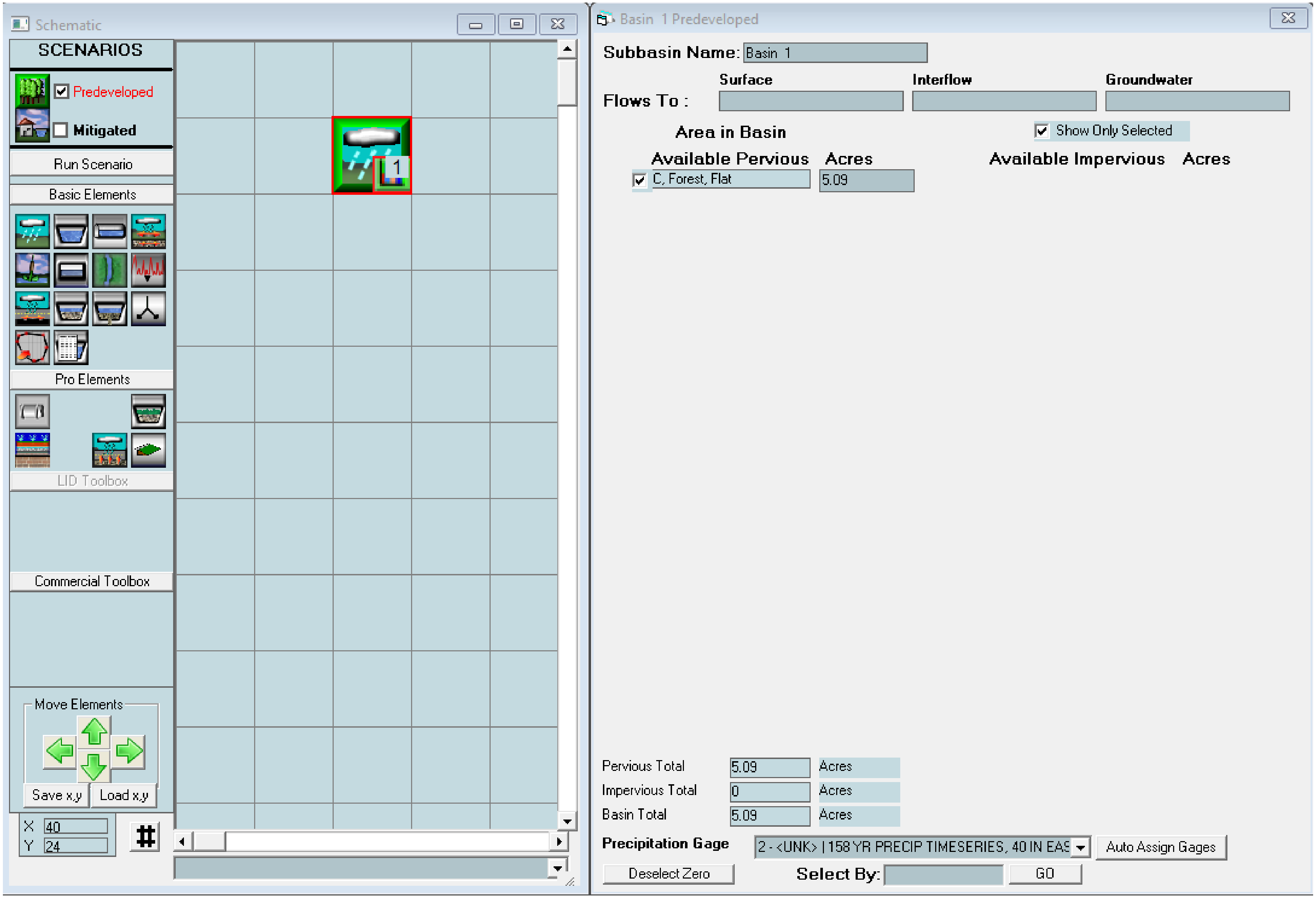
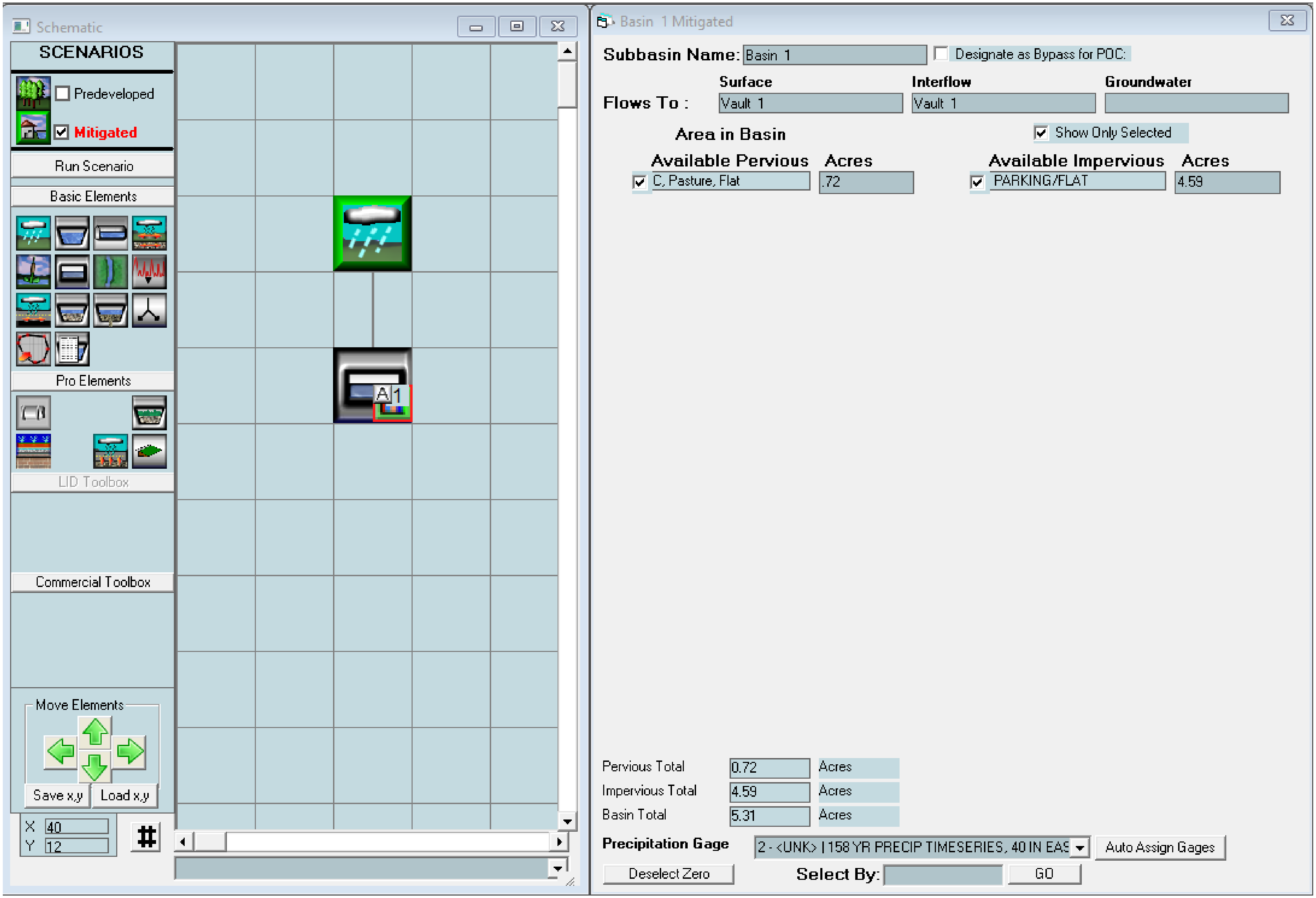
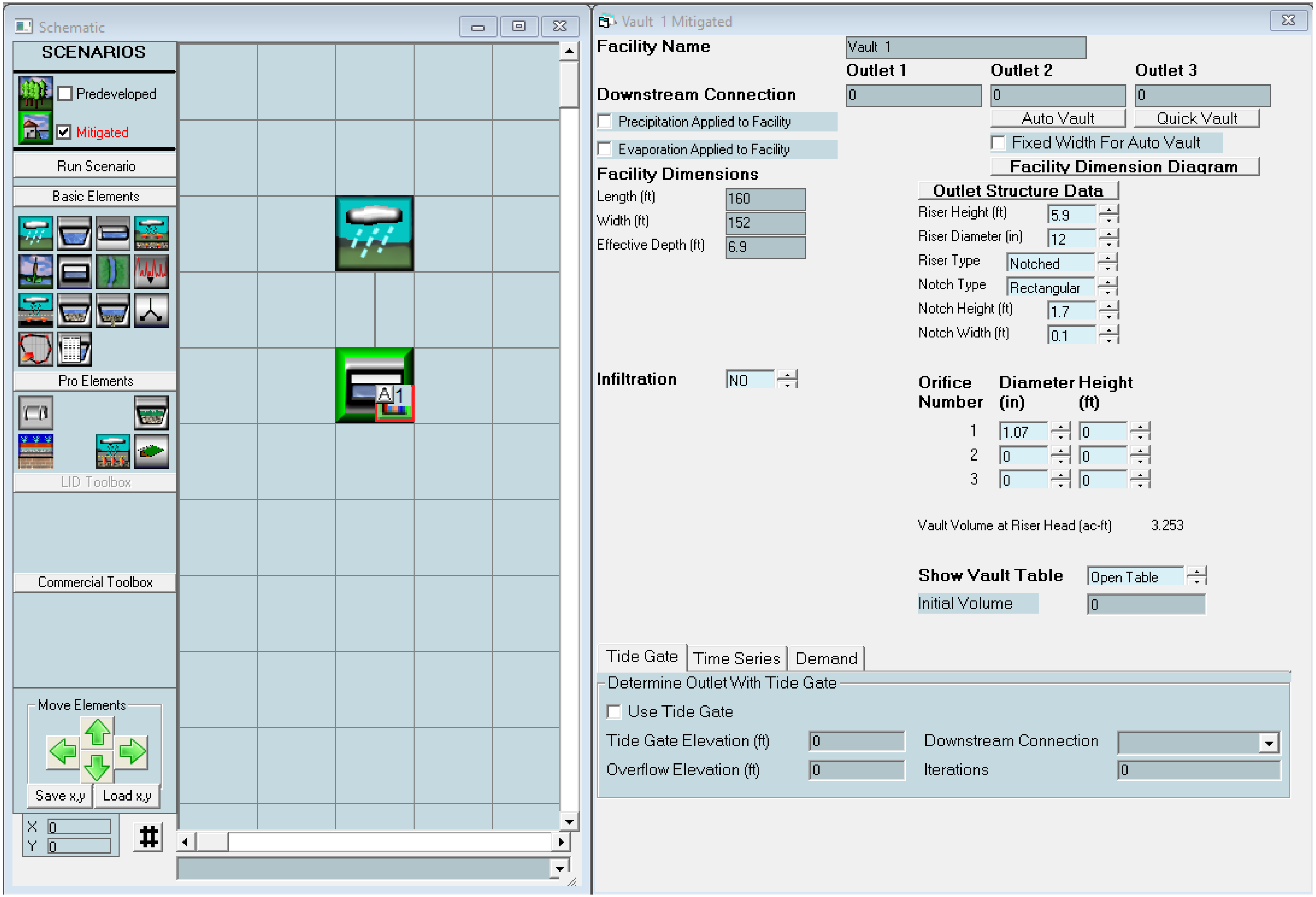
West Basin -Predeveloped Conditions



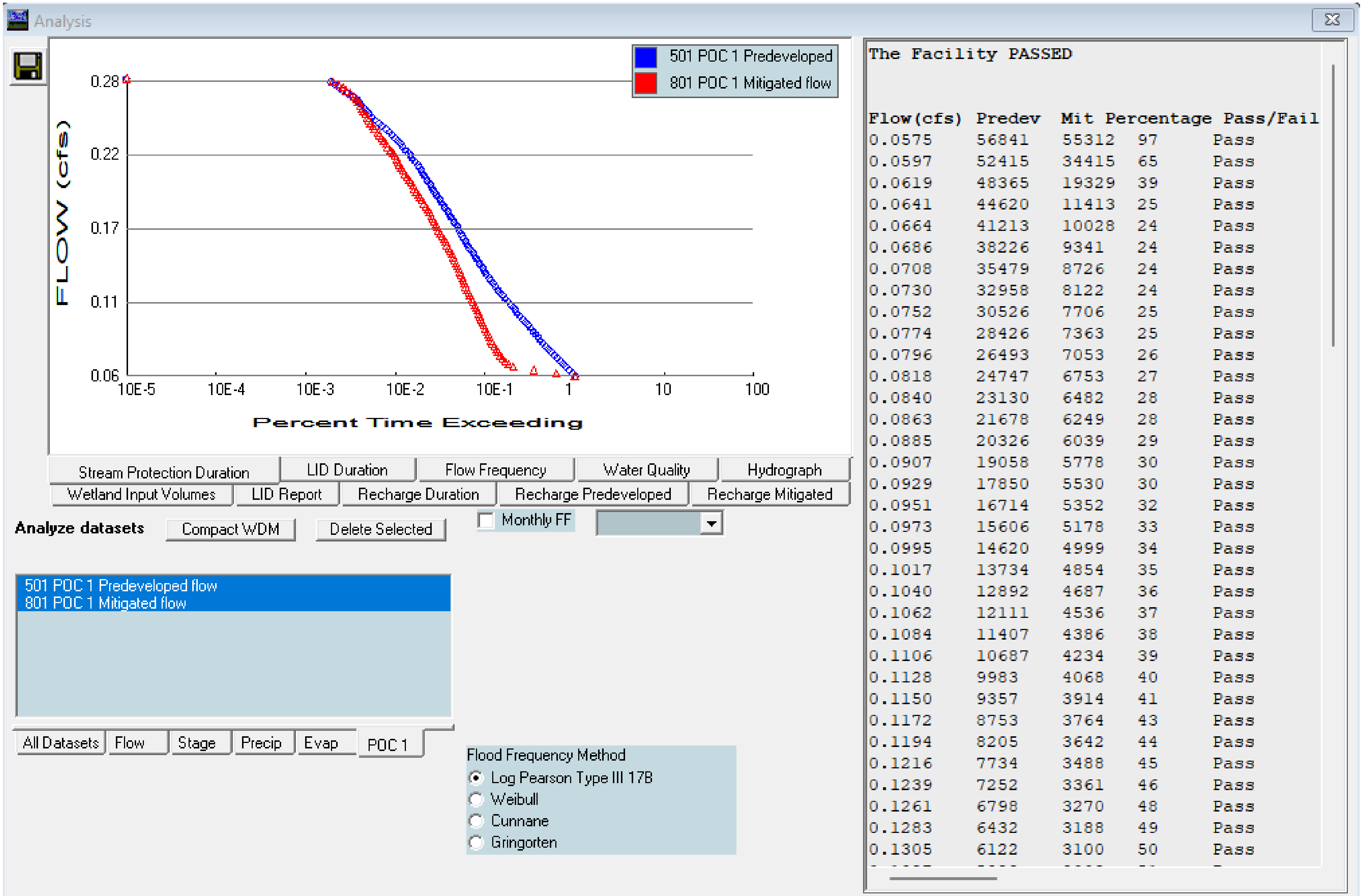
West Basin -Proposed Conditions



West Basin -Detention Vault

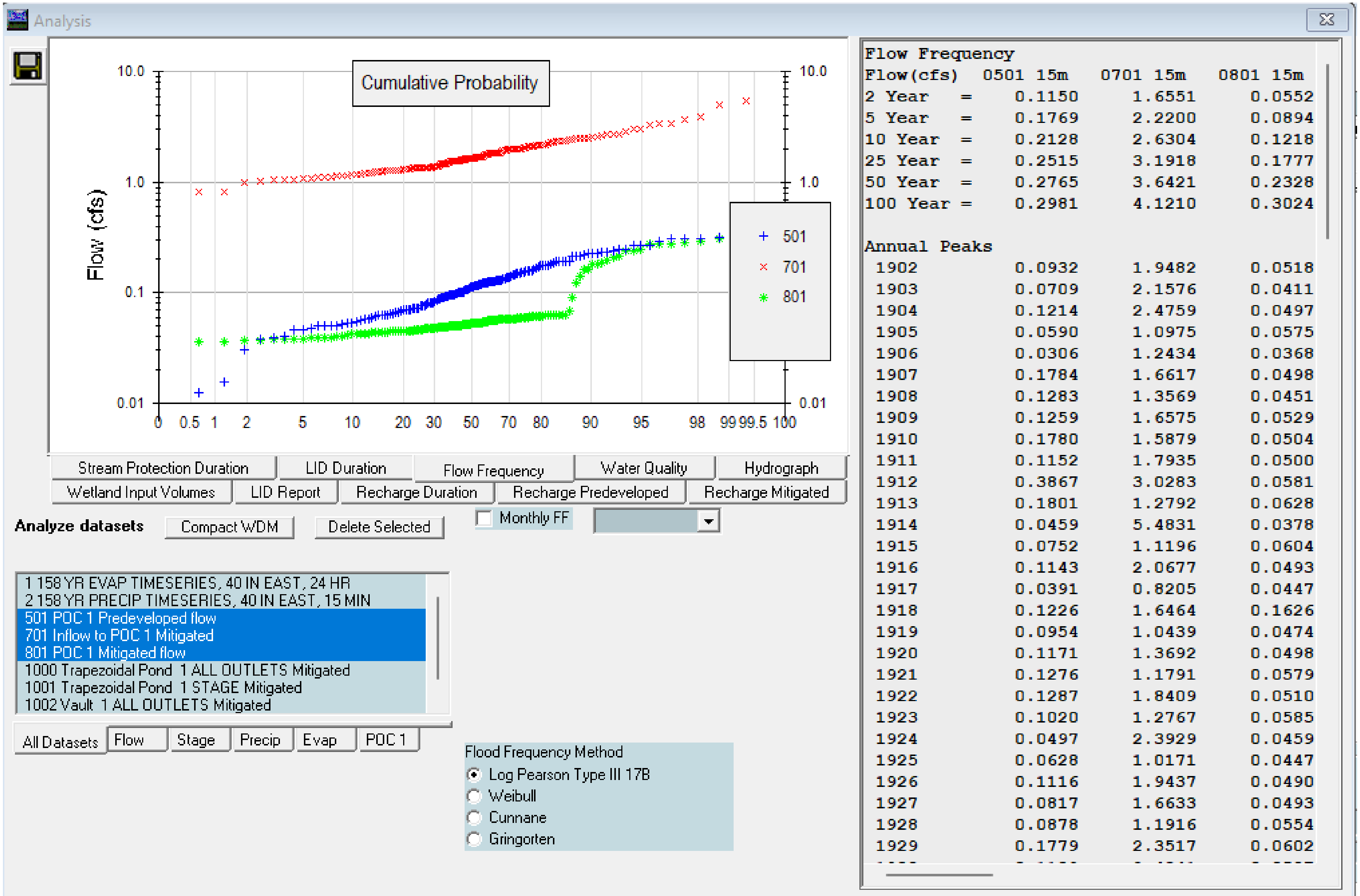


West Basin -Flow Duration



Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0575	56841	55312	97	Pass
0.0597	52415	34415	65	Pass
0.0619	48365	19329	39	Pass
0.0641	44620	11413	25	Pass
0.0664	41213	10028	24	Pass
0.0686	38226	9341	24	Pass
0.0708	35479	8726	24	Pass
0.0730	32958	8122	24	Pass
0.0752	30526	7706	25	Pass
0.0774	28426	7363	25	Pass
0.0796	26493	7053	26	Pass
0.0818	24747	6753	27	Pass
0.0840	23130	6482	28	Pass
0.0863	21678	6249	28	Pass
0.0885	20326	6039	29	Pass
0.0907	19058	5778	30	Pass
0.0929	17850	5530	30	Pass
0.0951	16714	5352	32	Pass
0.0973	15606	5178	33	Pass
0.0995	14620	4999	34	Pass
0.1017	13734	4854	35	Pass
0.1040	12892	4687	36	Pass
0.1062	12111	4536	37	Pass
0.1084	11407	4386	38	Pass
0.1106	10687	4234	39	Pass
0.1128	9983	4068	40	Pass
0.1150	9357	3914	41	Pass
0.1172	8753	3764	43	Pass
0.1194	8205	3642	44	Pass
0.1216	7734	3488	45	Pass
0.1239	7252	3361	46	Pass
0.1261	6798	3270	48	Pass
0.1283	6432	3188	49	Pass
0.1305	6122	3100	50	Pass

West Basin -Flows



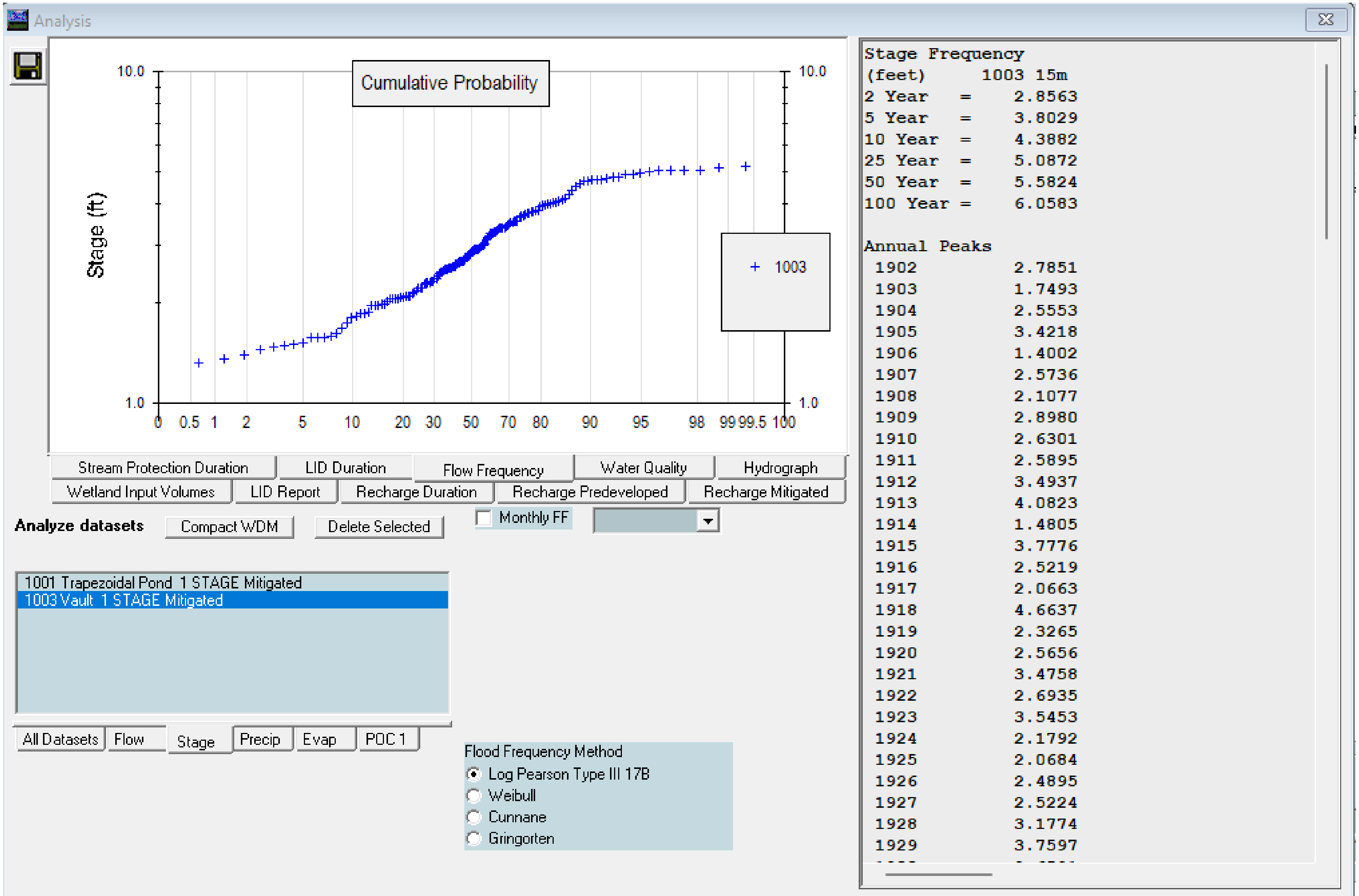
Flow Frequency

Flow(cfs)	0501 15m	0701 15m	0801 15m
2 Year =	0.1150	1.6551	0.0552
5 Year =	0.1769	2.2200	0.0894
10 Year =	0.2128	2.6304	0.1218
25 Year =	0.2515	3.1918	0.1777
50 Year =	0.2765	3.6421	0.2328
100 Year =	0.2981	4.1210	0.3024

Annual Peaks

1902	0.0932	1.9482	0.0518
1903	0.0709	2.1576	0.0411
1904	0.1214	2.4759	0.0497
1905	0.0590	1.0975	0.0575
1906	0.0306	1.2434	0.0368
1907	0.1784	1.6617	0.0498
1908	0.1283	1.3569	0.0451
1909	0.1259	1.6575	0.0529
1910	0.1780	1.5879	0.0504
1911	0.1152	1.7935	0.0500
1912	0.3867	3.0283	0.0581
1913	0.1801	1.2792	0.0628
1914	0.0459	5.4831	0.0378
1915	0.0752	1.1196	0.0604
1916	0.1143	2.0677	0.0493
1917	0.0391	0.8205	0.0447
1918	0.1226	1.6464	0.1626
1919	0.0954	1.0439	0.0474
1920	0.1171	1.3692	0.0498
1921	0.1276	1.1791	0.0579
1922	0.1287	1.8409	0.0510
1923	0.1020	1.2767	0.0585
1924	0.0497	2.3929	0.0459
1925	0.0628	1.0171	0.0447
1926	0.1116	1.9437	0.0490
1927	0.0817	1.6633	0.0493
1928	0.0878	1.1916	0.0554
1929	0.1779	2.3517	0.0602

West Basin -Detention Vault Stage



WWHM2012

PROJECT REPORT

General Model Information

Project Name:	22085-6 ft live
Site Name:	
Site Address:	
City:	
Report Date:	7/7/2023
Gage:	40 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

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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	5.09
Pervious Total	5.09
Impervious Land Use	acre
Impervious Total	0
Basin Total	5.09

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

A portion of the roof is bypassing treatment. Show this in the WWHM model. [drainage report, pg 41]

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.72
Pervious Total	0.72
Impervious Land Use	acre
PARKING FLAT	4.59
Impervious Total	4.59
Basin Total	5.31

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Routing Elements

Predeveloped Routing

Mitigated Routing

Vault 1

Width:	152 ft.
Length:	160 ft.
Depth:	6.9 ft.
Discharge Structure	
Riser Height:	5.9 ft.
Riser Diameter:	12 in.
Notch Type:	Rectangular
Notch Width:	0.100 ft.
Notch Height:	1.700 ft.
Orifice 1 Diameter:	1.07 in. Elevation:0 ft.
Element Flows To:	
Outlet 1	Outlet 2

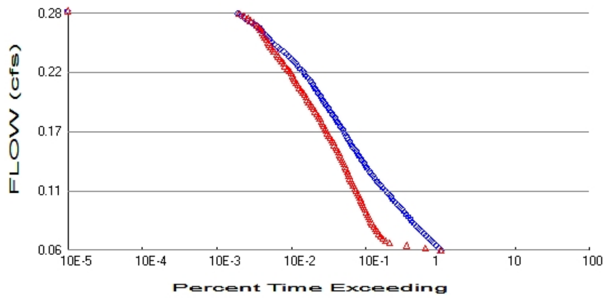
Vault Hydraulic Table

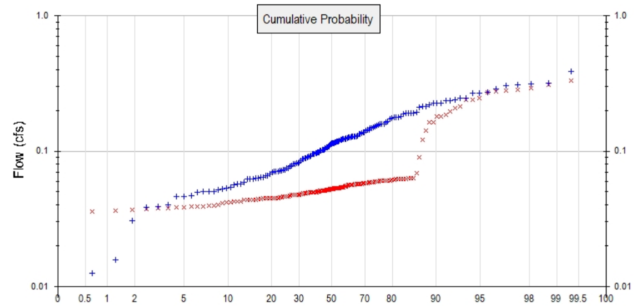
Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.558	0.000	0.000	0.000
0.0767	0.558	0.042	0.008	0.000
0.1533	0.558	0.085	0.012	0.000
0.2300	0.558	0.128	0.014	0.000
0.3067	0.558	0.171	0.017	0.000
0.3833	0.558	0.214	0.019	0.000
0.4600	0.558	0.256	0.021	0.000
0.5367	0.558	0.299	0.022	0.000
0.6133	0.558	0.342	0.024	0.000
0.6900	0.558	0.385	0.025	0.000
0.7667	0.558	0.428	0.027	0.000
0.8433	0.558	0.470	0.028	0.000
0.9200	0.558	0.513	0.029	0.000
0.9967	0.558	0.556	0.031	0.000
1.0733	0.558	0.599	0.032	0.000
1.1500	0.558	0.642	0.033	0.000
1.2267	0.558	0.684	0.034	0.000
1.3033	0.558	0.727	0.035	0.000
1.3800	0.558	0.770	0.036	0.000
1.4567	0.558	0.813	0.037	0.000
1.5333	0.558	0.856	0.038	0.000
1.6100	0.558	0.898	0.039	0.000
1.6867	0.558	0.941	0.040	0.000
1.7633	0.558	0.984	0.041	0.000
1.8400	0.558	1.027	0.042	0.000
1.9167	0.558	1.070	0.043	0.000
1.9933	0.558	1.112	0.043	0.000
2.0700	0.558	1.155	0.044	0.000
2.1467	0.558	1.198	0.045	0.000
2.2233	0.558	1.241	0.046	0.000
2.3000	0.558	1.284	0.047	0.000
2.3767	0.558	1.326	0.047	0.000
2.4533	0.558	1.369	0.048	0.000
2.5300	0.558	1.412	0.049	0.000
2.6067	0.558	1.455	0.050	0.000
2.6833	0.558	1.498	0.050	0.000
2.7600	0.558	1.540	0.051	0.000

2.8367	0.558	1.583	0.052	0.000
2.9133	0.558	1.626	0.053	0.000
2.9900	0.558	1.669	0.053	0.000
3.0667	0.558	1.712	0.054	0.000
3.1433	0.558	1.755	0.055	0.000
3.2200	0.558	1.797	0.055	0.000
3.2967	0.558	1.840	0.056	0.000
3.3733	0.558	1.883	0.057	0.000
3.4500	0.558	1.926	0.057	0.000
3.5267	0.558	1.969	0.058	0.000
3.6033	0.558	2.011	0.059	0.000
3.6800	0.558	2.054	0.059	0.000
3.7567	0.558	2.097	0.060	0.000
3.8333	0.558	2.140	0.060	0.000
3.9100	0.558	2.183	0.061	0.000
3.9867	0.558	2.225	0.062	0.000
4.0633	0.558	2.268	0.062	0.000
4.1400	0.558	2.311	0.063	0.000
4.2167	0.558	2.354	0.064	0.000
4.2933	0.558	2.397	0.073	0.000
4.3700	0.558	2.439	0.087	0.000
4.4467	0.558	2.482	0.104	0.000
4.5233	0.558	2.525	0.123	0.000
4.6000	0.558	2.568	0.144	0.000
4.6767	0.558	2.611	0.166	0.000
4.7533	0.558	2.653	0.189	0.000
4.8300	0.558	2.696	0.213	0.000
4.9067	0.558	2.739	0.238	0.000
4.9833	0.558	2.782	0.264	0.000
5.0600	0.558	2.825	0.289	0.000
5.1367	0.558	2.867	0.315	0.000
5.2133	0.558	2.910	0.342	0.000
5.2900	0.558	2.953	0.374	0.000
5.3667	0.558	2.996	0.407	0.000
5.4433	0.558	3.039	0.441	0.000
5.5200	0.558	3.081	0.477	0.000
5.5967	0.558	3.124	0.513	0.000
5.6733	0.558	3.167	0.703	0.000
5.7500	0.558	3.210	0.753	0.000
5.8267	0.558	3.253	0.804	0.000
5.9033	0.558	3.295	0.857	0.000
5.9800	0.558	3.338	1.094	0.000
6.0567	0.558	3.381	1.499	0.000
6.1333	0.558	3.424	1.971	0.000
6.2100	0.558	3.467	2.420	0.000
6.2867	0.558	3.509	2.770	0.000
6.3633	0.558	3.552	2.989	0.000
6.4400	0.558	3.595	3.172	0.000
6.5167	0.558	3.638	3.332	0.000
6.5933	0.558	3.681	3.481	0.000
6.6700	0.558	3.723	3.623	0.000
6.7467	0.558	3.766	3.758	0.000
6.8233	0.558	3.809	3.887	0.000
6.9000	0.558	3.852	4.010	0.000
6.9767	0.558	3.387	4.129	0.000

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 5.09
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.72
Total Impervious Area: 4.59

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.115006
5 year	0.176949
10 year	0.212753
25 year	0.251534
50 year	0.276481
100 year	0.298127

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.0552
5 year	0.089355
10 year	0.121841
25 year	0.177703
50 year	0.232848
100 year	0.302375

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.093	0.052
1903	0.071	0.041
1904	0.121	0.050
1905	0.059	0.057
1906	0.031	0.037
1907	0.178	0.050
1908	0.128	0.045
1909	0.126	0.053
1910	0.178	0.050
1911	0.115	0.050

1912	0.387	0.058
1913	0.180	0.063
1914	0.046	0.038
1915	0.075	0.060
1916	0.114	0.049
1917	0.039	0.045
1918	0.123	0.163
1919	0.095	0.047
1920	0.117	0.050
1921	0.128	0.058
1922	0.129	0.051
1923	0.102	0.058
1924	0.050	0.046
1925	0.063	0.045
1926	0.112	0.049
1927	0.082	0.049
1928	0.088	0.055
1929	0.178	0.060
1930	0.114	0.051
1931	0.108	0.053
1932	0.083	0.057
1933	0.092	0.053
1934	0.234	0.330
1935	0.108	0.090
1936	0.097	0.057
1937	0.156	0.050
1938	0.096	0.051
1939	0.008	0.036
1940	0.105	0.058
1941	0.064	0.039
1942	0.158	0.197
1943	0.080	0.053
1944	0.165	0.060
1945	0.127	0.053
1946	0.075	0.043
1947	0.053	0.045
1948	0.245	0.052
1949	0.213	0.063
1950	0.062	0.046
1951	0.080	0.045
1952	0.317	0.062
1953	0.288	0.164
1954	0.102	0.055
1955	0.089	0.042
1956	0.047	0.042
1957	0.152	0.060
1958	0.306	0.311
1959	0.191	0.276
1960	0.056	0.039
1961	0.192	0.181
1962	0.104	0.056
1963	0.051	0.038
1964	0.053	0.045
1965	0.215	0.286
1966	0.063	0.047
1967	0.096	0.044
1968	0.101	0.056
1969	0.096	0.051

1970	0.148	0.052
1971	0.227	0.121
1972	0.149	0.055
1973	0.193	0.062
1974	0.106	0.050
1975	0.240	0.274
1976	0.129	0.054
1977	0.057	0.037
1978	0.211	0.214
1979	0.062	0.047
1980	0.123	0.051
1981	0.113	0.054
1982	0.054	0.039
1983	0.192	0.058
1984	0.087	0.047
1985	0.137	0.047
1986	0.115	0.056
1987	0.219	0.142
1988	0.137	0.062
1989	0.126	0.048
1990	0.144	0.051
1991	0.115	0.056
1992	0.150	0.180
1993	0.155	0.052
1994	0.227	0.055
1995	0.052	0.048
1996	0.248	0.241
1997	0.102	0.044
1998	0.123	0.049
1999	0.012	0.044
2000	0.091	0.057
2001	0.050	0.036
2002	0.164	0.052
2003	0.141	0.054
2004	0.125	0.053
2005	0.228	0.056
2006	0.073	0.049
2007	0.077	0.053
2008	0.122	0.051
2009	0.081	0.048
2010	0.071	0.058
2011	0.064	0.045
2012	0.096	0.049
2013	0.072	0.038
2014	0.050	0.039
2015	0.098	0.046
2016	0.040	0.045
2017	0.175	0.061
2018	0.312	0.291
2019	0.308	0.278
2020	0.097	0.045
2021	0.159	0.069
2022	0.066	0.045
2023	0.133	0.057
2024	0.267	0.051
2025	0.119	0.053
2026	0.190	0.061
2027	0.072	0.046

2028	0.062	0.038
2029	0.129	0.062
2030	0.236	0.060
2031	0.078	0.042
2032	0.046	0.040
2033	0.071	0.042
2034	0.069	0.046
2035	0.269	0.240
2036	0.143	0.057
2037	0.038	0.043
2038	0.118	0.060
2039	0.016	0.031
2040	0.067	0.047
2041	0.090	0.044
2042	0.271	0.186
2043	0.130	0.062
2044	0.173	0.062
2045	0.117	0.059
2046	0.136	0.246
2047	0.100	0.058
2048	0.133	0.050
2049	0.119	0.054
2050	0.085	0.049
2051	0.121	0.053
2052	0.072	0.053
2053	0.127	0.208
2054	0.158	0.061
2055	0.065	0.040
2056	0.057	0.044
2057	0.089	0.056
2058	0.106	0.059
2059	0.187	0.063

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.3867	0.3301
2	0.3168	0.3106
3	0.3121	0.2905
4	0.3085	0.2856
5	0.3060	0.2782
6	0.2876	0.2758
7	0.2713	0.2736
8	0.2685	0.2459
9	0.2672	0.2410
10	0.2480	0.2402
11	0.2448	0.2143
12	0.2405	0.2078
13	0.2357	0.1971
14	0.2345	0.1859
15	0.2277	0.1810
16	0.2271	0.1802
17	0.2265	0.1638
18	0.2191	0.1626
19	0.2150	0.1419
20	0.2128	0.1211
21	0.2113	0.0900
22	0.1928	0.0688

23	0.1917	0.0632
24	0.1916	0.0628
25	0.1913	0.0628
26	0.1898	0.0625
27	0.1872	0.0623
28	0.1801	0.0621
29	0.1784	0.0621
30	0.1780	0.0619
31	0.1779	0.0617
32	0.1745	0.0614
33	0.1729	0.0607
34	0.1653	0.0607
35	0.1639	0.0604
36	0.1590	0.0604
37	0.1585	0.0602
38	0.1583	0.0601
39	0.1555	0.0598
40	0.1546	0.0597
41	0.1523	0.0594
42	0.1498	0.0592
43	0.1488	0.0585
44	0.1479	0.0584
45	0.1437	0.0584
46	0.1430	0.0581
47	0.1411	0.0581
48	0.1371	0.0579
49	0.1369	0.0577
50	0.1356	0.0575
51	0.1333	0.0572
52	0.1330	0.0572
53	0.1298	0.0571
54	0.1288	0.0571
55	0.1287	0.0569
56	0.1285	0.0565
57	0.1283	0.0563
58	0.1276	0.0562
59	0.1273	0.0561
60	0.1271	0.0561
61	0.1259	0.0560
62	0.1256	0.0555
63	0.1247	0.0554
64	0.1232	0.0551
65	0.1226	0.0546
66	0.1226	0.0541
67	0.1225	0.0538
68	0.1214	0.0538
69	0.1214	0.0538
70	0.1192	0.0534
71	0.1187	0.0533
72	0.1181	0.0530
73	0.1171	0.0529
74	0.1165	0.0529
75	0.1155	0.0529
76	0.1152	0.0529
77	0.1147	0.0527
78	0.1143	0.0526
79	0.1139	0.0526
80	0.1125	0.0524

81	0.1116	0.0521
82	0.1084	0.0518
83	0.1080	0.0518
84	0.1063	0.0516
85	0.1062	0.0514
86	0.1053	0.0511
87	0.1039	0.0510
88	0.1021	0.0509
89	0.1020	0.0509
90	0.1016	0.0508
91	0.1012	0.0507
92	0.1004	0.0507
93	0.0980	0.0504
94	0.0974	0.0504
95	0.0974	0.0500
96	0.0963	0.0499
97	0.0963	0.0498
98	0.0958	0.0498
99	0.0957	0.0497
100	0.0954	0.0496
101	0.0932	0.0495
102	0.0917	0.0493
103	0.0915	0.0493
104	0.0900	0.0491
105	0.0893	0.0490
106	0.0891	0.0489
107	0.0878	0.0487
108	0.0870	0.0482
109	0.0849	0.0479
110	0.0827	0.0477
111	0.0817	0.0474
112	0.0811	0.0474
113	0.0801	0.0473
114	0.0801	0.0473
115	0.0778	0.0472
116	0.0766	0.0470
117	0.0752	0.0464
118	0.0752	0.0463
119	0.0725	0.0462
120	0.0723	0.0459
121	0.0721	0.0456
122	0.0719	0.0455
123	0.0709	0.0451
124	0.0709	0.0451
125	0.0706	0.0450
126	0.0693	0.0449
127	0.0675	0.0448
128	0.0656	0.0447
129	0.0655	0.0447
130	0.0642	0.0446
131	0.0639	0.0445
132	0.0628	0.0442
133	0.0628	0.0438
134	0.0623	0.0438
135	0.0621	0.0437
136	0.0618	0.0437
137	0.0590	0.0435
138	0.0573	0.0427

139	0.0569	0.0424
140	0.0562	0.0423
141	0.0539	0.0420
142	0.0530	0.0419
143	0.0525	0.0411
144	0.0517	0.0403
145	0.0506	0.0396
146	0.0501	0.0393
147	0.0499	0.0391
148	0.0497	0.0390
149	0.0471	0.0389
150	0.0461	0.0382
151	0.0459	0.0382
152	0.0400	0.0379
153	0.0391	0.0378
154	0.0382	0.0374
155	0.0306	0.0368
156	0.0157	0.0363
157	0.0124	0.0357
158	0.0080	0.0313

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0575	56841	55312	97	Pass
0.0597	52415	34415	65	Pass
0.0619	48365	19329	39	Pass
0.0641	44620	11413	25	Pass
0.0664	41213	10028	24	Pass
0.0686	38226	9341	24	Pass
0.0708	35479	8726	24	Pass
0.0730	32958	8122	24	Pass
0.0752	30526	7706	25	Pass
0.0774	28426	7363	25	Pass
0.0796	26493	7053	26	Pass
0.0818	24747	6753	27	Pass
0.0840	23130	6482	28	Pass
0.0863	21678	6249	28	Pass
0.0885	20326	6039	29	Pass
0.0907	19058	5778	30	Pass
0.0929	17850	5530	30	Pass
0.0951	16714	5352	32	Pass
0.0973	15606	5178	33	Pass
0.0995	14620	4999	34	Pass
0.1017	13734	4854	35	Pass
0.1040	12892	4687	36	Pass
0.1062	12111	4536	37	Pass
0.1084	11407	4386	38	Pass
0.1106	10687	4234	39	Pass
0.1128	9983	4068	40	Pass
0.1150	9357	3914	41	Pass
0.1172	8753	3764	43	Pass
0.1194	8205	3642	44	Pass
0.1216	7734	3488	45	Pass
0.1239	7252	3361	46	Pass
0.1261	6798	3270	48	Pass
0.1283	6432	3188	49	Pass
0.1305	6122	3100	50	Pass
0.1327	5828	3009	51	Pass
0.1349	5557	2922	52	Pass
0.1371	5271	2824	53	Pass
0.1393	5009	2715	54	Pass
0.1416	4790	2624	54	Pass
0.1438	4536	2529	55	Pass
0.1460	4345	2441	56	Pass
0.1482	4166	2357	56	Pass
0.1504	3936	2269	57	Pass
0.1526	3713	2189	58	Pass
0.1548	3537	2090	59	Pass
0.1570	3366	2011	59	Pass
0.1593	3231	1923	59	Pass
0.1615	3091	1830	59	Pass
0.1637	2968	1748	58	Pass
0.1659	2853	1677	58	Pass
0.1681	2741	1624	59	Pass
0.1703	2599	1562	60	Pass
0.1725	2477	1499	60	Pass

0.1747	2359	1448	61	Pass
0.1769	2267	1386	61	Pass
0.1792	2160	1323	61	Pass
0.1814	2059	1262	61	Pass
0.1836	1950	1210	62	Pass
0.1858	1840	1150	62	Pass
0.1880	1748	1094	62	Pass
0.1902	1659	1042	62	Pass
0.1924	1579	992	62	Pass
0.1946	1510	945	62	Pass
0.1969	1445	903	62	Pass
0.1991	1368	866	63	Pass
0.2013	1298	830	63	Pass
0.2035	1243	793	63	Pass
0.2057	1182	750	63	Pass
0.2079	1129	696	61	Pass
0.2101	1079	671	62	Pass
0.2123	1026	640	62	Pass
0.2145	980	609	62	Pass
0.2168	925	591	63	Pass
0.2190	872	570	65	Pass
0.2212	819	550	67	Pass
0.2234	772	523	67	Pass
0.2256	717	486	67	Pass
0.2278	668	457	68	Pass
0.2300	629	435	69	Pass
0.2322	588	413	70	Pass
0.2345	549	389	70	Pass
0.2367	507	372	73	Pass
0.2389	475	354	74	Pass
0.2411	429	324	75	Pass
0.2433	392	308	78	Pass
0.2455	363	290	79	Pass
0.2477	329	278	84	Pass
0.2499	300	268	89	Pass
0.2522	281	255	90	Pass
0.2544	264	243	92	Pass
0.2566	248	233	93	Pass
0.2588	233	226	96	Pass
0.2610	219	212	96	Pass
0.2632	205	201	98	Pass
0.2654	186	189	101	Pass
0.2676	162	175	108	Pass
0.2698	143	157	109	Pass
0.2721	130	144	110	Pass
0.2743	117	128	109	Pass
0.2765	106	111	104	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.

