Deskin Grand Mound Site

Rochester, WA

Final Drainage and Erosion Control Report

Fuller Designs Project No. 2032

May 11, 2022

Prepared by:

FULLER DESIGNS

1101 Kresky Ave, Centralia, WA 98531; (360) 807-4420

FINAL DRAINAGE AND EROSION CONTROL REPORT

Deskin Grand Mound Site

6911 198th Avenue SW
Rochester, WA 98579

Project Information

Prepared for: Deskins, Ryan
Contact: Deskins, Ryan
1951 State Route 6
Chehalis, WA 98532
(360) 827-5268

Reviewing Agency

Jurisdiction: Thurston County Public Works
Contact: Jennifer Walker, Public Works Director

References

Thurston County 2016 Drainage Design and Erosion Control Manual (The 2016 DD&ECM)

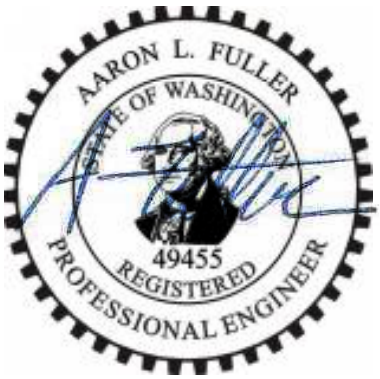
Project Engineer

Prepared by: Fuller Designs, Inc.
1101 Kresky Ave
Centralia WA 98531
(360) 807-4420

Contact: Aaron Fuller, PE

"I hereby certify that this Final Drainage and Erosion Control Report for the Deskin Grand Mound Site Design project has been prepared by me or under my supervision and meets minimum standards of Thurston County and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me."

6/28/22



EXP: 12/21/22

Table of Contents

FINAL DRAINAGE AND EROSION CONTROL REPORT

TABLE OF CONTENTS

SECTION 1 – PROPOSED PROJECT DESCRIPTION

Site Address: 6411 198th Ave SW, Rochester, WA 98579

Parcel Number(s): 51300100000

Total Site Area: 1.62 Acres

Zoning: R3-6/1 – Residential 3-6 Units per Acre

Sec, Town, Range: Section 11, Township 15, Range 3W

Proposed Improvements
The site is located on 198th Avenue SW approximately 650 feet west from the 198th Avenue SW / Sargent Road intersection. This project will create 7 new single-family lots, a private road, drainage, water and sanitary sewer utilities within the project site. An existing single-family building is located along the 198th Avenue SW frontage. This existing building will remain in place. A new access private road will be established to provide access to the proposed lots. The proposed private road will provide access to the site from 198th Avenue SW and 200th Avenue.

Stormwater runoff from the project site will be collected through the proposed private road. The proposed private road will be built with an inverted crown section which will collect runoff from the site and to Contech Stormfilter catch basins. Runoff will then be conveyed to a gravel trench where it will be infiltrated. The infiltration trench will serve as an attenuation system to infiltrate large storm events. 198th Street will be widened, sidewalk, curb and gutter will be added. Runoff from the new pavement areas will be routed to a proposed a Contech Stormfilter catch basin and ultimately to an infiltration trench within Lot 1.

The lot will be served by:

Thurston County	Water and Sanitary Sewer
Puget Sound Energy	Electricity
Comast	Telecommunications
Lemay, Inc.	Refuse & Recycling

The subject project property is completely bordered by residential zoning.

SECTION 2 – EXISTING CONDITONS DESCRIPTION

The site is located 650 feet west from the 198th Avenue SW / Sargent Road intersection. The lot currently fronts 198th Avenue SW. The lot has an existing single-family residence and is served by an existing gravel driveway. This existing driveway access is the primary access to the residence. The project area is mainly flat yard area that drains to the north. Runoff sheet flows to 198th Avenue SW and off the site in a westerly direction to

drainage paths which eventually contribute to an un-named tributary drainage of Chehalis River.

Vegetation onsite is consistent with medium to low density residential lots. Grasses and small shrubs are predominant throughout the site. Some trees are located within the project site and will be removed to allow the construction improvements.

Soils in the area include Spanaway gravelly sandy loam. A soil survey indicates this area is hydraulic group A, which have low runoff potential and high infiltration rates.

The project utilities and road improvements will be built in one phase. Individual lot improvements will be constructed as they are needed. The proposed construction schedule would be to start in spring of 2022 and be complete by summer 2022.

SECTION 3 – OFFSITE ANALYSIS REPORTS

The area immediately adjacent to the proposed project properties is:

- West – residential property
- South –residential property
- East – residential property
- North – 198th Avenue SW

Surrounding properties are approximately the same elevation as the project property and do not contribute runoff to the project site. Existing fences on the south and west properties delineate drainage boundaries. Given the high infiltration rates within project area, it is very likely most offsite runoff is infiltrated within each property.

The proposed project plans to infiltrate all 2-year, 5-year, 10-year 25-year, 50-year and 100-year storm runoff by implementing two infiltration trenches. Therefore, no impacts are anticipated to downstream facilities and further upstream analysis was deemed not necessary. This area has not been flagged as a possible stormwater problem area.

In the event the proposed onsite stormwater system fails, runoff will pond and sheet flow to 198th Avenue SW and off the site in a westerly direction along 198th Avenue SW for 2,750 feet and then sheet flow across private property before entering Chehalis River. Refer to Exhibit A in the back of this report.

SECTION 4 – APPLICABLE CORE REQUIREMENTS

The core requirements for stormwater development and redevelopment sites are listed in Volume 1 chapter 2 of the Thurston County 2016 Drainage Design and Erosion Control Manual (The 2016 DD&ECM). Not all core requirements of this section apply to all projects. Determination of applicable core requirements is based on section 2.3 of the 2016 DD&ECM.

Based on the thresholds given in figures 2.1 and 2.2 of the 2016 DD&ECM, the proposed project will create more than 5000 square feet of new hard surface areas and thus must address all core requirements. These requirements as they apply to the project are discussed in more detail below.

Core Requirement #1 – Stormwater Site Planning:

A Stormwater Site Plan has been prepared (see Erosion Control and Drainage Plans).

Core Requirement #2 – Construction Stormwater Pollution Prevention Plan

A Construction Stormwater Pollution Prevention Plan (SWPPP) has been prepared. See section 6.

Core Requirement #3 – Source Control of Pollution

All known, available, and reasonable source control BMPs shall be applied to the project to limit pollutants from encountering stormwater. Construction specific BMP's will be provided during and after construction (see Section 6 SWPPP and Section 10 for reference).

Core Requirement #4 – Preservation of Natural Drainage Systems and Outfalls

Stormwater from the project site will be infiltrated by two proposed infiltration trenches. The same discharge points will be used in both pre and post development. Improvements onsite do not propose to impact offsite natural drainage systems.

Core Requirement #5 – On-site Stormwater Management

This project is inside the UGA, and it is less than 5 acres. Therefore, per Figure 2-3 from 2016 DD&ECM the project developer has opted to meet the LID performance standard by implementing two infiltration trenches and Post-Construction Soil Quality and Depth BMP LID.01.

Core Requirement #6 – Runoff Treatment

This project proposes to create more than 5000 square feet of pollution-generating hard surface (PGHS) and is subject to this core requirement.

Roof and road surfaces runoff will be routed through pretreatment Contech Storm Filters to remove suspended solids and then routed into infiltration trenches in accordance with BMP IN.02.

The required water quality treatment flow rate for the project site is 0.089 cfs for Basin 1 and 0.006 cfs for Basin 2. To meet the required treatment flow rate for Basin 1, three Contech Stormfilter catch basins will be utilized to treat runoff before discharging runoff into the proposed infiltration trench. Each Contech Stormfilter catch basin has a capacity to treat 0.03 cfs (12.53 gmp). The combined treatment capacity of all three Contech Stormfilter catch basins is 0.09 cfs which meets the minimum required treatment flow rate for Basin 1.

To meet the required treatment flow rate for Basin 2, one Contech Stormfilter catch basins will be utilized to treat runoff before discharging runoff into the proposed infiltration trench. The proposed Contech Stormfilter catch basin has a capacity to treat 0.03 cfs (12.53 gmp) which meets the minimum required treatment flow rate for Basin 2.

Core Requirement #7 – Flow Control

The development pre and post runoff rates were compared based on existing and proposed land coverage types using the WWHM2012 continuous inflow model. 100% of the total runoff will be infiltrated directly to groundwater from basin 1.

Runoff from Basin 1 and Basin 2 will be captured with three proposed Contech Stormfilter catch basins. PVC piping will be utilized to route runoff from each Contech Stormfilter catch basin to the proposed infiltration trench. A perforated PVC pipe will be built along the entire length of the infiltration trench to distribute runoff evenly within the infiltration trench. The proposed infiltration trench will be filled with rock and underdrain pipe. The rock will be ¾" clean gravel. The proposed trench is designed to be approximately 3' wide, 4' deep and run parallel along the entire length of the easterly property boundary for approximately 510' for Basin 1 and 30' for Basin 2.

A field investigation was performed within the project limits to determine the infiltration rate of existing soils. Soil samples were obtained within the project site at a depth of 10' below existing ground surface and a sieve analysis was conducted. The investigation concluded the existing soils within the site have a design infiltration rate of 11.4 in/hr which was utilized to size the required infiltration trench geometry.

Infiltration trench sizing calculations were established by using the WWHM12 continuous inflow modeling software.

This proposed infiltration trenches will infiltrate all runoff. Post condition peak flow rates are equal to 0 cfs. Therefore, there are no impacts to downstream facilities. The resulting stormwater infrastructure is shown in the drawing details and supported by attached calculations.

Core Requirement #8 – Wetlands Protection

The thresholds identified in Core Requirement #6 – Runoff Treatment, and Core Requirement #7 – Flow Control structures are used to determine the applicability of this requirement to discharges to wetlands. Since this project does not discharge to any wetlands, Core Requirement #8 is not applicable.

Core Requirement #9 – Operation and Maintenance

Maintenance of storm drainage facilities (Stormfilter catch basins, infiltration trench, etc..) will be the responsibility of the Homeowner's Association. A draft storm drainage operation and maintenance plan is included in this report.

Core Requirement #10 – Financial Liability

To ensure compliance with standards hereon, performance bonding or other financial instruments may be required by Thurston County prior to final approval.

Core Requirement #11 – Offsite Analysis and Mitigation

As stated above the project improvements will capture and infiltrate all onsite flows. No offsite impacts are expected and therefore offsite analysis is not required. See Section 3 for offsite drainage analysis. Overflow runoff from the project will sheet flow 198th Avenue SW and sheet flow west to the Chehalis River as shown on Exhibit A.

SECTION 5 – PERMANENT STORMWATER CONTROL PLAN

A pre/post basin flow control analysis, basin map, sub basin water quality analysis, and infiltration trench calculations have been provided in the next few pages.

Sizing Infiltration Trenches

Stormwater calculations were performed to size two infiltration trenches. Using the WWHM model, the length and geometry of the infiltration trench were found to be a minimum of 510' long, 36" wide and 48" deep for Basin 1 and 30' long, 36" wide and 48" deep for Basin 2. The project will construct an infiltration trench of 510' LF for Basin 1 and 30' LF for Basin 2 which meet the required minimum infiltration trench geometry.

BASIN 1

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	HYDROLOGY MODELS
Site Name:	Deskin Grand Mount Site
Site Address:	
City:	
Report Date:	4/4/2022
Gage:	Grand Mound
Data Start:	1955/10/01
Data End:	2011/09/30
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
A B, Pasture, Flat	1.53
Pervious Total	1.53

Impervious Land Use	acre
ROOF TOPS FLAT	0.04
DRIVEWAYS FLAT	0.01
Impervious Total	0.05
Basin Total	1.58

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Pasture, Flat	0.89
Pervious Total	0.89

Impervious Land Use	acre
ROADS FLAT	0.38
ROOF TOPS FLAT	0.31
Impervious Total	0.69
Basin Total	1.58

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	510.00 ft.
Bottom Width:	3.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	4
Pour Space of material for first layer:	0.4
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	11.4
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	171.353
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	171.353
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	0 ft.
Riser Diameter:	0 in.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

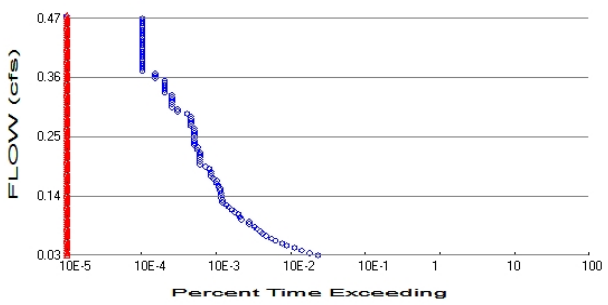
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.035	0.000	0.000	0.000
0.0444	0.035	0.000	0.000	0.403
0.0889	0.035	0.001	0.000	0.403
0.1333	0.035	0.001	0.000	0.403
0.1778	0.035	0.002	0.000	0.403
0.2222	0.035	0.003	0.000	0.403
0.2667	0.035	0.003	0.000	0.403
0.3111	0.035	0.004	0.000	0.403
0.3556	0.035	0.005	0.000	0.403
0.4000	0.035	0.005	0.000	0.403
0.4444	0.035	0.006	0.000	0.403
0.4889	0.035	0.006	0.000	0.403
0.5333	0.035	0.007	0.000	0.403
0.5778	0.035	0.008	0.000	0.403
0.6222	0.035	0.008	0.000	0.403
0.6667	0.035	0.009	0.000	0.403
0.7111	0.035	0.010	0.000	0.403
0.7556	0.035	0.010	0.000	0.403
0.8000	0.035	0.011	0.000	0.403
0.8444	0.035	0.011	0.000	0.403
0.8889	0.035	0.012	0.000	0.403
0.9333	0.035	0.013	0.000	0.403
0.9778	0.035	0.013	0.000	0.403
1.0222	0.035	0.014	0.000	0.403

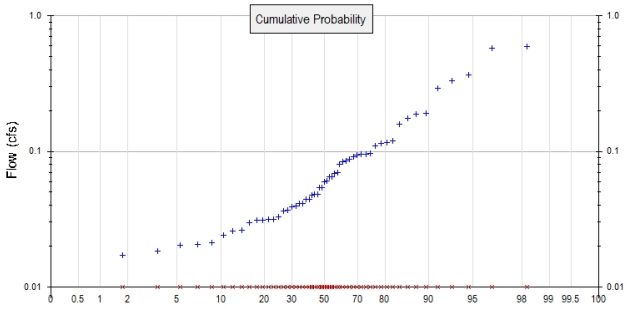
1.0667	0.035	0.015	0.000	0.403
1.1111	0.035	0.015	0.000	0.403
1.1556	0.035	0.016	0.000	0.403
1.2000	0.035	0.016	0.000	0.403
1.2444	0.035	0.017	0.000	0.403
1.2889	0.035	0.018	0.000	0.403
1.3333	0.035	0.018	0.000	0.403
1.3778	0.035	0.019	0.000	0.403
1.4222	0.035	0.020	0.000	0.403
1.4667	0.035	0.020	0.000	0.403
1.5111	0.035	0.021	0.000	0.403
1.5556	0.035	0.021	0.000	0.403
1.6000	0.035	0.022	0.000	0.403
1.6444	0.035	0.023	0.000	0.403
1.6889	0.035	0.023	0.000	0.403
1.7333	0.035	0.024	0.000	0.403
1.7778	0.035	0.025	0.000	0.403
1.8222	0.035	0.025	0.000	0.403
1.8667	0.035	0.026	0.000	0.403
1.9111	0.035	0.026	0.000	0.403
1.9556	0.035	0.027	0.000	0.403
2.0000	0.035	0.028	0.000	0.403
2.0444	0.035	0.028	0.000	0.403
2.0889	0.035	0.029	0.000	0.403
2.1333	0.035	0.030	0.000	0.403
2.1778	0.035	0.030	0.000	0.403
2.2222	0.035	0.031	0.000	0.403
2.2667	0.035	0.031	0.000	0.403
2.3111	0.035	0.032	0.000	0.403
2.3556	0.035	0.033	0.000	0.403
2.4000	0.035	0.033	0.000	0.403
2.4444	0.035	0.034	0.000	0.403
2.4889	0.035	0.035	0.000	0.403
2.5333	0.035	0.035	0.000	0.403
2.5778	0.035	0.036	0.000	0.403
2.6222	0.035	0.036	0.000	0.403
2.6667	0.035	0.037	0.000	0.403
2.7111	0.035	0.038	0.000	0.403
2.7556	0.035	0.038	0.000	0.403
2.8000	0.035	0.039	0.000	0.403
2.8444	0.035	0.040	0.000	0.403
2.8889	0.035	0.040	0.000	0.403
2.9333	0.035	0.041	0.000	0.403
2.9778	0.035	0.041	0.000	0.403
3.0222	0.035	0.042	0.000	0.403
3.0667	0.035	0.043	0.000	0.403
3.1111	0.035	0.043	0.000	0.403
3.1556	0.035	0.044	0.000	0.403
3.2000	0.035	0.045	0.000	0.403
3.2444	0.035	0.045	0.000	0.403
3.2889	0.035	0.046	0.000	0.403
3.3333	0.035	0.046	0.000	0.403
3.3778	0.035	0.047	0.000	0.403
3.4222	0.035	0.048	0.000	0.403
3.4667	0.035	0.048	0.000	0.403
3.5111	0.035	0.049	0.000	0.403
3.5556	0.035	0.050	0.000	0.403
3.6000	0.035	0.050	0.000	0.403

3.6444	0.035	0.051	0.000	0.403
3.6889	0.035	0.051	0.000	0.403
3.7333	0.035	0.052	0.000	0.403
3.7778	0.035	0.053	0.000	0.403
3.8222	0.035	0.053	0.000	0.403
3.8667	0.035	0.054	0.000	0.403
3.9111	0.035	0.054	0.000	0.403
3.9556	0.035	0.055	0.000	0.403
4.0000	0.035	0.056	0.000	0.403