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

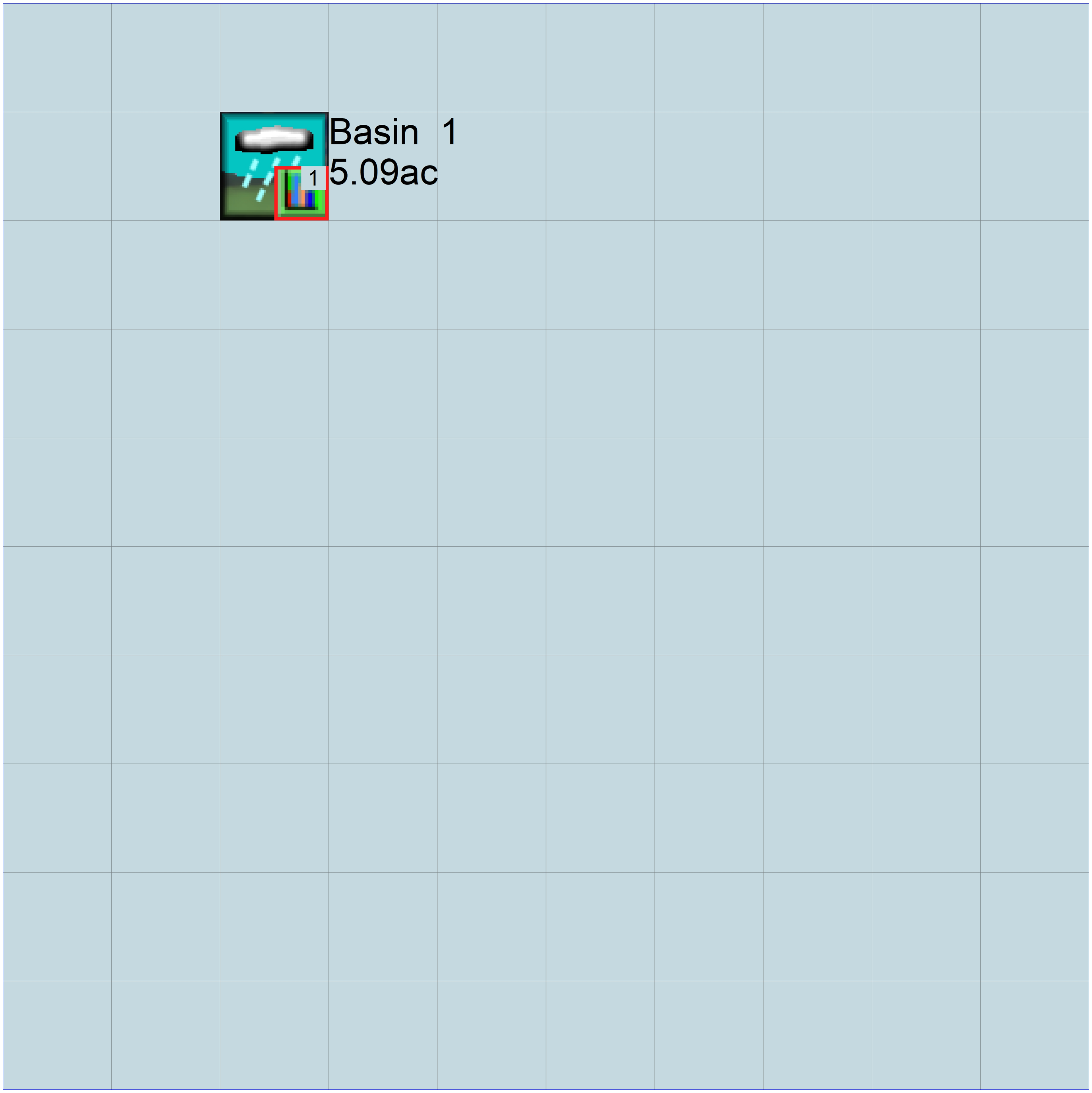
No PERLND changes have been made.

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   22085-6 ft live.wdm
MESSU      25   Pre22085-6 ft live.MES
           27   Pre22085-6 ft live.L61
           28   Pre22085-6 ft live.L62
           30   POC22085-6 ft live1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   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           ***
   10     C, Forest, Flat         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 ***
   10         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  *********
   10         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 ***
   10         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
   10              0       4.5      0.08       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10            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
   10              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#   ***
Basin  1***
PERLND  10                        5.09     COPY   501     12
PERLND  10                        5.09     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   22085-6 ft live.wdm
MESSU      25   Mit22085-6 ft live.MES
           27   Mit22085-6 ft live.L61
           28   Mit22085-6 ft live.L62
           30   POC22085-6 ft live1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      13
      IMPLND      11
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Vault  1                    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           ***
   13     C, Pasture, Flat        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 ***
   13         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  *********
```

```
  13         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 ***
  13         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
  13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  13              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  13            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
  13              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           ***
  11      PARKING/FLAT             1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  11         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  11         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     ***
  11         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  11             400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
```

```
    # -  # ***PETMAX    PETMIN
   11             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   11             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  13                        0.72     RCHRES   1      2
PERLND  13                        0.72     RCHRES   1      3
IMPLND  11                        4.59     RCHRES   1      5

******Routing******
PERLND  13                        0.72     COPY     1     12
IMPLND  11                        4.59     COPY     1     15
PERLND  13                        0.72     COPY     1     13
RCHRES   1                           1     COPY   501     16
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     Vault  1               1    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  0  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      0.03       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  0.0  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
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.558310  0.000000  0.000000
  0.076667  0.558310  0.042804  0.008603
  0.153333  0.558310  0.085608  0.012166
  0.230000  0.558310  0.128411  0.014900
  0.306667  0.558310  0.171215  0.017205
  0.383333  0.558310  0.214019  0.019236
  0.460000  0.558310  0.256823  0.021072
  0.536667  0.558310  0.299627  0.022760
  0.613333  0.558310  0.342430  0.024332
  0.690000  0.558310  0.385234  0.025808
  0.766667  0.558310  0.428038  0.027204
  0.843333  0.558310  0.470842  0.028532
  0.920000  0.558310  0.513646  0.029800
  0.996667  0.558310  0.556449  0.031017
  1.073333  0.558310  0.599253  0.032188
  1.150000  0.558310  0.642057  0.033318
  1.226667  0.558310  0.684861  0.034410
  1.303333  0.558310  0.727665  0.035469
  1.380000  0.558310  0.770468  0.036498
  1.456667  0.558310  0.813272  0.037498
  1.533333  0.558310  0.856076  0.038472
  1.610000  0.558310  0.898880  0.039422
  1.686667  0.558310  0.941684  0.040350
  1.763333  0.558310  0.984487  0.041257
  1.840000  0.558310  1.027291  0.042144
  1.916667  0.558310  1.070095  0.043013
  1.993333  0.558310  1.112899  0.043865
  2.070000  0.558310  1.155702  0.044700
  2.146667  0.558310  1.198506  0.045521
  2.223333  0.558310  1.241310  0.046326
  2.300000  0.558310  1.284114  0.047118
  2.376667  0.558310  1.326918  0.047897
  2.453333  0.558310  1.369721  0.048664
  2.530000  0.558310  1.412525  0.049418
  2.606667  0.558310  1.455329  0.050161
  2.683333  0.558310  1.498133  0.050894
  2.760000  0.558310  1.540937  0.051616
  2.836667  0.558310  1.583740  0.052328
  2.913333  0.558310  1.626544  0.053030
  2.990000  0.558310  1.669348  0.053723
  3.066667  0.558310  1.712152  0.054408
  3.143333  0.558310  1.754956  0.055083
  3.220000  0.558310  1.797759  0.055751
  3.296667  0.558310  1.840563  0.056411
  3.373333  0.558310  1.883367  0.057063
  3.450000  0.558310  1.926171  0.057708
  3.526667  0.558310  1.968975  0.058346
  3.603333  0.558310  2.011778  0.058976
  3.680000  0.558310  2.054582  0.059601
  3.756667  0.558310  2.097386  0.060218
  3.833333  0.558310  2.140190  0.060830
  3.910000  0.558310  2.182994  0.061435
```

```
  3.986667  0.558310  2.225797  0.062034
  4.063333  0.558310  2.268601  0.062628
  4.140000  0.558310  2.311405  0.063216
  4.216667  0.558310  2.354209  0.064513
  4.293333  0.558310  2.397013  0.073694
  4.370000  0.558310  2.439816  0.087495
  4.446667  0.558310  2.482620  0.104298
  4.523333  0.558310  2.525424  0.123342
  4.600000  0.558310  2.568228  0.144139
  4.676667  0.558310  2.611032  0.166330
  4.753333  0.558310  2.653835  0.189633
  4.830000  0.558310  2.696639  0.213816
  4.906667  0.558310  2.739443  0.238681
  4.983333  0.558310  2.782247  0.264055
  5.060000  0.558310  2.825051  0.289786
  5.136667  0.558310  2.867854  0.315736
  5.213333  0.558310  2.910658  0.342685
  5.290000  0.558310  2.953462  0.374620
  5.366667  0.558310  2.996266  0.407677
  5.443333  0.558310  3.039069  0.441818
  5.520000  0.558310  3.081873  0.477008
  5.596667  0.558310  3.124677  0.513218
  5.673333  0.558310  3.167481  0.702981
  5.750000  0.558310  3.210285  0.753208
  5.826667  0.558310  3.253088  0.804676
  5.903333  0.558310  3.295892  0.857107
  5.980000  0.558310  3.338696  1.094825
  6.056667  0.558310  3.381500  1.499909
  6.133333  0.558310  3.424304  1.971555
  6.210000  0.558310  3.467107  2.420936
  6.286667  0.558310  3.509911  2.770446
  6.363333  0.558310  3.552715  2.989223
  6.440000  0.558310  3.595519  3.172915
  6.516667  0.558310  3.638323  3.332233
  6.593333  0.558310  3.681126  3.481944
  6.670000  0.558310  3.723930  3.623604
  6.746667  0.558310  3.766734  3.758391
  6.823333  0.558310  3.809538  3.887219
  6.900000  0.558310  3.852342  4.010817
  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***
RCHRES   1 HYDR   RO     1 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
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
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       16
RCHRES     ROFLOW                          COPY            INPUT  MEAN
  END MASS-LINK   16

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

ERROR/WARNING ID: 238   1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1964/ 9/30 24: 0

RCHRES :   1

```
RELERR       STORS        STOR       MATIN      MATDIF
-0.28075     0.00000  0.0000E+00     0.00000  -6.855E-10
```

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238   1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1966/ 8/31 24: 0

RCHRES :   1

```
RELERR       STORS        STOR       MATIN      MATDIF
-2.065E-01     0.00000  0.0000E+00     0.00000  -1.028E-09
```

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238   1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:

DATE/TIME: 1989/ 8/31 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-7.406E-03	0.00000	0.0000E+00	0.00000	-3.596E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1992/ 8/31 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-1.094E-02	0.00000	0.0000E+00	0.00000	-2.427E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238 1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 2010/ 8/31 24: 0

RCHRES : 1

RELERR	STORS	STOR	MATIN	MATDIF
-1.099E-03	0.00000	0.0000E+00	0.00000	-2.443E-07

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.

REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

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

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

Disclaimer

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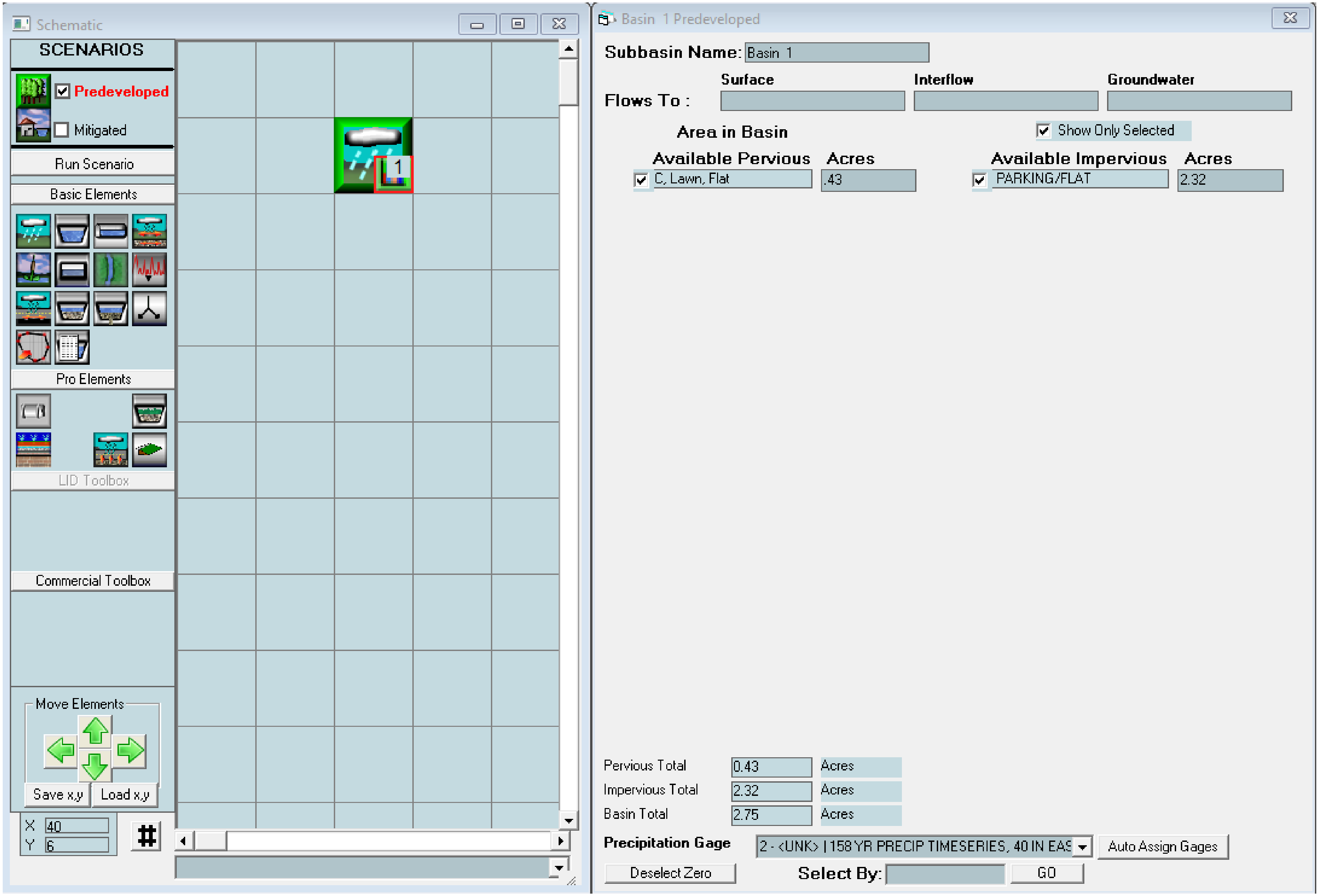
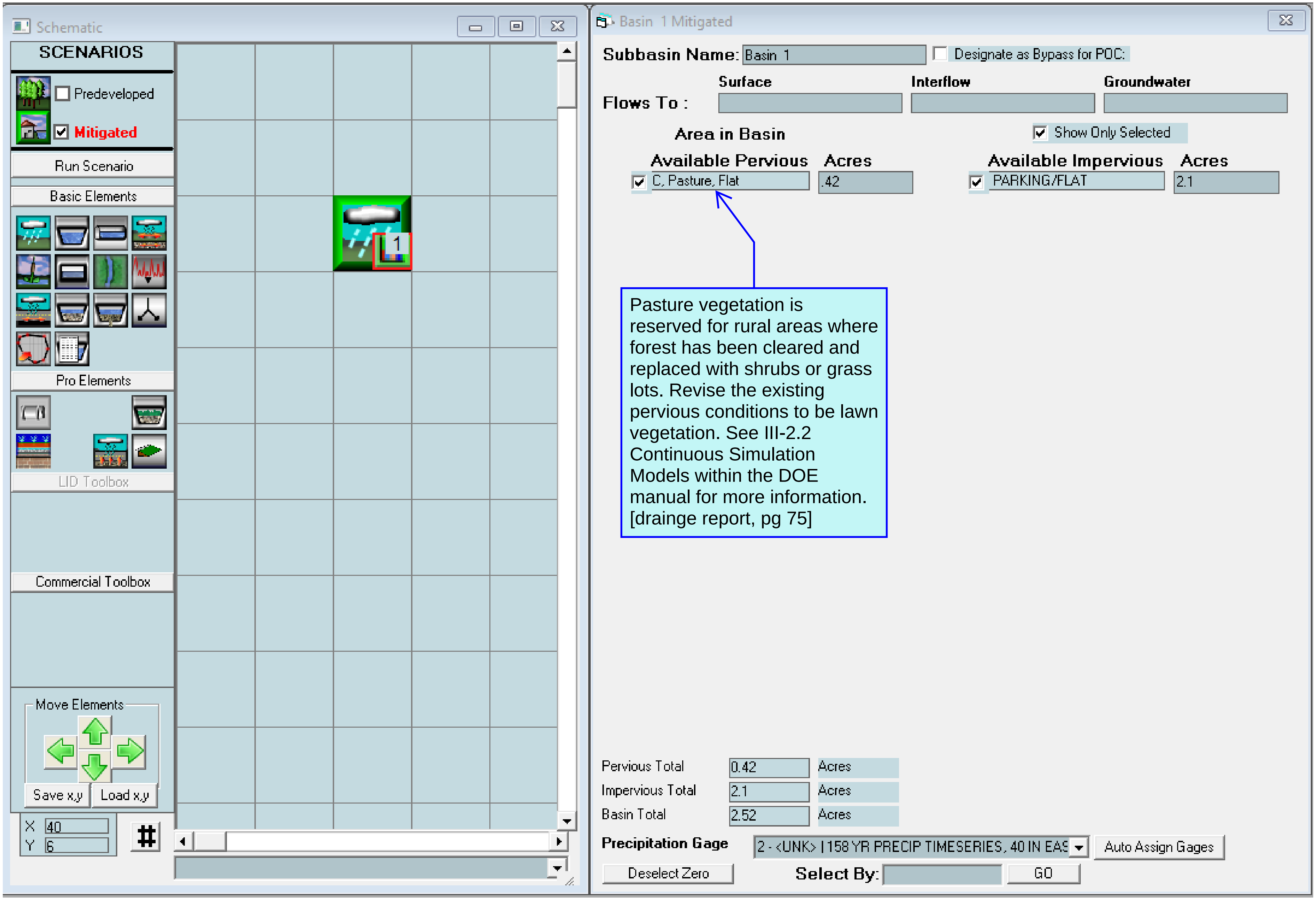
Figure 8
Wetland Protection WWHM Model

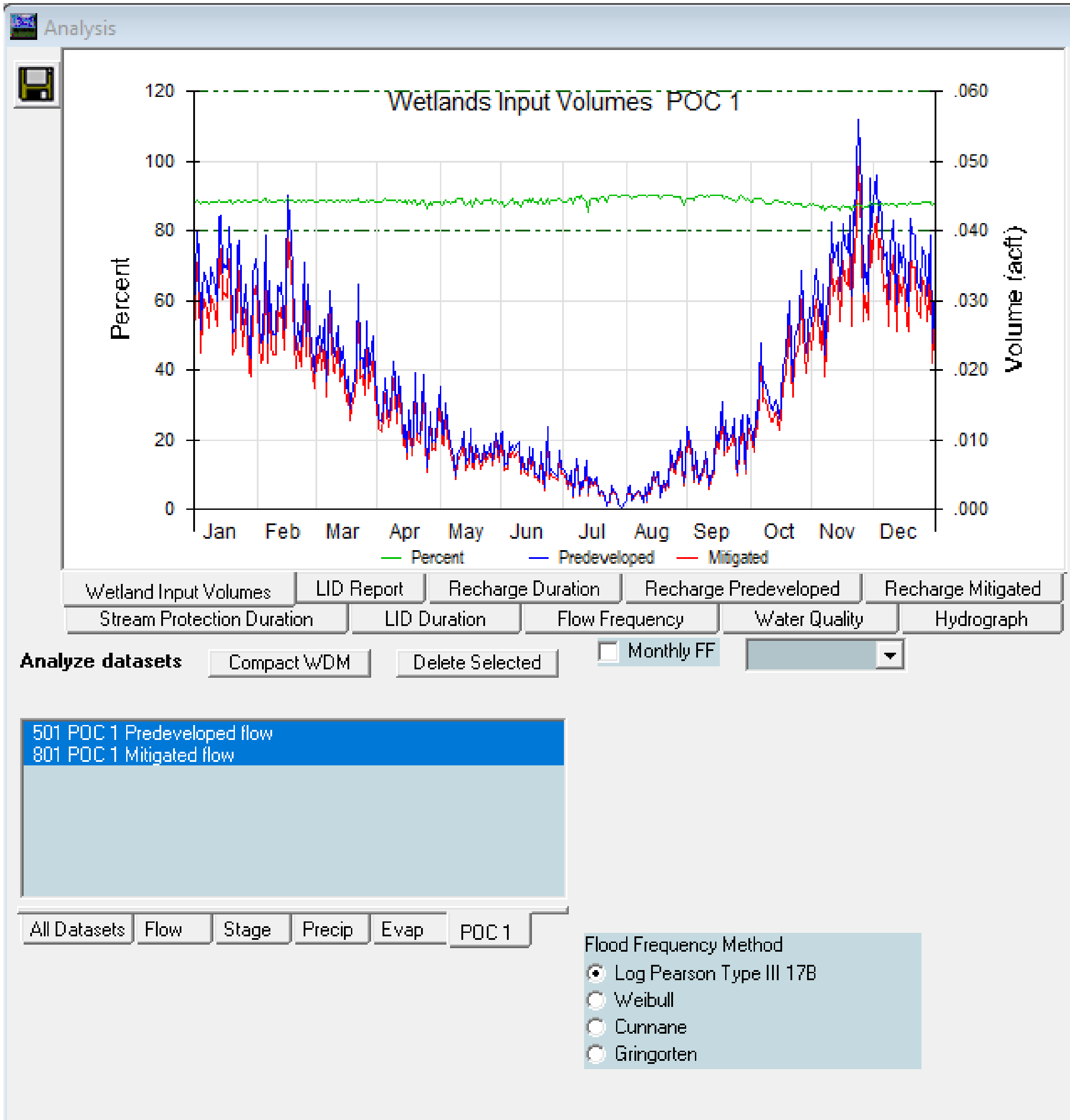
East Basin -Ex Conditions



East Basin -Proposed Conditions



East Basin -Wetland recharge



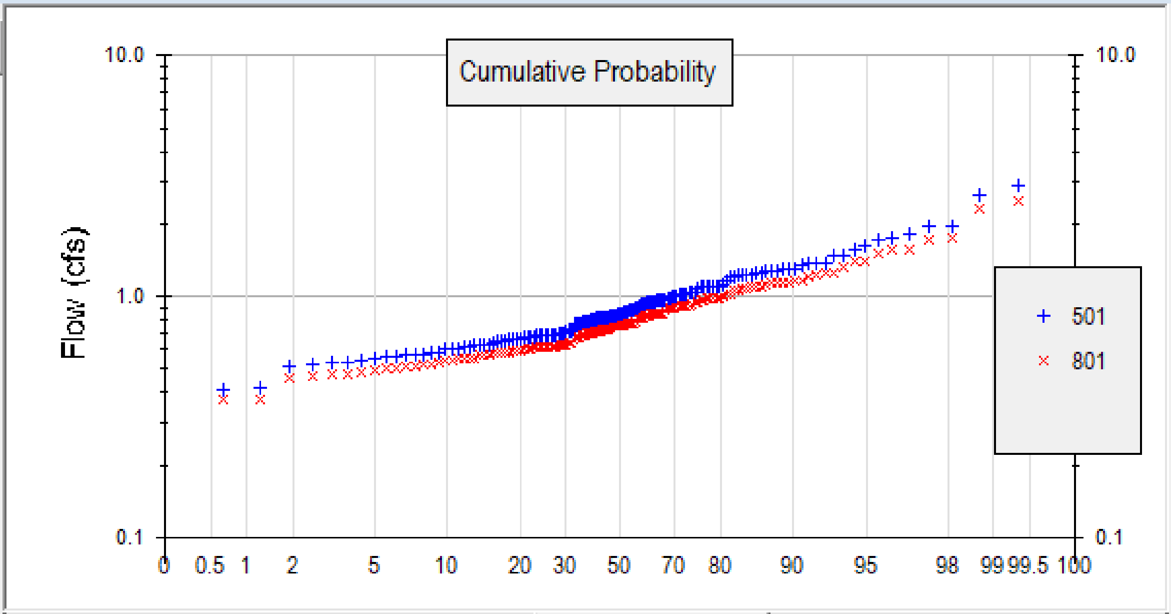
Wetlands Fluctuation for POC 1
Average Annual Volume (acft)

Month	Predevel	Mitigated	Percent	Pass/Fail
Jan	1.0094	0.8922	88.4	Pass
Feb	0.8473	0.7512	88.7	Pass
Mar	0.6954	0.6163	88.6	Pass
Apr	0.4126	0.3651	88.5	Pass
May	0.2869	0.2537	88.4	Pass
Jun	0.2167	0.1917	88.5	Pass
Jul	0.1048	0.0934	89.1	Pass
Aug	0.1250	0.1123	89.9	Pass
Sep	0.2598	0.2329	89.6	Pass
Oct	0.6074	0.5348	88.1	Pass
Nov	1.0853	0.9448	87.1	Pass
Dec	1.1368	0.9982	87.8	Pass

Day	Predevel	Mitigated	Percent	Pass/Fail
Jan1	0.0277	0.0244	88.0	Pass
2	0.0399	0.0354	88.7	Pass
3	0.0368	0.0325	88.3	Pass
4	0.0257	0.0226	87.7	Pass
5	0.0311	0.0275	88.3	Pass
6	0.0341	0.0302	88.5	Pass
7	0.0326	0.0287	88.2	Pass
8	0.0297	0.0261	88.1	Pass
9	0.0347	0.0306	88.2	Pass
10	0.0339	0.0300	88.5	Pass
11	0.0333	0.0294	88.3	Pass
12	0.0299	0.0263	88.2	Pass
13	0.0420	0.0372	88.6	Pass
14	0.0421	0.0373	88.5	Pass
15	0.0341	0.0301	88.3	Pass
16	0.0351	0.0310	88.4	Pass
17	0.0345	0.0305	88.4	Pass
18	0.0406	0.0360	88.7	Pass
19	0.0363	0.0321	88.6	Pass
20	0.0253	0.0223	88.0	Pass
21	0.0262	0.0232	88.5	Pass

East Basin -Flows

Analysis



Stream Protection Duration | LID Duration | Flow Frequency | Water Quality | Hydrograph

Wetland Input Volumes | LID Report | Recharge Duration | Recharge Predeveloped | Recharge Mitigated

Analyze datasets Compact WDM | Delete Selected | Monthly FF

501 POC 1 Predeveloped flow
801 POC 1 Mitigated flow

All Datasets | Flow | Stage | Precip | Evap | POC 1

Flood Frequency Method
- (•) Log Pearson Type III 17B
- ( ) Weibull
- ( ) Cunnane
- ( ) Gringorten

Flow Frequency

Flow(cfs)		Predeveloped	Mitigated
2 Year	=	0.8513	0.7584
5 Year	=	1.1488	1.0172
10 Year	=	1.3659	1.2052
25 Year	=	1.6641	1.4625
50 Year	=	1.9040	1.6688
100 Year	=	2.1598	1.8882

Annual Peaks

1902	0.9858	0.8913
1903	1.0936	0.9872
1904	1.3114	1.1375
1905	0.5623	0.5023
1906	0.6303	0.5689
1907	0.8672	0.7636
1908	0.6973	0.6220
1909	0.8384	0.7584
1910	0.8161	0.7268
1911	0.9331	0.8217
1912	1.6304	1.3961
1913	0.6487	0.5853
1914	2.8944	2.5089
1915	0.5724	0.5134
1916	1.0475	0.9461
1917	0.4148	0.3754
1918	0.8326	0.7533
1919	0.5357	0.4788
1920	0.7147	0.6280
1921	0.6074	0.5418
1922	0.9703	0.8452
1923	0.6628	0.5858
1924	1.2135	1.0948
1925	0.5201	0.4664
1926	0.9827	0.8893
1927	0.8427	0.7610
1928	0.6101	0.5469
1929	1.2291	1.0761

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	22085-wetland recharge ex conditions
Site Name:	
Site Address:	
City:	
Report Date:	7/3/2023
Gage:	40 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

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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.43
Pervious Total	0.43
Impervious Land Use	acre
PARKING FLAT	2.32
Impervious Total	2.32
Basin Total	2.75

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.42
Pervious Total	0.42
Impervious Land Use	acre
PARKING FLAT	2.1
Impervious Total	2.1
Basin Total	2.52

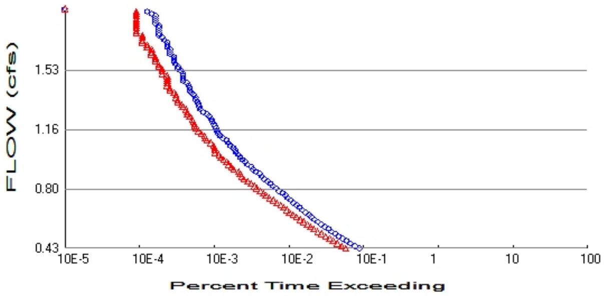
Element Flows To:

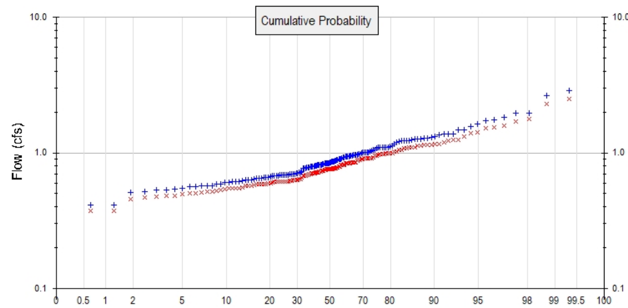
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.43
Total Impervious Area: 2.32

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.42
Total Impervious Area: 2.1

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.851333
5 year	1.148828
10 year	1.365934
25 year	1.664052
50 year	1.904006
100 year	2.159788

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.758376
5 year	1.017221
10 year	1.205242
25 year	1.462455
50 year	1.6688
100 year	1.888178

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.986	0.891
1903	1.094	0.987
1904	1.311	1.138
1905	0.562	0.502
1906	0.630	0.569
1907	0.867	0.764
1908	0.697	0.622
1909	0.838	0.758
1910	0.816	0.727
1911	0.933	0.822

1912	1.630	1.396
1913	0.649	0.585
1914	2.894	2.509
1915	0.572	0.513
1916	1.048	0.946
1917	0.415	0.375
1918	0.833	0.753
1919	0.536	0.479
1920	0.715	0.628
1921	0.607	0.542
1922	0.970	0.845
1923	0.663	0.586
1924	1.213	1.095
1925	0.520	0.466
1926	0.983	0.889
1927	0.843	0.761
1928	0.610	0.547
1929	1.229	1.076
1930	1.266	1.137
1931	0.617	0.550
1932	0.663	0.593
1933	0.653	0.586
1934	1.108	0.961
1935	0.568	0.514
1936	0.788	0.701
1937	1.010	0.914
1938	0.575	0.517
1939	0.701	0.632
1940	1.267	1.138
1941	1.377	1.244
1942	0.971	0.850
1943	0.940	0.836
1944	1.382	1.203
1945	1.013	0.904
1946	0.816	0.716
1947	0.612	0.549
1948	0.847	0.755
1949	1.289	1.163
1950	0.710	0.642
1951	1.097	0.993
1952	1.349	1.145
1953	1.234	1.056
1954	0.688	0.615
1955	0.634	0.573
1956	0.586	0.531
1957	0.682	0.611
1958	0.881	0.770
1959	0.884	0.771
1960	0.684	0.614
1961	1.950	1.707
1962	0.823	0.734
1963	0.602	0.545
1964	1.816	1.577
1965	0.851	0.737
1966	0.665	0.596
1967	0.968	0.844
1968	0.793	0.705
1969	0.715	0.638

1970	0.820	0.722
1971	0.810	0.708
1972	2.656	2.301
1973	1.469	1.327
1974	1.103	0.977
1975	1.202	1.022
1976	1.242	1.080
1977	0.512	0.458
1978	0.913	0.788
1979	0.957	0.839
1980	0.931	0.808
1981	0.857	0.765
1982	0.689	0.616
1983	0.953	0.840
1984	0.944	0.832
1985	1.100	0.952
1986	0.539	0.484
1987	0.943	0.853
1988	0.562	0.504
1989	0.549	0.497
1990	0.691	0.617
1991	1.047	0.916
1992	0.972	0.880
1993	1.077	0.974
1994	0.773	0.678
1995	0.584	0.524
1996	0.803	0.707
1997	0.705	0.629
1998	0.861	0.759
1999	0.946	0.854
2000	0.800	0.714
2001	0.642	0.581
2002	1.238	1.059
2003	0.679	0.607
2004	1.015	0.907
2005	1.975	1.767
2006	0.902	0.814
2007	1.032	0.913
2008	0.838	0.751
2009	0.631	0.571
2010	0.823	0.734
2011	0.842	0.762
2012	0.808	0.723
2013	0.778	0.681
2014	0.732	0.662
2015	1.280	1.096
2016	0.791	0.715
2017	1.233	1.102
2018	0.779	0.681
2019	1.164	1.016
2020	0.926	0.813
2021	0.769	0.685
2022	1.258	1.124
2023	1.560	1.408
2024	1.747	1.512
2025	0.817	0.739
2026	0.924	0.834
2027	1.007	0.908

2028	0.389	0.352
2029	0.661	0.588
2030	1.373	1.232
2031	0.413	0.372
2032	0.680	0.614
2033	0.859	0.778
2034	0.652	0.590
2035	0.874	0.770
2036	0.675	0.610
2037	0.904	0.818
2038	0.902	0.787
2039	1.717	1.552
2040	0.688	0.615
2041	0.873	0.776
2042	1.001	0.904
2043	1.098	0.992
2044	0.765	0.684
2045	0.624	0.557
2046	0.692	0.616
2047	0.833	0.754
2048	0.684	0.619
2049	1.015	0.917
2050	0.782	0.694
2051	1.125	0.980
2052	0.822	0.744
2053	0.695	0.627
2054	1.469	1.250
2055	0.794	0.710
2056	1.096	0.989
2057	0.531	0.477
2058	1.024	0.927
2059	1.292	1.169

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	2.8944	2.5089
2	2.6556	2.3009
3	1.9754	1.7669
4	1.9496	1.7074
5	1.8162	1.5769
6	1.7465	1.5520
7	1.7168	1.5121
8	1.6304	1.4085
9	1.5603	1.3961
10	1.4694	1.3270
11	1.4691	1.2501
12	1.3818	1.2443
13	1.3770	1.2319
14	1.3727	1.2026
15	1.3494	1.1692
16	1.3114	1.1628
17	1.2923	1.1448
18	1.2893	1.1376
19	1.2797	1.1375
20	1.2667	1.1365
21	1.2660	1.1236
22	1.2584	1.1019

23	1.2425	1.0965
24	1.2382	1.0948
25	1.2342	1.0796
26	1.2333	1.0761
27	1.2291	1.0591
28	1.2135	1.0562
29	1.2015	1.0219
30	1.1636	1.0157
31	1.1250	0.9927
32	1.1085	0.9921
33	1.1033	0.9886
34	1.0998	0.9872
35	1.0980	0.9796
36	1.0969	0.9768
37	1.0958	0.9742
38	1.0936	0.9609
39	1.0772	0.9523
40	1.0475	0.9461
41	1.0472	0.9269
42	1.0323	0.9174
43	1.0242	0.9164
44	1.0148	0.9139
45	1.0147	0.9132
46	1.0133	0.9079
47	1.0096	0.9068
48	1.0069	0.9044
49	1.0005	0.9041
50	0.9858	0.8913
51	0.9827	0.8893
52	0.9720	0.8799
53	0.9709	0.8541
54	0.9703	0.8532
55	0.9679	0.8505
56	0.9569	0.8452
57	0.9527	0.8439
58	0.9463	0.8403
59	0.9444	0.8386
60	0.9431	0.8358
61	0.9395	0.8343
62	0.9331	0.8320
63	0.9310	0.8217
64	0.9261	0.8185
65	0.9239	0.8139
66	0.9130	0.8128
67	0.9044	0.8084
68	0.9021	0.7882
69	0.9017	0.7866
70	0.8838	0.7777
71	0.8806	0.7757
72	0.8744	0.7708
73	0.8735	0.7704
74	0.8672	0.7702
75	0.8606	0.7655
76	0.8592	0.7636
77	0.8566	0.7619
78	0.8506	0.7610
79	0.8466	0.7587
80	0.8427	0.7584

81	0.8417	0.7545
82	0.8384	0.7535
83	0.8377	0.7533
84	0.8326	0.7506
85	0.8325	0.7441
86	0.8232	0.7394
87	0.8225	0.7366
88	0.8220	0.7344
89	0.8198	0.7344
90	0.8169	0.7268
91	0.8161	0.7233
92	0.8161	0.7216
93	0.8104	0.7156
94	0.8083	0.7154
95	0.8033	0.7141
96	0.7998	0.7098
97	0.7940	0.7083
98	0.7930	0.7071
99	0.7905	0.7050
100	0.7877	0.7011
101	0.7823	0.6936
102	0.7788	0.6852
103	0.7783	0.6839
104	0.7729	0.6811
105	0.7686	0.6808
106	0.7647	0.6779
107	0.7317	0.6623
108	0.7151	0.6422
109	0.7147	0.6379
110	0.7095	0.6318
111	0.7047	0.6293
112	0.7008	0.6280
113	0.6973	0.6274
114	0.6947	0.6220
115	0.6924	0.6188
116	0.6911	0.6167
117	0.6887	0.6163
118	0.6877	0.6160
119	0.6876	0.6152
120	0.6844	0.6147
121	0.6843	0.6144
122	0.6817	0.6143
123	0.6796	0.6105
124	0.6790	0.6103
125	0.6752	0.6074
126	0.6655	0.5963
127	0.6628	0.5927
128	0.6627	0.5904
129	0.6611	0.5881
130	0.6525	0.5858
131	0.6523	0.5856
132	0.6487	0.5853
133	0.6419	0.5812
134	0.6342	0.5733
135	0.6309	0.5708
136	0.6303	0.5689
137	0.6237	0.5567
138	0.6166	0.5502

139	0.6118	0.5488
140	0.6101	0.5469
141	0.6074	0.5448
142	0.6021	0.5418
143	0.5863	0.5306
144	0.5845	0.5239
145	0.5751	0.5171
146	0.5724	0.5138
147	0.5677	0.5134
148	0.5623	0.5043
149	0.5621	0.5023
150	0.5486	0.4965
151	0.5394	0.4841
152	0.5357	0.4788
153	0.5306	0.4767
154	0.5201	0.4664
155	0.5117	0.4583
156	0.4148	0.3754
157	0.4125	0.3717
158	0.3893	0.3522

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.4257	4802	3190	66	Pass
0.4406	4223	2819	66	Pass
0.4555	3688	2466	66	Pass
0.4705	3258	2165	66	Pass
0.4854	2902	1938	66	Pass
0.5003	2572	1705	66	Pass
0.5153	2305	1500	65	Pass
0.5302	2063	1352	65	Pass
0.5451	1869	1189	63	Pass
0.5601	1675	1073	64	Pass
0.5750	1495	976	65	Pass
0.5899	1363	864	63	Pass
0.6049	1230	784	63	Pass
0.6198	1111	697	62	Pass
0.6347	1018	629	61	Pass
0.6497	924	559	60	Pass
0.6646	836	515	61	Pass
0.6795	767	467	60	Pass
0.6945	698	430	61	Pass
0.7094	637	378	59	Pass
0.7243	587	343	58	Pass
0.7393	532	304	57	Pass
0.7542	493	271	54	Pass
0.7691	454	249	54	Pass
0.7841	408	228	55	Pass
0.7990	378	203	53	Pass
0.8139	342	192	56	Pass
0.8289	311	171	54	Pass
0.8438	283	155	54	Pass
0.8587	258	138	53	Pass
0.8736	240	129	53	Pass
0.8886	222	122	54	Pass
0.9035	199	117	58	Pass
0.9184	183	101	55	Pass
0.9334	174	94	54	Pass
0.9483	154	87	56	Pass
0.9632	143	81	56	Pass
0.9782	132	74	56	Pass
0.9931	123	67	54	Pass
1.0080	116	64	55	Pass
1.0230	109	56	51	Pass
1.0379	105	56	53	Pass
1.0528	100	56	56	Pass
1.0678	90	54	60	Pass
1.0827	86	50	58	Pass
1.0976	81	44	54	Pass
1.1126	72	42	58	Pass
1.1275	66	41	62	Pass
1.1424	62	37	59	Pass
1.1574	61	34	55	Pass
1.1723	58	31	53	Pass
1.1872	57	30	52	Pass
1.2022	54	30	55	Pass

1.2171	52	29	55	Pass
1.2320	51	28	54	Pass
1.2470	47	26	55	Pass
1.2619	44	24	54	Pass
1.2768	39	24	61	Pass
1.2918	36	23	63	Pass
1.3067	35	21	60	Pass
1.3216	34	20	58	Pass
1.3366	33	18	54	Pass
1.3515	31	18	58	Pass
1.3664	31	17	54	Pass
1.3814	29	17	58	Pass
1.3963	27	16	59	Pass
1.4112	26	14	53	Pass
1.4262	26	14	53	Pass
1.4411	25	13	52	Pass
1.4560	24	13	54	Pass
1.4710	21	13	61	Pass
1.4859	21	13	61	Pass
1.5008	21	13	61	Pass
1.5158	21	11	52	Pass
1.5307	20	11	55	Pass
1.5456	18	11	61	Pass
1.5606	18	10	55	Pass
1.5755	17	10	58	Pass
1.5904	16	9	56	Pass
1.6054	16	9	56	Pass
1.6203	16	9	56	Pass
1.6352	14	8	57	Pass
1.6501	14	8	57	Pass
1.6651	14	8	57	Pass
1.6800	13	7	53	Pass
1.6949	13	7	53	Pass
1.7099	13	6	46	Pass
1.7248	12	6	50	Pass
1.7397	11	6	54	Pass
1.7547	10	6	60	Pass
1.7696	10	5	50	Pass
1.7845	10	5	50	Pass
1.7995	10	5	50	Pass
1.8144	10	5	50	Pass
1.8293	9	5	55	Pass
1.8443	9	5	55	Pass
1.8592	9	5	55	Pass
1.8741	9	5	55	Pass
1.8891	8	5	62	Pass
1.9040	7	5	71	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
Total Volume Infiltrated		0.00	0.00	0.00		0.00	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.

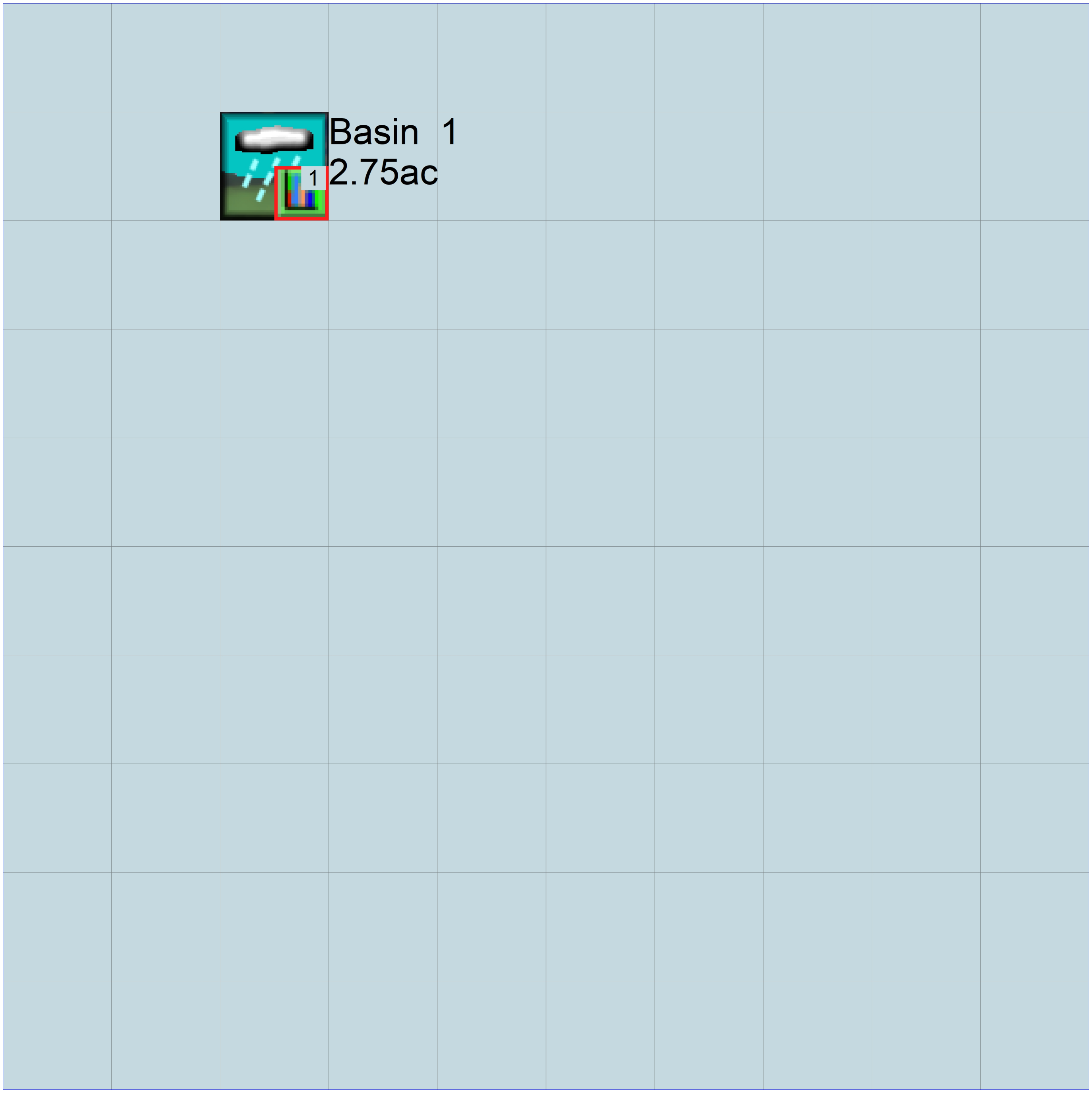
PERLND Changes

No PERLND changes have been made.

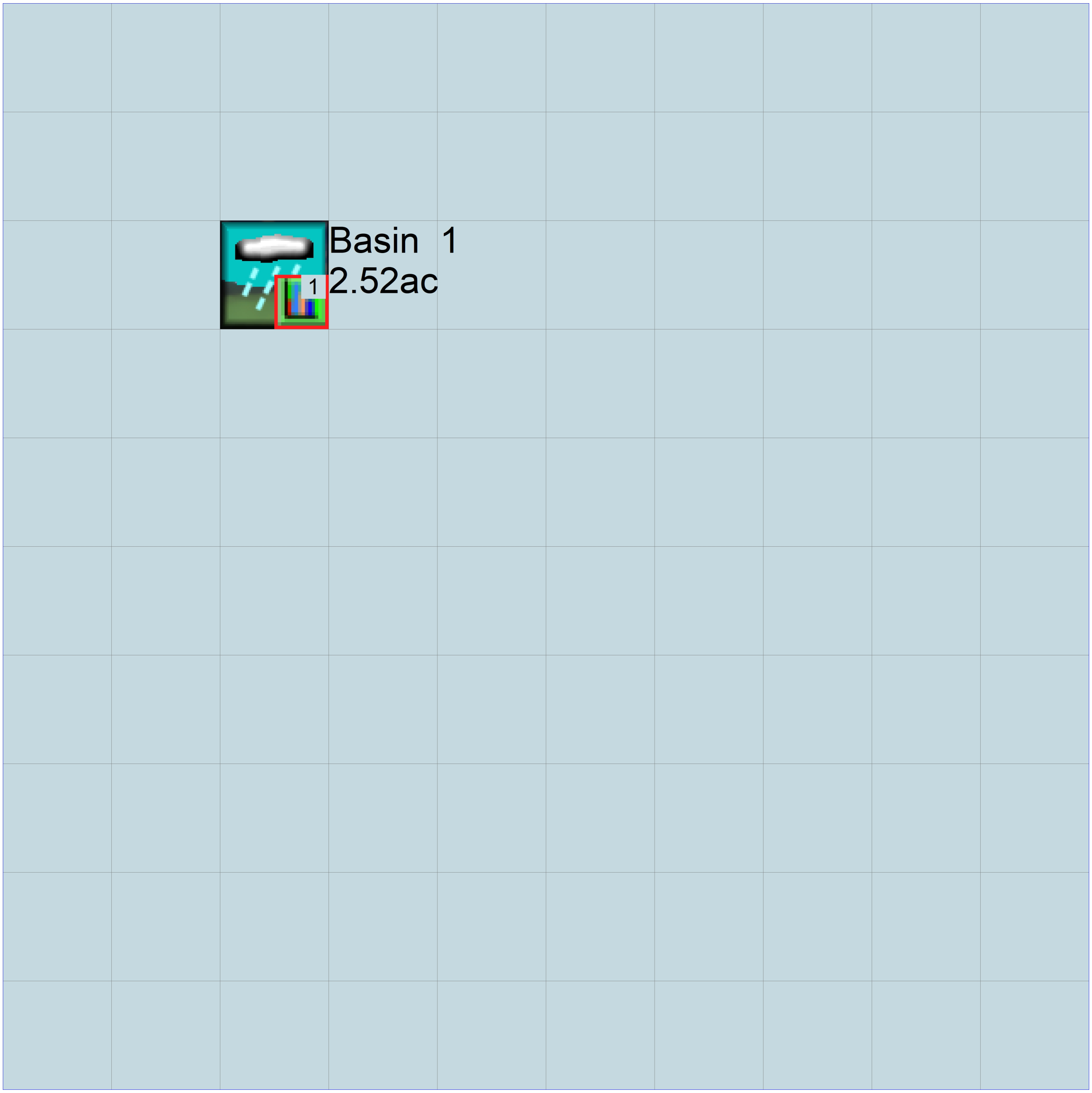
IMPLND Changes

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   22085-wetland recharge ex conditions.wdm
MESSU      25   Pre22085-wetland recharge ex conditions.MES
           27   Pre22085-wetland recharge ex conditions.L61
           28   Pre22085-wetland recharge ex conditions.L62
           30   POC22085-wetland recharge ex conditions1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND      11
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    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           ***
   16     C, Lawn, Flat           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
  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
  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
  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
  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
  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
  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
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name-------> Unit-systems   Printer ***
    # -  #                    User  t-series Engl Metr ***
                                     in  out           ***
   11      PARKING/FLAT          1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   11         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   11         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     ***
   11         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   11           400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   11             0         0
```

```
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   11             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  16                        0.43     COPY   501     12
PERLND  16                        0.43     COPY   501     13
IMPLND  11                        2.32     COPY   501     15

******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

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


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   22085-wetland recharge ex conditions.wdm
MESSU      25   Mit22085-wetland recharge ex conditions.MES
           27   Mit22085-wetland recharge ex conditions.L61
           28   Mit22085-wetland recharge ex conditions.L62
           30   POC22085-wetland recharge ex conditions1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      13
      IMPLND      11
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   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           ***
   13      C, Pasture, Flat        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 ***
   13         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  *********
   13         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 ***
   13         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
   13             0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   13             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                     ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13          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
   13             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           ***
   11      PARKING/FLAT           1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    ***
   11         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   11         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      ***
   11         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   11           400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   11             0         0
```

```
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   11             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->    <-Target->   MBLK   ***
<Name>   #                  <-factor->    <Name>   #   Tbl#   ***
Basin  1***
PERLND  13                        0.42    COPY   501     12
PERLND  13                        0.42    COPY   501     13
IMPLND  11                         2.1    COPY   501     15

******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     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
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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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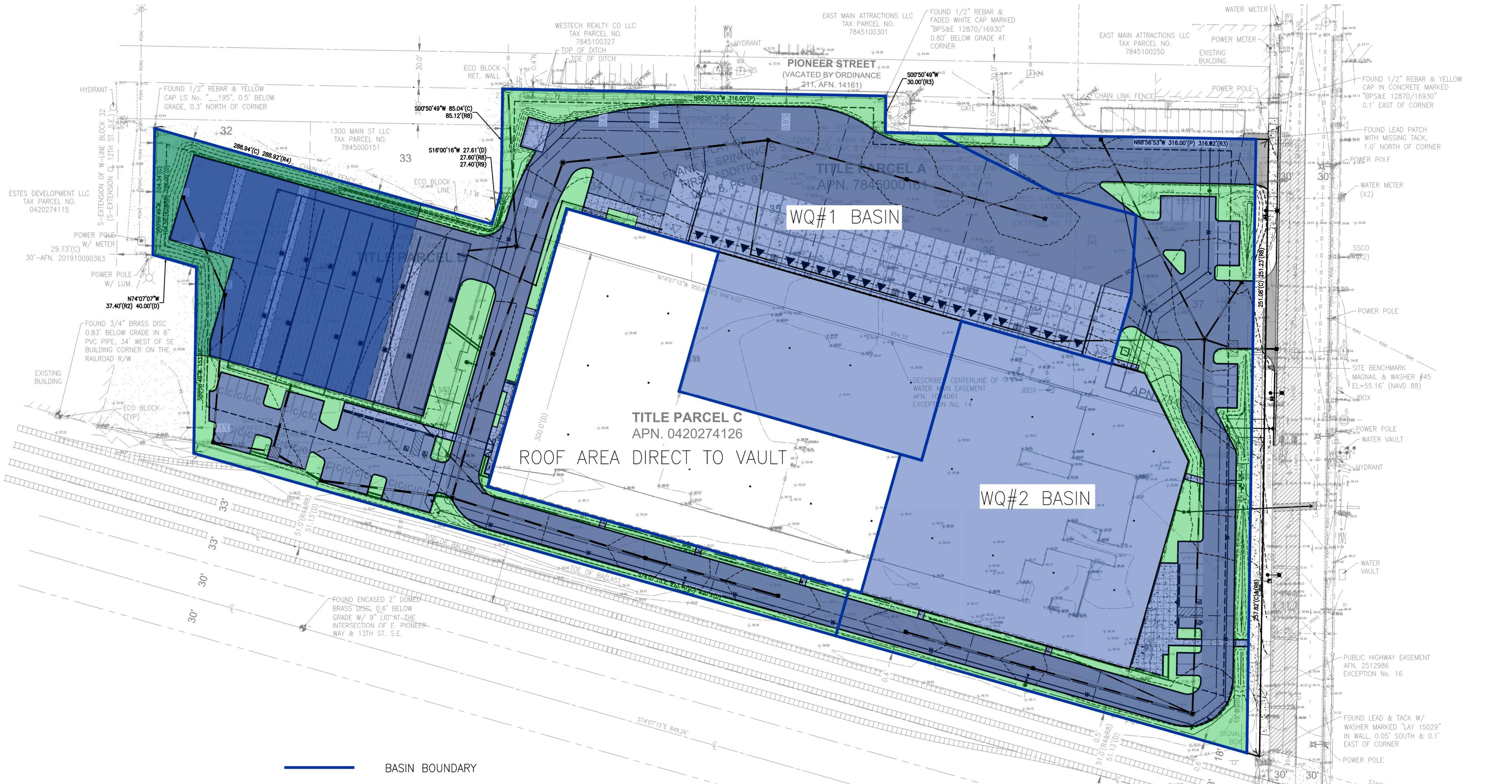
Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

Figure 9
Water Quality Calculations

WATER QUALTY BASIN MAP EXHIBIT



(line)	BASIN BOUNDARY
(green)	PERVIOUS AREA
(blue)	IMPERVIOUS AREA

N

SCALE: 1"=40'

SURFACE COVERAGE	WQ#1 BASIN ACREAGE	WQ#2 BASIN ACREAGE
TOTAL AREA	4.08	2.52
IMPERVIOUS AREA	3.36	2.10
PERVIOUS AREA	0.72	0.42

Include the bypass basin within the table. [drainage plans, pg 110]

Know what's below. Call before you dig. Dial 811

Title: WATER QUALITY BASIN MAP EXHIBIT

FORTRESS - PUYALLUP

For: CREF3 PUYALLUP OWNER LLC
11611 SAN VICENTE BLVD
10TH FLOOR
LOS ANGELES, CA 90049

Scale: Horizontal 1"=40' Vertical N/A

Designed VMS Drawn VMS Checked KEH Approved KEH Date 10/04/22

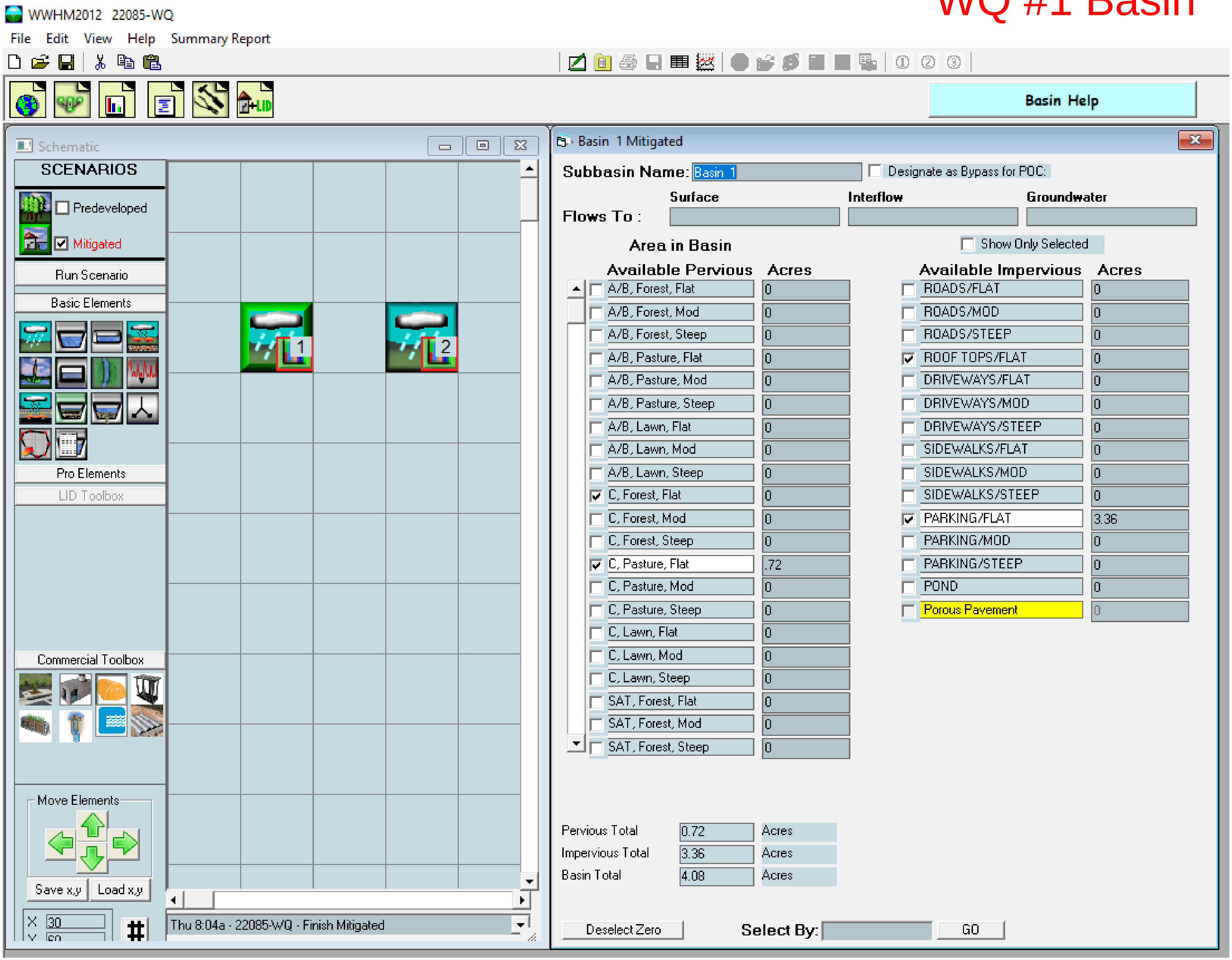
Barghausen Consulting Engineers, Inc.
18215 72nd Avenue South
Kent, WA 98032
425.251.6222
barghausen.com

Job Number 22085

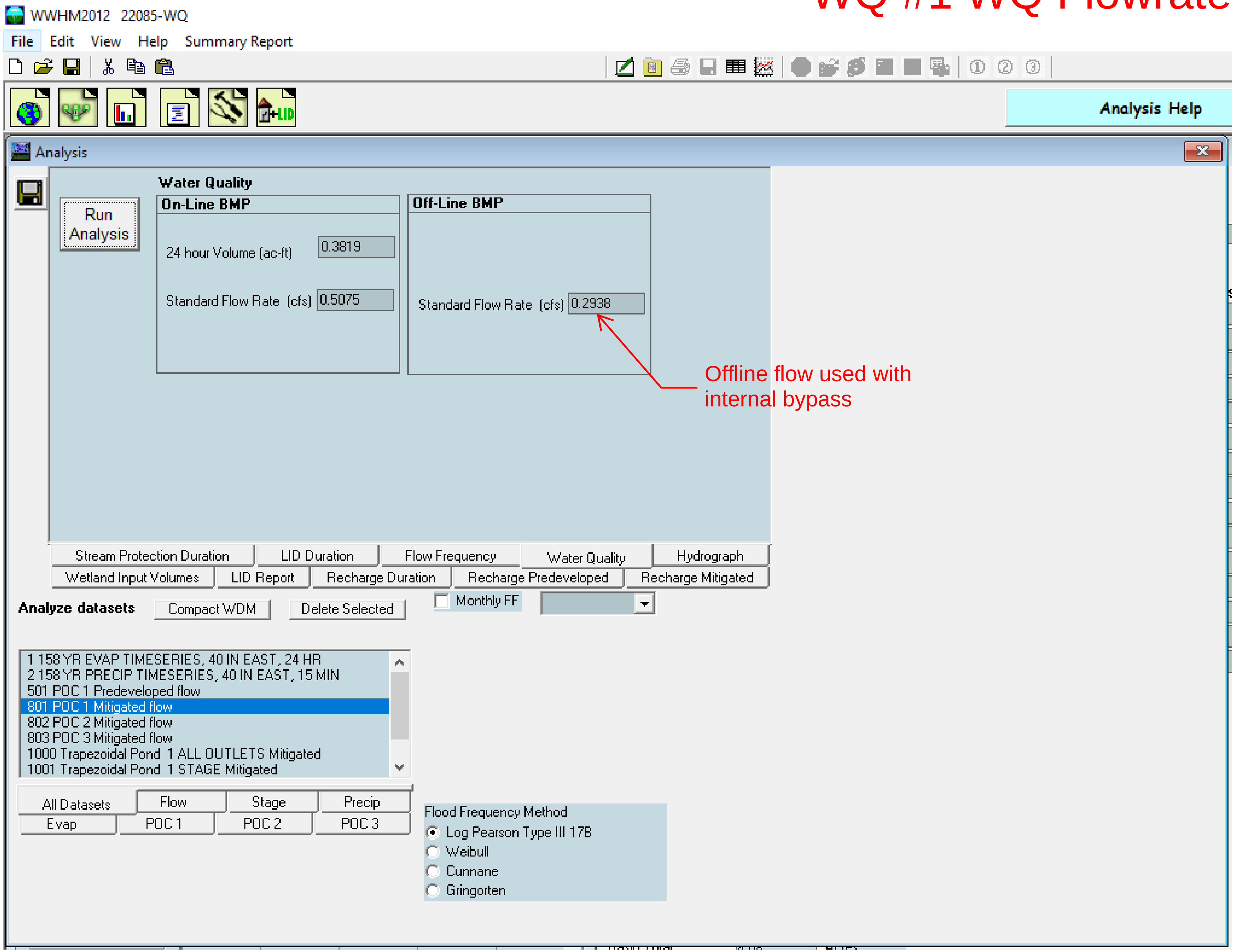
Sheet 2 of 2

P:\22000s\22085\exhibit\WQ basin map.dwg 7/27/2023 8:15 AM KHARRIS

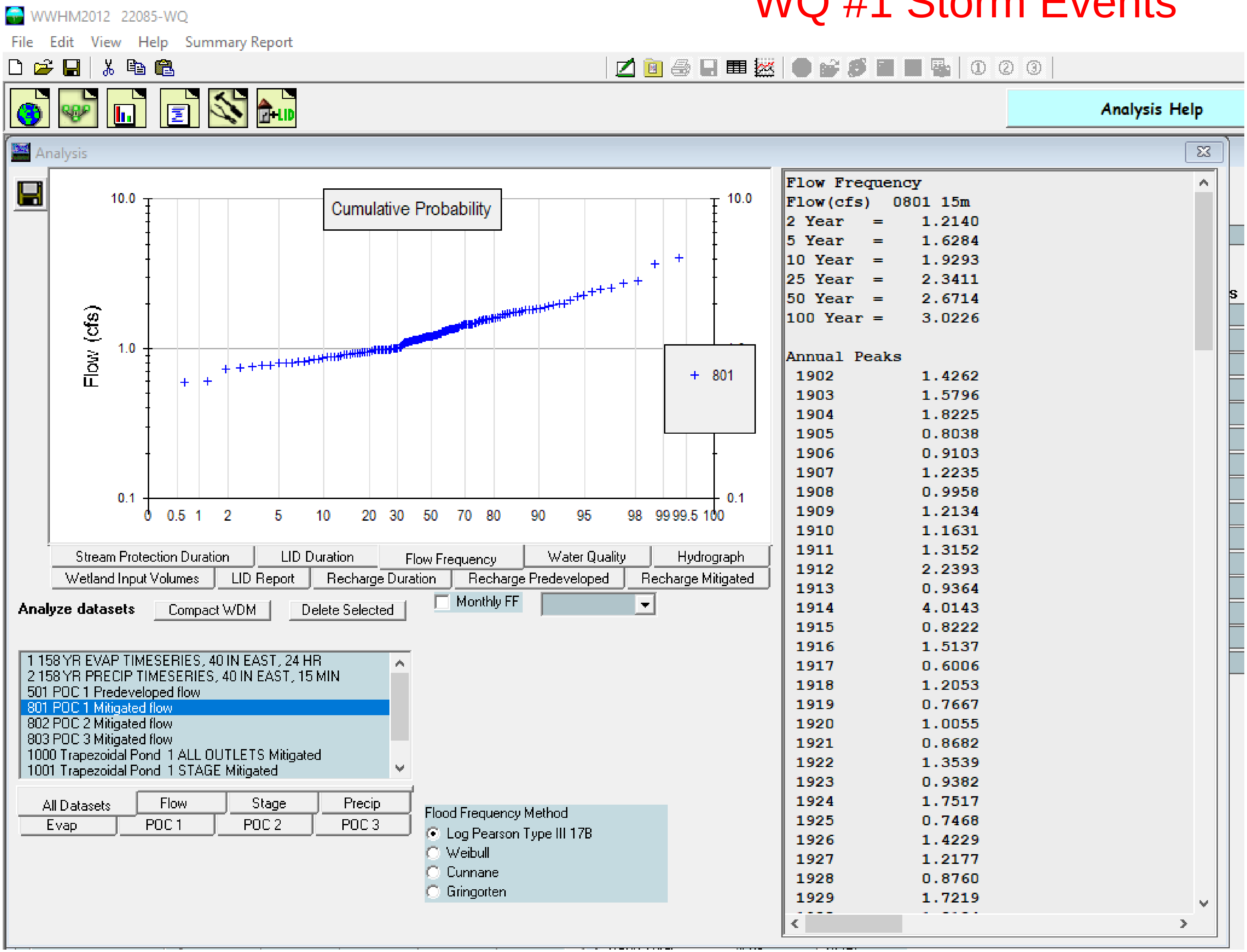
WQ #1 Basin


WWHM2012 22085-WQ
File Edit View Help Summary Report
Basin Help
Schematic
SCENARIOS
Predeveloped
Mitigated
Run Scenario
Basic Elements
Pro Elements
LID Toolbox
Commercial Toolbox
Move Elements
Save x,y Load x,y
Thu 8:04a - 22085-WQ - Finish Mitigated
Basin 1 Mitigated
Subbasin Name: Basin 1
Designate as Bypass for POC:
Surface Interflow Groundwater
Flows To :
Area in Basin
Show Only Selected
Available Pervious Acres
A/B, Forest, Flat 0
A/B, Forest, Mod 0
A/B, Forest, Steep 0
A/B, Pasture, Flat 0
A/B, Pasture, Mod 0
A/B, Pasture, Steep 0
A/B, Lawn, Flat 0
A/B, Lawn, Mod 0
A/B, Lawn, Steep 0
C, Forest, Flat 0
C, Forest, Mod 0
C, Forest, Steep 0
C, Pasture, Flat .72
C, Pasture, Mod 0
C, Pasture, Steep 0
C, Lawn, Flat 0
C, Lawn, Mod 0
C, Lawn, Steep 0
SAT, Forest, Flat 0
SAT, Forest, Mod 0
SAT, Forest, Steep 0
Available Impervious Acres
ROADS/FLAT 0
ROADS/MOD 0
ROADS/STEEP 0
ROOF TOPS/FLAT 0
DRIVEWAYS/FLAT 0
DRIVEWAYS/MOD 0
DRIVEWAYS/STEEP 0
SIDEWALKS/FLAT 0
SIDEWALKS/MOD 0
SIDEWALKS/STEEP 0
PARKING/FLAT 3.36
PARKING/MOD 0
PARKING/STEEP 0
POND 0
Porous Pavement 0
Pervious Total 0.72 Acres
Impervious Total 3.36 Acres
Basin Total 4.08 Acres
Deselect Zero
Select By:
GO

WQ #1 WQ Flowrate



WQ #1 Storm Events

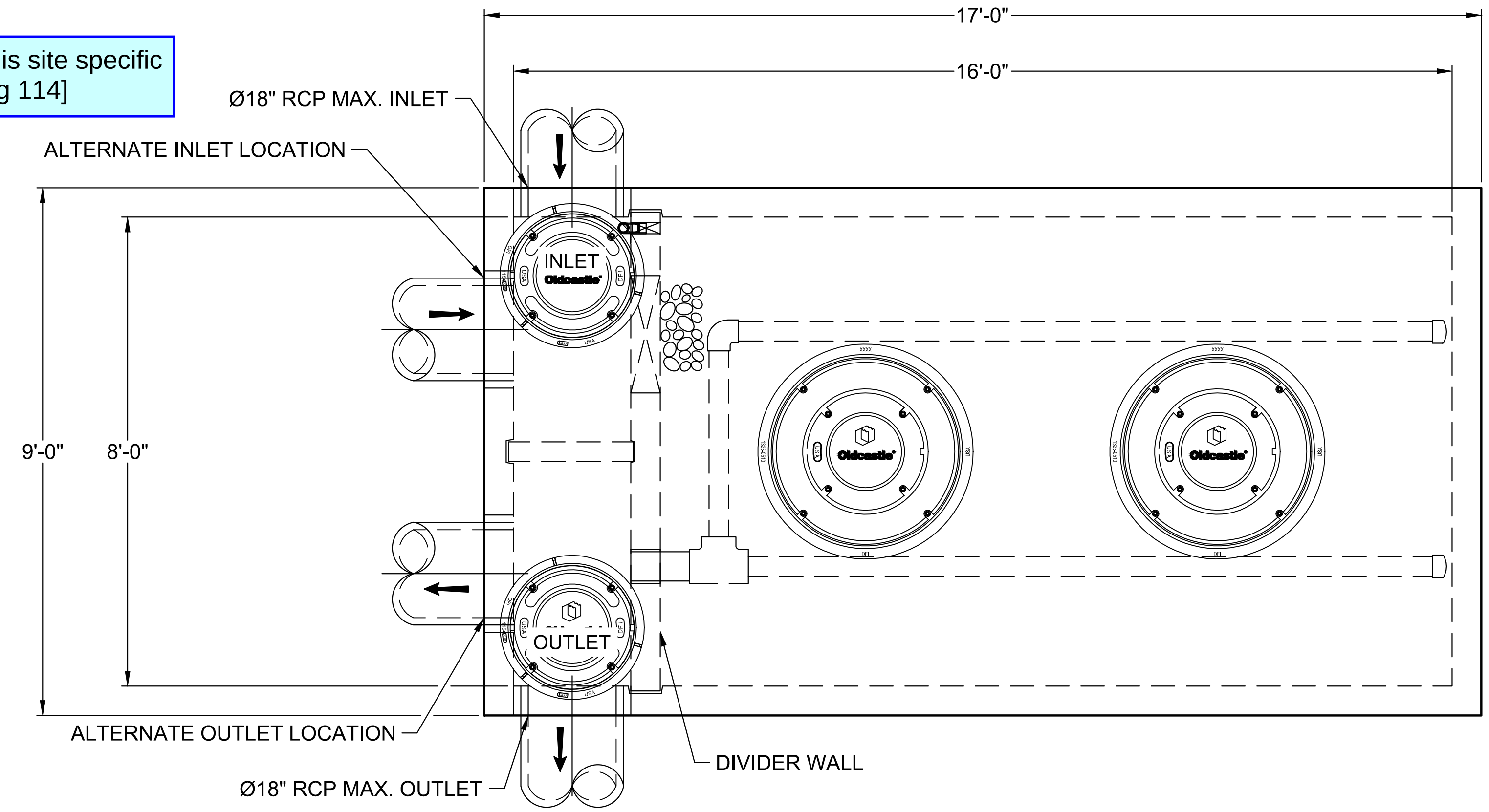


SITE SPECIFIC DATA				
Structure ID				ID
Treatment Flow Rate (cfs)				-
Peak Flow Rate (cfs)				-
Rim Elevation				-
Top of Vault Elevation				-
Pipe Data	Pipe Location	Pipe Size	Pipe Type	Invert Elevation
Inlet	-	-	-	-
Outlet	-	-	-	-
Notes:				

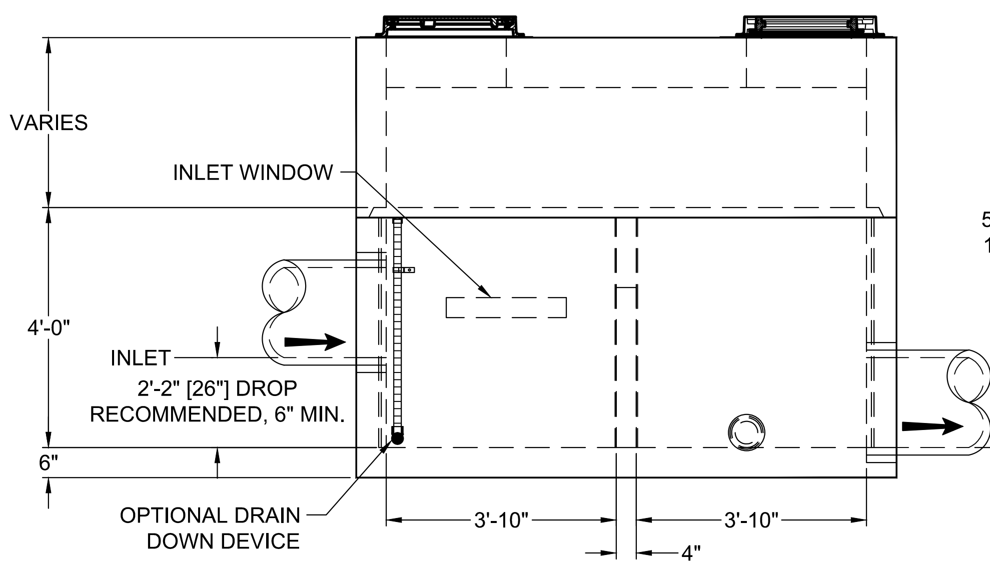
Fill out the rest of this site specific data chart. [civils, pg 114]

PERFORMANCE SPECIFICATIONS	
Treatment Flow Capacities:*	
NJDEP 80% Removal, 75 micron	0.432 cfs
WA Ecology GULD - Basic, Enhanced & Phosphorus	0.384 cfs
Bypass Capacity	6.5 cfs

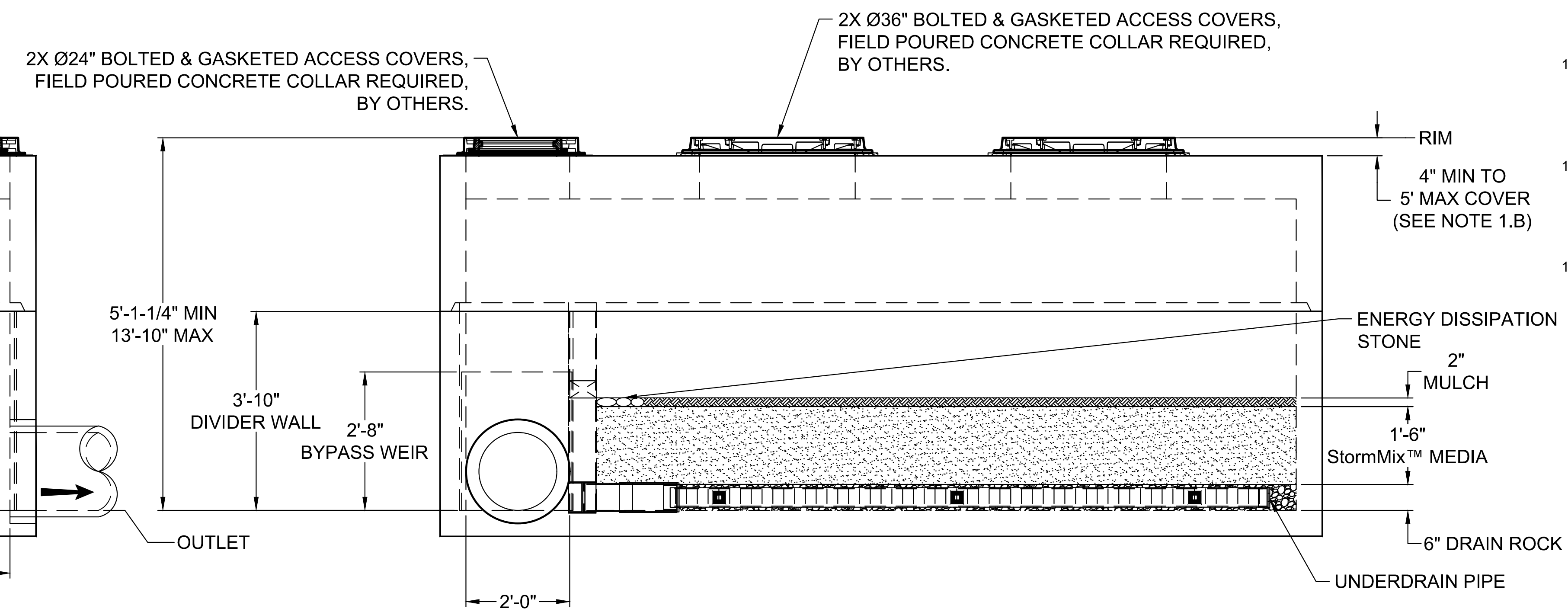
*Contact Oldcastle for alternative treatment flow capacities.