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.53
Total Impervious Area: 0.05

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.89
Total Impervious Area: 0.69

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.059054
5 year	0.127744
10 year	0.199471
25 year	0.331599
50 year	0.469058
100 year	0.648879

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	0.191	0.000
1957	0.577	0.000
1958	0.041	0.000
1959	0.032	0.000
1960	0.091	0.000
1961	0.044	0.000
1962	0.030	0.000
1963	0.330	0.000
1964	0.115	0.000
1965	0.095	0.000

1966	0.031	0.000
1967	0.110	0.000
1968	0.048	0.000
1969	0.039	0.000
1970	0.033	0.000
1971	0.097	0.000
1972	0.119	0.000
1973	0.054	0.000
1974	0.048	0.000
1975	0.094	0.000
1976	0.059	0.000
1977	0.039	0.000
1978	0.070	0.000
1979	0.037	0.000
1980	0.044	0.000
1981	0.189	0.000
1982	0.054	0.000
1983	0.081	0.000
1984	0.065	0.000
1985	0.021	0.000
1986	0.084	0.000
1987	0.087	0.000
1988	0.020	0.000
1989	0.018	0.000
1990	0.369	0.000
1991	0.175	0.000
1992	0.031	0.000
1993	0.048	0.000
1994	0.017	0.000
1995	0.068	0.000
1996	0.085	0.000
1997	0.065	0.000
1998	0.041	0.000
1999	0.159	0.000
2000	0.291	0.000
2001	0.026	0.000
2002	0.116	0.000
2003	0.061	0.000
2004	0.590	0.000
2005	0.031	0.000
2006	0.095	0.000
2007	0.026	0.000
2008	0.021	0.000
2009	0.036	0.000
2010	0.024	0.000
2011	0.016	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.5903	0.0000
2	0.5767	0.0000
3	0.3689	0.0000
4	0.3297	0.0000
5	0.2909	0.0000
6	0.1907	0.0000
7	0.1892	0.0000
8	0.1750	0.0000

9	0.1593	0.0000
10	0.1188	0.0000
11	0.1162	0.0000
12	0.1150	0.0000
13	0.1101	0.0000
14	0.0973	0.0000
15	0.0949	0.0000
16	0.0946	0.0000
17	0.0936	0.0000
18	0.0913	0.0000
19	0.0869	0.0000
20	0.0851	0.0000
21	0.0835	0.0000
22	0.0807	0.0000
23	0.0695	0.0000
24	0.0684	0.0000
25	0.0651	0.0000
26	0.0646	0.0000
27	0.0608	0.0000
28	0.0593	0.0000
29	0.0540	0.0000
30	0.0540	0.0000
31	0.0484	0.0000
32	0.0483	0.0000
33	0.0475	0.0000
34	0.0444	0.0000
35	0.0441	0.0000
36	0.0415	0.0000
37	0.0411	0.0000
38	0.0395	0.0000
39	0.0390	0.0000
40	0.0369	0.0000
41	0.0364	0.0000
42	0.0330	0.0000
43	0.0316	0.0000
44	0.0313	0.0000
45	0.0311	0.0000
46	0.0311	0.0000
47	0.0295	0.0000
48	0.0261	0.0000
49	0.0257	0.0000
50	0.0241	0.0000
51	0.0211	0.0000
52	0.0206	0.0000
53	0.0203	0.0000
54	0.0185	0.0000
55	0.0171	0.0000
56	0.0162	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0295	454	0	0	Pass
0.0340	349	0	0	Pass
0.0384	273	0	0	Pass
0.0428	220	0	0	Pass
0.0473	173	0	0	Pass
0.0517	151	0	0	Pass
0.0562	123	0	0	Pass
0.0606	108	0	0	Pass
0.0650	91	0	0	Pass
0.0695	82	0	0	Pass
0.0739	77	0	0	Pass
0.0784	70	0	0	Pass
0.0828	64	0	0	Pass
0.0872	55	0	0	Pass
0.0917	54	0	0	Pass
0.0961	43	0	0	Pass
0.1006	41	0	0	Pass
0.1050	39	0	0	Pass
0.1094	35	0	0	Pass
0.1139	32	0	0	Pass
0.1183	29	0	0	Pass
0.1228	27	0	0	Pass
0.1272	24	0	0	Pass
0.1316	24	0	0	Pass
0.1361	23	0	0	Pass
0.1405	23	0	0	Pass
0.1450	23	0	0	Pass
0.1494	22	0	0	Pass
0.1538	22	0	0	Pass
0.1583	21	0	0	Pass
0.1627	20	0	0	Pass
0.1672	20	0	0	Pass
0.1716	18	0	0	Pass
0.1760	17	0	0	Pass
0.1805	17	0	0	Pass
0.1849	17	0	0	Pass
0.1894	16	0	0	Pass
0.1938	14	0	0	Pass
0.1982	12	0	0	Pass
0.2027	12	0	0	Pass
0.2071	12	0	0	Pass
0.2116	12	0	0	Pass
0.2160	12	0	0	Pass
0.2204	12	0	0	Pass
0.2249	11	0	0	Pass
0.2293	11	0	0	Pass
0.2338	10	0	0	Pass
0.2382	10	0	0	Pass
0.2426	10	0	0	Pass
0.2471	10	0	0	Pass
0.2515	10	0	0	Pass
0.2560	10	0	0	Pass
0.2604	10	0	0	Pass

0.2648	10	0	0	Pass
0.2693	9	0	0	Pass
0.2737	9	0	0	Pass
0.2782	9	0	0	Pass
0.2826	9	0	0	Pass
0.2870	9	0	0	Pass
0.2915	8	0	0	Pass
0.2959	6	0	0	Pass
0.3003	6	0	0	Pass
0.3048	5	0	0	Pass
0.3092	5	0	0	Pass
0.3137	5	0	0	Pass
0.3181	5	0	0	Pass
0.3225	5	0	0	Pass
0.3270	5	0	0	Pass
0.3314	4	0	0	Pass
0.3359	4	0	0	Pass
0.3403	4	0	0	Pass
0.3447	4	0	0	Pass
0.3492	4	0	0	Pass
0.3536	4	0	0	Pass
0.3581	3	0	0	Pass
0.3625	3	0	0	Pass
0.3669	3	0	0	Pass
0.3714	2	0	0	Pass
0.3758	2	0	0	Pass
0.3803	2	0	0	Pass
0.3847	2	0	0	Pass
0.3891	2	0	0	Pass
0.3936	2	0	0	Pass
0.3980	2	0	0	Pass
0.4025	2	0	0	Pass
0.4069	2	0	0	Pass
0.4113	2	0	0	Pass
0.4158	2	0	0	Pass
0.4202	2	0	0	Pass
0.4247	2	0	0	Pass
0.4291	2	0	0	Pass
0.4335	2	0	0	Pass
0.4380	2	0	0	Pass
0.4424	2	0	0	Pass
0.4469	2	0	0	Pass
0.4513	2	0	0	Pass
0.4557	2	0	0	Pass
0.4602	2	0	0	Pass
0.4646	2	0	0	Pass
0.4691	2	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.1351 acre-feet
On-line facility target flow:	0.1585 cfs.
Adjusted for 15 min:	0.1585 cfs.
Off-line facility target flow:	0.0899 cfs.
Adjusted for 15 min:	0.0899 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
Gravel Trench Bed 1 POC	☐	155.93			☐	100.00			
Total Volume Infiltrated		155.93	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

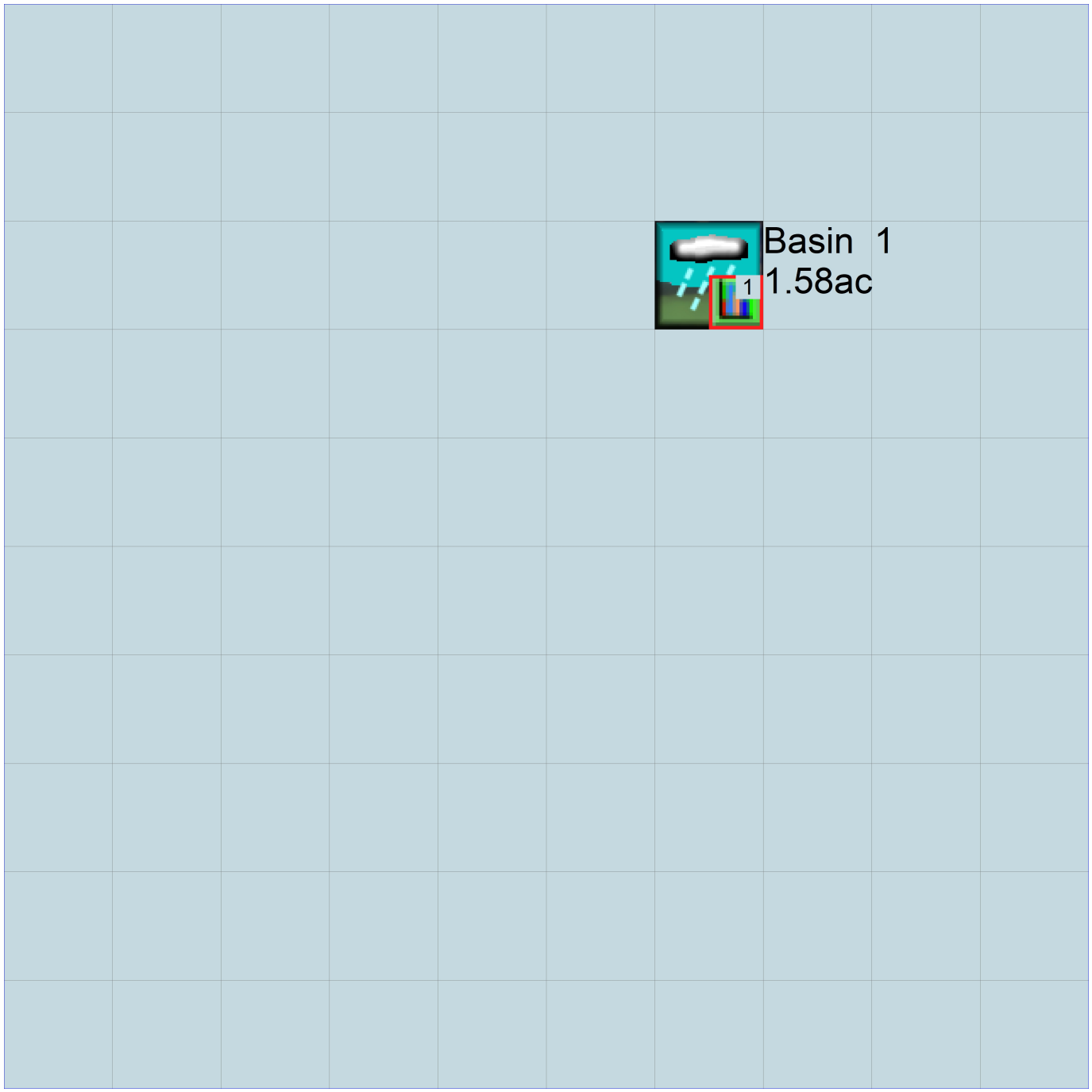
PERLND Changes

No PERLND changes have been made.

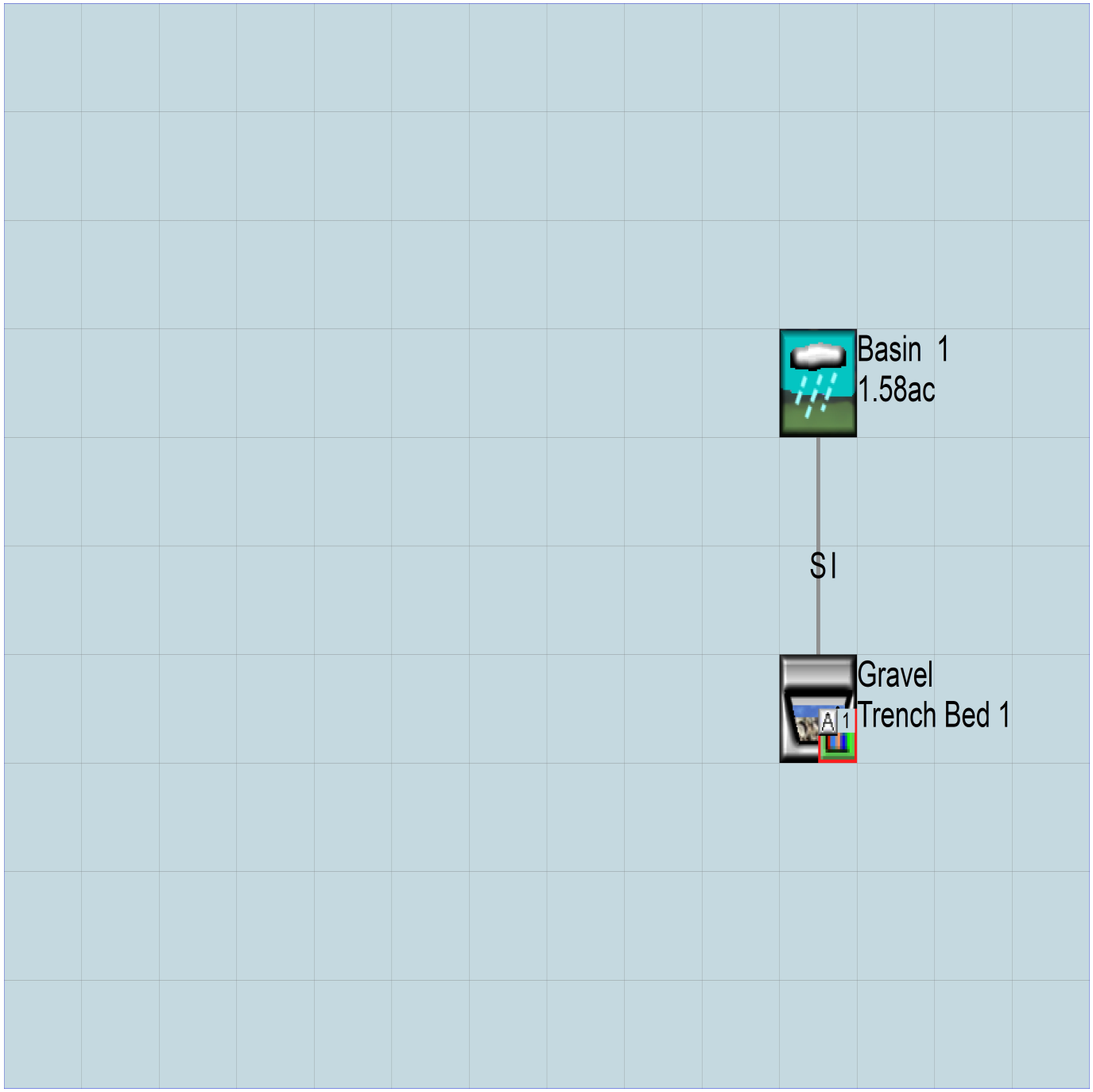
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2011 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   HYDROLOGY MODELS.wdm
MESSU       25   PreHYDROLOGY MODELS.MES
            27   PreHYDROLOGY MODELS.L61
            28   PreHYDROLOGY MODELS.L62
            30   POCHYDROLOGY MODELS1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND       4
      IMPLND       4
      IMPLND       5
      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           ***
    4     A/B, 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 ***
    4         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  *********
    4         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 ***
    4         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
    4              0         5       1.5       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    4              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    4          0.15       0.5       0.3         0       0.7       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
    4              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
    5         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    0    1    9
    5         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     ***
    4         0    0    0    0    0
    5         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
```

```
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
    5              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
    5              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   4                       1.53     COPY   501     12
PERLND   4                       1.53     COPY   501     13
IMPLND   4                       0.04     COPY   501     15
IMPLND   5                       0.01     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    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           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       1955 10 01        END    2011 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   HYDROLOGY MODELS.wdm
MESSU       25   MitHYDROLOGY MODELS.MES
            27   MitHYDROLOGY MODELS.L61
            28   MitHYDROLOGY MODELS.L62
            30   POCHYDROLOGY MODELS1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       4
      IMPLND       1
      IMPLND       4
      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        Gravel Trench Bed 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           ***
    4     A/B, 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 ***
    4         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  *********
    4         0    0    4    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 ***
    4         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
    4              0         5       1.5       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    4              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    4          0.15       0.5       0.3         0       0.7       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
    4              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

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

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

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
  END PRINT-INFO

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

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

```
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

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

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   4                        0.89     RCHRES   1      2
PERLND   4                        0.89     RCHRES   1      3
IMPLND   1                        0.38     RCHRES   1      5
IMPLND   4                        0.31     RCHRES   1      5

******Routing******
PERLND   4                        0.89     COPY     1     12
IMPLND   1                        0.38     COPY     1     15
IMPLND   4                        0.31     COPY     1     15
PERLND   4                        0.89     COPY     1     13
RCHRES   1                           1     COPY   501     17
END SCHEMATIC

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



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
    1     Gravel Trench Be-010    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

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

  HYDR-PARM1
```