PLAN VIEW



LEFT END VIEW



ELEVATION VIEW

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 (WITH IMPACT)
   B. DESIGN SOIL COVER: 5'-0" MAXIMUM
   C. ASSUMED WATER TABLE: BELOW BASE OF PRECAST (ENGINEER-OF-RECORD TO CONFIRM SITE WATER TABLE ELEVATION)
   D. LATERAL EARTH PRESSURE: 45 PCF (DRAINED)
   E. LATERAL LIVE LOAD SURCHARGE: 80 PSF (APPLIED TO 8'-0" BELOW GRADE)
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28-DAY MINIMUM COMPRESSIVE STRENGTH: 5,000 PSI MINIMUM.
3. REINFORCING: REBAR, ASTM A615/A706, GRADE 60
4. CEMENT: ASTM C150
5. REQUIRED ALLOWABLE SOIL BEARING CAPACITY: 2,500 PSF
6. REFERENCE STANDARD:
   A. ASTM C890
   B. ASTM C913
   C. ACI 318-14
7. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. ENGINEER-OF-RECORD SHALL VERIFY FY THAT NOTED PARAMETERS MEET OR EXCEED PROJECT REQUIREMENTS. IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW.
8. INLET AND OUTLET HOLES WILL BE FACTORY CORED/CAST PER PLANS AND CUSTOMER REQUIREMENTS. INLET AND OUTLET LOCATIONS CAN BE MIRRORED.
9. CONTRACTOR RESPONSIBLE TO VERIFY ALL SIZES, LOCATIONS, AND ELEVATIONS OF OPENINGS.
10. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
11. SECTION HEIGHTS, SLAB/WALL THICKNESSES, AND KEYWAYS ARE SUBJECT TO CHANGE AS REQUIRED FOR SITE REQUIREMENTS AND/OR DUE TO PRODUCT AVAILABILITY AND PRODUCTION FACILITY CONSTRAINTS.
12. MAXIMUM PICK WEIGHTS*:
    A. TOP: XX,XXX LBS
    B. BASE: XX,XXX LBS*
    (* COMBINED WEIGHT OF BASE INCLUDES BYPASS WEIR, DIVIDER WALL, ROCK & MEDIA)
13. INTERNALS SHALL CONSIST OF UNDERDRAIN PIPE, ROCK, STORMMIX™ MEDIA, MULCH, DIVIDER WALL, BYPASS WEIR AND OPTIONAL DRAIN DOWN.

Bioretention/ Biofiltration

Oldcastle Infrastructure™ A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

BioPod™ Biofilter System (STANDARD)

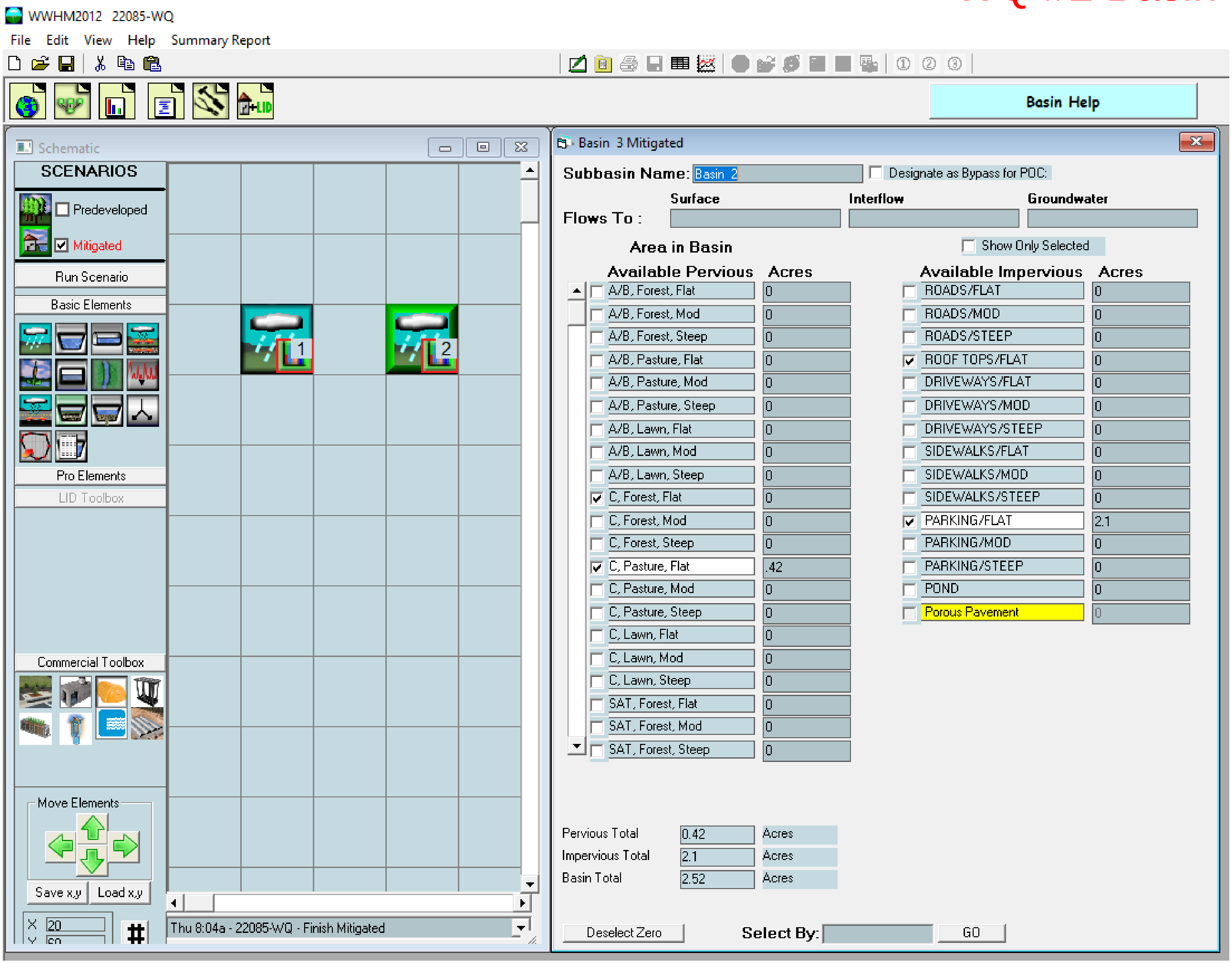
Underground Vault with Internal Bypass

CUSTOMER
-

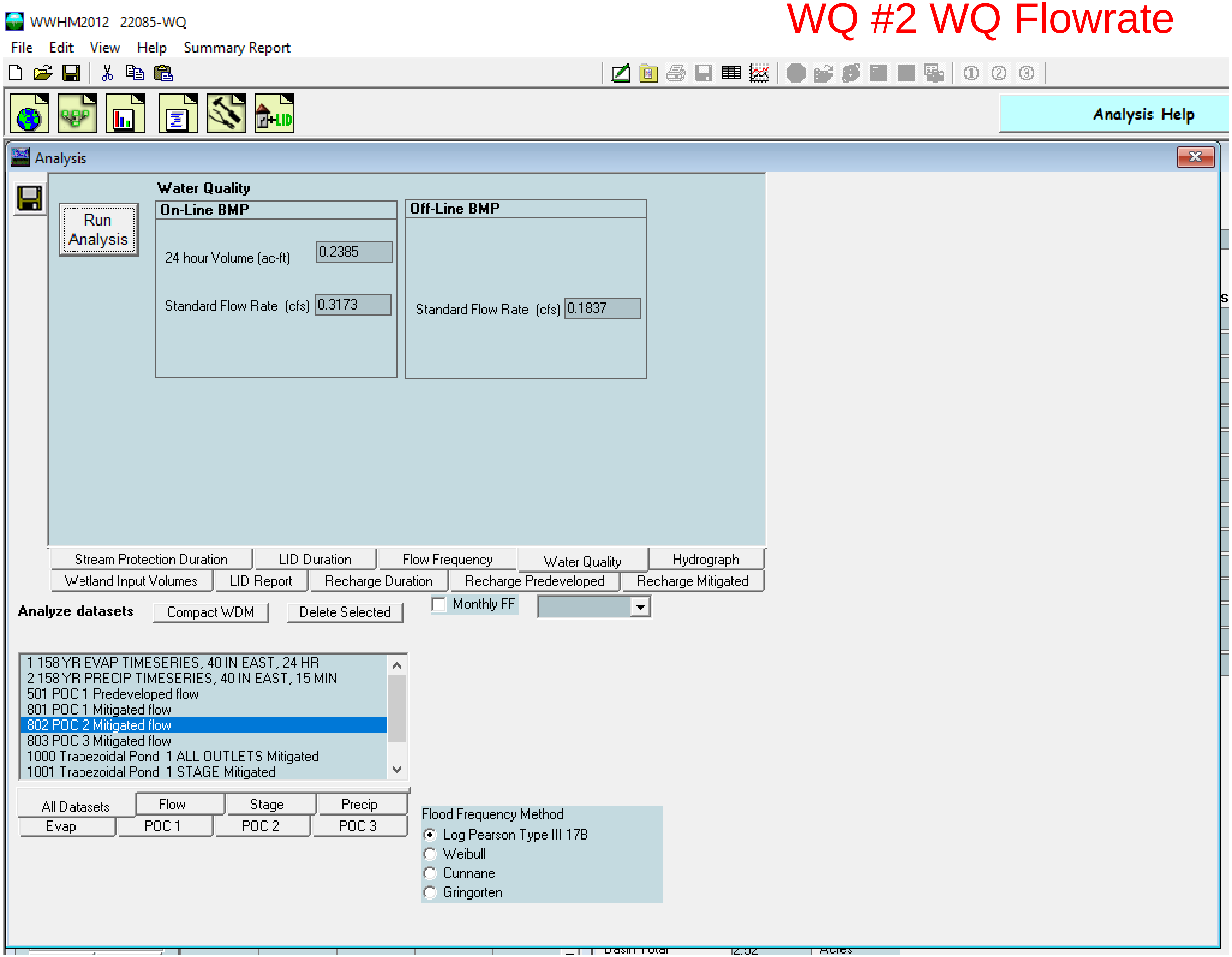
PROJECT NAME
-

SHEET NAME	REVISION	SHEET
Specifier Drawing BPU-816IB	- REV DATE -	1 OF 1

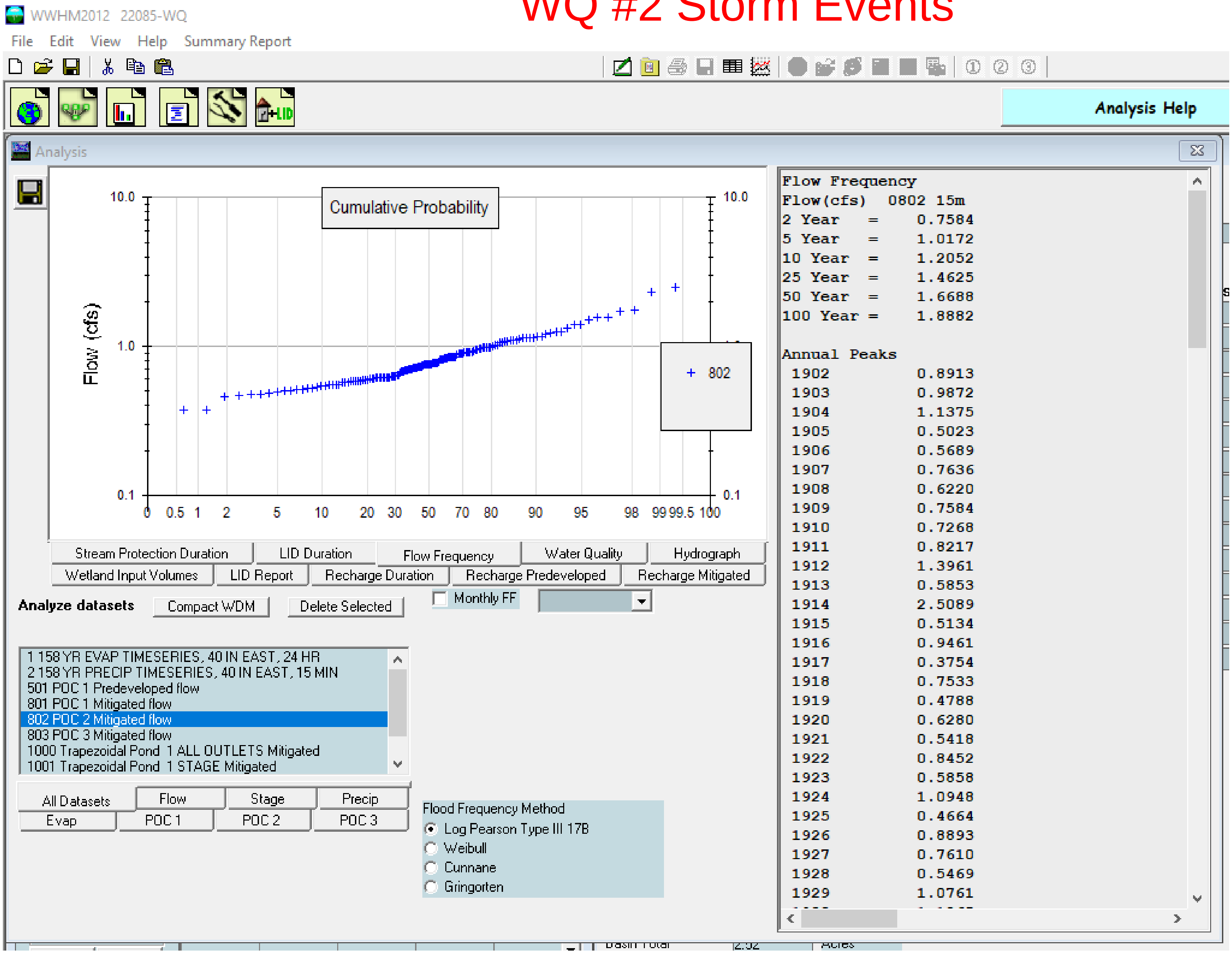
WQ #2 Basin


WWHM2012 22085-WQ
File Edit View Help Summary Report
Basin Help
Schematic
SCENARIOS
Predeveloped
Mitigated
Run Scenario
Basic Elements
Pro Elements
LID Toolbox
Commercial Toolbox
Move Elements
Save x,y Load x,y
X 20
Thu 8:04a - 22085-WQ - Finish Mitigated
Basin 3 Mitigated
Subbasin Name: Basin 2
Designate as Bypass for POC:
Surface
Interflow
Groundwater
Flows To :
Area in Basin
Show Only Selected
Available Pervious Acres
A/B, Forest, Flat 0
A/B, Forest, Mod 0
A/B, Forest, Steep 0
A/B, Pasture, Flat 0
A/B, Pasture, Mod 0
A/B, Pasture, Steep 0
A/B, Lawn, Flat 0
A/B, Lawn, Mod 0
A/B, Lawn, Steep 0
C, Forest, Flat 0
C, Forest, Mod 0
C, Forest, Steep 0
C, Pasture, Flat .42
C, Pasture, Mod 0
C, Pasture, Steep 0
C, Lawn, Flat 0
C, Lawn, Mod 0
C, Lawn, Steep 0
SAT, Forest, Flat 0
SAT, Forest, Mod 0
SAT, Forest, Steep 0
Available Impervious Acres
ROADS/FLAT 0
ROADS/MOD 0
ROADS/STEEP 0
ROOF TOPS/FLAT 0
DRIVEWAYS/FLAT 0
DRIVEWAYS/MOD 0
DRIVEWAYS/STEEP 0
SIDEWALKS/FLAT 0
SIDEWALKS/MOD 0
SIDEWALKS/STEEP 0
PARKING/FLAT 2.1
PARKING/MOD 0
PARKING/STEEP 0
POND 0
Porous Pavement 0
Pervious Total 0.42 Acres
Impervious Total 2.1 Acres
Basin Total 2.52 Acres
Deselect Zero
Select By:
GO

WQ #2 WQ Flowrate



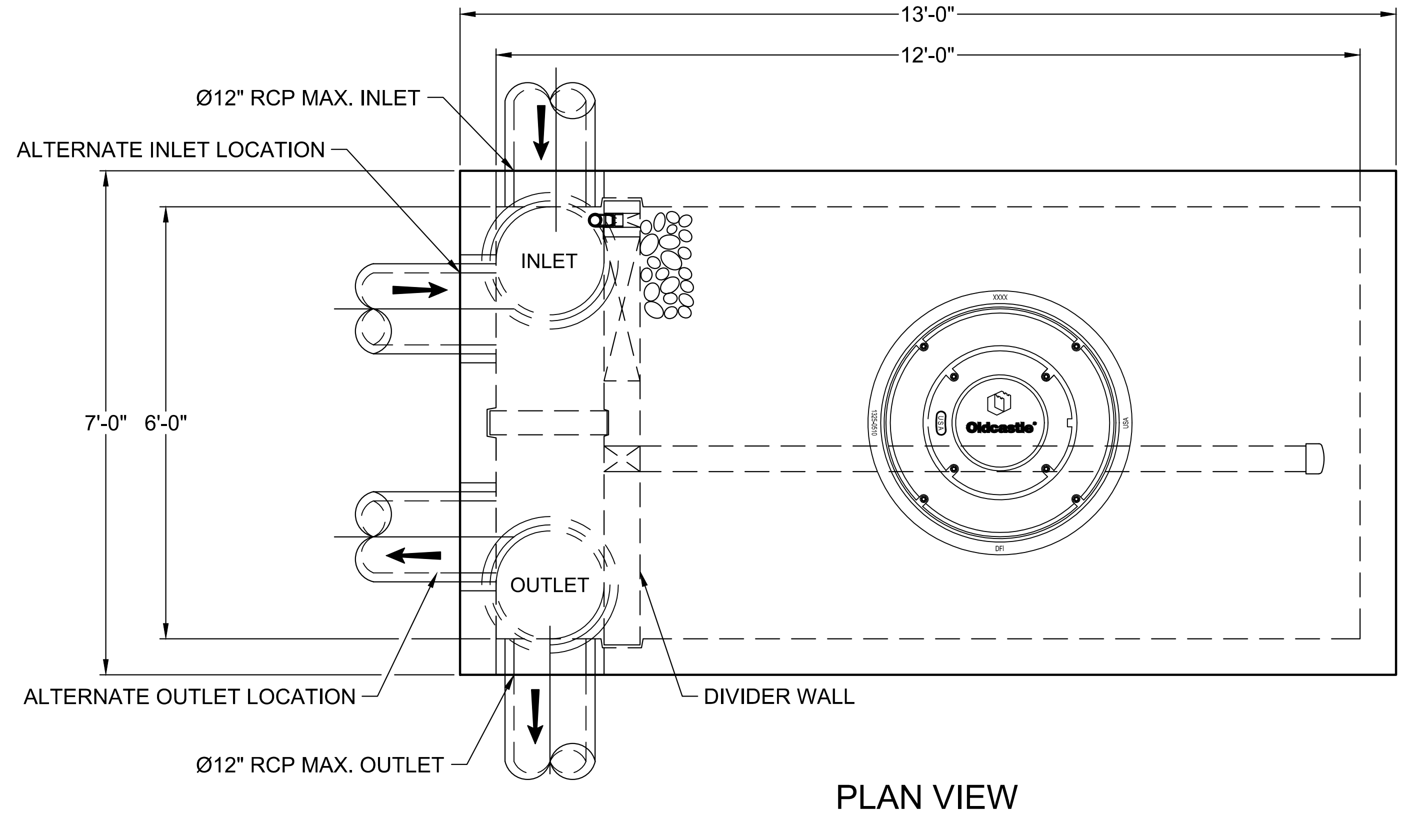
WQ #2 Storm Events



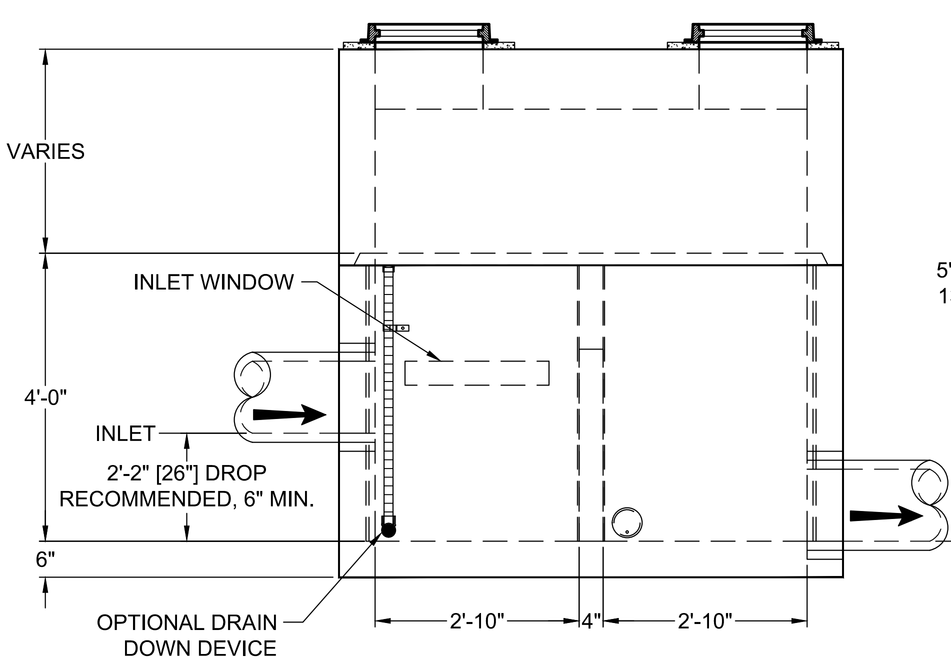
SITE SPECIFIC DATA				
Structure ID				WQ#3
Treatment Flow Rate (cfs)				0.1837
Peak Flow Rate (cfs)				1.8882
Rim Elevation				55.41
Top of Vault Elevation				
Pipe Data	Pipe Location	Pipe Size	Pipe Type	Invert Elevation
Inlet	W	12"	CPEP	49.55
Outlet	E	12"	CPEP	49.25
Notes:				

PERFORMANCE SPECIFICATIONS	
Treatment Flow Capacities:*	
NJDEP 80% Removal, 75 micron	0.240 cfs
WA Ecology GULD - Basic, Enhanced & Phosphorus	0.213 cfs
Bypass Capacity	5.0 cfs

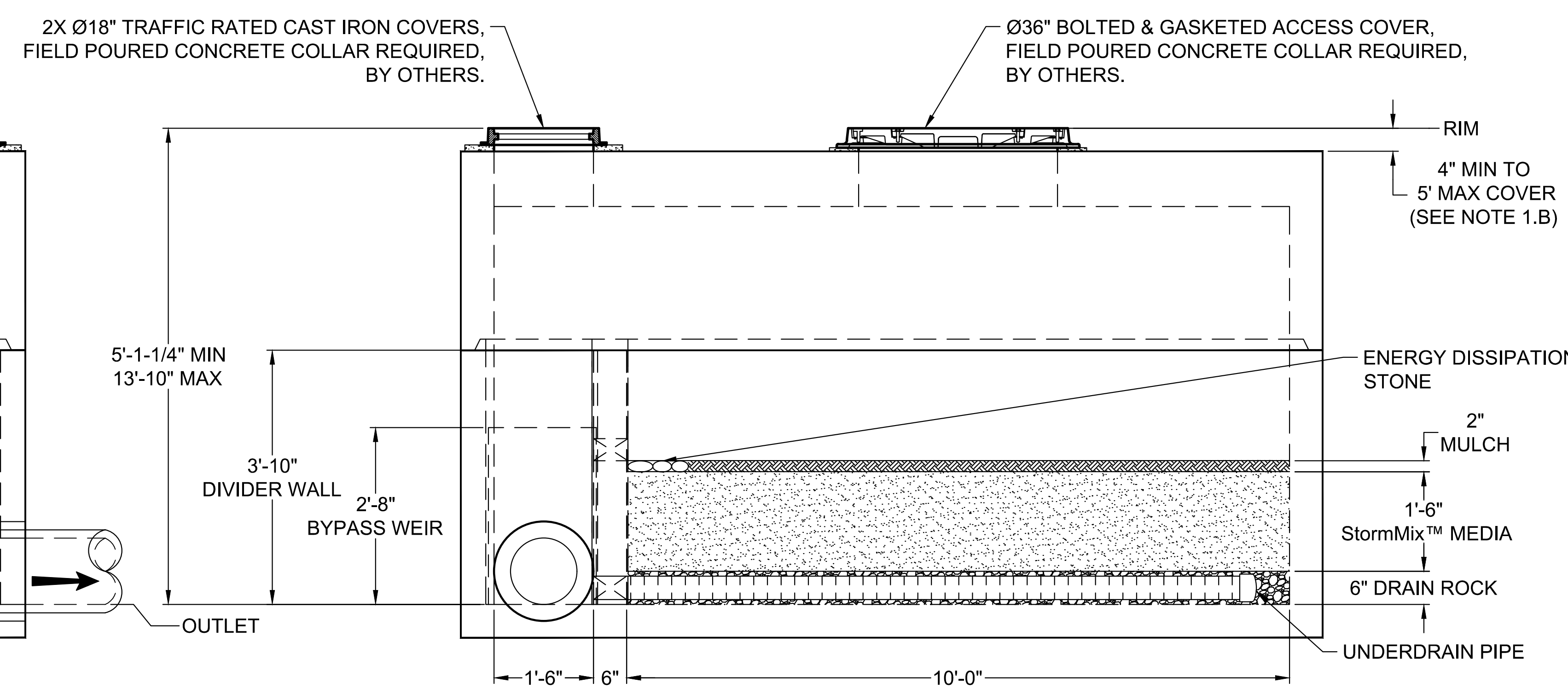
*Contact Oldcastle for alternative treatment flow capacities.



PLAN VIEW



LEFT END VIEW



ELEVATION VIEW

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 (WITH IMPACT)
   B. DESIGN SOIL COVER: 5'-0" MAXIMUM
   C. ASSUMED WATER TABLE: BELOW BASE OF PRECAST (ENGINEER-OF-RECORD TO CONFIRM SITE WATER TABLE ELEVATION)
   D. LATERAL EARTH PRESSURE: 45 PCF (DRAINED)
   E. LATERAL LIVE LOAD SURCHARGE: 80 PSF (APPLIED TO 8'-0" BELOW GRADE)
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28-DAY MINIMUM COMPRESSIVE STRENGTH: 5,000 PSI MINIMUM.
3. REINFORCING: REBAR, ASTM A615/A706, GRADE 60
4. CEMENT: ASTM C150
5. REQUIRED ALLOWABLE SOIL BEARING CAPACITY: 2,500 PSF
6. REFERENCE STANDARD:
   A. ASTM C890
   B. ASTM C913
   C. ACI 318-14
7. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. ENGINEER-OF-RECORD SHALL VERIFY FY THAT NOTED PARAMETERS MEET OR EXCEED PROJECT REQUIREMENTS. IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW.
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9. CONTRACTOR RESPONSIBLE TO VERIFY ALL SIZES, LOCATIONS, AND ELEVATIONS OF OPENINGS.
10. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
11. SECTION HEIGHTS, SLAB/WALL THICKNESSES, AND KEYWAYS ARE SUBJECT TO CHANGE AS REQUIRED FOR SITE REQUIREMENTS AND/OR DUE TO PRODUCT AVAILABILITY AND PRODUCTION FACILITY CONSTRAINTS.
12. MAXIMUM PICK WEIGHTS*:
    A. TOP: XX,XXX LBS
    B. BASE: XX,XXX LBS*
    (* COMBINED WEIGHT OF BASE INCLUDES BYPASS WEIR, DIVIDER WALL, ROCK & MEDIA)
13. INTERNALS SHALL CONSIST OF UNDERDRAIN PIPE, ROCK, STORMMIX™ MEDIA, MULCH, DIVIDER WALL, BYPASS WEIR AND OPTIONAL DRAIN DOWN.

Bioretention/
Biofiltration

Oldcastle Infrastructure™
A CRH COMPANY

Ph: 800.579.8819 | www.oldcastleinfrastructure.com/stormwater

BioPod™ Biofilter System (STANDARD)
Underground Vault with Internal Bypass

CUSTOMER
-

PROJECT NAME
-

SHEET NAME	REVISION	SHEET
Specifier Drawing BPU-612IB	-	1 OF 1
	REV DATE -	

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

March 2022

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), DISSOLVED METALS (ENHANCED), AND PHOSPHORUS TREATMENT

For

Oldcastle Infrastructure, Inc.'s
The BioPod™ Biofilter
(Formerly the TreePod Biofilter)

Ecology's Decision

Based on Oldcastle Infrastructure, Inc. application submissions for The BioPod™ Biofilter (BioPod), Ecology hereby issues the following use level designation:

1) General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus Treatment:
   - Sized at a hydraulic loading rate of 1.6 gallons per minute (gpm) per square foot (sq ft) of media surface area.
   - Constructed with a minimum media thickness of 18-inches (1.5-feet)
2) Ecology approves the BioPod at the hydraulic loading rate listed above, to achieve the maximum water quality design flow rate. The water quality design flow rates are calculated using the following procedures:
   - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology- approved continuous runoff model.
   - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
   - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
3) For systems that have a drain down outlet, designers must increase the water quality design flow rate calculated in Item 2, above, to account for the water that will enter the initial bay but won't be treated by the engineered soil. Multiply the flow rate determined above by 1.05

to determine the required flowrate for the BioPod unit.

4) The GULD has no expiration date, but may be amended or revoked by Ecology.

Ecology's Conditions of Use

The BioPod shall comply with these conditions:

1) Applicants shall design, assemble, install, operate, and maintain the BioPod installations in accordance with Oldcastle Infrastructure Inc.'s applicable manuals and the Ecology Decision.

2) The minimum size filter surface-area for use in Washington is determined by using the design water quality flow rate (as determined in Ecology Decision, Item 3, above) and the hydraulic loading rate (as identified in Ecology Decision, Item 1, above). Calculate the required area by dividing the water quality design flow rate (cu-ft/sec) by the hydraulic loading rate (converted to ft/sec) to obtain the required surface area (sq ft) of the BioPod unit.

3) BioPod media shall conform to the specifications submitted to and approved by Ecology.

4) The applicant tested the BioPod without plants. This GULD applies to the BioPod Stormwater Treatment System whether plants are included in the final product or not.

5) Maintenance: The required inspection/maintenance interval for stormwater treatment devices is often dependent on the efficiency of the device and the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.

   - The BioPod is designed for a target maintenance interval of 1 year. Maintenance includes replacing the mulch, assessing plant health, removal of trash, and raking the top few inches of engineered media.
   - The BioPod system initially tested at the Lake Union Ship Canal Test Facility in Seattle, WA required maintenance after 1.5 months, or 6.3% of a water year. Monitoring personnel observed similar maintenance issues with other systems evaluated at the Test Facility. Runoff from the Test Facility may be unusual and maintenance requirements of systems installed at the Test Facility may not be indicative of typical maintenance requirements. Because of this, the initial version of the GULD required Oldcastle to subsequently "conduct hydraulic testing to obtain information about maintenance requirements on a site with runoff that is more typical of the Pacific Northwest". Quarterly testing from a 15-month maintenance frequency assessment conducted on a BioPod system installed along a roadway in Des Moines, WA indicated the system was able to treat a full water year before requiring maintenance.
   - Test results provided to Ecology from a BioPod System evaluated in a lab following New Jersey Department of Environmental Protection Laboratory Protocol for Filtration MTDs have indicated the BioPod System is capable of longer maintenance intervals.
   - Owners/operators must inspect BioPod systems for a minimum of twelve months from the start of post-construction operation to determine site-specific inspection/maintenance schedules and requirements. Owners/operators must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According

to the SWMMEW, the wet season in eastern Washington is October 1 to June 30.) After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flow rate and/or a decrease in pollutant removal ability.

6) Install the BioPod in such a manner that you bypass flows exceeding the maximum operating rate and you will not resuspend captured sediment.
7) Discharges from the BioPod shall not cause or contribute to water quality standard violations in receiving waters.

Approved Alternate Configurations

BioPod Internal Bypass

1) The BioPod Internal Bypass configuration may be combined with a Curb Inlet, Grated Inlet, and Piped-In Inlet. Water quality flows and peak flows are directed from the curb, overhead grate, or piped inlet to a contoured inlet rack. The inlet rack disperses water quality flows over the top surface of the biofiltration chamber. Excess flows are diverted over a curved bypass weir to the outlet area without passing through the treatment area. Both water quality flows and bypass flows are combined in the outlet area prior to being discharged out of the system.
2) To select a BioPod Internal Bypass unit, the designer must determine the size of the standard unit using the sizing guidance described above. Systems that have an internal bypass may use the off-line water quality design flow rate.
3) The internal bypass configuration has a maximum flow rate of 900 gallons per minute. Sites where the anticipated flow rate at the treatment device is larger than 900 gpm must use an external bypass, or size the treatment device for the on-line water quality design flow rate.

Applicant:	Oldcastle Infrastructure, Inc.
Applicant's Address:	7100 Longe St, Suite 100 Stockton, CA 95206

Application Documents:

BioPod™ Stormwater Filter Maintenance Frequency Assessment, Prepared for Oldcastle Infrastructure, Inc., Prepared by Herrera Environmental Consultants, Inc. February 2022

Technical Evaluation Report TreePod™ BioFilter System Performance Certification Project, Prepared for Oldcastle, Inc., Prepared by Herrera Environmental Consultants, Inc. February 2018

Technical Memorandum: Response to Board of External Reviewers' Comments on the Technical Evaluation Report for the TreePod™ Biofilter System Performance Certification Project, Oldcastle, Inc. and Herrera Environmental Consultants, Inc., February 2018

Technical Memorandum: Response to Board of External Reviewers' Comments on the Technical Evaluation Report for the TreePod™ Biofilter System Performance Certification Project, Oldcastle, Inc. and Herrera Environmental Consultants, Inc., January 2018

Application for Pilot Use Level Designation, TreePod™ Biofilter – Stormwater Treatment System, Oldcastle Stormwater Solutions, May 2016

Emerging Stormwater Treatment Technologies Application for Certification: The TreePod™ Biofilter, Oldcastle Stormwater Solutions, April 2016

Applicant's Use Level Request:

- General Use Level Designation as a Basic, Enhanced, and Phosphorus Treatment device in accordance with Ecology's *Stormwater Management Manual for Western Washington*

Applicant's Performance Claims:

Based on results from laboratory and field-testing, the applicant claims the BioPod™ Biofilter operating at a hydraulic loading rate of 153 inches per hour is able to remove:

- 80% of Total Suspended Solids (TSS) for influent concentrations greater than 100 mg/L and achieve a 20 mg/L effluent for influent concentrations less than 100 mg/L.
- 60% dissolved zinc for influent concentrations 0.02 to 0.3 mg/L.
- 30% dissolved copper for influent concentrations 0.005 to 0.02 mg/L.
- 50% or greater total phosphorus for influent concentrations 0.1 to 0.5 mg/L.

Ecology's Recommendations:

Ecology finds that:

- Oldcastle Infrastructure, Inc. has shown Ecology, through laboratory and field testing, that the BioPod™ Biofilter is capable of attaining Ecology's Basic, Total Phosphorus, and Enhanced treatment goals.

Findings of Fact:

Field Testing

- Herrera Environmental Consultants, Inc. conducted monitoring of the BioPod™ Biofilter at the Lake Union Ship Canal Test Facility in Seattle Washington between November 2016 and April 2018. Herrera collected flow-weight composite samples during 14 separate storm events and peak flow grab samples during 3 separate storm events. The system was sized at an infiltration rate of 153 inches per hour or a hydraulic loading rate of 1.6 gpm/ft^2.

- The D_{50} of the influent PSD ranged from 3 to 292 microns, with an average D_{50} of 28 microns.
- Influent TSS concentrations ranged from 17 mg/L to 666 mg/L, with a mean concentration of 98 mg/L. For all samples (influent concentrations above and below 100 mg/L) the bootstrap estimate of the lower 95 percent confidence limit (LCL 95) of the mean TSS reduction was 84% and the bootstrap estimate of the upper 95 percent confidence limit (UCL95) of the mean TSS effluent concentration was 8.2 mg/L.
- Dissolved copper influent concentrations from the 17 events ranged from 9.0 µg/L to 21.1 µg/L. The 21.1 µg/L data point was reduced to 20.0 µg/L, the upper limit to the TAPE allowed influent concentration range, prior to calculating the pollutant removal. A bootstrap estimate of the LCL95 of the mean dissolved copper reduction was 35%.
- Dissolved zinc influent concentrations from the 17 events ranged from 26.1 µg/L to 43.3 µg/L. A bootstrap estimate of the LCL95 of the mean dissolved zinc reduction was 71%.
- Total phosphorus influent concentrations from the 17 events ranged from 0.064 mg/L to 1.56 mg/L. All influent data greater than 0.5 mg/L were reduced to 0.5 mg/L, the upper limit to the TAPE allowed influent concentration range, prior to calculating the pollutant removal. A bootstrap estimate of the LCL95 of the mean total phosphorus reduction was 64%.
- The system experienced rapid sediment loading and needed to be maintained after 1.5 months. Monitoring personnel observed similar sediment loading issues with other systems evaluated at the Test Facility. The runoff from the Test Facility may not be indicative of maintenance requirements for all sites.

- Herrera Environmental Consultants, Inc. conducted a maintenance frequency assessment of the BioPod™ installed along a roadway in Des Moines, WA between September 2020 and January 2022.
  - Herrera collected influent grab samples during 10 storm events and paired effluent samples during 5 storm events. Influent concentrations ranged from 1 mg/L to 164 mg/L, with a median concentration of 23 mg/L. Effluent concentrations ranged from 1 mg/L to 19 mg/L, with a median of 5 mg/L.
  - Herrera collected influent PSD samples during 3 storm events. The D_{50} for the samples were 42, 1306, and 57 microns. The 1306 micron value was collected during an event with an influent TSS concentration of 1 mg/L. It is assumed this sample was atypical and that it contained a few grains of very coarse sand and almost no other particles.
  - Herrera used a water truck to conduct flow testing 7 times to assess how long the system could filter at the design flow rate without bypass. Results show the system was able to treat up to a full water year before the system needed maintenance.

Laboratory Testing

- Good Harbour Laboratories (GHL) conducted laboratory testing at their site in Mississauga, Ontario in October 2017 following the New Jersey Department of Environmental Protection Laboratory Protocol for Filtration MTDs. The testing evaluated a 4-foot by 6-foot standard biofiltration chamber and inlet contour rack with bypass weir. The test sediment used during the testing was custom blended by GHL using various commercially available silica sands, which had an average d_{50} of 69 µm. Based on the lab test results:

  - GHL evaluated removal efficiency over 15 events at a Maximum Treatment Flow Rate (MTFR) of 37.6 gpm, which corresponds to a MTFR to effective filtration treatment area ratio of 1.80 gpm/ft^2. The system, operating at 100% of the MTFR with an average influent concentration of 201.3 mg/L, had an average removal efficiency of 99 percent.
  - GHL evaluated sediment mass loading capacity over an additional 16 events using an influent SSC concentration of 400 mg/L. The first 11 runs were evaluated at 100% of the MTFR. The BioPod began to bypass, so the remaining 5 runs were evaluated at 90% of the MTFR. The total mass of the sediment captured was 245.0 lbs and the cumulative mass removal efficiency was 96.3%.

- Herrera Environmental Consultants Inc. conducted laboratory testing in September 2014 at the Seattle University Engineering Laboratory. The testing evaluated the flushing characteristics, hydraulic conductivity, and pollutant removal ability of twelve different media blends. Based on this testing, Oldcastle Infrastructure, Inc. selected one media blend, Mix 8, for inclusion in their TAPE evaluation of the BioPod™ Biofilter.
  - Herrera evaluated Mix 8 in an 8-inch diameter by 36-inch tall polyvinyl chloride (PVC) column. The column contained 18-inches of Mix 8 on top of 6-inches of pea gravel. The BioPod will normally include a 3-inch mulch layer on top of the media layer; however, this was not included in the laboratory testing.
  - Mix 8 has a hydraulic conductivity of 218 inches per hour; however, evaluation of the pollutant removal ability of the media was based on an infiltration rate of 115 inches per hour. The media was tested at 75%, 100%, and 125% of the infiltration rate. Based on the lab test results:
    - The system was evaluated using natural stormwater. The dissolved copper and dissolved zinc concentrations in the natural stormwater were lower than the TAPE influent standards; therefore, the stormwater was spiked with 66.4 mL of 100 mg/L Cu solution and 113.6 mL of 1,000 mg/L Zn solution.
    - The BioPod removed an average of 81% of TSS, with a mean influent concentration of 48.4 mg/L and a mean effluent concentration of 9.8 mg/L.
    - The BioPod removed an average of 94% of dissolved copper, with a mean influent concentration of 10.6 µg/L and a mean effluent concentration of 0.6 µg/L.
    - The BioPod removed an average of 97% of dissolved zinc, with a mean influent concentration of 117 µg/L and a mean effluent concentration of 4 µg/L.
    - The BioPod removed an average of 97% of total phosphorus, with a mean influent concentration of 2.52 mg/L and a mean effluent concentration of 0.066 mg/L. When total phosphorus influent concentrations were capped at the TAPE upper limit of 0.5 mg/L, calculations showed an average removal of 87%.