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

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------->      ***
    1              1       0.1       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)     (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.035124  0.000000  0.000000  0.000000
  0.044444  0.035124  0.000624  0.000000  0.403750
  0.088889  0.035124  0.001249  0.000000  0.403750
  0.133333  0.035124  0.001873  0.000000  0.403750
  0.177778  0.035124  0.002498  0.000000  0.403750
  0.222222  0.035124  0.003122  0.000000  0.403750
  0.266667  0.035124  0.003747  0.000000  0.403750
  0.311111  0.035124  0.004371  0.000000  0.403750
  0.355556  0.035124  0.004995  0.000000  0.403750
  0.400000  0.035124  0.005620  0.000000  0.403750
  0.444444  0.035124  0.006244  0.000000  0.403750
  0.488889  0.035124  0.006869  0.000000  0.403750
  0.533333  0.035124  0.007493  0.000000  0.403750
  0.577778  0.035124  0.008118  0.000000  0.403750
  0.622222  0.035124  0.008742  0.000000  0.403750
  0.666667  0.035124  0.009366  0.000000  0.403750
  0.711111  0.035124  0.009991  0.000000  0.403750
  0.755556  0.035124  0.010615  0.000000  0.403750
  0.800000  0.035124  0.011240  0.000000  0.403750
  0.844444  0.035124  0.011864  0.000000  0.403750
  0.888889  0.035124  0.012489  0.000000  0.403750
  0.933333  0.035124  0.013113  0.000000  0.403750
  0.977778  0.035124  0.013737  0.000000  0.403750
  1.022222  0.035124  0.014362  0.000000  0.403750
  1.066667  0.035124  0.014986  0.000000  0.403750
  1.111111  0.035124  0.015611  0.000000  0.403750
  1.155556  0.035124  0.016235  0.000000  0.403750
  1.200000  0.035124  0.016860  0.000000  0.403750
  1.244444  0.035124  0.017484  0.000000  0.403750
  1.288889  0.035124  0.018108  0.000000  0.403750
  1.333333  0.035124  0.018733  0.000000  0.403750
  1.377778  0.035124  0.019357  0.000000  0.403750
  1.422222  0.035124  0.019982  0.000000  0.403750
  1.466667  0.035124  0.020606  0.000000  0.403750
  1.511111  0.035124  0.021230  0.000000  0.403750
  1.555556  0.035124  0.021855  0.000000  0.403750
  1.600000  0.035124  0.022479  0.000000  0.403750
  1.644444  0.035124  0.023104  0.000000  0.403750
  1.688889  0.035124  0.023728  0.000000  0.403750
  1.733333  0.035124  0.024353  0.000000  0.403750
  1.777778  0.035124  0.024977  0.000000  0.403750
  1.822222  0.035124  0.025601  0.000000  0.403750
```

```
  1.866667  0.035124  0.026226  0.000000  0.403750
  1.911111  0.035124  0.026850  0.000000  0.403750
  1.955556  0.035124  0.027475  0.000000  0.403750
  2.000000  0.035124  0.028099  0.000000  0.403750
  2.044444  0.035124  0.028724  0.000000  0.403750
  2.088889  0.035124  0.029348  0.000000  0.403750
  2.133333  0.035124  0.029972  0.000000  0.403750
  2.177778  0.035124  0.030597  0.000000  0.403750
  2.222222  0.035124  0.031221  0.000000  0.403750
  2.266667  0.035124  0.031846  0.000000  0.403750
  2.311111  0.035124  0.032470  0.000000  0.403750
  2.355556  0.035124  0.033095  0.000000  0.403750
  2.400000  0.035124  0.033719  0.000000  0.403750
  2.444444  0.035124  0.034343  0.000000  0.403750
  2.488889  0.035124  0.034968  0.000000  0.403750
  2.533333  0.035124  0.035592  0.000000  0.403750
  2.577778  0.035124  0.036217  0.000000  0.403750
  2.622222  0.035124  0.036841  0.000000  0.403750
  2.666667  0.035124  0.037466  0.000000  0.403750
  2.711111  0.035124  0.038090  0.000000  0.403750
  2.755556  0.035124  0.038714  0.000000  0.403750
  2.800000  0.035124  0.039339  0.000000  0.403750
  2.844444  0.035124  0.039963  0.000000  0.403750
  2.888889  0.035124  0.040588  0.000000  0.403750
  2.933333  0.035124  0.041212  0.000000  0.403750
  2.977778  0.035124  0.041837  0.000000  0.403750
  3.022222  0.035124  0.042461  0.000000  0.403750
  3.066667  0.035124  0.043085  0.000000  0.403750
  3.111111  0.035124  0.043710  0.000000  0.403750
  3.155556  0.035124  0.044334  0.000000  0.403750
  3.200000  0.035124  0.044959  0.000000  0.403750
  3.244444  0.035124  0.045583  0.000000  0.403750
  3.288889  0.035124  0.046208  0.000000  0.403750
  3.333333  0.035124  0.046832  0.000000  0.403750
  3.377778  0.035124  0.047456  0.000000  0.403750
  3.422222  0.035124  0.048081  0.000000  0.403750
  3.466667  0.035124  0.048705  0.000000  0.403750
  3.511111  0.035124  0.049330  0.000000  0.403750
  3.555556  0.035124  0.049954  0.000000  0.403750
  3.600000  0.035124  0.050579  0.000000  0.403750
  3.644444  0.035124  0.051203  0.000000  0.403750
  3.688889  0.035124  0.051827  0.000000  0.403750
  3.733333  0.035124  0.052452  0.000000  0.403750
  3.777778  0.035124  0.053076  0.000000  0.403750
  3.822222  0.035124  0.053701  0.000000  0.403750
  3.866667  0.035124  0.054325  0.000000  0.403750
  3.911111  0.035124  0.054949  0.000000  0.403750
  3.955556  0.035124  0.055574  0.000000  0.403750
  4.000000  0.035124  0.056198  0.000000  0.403750
  4.044444  0.035124  0.057759  0.000000  0.403750
  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    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           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   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 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       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

This program and accompanying documentation are provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by End User. Clear Creek Solutions Inc. and the governmental licensee or sublicensees disclaim all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions Inc. or their authorized representatives have been advised of the possibility of such damages.

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

BASIN 2

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	HYDROLOGY MODELS
Site Name:	Deskin Grand Mount Site
Site Address:	
City:	
Report Date:	4/4/2022
Gage:	Grand Mound
Data Start:	1955/10/01
Data End:	2011/09/30
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
A B, Pasture, Flat	0.1
Pervious Total	0.1
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.1

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Pasture, Flat	0.05
Pervious Total	0.05

Impervious Land Use	acre
ROADS FLAT	0.05
Impervious Total	0.05
Basin Total	0.1

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	30.00 ft.
Bottom Width:	3.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	4
Pour Space of material for first layer:	0.4
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	11.4
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	12.144
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	12.144
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	0 ft.
Riser Diameter:	0 in.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

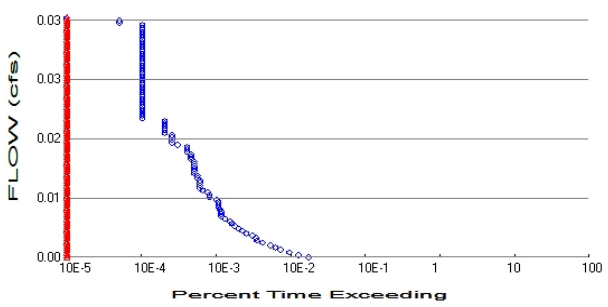
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.002066	0.000000	0.000	0.000
0.0444	0.002066	0.000037	0.000	0.023
0.0889	0.002066	0.000073	0.000	0.023
0.1333	0.002066	0.000110	0.000	0.023
0.1778	0.002066	0.000147	0.000	0.023
0.2222	0.002066	0.000184	0.000	0.023
0.2667	0.002066	0.000220	0.000	0.023
0.3111	0.002066	0.000257	0.000	0.023
0.3556	0.002066	0.000294	0.000	0.023
0.4000	0.002066	0.000331	0.000	0.023
0.4444	0.002066	0.000367	0.000	0.023
0.4889	0.002066	0.000404	0.000	0.023
0.5333	0.002066	0.000441	0.000	0.023
0.5778	0.002066	0.000478	0.000	0.023
0.6222	0.002066	0.000514	0.000	0.023
0.6667	0.002066	0.000551	0.000	0.023
0.7111	0.002066	0.000588	0.000	0.023
0.7556	0.002066	0.000624	0.000	0.023
0.8000	0.002066	0.000661	0.000	0.023
0.8444	0.002066	0.000698	0.000	0.023
0.8889	0.002066	0.000735	0.000	0.023
0.9333	0.002066	0.000771	0.000	0.023
0.9778	0.002066	0.000808	0.000	0.023
1.0222	0.002066	0.000845	0.000	0.023

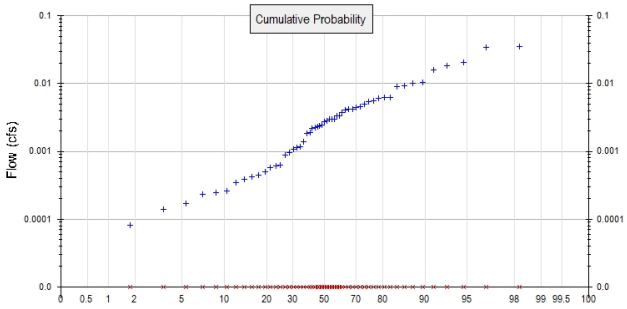
1.0667	0.002066	0.000882	0.000	0.023
1.1111	0.002066	0.000918	0.000	0.023
1.1556	0.002066	0.000955	0.000	0.023
1.2000	0.002066	0.000992	0.000	0.023
1.2444	0.002066	0.001028	0.000	0.023
1.2889	0.002066	0.001065	0.000	0.023
1.3333	0.002066	0.001102	0.000	0.023
1.3778	0.002066	0.001139	0.000	0.023
1.4222	0.002066	0.001175	0.000	0.023
1.4667	0.002066	0.001212	0.000	0.023
1.5111	0.002066	0.001249	0.000	0.023
1.5556	0.002066	0.001286	0.000	0.023
1.6000	0.002066	0.001322	0.000	0.023
1.6444	0.002066	0.001359	0.000	0.023
1.6889	0.002066	0.001396	0.000	0.023
1.7333	0.002066	0.001433	0.000	0.023
1.7778	0.002066	0.001469	0.000	0.023
1.8222	0.002066	0.001506	0.000	0.023
1.8667	0.002066	0.001543	0.000	0.023
1.9111	0.002066	0.001579	0.000	0.023
1.9556	0.002066	0.001616	0.000	0.023
2.0000	0.002066	0.001653	0.000	0.023
2.0444	0.002066	0.001690	0.000	0.023
2.0889	0.002066	0.001726	0.000	0.023
2.1333	0.002066	0.001763	0.000	0.023
2.1778	0.002066	0.001800	0.000	0.023
2.2222	0.002066	0.001837	0.000	0.023
2.2667	0.002066	0.001873	0.000	0.023
2.3111	0.002066	0.001910	0.000	0.023
2.3556	0.002066	0.001947	0.000	0.023
2.4000	0.002066	0.001983	0.000	0.023
2.4444	0.002066	0.002020	0.000	0.023
2.4889	0.002066	0.002057	0.000	0.023
2.5333	0.002066	0.002094	0.000	0.023
2.5778	0.002066	0.002130	0.000	0.023
2.6222	0.002066	0.002167	0.000	0.023
2.6667	0.002066	0.002204	0.000	0.023
2.7111	0.002066	0.002241	0.000	0.023
2.7556	0.002066	0.002277	0.000	0.023
2.8000	0.002066	0.002314	0.000	0.023
2.8444	0.002066	0.002351	0.000	0.023
2.8889	0.002066	0.002388	0.000	0.023
2.9333	0.002066	0.002424	0.000	0.023
2.9778	0.002066	0.002461	0.000	0.023
3.0222	0.002066	0.002498	0.000	0.023
3.0667	0.002066	0.002534	0.000	0.023
3.1111	0.002066	0.002571	0.000	0.023
3.1556	0.002066	0.002608	0.000	0.023
3.2000	0.002066	0.002645	0.000	0.023
3.2444	0.002066	0.002681	0.000	0.023
3.2889	0.002066	0.002718	0.000	0.023
3.3333	0.002066	0.002755	0.000	0.023
3.3778	0.002066	0.002792	0.000	0.023
3.4222	0.002066	0.002828	0.000	0.023
3.4667	0.002066	0.002865	0.000	0.023
3.5111	0.002066	0.002902	0.000	0.023
3.5556	0.002066	0.002938	0.000	0.023
3.6000	0.002066	0.002975	0.000	0.023

3.6444	0.002066	0.003012	0.000	0.023
3.6889	0.002066	0.003049	0.000	0.023
3.7333	0.002066	0.003085	0.000	0.023
3.7778	0.002066	0.003122	0.000	0.023
3.8222	0.002066	0.003159	0.000	0.023
3.8667	0.002066	0.003196	0.000	0.023
3.9111	0.002066	0.003232	0.000	0.023
3.9556	0.002066	0.003269	0.000	0.023
4.0000	0.002066	0.003306	0.000	0.023

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.1
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.05
Total Impervious Area: 0.05

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.002101
5 year	0.006966
10 year	0.012687
25 year	0.023563
50 year	0.034767
100 year	0.048975

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.011	0.000
1957	0.034	0.000
1958	0.001	0.000
1959	0.001	0.000
1960	0.004	0.000
1961	0.002	0.000
1962	0.000	0.000
1963	0.019	0.000
1964	0.006	0.000
1965	0.005	0.000

1966	0.001	0.000
1967	0.006	0.000
1968	0.002	0.000
1969	0.001	0.000
1970	0.001	0.000
1971	0.004	0.000
1972	0.006	0.000
1973	0.002	0.000
1974	0.002	0.000
1975	0.005	0.000
1976	0.002	0.000
1977	0.000	0.000
1978	0.003	0.000
1979	0.001	0.000
1980	0.002	0.000
1981	0.010	0.000
1982	0.003	0.000
1983	0.003	0.000
1984	0.003	0.000
1985	0.000	0.000
1986	0.004	0.000
1987	0.004	0.000
1988	0.000	0.000
1989	0.000	0.000
1990	0.021	0.000
1991	0.009	0.000
1992	0.001	0.000
1993	0.002	0.000
1994	0.000	0.000
1995	0.003	0.000
1996	0.005	0.000
1997	0.003	0.000
1998	0.001	0.000
1999	0.009	0.000
2000	0.016	0.000
2001	0.000	0.000
2002	0.006	0.000
2003	0.003	0.000
2004	0.035	0.000
2005	0.000	0.000
2006	0.004	0.000
2007	0.001	0.000
2008	0.000	0.000
2009	0.001	0.000
2010	0.000	0.000
2011	0.000	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0351	0.0000
2	0.0343	0.0000
3	0.0208	0.0000
4	0.0185	0.0000
5	0.0160	0.0000
6	0.0105	0.0000
7	0.0101	0.0000
8	0.0093	0.0000

9	0.0090	0.0000
10	0.0063	0.0000
11	0.0062	0.0000
12	0.0060	0.0000
13	0.0056	0.0000
14	0.0054	0.0000
15	0.0049	0.0000
16	0.0046	0.0000
17	0.0044	0.0000
18	0.0042	0.0000
19	0.0042	0.0000
20	0.0041	0.0000
21	0.0038	0.0000
22	0.0033	0.0000
23	0.0033	0.0000
24	0.0030	0.0000
25	0.0030	0.0000
26	0.0029	0.0000
27	0.0028	0.0000
28	0.0028	0.0000
29	0.0025	0.0000
30	0.0024	0.0000
31	0.0023	0.0000
32	0.0022	0.0000
33	0.0022	0.0000
34	0.0019	0.0000
35	0.0019	0.0000
36	0.0014	0.0000
37	0.0012	0.0000
38	0.0012	0.0000
39	0.0011	0.0000
40	0.0010	0.0000
41	0.0009	0.0000
42	0.0006	0.0000
43	0.0006	0.0000
44	0.0006	0.0000
45	0.0005	0.0000
46	0.0005	0.0000
47	0.0004	0.0000
48	0.0004	0.0000
49	0.0004	0.0000
50	0.0003	0.0000
51	0.0002	0.0000
52	0.0002	0.0000
53	0.0002	0.0000
54	0.0001	0.0000
55	0.0001	0.0000
56	0.0001	0.0000

Duration Flows

The Facility PASSED

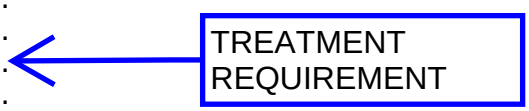
Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0011	336	0	0	Pass
0.0014	248	0	0	Pass
0.0017	187	0	0	Pass
0.0021	144	0	0	Pass
0.0024	123	0	0	Pass
0.0028	104	0	0	Pass
0.0031	82	0	0	Pass
0.0034	70	0	0	Pass
0.0038	67	0	0	Pass
0.0041	60	0	0	Pass
0.0045	50	0	0	Pass
0.0048	44	0	0	Pass
0.0051	39	0	0	Pass
0.0055	35	0	0	Pass
0.0058	32	0	0	Pass
0.0062	30	0	0	Pass
0.0065	26	0	0	Pass
0.0068	23	0	0	Pass
0.0072	23	0	0	Pass
0.0075	23	0	0	Pass
0.0079	22	0	0	Pass
0.0082	21	0	0	Pass
0.0085	21	0	0	Pass
0.0089	21	0	0	Pass
0.0092	20	0	0	Pass
0.0096	16	0	0	Pass
0.0099	16	0	0	Pass
0.0102	15	0	0	Pass
0.0106	13	0	0	Pass
0.0109	12	0	0	Pass
0.0113	12	0	0	Pass
0.0116	12	0	0	Pass
0.0119	12	0	0	Pass
0.0123	11	0	0	Pass
0.0126	11	0	0	Pass
0.0130	10	0	0	Pass
0.0133	10	0	0	Pass
0.0137	10	0	0	Pass
0.0140	10	0	0	Pass
0.0143	10	0	0	Pass
0.0147	10	0	0	Pass
0.0150	9	0	0	Pass
0.0154	9	0	0	Pass
0.0157	9	0	0	Pass
0.0160	8	0	0	Pass
0.0164	8	0	0	Pass
0.0167	8	0	0	Pass
0.0171	6	0	0	Pass
0.0174	5	0	0	Pass
0.0177	5	0	0	Pass
0.0181	5	0	0	Pass
0.0184	5	0	0	Pass
0.0188	4	0	0	Pass

0.0191	4	0	0	Pass
0.0194	4	0	0	Pass
0.0198	4	0	0	Pass
0.0201	4	0	0	Pass
0.0205	4	0	0	Pass
0.0208	2	0	0	Pass
0.0211	2	0	0	Pass
0.0215	2	0	0	Pass
0.0218	2	0	0	Pass
0.0222	2	0	0	Pass
0.0225	2	0	0	Pass
0.0228	2	0	0	Pass
0.0232	2	0	0	Pass
0.0235	2	0	0	Pass
0.0239	2	0	0	Pass
0.0242	2	0	0	Pass
0.0245	2	0	0	Pass
0.0249	2	0	0	Pass
0.0252	2	0	0	Pass
0.0256	2	0	0	Pass
0.0259	2	0	0	Pass
0.0263	2	0	0	Pass
0.0266	2	0	0	Pass
0.0269	2	0	0	Pass
0.0273	2	0	0	Pass
0.0276	2	0	0	Pass
0.0280	2	0	0	Pass
0.0283	2	0	0	Pass
0.0286	2	0	0	Pass
0.0290	2	0	0	Pass
0.0293	2	0	0	Pass
0.0297	2	0	0	Pass
0.0300	2	0	0	Pass
0.0303	2	0	0	Pass
0.0307	2	0	0	Pass
0.0310	2	0	0	Pass
0.0314	2	0	0	Pass
0.0317	2	0	0	Pass
0.0320	2	0	0	Pass
0.0324	2	0	0	Pass
0.0327	2	0	0	Pass
0.0331	2	0	0	Pass
0.0334	2	0	0	Pass
0.0337	2	0	0	Pass
0.0341	2	0	0	Pass
0.0344	1	0	0	Pass
0.0348	1	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0097 acre-feet
On-line facility target flow:	0.0114 cfs.
Adjusted for 15 min:	0.0114 cfs.
Off-line facility target flow:	0.0065 cfs.
Adjusted for 15 min:	0.0065 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
Gravel Trench Bed 1 POC	☐	11.05			☐	100.00			
Total Volume Infiltrated		11.05	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

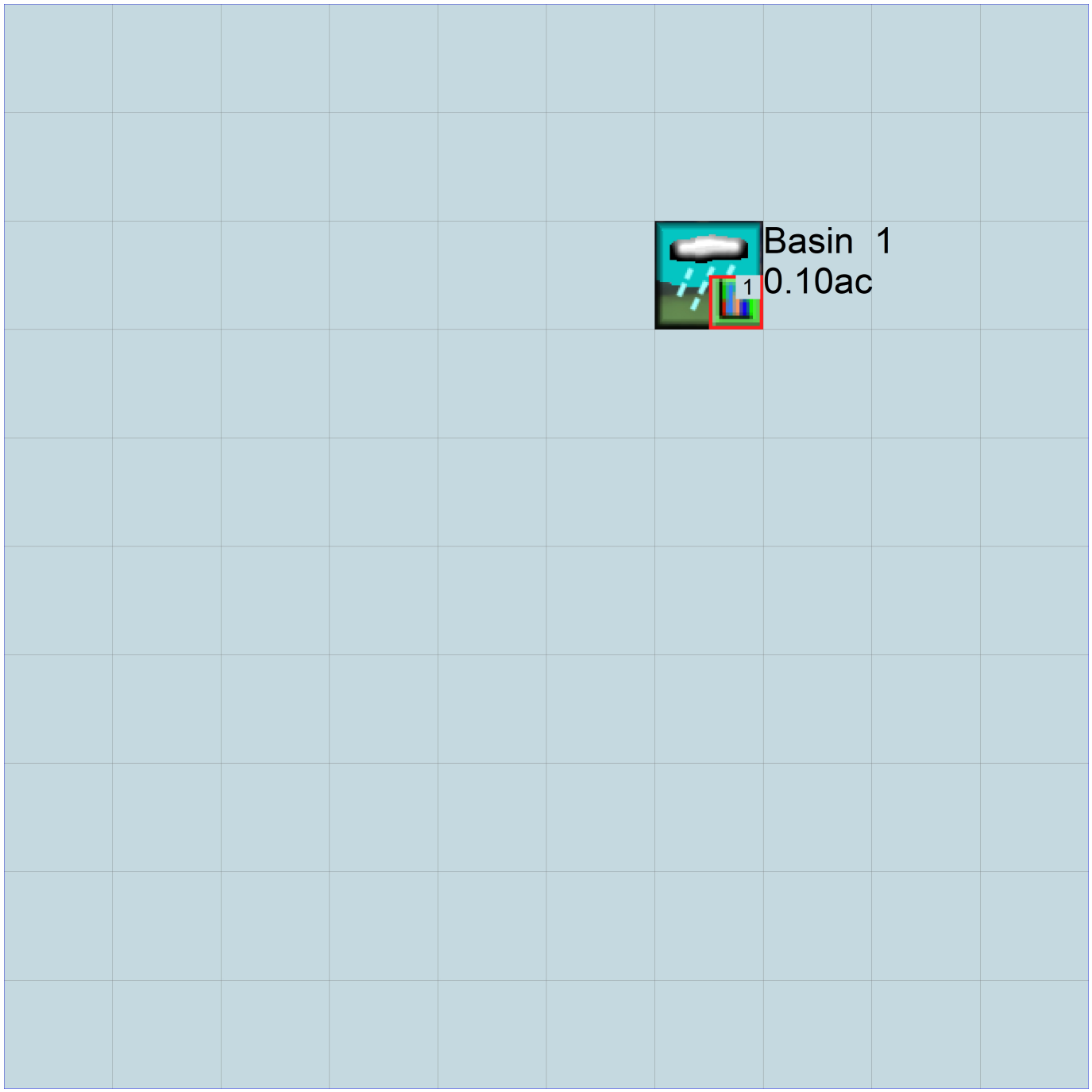
PERLND Changes

No PERLND changes have been made.

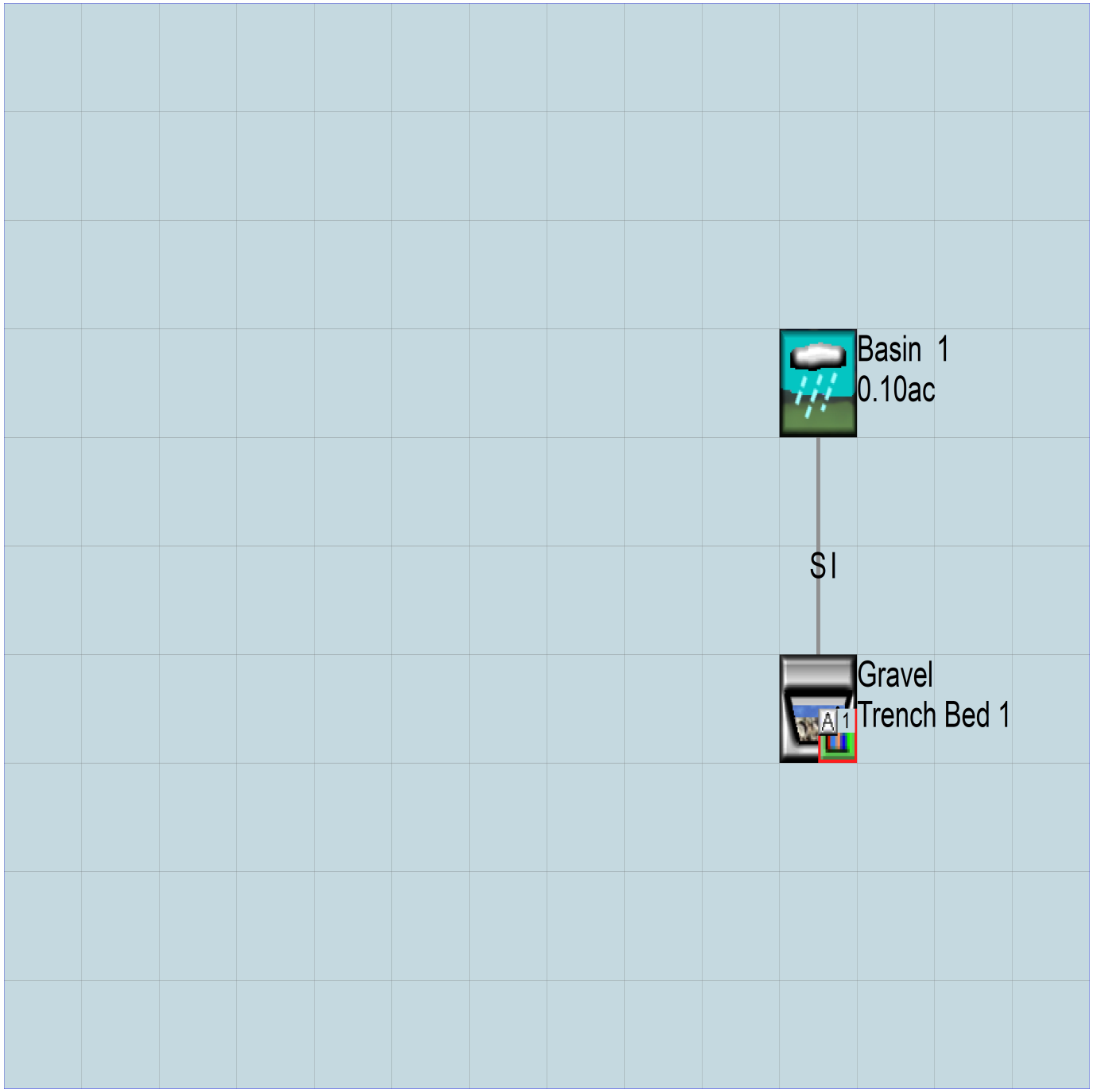
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2011 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   HYDROLOGY MODELS.wdm
MESSU       25   PreHYDROLOGY MODELS.MES
            27   PreHYDROLOGY MODELS.L61
            28   PreHYDROLOGY MODELS.L62
            30   POCHYDROLOGY MODELS1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       4
      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           ***
    4     A/B, 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 ***
    4         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  *********
    4         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 ***
    4         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
    4               0         5       1.5       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    4              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    4          0.15       0.5       0.3         0       0.7       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
    4               0         0         0         0         3         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   4                        0.1     COPY   501     12
PERLND   4                        0.1     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    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           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       1955 10 01        END    2011 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   HYDROLOGY MODELS.wdm
MESSU       25   MitHYDROLOGY MODELS.MES
            27   MitHYDROLOGY MODELS.L61
            28   MitHYDROLOGY MODELS.L62
            30   POCHYDROLOGY MODELS1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       4
      IMPLND       1
      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        Gravel Trench Bed 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           ***
    4     A/B, 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 ***
    4         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  *********
```

```
    4         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 ***
    4         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
    4              0         5       1.5       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    4              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    4          0.15       0.5       0.3         0       0.7       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
    4              0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

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

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

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO

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

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

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

```
    # -  # ***PETMAX    PETMIN
    1              0         0
  END IWAT-PARM3

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   4                        0.05     RCHRES   1      2
PERLND   4                        0.05     RCHRES   1      3
IMPLND   1                        0.05     RCHRES   1      5

******Routing******
PERLND   4                        0.05     COPY     1     12
IMPLND   1                        0.05     COPY     1     15
PERLND   4                        0.05     COPY     1     13
RCHRES   1                           1     COPY   501     17
END SCHEMATIC

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



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
    1     Gravel Trench Be-010    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

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

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

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
    <------><--------><--------><--------><--------><--------><-------->      ***
```

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.002066  0.000000  0.000000  0.000000
  0.044444  0.002066  0.000037  0.000000  0.023750
  0.088889  0.002066  0.000073  0.000000  0.023750
  0.133333  0.002066  0.000110  0.000000  0.023750
  0.177778  0.002066  0.000147  0.000000  0.023750
  0.222222  0.002066  0.000184  0.000000  0.023750
  0.266667  0.002066  0.000220  0.000000  0.023750
  0.311111  0.002066  0.000257  0.000000  0.023750
  0.355556  0.002066  0.000294  0.000000  0.023750
  0.400000  0.002066  0.000331  0.000000  0.023750
  0.444444  0.002066  0.000367  0.000000  0.023750
  0.488889  0.002066  0.000404  0.000000  0.023750
  0.533333  0.002066  0.000441  0.000000  0.023750
  0.577778  0.002066  0.000478  0.000000  0.023750
  0.622222  0.002066  0.000514  0.000000  0.023750
  0.666667  0.002066  0.000551  0.000000  0.023750
  0.711111  0.002066  0.000588  0.000000  0.023750
  0.755556  0.002066  0.000624  0.000000  0.023750
  0.800000  0.002066  0.000661  0.000000  0.023750
  0.844444  0.002066  0.000698  0.000000  0.023750
  0.888889  0.002066  0.000735  0.000000  0.023750
  0.933333  0.002066  0.000771  0.000000  0.023750
  0.977778  0.002066  0.000808  0.000000  0.023750
  1.022222  0.002066  0.000845  0.000000  0.023750
  1.066667  0.002066  0.000882  0.000000  0.023750
  1.111111  0.002066  0.000918  0.000000  0.023750
  1.155556  0.002066  0.000955  0.000000  0.023750
  1.200000  0.002066  0.000992  0.000000  0.023750
  1.244444  0.002066  0.001028  0.000000  0.023750
  1.288889  0.002066  0.001065  0.000000  0.023750
  1.333333  0.002066  0.001102  0.000000  0.023750
  1.377778  0.002066  0.001139  0.000000  0.023750
  1.422222  0.002066  0.001175  0.000000  0.023750
  1.466667  0.002066  0.001212  0.000000  0.023750
  1.511111  0.002066  0.001249  0.000000  0.023750
  1.555556  0.002066  0.001286  0.000000  0.023750
  1.600000  0.002066  0.001322  0.000000  0.023750
  1.644444  0.002066  0.001359  0.000000  0.023750
  1.688889  0.002066  0.001396  0.000000  0.023750
  1.733333  0.002066  0.001433  0.000000  0.023750
  1.777778  0.002066  0.001469  0.000000  0.023750
  1.822222  0.002066  0.001506  0.000000  0.023750
  1.866667  0.002066  0.001543  0.000000  0.023750
  1.911111  0.002066  0.001579  0.000000  0.023750
  1.955556  0.002066  0.001616  0.000000  0.023750
  2.000000  0.002066  0.001653  0.000000  0.023750
  2.044444  0.002066  0.001690  0.000000  0.023750
  2.088889  0.002066  0.001726  0.000000  0.023750
  2.133333  0.002066  0.001763  0.000000  0.023750
  2.177778  0.002066  0.001800  0.000000  0.023750
  2.222222  0.002066  0.001837  0.000000  0.023750
  2.266667  0.002066  0.001873  0.000000  0.023750
```

```
  2.311111  0.002066  0.001910  0.000000  0.023750
  2.355556  0.002066  0.001947  0.000000  0.023750
  2.400000  0.002066  0.001983  0.000000  0.023750
  2.444444  0.002066  0.002020  0.000000  0.023750
  2.488889  0.002066  0.002057  0.000000  0.023750
  2.533333  0.002066  0.002094  0.000000  0.023750
  2.577778  0.002066  0.002130  0.000000  0.023750
  2.622222  0.002066  0.002167  0.000000  0.023750
  2.666667  0.002066  0.002204  0.000000  0.023750
  2.711111  0.002066  0.002241  0.000000  0.023750
  2.755556  0.002066  0.002277  0.000000  0.023750
  2.800000  0.002066  0.002314  0.000000  0.023750
  2.844444  0.002066  0.002351  0.000000  0.023750
  2.888889  0.002066  0.002388  0.000000  0.023750
  2.933333  0.002066  0.002424  0.000000  0.023750
  2.977778  0.002066  0.002461  0.000000  0.023750
  3.022222  0.002066  0.002498  0.000000  0.023750
  3.066667  0.002066  0.002534  0.000000  0.023750
  3.111111  0.002066  0.002571  0.000000  0.023750
  3.155556  0.002066  0.002608  0.000000  0.023750
  3.200000  0.002066  0.002645  0.000000  0.023750
  3.244444  0.002066  0.002681  0.000000  0.023750
  3.288889  0.002066  0.002718  0.000000  0.023750
  3.333333  0.002066  0.002755  0.000000  0.023750
  3.377778  0.002066  0.002792  0.000000  0.023750
  3.422222  0.002066  0.002828  0.000000  0.023750
  3.466667  0.002066  0.002865  0.000000  0.023750
  3.511111  0.002066  0.002902  0.000000  0.023750
  3.555556  0.002066  0.002938  0.000000  0.023750
  3.600000  0.002066  0.002975  0.000000  0.023750
  3.644444  0.002066  0.003012  0.000000  0.023750
  3.688889  0.002066  0.003049  0.000000  0.023750
  3.733333  0.002066  0.003085  0.000000  0.023750
  3.777778  0.002066  0.003122  0.000000  0.023750
  3.822222  0.002066  0.003159  0.000000  0.023750
  3.866667  0.002066  0.003196  0.000000  0.023750
  3.911111  0.002066  0.003232  0.000000  0.023750
  3.955556  0.002066  0.003269  0.000000  0.023750
  4.000000  0.002066  0.003306  0.000000  0.023750
  4.044444  0.002066  0.003398  0.000000  0.023750
  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    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           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   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 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       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

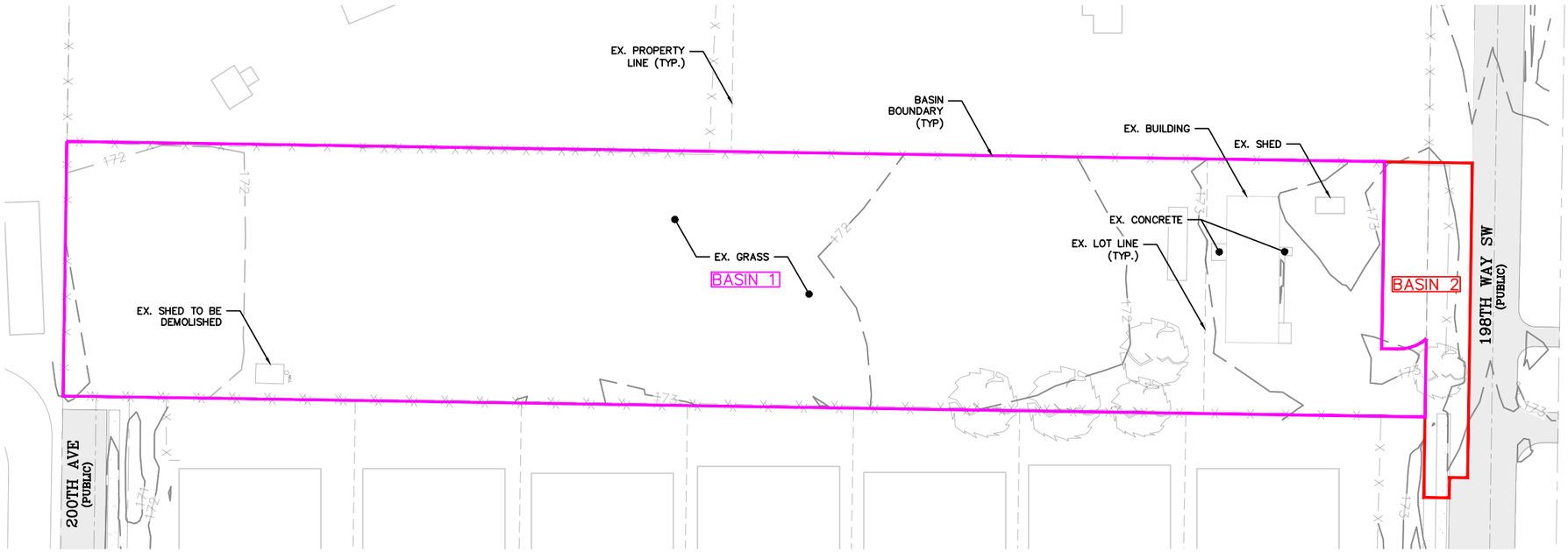
Legal Notice

This program and accompanying documentation are provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by End User. Clear Creek Solutions Inc. and the governmental licensee or sublicensees disclaim all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions Inc. be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions Inc. or their authorized representatives have been advised of the possibility of such damages.