Other BioPod Related Issues to be Addressed by the Company:

1. None identified at this time.

Technology Description: Download at https://oldcastleprecast.com/stormwater/bioretention-biofiltration-applications/bioretention-biofiltration-solutions/

Contact Information:

Applicant: Chris Demarest
Oldcastle Infrastructure, Inc.
(925)667-7100
Chris.demarest@oldcastle.com

Applicant website: https://oldcastleprecast.com/stormwater/

Ecology web link: https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 870-0983
douglas.howie@ecy.wa.gov

Revision History

Date	Revision
March 2018	GULD granted for Basic Treatment
March 2018	Provisional GULD granted for Enhanced and Phosphorus Treatment
June 2016	PULD Granted
April 2018	GULD for Basic and Provisional GULD for Enhanced and Phosphorus granted, changed name to BioPod from TreePod
July 2018	GULD for Enhanced and Phosphorus granted
September 2018	Changed Address for Oldcastle
December 2018	Added minimum media thickness requirement
May 2019	Changed language on who must Install and maintain the device from Oldcastle to Applicants
August 2019	Added text on sizing using infiltration rate and water quality design flow rate
October 2019	Added text describing ability to use off-line design water quality flow rate for sizing due to internal bypass
December 2021	Extended approval to installations without plants, added sizing adjustment when using facilities with a drawdown outlet
March 2022	Added results from the maintenance frequency assessment to the Ecology's Conditions of Use and the Findings of Fact sections

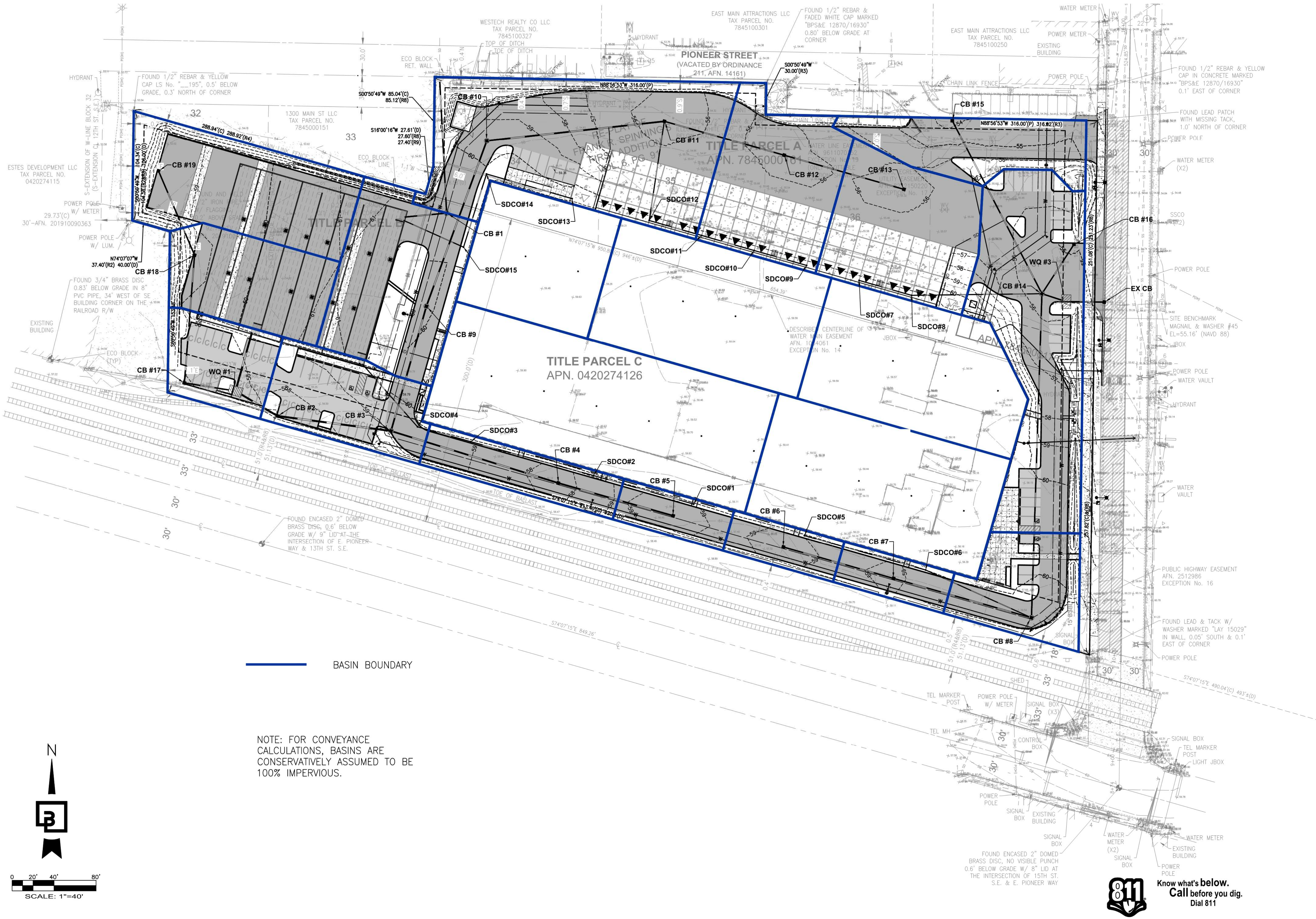
Tab 5.0

5.0 CONVEYANCE SYSTEM ANALYSIS AND DESIGN

The conveyance system for this project consists of a series of catch basins and storm drainage conveyance pipes. Pipe sizing calculations are included in Figure 10. The 25-year and 100-year storm events are analyzed.

Figure 10
Conveyance Calculations

CONVEYANCE BASIN MAP EXHIBIT



BASIN BOUNDARY

NOTE: FOR CONVEYANCE CALCULATIONS, BASINS ARE CONSERVATIVELY ASSUMED TO BE 100% IMPERVIOUS.

Know what's **below.** **Call** before you dig. Dial 811

No.	Date	By	Ckd.	Appr.	Revision

Title: CONVEYANCE BASIN MAP EXHIBIT

FORTRESS - PUYALLUP

For: CREF3 PUYALLUP OWNER LLC
11611 SAN VICENTE BLVD
10TH FLOOR
LOS ANGELES, CA 90049

Scale: Horizontal 1"=40'; Vertical N/A

Designed VMS
Drawn VMS
Checked KEH
Approved KEH
Date 10/04/22

Barghausen Consulting Engineers, Inc.
18215 72nd Avenue South
Kent, WA 98032
425.251.6222
barghausen.com

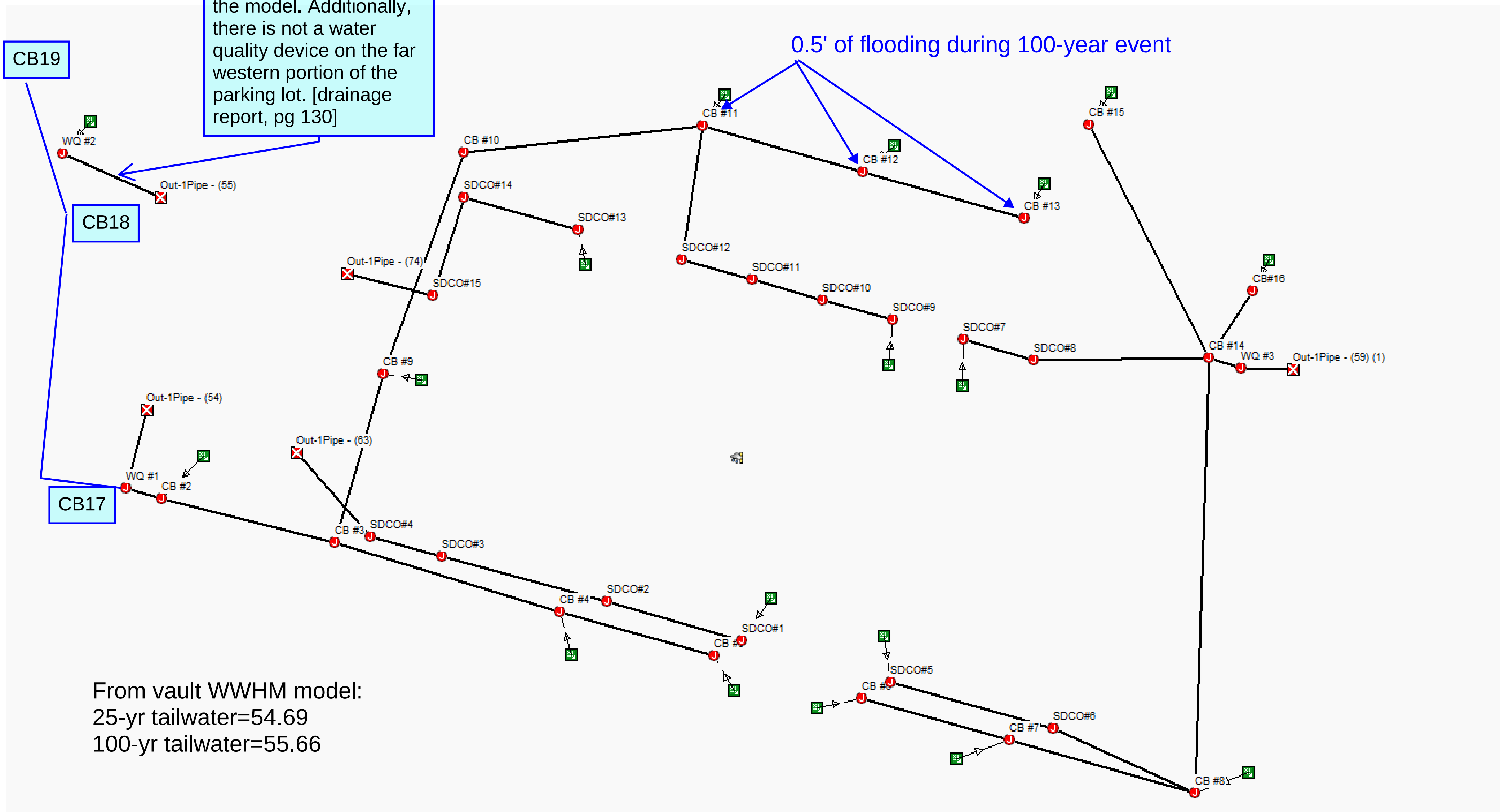
Job Number 22085

Sheet of

P:\22000s\22085\exhibit\conveyance map.dwg 7/3/2023 8:49 AM KHARRIS

Conveyance Model Diagram

The west side of the model does not appear to correctly represent the site conditions. CB's 19, 18, 17 and the associate pipes are missing from the model. Additionally, there is not a water quality device on the far western portion of the parking lot. [drainage report, pg 130]



From vault WWHM model:
25-yr tailwater=54.69
100-yr tailwater=55.66

25-yr storm event

Autodesk® Storm and Sanitary Analysis 2024 - Version 13.6.268 (Build 0)

****
Project Description
****

File Name 22085-conveyance25.SPF

****
Analysis Options
****

Flow Units .... cfs
Subbasin Hydrograph Method. Santa Barbara UH
Time of Concentration...... SCS TR-55
Link Routing Method .... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date JUN-30-2023 00:00:00
Ending Date JUL-01-2023 00:00:00
Report Time Step 00:00:10

****
Element Count
****

Number of rain gages 1
Number of subbasins 20
Number of nodes 39
Number of links 35

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	25-yr	CUMULATIVE	6.00

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Imperv. Area %	Raingage
Sub-17	0.19	100.00	Rain Gage-01
Sub-18	0.30	100.00	Rain Gage-01
Sub-19	0.44	100.00	Rain Gage-01
Sub-CB #11	0.80	100.00	Rain Gage-01
Sub-CB #12	0.39	100.00	Rain Gage-01
Sub-CB #13	0.41	100.00	Rain Gage-01
Sub-CB #15	0.26	100.00	Rain Gage-01
Sub-CB #2	0.28	100.00	Rain Gage-01
Sub-CB #4	0.18	100.00	Rain Gage-01
Sub-CB #5	0.10	100.00	Rain Gage-01
Sub-CB #6	0.10	100.00	Rain Gage-01
Sub-CB #7	0.10	100.00	Rain Gage-01
Sub-CB #8	0.24	100.00	Rain Gage-01
Sub-CB #9	0.44	100.00	Rain Gage-01
Sub-CB#16	0.65	100.00	Rain Gage-01
Sub-SDCO#1	0.87	100.00	Rain Gage-01
Sub-SDCO#13	0.36	100.00	Rain Gage-01
Sub-SDCO#5	0.63	100.00	Rain Gage-01

Sub-SDCO#7	0.54	100.00	Rain Gage-01
Sub-SDCO#9	0.57	100.00	Rain Gage-01

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CB #10	JUNCTION	51.40	59.62	0.00	
CB #11	JUNCTION	51.86	55.50	3344.00	
CB #12	JUNCTION	52.18	55.50	3960.00	
CB #13	JUNCTION	52.50	55.50	3580.00	
CB #14	JUNCTION	51.35	55.50	0.00	
CB #15	JUNCTION	50.60	53.60	0.00	
CB #2	JUNCTION	50.28	57.22	0.00	
CB #3	JUNCTION	50.62	59.12	0.00	
CB #4	JUNCTION	53.93	57.50	0.00	
CB #5	JUNCTION	55.50	58.50	0.00	
CB #6	JUNCTION	54.50	58.50	0.00	
CB #7	JUNCTION	53.95	58.50	0.00	
CB #8	JUNCTION	53.27	59.00	0.00	
CB #9	JUNCTION	50.95	59.40	0.00	
CB#16	JUNCTION	51.63	54.63	0.00	
CB#17	JUNCTION	53.95	56.86	0.00	
CB#18	JUNCTION	54.56	58.52	0.00	
CB#19	JUNCTION	55.00	58.03	0.00	
SDCO#1	JUNCTION	57.00	59.97	0.00	
SDCO#10	JUNCTION	55.14	57.05	0.00	
SDCO#11	JUNCTION	54.62	57.05	0.00	
SDCO#12	JUNCTION	54.10	57.05	0.00	
SDCO#13	JUNCTION	58.50	60.81	0.00	
SDCO#14	JUNCTION	57.65	60.39	0.00	
SDCO#15	JUNCTION	56.92	60.75	0.00	
SDCO#2	JUNCTION	56.01	59.92	0.00	
SDCO#3	JUNCTION	54.80	59.33	0.00	
SDCO#4	JUNCTION	54.27	59.61	0.00	
SDCO#5	JUNCTION	58.80	59.97	0.00	
SDCO#6	JUNCTION	57.60	60.28	0.00	
SDCO#7	JUNCTION	55.78	57.05	0.00	
SDCO#8	JUNCTION	55.26	57.05	0.00	
SDCO#9	JUNCTION	55.66	57.05	0.00	
WQ #1	JUNCTION	50.22	57.61	0.00	
WQ #2	JUNCTION	49.25	55.41	0.00	
Out-1Pipe - (54)	OUTFALL	49.60	51.10	0.00	
Out-1Pipe - (59) (1)	OUTFALL	49.00	50.00	0.00	
Out-1Pipe - (63)	OUTFALL	49.60	50.27	0.00	
Out-1Pipe - (74)	OUTFALL	49.60	50.98	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01	CB#19	CB#18	CONDUIT	87.0	0.5057	0.0120
Link-02	CB#18	CB#17	CONDUIT	122.0	0.5000	0.0120
Link-03	CB#17	WQ #1	CONDUIT	49.0	7.6122	0.0120
Pipe - (42)	CB #13	CB #12	CONDUIT	118.7	0.2696	0.0120
Pipe - (43)	CB #12	CB #11	CONDUIT	118.7	0.2696	0.0120
Pipe - (44)	CB #11	CB #10	CONDUIT	170.2	0.2703	0.0120
Pipe - (45)	CB #10	CB #9	CONDUIT	167.8	0.2683	0.0120
Pipe - (46)	CB #9	CB #3	CONDUIT	123.5	0.2673	0.0120
Pipe - (47)	CB #7	CB #8	CONDUIT	136.7	0.4976	0.0120

Pipe - (48)	CB #6	CB #7	CONDUIT	109.2	0.5000	0.0120
Pipe - (49)	SDCO#1	SDCO#2	CONDUIT	99.3	0.9968	0.0140
Pipe - (50)	CB #5	CB #4	CONDUIT	113.8	1.3792	0.0120
Pipe - (51)	CB #4	CB #3	CONDUIT	166.9	0.5000	0.0120
Pipe - (52)	CB #3	CB #2	CONDUIT	126.9	0.2678	0.0120
Pipe - (53)	CB #2	WQ #1	CONDUIT	26.1	0.2302	0.0120
Pipe - (54)	WQ #1	Out-1Pipe - (54)	CONDUIT	57.8	1.0728	0.0120
Pipe - (58)	CB #14	CB #15	CONDUIT	185.6	0.4037	0.0120
Pipe - (59)	CB #14	WQ #2	CONDUIT	24.3	8.6409	0.0120
Pipe - (59) (1)	WQ #2	Out-1Pipe - (59) (1)	CONDUIT	36.3	0.6896	0.0120
Pipe - (59) (2)	CB#16	CB #14	CONDUIT	56.1	0.5000	0.0120
Pipe - (60)	CB #8	CB #14	CONDUIT	308.8	0.4987	0.0120
Pipe - (61)	SDCO#2	SDCO#3	CONDUIT	121.2	0.9983	0.0140
Pipe - (62)	SDCO#3	SDCO#4	CONDUIT	52.8	1.0000	0.0140
Pipe - (63)	SDCO#4	Out-1Pipe - (63)	CONDUIT	79.5	5.8724	0.0140
Pipe - (64)	SDCO#5	SDCO#6	CONDUIT	120.1	0.9992	0.0140
Pipe - (65)	SDCO#6	CB #8	CONDUIT	110.6	3.3461	0.0140
Pipe - (66)	SDCO#7	SDCO#8	CONDUIT	52.0	1.0000	0.0140
Pipe - (67)	SDCO#8	CB #14	CONDUIT	124.2	3.1483	0.0140
Pipe - (68)	SDCO#9	SDCO#10	CONDUIT	51.9	1.0013	0.0140
Pipe - (69)	SDCO#10	SDCO#11	CONDUIT	52.0	0.9992	0.0140
Pipe - (70)	SDCO#11	SDCO#12	CONDUIT	52.0	1.0000	0.0140
Pipe - (71)	SDCO#12	CB #11	CONDUIT	95.7	2.3406	0.0140
Pipe - (72)	SDCO#13	SDCO#14	CONDUIT	84.9	1.0000	0.0140
Pipe - (73)	SDCO#14	SDCO#15	CONDUIT	73.0	1.0000	0.0140
Pipe - (74)	SDCO#15	Out-1Pipe - (74)	CONDUIT	62.4	10.6001	0.0140

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	1.00	1.00	1	0.79	0.25	2.74
Link-02	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Link-03	CIRCULAR	1.00	1.00	1	0.79	0.25	10.65
Pipe - (42)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.00
Pipe - (43)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.00
Pipe - (44)	CIRCULAR	1.25	1.25	1	1.23	0.31	3.64
Pipe - (45)	CIRCULAR	1.25	1.25	1	1.23	0.31	3.62
Pipe - (46)	CIRCULAR	1.25	1.25	1	1.23	0.31	3.62
Pipe - (47)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.72
Pipe - (48)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Pipe - (49)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (50)	CIRCULAR	1.25	1.25	1	1.23	0.31	8.22

Pipe - (51)	CIRCULAR	1.25	1.25	1	1.23	0.31	4.95
Pipe - (52)	CIRCULAR	1.50	1.50	1	1.77	0.38	5.89
Pipe - (53)	CIRCULAR	1.50	1.50	1	1.77	0.38	5.46
Pipe - (54)	CIRCULAR	1.50	1.50	1	1.77	0.38	11.79
Pipe - (58)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.45
Pipe - (59)	CIRCULAR	1.00	1.00	1	0.79	0.25	11.35
Pipe - (59) (1)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.21
Pipe - (59) (2)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Pipe - (60)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Pipe - (61)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (62)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (63)	CIRCULAR	0.67	0.67	1	0.35	0.17	2.72
Pipe - (64)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (65)	CIRCULAR	0.67	0.67	1	0.35	0.17	2.05
Pipe - (66)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (67)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.99
Pipe - (68)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (69)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (70)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (71)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.72
Pipe - (72)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (73)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (74)	CIRCULAR	0.67	0.67	1	0.35	0.17	3.65

```
**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         2.250         3.444
Surface Runoff ...........         2.095         3.208
Continuity Error (%) .....         0.000


**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.028         0.009
External Outflow .........         2.096         0.683
Initial Stored Volume ....         0.016         0.005
Final Stored Volume ......         0.038         0.012
Continuity Error (%) .....         0.001


*****************************************
```

Composite Curve Number Computations Report
****

Subbasin Sub-17

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.19		98.00

Subbasin Sub-18

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.30		98.00

Subbasin Sub-19

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.44		98.00

Subbasin Sub-CB #11

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.80		98.00

Subbasin Sub-CB #12

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.39		98.00

Subbasin Sub-CB #13

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.41		98.00

Subbasin Sub-CB #15

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.26		98.00

Subbasin Sub-CB #2

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.28		98.00

```
---------------------
Subbasin Sub-CB #4
---------------------
                                                         Area          Soil
Soil/Surface Description                               (acres)        Group           CN
-------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.18                       98.00

---------------------
Subbasin Sub-CB #5
---------------------
                                                         Area          Soil
Soil/Surface Description                               (acres)        Group           CN
-------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.10                       98.00

---------------------
Subbasin Sub-CB #6
---------------------
                                                         Area          Soil
Soil/Surface Description                               (acres)        Group           CN
-------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.10                       98.00

---------------------
Subbasin Sub-CB #7
---------------------
                                                         Area          Soil
Soil/Surface Description                               (acres)        Group           CN
-------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.10                       98.00

---------------------
Subbasin Sub-CB #8
---------------------
                                                         Area          Soil
Soil/Surface Description                               (acres)        Group           CN
-------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.24                       98.00

---------------------
Subbasin Sub-CB #9
---------------------
                                                         Area          Soil
Soil/Surface Description                               (acres)        Group           CN
-------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.44                       98.00

---------------------
Subbasin Sub-CB#16
---------------------
                                                         Area          Soil
Soil/Surface Description                               (acres)        Group           CN
-------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.65                       98.00

----------------------
Subbasin Sub-SDCO#1
----------------------
                                                         Area          Soil
Soil/Surface Description                               (acres)        Group           CN
-------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.87                       98.00

-----------------------
Subbasin Sub-SDCO#13
-----------------------
```

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.36		98.00

Subbasin Sub-SDCO#5

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.63		98.00

Subbasin Sub-SDCO#7

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.54		98.00

Subbasin Sub-SDCO#9

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.57		98.00

****
Runoff Coefficient Computations Report
****

Subbasin Sub-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.19	-	0.72
Composite Area & Weighted Runoff Coeff.	0.19		0.72

Subbasin Sub-18

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.30	-	0.72
Composite Area & Weighted Runoff Coeff.	0.30		0.72

Subbasin Sub-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.44	-	0.72
Composite Area & Weighted Runoff Coeff.	0.44		0.72

Subbasin Sub-CB #11

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.80	-	0.50

Composite Area & Weighted Runoff Coeff.	0.80		0.50

```
----------------------
Subbasin Sub-CB #12
----------------------
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.39	-	0.50
Composite Area & Weighted Runoff Coeff.	0.39		0.50

```
----------------------
Subbasin Sub-CB #13
----------------------
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.41	-	0.50
Composite Area & Weighted Runoff Coeff.	0.41		0.50

```
----------------------
Subbasin Sub-CB #15
----------------------
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.26	-	0.50
Composite Area & Weighted Runoff Coeff.	0.26		0.50

```
---------------------
Subbasin Sub-CB #2
---------------------
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.47	-	0.50
Composite Area & Weighted Runoff Coeff.	0.47		0.50

```
---------------------
Subbasin Sub-CB #4
---------------------
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.18	-	0.50
Composite Area & Weighted Runoff Coeff.	0.18		0.50

```
---------------------
Subbasin Sub-CB #5
---------------------
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.50
Composite Area & Weighted Runoff Coeff.	0.10		0.50

```
---------------------
Subbasin Sub-CB #6
---------------------
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.50
Composite Area & Weighted Runoff Coeff.	0.10		0.50

```
---------------------
Subbasin Sub-CB #7
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.50
Composite Area & Weighted Runoff Coeff.	0.10		0.50

Subbasin Sub-CB #8

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.24	-	0.50
Composite Area & Weighted Runoff Coeff.	0.24		0.50

Subbasin Sub-CB #9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.44	-	0.50
Composite Area & Weighted Runoff Coeff.	0.44		0.50

Subbasin Sub-CB#16

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.65	-	0.72
Composite Area & Weighted Runoff Coeff.	0.65		0.72

Subbasin Sub-SDCO#1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.87	-	0.50
Composite Area & Weighted Runoff Coeff.	0.87		0.50

Subbasin Sub-SDCO#13

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.36	-	0.50
Composite Area & Weighted Runoff Coeff.	0.36		0.50

Subbasin Sub-SDCO#5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.63	-	0.50
Composite Area & Weighted Runoff Coeff.	0.63		0.50

Subbasin Sub-SDCO#7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

-	0.54	-	0.50
Composite Area & Weighted Runoff Coeff.	0.54		0.50

Subbasin Sub-SDCO#9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.57	-	0.50
Composite Area & Weighted Runoff Coeff.	0.57		0.50

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

```
        Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
```

Channel Flow Equation

```
        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
        Aq = Flow Area (ft²)
        Wp = Wetted Perimeter (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
        n  = Manning's Roughness
```

```
  ------------------
  Subbasin Sub-17
  ------------------

==================================================================================================
          Total TOC (minutes):                         0.00

==================================================================================================


  ------------------
  Subbasin Sub-18
  ------------------

==================================================================================================
          Total TOC (minutes):                         0.00

==================================================================================================


  ------------------
  Subbasin Sub-19
  ------------------

==================================================================================================
          Total TOC (minutes):                         0.00

==================================================================================================


  ----------------------
  Subbasin Sub-CB #11
  ----------------------

==================================================================================================
          Total TOC (minutes):                         0.00

==================================================================================================


  ----------------------
  Subbasin Sub-CB #12
  ----------------------

==================================================================================================
          Total TOC (minutes):                         0.00

==================================================================================================


  ----------------------
  Subbasin Sub-CB #13
  ----------------------

==================================================================================================
          Total TOC (minutes):                         0.00

==================================================================================================


  ----------------------
  Subbasin Sub-CB #15
  ----------------------

==================================================================================================
          Total TOC (minutes):                         0.00
```

```
================================================================================================

  ---------------------
  Subbasin Sub-CB #2
  ---------------------

================================================================================================
         Total TOC (minutes):                          0.00

================================================================================================

  ---------------------
  Subbasin Sub-CB #4
  ---------------------

================================================================================================
         Total TOC (minutes):                          0.00

================================================================================================

  ---------------------
  Subbasin Sub-CB #5
  ---------------------

================================================================================================
         Total TOC (minutes):                          0.00

================================================================================================

  ---------------------
  Subbasin Sub-CB #6
  ---------------------

================================================================================================
         Total TOC (minutes):                          0.00

================================================================================================

  ---------------------
  Subbasin Sub-CB #7
  ---------------------

================================================================================================
         Total TOC (minutes):                          0.00

================================================================================================

  ---------------------
  Subbasin Sub-CB #8
  ---------------------

================================================================================================
         Total TOC (minutes):                          0.00

================================================================================================

  ---------------------
  Subbasin Sub-CB #9
  ---------------------
```

```
==============================================================================================
         Total TOC (minutes):                          0.00

==============================================================================================


  --------------------
  Subbasin Sub-CB#16
  --------------------

==============================================================================================
         Total TOC (minutes):                          0.00

==============================================================================================


  ---------------------
  Subbasin Sub-SDCO#1
  ---------------------

==============================================================================================
         Total TOC (minutes):                          0.00

==============================================================================================


  ----------------------
  Subbasin Sub-SDCO#13
  ----------------------

==============================================================================================
         Total TOC (minutes):                          0.00

==============================================================================================


  ---------------------
  Subbasin Sub-SDCO#5
  ---------------------

==============================================================================================
         Total TOC (minutes):                          0.00

==============================================================================================


  ---------------------
  Subbasin Sub-SDCO#7
  ---------------------

==============================================================================================
         Total TOC (minutes):                          0.00

==============================================================================================


  ---------------------
  Subbasin Sub-SDCO#9
  ---------------------

==============================================================================================
         Total TOC (minutes):                          0.00

==============================================================================================
```

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Sub-17	3.44	3.21	0.15	98.000	0	00:05:00
Sub-18	3.44	3.21	0.24	98.000	0	00:05:00
Sub-19	3.44	3.21	0.35	98.000	0	00:05:00
Sub-CB #11	3.44	3.21	0.64	98.000	0	00:05:00
Sub-CB #12	3.44	3.21	0.32	98.000	0	00:05:00
Sub-CB #13	3.44	3.21	0.33	98.000	0	00:05:00
Sub-CB #15	3.44	3.21	0.21	98.000	0	00:05:00
Sub-CB #2	3.44	3.21	0.23	98.000	0	00:05:00
Sub-CB #4	3.44	3.21	0.14	98.000	0	00:05:00
Sub-CB #5	3.44	3.21	0.08	98.000	0	00:05:00
Sub-CB #6	3.44	3.21	0.08	98.000	0	00:05:00
Sub-CB #7	3.44	3.21	0.08	98.000	0	00:05:00
Sub-CB #8	3.44	3.21	0.20	98.000	0	00:05:00
Sub-CB #9	3.44	3.21	0.35	98.000	0	00:05:00
Sub-CB#16	3.44	3.21	0.52	98.000	0	00:05:00
Sub-SDCO#1	3.44	3.21	0.70	98.000	0	00:05:00
Sub-SDCO#13	3.44	3.21	0.29	98.000	0	00:05:00
Sub-SDCO#5	3.44	3.21	0.51	98.000	0	00:05:00
Sub-SDCO#7	3.44	3.21	0.44	98.000	0	00:05:00
Sub-SDCO#9	3.44	3.21	0.46	98.000	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CB #10	3.32	5.33	56.73	0	00:01	0	0	0:00:00
CB #11	2.87	3.48	55.34	0	07:54	0	0	0:00:00
CB #12	2.55	3.21	55.39	0	07:54	0	0	0:00:00
CB #13	2.24	3.00	55.50	0	00:03	0.00	1	0:00:00
CB #14	0.12	0.30	51.65	0	07:56	0	0	0:00:00
CB #15	0.85	1.06	51.66	0	07:55	0	0	0:00:00
CB #2	4.42	6.94	57.22	0	00:00	0.02	0	0:00:00
CB #3	4.08	4.30	54.92	0	07:55	0	0	0:00:00
CB #4	0.78	1.00	54.93	0	00:04	0	0	0:00:00
CB #5	0.04	0.09	55.59	0	07:54	0	0	0:00:00
CB #6	0.05	0.12	54.62	0	07:54	0	0	0:00:00
CB #7	0.07	0.16	54.11	0	07:55	0	0	0:00:00
CB #8	0.16	0.40	53.67	0	07:56	0	0	0:00:00
CB #9	3.76	4.47	55.42	0	00:01	0	0	0:00:00
CB#16	0.13	0.33	51.96	0	07:54	0	0	0:00:00
CB#17	0.75	0.87	54.82	0	07:55	0	0	0:00:00
CB#18	0.15	0.32	54.88	0	07:55	0	0	0:00:00
CB#19	0.10	0.24	55.24	0	07:54	0	0	0:00:00
SDCO#1	0.15	0.41	57.41	0	07:54	0	0	0:00:00
SDCO#10	0.13	0.60	55.74	0	07:56	0	0	0:00:00
SDCO#11	0.15	1.02	55.64	0	07:55	0	0	0:00:00
SDCO#12	0.65	1.43	55.53	0	07:55	0	0	0:00:00
SDCO#13	0.10	0.24	58.74	0	07:54	0	0	0:00:00
SDCO#14	0.10	0.24	57.89	0	07:55	0	0	0:00:00
SDCO#15	0.05	0.13	57.05	0	07:55	0	0	0:00:00

SDCO#2	0.15	0.39	56.40	0	07:48	0	0	0:00:00
SDCO#3	0.15	0.49	55.29	0	07:57	0	0	0:00:00
SDCO#4	0.44	0.79	55.06	0	07:56	0	0	0:00:00
SDCO#5	0.13	0.34	59.14	0	07:54	0	0	0:00:00
SDCO#6	0.09	0.23	57.83	0	07:55	0	0	0:00:00
SDCO#7	0.12	0.31	56.09	0	07:54	0	0	0:00:00
SDCO#8	0.09	0.21	55.47	0	07:54	0	0	0:00:00
SDCO#9	0.12	0.30	55.96	0	07:54	0	0	0:00:00
WQ #1	4.48	6.09	56.31	0	00:00	0	0	0:00:00
WQ #2	0.76	1.30	50.55	0	00:00	0	0	0:00:00
Out-1Pipe - (54)	5.09	5.09	54.69	0	00:00	0	0	0:00:00
Out-1Pipe - (59) (1)	1.00	1.00	50.00	0	00:00	0	0	0:00:00
Out-1Pipe - (63)	5.09	5.09	54.69	0	00:00	0	0	0:00:00
Out-1Pipe - (74)	5.09	5.09	54.69	0	00:00	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
CB #10	JUNCTION	0.00	4.45	0	00:01	0.00		
CB #11	JUNCTION	0.64	3.64	0	00:02	0.00		
CB #12	JUNCTION	0.32	2.67	0	00:02	0.00		
CB #13	JUNCTION	0.33	2.14	0	00:03	0.87	0	00:03
CB #14	JUNCTION	0.00	2.02	0	07:55	0.00		
CB #15	JUNCTION	0.21	0.21	0	07:54	0.00		
CB #2	JUNCTION	0.23	27.84	0	00:00	26.19	0	00:00
CB #3	JUNCTION	0.00	6.49	0	00:00	0.00		
CB #4	JUNCTION	0.14	1.14	0	00:03	0.00		
CB #5	JUNCTION	0.08	0.08	0	07:54	0.00		
CB #6	JUNCTION	0.08	0.08	0	07:54	0.00		
CB #7	JUNCTION	0.08	0.16	0	07:54	0.00		
CB #8	JUNCTION	0.20	0.86	0	07:55	0.00		
CB #9	JUNCTION	0.35	4.46	0	00:01	0.00		
CB#16	JUNCTION	0.52	0.52	0	07:54	0.00		
CB#17	JUNCTION	0.15	1.65	0	00:00	0.00		
CB#18	JUNCTION	0.24	0.60	0	07:54	0.00		
CB#19	JUNCTION	0.35	0.35	0	07:54	0.00		
SDCO#1	JUNCTION	0.70	0.70	0	07:54	0.00		
SDCO#10	JUNCTION	0.00	0.46	0	07:54	0.00		
SDCO#11	JUNCTION	0.00	0.46	0	08:01	0.00		
SDCO#12	JUNCTION	0.00	0.79	0	00:04	0.00		
SDCO#13	JUNCTION	0.29	0.29	0	07:54	0.00		
SDCO#14	JUNCTION	0.00	0.29	0	07:54	0.00		
SDCO#15	JUNCTION	0.00	0.29	0	07:55	0.00		
SDCO#2	JUNCTION	0.00	0.70	0	07:54	0.00		
SDCO#3	JUNCTION	0.00	0.70	0	07:55	0.00		
SDCO#4	JUNCTION	0.00	0.70	0	07:57	0.00		
SDCO#5	JUNCTION	0.51	0.51	0	07:54	0.00		
SDCO#6	JUNCTION	0.00	0.50	0	07:54	0.00		
SDCO#7	JUNCTION	0.44	0.44	0	07:54	0.00		
SDCO#8	JUNCTION	0.00	0.44	0	07:54	0.00		
SDCO#9	JUNCTION	0.46	0.46	0	07:54	0.00		
WQ #1	JUNCTION	0.00	15.77	0	00:00	0.00		
WQ #2	JUNCTION	0.00	2.02	0	07:56	0.00		
Out-1Pipe - (54)	OUTFALL	0.00	15.77	0	00:00	0.00		
Out-1Pipe - (59) (1)	OUTFALL	0.00	2.02	0	07:56	0.00		
Out-1Pipe - (63)	OUTFALL	0.00	0.70	0	07:57	0.00		
Out-1Pipe - (74)	OUTFALL	0.00	0.29	0	07:55	0.00		

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Out-1Pipe - (54)	99.97	0.65	15.77
Out-1Pipe - (59) (1)	98.96	0.40	2.02
Out-1Pipe - (63)	98.35	0.14	0.70
Out-1Pipe - (74)	98.25	0.06	0.29
System	98.88	1.25	17.15

The conveyance pipe calculation shows 7 pipe connections unable to convey the 25 year storm event. Revise accordingly.[drainage report, pg 146]

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Link-01	CONDUIT	0 07:54	1.97	1.00	0.35	2.74	0.13	0.28	0	Calculated
Link-02	CONDUIT	0 07:55	1.23	1.00	0.60	2.73	0.22	0.59	0	Calculated
Link-03	CONDUIT	0 00:00	3.67	1.00	1.65	10.65	0.15	0.94	0	Calculated
Pipe - (42)	CONDUIT	0 00:03	3.27	1.00	2.14	2.00	1.07	1.00	1437	SURCHARGED
Pipe - (43)	CONDUIT	0 00:02	4.16	1.00	2.67	2.00	1.33	1.00	1437	SURCHARGED
Pipe - (44)	CONDUIT	0 00:02	3.46	1.00	3.62	3.64	0.99	1.00	1438	SURCHARGED
Pipe - (45)	CONDUIT	0 00:01	3.76	1.00	4.45	3.62	1.23	1.00	1439	SURCHARGED
Pipe - (46)	CONDUIT	0 00:01	3.63	1.00	4.46	3.62	1.23	1.00	1440	SURCHARGED
Pipe - (47)	CONDUIT	0 07:55	0.89	1.00	0.16	2.72	0.06	0.28	0	Calculated
Pipe - (48)	CONDUIT	0 07:54	1.22	1.00	0.08	2.73	0.03	0.14	0	Calculated
Pipe - (49)	CONDUIT	0 07:54	3.27	1.00	0.70	1.12	0.63	0.59	0	Calculated
Pipe - (50)	CONDUIT	0 07:54	0.16	1.00	0.08	8.22	0.01	0.43	0	Calculated
Pipe - (51)	CONDUIT	0 00:00	3.47	1.00	1.75	4.95	0.35	0.90	0	Calculated
Pipe - (52)	CONDUIT	0 00:00	7.36	1.00	13.01	5.89	2.21	1.00	1440	SURCHARGED
Pipe - (53)	CONDUIT	0 00:00	8.40	1.00	14.83	5.46	2.72	1.00	1440	SURCHARGED
Pipe - (54)	CONDUIT	0 00:00	9.29	1.00	15.77	11.79	1.34	1.00	1440	SURCHARGED

```
  Pipe - (58)          CONDUIT      0  07:54      0.39    1.00         0.21         2.45       0.09
0.65           0  Calculated
  Pipe - (59)          CONDUIT      0  07:56      3.97    1.00         2.02        11.35       0.18
0.62           0  Calculated
  Pipe - (59) (1)      CONDUIT      0  07:56      2.62    1.00         2.02         3.21       0.63
1.00           0  SURCHARGED
  Pipe - (59) (2)      CONDUIT      0  07:54      2.55    1.00         0.52         2.73       0.19
0.31           0  Calculated
  Pipe - (60)          CONDUIT      0  07:57      3.01    1.00         0.86         2.73       0.31
0.39           0  Calculated
  Pipe - (61)          CONDUIT      0  07:55      3.19    1.00         0.70         1.12       0.63
0.65           0  Calculated
  Pipe - (62)          CONDUIT      0  07:57      2.17    1.00         0.70         1.12       0.62
0.87           0  Calculated
  Pipe - (63)          CONDUIT      0  07:57      2.00    1.00         0.70         2.72       0.26
1.00          25  SURCHARGED
  Pipe - (64)          CONDUIT      0  07:54      3.53    1.00         0.50         1.12       0.45
0.43           0  Calculated
  Pipe - (65)          CONDUIT      0  07:55      4.76    1.00         0.50         2.05       0.25
0.34           0  Calculated
  Pipe - (66)          CONDUIT      0  07:54      2.87    1.00         0.44         1.12       0.39
0.45           0  Calculated
  Pipe - (67)          CONDUIT      0  07:54      3.60    1.00         0.44         1.99       0.22
0.38           0  Calculated
  Pipe - (68)          CONDUIT      0  07:54      2.78    1.00         0.46         1.12       0.41
0.67           0  Calculated
  Pipe - (69)          CONDUIT      0  08:01      2.12    1.00         0.46         1.12       0.41
0.95           0  Calculated
  Pipe - (70)          CONDUIT      0  08:01      1.83    1.00         0.46         1.12       0.41
1.00          27  SURCHARGED
  Pipe - (71)          CONDUIT      0  00:00      6.65    1.00         0.82         1.72       0.48
1.00         114  SURCHARGED
  Pipe - (72)          CONDUIT      0  07:54      2.56    1.00         0.29         1.12       0.26
0.36           0  Calculated
  Pipe - (73)          CONDUIT      0  07:55      2.61    1.00         0.29         1.12       0.26
0.35           0  Calculated
  Pipe - (74)          CONDUIT      0  07:55      1.32    1.00         0.29         3.65       0.08
0.59           0  Calculated


  *******************************
  Highest Flow Instability Indexes
  *******************************
  All links are stable.

  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (47) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (49) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (50) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (58) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (59) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (61) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
```

```
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (63) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (64) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (67) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (68) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (69) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (71) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.

  Analysis began on:  Thu Jul 27 09:40:18 2023
  Analysis ended on:  Thu Jul 27 09:40:22 2023
  Total elapsed time: 00:00:04
```

100-yr storm event

```
Autodesk® Storm and Sanitary Analysis 2024 - Version 13.6.268 (Build 0)
----------------------------------------------------------------------------------------

*******************
Project Description
*******************
File Name ................. 22085-conveyance100rev.SPF


****************
Analysis Options
****************
Flow Units ................ cfs
Subbasin Hydrograph Method. Santa Barbara UH
Time of Concentration...... SCS TR-55
Link Routing Method ....... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date ............. JUN-30-2023 00:00:00
Ending Date ............... JUL-01-2023 00:00:00
Report Time Step .......... 00:00:10


*************
Element Count
*************
Number of rain gages ...... 1
Number of subbasins ....... 20
Number of nodes ........... 39
Number of links ........... 35


****************
Raingage Summary
****************
Gage                Data                Data        Recording
ID                  Source              Type         Interval
                                                          min
------------------------------------------------------------
Rain Gage-01        100-yr              CUMULATIVE      6.00


****************
Subbasin Summary
****************
Subbasin                 Total   Imperv.    Raingage
                          Area      Area
ID                       acres         %
----------------------------------------------------
Sub-17                    0.19    100.00    Rain Gage-01
Sub-18                    0.30    100.00    Rain Gage-01
Sub-19                    0.44    100.00    Rain Gage-01
Sub-CB #11                0.80    100.00    Rain Gage-01
Sub-CB #12                0.39    100.00    Rain Gage-01
Sub-CB #13                0.41    100.00    Rain Gage-01
Sub-CB #15                0.26    100.00    Rain Gage-01
Sub-CB #2                 0.28    100.00    Rain Gage-01
Sub-CB #4                 0.18    100.00    Rain Gage-01
Sub-CB #5                 0.10    100.00    Rain Gage-01
Sub-CB #6                 0.10    100.00    Rain Gage-01
Sub-CB #7                 0.10    100.00    Rain Gage-01
Sub-CB #8                 0.24    100.00    Rain Gage-01
Sub-CB #9                 0.44    100.00    Rain Gage-01
Sub-CB#16                 0.65    100.00    Rain Gage-01
Sub-SDCO#1                0.87    100.00    Rain Gage-01
Sub-SDCO#13               0.36    100.00    Rain Gage-01
Sub-SDCO#5                0.63    100.00    Rain Gage-01
```

Sub-SDCO#7	0.54	100.00	Rain Gage-01
Sub-SDCO#9	0.57	100.00	Rain Gage-01

****
Node Summary
****

Node ID		Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CB #10		JUNCTION	51.40	59.62	0.00	
CB #11		JUNCTION	51.86	55.50	3344.00	
CB #12		JUNCTION	52.18	55.50	3960.00	
CB #13		JUNCTION	52.50	55.50	3580.00	
CB #14		JUNCTION	51.35	55.50	0.00	
CB #15		JUNCTION	50.60	53.60	0.00	
CB #2		JUNCTION	50.28	57.22	0.00	
CB #3		JUNCTION	50.62	59.12	0.00	
CB #4		JUNCTION	53.93	57.50	0.00	
CB #5		JUNCTION	55.50	58.50	0.00	
CB #6		JUNCTION	54.50	58.50	0.00	
CB #7		JUNCTION	53.95	58.50	0.00	
CB #8		JUNCTION	53.27	59.00	0.00	
CB #9		JUNCTION	50.95	59.40	0.00	
CB#16		JUNCTION	51.63	54.63	0.00	
CB#17		JUNCTION	53.95	56.86	0.00	
CB#18		JUNCTION	54.56	58.52	0.00	
CB#19		JUNCTION	55.00	58.03	0.00	
SDCO#1		JUNCTION	57.00	59.97	0.00	
SDCO#10		JUNCTION	55.14	57.05	0.00	
SDCO#11		JUNCTION	54.62	57.05	0.00	
SDCO#12		JUNCTION	54.10	57.05	0.00	
SDCO#13		JUNCTION	58.50	60.81	0.00	
SDCO#14		JUNCTION	57.65	60.39	0.00	
SDCO#15		JUNCTION	56.92	60.75	0.00	
SDCO#2		JUNCTION	56.01	59.92	0.00	
SDCO#3		JUNCTION	54.80	59.33	0.00	
SDCO#4		JUNCTION	54.27	59.61	0.00	
SDCO#5		JUNCTION	58.80	59.97	0.00	
SDCO#6		JUNCTION	57.60	60.28	0.00	
SDCO#7		JUNCTION	55.78	57.05	0.00	
SDCO#8		JUNCTION	55.26	57.05	0.00	
SDCO#9		JUNCTION	55.66	57.05	0.00	
WQ #1		JUNCTION	50.22	57.61	0.00	
WQ #2		JUNCTION	49.25	55.41	0.00	
Out-1Pipe - (54)		OUTFALL	49.60	51.10	0.00	
Out-1Pipe - (59)	(1)	OUTFALL	49.00	50.00	0.00	
Out-1Pipe - (63)		OUTFALL	49.60	50.27	0.00	
Out-1Pipe - (74)		OUTFALL	49.60	50.98	0.00	

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01	CB#19	CB#18	CONDUIT	87.0	0.5057	0.0120
Link-02	CB#18	CB#17	CONDUIT	122.0	0.5000	0.0120
Link-03	CB#17	WQ #1	CONDUIT	49.0	7.6122	0.0120
Pipe - (42)	CB #13	CB #12	CONDUIT	118.7	0.2696	0.0120
Pipe - (43)	CB #12	CB #11	CONDUIT	118.7	0.2696	0.0120
Pipe - (44)	CB #11	CB #10	CONDUIT	170.2	0.2703	0.0120
Pipe - (45)	CB #10	CB #9	CONDUIT	167.8	0.2683	0.0120
Pipe - (46)	CB #9	CB #3	CONDUIT	123.5	0.2673	0.0120
Pipe - (47)	CB #7	CB #8	CONDUIT	136.7	0.4976	0.0120

Pipe - (48)	CB #6	CB #7	CONDUIT	109.2	0.5000	0.0120
Pipe - (49)	SDCO#1	SDCO#2	CONDUIT	99.3	0.9968	0.0140
Pipe - (50)	CB #5	CB #4	CONDUIT	113.8	1.3792	0.0120
Pipe - (51)	CB #4	CB #3	CONDUIT	166.9	0.5000	0.0120
Pipe - (52)	CB #3	CB #2	CONDUIT	126.9	0.2678	0.0120
Pipe - (53)	CB #2	WQ #1	CONDUIT	26.1	0.2302	0.0120
Pipe - (54)	WQ #1	Out-1Pipe - (54)	CONDUIT	57.8	1.0728	0.0120
Pipe - (58)	CB #14	CB #15	CONDUIT	185.6	0.4037	0.0120
Pipe - (59)	CB #14	WQ #2	CONDUIT	24.3	8.6409	0.0120
Pipe - (59) (1)	WQ #2	Out-1Pipe - (59) (1)	CONDUIT	36.3	0.6896	0.0120
Pipe - (59) (2)	CB#16	CB #14	CONDUIT	56.1	0.5000	0.0120
Pipe - (60)	CB #8	CB #14	CONDUIT	308.8	0.4987	0.0120
Pipe - (61)	SDCO#2	SDCO#3	CONDUIT	121.2	0.9983	0.0140
Pipe - (62)	SDCO#3	SDCO#4	CONDUIT	52.8	1.0000	0.0140
Pipe - (63)	SDCO#4	Out-1Pipe - (63)	CONDUIT	79.5	5.8724	0.0140
Pipe - (64)	SDCO#5	SDCO#6	CONDUIT	120.1	0.9992	0.0140
Pipe - (65)	SDCO#6	CB #8	CONDUIT	110.6	3.3461	0.0140
Pipe - (66)	SDCO#7	SDCO#8	CONDUIT	52.0	1.0000	0.0140
Pipe - (67)	SDCO#8	CB #14	CONDUIT	124.2	3.1483	0.0140
Pipe - (68)	SDCO#9	SDCO#10	CONDUIT	51.9	1.0013	0.0140
Pipe - (69)	SDCO#10	SDCO#11	CONDUIT	52.0	0.9992	0.0140
Pipe - (70)	SDCO#11	SDCO#12	CONDUIT	52.0	1.0000	0.0140
Pipe - (71)	SDCO#12	CB #11	CONDUIT	95.7	2.3406	0.0140
Pipe - (72)	SDCO#13	SDCO#14	CONDUIT	84.9	1.0000	0.0140
Pipe - (73)	SDCO#14	SDCO#15	CONDUIT	73.0	1.0000	0.0140
Pipe - (74)	SDCO#15	Out-1Pipe - (74)	CONDUIT	62.4	10.6001	0.0140

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft^2	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	1.00	1.00	1	0.79	0.25	2.74
Link-02	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Link-03	CIRCULAR	1.00	1.00	1	0.79	0.25	10.65
Pipe - (42)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.00
Pipe - (43)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.00
Pipe - (44)	CIRCULAR	1.25	1.25	1	1.23	0.31	3.64
Pipe - (45)	CIRCULAR	1.25	1.25	1	1.23	0.31	3.62
Pipe - (46)	CIRCULAR	1.25	1.25	1	1.23	0.31	3.62
Pipe - (47)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.72
Pipe - (48)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Pipe - (49)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (50)	CIRCULAR	1.25	1.25	1	1.23	0.31	8.22

Pipe - (51)	CIRCULAR	1.25	1.25	1	1.23	0.31	4.95
Pipe - (52)	CIRCULAR	1.50	1.50	1	1.77	0.38	5.89
Pipe - (53)	CIRCULAR	1.50	1.50	1	1.77	0.38	5.46
Pipe - (54)	CIRCULAR	1.50	1.50	1	1.77	0.38	11.79
Pipe - (58)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.45
Pipe - (59)	CIRCULAR	1.00	1.00	1	0.79	0.25	11.35
Pipe - (59) (1)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.21
Pipe - (59) (2)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Pipe - (60)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.73
Pipe - (61)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (62)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (63)	CIRCULAR	0.67	0.67	1	0.35	0.17	2.72
Pipe - (64)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (65)	CIRCULAR	0.67	0.67	1	0.35	0.17	2.05
Pipe - (66)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (67)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.99
Pipe - (68)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (69)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (70)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (71)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.72
Pipe - (72)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (73)	CIRCULAR	0.67	0.67	1	0.35	0.17	1.12
Pipe - (74)	CIRCULAR	0.67	0.67	1	0.35	0.17	3.65

```
**************************        Volume         Depth
Runoff Quantity Continuity       acre-ft        inches
**************************     ---------       -------
Total Precipitation ......         2.641         4.043
Surface Runoff ...........         2.485         3.804
Continuity Error (%) .....         0.000


**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************     ---------     ---------
External Inflow ..........         0.073         0.024
External Outflow .........         2.481         0.808
Initial Stored Volume ....         0.016         0.005
Final Stored Volume ......         0.086         0.028
Continuity Error (%) .....         0.002


*******************************************
```

Composite Curve Number Computations Report
****

Subbasin Sub-17

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.19		98.00

Subbasin Sub-18

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.30		98.00

Subbasin Sub-19

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.44		98.00

Subbasin Sub-CB #11

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.80		98.00

Subbasin Sub-CB #12

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.39		98.00

Subbasin Sub-CB #13

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.41		98.00

Subbasin Sub-CB #15

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.26		98.00

Subbasin Sub-CB #2

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.28		98.00

```
---------------------
Subbasin Sub-CB #4
---------------------
                                                           Area          Soil
Soil/Surface Description                                 (acres)        Group           CN
------------------------------------------------------------------------------------------
Composite Area & Weighted CN                                0.18                     98.00

---------------------
Subbasin Sub-CB #5
---------------------
                                                           Area          Soil
Soil/Surface Description                                 (acres)        Group           CN
------------------------------------------------------------------------------------------
Composite Area & Weighted CN                                0.10                     98.00

---------------------
Subbasin Sub-CB #6
---------------------
                                                           Area          Soil
Soil/Surface Description                                 (acres)        Group           CN
------------------------------------------------------------------------------------------
Composite Area & Weighted CN                                0.10                     98.00

---------------------
Subbasin Sub-CB #7
---------------------
                                                           Area          Soil
Soil/Surface Description                                 (acres)        Group           CN
------------------------------------------------------------------------------------------
Composite Area & Weighted CN                                0.10                     98.00

---------------------
Subbasin Sub-CB #8
---------------------
                                                           Area          Soil
Soil/Surface Description                                 (acres)        Group           CN
------------------------------------------------------------------------------------------
Composite Area & Weighted CN                                0.24                     98.00

---------------------
Subbasin Sub-CB #9
---------------------
                                                           Area          Soil
Soil/Surface Description                                 (acres)        Group           CN
------------------------------------------------------------------------------------------
Composite Area & Weighted CN                                0.44                     98.00

---------------------
Subbasin Sub-CB#16
---------------------
                                                           Area          Soil
Soil/Surface Description                                 (acres)        Group           CN
------------------------------------------------------------------------------------------
Composite Area & Weighted CN                                0.65                     98.00

----------------------
Subbasin Sub-SDCO#1
----------------------
                                                           Area          Soil
Soil/Surface Description                                 (acres)        Group           CN
------------------------------------------------------------------------------------------
Composite Area & Weighted CN                                0.87                     98.00

-----------------------
Subbasin Sub-SDCO#13
-----------------------
```

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.36		98.00

Subbasin Sub-SDCO#5

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.63		98.00

Subbasin Sub-SDCO#7

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.54		98.00

Subbasin Sub-SDCO#9

Soil/Surface Description	Area (acres)	Soil Group	CN
Composite Area & Weighted CN	0.57		98.00

****
Runoff Coefficient Computations Report
****

Subbasin Sub-17

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.19	-	0.72
Composite Area & Weighted Runoff Coeff.	0.19		0.72

Subbasin Sub-18

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.30	-	0.72
Composite Area & Weighted Runoff Coeff.	0.30		0.72

Subbasin Sub-19

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.44	-	0.72
Composite Area & Weighted Runoff Coeff.	0.44		0.72

Subbasin Sub-CB #11

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.80	-	0.50

Composite Area & Weighted Runoff Coeff.	0.80		0.50

Subbasin Sub-CB #12

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.39	-	0.50
Composite Area & Weighted Runoff Coeff.	0.39		0.50

Subbasin Sub-CB #13

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.41	-	0.50
Composite Area & Weighted Runoff Coeff.	0.41		0.50

Subbasin Sub-CB #15

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.26	-	0.50
Composite Area & Weighted Runoff Coeff.	0.26		0.50

Subbasin Sub-CB #2

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.47	-	0.50
Composite Area & Weighted Runoff Coeff.	0.47		0.50

Subbasin Sub-CB #4

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.18	-	0.50
Composite Area & Weighted Runoff Coeff.	0.18		0.50

Subbasin Sub-CB #5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.50
Composite Area & Weighted Runoff Coeff.	0.10		0.50

Subbasin Sub-CB #6

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.50
Composite Area & Weighted Runoff Coeff.	0.10		0.50

Subbasin Sub-CB #7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.10	-	0.50
Composite Area & Weighted Runoff Coeff.	0.10		0.50

Subbasin Sub-CB #8

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.24	-	0.50
Composite Area & Weighted Runoff Coeff.	0.24		0.50

Subbasin Sub-CB #9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.44	-	0.50
Composite Area & Weighted Runoff Coeff.	0.44		0.50

Subbasin Sub-CB#16

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.65	-	0.72
Composite Area & Weighted Runoff Coeff.	0.65		0.72

Subbasin Sub-SDCO#1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.87	-	0.50
Composite Area & Weighted Runoff Coeff.	0.87		0.50

Subbasin Sub-SDCO#13

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.36	-	0.50
Composite Area & Weighted Runoff Coeff.	0.36		0.50

Subbasin Sub-SDCO#5

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.63	-	0.50
Composite Area & Weighted Runoff Coeff.	0.63		0.50

Subbasin Sub-SDCO#7

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.

-	0.54	-	0.50
Composite Area & Weighted Runoff Coeff.	0.54		0.50

Subbasin Sub-SDCO#9

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.57	-	0.50
Composite Area & Weighted Runoff Coeff.	0.57		0.50

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

```
        Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
```

Channel Flow Equation

```
        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
        Aq = Flow Area (ft²)
        Wp = Wetted Perimeter (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
        n  = Manning's Roughness
```

```
  ------------------
  Subbasin Sub-17
  ------------------

================================================================================================
          Total TOC (minutes):                          0.00

================================================================================================


  ------------------
  Subbasin Sub-18
  ------------------

================================================================================================
          Total TOC (minutes):                          0.00

================================================================================================


  ------------------
  Subbasin Sub-19
  ------------------

================================================================================================
          Total TOC (minutes):                          0.00

================================================================================================


  ----------------------
  Subbasin Sub-CB #11
  ----------------------

================================================================================================
          Total TOC (minutes):                          0.00

================================================================================================


  ----------------------
  Subbasin Sub-CB #12
  ----------------------

================================================================================================
          Total TOC (minutes):                          0.00

================================================================================================


  ----------------------
  Subbasin Sub-CB #13
  ----------------------

================================================================================================
          Total TOC (minutes):                          0.00

================================================================================================


  ----------------------
  Subbasin Sub-CB #15
  ----------------------

================================================================================================
          Total TOC (minutes):                          0.00
```

```
==================================================================================================

  ---------------------
  Subbasin Sub-CB #2
  ---------------------

==================================================================================================
        Total TOC (minutes):                          0.00

==================================================================================================

  ---------------------
  Subbasin Sub-CB #4
  ---------------------

==================================================================================================
        Total TOC (minutes):                          0.00

==================================================================================================

  ---------------------
  Subbasin Sub-CB #5
  ---------------------

==================================================================================================
        Total TOC (minutes):                          0.00

==================================================================================================

  ---------------------
  Subbasin Sub-CB #6
  ---------------------

==================================================================================================
        Total TOC (minutes):                          0.00

==================================================================================================

  ---------------------
  Subbasin Sub-CB #7
  ---------------------

==================================================================================================
        Total TOC (minutes):                          0.00

==================================================================================================

  ---------------------
  Subbasin Sub-CB #8
  ---------------------

==================================================================================================
        Total TOC (minutes):                          0.00

==================================================================================================

  ---------------------
  Subbasin Sub-CB #9
  ---------------------
```

```
===============================================================================================
         Total TOC (minutes):                        0.00

===============================================================================================


  ---------------------
  Subbasin Sub-CB#16
  ---------------------

===============================================================================================
         Total TOC (minutes):                        0.00

===============================================================================================


  ----------------------
  Subbasin Sub-SDCO#1
  ----------------------

===============================================================================================
         Total TOC (minutes):                        0.00

===============================================================================================


  -----------------------
  Subbasin Sub-SDCO#13
  -----------------------

===============================================================================================
         Total TOC (minutes):                        0.00

===============================================================================================


  ----------------------
  Subbasin Sub-SDCO#5
  ----------------------

===============================================================================================
         Total TOC (minutes):                        0.00

===============================================================================================


  ----------------------
  Subbasin Sub-SDCO#7
  ----------------------

===============================================================================================
         Total TOC (minutes):                        0.00

===============================================================================================


  ----------------------
  Subbasin Sub-SDCO#9
  ----------------------

===============================================================================================
         Total TOC (minutes):                        0.00

===============================================================================================
```

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Sub-17	4.04	3.80	0.18	98.000	0	00:05:00
Sub-18	4.04	3.80	0.29	98.000	0	00:05:00
Sub-19	4.04	3.80	0.42	98.000	0	00:05:00
Sub-CB #11	4.04	3.80	0.76	98.000	0	00:05:00
Sub-CB #12	4.04	3.80	0.37	98.000	0	00:05:00
Sub-CB #13	4.04	3.80	0.39	98.000	0	00:05:00
Sub-CB #15	4.04	3.80	0.25	98.000	0	00:05:00
Sub-CB #2	4.04	3.80	0.27	98.000	0	00:05:00
Sub-CB #4	4.04	3.80	0.17	98.000	0	00:05:00
Sub-CB #5	4.04	3.80	0.10	98.000	0	00:05:00
Sub-CB #6	4.04	3.80	0.10	98.000	0	00:05:00
Sub-CB #7	4.04	3.80	0.10	98.000	0	00:05:00
Sub-CB #8	4.04	3.80	0.23	98.000	0	00:05:00
Sub-CB #9	4.04	3.80	0.42	98.000	0	00:05:00
Sub-CB#16	4.04	3.80	0.62	98.000	0	00:05:00
Sub-SDCO#1	4.04	3.80	0.83	98.000	0	00:05:00
Sub-SDCO#13	4.04	3.80	0.34	98.000	0	00:05:00
Sub-SDCO#5	4.04	3.80	0.60	98.000	0	00:05:00
Sub-SDCO#7	4.04	3.80	0.52	98.000	0	00:05:00
Sub-SDCO#9	4.04	3.80	0.54	98.000	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CB #10	4.29	6.61	58.01	0	00:01	0	0	0:00:00
CB #11	3.84	4.09	55.95	0	08:12	0.43	1437	0:00:00
CB #12	3.53	3.78	55.96	0	08:17	0.51	1436	0:00:00
CB #13	3.21	3.47	55.97	0	08:18	0.47	1437	0:00:00
CB #14	0.13	0.34	51.69	0	07:56	0	0	0:00:00
CB #15	0.87	1.11	51.71	0	07:55	0	0	0:00:00
CB #2	5.39	6.94	57.22	0	00:00	0.03	0	0:00:00
CB #3	5.06	5.16	55.78	0	08:00	0	0	0:00:00
CB #4	1.75	2.09	56.02	0	00:02	0	0	0:00:00
CB #5	0.18	0.29	55.79	0	08:00	0	0	0:00:00
CB #6	0.06	0.13	54.63	0	07:54	0	0	0:00:00
CB #7	0.08	0.18	54.13	0	07:55	0	0	0:00:00
CB #8	0.18	0.44	53.71	0	07:56	0	0	0:00:00
CB #9	4.74	5.40	56.35	0	00:01	0	0	0:00:00
CB#16	0.14	0.36	51.99	0	07:54	0	0	0:00:00
CB#17	1.72	2.87	56.82	0	00:00	0	0	0:00:00
CB#18	1.11	1.26	55.82	0	00:03	0	0	0:00:00
CB#19	0.68	0.89	55.89	0	00:03	0	0	0:00:00
SDCO#1	0.18	0.99	57.99	0	07:51	0	0	0:00:00
SDCO#10	0.61	1.33	56.47	0	08:00	0	0	0:00:00
SDCO#11	1.12	1.70	56.32	0	08:00	0	0	0:00:00
SDCO#12	1.62	2.06	56.16	0	08:00	0	0	0:00:00
SDCO#13	0.11	0.26	58.76	0	07:54	0	0	0:00:00
SDCO#14	0.11	0.26	57.91	0	07:55	0	0	0:00:00
SDCO#15	0.06	0.14	57.06	0	07:55	0	0	0:00:00

SDCO#2	0.19	1.34	57.35	0	07:51	0	0	0:00:00
SDCO#3	0.93	1.99	56.79	0	00:01	0	0	0:00:00
SDCO#4	1.43	2.60	56.87	0	00:00	0	0	0:00:00
SDCO#5	0.15	0.38	59.18	0	07:54	0	0	0:00:00
SDCO#6	0.10	0.25	57.85	0	07:55	0	0	0:00:00
SDCO#7	0.13	0.34	56.12	0	07:54	0	0	0:00:00
SDCO#8	0.10	0.23	55.49	0	07:54	0	0	0:00:00
SDCO#9	0.17	0.96	56.62	0	08:00	0	0	0:00:00
WQ #1	5.45	6.51	56.73	0	00:00	0	0	0:00:00
WQ #2	0.77	1.56	50.81	0	00:00	0	0	0:00:00
Out-1Pipe - (54)	6.06	6.06	55.66	0	00:00	0	0	0:00:00
Out-1Pipe - (59) (1)	1.00	1.00	50.00	0	00:00	0	0	0:00:00
Out-1Pipe - (63)	6.06	6.06	55.66	0	00:00	0	0	0:00:00
Out-1Pipe - (74)	6.06	6.06	55.66	0	00:00	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	hh:mm
CB #10	JUNCTION	0.00	5.43	0	00:01	0.00		
CB #11	JUNCTION	0.76	3.99	0	00:01	0.65	0	00:06
CB #12	JUNCTION	0.37	3.13	0	00:02	0.55	0	00:07
CB #13	JUNCTION	0.39	2.54	0	00:03	1.64	0	00:03
CB #14	JUNCTION	0.00	2.39	0	07:55	0.00		
CB #15	JUNCTION	0.25	0.25	0	07:54	0.00		
CB #2	JUNCTION	0.27	24.59	0	00:00	24.29	0	00:00
CB #3	JUNCTION	0.00	7.68	0	00:00	0.00		
CB #4	JUNCTION	0.17	1.76	0	00:02	0.00		
CB #5	JUNCTION	0.10	0.29	0	00:02	0.00		
CB #6	JUNCTION	0.10	0.10	0	07:54	0.00		
CB #7	JUNCTION	0.10	0.19	0	07:54	0.00		
CB #8	JUNCTION	0.23	1.02	0	07:55	0.00		
CB #9	JUNCTION	0.42	5.48	0	00:01	0.00		
CB#16	JUNCTION	0.62	0.62	0	07:54	0.00		
CB#17	JUNCTION	0.18	2.26	0	00:00	0.00		
CB#18	JUNCTION	0.29	1.10	0	00:01	0.00		
CB#19	JUNCTION	0.42	0.59	0	00:02	0.00		
SDCO#1	JUNCTION	0.83	0.83	0	07:54	0.00		
SDCO#10	JUNCTION	0.00	0.54	0	07:54	0.00		
SDCO#11	JUNCTION	0.00	0.56	0	00:03	0.00		
SDCO#12	JUNCTION	0.00	0.92	0	00:03	0.00		
SDCO#13	JUNCTION	0.34	0.34	0	07:54	0.00		
SDCO#14	JUNCTION	0.00	0.34	0	07:54	0.00		
SDCO#15	JUNCTION	0.00	0.34	0	07:55	0.00		
SDCO#2	JUNCTION	0.00	0.83	0	07:54	0.00		
SDCO#3	JUNCTION	0.00	0.83	0	07:54	0.00		
SDCO#4	JUNCTION	0.00	1.01	0	00:00	0.00		
SDCO#5	JUNCTION	0.60	0.60	0	07:54	0.00		
SDCO#6	JUNCTION	0.00	0.60	0	07:54	0.00		
SDCO#7	JUNCTION	0.52	0.52	0	07:54	0.00		
SDCO#8	JUNCTION	0.00	0.52	0	07:54	0.00		
SDCO#9	JUNCTION	0.54	0.54	0	07:54	0.00		
WQ #1	JUNCTION	0.00	16.69	0	00:00	0.00		
WQ #2	JUNCTION	0.00	2.39	0	07:56	0.00		
Out-1Pipe - (54)	OUTFALL	0.00	16.69	0	00:00	0.00		
Out-1Pipe - (59) (1)	OUTFALL	0.00	2.39	0	07:56	0.00		
Out-1Pipe - (63)	OUTFALL	0.00	1.01	0	00:00	0.00		
Out-1Pipe - (74)	OUTFALL	0.00	0.34	0	07:55	0.00		

****
Outfall Loading Summary
****

Outfall Node ID		Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Out-1Pipe - (54)		100.00	0.77	16.69
Out-1Pipe - (59)	(1)	99.17	0.48	2.39
Out-1Pipe - (63)		99.04	0.17	1.01
Out-1Pipe - (74)		98.50	0.07	0.34
System		99.18	1.49	18.75

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Link-01	CONDUIT	0 00:02	1.26	1.00	0.59	2.74	0.22	0.94	0	Calculated
Link-02	CONDUIT	0 00:01	2.10	1.00	1.10	2.73	0.40	1.00	1437	SURCHARGED
Link-03	CONDUIT	0 00:00	4.51	1.00	2.26	10.65	0.21	1.00	1439	SURCHARGED
Pipe - (42)	CONDUIT	0 00:03	3.73	1.00	2.54	2.00	1.27	1.00	1437	SURCHARGED
Pipe - (43)	CONDUIT	0 00:02	4.53	1.00	3.13	2.00	1.56	1.00	1437	SURCHARGED
Pipe - (44)	CONDUIT	0 00:01	4.34	1.00	3.96	3.64	1.09	1.00	1438	SURCHARGED
Pipe - (45)	CONDUIT	0 00:01	4.48	1.00	5.43	3.62	1.50	1.00	1439	SURCHARGED
Pipe - (46)	CONDUIT	0 00:01	4.46	1.00	5.48	3.62	1.51	1.00	1440	SURCHARGED
Pipe - (47)	CONDUIT	0 07:55	0.93	1.00	0.19	2.72	0.07	0.31	0	Calculated
Pipe - (48)	CONDUIT	0 07:54	1.27	1.00	0.10	2.73	0.03	0.15	0	Calculated
Pipe - (49)	CONDUIT	0 07:54	3.11	1.00	0.83	1.12	0.74	1.00	12	SURCHARGED
Pipe - (50)	CONDUIT	0 00:02	0.46	1.00	0.29	8.22	0.03	0.62	0	Calculated
Pipe - (51)	CONDUIT	0 00:00	2.84	1.00	1.85	4.95	0.37	1.00	1437	SURCHARGED
Pipe - (52)	CONDUIT	0 00:00	7.08	1.00	10.93	5.89	1.86	1.00	1440	SURCHARGED
Pipe - (53)	CONDUIT	0 00:00	9.00	1.00	14.16	5.46	2.59	1.00	1440	SURCHARGED
Pipe - (54)	CONDUIT	0 00:00	10.43	1.00	16.69	11.79	1.42	1.00	1440	SURCHARGED

```
  Pipe - (58)          CONDUIT      0  07:54      0.44    1.00        0.25        2.45       0.10
0.67          0  Calculated
  Pipe - (59)          CONDUIT      0  07:56      4.25    1.00        2.39       11.35       0.21
0.67          0  Calculated
  Pipe - (59) (1)      CONDUIT      0  07:56      3.04    1.00        2.39        3.21       0.74
1.00         16  SURCHARGED
  Pipe - (59) (2)      CONDUIT      0  07:54      2.62    1.00        0.62        2.73       0.23
0.35          0  Calculated
  Pipe - (60)          CONDUIT      0  07:57      3.14    1.00        1.01        2.73       0.37
0.43          0  Calculated
  Pipe - (61)          CONDUIT      0  07:54      2.37    1.00        0.83        1.12       0.74
1.00         24  SURCHARGED
  Pipe - (62)          CONDUIT      0  07:54      2.37    1.00        0.83        1.12       0.74
1.00       1438  SURCHARGED
  Pipe - (63)          CONDUIT      0  00:00      2.91    1.00        1.01        2.72       0.37
1.00       1440  SURCHARGED
  Pipe - (64)          CONDUIT      0  07:54      3.67    1.00        0.60        1.12       0.53
0.47          0  Calculated
  Pipe - (65)          CONDUIT      0  07:55      4.97    1.00        0.60        2.05       0.29
0.38          0  Calculated
  Pipe - (66)          CONDUIT      0  07:54      2.98    1.00        0.52        1.12       0.46
0.50          0  Calculated
  Pipe - (67)          CONDUIT      0  07:54      3.71    1.00        0.52        1.99       0.26
0.43          0  Calculated
  Pipe - (68)          CONDUIT      0  07:54      1.55    1.00        0.54        1.12       0.48
1.00         27  SURCHARGED
  Pipe - (69)          CONDUIT      0  07:54      1.55    1.00        0.54        1.12       0.48
1.00        143  SURCHARGED
  Pipe - (70)          CONDUIT      0  00:03      2.44    1.00        0.56        1.12       0.50
1.00       1436  SURCHARGED
  Pipe - (71)          CONDUIT      0  00:03      6.63    1.00        0.92        1.72       0.53
1.00       1437  SURCHARGED
  Pipe - (72)          CONDUIT      0  07:54      2.66    1.00        0.34        1.12       0.30
0.39          0  Calculated
  Pipe - (73)          CONDUIT      0  07:55      2.72    1.00        0.34        1.12       0.30
0.39          0  Calculated
  Pipe - (74)          CONDUIT      0  07:55      1.54    1.00        0.34        3.65       0.09
0.60          0  Calculated


  ********************************
  Highest Flow Instability Indexes
  ********************************
  All links are stable.

  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (47) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (49) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (50) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (58) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit Pipe - (59) is below upstream
node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (61) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
```

```
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (63) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (64) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (67) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (68) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (69) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (71) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.

  Analysis began on:  Thu Jul 27 09:55:02 2023
  Analysis ended on:  Thu Jul 27 09:55:06 2023
  Total elapsed time: 00:00:04
```

Tab 6.0

6.0 SPECIAL REPORTS AND STUDIES

The following special reports and studies are included in this section:

- *Geotechnical Report*

Figure 11
Geotechnical Report

GEOTECHNICAL REPORT

240 – 15th Street SE Industrial
240 – 15th Street Southeast
Puyallup, Washington

Project No. T-8661

Terra Associates, Inc.

Prepared for:

Cref3 Puyallup Owner, LLC
Los Angeles, California

January 12, 2022
Revised June 23, 2023

TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

January 12, 2022
Revised June 23, 2023
Project No. T-8661

Mr. Michael Cohn
Cref3 Puyallup Owner, LLC
11611 San Vicente Boulevard, 10th Floor
Los Angeles, California 90049

Subject: Geotechnical Report
240 – 15th Street SE Industrial
240 – 15th Street Southeast
Puyallup, Washington

Dear Mr. Cohn:

As requested, we have conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

The native soils observed in the test borings are alluvial deposits generally consisting of loose to medium dense, wet, fine sand, silty fine sand, and silt with varying proportions of fine sand. The CPT data shows similar interbedded alluvial soils extending to a depth of about 80 feet. Groundwater levels at the site range between depths of about two and one-half feet and five feet. In our opinion, the soil and groundwater conditions observed at the site would not preclude the proposed development provided the recommendations contained herein are incorporated into design and construction.

We trust the information presented in this report is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

John C. Sadler, L.E.G., L.H.G.
Senior Engineering Geologist

CAROLYN S. DECKER
STATE OF WASHINGTON
47016
REGISTERED
PROFESSIONAL ENGINEER

6-23-2023

Carolyn S. Decker, P.E.
President

12220 113th Avenue NE, Ste. 130, Kirkland, Washington 98034
Phone (425) 821-7777

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Figures

Appendices

Geotechnical Report
240 – 15th Street SE Industrial
240 – 15th Street Southeast
Puyallup, Washington

1.0 PROJECT DESCRIPTION

The proposed project is an industrial development consisting of a warehouse-style building and associated paved access, parking, and utility improvements. A conceptual site plan by Mackenzie, dated September 27, 2021, shows a 131,250 square-foot building in the central portion of the site. Truck and trailer parking is shown on the northern and western sides of the building, respectively. Passenger vehicle parking is shown on the eastern side of the building. Building plans are currently not available; however, we expect the building will be constructed using precast concrete tilt-up perimeter wall panels with interior columns spaced at 30 to 50 feet. Building floors will be constructed at grade with dock high access on the northern side of the building. Structural loading is expected to be light to moderate, with isolated columns carrying loads of 50 to 100 kips, and bearing walls carrying 4 to 8 kips per foot.

The recommendations in this report are based on our understanding of the design features outlined above. We should review design drawings as they become available to verify that our recommendations have been properly interpreted and to supplement them, if required.

2.0 SCOPE OF WORK

Our scope of work for this project included subsurface exploration, laboratory testing, office review, engineering analysis, and preparation of this report. Our subsurface exploration included ten test borings drilled to maximum depths of 6.5 feet and 31.5 feet with a limited access, track-mounted drill rig using hollow-stem auger drilling methods, one approximately 60-foot deep cone penetration test (CPTs), and one approximately 84-foot deep CPT.

Using the results of our subsurface explorations and laboratory testing, analyses were undertaken to develop geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Geologic hazards per the City of Puyallup Municipal Code.
- Seismic Site Class.
- Site preparation and grading including recommendations for building preload or surcharge to mitigate floor and foundation settlement.

- Excavations.
- Foundations.
- Slab-on-grade floors.
- Lateral earth pressures for wall design.
- Subsurface drainage.
- Infiltration feasibility.
- Utilities.
- Pavement.

3.0 SITE CONDITIONS

3.1 Surface

The site is an approximately 8.74-acre assemblage of three parcels located northwest of and adjacent to the intersection of 15th Street Southeast and East Pioneer Avenue in Puyallup, Washington. The site location is shown on Figure 1.

Existing site improvements include a small office building in the northeastern portion of the site, a vacant industrial building in the southeast corner of the site, and the remains of a large cold-storage warehouse in the central portion of the site that was recently destroyed by fire. Areas around the buildings are typically surfaced with asphalt or concrete pavement or crushed gravel. An open area of the site located west of the cold storage building is an undeveloped grass field. Site topography is relatively flat.

3.2 Soils

The native soils observed in the test borings are alluvial deposits generally consisting of loose to medium dense, wet, fine sand, silty fine sand, and silt with varying proportions of fine sand and traces of fine organic particles. Fine-grained sand deposits encountered between depths of 20 and 21.5 feet in Borings B-1, B-2, B-6, and B-10 contained numerous fine pumice grains.

The upper approximately 3 to 4 feet of soil encountered in Borings B-7 through B-10 consists of loose to medium dense, silty fine sand that is interpreted to be fill. The fill materials observed in Borings B-7 and B-10 contain numerous wood shavings or fragments.

The CPT data shows interbedded alluvial soils extending the full 60-foot depth of CPT-2 and to a depth of about 80 feet in CPT-1. Soil behavior types determined from the CPT data generally consist of about 30 feet of sand to silty sand and silty sand to sandy silt with scattered clayey silt to silty clay interbeds underlain primarily by interbedded sandy silt to silty clay. A soil behavior type consistent with gravelly sand to sand was encountered below a depth of about 80 feet in CPT-1. In general, where cohesive silt and clay soils are indicated, correlated N_{60} values, indicate consistencies in the medium stiff to stiff range above a depth of about 72 feet and stiff to very stiff below that depth. Where cohesionless sand, silty sand, and silt soils are indicated, correlated N_{60} values indicate relative densities typically in the loose to medium dense range. The soil conditions determined from the CPTs are generally consistent with those observed in the test borings.

The *Geologic map of the Tacoma 1:100,000-scale quadrangle, Washington,* by J.E. Schuster (2015), shows surficial geology at the site mapped as Holocene alluvium (Qa). The soils observed in our subsurface explorations are consistent with this geologic map unit.

Detailed descriptions of the conditions observed in our subsurface explorations are given on the Boring Logs in Appendix A. The CPT data plots are also attached in Appendix A. The approximate test boring and CPT locations are shown on Figure 2.

3.3 Groundwater

Groundwater was encountered in all of the test borings with groundwater levels typically encountered below a depth of about 5 feet. Pore pressure dissipation testing performed in CPT-2 determined a hydrostatic level approximately 5 feet below ground surface as well. Borings B-3 through B-5 and Boring B-7 all encountered wet soils below depths of about 2.5 to 3 feet.

The depths to groundwater at the site will fluctuate on a seasonal basis with maximum levels occurring during the wet winter and spring months. Considering that our field work occurred during late November, we expect that the observed groundwater levels are approaching seasonal high levels.

3.4 Seismic Site Class

Soil conditions at the site, as discussed in the following section, will be subject to the soil liquefaction phenomenon. Because of this condition, per the current International Building Code (IBC), subsurface conditions would be assigned site class "F" which would require performing a site-specific seismic analysis to determine seismic forces for structural design. However, the IBC allows for using code derived seismic values for the soil conditions indicated if the building's fundamental period is equal to or less than 0.5 seconds. We expect that the proposed industrial building will fall into this category. In this case, based on soil conditions encountered and our knowledge of the area geology, site class "D" can be used to determine seismic design forces.

3.5 Geologic Hazards

Chapter 21.06.1210(1) of the Puyallup Municipal Code (PMC) defines geologic hazard areas as "…areas susceptible to erosion, landsliding, earthquake, volcanic activity or other potentially hazardous geological processes." Site conditions do not meet the PMC criteria defining landslide hazard areas or erosion hazard areas. In our opinion, site conditions are susceptible to potential seismic and volcanic hazards as discussed below.

3.5.1 Seismic Hazards

Chapter 21.06.1210(3)(c) of the PMC defines seismic hazard areas as "…areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement or subsidence, soil liquefaction, or tsunamis. Settlement and soil liquefaction conditions occur in areas underlain by cohesionless, loose, or soft-saturated soils of low density, typically in association with a shallow ground water table."

The site conditions are not susceptible to seismically-induced slope failure and the site is not located within an area that is susceptible to tsunamis inundation. In our opinion, potential hazards associated with ground shaking would be adequately mitigated by designing with seismic forces determined by local building codes or site specific seismic analysis, if needed.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations. Liquefaction mainly affects geologically recent deposits of fine-grained sands underlying the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction; thus, eliminating the soil's strength.

We completed a liquefaction analysis using the computer program LiquefyPro published by CivilTech Corporation. The analysis was completed using a site modified peak ground acceleration (PGA_M) of 0.60g representing the peak horizontal acceleration for the maximum considered earthquake (MCE) having a 2 percent probability of exceedance in 50 years. The value was obtained for Latitude 47.18978287°N and Longitude -122.27573704°W using the Structural Engineers Association of California (SEAOC) U.S. Seismic Design Maps website (https://seismicmaps.org/) accessed on December 27, 2021. The results of the liquefaction analysis are attached in Appendix B.