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

SECTION 11 TOWNSHIP 15 RANGE 3W QUARTER NE SE PLAT



0' 30' 60' 120'

SCALE 1:60

PRE DEVELOPED CONDITION:

BASIN 1

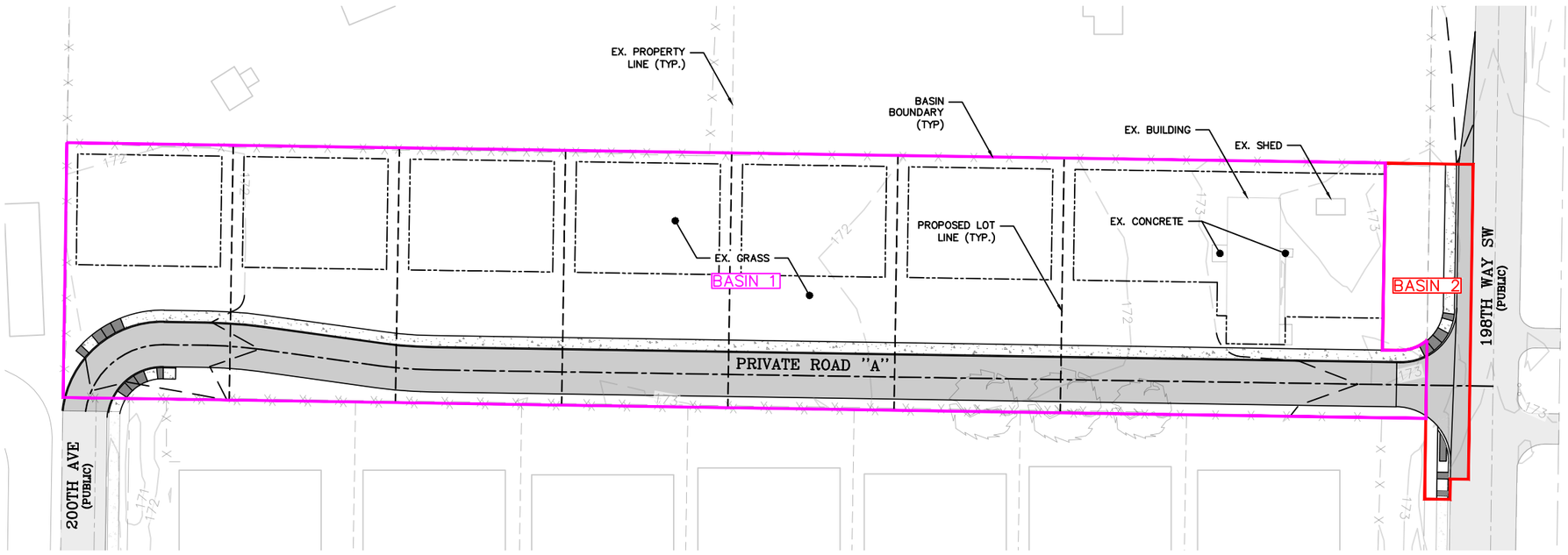
(EL) EX LAWN AREA = 67060 SF
(EC) EX CONCRETE = 200 SF
(EP) EX BUILDING = 1790 SF

TOTAL AREA = 69050 SF = 1.58 ACRE

BASIN 2

(EL) EX LAWN AREA = 4330 SF
(EC) EX CONCRETE = 230 SF

TOTAL AREA = 4560 SF = 0.10 ACRE



POST DEVELOPED CONDITION:

BASIN 1

(EL) EX LAWN AREA = 38970 SF
(EC) EX CONCRETE = 200 SF
(EP) EX BUILDING = 1680 SF
(PP) PROPOSED PAVEMENT = 12340 SF
(PC) PROPOSED CONCRETE SIDEWALK = 3860 SF
(PB) PROPOSED BUILDING (TYP OF 6) = 12000 SF

NEW IMPERVIOUS = (PP+PC+PB) = 28200 SF

TOTAL AREA = 69050 SF = 1.58 ACRE

BASIN 2

(EL) EX LAWN AREA = 2400 SF
(PP) PROPOSED PAVEMENT = 1470 SF
(PC) PROPOSED CONCRETE SIDEWALK = 690 SF

NEW IMPERVIOUS = (PP+PC) = 2160 SF

TOTAL AREA = 4560 SF = 0.10 ACRE

PRELIMINARY
FOR PERMIT ONLY

DRAWING TITLE: BASIN MAP - PRE AND POST DEVELOPED
SCALE: 1:60
DATE: 05/06/22
DRAWN: SD
CHECKED: AF/SA
PROJECT NAME: DESKIN GRAND MOUND SITE

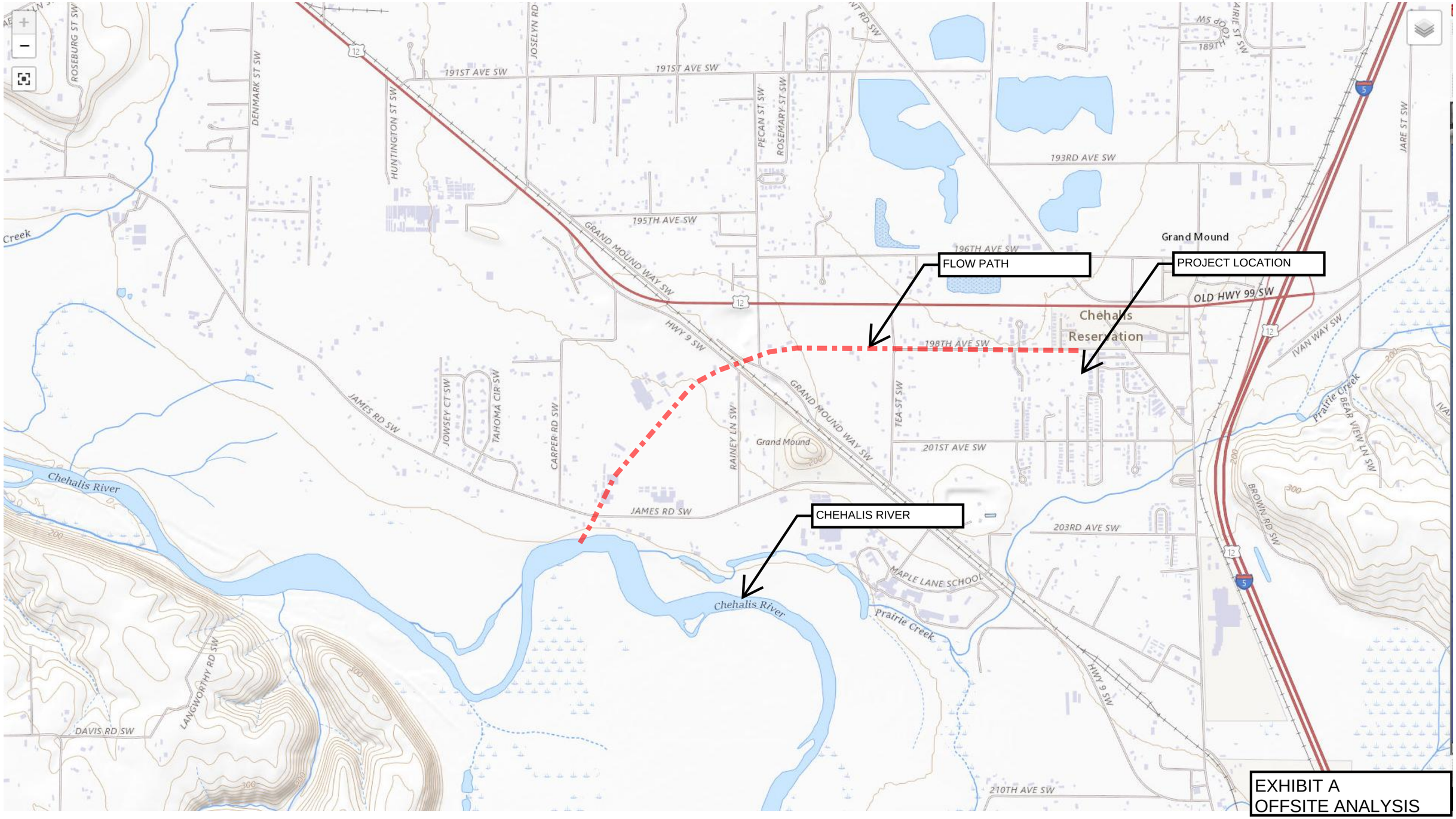
FULLER DESIGNS
1101 KRESKY AVE
CENTRALIA, WA 98531
(360) 807-4420

REV:	DESCRIPTION:	DATE:
0	ISSUED FOR CONSTRUCTION	05/06/22

BSN

1 OF 1

OFFSITE RUNOFF PATH EXHIBIT


FLOW PATH
PROJECT LOCATION
CHEHALIS RIVER
EXHIBIT A
OFFSITE ANALYSIS
191ST AVE SW
195TH AVE SW
196TH AVE SW
198TH AVE SW
201ST AVE SW
203RD AVE SW
210TH AVE SW
193RD AVE SW
GRAND MOUND WAY SW
HWY 9 SW
OLD HWY 99 SW
JAMES RD SW
DAVIS RD SW
Chehalis River
Prairie Creek
Grand Mound
Chehalis Reservation
ROSEBURG ST SW
DENMARK ST SW
HUNTINGTON ST SW
JOSELYN RD
PECAN ST SW
ROSEMARY ST SW
JOWSEY CT SW
TAHOMA CIR SW
CARPER RD SW
RAINEY LN SW
TEA ST SW
MAPLE LANE SCHOOL
LANGWORTHY RD SW
IVAN WAY SW
BROWN RD SW
BEAR VIEW LN SW
JARE ST SW

SECTION 6 – CONSTRUCTION SWPPP

This project is required to prepare a construction Storm Water Pollution Prevention Plan in accordance with Core Requirement #2 and must be prepared in accordance with Volume II chapter 2 of the 2016 DD&ECM

This drainage and erosion control report is intended to supplement the construction SWPPP by utilizing other sections in this report to cover required narrative elements. Also, the construction and erosion control plans supplied for the project are to act as the required drawing component of the construction SWPPP.

Intended BMPs which should be used during construction include but are not limited to:

- BMP C101: Preserving Natural Vegetation
- BMP C102: Buffer Zones
- BMP C103: High Visibility Fence
- BMP C105: Stabilized Construction Entrance / Exit
- BMP C120: Temporary and Permanent Seeding
- BMP C123: Plastic Covering
- BMP C125: Topsoiling / Composting
- BMP C140: Dust Control
- BMP C152: Sawcutting and Surfacing Pollution Prevention
- BMP C153: Material Delivery, Storage and Containment
- BMP C154: Concrete Washout Area
- BMP C160: Certified Erosion and Sediment Control Lead
- BMP C162: Scheduling
- BMP C233: Silt Fence

CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

FOR

Deskin Grand Mound Site

1951 State Route 6
Chehalis, WA 98532

Prepared by:

FULLER DESIGNS

1101 Kresky Ave
Centralia, WA 98531
(360) 807-4420

General Requirements

Clearing and grading activities for this project shall be permitted only to the approved site development plan. These clearing and grading areas were established to preserve sensitive areas, buffers, native growth protection easements, and tree retention areas. These areas are delineated on the site plans and shall be marked on the development site.

The SWPPP shall be implemented beginning with initial land disturbance and until final stabilization. Sediment and Erosion control BMPs shall be consistent with the BMPs contained in chapters 2 and 3 of Volume II of the 2016 DD&ECM.

Seasonal Work Limitations - From October 15 through April 1, clearing, grading, and other soil disturbing activities shall only be permitted if shown to the satisfaction of the local permitting authority that silt-laden runoff will be prevented from leaving the site through a combination of the following:

1. Site conditions including existing vegetative coverage, slope, soil type and proximity to receiving waters.
2. Limitations on activities and the extent of disturbed areas.
3. Proposed erosion and sediment control measures.

Project Requirements - Construction SWPPP Elements

In most cases, all the following elements shall apply and be implemented throughout construction. Self-contained sites (discharges only to groundwater) must comply with all elements except for Element 3: Control Flow Rates.

Element 1: Preserve Vegetation/Mark Clearing Limits

- Before beginning land disturbing activities, including clearing and grading, clearly mark all clearing limits, sensitive areas and their buffers, and trees that are to be preserved within the construction area.
- Retain the duff layer, native topsoil, and natural vegetation in an undisturbed state to the maximum degree practicable.

Element 2: Establish Construction Access

- Limit construction vehicle access and exit to one route, if possible.
- Stabilize access points with a pad of quarry spalls, crushed rock, or other equivalent BMPs, to minimize tracking of sediment onto public roads.
- Locate wheel wash or tire baths on site, if the stabilized construction entrance is not effective in preventing tracking sediment onto roads.
- If sediment is tracked off site, clean the affected roadway thoroughly at the end of each day, or more frequently as necessary (for example, during wet weather). Remove sediment from roads by shoveling, sweeping, or pick up and transport the sediment to a controlled sediment disposal area.
- Conduct street washing only after sediment is removed in accordance with the above bullet.

- Control street wash wastewater by pumping back on-site, or otherwise prevent it from discharging into systems tributary to waters of the State.

Element 3: Control Flow Rates

- Protect properties and waterways downstream of development sites from erosion and the associated discharge of turbid waters due to increases in the velocity and peak volumetric flow rate of stormwater runoff from the project site.
- Where necessary to comply with the bullet above, construct stormwater retention or detention facilities as one of the first steps in grading. Assure that detention facilities function properly before constructing site improvements (e.g. impervious surfaces).
- If permanent infiltration ponds are used for flow control during construction, protect these facilities from siltation during the construction phase.

Element 4: Install Sediment Controls

- Design, install, and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants.
- Construct sediment control BMPs (sediment ponds, traps, filters, etc.) as one of the first steps in grading. These BMPs shall be functional before other land disturbing activities take place.
- Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site.
- Direct stormwater runoff from disturbed areas through a sediment pond or other appropriate sediment removal BMP, before the runoff leaves a construction site or before discharge to an infiltration facility. Runoff from fully stabilized areas may be discharged without a sediment removal BMP but must meet the flow control performance standard in Element #3, bullet #1.
- Locate BMPs intended to trap sediment on-site in a manner to avoid interference with the movement of juvenile salmonids attempting to enter off-channel areas or drainages.
- Where feasible, design outlet structures that withdraw impounded stormwater from the surface to avoid discharging sediment that is still suspended lower in the water column.

Element 5: Stabilize Soils

- Stabilize exposed and unworked soils by application of effective BMPs that prevent erosion. Applicable BMPs include but are not limited to: temporary and permanent seeding, sodding, mulching, plastic covering, erosion control fabrics and matting, soil application of polyacrylamide (PAM), the early application of gravel base early on areas to be paved, and dust control.
- Control stormwater volume and velocity within the site to minimize soil erosion.
- Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion.
- Soils must not remain exposed and unworked for more than the time periods set forth below to prevent erosion:
    - During the dry season (April 2 – October 14): 7 days

    - During the wet season (October 15 - April 1): 2 days
    - Note that projects performing work under a NPDES Construction Stormwater General Permit issued by Ecology will have more restrictive time periods.
- Stabilize soils at the end of the shift before a holiday or weekend if needed based on the weather forecast.
- Stabilize soil stockpiles from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways and drainage channels.
- Minimize the amount of soil exposed during construction activity.
- Minimize the disturbance of steep slopes.
- Minimize soil compaction and, unless infeasible, preserve topsoil.

Element 6: Protect Slopes

- Design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking).
- Divert off-site stormwater (run-on) or ground water away from slopes and disturbed areas with interceptor dikes, pipes and/or swales. Off-site stormwater should be managed separately from stormwater generated on the site.
- At the top of slopes, collect drainage in pipe slope drains or protected channels to prevent erosion.
- Place excavated material on the uphill side of trenches, consistent with safety and space considerations.
- Place check dams at regular intervals within constructed channels that are cut down a slope.

Element 7: Protect Drain Inlets

- Protect all storm drain inlets made operable during construction so that stormwater runoff shall not enter the conveyance system without first being filtered or treated to remove sediment.
- Clean or remove and replace inlet protection devices when sediment has filled one-third of the available storage (unless a different standard is specified by the product manufacturer).

Element 8: Stabilize Channels and Outlets

- Design, construct, and stabilize all on-site conveyance channels.
- Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream reaches at the outlets of all conveyance systems.

Element 9: Control Pollutants

- Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants.

- Handle and dispose of all pollutants, including waste materials and demolition debris that occur on-site in a manner that does not cause contamination of stormwater.
- Provide cover, containment, and protection from vandalism for all chemicals, liquid products, petroleum products, and other materials that have the potential to pose a threat to human health or the environment. On-site fueling tanks must include secondary containment. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest take within the containment structure. Double-walled tanks do not require additional secondary containment.
- Conduct maintenance, fueling, and repair of heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident.
- Discharge wheel wash or tire bath wastewater to a separate on-site treatment system that prevents discharge to surface water, such as closed-loop recirculation or upland application, or to the sanitary sewer, with local sewer district approval.
- Apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemical to stormwater runoff. Follow manufacturers' label requirements for application rates and procedures.
- Use BMPs to prevent contamination of stormwater runoff by pH modifying sources. The sources for this contamination include, but are not limited to: bulk cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, exposed aggregate processes, dewatering concrete vaults, concrete pumping and mixer washout waters.
- Adjust the pH of stormwater if necessary to prevent violations of water quality standards.
- Assure that washout of concrete trucks is performed off-site or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Do not dump excess concrete on-site, except in designated concrete washout areas. Concrete spillage or concrete discharge to surface waters of the State is prohibited.
- Obtain written approval from Ecology before using chemical treatment other than CO2 or dry ice to adjust pH.

Element 10: Control De-Watering

- Discharge foundation, vault, and trench de-watering water, which has similar characteristics to stormwater runoff at the site, into a controlled conveyance system before discharge to a sediment trap or sediment pond.
- Discharge clean, non-turbid de-watering water, such as well-point ground water, to systems tributary to, or directly into surface waters of the State, as specified in Element #8, provided the de-watering flow does not cause erosion or flooding of receiving waters. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the State" may exist on a construction site as well as off site; for example, a creek running through a site.
- Handle highly turbid or otherwise contaminated dewatering water separately from stormwater.
- Other treatment or disposal options may include:
    1. Infiltration.

2. Transport off-site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.
3. Ecology-approved on-site chemical treatment or other suitable treatment technologies.
4. Sanitary or combined sewer discharge with local sewer district approval, if there is no other option.
5. Use of a sedimentation bag that discharges to a ditch or swale for small volumes of localized dewatering.

Element 11: Maintain BMPs

- Maintain and repair all temporary and permanent erosion and sediment control BMPs as needed to assure continued performance of their intended function in accordance with BMP specifications.
- Remove all temporary erosion and sediment control BMPs within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

Element 12: Manage the Project

- Phase development projects to the maximum degree practicable and consider seasonal work limitations.
- Inspection and monitoring – Inspect, maintain and repair all BMPs as needed to assure continued performance of their intended function. Projects regulated under the Construction Stormwater General Permit must conduct site inspections and monitoring in accordance with Special Condition S4 of the Construction Stormwater General Permit.
- Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP.
- Projects that disturb one or more acres must have site inspections conducted by a Certified Erosion and Sediment Control Lead (CESCL). Project sites disturbing less than one acre may have a CESCL or a person without CESCL certification conduct inspections. By the initiation of construction, the SWPPP must identify the CESCL or inspector, who must be present onsite or on-call at all times.
- The CESCL or inspector (project sites less than one acre) must have the skills to assess the:
    - Site conditions and construction activities that could impact the quality of stormwater.
    - Effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
- The CESCL or inspector must examine stormwater visually for the presence of suspended sediment, turbidity, discoloration, and oil sheen. They must evaluate the effectiveness of BMPs and determine if it is necessary to install, maintain, or repair BMPs to improve the quality of stormwater discharges.
- Based on the results of the inspection, construction site operators must correct the problems identified by:
    - Reviewing the SWPPP for compliance with the 13 construction SWPPP elements and making appropriate revisions within seven (7) calendar days of the inspection.
- Immediately beginning the process of fully implementing and maintaining appropriate source control and/or treatment BMPs as soon as possible, addressing the problems not

later than within 10 days of the inspection. If installation of necessary treatment BMPs is not feasible within 10 days, the construction site operator may request an extension within the initial 10day response period.

- Documenting BMP implementation and maintenance in the site log book (sites larger than 1 acre).
- The CESCL or inspector must inspect all areas disturbed by construction activities, all BMPs, and all stormwater discharge points at least once every calendar week and within 24 hours of any discharge from the site. (For purposes of this condition, individual discharge events that last more than one day do not require daily inspections. For example, if a stormwater pond discharges continuously over the course of a week, only one inspection is required that week.) The CESCL or inspector may reduce the inspection frequency for temporary stabilized, inactive sites to once every calendar month.

Element 13: Protect Low Impact Development BMPs

- Protect all Bioretention and Rain Garden BMPs from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden BMPs. Restore the BMPs to their fully functioning condition if they accumulate sediment during construction. Restoring the BMP must include removal of sediment and any sediment-laden Bioretention/rain garden soils, and replacing the removed soils with soils meeting the design specification.
- Prevent compacting Bioretention and rain garden BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
- Control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements or base materials.
- Pavement fouled with sediments or no longer passing an initial infiltration test must be cleaned using procedures in accordance with this manual or the manufacturer’s procedures.
- Keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.

SECTION 7 – SPECIAL REPORTS AND STUDIES

A Sieve Analysis was performed on the project by Fuller Designs, which evaluated the infiltration rates within the project site. This report is included below. A field investigation was performed to determine existing water wells in the vicinity of the project, findings have been included in this section. Infiltration receptor characterization study was prepared for the project, and it has been included in this section.

Deskin Grand Mound Site

Rochester, WA

Sieve Analysis

Fuller Designs Project No. 2032

June 23, 2021

Prepared by:

FULLER DESIGNS

1101 Kresky Ave, Centralia, WA 98531; (360) 807-4420

Sieve Analysis Results

Sieve Analysis Data Sheet

ASTM D422-63(2007)

Project Name:	Deskins - 198th street	**Tested By:**	N/A	**Date:**	5/19/2021
Location:	Ground Mound, WA	**Checked By:**	N/A	**Date:**	5/19/2021
Boring No:	1	**Test Number:**	1		
Sample Depth:	10'	**Gnd Elev.:**	n/a		

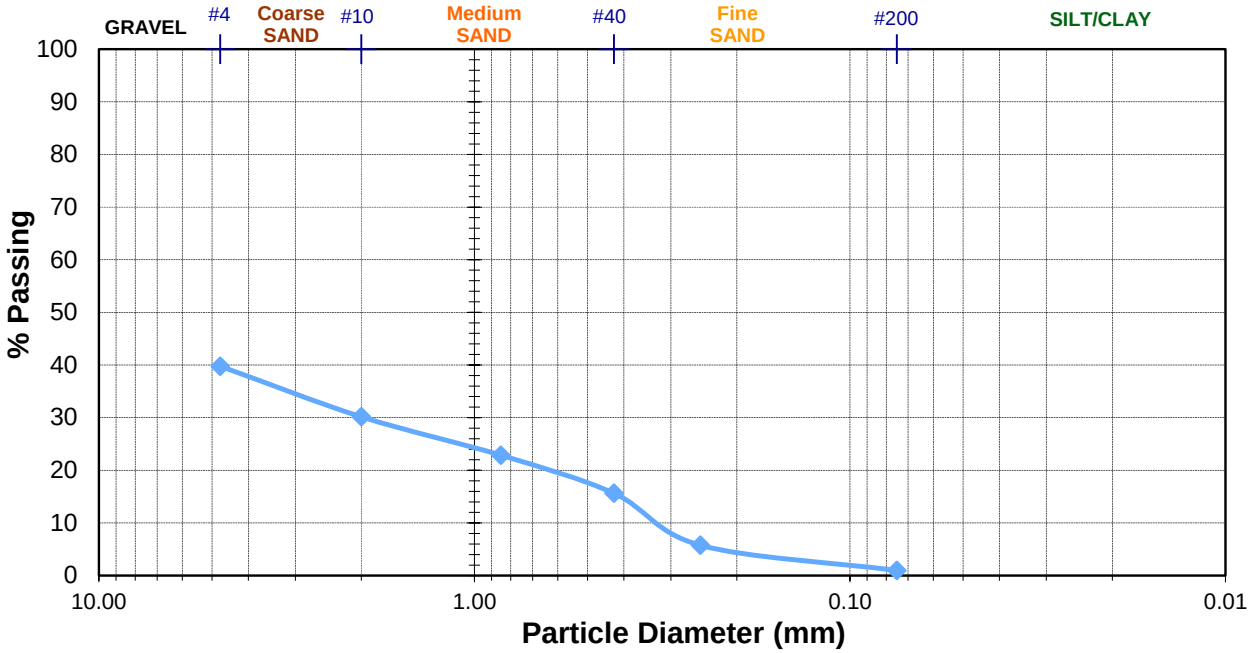
USCS Soil Classification: GW or GP

Notes:

Weight of Container (g): 165.2 **Weight of Container & Soil (g):** 749.1

Weight of Dry Sample (g): 583.9

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
#4	4.75	485.9	837.7	351.8	60.3	39.7
#10	2.00	452.8	508.8	56.0	9.6	30.2
#20	0.85	383.1	425.8	42.7	7.3	22.8
#40	0.43	346.7	388.8	42.1	7.2	15.6
#60	0.25	329.2	386.9	57.7	9.9	5.8
#200	0.075	315	343	28.0	4.8	1.0
Pan		348.1	353.4	5.3	0.9	0.0
			TOTAL:	**583.6**	**99.9**	



Grain Size Distribution Curve Results:

% Gravel:	60.3	**D_{10}:**	0.3	**Short-K_{sat}:**	93.43
% Sand:	38.8	**D_{30}:**	2	**Long-K_{sat}:**	25.23
% Fines:	0.9	**D_{60}:**	7		
		D_{90}:	10		
		fines	0.075		

Saturation Correction Factors

CF_v:	0.8
CF_t:	0.4
CF_m:	0.9
CF_T:	0.27

Infiltration Rate Adjustment Calculations

Calculate the Hydraulic Gradient

The steady state hydraulic gradient (i) is calculated as follows:

$$i = \frac{D_{wt} + D_{pond}}{138.62(K^{0.1})} \times CF_{size} \qquad (3)$$

Note: The units in this equation vary from the units normally used in this manual.

Where:

D_{wt} is the depth from the base of the infiltration facility to the water table in feet

K is the saturated hydraulic conductivity in feet/day

D_{pond} is the depth of water in the facility in feet (see Massmann et al. 2003, for the development of this equation)

CF_{size}, is the correction for pond size. The correction factor was developed for ponds with bottom areas between 0.6 and 6 acres in size. For small ponds (ponds with area less than or equal to 2/3 acre), the correction factor is equal to 1.0. For large ponds (ponds with area greater than or equal to 6 acres), the correction factor is 0.2, as shown in Equation 4.

$$CF_{size} = 0.73(A_{pond})^{-0.76} \qquad (4)$$

Dwt=	30	ft
Dpond =	4	
K=	93.43	in/hr
K=	186.86	ft/day
i=	0.145379	

FROM ADJECENT WATER WELL DATA

Adjustment for Pond Aspect Ratio

Adjust the infiltration rate for the effect of pond aspect ratio by multiplying the infiltration rate determined above by the aspect ratio correction factor CF_{aspect} as shown in the following equation:

$$CF_{aspect} = 0.02A_r + 0.98 \qquad (6)$$

Where, A_r is the aspect ratio for the pond (length/width). In no case shall CF_{aspect} be greater than 1.4. The final infiltration rate will therefore be as follows:

$$f = K \times i \times CF_{aspect} \times CF_{silt/bio} \qquad (7)$$

The rates calculated based on Equation 7 are long-term design rates. No additional reduction factor or factor of safety is needed.

Table A.3. Infiltration Rate Reduction Factors to Account for Biofouling and Siltation Effects for Ponds (Massmann, 2003)

Potential for Biofouling	Degree of Long-Term Maintenance/Performance Monitoring	Infiltration Rate Reduction Factor, $CF_{silt/bio}$
Low	Average to High	0.9
Low	Low	0.6
High	Average to High	0.5
High	Low	0.2

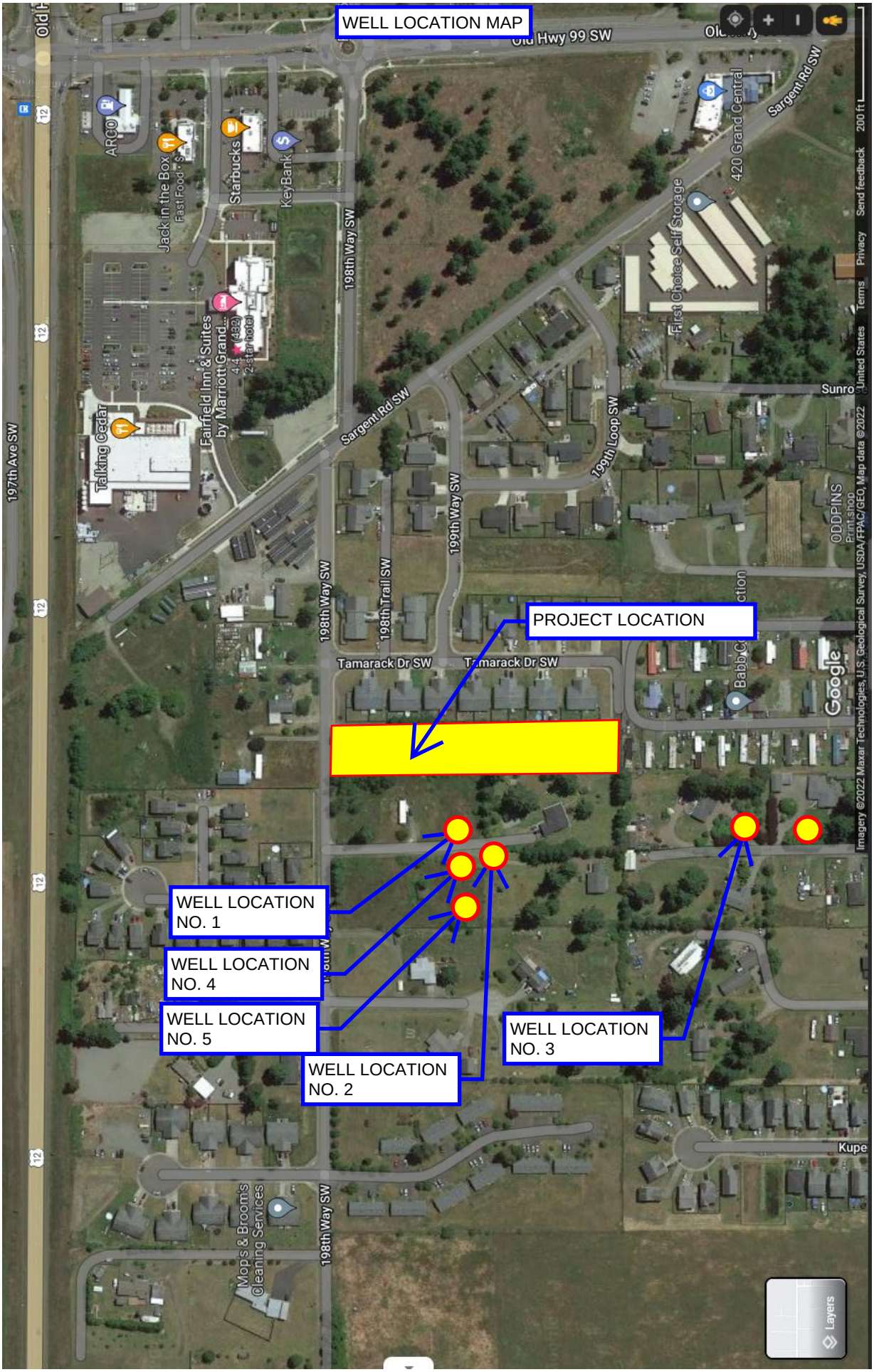
CF size =	1.00		
CF silt/bio=	0.6		
f=	22.819	ft/day	
f=	11.4095	in/hr	Design Infiltration Rate

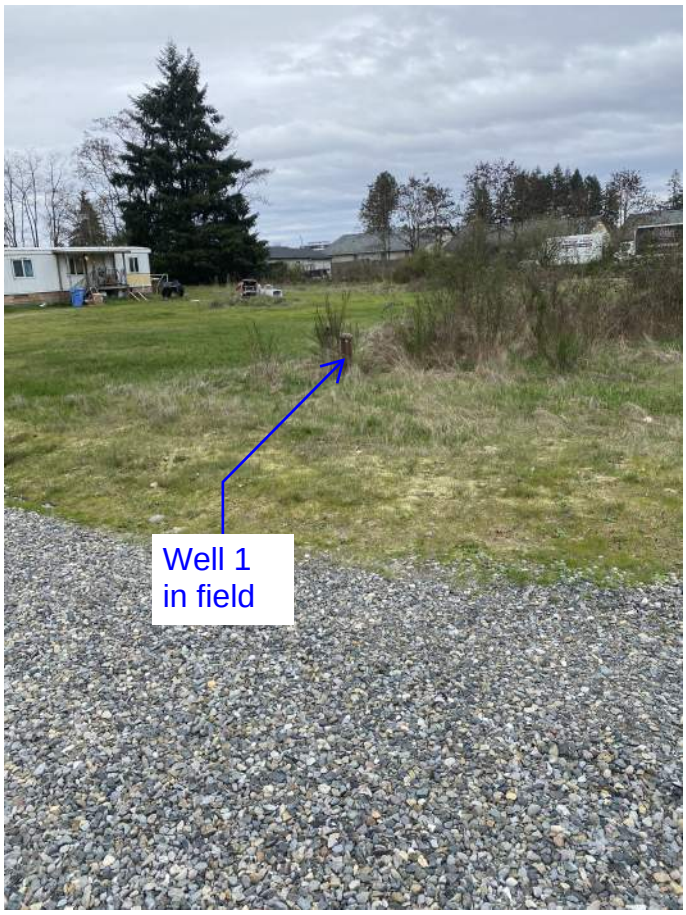
MIN. INFILTRATION RATE TO BE USED FOR INFILTRATION TRENCH SIZING