The results of our analysis indicate the site is a seismic hazard area with respect to soil liquefaction. Soil liquefaction could occur during the design earthquake event resulting in total settlements ranging between about four and one-half and seven inches with about one-half of this settlement likely being differential in nature. In our opinion, this amount of settlement has the potential to structurally impair the building. The structural engineer should review the estimated settlement to determine if additional mitigation measures are necessary. Additionally, cosmetic damage to the structure in the form of misaligned doors and windows, cracking, and floor settlement could occur. Some utility connections may also be impacted. If the owner is not willing to accept the risk of building damage requiring repair should liquefaction-induced settlements occur, foundations should be supported on ground improved using stone columns designed to mitigate soil liquefaction settlements below the building foundations.

3.5.2 Volcanic Hazards

Chapter 21.06.1210(3)(d) of the PMC defines volcanic hazard areas as "…areas subject to pyroclastic flows, lava flows, debris avalanche, inundation by debris flows, lahars, mudflows, or related flooding resulting from volcanic activity. Volcanic hazard areas shall be classified as Case I or Case II lahars per the definitions in PMC 21.06.210." The site is located in a potential Case II lahar inundation zone. Therefore, per the PMC, the site is considered a volcanic hazard area.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

In our opinion, there are no geotechnical considerations that would preclude development of the site as planned. The fine-grained native soils observed at the site will consolidate under static dead loads imposed by the structure and by product loading on structure floor slabs. To mitigate the potential for post-construction settlement due to this consolidation, we recommend preloading the building location. Preloading will involve placing the structural fill required to achieve the finish floor elevation and allowing settlements to occur under this load before building construction is initiated. We expect that these settlements would occur in about two to four weeks following full application of the building fill.

The preloading program will adequately mitigate post-construction settlement under static loading but will not eliminate the risk of damage resulting from seismically-induced soil liquefaction. If the owner is not willing to accept the risk of building damage requiring repair should liquefaction-induced settlements occur, foundations should be supported on ground improved using stone columns designed to mitigate soil liquefaction settlements below the building foundations. The use of stone columns to improve the foundation subgrade would preclude the need for preloading.

After completing the preload, building construction can begin. The buildings can be supported on conventional spread footings bearing on a minimum of two feet of compacted structural fill. Overexcavation of native soils and replacement with structural fill will likely be required where deeper footing depths are required, such as below the perimeter foundations adjacent to the loading dock areas or where perimeter footings are deepened for seismic resistance. In our opinion, mitigation of the weak subgrade soils in paved areas will require cement amending or excavation and replacement with imported gravel base material.

The native soils encountered at the site contain a sufficient percentage of fines that will make it difficult to compact as structural fill when too wet. The ability to use soils from site excavations as structural fill will depend on the soil moisture content and the prevailing weather conditions at the time of construction. The contractor should be prepared to dry the native soils by aeration during the normally dry summer season to facilitate compaction as structural fill. Alternatively, stabilizing the moisture in the native soil with cement or lime can be considered. If grading activities will take place during the winter season, the contractor should be prepared to import clean granular material for use as structural fill and backfill.

The following sections provide detailed recommendations regarding the above issues and other geotechnical design considerations. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

In general, it will not be necessary to strip the organic surface layer where structural fill thicknesses above existing grade are a minimum of 3 feet and 2 feet in building and pavement areas, respectively. However, existing surface vegetation, such as that in the western portion of the site, should be mowed close to the ground with the cut debris removed from the site. Clearing of trees should include removal of the entire tree root ball. Where structural fill thicknesses are less than the recommended minimums, both the organic surface soil and vegetation should be stripped from below building and pavement areas. In this case surface stripping depths of four to six inches should be expected. Topsoil will not be suitable for use as structural fill, but can be used in landscaped areas.

We recommend removing existing building foundations and slabs and abandoning underground septic systems and other buried utilities from the planned development area. Abandoned utility pipes that fall outside of new building areas can be left in place provided they are sealed to prevent intrusion of groundwater seepage and soil.

Prior to placing fill or constructing footings, all exposed bearing surfaces should be observed by a representative of Terra Associates, Inc. to verify that soil conditions are as expected and suitable for support of new fill or building elements. Our representative may request proofrolling the exposed subgrade for pavement and floor slab support with a loaded ten yard dump truck. If unstable soils are observed and cannot be stabilized in place by compaction, the affected soils should be excavated and removed to firm bearing and grade restored with new structural fill.

All building footings should obtain support on a minimum of two feet of granular structural fill. The fill should extend laterally from the edge of footing a minimum distance of one-foot. Based on planned grades, for normal perimeter footings bearing at the frost depth and interior footings immediately below the slab-on-grade floor, we expect that this requirement will be met over most of the building area with the fill depth required to achieve the design floor elevations. Deeper footings such as the perimeter footings adjacent the loading docks and for shear walls may require some overexcavation and grade restoration with structural fill.

Our study indicates that the native soils contain a sufficient percentage of fines (silt and clay size particles) that will make them difficult to compact as structural fill if they are too wet or too dry. Accordingly, the ability to use these native soils from site excavations as structural fill will depend upon their moisture content and the prevailing weather conditions when site grading activities take place. Native soils that are too wet to properly compact could be dried by aeration during dry weather conditions or mixed with an additive such as cement or lime to stabilize the soil and facilitate compaction. If an additive is used, additional Best Management Practices (BMPs) for its use will need to be incorporated into the Temporary Erosion and Sedimentation Control plan (TESC) for the project. If grading activities are planned during the wet winter months, and the onsite soils become too wet to achieve adequate compaction, the owner or contractor should be prepared to treat soils with lime, cement, or import wet weather structural fill.

For this purpose, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

*Based on the 3/4-inch fraction

Prior to use, Terra Associates, Inc. should examine and test all materials to be imported to the site for use as structural fill. If building subgrades were constructed using native soils and will be exposed during wet weather, it would be advisable to place 12 inches of this granular structural fill on the building pad to prevent deterioration of the floor subgrade.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-698 (Standard Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this same ASTM standard. In nonstructural areas the degree of compaction can be reduced to 90 percent.

4.3 Preload

We recommend preloading the building areas to limit building and floor slab settlements to tolerable levels. For this procedure, we recommend placing structural fill in the building areas to the design floor elevation, and delaying building construction until settlement under this fill load has occurred. The preload fill should extend a minimum of five feet beyond the building perimeter. A minimum of three feet of fill should be placed. If this fill depth exceeds that required to achieve design floor grade, the surplus depth would be treated as a surcharge and removed following completion of settlement as indicated by survey readings at settlement markers as discussed below.

Total settlement under the building fill is estimated in the range of one to three inches. These settlements are expected to occur in about three to four weeks following full application of the building fill.

To verify the amount of settlement and the time rate of movement, the preload program should be monitored by installing settlement markers. The settlement markers should be installed on the existing grade prior to placing any building or preload fills. Once installed, elevations of both the fill height and marker should be taken daily until the full height of the preload is in place. Once fully preloaded, readings should continue weekly until the anticipated settlements have occurred. A typical settlement marker detail is provided as Figure 3.

It is critical that the grading contractor recognize the importance of the settlement marker installations. All efforts must be made to protect the markers from damage during fill placement. It is difficult, if not impossible, to evaluate the progress of the preload program if the markers are damaged or destroyed by construction equipment. As a result, it may be necessary to install new markers and extend the surcharging time period in order to ensure that settlements have ceased and building construction can begin.

Following the successful completion of the preload program, with foundations designed as recommended in Section 4.5 of this report, you should expect maximum total and differential post-construction static settlements of 0.5 inches for perimeter foundations and 1 inch for interior columns.

4.4 Excavations

All excavations at the site associated with confined spaces, such as lower building level retaining walls, must be completed in accordance with local, state, or federal requirements. Based on current Washington Industrial Safety and Health Act (WISHA) regulations, the site soils would be classified as a Type C soil.

For properly dewatered excavations in Type C soils that are greater than 4 feet and less than 20 feet in depth, the side slopes should be laid back at an inclination of 1.5:1 (Horizontal:Vertical) or flatter. If there is insufficient room to complete the excavations in this manner, or if excavations greater than 20 feet in depth are planned, using temporary shoring to support the excavations may need to be considered.

Based on our study, groundwater seepage should be anticipated within excavations extending below depths of about two and one-half to five feet. Excavations extending below these depths will likely encounter groundwater seepage with volumes and flow rates sufficient to require some level of dewatering. Shallow excavations that do not extend more than two feet below the groundwater table can likely be dewatered by conventional sump-pumping procedures along with a system of collection trenches. Deeper excavations will likely require dewatering by well points or isolated deep-pump wells. The utility subcontractor should be prepared to implement excavation dewatering by well point or deep-pump wells, as needed. This will be an especially critical consideration for any deep excavations such as stormwater detention vaults, lift stations, and sanitary sewer tie-ins.

This information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Terra Associates, Inc. assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

4.5 Foundations

In our opinion, following the completion of a successful preload program, the building may be supported on conventional spread footing foundations bearing on a minimum of 2 feet of structural fill placed and compacted as recommended in Section 4.2 of this report. Foundations exposed to the weather should bear at a minimum depth of one and one-half feet below adjacent grades for frost protection.

We recommend designing foundations for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used. With the expected building loads and this bearing stress applied, in general, total and differential settlements should not exceed 0.5 inches for perimeter foundations and 1 inch for interior column supports.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressures acting on the sides of the footings can also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf). We do not recommend including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundation will be constructed neat against competent native soil or backfilled with structural fill, as described in Section 4.2 of this report. The values recommended include a safety factor of 1.5.

4.6 Lateral Earth Pressures for Retaining Walls

The magnitude of earth pressure development on below-grade walls, such as basement or retaining walls, will partly depend upon the quality of the wall backfill. We recommend placing and compacting wall backfill as structural fill as described in Section 4.2 of this report. To guard against hydrostatic pressure development, drainage must be installed behind the wall. A typical wall drainage detail is shown on Figure 4.

With wall backfill placed and compacted as recommended and drainage properly installed, unrestrained walls can be designed for an active earth pressure equivalent to a fluid weighing 35 pcf. For restrained walls, an additional uniform lateral pressure of 100 psf should be included. For evaluating the walls under seismic loading, a uniform earth pressure equivalent to 8H psf, where H is the height of the retained earth in feet, can be used. These values assume a horizontal backfill condition and that no other surcharge loading, such as traffic, sloping embankments, or adjacent buildings, will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design.

Friction at the base of the wall foundation and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 4.5.

4.7 Slab-on-Grade Floors

Slab-on-grade floors may be supported on subgrades prepared as recommended in Section 4.2 of this report. Immediately below the floor slabs, we recommend placing a 4-inch thick capillary break layer of clean, free-draining, coarse sand or fine gravel that has less than 5 percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slabs.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab.

It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will be ineffective in assisting in uniform curing of the slab and can actually serve as a water supply for moisture transmission through the slab and affecting floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained. We recommend floor designers and contractors refer to the American Concrete Institute (ACI) Manual of Concrete Practice for further information regarding vapor barrier installation below slab-on-grade floors.

For design of the floor slabs on grade, a subgrade modulus (k_s) of 100 pounds per cubic inch (pci) can be used.

4.8 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the building at all times. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building area. We recommend providing positive gradient away from the building perimeter.

Subsurface

We expect that building floor elevations will be above existing surface grades and that permanent hard surfaces will extend to the building over most of its perimeter. With these conditions, it is our opinion that building foundation drains would not be required. However, footing drains associated with retaining wall drainage, such as loading dock walls should be installed. Foundation drains should also be installed where landscaping is adjacent to the building.

4.9 Infiltration Feasibility

Based on the shallow seasonal water table and the fine-grained nature of the soils observed across the site, it is our opinion that infiltration is not a feasible option for stormwater management.

4.10 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Associates (APWA) or local jurisdictional specifications. At a minimum, trench backfill should be placed and compacted as structural fill as described in Section 4.2 of this report. At the time of our study, soil moisture contents were generally above optimum; therefore, drying back or other means to condition the material will probably be necessary to facilitate proper compaction. If utility construction takes place during the winter, it may be necessary to import suitable wet weather fill for utility trench backfilling.

For any structure installed below a depth of approximately two and one-half feet, buoyancy effects must be considered. Buoyancy or uplift will be resisted by the weight of the structure and the weight of the soil overlying its foundation or cover. For backfill placed as structural fill, a soil unit weight of 110 pcf can be used.

Buoyancy, or an unbalanced hydrostatic head, will also impact the trench bottom stability. Where an unbalanced hydrostatic head exists in the trench excavation, the trench bottom can heave and, subsequently, become unstable causing installed utility pipes to settle when overburdened stresses from utility trench backfill are replaced.

Two methods for stabilizing the trench bottoms can be considered. The first involves using well point dewatering systems to lower the groundwater table adjacent to utility excavation and prevent development of an unbalanced hydrostatic head. Single-stage well point dewatering systems are typically effective for utility excavations occurring to depths of 15 to 20 feet.

The second method that can be used to mitigate heave or unstable soil conditions at the trench bottom involves overexcavation of the affected soils and replacement with additional free-draining bedding material. As a general rule, the depth of overexcavation below the pipe invert and replacement with free-draining bedding material would be equivalent to one foot for every two feet of unbalanced hydrostatic head.

4.11 Pavements

Pavements should be constructed on subgrades prepared as recommended in Section 4.2 of this report. Regardless of the degree of relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. Proofrolling the subgrade with heavy construction equipment should be completed to verify this condition.

The pavement design section is dependent upon the supporting capability of the subgrade soils and the traffic conditions to which it will be subjected. We expect traffic at the facility will consist of cars and light trucks, along with heavy traffic in the form of tractor-trailer-rigs. For design considerations, we have assumed traffic in parking and in car/light truck access pavement areas can be represented by an 18-kip Equivalent Single Axle Loading (ESAL) of 50,000 over a 20-year design life. For heavy traffic pavement areas, we have assumed an ESAL of 300,000 would be representative of the expected loading. These ESALs represent loading approximately equivalent to 3 and 18, loaded (80,000-pound GVW) tractor-trailer rigs traversing the pavement daily in each area, respectively.

With a stable subgrade prepared as recommended, for the design ESAL values, we recommend the following pavement sections:

Light Traffic/Car Access:

- 2 inches of hot mix asphalt (HMA) over 6 inches of crushed rock surfacing (CRS).
- 4 inches full depth HMA.

Heavy Traffic/Truck Access:

- 3 inches of HMA over 8 inches of CRS.
- 6 inches full depth HMA.

For exterior Portland cement concrete (PCC) pavement, we recommend the following:

- 6 inches of PCC over 2 inches of CRS.
    - 28-day compressive strength – 4,000 psi.
    - Control joints spaced at a maximum of 15 feet.

Soil cement stabilization or constructing a soil cement base for support of the pavement section can also be considered as an alternate to the above conventional pavement sections. Assuming a properly constructed soil cement base having a minimum thickness of 12 inches and a minimum 7-day compressive strength of 100 pounds per square inch (psi), the following pavement sections are recommended:

Light Traffic/Car Access:

- 2 inches of HMA over 12 inches of soil cement base (SCB).

Heavy Traffic/Truck Access:

- 3 inches of HMA over 12 inches of SCB.
- 6 inches of PCC over 12 inches of SCB.

The design of the soil cement base should be completed using samples of the subgrade exposed at the time of construction.

The paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for ½-inch class HMA and CRS.

Long-term pavement performance will depend upon surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils and reducing their supporting capability. For optimum pavement performance, we recommend surface drainage gradients of at least two percent. Some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

5.0 ADDITIONAL SERVICES

Terra Associates, Inc. should review the final design and specifications in order to verify that earthwork recommendations have been properly interpreted and incorporated into project design and construction. We should also provide geotechnical services during construction in order to observe compliance with the design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

6.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. This report is the property of Terra Associates, Inc. and is intended for specific application to the 240 – 15th Street SE Industrial project in Puyallup, Washington. This report is for the exclusive use of Fortress, LLC, and its authorized representatives.

The analyses and recommendations presented in this report are based upon data obtained from the subsurface explorations completed onsite. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.

REFERENCE: WSDOT GEOPORTAL

NOT TO SCALE

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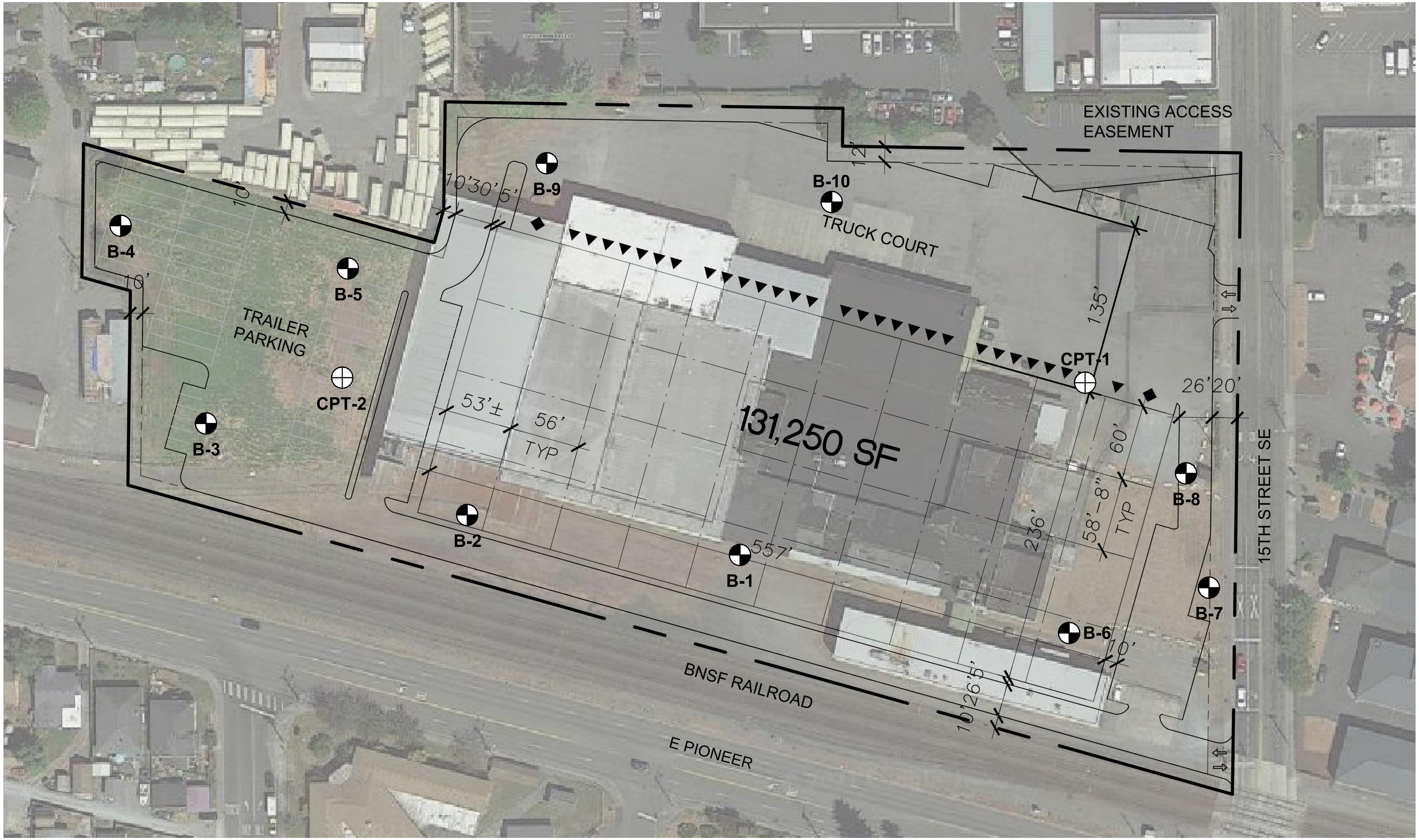
Geology and
Environmental Earth Sciences

VICINITY MAP
240 - 15TH STREET SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj. No.T-8661	Date JUNE 2023	Figure 1



NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE:

MACKENZIE

LEGEND:

- APPROXIMATE BORING LOCATION
- APPROXIMATE CPT LOCATION

0 80 160

APPROXIMATE SCALE IN FEET

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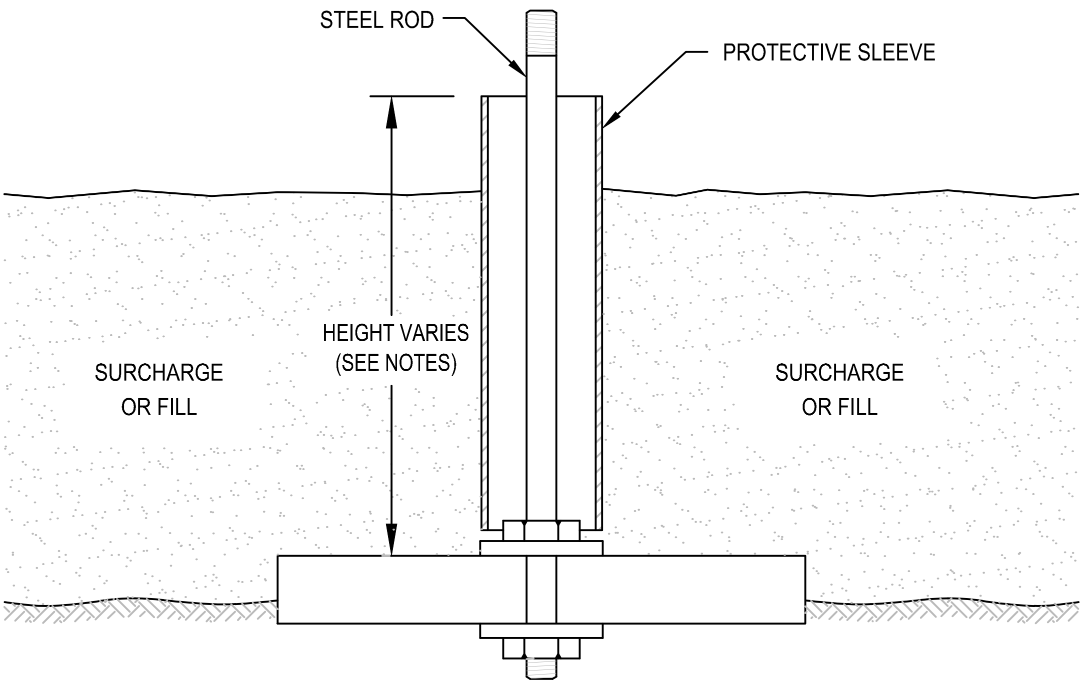
Geology and
Environmental Earth Sciences

EXPLORATION LOCATION PLAN
240 - 15TH STREET SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj. No.T-8661	Date JUNE 2023	Figure 2



NOT TO SCALE

NOTES:

1. BASE CONSISTS OF 3/4" THICK, 2'x2' PLYWOOD WITH CENTER DRILLED 5/8" DIAMETER HOLE.
2. BEDDING MATERIAL, IF REQUIRED, SHOULD CONSIST OF CLEAN COARSE SAND.
3. MARKER ROD IS 1/2" DIAMETER STEEL ROD THREADED AT BOTH ENDS.
4. MARKER ROD IS ATTACHED TO BASE BY NUT AND WASHER ON EACH SIDE OF BASE.
5. PROTECTIVE SLEEVE SURROUNDING MARKER ROD SHOULD CONSIST OF 2" DIAMETER PLASTIC TUBING. SLEEVE IS NOT ATTACHED TO ROD OR BASE.
6. ADDITIONAL SECTIONS OF STEEL ROD CAN BE CONNECTED WITH THREADED COUPLINGS.
7. ADDITIONAL SECTIONS OF PLASTIC PROTECTIVE SLEEVE CAN BE CONNECTED WITH PRESS-FIT PLASTIC COUPLINGS.
8. STEEL MARKER ROD SHOULD EXTEND AT LEAST 6" ABOVE TOP OF PLASTIC PROTECTIVE SLEEVE.
9. PLASTIC PROTECTIVE SLEEVE SHOULD EXTEND AT LEAST 1" ABOVE TOP OF FILL SURFACE.

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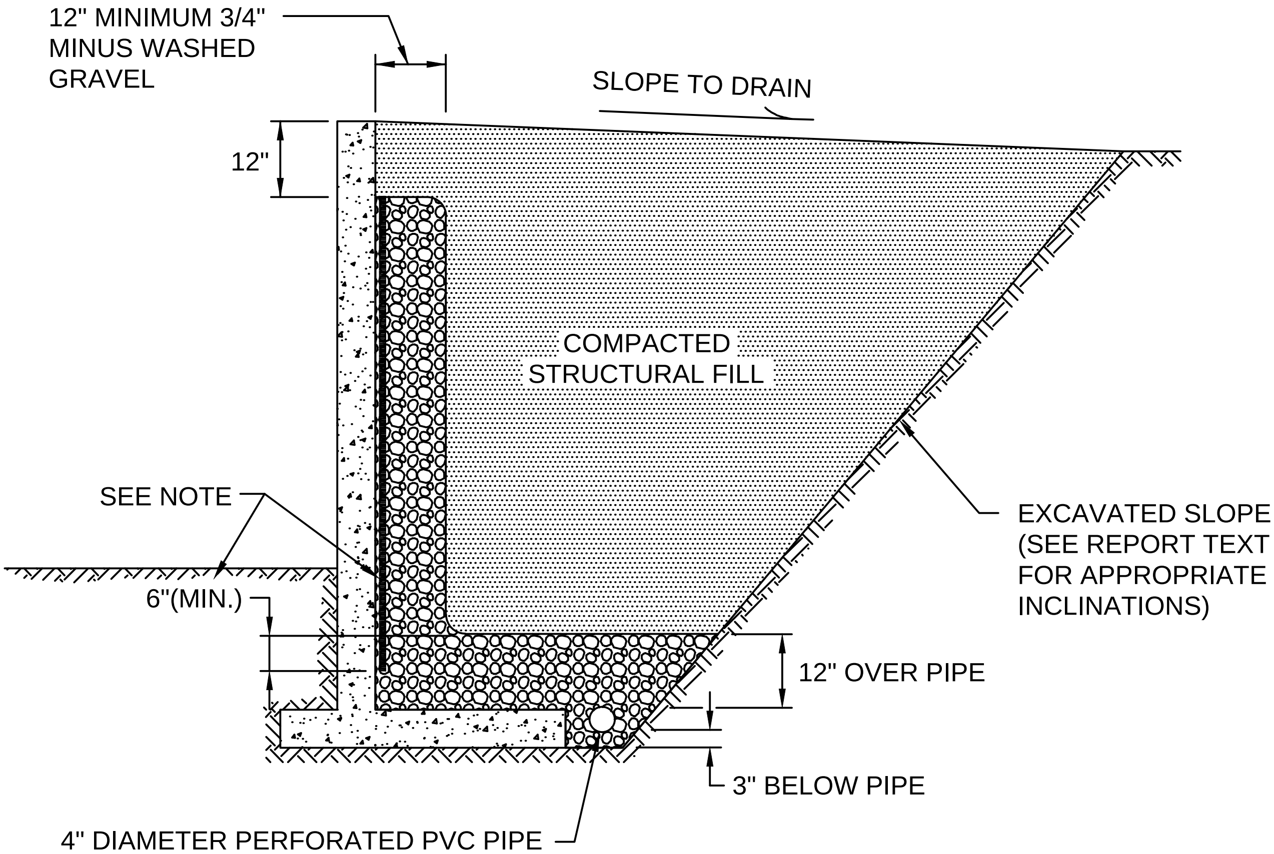
Environmental Earth Sciences

TYPICAL SETTLEMENT MARKER DETAIL
240 - 15TH STREET SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj. No.T-8661	Date JUNE 2023	Figure 3



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.

Terra Associates, Inc.
Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

TYPICAL WALL DRAINAGE DETAIL
240 - 15TH STREET SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj. No.T-8661	Date JUNE 2023	Figure 4

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

240 – 15th Street SE Industrial
Puyallup, Washington

We explored subsurface conditions at the site by drilling six 31.5-foot deep test borings and four 6.5-foot deep test borings with a track-mounted drill rig using hollow-stem auger drilling methods, and by conducting two cone penetration tests (CPTs) to maximum depths of about 60 feet and about 84 feet. The test boring and CPT locations were approximately determined in the field by pacing and sighting from existing site features. The test boring and CPT locations are shown on Figure 2. The Boring Logs are presented as Figures A-2 through A-11.

An engineering geologist from our office conducted the field exploration. Our representative classified the soil conditions encountered, maintained a log of each boring, obtained representative soil samples, and recorded groundwater levels observed during drilling. Soil samples were obtained during drilling in general accordance with ASTM Test Designation D-1586. Using this procedure, a 2-inch (outside diameter) split barrel sampler is driven into the ground 18 inches using a 140-pound hammer free falling a height of 30 inches the number of blows required to drive the sampler 12 inches after an initial 6-inch set is referred to as the Standard Penetration Resistance value or N value. This is an index related to the consistency of cohesive soils and relative density of cohesionless materials. N values obtained for each sampling interval are recorded on the Boring Logs. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1.

Representative soil samples obtained from the test borings were placed in sealed plastic bags and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the Boring Logs. Grain size analyses were performed on eight soil samples. The results are shown on Figures A-12 through A-14.

In Situ Engineering, under subcontract to Terra Associates, Inc., performed the CPTs at locations selected by Terra Associates, Inc. The CPT consists of pushing an instrumented, approximately one and one-half inch diameter cone into the ground at a constant rate. During advancement, continuous measurements are made of the resistance to penetration of the cone and the friction of the outer surface of a sleeve. The cone is also equipped with a porous filter and a pressure transducer for measuring the generated groundwater or pore water pressure. Measurements of tip and sleeve frictional resistance, pore pressure, and interpreted soil conditions are summarized in graphical form on the attached CPT Logs.

MAJOR DIVISIONS				LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	More than 50% material larger than No. 200 sieve size	**GRAVELS** More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
			Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
		SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
				SP	Poorly-graded sands, sands with gravel, little or no fines.
			Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
				SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS	More than 50% material smaller than No. 200 sieve size	**SILTS AND CLAYS** Liquid Limit is less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.
				CL	Inorganic clays of low to medium plasticity. (Lean clay)
				OL	Organic silts and organic clays of low plasticity.
		SILTS AND CLAYS Liquid Limit is greater than 50%		MH	Inorganic silts, elastic.
				CH	Inorganic clays of high plasticity. (Fat clay)
				OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS				PT	Peat.

DEFINITION OF TERMS AND SYMBOLS

	Density	Standard Penetration Resistance in Blows/Foot
COHESIONLESS	Very Loose	0-4
	Loose	4-10
	Medium Dense	10-30
	Dense	30-50
	Very Dense	>50

	Consistancy	Standard Penetration Resistance in Blows/Foot
COHESIVE	Very Soft	0-2
	Soft	2-4
	Medium Stiff	4-8
	Stiff	8-16
	Very Stiff	16-32
	Hard	>32

Symbol	Definition
I	2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
Ⅱ	2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
▼	WATER LEVEL (Date)
Tr	TORVANE READINGS, tsf
Pp	PENETROMETER READING, tsf
DD	DRY DENSITY, pounds per cubic foot
LL	LIQUID LIMIT, percent
PI	PLASTIC INDEX
N	STANDARD PENETRATION, blows per foot

Terra Associates, Inc.
Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

UNIFIED SOIL CLASSIFICATION SYSTEM
240 - 15TH STREET SE INDUSTRIAL
PUYALLUP, WASHINGTON

Proj. No.T-8661 | Date JUNE 2023 | Figure A-1

LOG OF BORING NO. 1

Figure No. A-2

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot	Moisture Content (%)
0				
	Dark brown to gray-brown SAND, fine grained, moist. (SP)	Medium Dense	12	23.9
5	- Becomes fine to medium grained and wet below 5 feet.		10	24.3
	- Trace of brown silt seams and gray silt pockets below 8.5 feet.		12	23.7
10			12	23.9
	Dark gray-brown silty SAND, fine grained, wet, trace of dark brown fine organic particles and wood fragments. (SM)		22	35.4
15			12	30.1
	Dark gray-brown sandy SILT, fine sand, wet. (ML)			
	Dark gray-brown SAND, fine grained, wet, scattered layers containing numerous fine pumice fragments, trace of silt seams. (SP)			
20			12	24.7
	Dark gray-brown silty SAND to sandy SILT, fine sand, wet. (SM/ML)			
25			14	26.5
	Dark gray-brown SAND, fine to medium grained, wet. (SP)			
30	Dark gray-brown SAND with silt to silty SAND, fine sand, wet, scattered brown silt seams, trace of wood fragments and gray-brown silt pockets. (SP-SM/SM)	Loose	6	64.8
	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet.			
35				

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 2

Figure No. A-3

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot	Moisture Content (%)
0 – 13.5	Dark brown to dark gray-brown SAND, fine grained, moist, scattered silty fine sand seams and layers. (SP)	Loose (0 – 4.5)	9	27.2
5 ▼	- Becomes wet below 5 feet.	Medium Dense	10	26.4
	- Numerous silty fine sand seams and trace of dark brown organic partings and seams below 8 feet.		12	31.6
10			13	25.7
			27	29.1
13.5 – 15.5	Dark gray-brown silty SAND, fine grained, wet. (SM)		15	33.9
15.5 – 19.5	Interbedded dark gray-brown silty fine SAND to fine sandy SILT and fine to medium grained SAND, wet, trace of fine dark brown organic fragments. (SM/ML and SP)			
19.5 – 23.5	Dark gray-brown SAND, fine grained, wet, numerous fine pumice fragments. (SP)		12	27.4
23.5 – 26.5	Dark gray SILT, wet, trace of fine black organic fragments. (ML)		13	39.4 / 25.7
26.5 – 28.5	Dark gray-brown silty SAND, fine grained, wet. (SM)			
28.5 – 31.5	Dark gray-brown SAND, fine grained, wet. (SP)	Loose	6	31.0
31.5 – 32	Dark gray-brown SILT, wet. (ML)			
	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet.			

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 3

Figure No. A-4

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 3 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot (10 30 50)	Moisture Content (%)
0					
2.5	I	Dark gray-brown SAND with silt, fine grained, moist (wet below 3 feet), trace of gray silty fine sand layers, mottled above 3 feet. (SP-SM)	Medium Dense	11	25.2
3 (▼)					
5	I	- Scattered iron-oxide stained pockets below 5 feet.	Loose	9	28.8
6		Dark gray SILT, wet. (ML)			
6.5		Boring terminated at 6.5 feet. Groundwater encountered below about 3 feet.			
10					

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 4

Figure No. A-5

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 2.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot (10 30 50)	Moisture Content (%)
0					
▼ 2.5	I	Dark gray-brown SAND, fine to medium grained, wet. (SP)	Loose	8	25.5
5	I			5	
		Dark gray-brown SILT to sandy SILT, fine sand, wet, coarse wood fragment at 6.5 feet. (ML)			44.0
		Boring terminated at 6.5 feet. Groundwater encountered below about 2.5 feet.			
10					

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 5

Figure No. A-6

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 2.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot (10 30 50)	Moisture Content (%)
0					
▼ 2.5	I	No recovery at 2.5 feet. Sampler wet.	Medium Dense	21	
5	I	Dark gray-brown SAND, fine to medium grained, wet. (SP)	Medium Dense	13	22.2
		Boring terminated at 6.5 feet. Groundwater encountered below about 2.5 feet.			
10					

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 6

Figure No. A-7

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot	Moisture Content (%)
0–4.5	Dark brown SAND, fine grained, moist. (SP)	Medium Dense	12	23.8
4.5–13.3	Dark gray-brown SAND to SAND with silt, fine to medium grained, wet. (SP/SP-SM)	Medium Dense	10 10 10 29	24.1 23.2 21.6 26.1
13.3–15	Dark gray-brown silty SAND, fine grained, wet. (SM)	Medium Dense	10	23.4
15–18	Interbedded dark gray-brown fine to medium SAND and silty fine SAND, wet. (SP and SM)	Medium Dense		25.6
18–19.5	Dark gray SILT, wet, wood fragments in tip of sampler. (ML)	Medium Dense		
19.5–23	Dark gray SAND to SAND with silt, fine grained, wet, numerous fine pumice fragments. (SP/SP-SM)	Medium Dense	22	27.6
23–28	Interbedded dark gray-brown fine SAND and gray SILT, wet, trace of wood fragments. (SP and ML)	Loose	7	31.6
28–31.5	Dark gray SAND, fine grained, wet. (SP)	Medium Dense	25	25.4
31.5	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet.			

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 7

Figure No. A-8

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 2.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot (10 30 50)	Moisture Content (%)
0					
▼ 2.5	I	Fill: Dark brown silty SAND, fine grained, wet, numerous wood fragments. (SM)	Loose	9	
	I	Brown to gray-brown sandy SILT to silty SAND, fine grained, wet, mottled. (ML/SM)	Loose		30.8
5	I	Dark gray-brown SAND, fine grained, wet, scattered silty fine sand seams, trace of wood fragments. (SP)	Loose	8	25.2
		Boring terminated at 6.5 feet. Groundwater encountered below about 2.5 feet.			
10					

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 8

Figure No. A-9

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** November 30, 2021

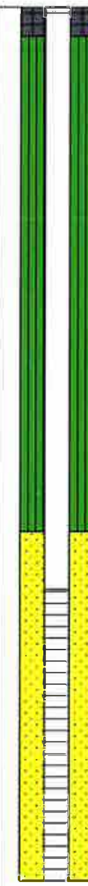
Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density
0–5	Gray-brown SAND with silt to silty SAND, fine grained, moist, mottled. (SP-SM/SM) (Possible fill)	Loose
5–7	Dark brown SAND, fine grained, wet, numerous silty fine sand seams below 6 feet. (SP)	Loose
7–14.5	Dark gray-brown to dark gray SAND, fine to medium grained, wet, trace of fine to coarse gravel above 9 feet. (SP) - Scattered brown silt pockets below 10 feet. - Scattered wood fragments at 13 feet.	Medium Dense
14.5–18	Interbedded dark gray-brown fine SAND and gray SILT, wet. (SP and ML)	Medium Dense
18–21	Gray sandy SILT, fine sand, moist to wet, trace of dark brown organic fragments. (ML)	Loose
21–23	Dark gray-brown SAND, fine grained, wet. (SP)	Loose
23–28	Gray to gray-brown sandy SILT, fine sand, wet, trace of dark brown organic fragments. (ML)	Loose
28–31.5	Dark gray SAND with silt to silty SAND, fine grained, wet, scattered gray silt seams. (SP-SM/SM)	Medium Dense
31.5	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet. Installed 2-inch diameter monitoring well to 30 feet. DOE Well ID - BMR-595	

Sample Depth (ft)	SPT (N) Blows / foot	Moisture Content (%)
2.5	6	21.1
5	7	28.4
7.5	15	20.0
10	11	27.8
12.5	20	31.6
15	12	27.5
20	9	38.2
25	6	36.1
30	10	28.4

Observ. Well



NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 9

Figure No. A-10

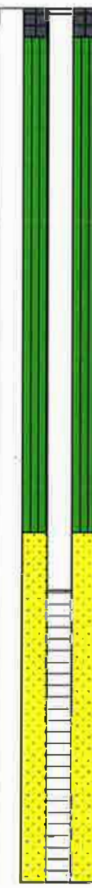
Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** December 1, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows / foot	Moisture Content (%)
0–5	Brown silty SAND, fine grained, moist, scattered fine to coarse angular gravel. (SM) (Possible fill/disturbed)	Medium Dense	14	13.7
5–15	Brown to dark gray-brown SAND, fine grained, moist (wet below 5.5 feet), scattered brown silt to silty fine sand seams and layers above 9 feet. (SP)	Medium Dense	12 13	24.2 22.5
	- Trace of organic partings and fine pumice graines between 10 and 11.5 feet.	Medium Dense	10	29.4
	- Scattered brown silt seams below 12.5 feet.	Medium Dense	28	28.4
15	Interbedded dark gray-brown SAND and gray silty SAND to sandy SILT, fine sand, wet. (SP and SM/ML)	Loose	8	30.8
20–25	Dark gray to green-gray SILT, wet, scattered dark gray-brown fine sand seams and layers. (ML)	Loose	9	33.9
25		Medium Dense	13	35.9 30.7
	Dark gray-brown SAND, fine grained, wet. (SP)			
30	- Scattered clayey silt layers between 30 and 30.5 feet.	Loose	5	30.4
	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet. Installed 2-inch diameter monitoring well to 30 feet. DOE Well ID - BMR-596			

Observ. Well



NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 10

Figure No. A-11

Project: 240 - 15th Street SE Industrial **Project No:** T-8661 **Date Drilled:** December 1, 2021

Client: Fortress, LLC **Driller:** Boretec1 **Logged By:** JCS

Location: Puyallup, Washington **Depth to Groundwater:** 5 ft **Approx. Elev:** NA

Depth (ft)	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot	Moisture Content (%)
0–4	Fill: Dark brown to tan silty SAND with gravel, fine sand, fine to coarse gravel, moist to wet, numerous wood shavings. (SM)	Medium Dense	11	16.0
4–5.5	Gray-brown SAND, fine grained, moist, mottled. (SP)	Loose	8	25.7
5.5–15	Dark gray-brown SAND, fine grained, wet, mottled. (SP) - 1-inch silt layer at 10.5 feet. - Trace of wood fragments below 10.5 feet	Medium Dense	12 (7.5 ft) 20 (10 ft) 11 (12.5 ft)	26.1 26.9 27.6
15–18.5	Dark gray sandy SILT to silty SAND, fine sand, wet, trace of wood fragments. (ML/SM)	Medium Dense	17	28.7
18.5–23.5	Gray-brown SAND, fine to medium grained, wet, scattered fine pumice grains. (SP)	Medium Dense	12	21.6
23.5–31.5	Interbedded gray SILT to sandy SILT and dark gray-brown SAND, fine sand, wet, trace of wood fragments. (ML and SP)	Medium Dense	10 (25 ft) 10 (30 ft)	26.2 28.1
31.5	Boring terminated at 31.5 feet. Groundwater encountered below 5 feet.			