Soil Sample Photos

TEST PIT LOCATION MAP
NTS


197th Ave SW
Talking Cedar
ARCO
Jack in the Box
Fast Food · $
Fairfield Inn & Suites by Marriott Grand...
4.4 (432)
2-star hotel
Starbucks
KeyBank
Mop's & Broom's Cleaning Services
Aspenwood Ct SW
198th Way SW
198th Way SW
198th Way SW
198th Way SW
Sargent Rd SW
Tamarack Dr SW
198th Trail SW
199th Way SW
Tamarack Dr SW
PROJECT LOCATION
199th Loop SW
Old Hwy 99 SW
First Choice Self Storage
420 Grand Central
Babb Cons
Sargent Rd SW
Layers
Google
ODDPINS
Print shop
Imagery ©2022 Maxar Technologies, U.S. Geological Survey, USDA/FPAC/GEO, Map data ©2022
United States
Terms
Privacy
Send feedback
200 ft
VICINITY MAP


WELL LOCATION MAP
PROJECT LOCATION
WELL LOCATION NO. 1
WELL LOCATION NO. 4
WELL LOCATION NO. 5
WELL LOCATION NO. 2
WELL LOCATION NO. 3
Old Hwy 99 SW
Sargent Rd SW
198th Way SW
199th Way SW
199th Loop SW
198th Trail SW
Tamarack Dr SW
197th Ave SW
Jack in the Box
Starbucks
KeyBank
Fairfield Inn & Suites by Marriott Grand...
Talking Cedar
First Choice Self Storage
420 Grand Central
Sunro
Kupe
Mop's & Brooms Cleaning Services
Google


Well 1
in field


Well 2 next to driveway in
small decorative structure


Well 3
in well
house


Well 4
in field


Well 5
in field

WATER TABLE DATA

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

Construction/Decommission *("x" in circle)*

○ Construction

⊗ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* 190922

CURRENT
Notice of Intent No. A125903

Unique Ecology Well ID Tag No. _____

Water Right Permit No. _____

Property Owner Name Carl Teitge Investments

Well Street Address 6435 SW 291st

City Rochester County Thurston

Location NW 1/4-1/4 SE 1/4 Sec 11 Twn 15N R 3 EWM or WWM (circle one)

Lat/Long (s, t, r Still **REQUIRED**) Lat Deg _____ Lat Min/Sec _____

Long Deg _____ Long Min/Sec _____

Tax Parcel No. 513033 000 000

PROPOSED USE: ☑ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☐ Other _____

TYPE OF WORK: Owner's number of well (if more than one) 1

☐ New well ☐ Reconditioned *Method:* ☐ Dug ☐ Bored ☐ Driven ☐ Deepened Decomission ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled _____ ft.
Depth of completed well 55 ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded _____" Diam. from _____ ft. to _____ ft.
☐ Liner installed _____" Diam. from _____ ft. to _____ ft.
☐ Threaded _____" Diam. from _____ ft. to _____ ft.

Perforations: ☐ Yes ☐ No
Type of perforator used _____
SIZE of perfs _____ in. by _____ in. and no. of perfs _____ from _____ ft. to _____ ft.

Screens: ☐ Yes ☐ No ☐ K-Pac Location _____
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ from _____ ft. to _____ ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☐ No ☐ Size of gravel/sand _____
Materials placed from _____ ft. to _____ ft.

Surface Seal: ☐ Yes ☐ No To what depth? _____ ft.
Material used in seal _____
Did any strata contain unusable water? ☐ Yes ☐ No
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

PUMP: Manufacturer's Name _____
Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level _____ ft.
Static level 34 ft. below top of well Date 12-7-05
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom? _____
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? ☐ Yes ☐ No

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Top Soil	0	2
Clay cobble		
Gravel	2	55
Decommission		

USE TO ESTIMATE DEPTH OF TRENCH BOTTOM TO WATER

RECEIVED
MAR 01 2006
DEPARTMENT OF ECOLOGY
WELL DRILLING UNIT

DEPT OF ECOLOGY FEB 27 AM 9:11

Start Date 12-7-05 Completed Date 12-7-05

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☑ Driller ☐ Engineer ☐ Trainee Name (Print) Rick Vernon

Driller/Engineer/Trainee Signature _____

Driller or trainee License No. 2067

Drilling Company Vernon's Well Drilling

Address 463 Meier Rd.

City, State, Zip Winlock Wa 98596

Contractor's Registration No. VERNOWD088MP Date 12-7-05

If TRAINEE,
Driller's Licensed No. _____
Driller's Signature _____

Ecology is an Equal Opportunity Employer.

SOIL SURVEY

Thurston County Area, Washington

110—Spanaway gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2ndb6
Elevation: 330 to 1,310 feet
Mean annual precipitation: 35 to 65 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Spanaway and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Spanaway

Setting

Landform: Terraces, outwash plains
Parent material: Volcanic ash over gravelly outwash

Typical profile

H1 - 0 to 15 inches: gravelly sandy loam
H2 - 15 to 20 inches: very gravelly loam
H3 - 20 to 60 inches: extremely gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Forage suitability group: Droughty Soils (G002XS401WA)
Other vegetative classification: Droughty Soils (G002XS401WA)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 14, Jun 4, 2020

Soil Map—Thurston County Area, Washington
(Deskins)

Map Scale: 1:1,510 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 14, Jun 4, 2020

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

Date(s) aerial images were photographed: Mar 29, 2016—Oct 10, 2016

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
110	Spanaway gravelly sandy loam, 0 to 3 percent slopes	8.4	100.0%
Totals for Area of Interest		**8.4**	**100.0%**

Appendix I-D
Facility Summary Form

THURSTON COUNTY
FACILITY SUMMARY FORM

Complete one (1) for each facility on the project site including flow control and water quality treatment facilities (BMPs) such as, but not limited to: detention ponds, vaults, or tanks; infiltration ponds, trenches, swales, or vaults; bioretention facilities (rain gardens, bioretention swales/slopes); biofiltration BMPs (filter strip, biofiltration swale); oil/water separators; wet ponds; constructed wetlands; dispersion areas & flow spreaders; StormFilters™ & other proprietary devices; sand filters; etc. Attach 8 1/2 x 11 sketch showing location of facility. Applicant may prepare one copy of pages 1 to 4 for the project and then attach multiple copies of pages 5 & 6 for each separate facility.

Facility Name or Identifier (e.g., Pond A): Infiltration Trench 1, Infiltration Trench 2, Contech Cartridge Catch Basin Filters

Total Number of Facilities Associated with Project: 6
(For which a Facility Summary Form is being prepared)

Name of Road or Street to Access Facility: 198TH WAY AND 200TH AVE

Name of Nearest Major Cross Street: 198TH WAY

Hearings Examiner Case Number: _____

Thurston County Project No./Bldg Permit No.: PROJECT #2021106455

Parcel Number(s): PARCEL #51300100000

To be completed by Utility Staff:

Utility Facility Number _____

Project Number (num) _____

Parcel Number Status, (num, 1ch) _____
(0, Known; 1, Public; 2 Unknown; 3, Unassigned)

Basin and Subbasin: (num, 6ch) _____ _____ _____
(2ch for basin, 2ch for subbasin, 2ch future)

Part 1 - Project Name and Proponent

Project Name: DESKIN GRAND MOUND SITE

Project Owner: DESKINS, RYAN

Project Contact: DESKINS, RYAN

Address: 1951 STATE ROUTE 6, CHEHALIS, WA 98532

Phone: _____

Project Proponent: (if different) _____

Address: _____

Phone: _____

Project Engineer: AARON L. FULLER

Firm: FULLER DESIGNS, INC. **Phone:** (360) 807-4420

Part 2 - Project Location

Section 11

Township 15

Range 3W

Names and Addresses of Adjacent Property Owners: (attach add'l sheet if required)

GILGAL HOMES, LLC 6431 198TH AVE.

MASSEY, JEREMY D & DANIELLE E 6507 198TH AVE.

PRAIRIE PINES, LLC 6410 201ST AVE.

TAMARACK, LLC I:

19901-19903 TAMARACK DR, 19843-19845 TAMARACK DR,19835-19837 TAMARACK DR,19927-19929 TAMARACK DR, 19821-19823 TAMARACK DR, 19815-19817 TAMARACK DR, 19809-19811 TAMARACK DR

Part 3 - Type of Permit Application

Type of permit (e.g., Building, Plat, etc.): _____

Other Permits (circle)

WDFW HPA	**COE 404**	**COE Wetlands**
DOE Dam Safety	**FEMA Floodplain**	**Shoreline Mgmt**
Rockery/Retaining Wall	**Encroachment**	**Grading**
NPDES Construction Storm	**NPDES Industrial**	**Forest Practices/Clearing**

Other _____

Other Agencies (Federal, State, Local, etc.) that have had or will review this Drainage and Erosion Control Plan:

Part 4 - Proposed Project Description

What stream/lake/saltwater basin is this project in (e.g., Salmon, Green Cove, Woodland):

PROJECT IS TRIBUTARY TO THE CHEHALIS RIVER

Project Area, acres (total area of all parcels) 1.62

Project Area Disturbed, acres (total of all areas disturbed by project) 1.62
(Include all area cleared, graded, etc. as part of this project)

Onsite Impervious Surfaces: *(excluding offsite public / private street frontage).*

Existing Impervious Surface, acres: 0.05

Replaced Impervious Surface, acres: 0.00

Existing Impervious Converted to Landscape, acres: 0.00

New Impervious Surface, acres: 0.36

Total Impervious, acres (existing, new, and replaced): 0.36

Zoning: R3-6/1

Onsite:

Residential Subdivision:

Number of Lots: 7

Lot size (average), acres: 0.23

Building Permit/Commercial Plat:

Building(s) Footprint, acres: 0.28

Concrete Paving, acres: 0.08

Gravel Surface, acres: 0.00

Lattice Block or Porous Paving, acres: 0.00

New Public Roads (including gravel shoulder), acres: 0.03

New Private Roads (including gravel shoulder), acres: 0.28

Frontage Improvements (including gravel shoulder), acres: 0.10

Existing road frontage to center of right-of-way, acres: 0.08

Part 5 - Pre-Developed Project Site Characteristics

Stream through site, y/n: NO

Name: N/A

DNR Type: N/A

Type of feature this facility discharges to (i.e., lake, stream, intermittent stream, pothole, roadside ditch, sheet flow to adjacent private property, etc:
N/A

Swales, Ravines, y/n: N/A

Steep slopes, (steeper than 15%) y/n: N/A

Erosion hazard, y/n: N/A
(soil types classified "highly erodible" by NRCS soil survey)

100 yr. Floodplain, y/n: N/A

Lakes or Wetlands, y/n: N/A

Seeps/Springs, y/n: N/A

High Groundwater Table, y/n: NO
(depth to seasonal high groundwater table less than 5-feet)

Wellhead Protection or Aquifer Sensitive Area, y/n: N/A

Other: _____

BASIN 1 - INFILTRATION TRENCH

Part 6 - Facility Description

Facility Type: INFILTRATION TRENCH

Facility Description:

INFILTRATION TRENCH CONSISTING OF 510 LF. INFILTRATION TRENCH IS 36" WIDE, 48" DEEP. 6" PERFORATED PIPE WILL BE PLACED WITHIN THE TRENCH. CONTECH CONCRETE CATCH BASINS WILL BE PLACED UPSTREAM OF THE INFILTRATION TRENCH TO PROVIDE RUNOFF TREATMENT.

Total Area Tributary to Facility Including Offsite (acres): 1.58

Total Onsite Area Tributary to Facility (acres): 1.58

Design Impervious Area Tributary to Facility (acres): 0.64

Design Landscaped Area Tributary to Facility (acres): 0.94

Design Native Vegetation Area Tributary to Facility (acres): 0.00

Design Total Tributary Area to Facility (acres): 1.58

Water Quality Design Volume: N/A

Water Quality Design Flow: 0.089 CFS

100 Year return interval, 24-hr Design Flow: 0.00 CFS

Part 7 - Release to Groundwater (if applicable)

Design Infiltration Rate 11.4 **in/hr**

Average Annual Infiltration per WWHM 100%

Designed for 100% Infiltration Y/N: Y

Designed for Infiltration Treatment Y/N: N

Part 8 - Release to Surface Water (if applicable) N/A

Discharge Structure: (check all that apply)

Single orifice _____ **Elev.** _____ **Dia.** _____

Multiple orifice _____ **Elev. 1** _____ **Dia.** _____

Elev. 2 _____ **Dia.** _____

Elev. 3 _____ **Dia.** _____

Weir _____ **Elev.** _____ **Type** _____

Overflow Weir _____ Elev. _____ Dia/Width: _____

Spillway _____ Elev. _____ Max Elev. _____

Pump(s) _____ Model/Type: _____ Rating: _____

Other _____

Discharge to surface water:

Return Period	**Pre Developed:**	**Post Developed:**
2 year:	0.05	0
5 year:	0.13	0
10 year:	0.20	0
25 year:	0.33	0
50 year:	0.47	0
100 year:	0.65	0

Pond Information: N/A

Design Max surface water elevation: _____ ft (msl)

Design Maximum pond depth: _____ ft

Pond Volume at Max design water level:_____ cubic feet

Overflow water elevation: _____ ft (msl)

Sediment storage volume: _____ft (depth below outlet)

BASIN 2 - INFILTRATION TRENCH

Part 6 - Facility Description

Facility Type: INFILTRATION TRENCH

Facility Description:

INFILTRATION TRENCH CONSISTING OF 510 LF. INFILTRATION TRENCH IS 36" WIDE, 30" DEEP. 6" PERFORATED PIPE WILL BE PLACED WITHIN THE TRENCH. CONTECH CONCRETE CATCH BASINS WILL BE PLACED UPSTREAM OF THE INFILTRATION TRENCH TO PROVIDE RUNOFF TREATMENT.

Total Area Tributary to Facility Including Offsite (acres): 0.10

Total Onsite Area Tributary to Facility (acres): 0.10

Design Impervious Area Tributary to Facility (acres): 0.05

Design Landscaped Area Tributary to Facility (acres): 0.05

Design Native Vegetation Area Tributary to Facility (acres): 0.00

Design Total Tributary Area to Facility (acres): 0.10

Water Quality Design Volume: N/A

Water Quality Design Flow: 0.0065 CFS

100 Year return interval, 24-hr Design Flow: 0.00 CFS

Part 7 - Release to Groundwater (if applicable)

Design Infiltration Rate 11.4 **in/hr**

Average Annual Infiltration per WWHM 100%

Designed for 100% Infiltration Y/N: Y

Designed for Infiltration Treatment Y/N: N

Part 8 - Release to Surface Water (if applicable) N/A

Discharge Structure: (check all that apply)

Single orifice _____ **Elev.** _____ **Dia.** _____

Multiple orifice _____ **Elev. 1** _____ **Dia.** _____

Elev. 2 _____ **Dia.** _____

Elev. 3 _____ **Dia.** _____

Weir _____ **Elev.** _____ **Type** _____

Overflow Weir _____ Elev. _____ Dia/Width: _____

Spillway _____ Elev. _____ Max Elev. _____

Pump(s) _____ Model/Type: _____ Rating: _____

Other _____

Discharge to surface water:

Return Period	**Pre Developed:**	**Post Developed:**
2 year:	0.00	0
5 year:	0.00	0
10 year:	0.01	0
25 year:	0.02	0
50 year:	0.03	0
100 year:	0.05	0

Pond Information: N/A

Design Max surface water elevation: _____ ft (msl)

Design Maximum pond depth: _____ ft

Pond Volume at Max design water level:_____ cubic feet

Overflow water elevation: _____ ft (msl)

Sediment storage volume: _____ft (depth below outlet)

Maintenance Agreement

Fuller Designs Project No. 2032

June 23, 2021

Prepared by:

1101 Kresky Ave, Centralia, WA 98531 (360) 807-4420

AFTER RECORDING RETURN TO:

_____

_____

_____

PLEASE PRINT OR TYPE ALL INFORMATION

DOCUMENT TITLE(S) (OR TRANSACTIONS CONTAINED THEREIN):

Stormwater Maintenance Agreement

REFERENCE NUMBER(S) OF DOCUMENTS ASSIGNED/RELEASED:

_____

GRANTOR/BORROWER (LAST NAME FIRST, FIRST NAME AND INITIALS):

Deskins Ryan

_____

ADDITIONAL NAMES LISTED ON PAGE N/A OF DOCUMENT.

GRANTEE/ASSIGNEE/BENEFICIARY (LAST NAME FIRST, FIRST NAME AND INITIALS):

County of Washington, Thurston

_____

ADDITIONAL NAMES LISTED ON PAGE N/A OF DOCUMENT.

LEGAL DESCRIPTION (ABBREVIATED: I.E. LOT, BLOCK, PLAT OR SECTION, TOWNSHIP, RANGE)

Section 11 Township 15 Range 3W Quarter NE SE Plat GRAND VALLEY FRUIT & GARDEN TRACTS SS-2043 LT 1

_____

COMPLETE LEGAL DESCRIPTION IS LISTED ON PAGE N/A OF DOCUMENT.

ASSESSOR'S TAX PARCEL NUMBER(S)

51300100000

THE AUDITOR/RECORDER WILL RELY ON THE INFORMATION PROVIDED ON THIS FORM. THE STAFF WILL NOT READ THE DOCUMENT TO VERIFY THE ACCURACY OR COMPLETENESS OF THE INDEXING INFORMATION PROVIDED HEREIN.

Parcel Number(s): 51300100000
Project Name: Deskin Grand Mount Site
Address: 6411 198TH Ave SW, Rochester, WA 98579

THIS AGREEMENT, made this _____ day of _____, 20__, by and between Angie Boggs , hereinafter referred to as the "Owners(s)" of the following property and Lewis County hereinafter referred to as the "County".

WITNESSETH, that

WHEREAS, Owner has submitted for approval by County a permit application and Site Plan for the construction and installation of stormwater management facilities pursuant to County Code chapter 15.45; and

WHEREAS, the County Code requires, as a condition of permit approval, a maintenance agreement between the County and the Owner ensuring the Owner constructs and maintains the stormwater facilities identified in the Site Plan.

THEREFORE, the Owner of certain real property, with full authority to execute deeds, mortgages, other covenants, do hereby covenant with the County and agree as follows:

1. Owner shall construct and install stormwater management facilities as depicted and shown on the Record Drawings for the above referenced parcel number(s)

2. Owner shall continuously maintain the stormwater management facilities as shown on the Site Plan in good working order and as specified in the maintenance schedule.

3. Owner hereby grants County, its authorized agents and employees, to enter onto the Property to inspect the stormwater facilities pursuant to Chapter 15.45 of the County Code.

4. In the event Owner fails to maintain the stormwater management facilities as shown on the Site Plan in good working order acceptable to the County, the County may enter the Property and take whatever steps deemed necessary and appropriate to maintain (including repair or replace) said stormwater facilities. It is expressly understood and agreed that the County is under no obligation to maintain or repair or replace said facilities, and in no event shall this Agreement be construed to impose such an obligation on the County.

5. In the event that the County performs work of any nature pursuant to section 4 of this agreement or expends any funds in performance of such work for labor, equipment, supplies or materials, Owner shall reimburse County for all reasonable costs incurred. Owner, its executors, administrators, assigns, heirs, and any other successors in interest, shall reimburse County for all costs within thirty (30) days of Owner's receipt of written

demand by the County for reasonable costs incurred, including but not limited to attorney fees, collection costs, and interest at the statutory rate.

6. It is the intent of this Agreement to ensure the continuous and proper maintenance of stormwater management facilities by the Owner, its heirs, successors and assigns; provided, however, that this Agreement shall not be deemed to create or affect any additional liability of any party for damage alleged to result from or caused by stormwater management.

7. Owner, its executors, administrators, assigns, and any other successors in interest, shall indemnify and hold the County, its agents and employees harmless from any and all damages, accidents, casualties, occurrences, or claims which might arise or be asserted against County, its agents or employees, from the construction, presence, existence, or maintenance, of the stormwater management facilities by Owner.

8. This Agreement shall be recorded among the land records of Lewis County, Washington, and shall constitute a covenant running with the land, and shall be binding upon Owner, its administrators, executors, assigns, heirs, and any other successor in interest.

_____
Name (Signature)

_____
Name (Print)

_____
Title

_____
Date

State of Washington

County of _____

I certify that I know or have satisfactory evidence that _____ (name of person) is the person who appeared before me, and said person acknowledged that (he/she) signed this instrument and acknowledged it to be (his/her) free and voluntary act for the uses and purposes mentioned in the instrument.

Dated:_____

(Seal or stamp)

_____
Signature

_____
Title

My appointment expires:_____

Operation and Maintenance Manual

Fuller Designs Project No. CD- 2032

June 23, 2021

Prepared by:

1101 Kresky Ave, Centralia, WA 98531 (360) 807-4420

SECTION 8 – OPERATION AND MAINTENANCE MANUAL

The Following pages contain maintenance needs for most of the components that are part of your drainage system, as well as components that you may not have. Let us know if there are any components that are missing from these pages. Ignore the requirements that do not apply to your system. You should plan to complete a checklist for all system components on the following schedule

1. Monthly from November through April
2. Once in late summer (preferably September).
3. After any major storm (use 1" of precipitation in 24 hours) for any items marked "S".

Using photocopies of these pages, check off the items you looked for after each inspection. Add comments on issues found and actions taken. Keep these records in your files. These files will be needed to write your annual report if required. Some items may not need to be looked at every time an inspection is done. Use the suggest frequency at the left of each item as a guideline for your inspection.

You may call the jurisdiction for technical assistance. Please do not hesitate to call, especially if you are unsure whether a situation you have discovered may be a developing issue.

CONTECH®
ENGINEERED SOLUTIONS

OPERATION AND MAINTENANCE

CatchBasin StormFilter™

Important: These guidelines should be used as a part of your site stormwater plan.

Overview

The CatchBasin StormFilter™ (CBSF) consists of a multi-chamber steel, concrete, or plastic catch basin unit. The steel CBSF is offered both as a standard and as a deep unit for additional internal overflow and sediment capacity.

The CBSF is installed flush with the finished grade and is applicable for both constrained lot and retrofit applications. Steel and concrete units can accept surface and piped influent for roof leaders or similar applications.

The steel, concrete and plastic CBSF units have capacities of 4, 8 and 2 cartridges, respectively. Internal overflow capacity varies by system type from 0.5 cfs for the plastic, 1.3 cfs for the concrete and 1.0 or 1.8 cfs for the steel unit.

Design Operation

The CBSF is installed as the primary receiver of runoff, similar to a standard, grated catch basin. The steel and concrete CBSF units have an H-20 rated, traffic bearing lid that allows the filter to be installed in parking lots, and for all practical purposes, takes up no land area. Plastic units can be used in landscaped areas or other non-traffic-bearing applications.

The steel CBSF consists of a sumped inlet chamber and cartridge chamber(s). Runoff enters the sumped inlet chamber either by sheet flow from a paved surface or from an inlet pipe discharging directly to the unit vault. The inlet chamber is equipped with an internal baffle, which traps debris and floating oil and grease, and an overflow weir. While in the inlet chamber, heavier solids are allowed to settle into the deep sump, while lighter solids and soluble pollutants are directed into the cartridge chamber through a port between the baffle and the overflow weir.

The concrete and plastic units operate similarly minus the presence of the inlet chamber or deep sump.

Once in the cartridge chamber, polluted water ponds and percolates horizontally through the media in the filter cartridges. Treated water collects in the cartridge's center tube from where it is directed to the outlet chamber and discharged to the outlet pipe on the downstream side of the overflow weir.

When influent flows exceed the water quality design value, excess water spills over the overflow weir, bypassing the cartridge bay, and discharges to the outlet pipe.

Applications

The CBSF is particularly useful where small flows are being treated or for sites that have little available hydraulic head. The unit is ideal for applications in which standard catch basins are to be used. Both water quality and catchment issues can be resolved with the use of the CBSF.

Retro-Fit

The retrofit market has many possible applications for the CBSF. The CBSF can be installed by replacing an existing catch basin without having to "chase the grade," thus reducing the high cost of re piping the storm system.

CatchBasin StormFilter™

Maintenance Guidelines

Maintenance procedures for typical catch basins can be applied to the CatchBasin StormFilter (CBSF). The filter cartridges contained in the CBSF are easily removed and replaced during maintenance activities according to the following guidelines.

1. Establish a safe working area as per typical catch basin service activity.
2. Remove steel grate and diamond plate cover (weight 100 lbs. each) or plastic grating.
3. Turn cartridge(s) approximately ¼ turn counter-clockwise to disconnect from pipe manifold.
4. Remove cartridge(s) from catch basin by hand or with appropriate hoisting equipment.
5. Remove accumulated sediment via vactor truck from all interior chambers.
6. Rinse interior of both bays and vactor remaining water and sediment.
7. Install fresh cartridge(s), by rotating ¼ turn clockwise, taking care not to damage cartridge connectors.
8. Replace cover(s).
9. Dispose of accumulated debris and spent media in accordance with local regulations.
10. Return used, empty cartridges to Contech for refurbishing.

Media may be removed from the filter cartridges using the vactor truck before the cartridges are removed from the catch basin structure once the top cap and hood are removed. The vactor truck must be equipped with a hose capable of reaching areas of restricted clearance.

Empty cartridges can be easily removed from the catch basin structure by hand. Empty cartridges should be reassembled and returned to Contech as appropriate.

Refurbished cartridges are available from Contech on an exchange basis. Contact the maintenance department of Contech at 513-645-7770 for more information.

Onsite maintenance is estimated at 26 minutes once setup for a single cartridge unit. Add approximately 5 minutes for each additional cartridge.

Mosquito Abatement

In certain areas of the United States, mosquito abatement is desirable to reduce the incidence of vectors.

In BMPs with standing water, which could provide mosquito breeding habitat, certain abatement measures can be taken.

1. Periodic observation of the standing water to determine if the facility is harboring mosquito larvae.
2. Regular catch basin maintenance.
3. Use of larvicides containing Bacillus thuringiensis israelensis (BTI). BTI is a bacterium toxic to mosquito and black fly larvae.

In some cases, the presence of petroleum hydrocarbons may interrupt the mosquito growth cycle.

Using Larvicides in the CatchBasin StormFilter

Larvicides should be used according to manufacturer's recommendations.

Two widely available products are Mosquito Dunks and Summit B.t.i. Briquets. For more information, visit https://www.amvac.com/products/summit-bti-briquets.

The larvicide must be in contact with the permanent pool. The larvicide should also be fastened to the CatchBasin StormFilter to prevent displacement by high flows. A magnet can be used with a steel catch basin.

For more information on mosquito abatement in stormwater BMPs, refer to the following: https://anrcatalog.ucanr.edu/pdf/8125.pdf.

#2 – Maintenance Checklist for Infiltration Basins and Trenches:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash and Debris	Any trash and debris which exceed five cubic feet per 1,000 square feet. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
General	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined in the Thurston County Noxious Weeds List. (Apply requirements of adopted integrated pest management policies for the use	No danger of poisonous vegetation where maintenance personnel or the public might normally be. *(Coordinate with Tacoma-Pierce County Health Department) Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies required.*
General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. *(Coordinate removal/cleanup with Thurston County Water Resources 360-754-4681 and/or Dept. of Ecology Spill Response 800-424-8802.)*
General	Rodent Holes	If the facility is constructed with a dam or berm, look for rodent holes or any evidence of water piping through the dam or berm.	Rodents removed and dam or berm repaired. *(Coordinate with Thurston County; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)*
General	Beaver Dams	Beaver dam results in an adverse change in the functioning of the facility.	Facility returned to design function. *(Contact WDFW Region 6 to identify the appropriate Nuisance Wildlife Control Operator)*
General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. *Apply insecticides in compliance with adopted integrated pest management policies.*
General	Performance	Check crest gauge against design expectations (see Maintenance and Source Control Manual).	Crest gauge results reflect design performance expectations. Reading recorded. County notified if not meeting design performance.
Crest Gauge	Crest Gauge Missing/ Broken	Crest gauge is not functioning properly, has been vandalized, or is missing.	Crest gauge present and functioning. Repair/replace crest gauge if missing or broken.
Storage Area	Water Not Infiltrating	Water ponding in infiltration basin after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90 percent of its designed capabilities. If 2 inches or more sediment is present, remove).	Facility infiltrates as designed. Sediment is removed and/or facility is cleaned so that infiltration system works according to design.

#2 – Maintenance Checklist for Infiltration Basins and Trenches:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than one-half full.	Filter bag less than one-half full. Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Water flows through filter. Replace gravel in rock filter if needed.
Trenches	Observation Well (Use Surface of Trench if Well is Not Present)	Water ponds at surface during storm events. Less than 90 percent of design infiltration rate.	Remove and replace/clean rock and geomembrane.
Ponds	Vegetation	Exceeds 18 inches.	Grass or groundcover mowed to a height no greater than 6 inches.
Ponds	Vegetation	Bare spots.	No bare spots. Revegetate and stabilize immediately.
Side Slopes of Pond	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. *If erosion is occurring on compacted slope, a professional engineer should be consulted to resolve source of erosion.*
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works.	Dike is built back to the design elevation. *If settlement is significant, a professional engineer should be consulted to determine the cause of the settlement.*
Pond Berms (Dikes)	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue.	No water flow through pond berm. Piping eliminated. Erosion potential eliminated. *Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.*
General	Hazard Trees	If dead, diseased, or dying trees are identified.	Hazard trees removed. (*Use a certified Arborist to determine health of tree or removal requirements).*
General	Tree Growth and Dense Vegetation	Tree growth and dense vegetation which impedes inspection, maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements).	Trees and vegetation do not hinder inspection or maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).

#2 – Maintenance Checklist for Infiltration Basins and Trenches:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Pond Berms (Dikes)	Tree Growth	Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees on berms removed. *If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A professional engineer should be consulted for proper berm/spillway restoration.*
Emergency Overflow/ Spillway	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees on emergency spillways removed. *If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A professional engineer should be consulted for proper berm/spillway restoration.*
Emergency Overflow/ Spillway	Rock Missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway.	Rocks and pad depth restored to design standards. (Riprap on inside slopes need not be replaced.)
Emergency Overflow/ Spillway	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. *If erosion is occurring on compacted berms a professional engineer should be consulted to resolve source of erosion.*
Presettling Ponds and Vaults	Facility or sump filled with Sediment and/or Debris	6 inches or designed sediment trap depth of sediment.	No sediment present in presettling pond or vault. Sediment is removed.
Drain Rock	Water Ponding	If water enters the facility from the surface, inspect to see if water is ponding at the surface during storm events. If buried drain rock, observe drawdown through observation port or cleanout.	No water ponding on surface during storm events. *Clear piping through facility when ponding occurs. Replace rock material/sand reservoirs as necessary. Tilling of subgrade below reservoir may be necessary (for trenches) prior to backfill.*

If you are unsure whether a problem exists, contact a professional engineer.

#5 – Maintenance Checklist for Catch Basins:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	"Dump no pollutants" (or similar) stencil or stamp not visible	Stencil or stamp should be visible and easily read.	Warning signs (e.g., "Dump No Waste-Drains to Stream" or "Only rain down the drain"/ "Puget Sound starts here") painted or embossed on or adjacent to all storm drain inlets.
General	Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inlet capacity by more than 10 percent.	No trash or debris located immediately in front of catch basin or on grate opening.
General	Trash and Debris	Trash or debris (in the basin) that exceeds 1/3 of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
General	Trash and Debris	Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.	Inlet and outlet pipes free of trash or debris.
General	Trash and Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
General	Sediment	Sediment (in the basin) that exceeds 1/3 of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.
General	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than one-fourth inch.	No holes and cracks in the top slab allowing material to run into the basin.
General	Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab, i.e., separation of more than three-fourth inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
General	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
General	Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than one-half-inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regrouted and secure at basin wall.
General	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
General	Vegetation	Vegetation growing across and blocking more than 10 percent of the basin opening.	No vegetation blocking opening to basin.

#5 – Maintenance Checklist for Catch Basins:

Drainage System Feature	Defect or Problem	Condition When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Vegetation	Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth present.
General	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. *(Coordinate removal/cleanup with Thurston County Water Resources 360-754-4681 and/or Dept. of Ecology Spill Response 800- 424-8802.)*
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is in place and secured.
Catch Basin Cover	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half-inch of thread.	Mechanism opens with proper tools.
Catch Basin Cover	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Grates	Grate Opening Unsafe	Grate with opening wider than seven-eighths of an inch.	Grate opening meets design standards.
Grates	Trash and Debris	Trash and debris that is blocking more than 20 percent of grate surface inletting capacity.	Grate free of trash and debris.
Grates	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

If you are unsure whether a problem exists, contact a professional engineer.

SECTION 9 – VERIFICATION OF PERFORMANCE AND CONTINGENCY PLAN

Property owner will schedule project engineer or designee to inspect the infiltration facilities before, during and after construction as necessary to ensure facilities are built to design specifications that proper procedures are employed in construction that the infiltration surface is not compacted and that protection from sedimentation is in place.

Verification testing will be completed during the first 1 to 2 years of operation. Observation wells will be provided for the infiltration trench to monitor performance. Verification testing will ensure that the infiltration facility operates as designed including configuration of estimated design infiltration rates. A facility monitoring and evaluation report will be provided to document the results of the verification testing.

In the event the infiltration facilities underperform, the infiltration trench within Basin will be increased in length to provide additional infiltration capacity. The infiltration trench can be extended approximately 40’ to the north and 40’ to the south. The proposed Infiltration trench within Basin 2 can be extended by an additional 45’to the east in the event the proposed size underperforms. In the event the infiltration facilities fail, runoff from the project site will overflow to 198th Street.

SECTION 10 – SOURCE CONTROL PLAN

The actions we take each day in and around our homes have a profound effect on surface water quality and fish habitat. Stormwater goes directly to our groundwater, lakes, streams, and to Puget Sound. It does not go to the wastewater treatment plant. Any pollutants that get into the stormwater go directly to surface or groundwater. Small amounts of pollution from many different sources can significantly affect our waterways. Stormwater BMPs discussed in this section are practical ways to keep stormwater from becoming polluted in the first place. Property owners in this subdivision will be educated and directed to use these BMPs.

This section provides a general list of activities conducted by home owners and describes the BMPs that may be required or recommended to prevent stormwater pollution. The list includes brief information on applicability. More detailed information for the BMPs described in this section can be found in the Thurston County Drainage Design and Erosion Control Manual, Volume IV or by contacting the Thurston County Storm and Surface Water Utility at (360) 754-4681. BMPs for the following activities are described in this section:

1. ***Automobile Washing***
2. ***Automobile Maintenance***
3. ***Storage of Solid Wastes and Food Wastes***
4. ***Composting***
5. ***Yard Maintenance and Gardening***
6. ***Swimming Pool and Spa Cleaning and Maintenance***
7. ***Household Hazardous Material use, Storage and Disposal***
8. ***Pet Waste Management***
9. ***Illicit Discharge Detection and Elimination***