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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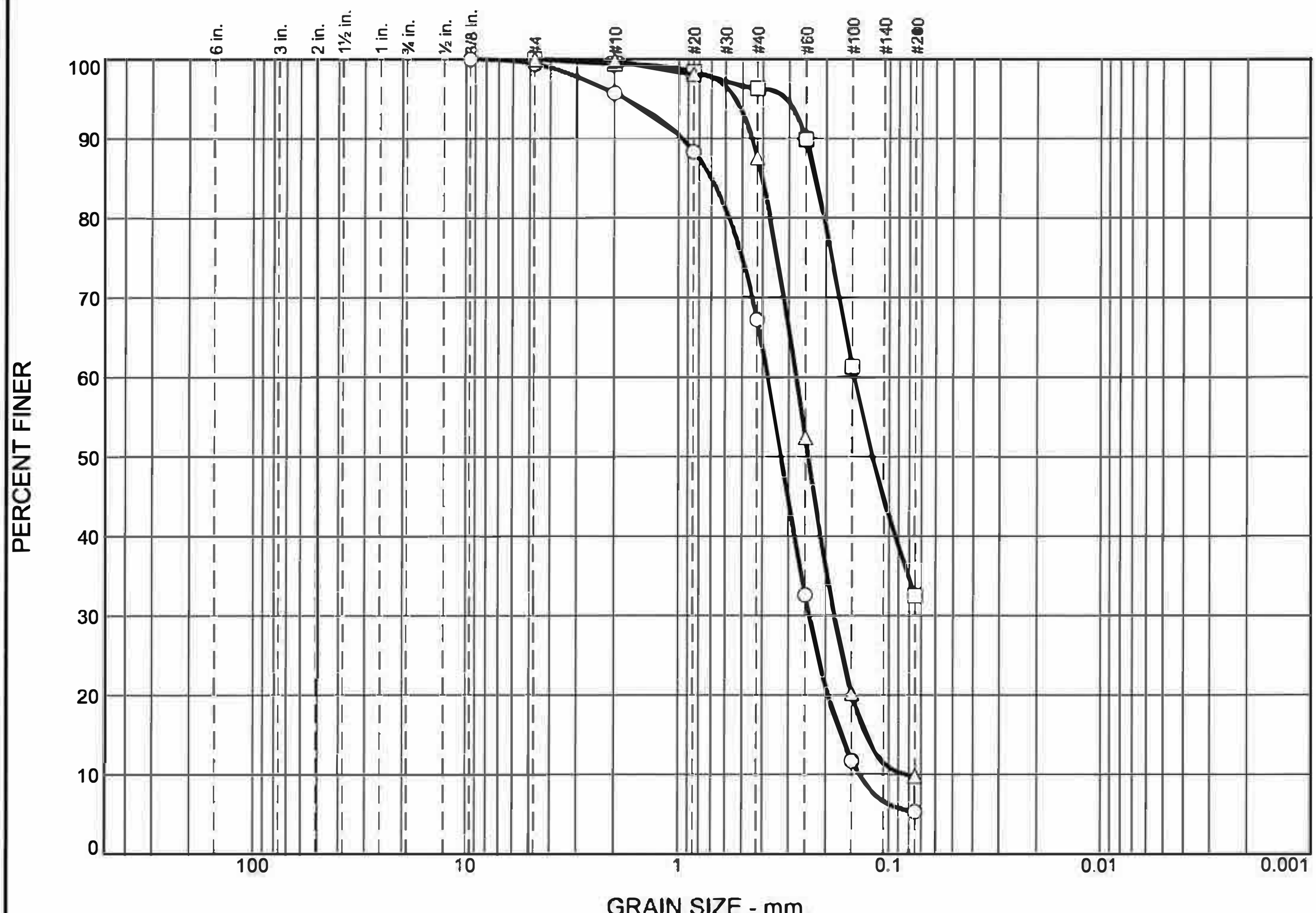
Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.6	3.7	28.5	61.9	5.3	
□	0.0	0.0	0.0	0.6	3.1	63.8	32.5	
△	0.0	0.0	0.0	0.2	12.2	77.8	9.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7016	0.3770	0.3250	0.2390	0.1692	0.1384	1.09	2.72
□			0.2237	0.1466	0.1198					
△			0.4026	0.2764	0.2421	0.1812	0.1285	0.0836	1.42	3.31

Material Description	USCS	AASHTO
○ SAND with silt	SP-SM	
□ silty SAND	SM	
△ SAND with silt	SP-SM	

Project No. T-8661 **Client:** Fortress,LLC

Project: 240 - 15 Street SE Industrial

○ **Location:** B-1 **Depth:** 5'

□ **Location:** B-1 **Depth:** 12.5'

△ **Location:** B-3 **Depth:** 2.5'

Remarks:

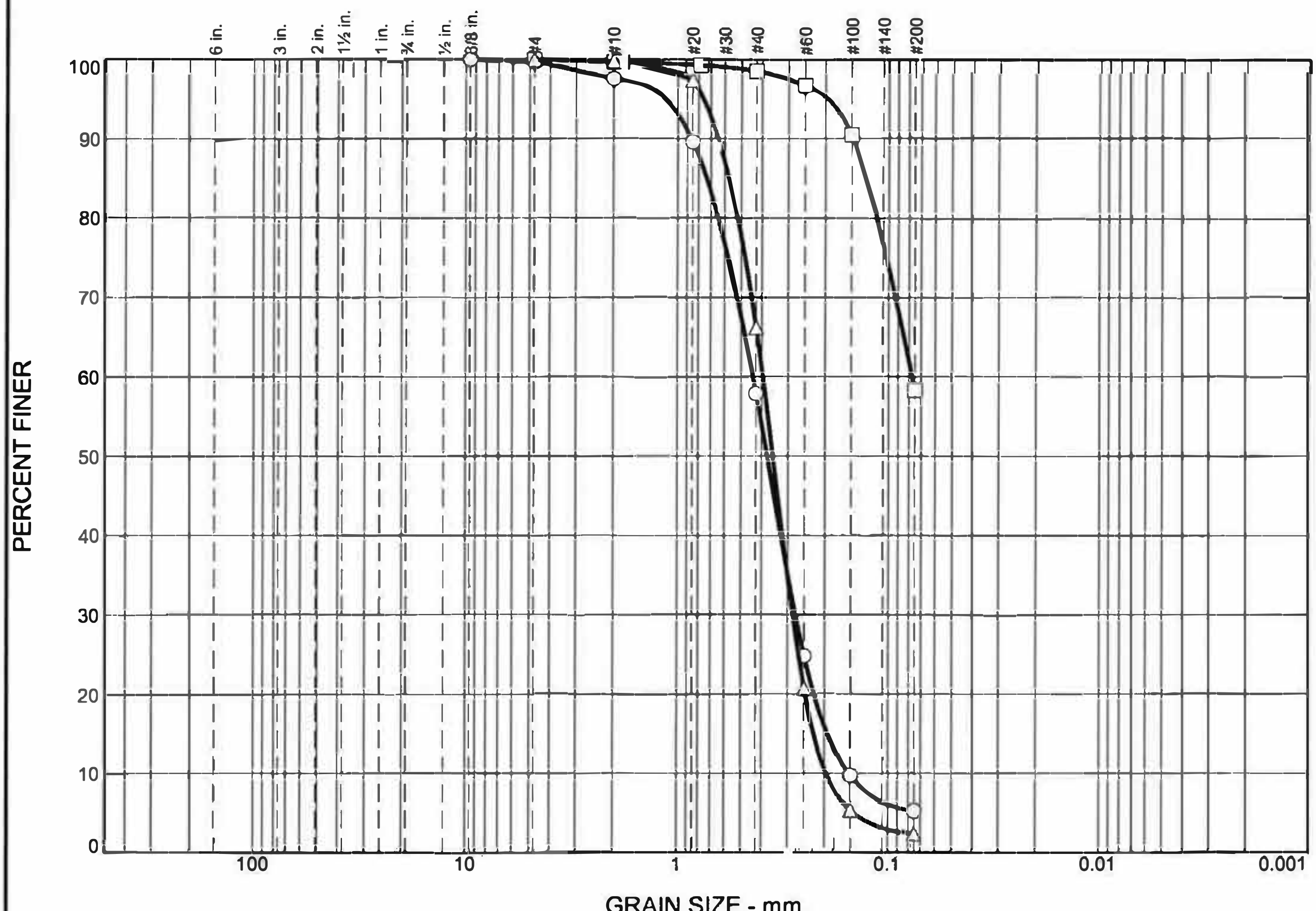
Terra Associates, Inc.

Kirkland, WA

Figure A-12

Tested By: FQ

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.3	2.1	39.7	52.6	5.3	
□	0.0	0.0	0.0	0.3	1.2	40.2	58.3	
△	0.0	0.0	0.0	0.2	33.6	63.8	2.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7323	0.4396	0.3765	0.2755	0.1932	0.1530	1.13	2.87
□			0.1275	0.0773						
△			0.5722	0.3949	0.3538	0.2835	0.2252	0.1964	1.04	2.01

Material Description	USCS	AASHTO
○ SAND with silt	SP-SM	
□ sandy SILT	ML	
△ SAND	SP	

Project No. T-8661 **Client:** Fortress,LLC

Project: 240 - 15 Street SE Industrial

○ **Location:** B-6 **Depth:** 7.5'

□ **Location:** B-7 **Depth:** 3'

△ **Location:** B-8 **Depth:** 10'

Remarks:

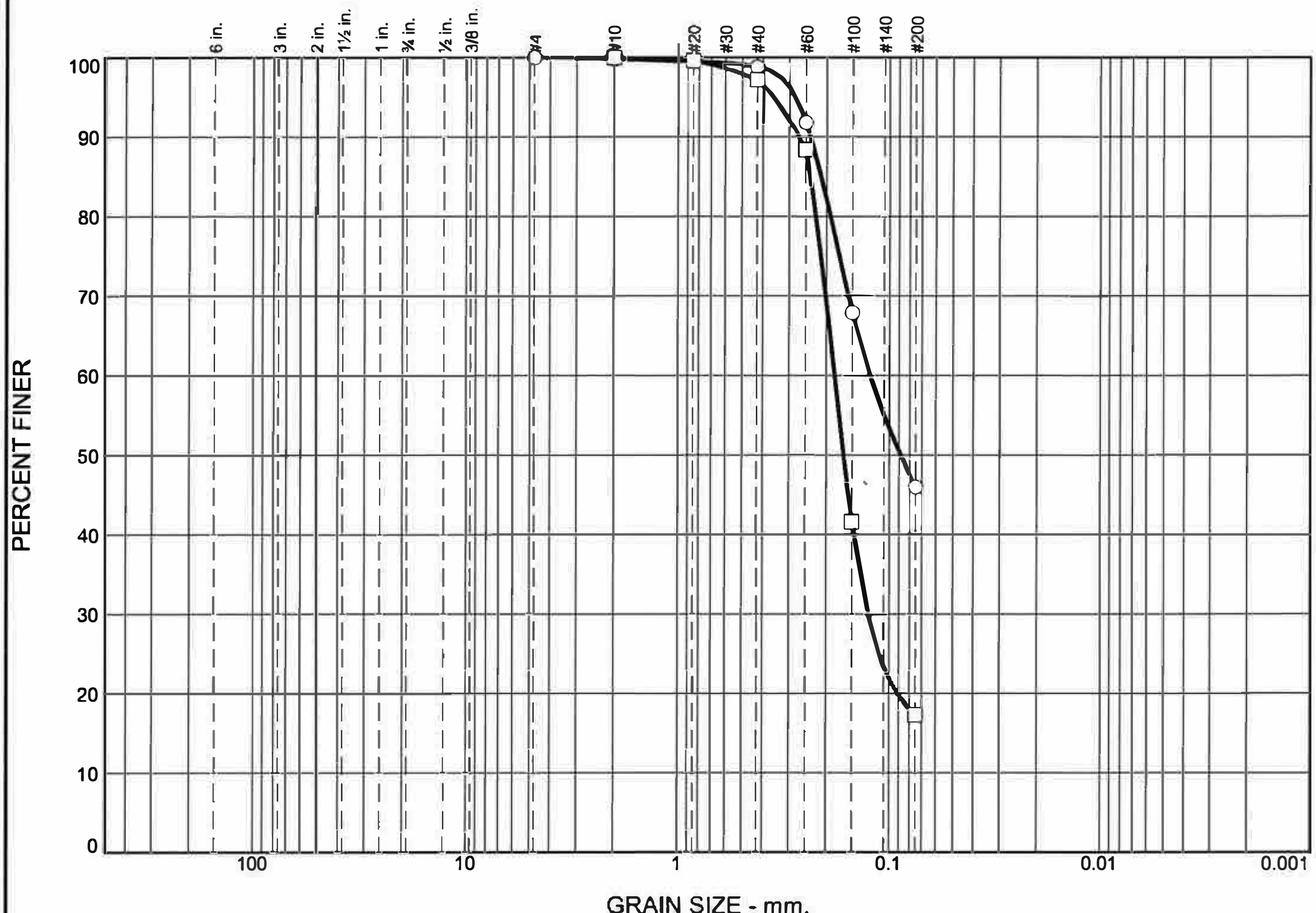
Terra Associates, Inc.

Kirkland, WA

Figure A-13

Tested By: FQ

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	1.0	52.8	46.0	
□	0.0	0.0	0.0	0.0	2.8	79.9	17.3	

╳	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2117	0.1233	0.0881					
□			0.2379	0.1822	0.1648	0.1254				

Material Description	USCS	AASHTO
○ silty SAND	SM	
□ silty SAND	SM	

Project No. T-8661 **Client:** Fortress,LLC
Project: 240 - 15 Street SE Industrial

○ **Location:** B-8 **Depth:** 30'
□ **Location:** B-9 **Depth:** 10'

Remarks:

Terra Associates, Inc.

Kirkland, WA

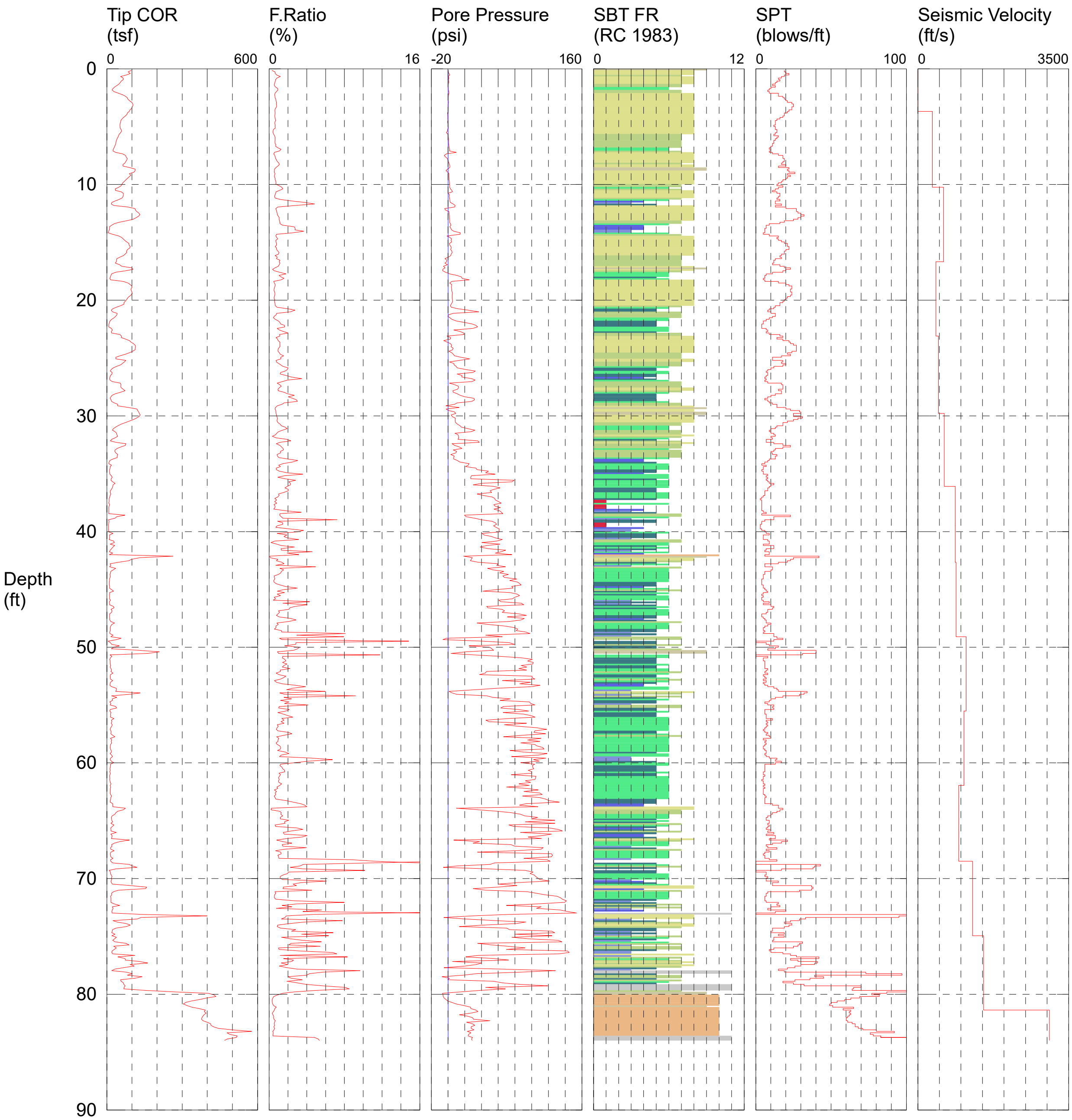
Figure A-14

Tested By: FQ

CPT- 01

CPT CONTRUCTOR: In Situ Engineering
CUSTOMER: Terra Asso
LOCATION: Puyallup
JOB NUMBER: T-8661
COMMENT: 240 - 15th St SE
COMMENT:

OPERATOR: Okbay
CONE ID: DDG1369
TEST DATE: 12/8/2021 9:38:13 AM
PREDRILL: 0 ft
BACK FILL: 20% Grout + Bentonite Chips
SURFACE PATCH: None



TOTAL DEPTH: 83.990 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

HOLE NUMBER: CPT- 01

OPERATOR: Okbay

CUSTOMER: Terra Asso

LOCATION: Puyallup

JOB NUMBER: T-8661

CPT CONTRUCTOR: In Situ Engineering

CONE ID: DDG1369

TEST DATE: 12/8/2021 9:38:13 AM

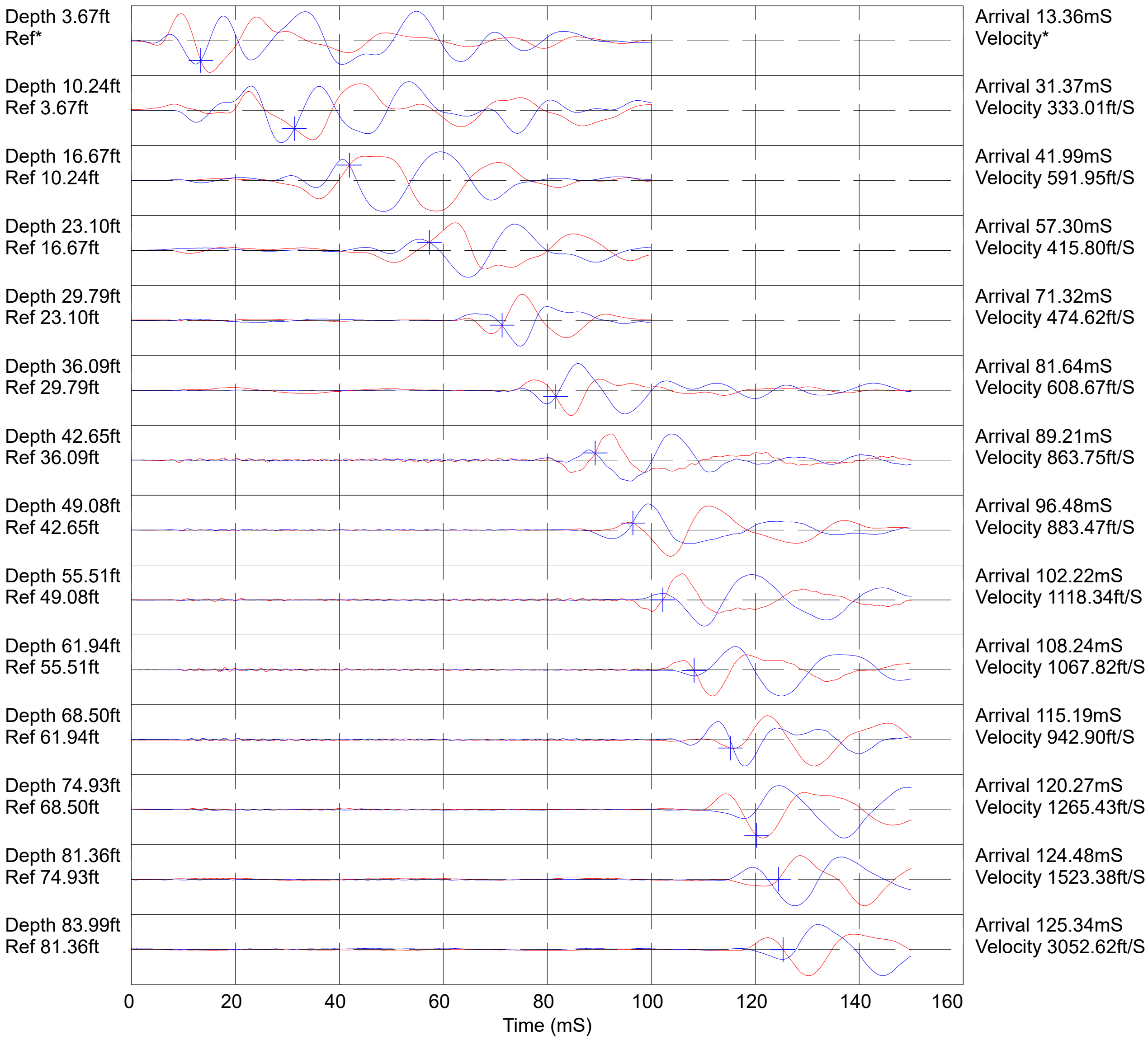
COMMENT: 240 - 15th St SE

PREDRILL0 ft

BACK FILL: 20% Grout + Bentonite Chips

SURFACE PATCH: none

HOLE NUMBER: CPT- 01



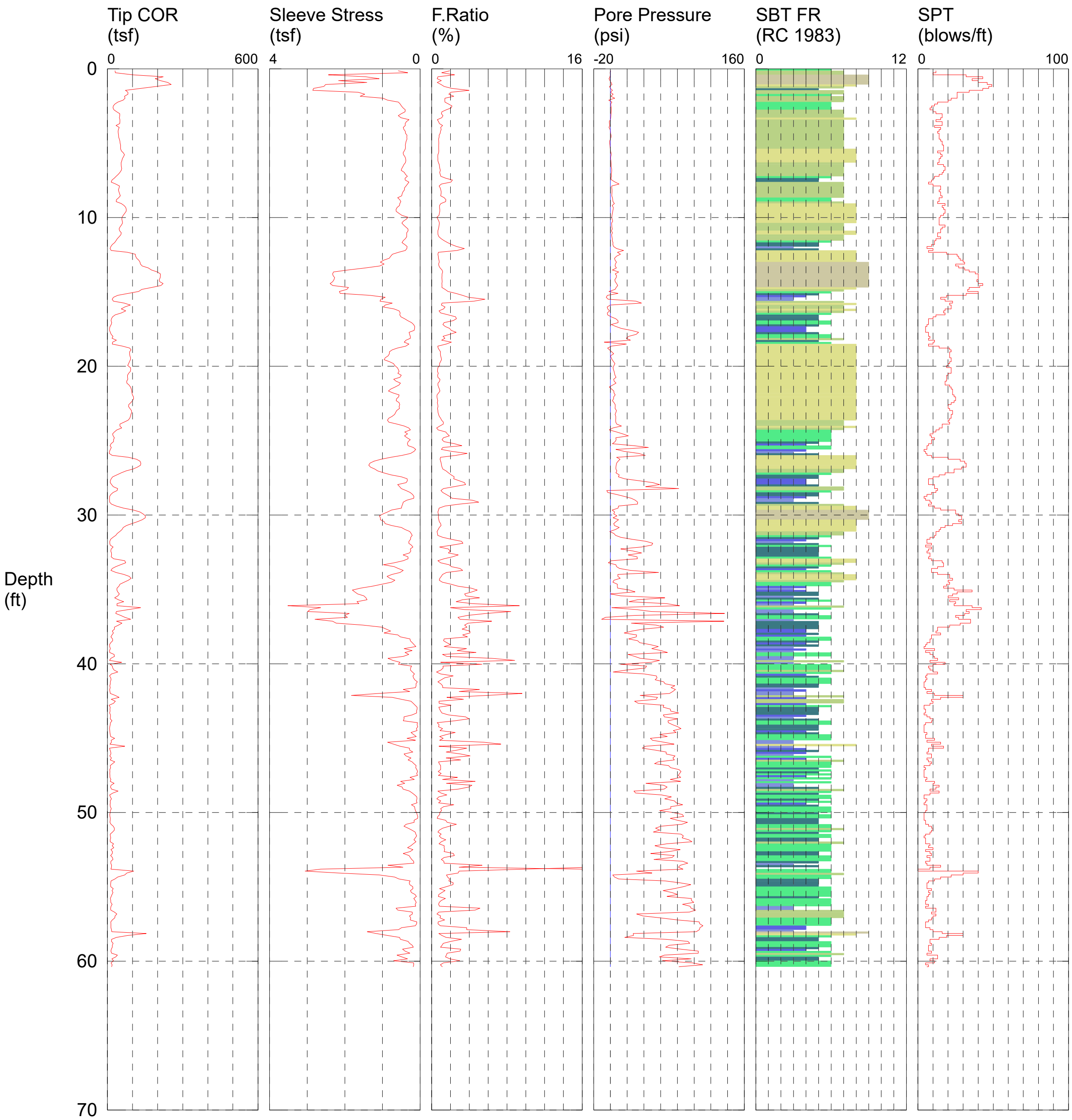
Hammer to Rod String Distance (ft): 2.79
* = Not Determined

COMMENT: 240 - 15th St SE

CPT- 02

CPT CONTRUCTOR: In Situ Engineering
CUSTOMER: Terra Asso
LOCATION: Puyallup
JOB NUMBER: T-8661
COMMENT: 240 - 15th St SE
COMMENT:

OPERATOR: Okbay
CONE ID: DDG1369
TEST DATE: 12/8/2021 12:37:48 PM
PREDRILL: 0 ft
BACK FILL: 20% Grout + Bentonite Chips
SURFACE PATCH: None



TOTAL DEPTH: 60.367 ft

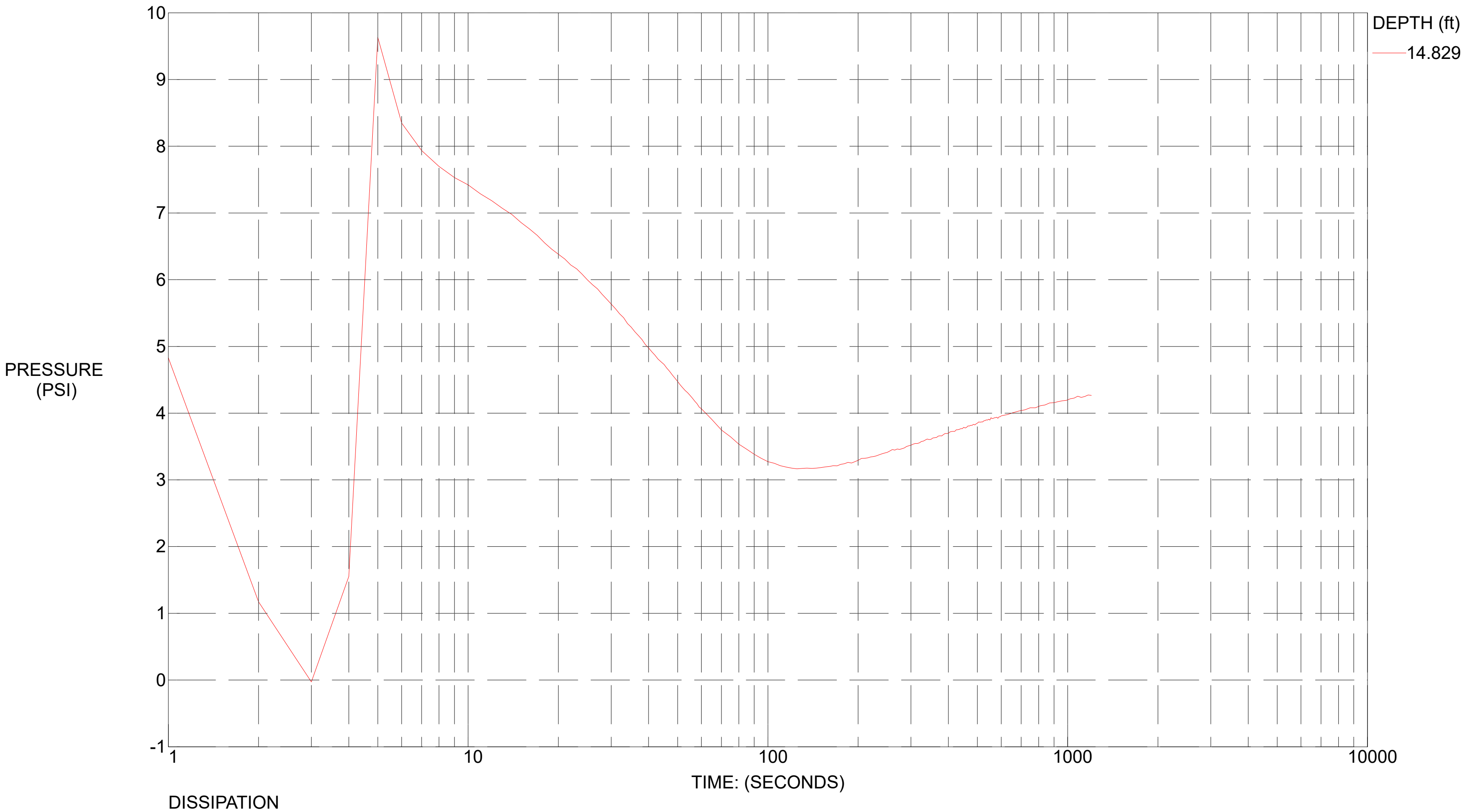
1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

CPT- 02

CPT CONTRUCTOR: In Situ Engineering
CUSTOMER: Terra Asso
LOCATION: Puyallup
JOB NUMBER: T-8661

OPERATOR: Okbay
CONE ID: DDG1369
TEST DATE: 12/8/2021 12:37:48 PM
PREDRILL: 0 ft
BACK FILL: 20% Grout + Bentonite Chips
SURFACE PATCH: Cold Patch



APPENDIX B

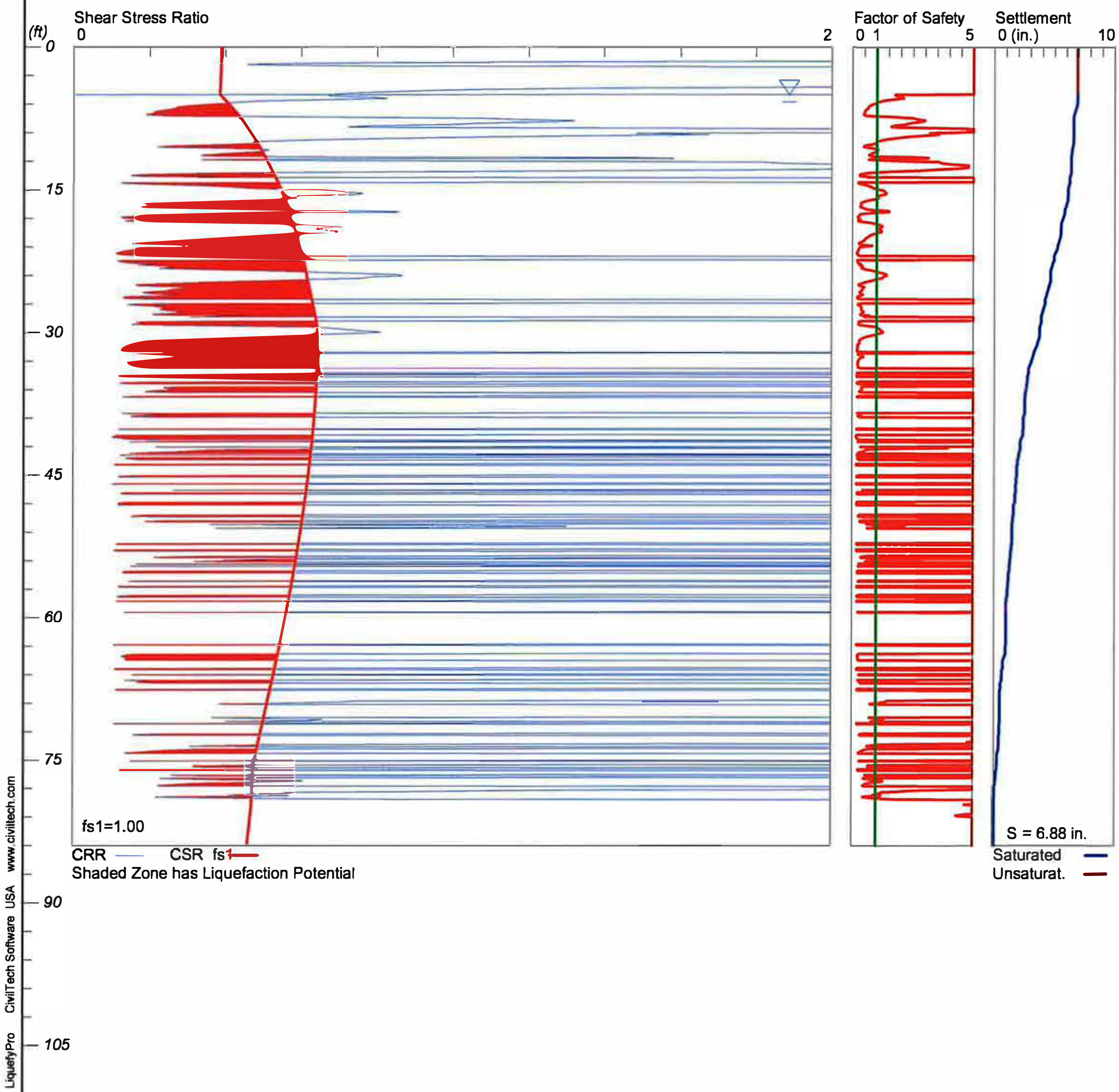
LIQUEFACTION ANALYSES

LIQUEFACTION ANALYSIS

240 - 15th St SE Industrial

Hole No.=CPT-1 Water Depth=5.0 ft
Ground Improvement of Fill=3 ft

Magnitude=7
Acceleration=0.6g

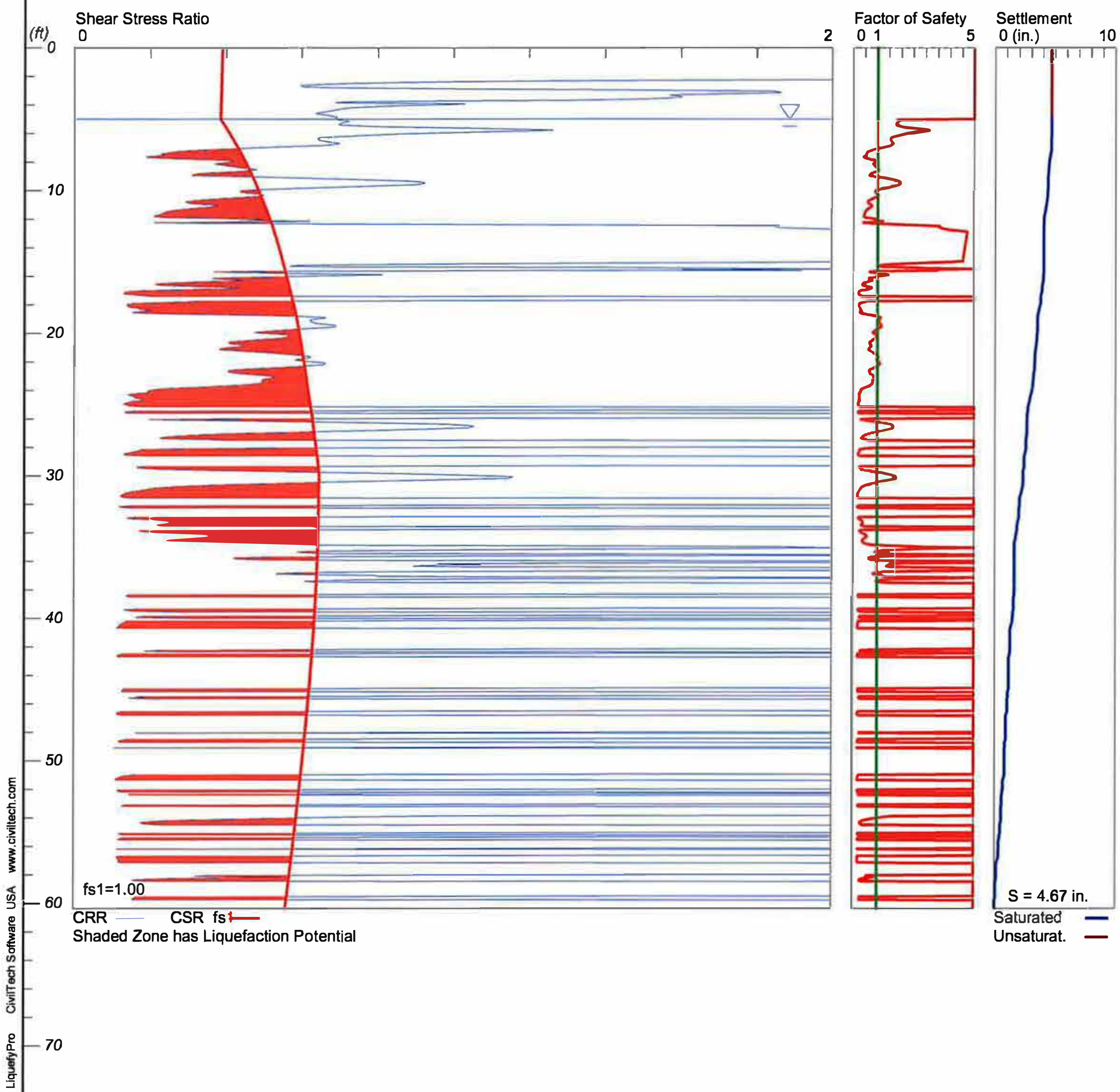


LIQUEFACTION ANALYSIS

240 - 15th St SE Industrial

Hole No.=CPT-2 Water Depth=5.0 ft ***Magnitude=7***

Ground Improvement of Fill=3 ft ***Acceleration=0.6g***



Tab 7.0

7.0 OTHER PERMITS

Other permits that may be required for this project include:

- SEPA Environmental Checklist
- Civil Construction Permit
- Building Permits
- Construction Stormwater General Permit
- Fire Permit

Tab 8.0

8.0 ESC ANALYSIS AND DESIGN

An erosion and sediment control plan will be prepared as part of the civil construction plan set. These plans will follow the measures outlined in the Erosion and Sediment Control Standards. The measures outlined in the Manual are discussed below.

Clearing Limits: Prior to any site clearing or grading, the construction limits will be clearly marked with a combination of silt fencing and/or brightly colored survey tape.

Cover Measures: Temporary and permanent cover measures shall be provided when necessary to protect disturbed areas. Temporary cover shall be installed if an area is to remain unworked for more than seven days during the dry season (May 1 to September 30) or for more than two days during the wet season (October 1 to April 30), unless otherwise noted by the City. Any area to remain unworked for more than 30 days shall be seeded or sodded, unless the City determines that winter weather makes vegetation establishment unfeasible. During the wet season, slopes and stockpiles 3H:1V or steeper with more than 10 feet of vertical relief shall be covered if they are to remain unworked for more than 12 hours. The CESCL lead shall be responsible for determining what specific measures to implement to suit changing site conditions.

Perimeter Protection: Silt fence shall be installed along the property lines prior to any upstream grading to prevent and filter sediment sheet flow from adjacent areas.

Traffic Area Stabilization: A construction entrance will be installed to minimize erosion tracking of sediment offsite. Should there be parking areas used by construction traffic onsite they shall also require stabilization.

Sediment Retention: Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site.

Surface Water Controls: Surface water controls shall be installed in the form of temporary "v" ditches with rock check dams to intercept and convey surface water from disturbed areas to the sediment trap.

Dust Control: Preventative measures to minimize the wind transport of soil shall be taken as necessary depending on site conditions. The most common method shall be to spray exposed soils until wet, but not so wet as to cause the soils to generate runoff from the spraying.

Tab 9.0

9.0 BOND QUANTITIES, FACILITY SUMMARIES, AND DECLARATION OF COVENANT

All required bonding and financial guarantees will be provided as required by the City of Puyallup.

Tab 10.0

10.0 OPERATIONS AND MAINTENANCE MANUAL

The proposed on-site facilities will be owned and maintained by the owner. An Operations and Maintenance Manual has been completed and submitted as a separate document with the permit construction plans.