murraysmith

CITY OF CAMAS

Lower Prune Hill Stormwater Site Plan

March 2022

Lower Prune Hill Stormwater Site Plan

City of Camas

March 2022

DRAFT

Murraysmith

1102 Broadway Plaza
Suite 401
Tacoma, WA 98402

DRAFT

THIS PAGE INTENTIONALLY LEFT BLANK

DRAFT

Table of Contents

Storm Drainage Report

DRAFT

THIS PAGE INTENTIONALLY LEFT BLANK

DRAFT

Storm Drainage Report

Section A - Project Overview

Murraysmith, Inc. (Murraysmith) has prepared a summary of the storm drainage design for the City of Camas (City) Lower Prune Hill Booster Pump Station and 0.5 million gallons (MG) Reservoir Improvements project. This project consists of replacing the 0.5 MG concrete reservoir with a new 0.5 MG welded steel reservoir, a new pump station and associated onsite water mains, a new asphalt access road, stormwater improvements, and landscaping. A 260-foot long retaining wall with a maximum height of approximately 17 feet will encompass the proposed reservoir and pump station. According to City of Camas Municipal Code (CMC) 14.02.030, the project is subject to the requirements of the most current edition of the City of Camas Design Standards Manual and the latest edition of the Department of Ecology Stormwater Management Manual for Western Washington (DOE SMMWW). This report provides a summary of the stormwater design and will be used by the City for permitting purposes.

The reservoir and pump station are located on approximately 1.93 acres of City-owned property near the intersection of NW 18th Loop and NW Ostensen Canyon Road. The site is bordered by NW 18th Loop to the south and east and by residential lots to the north and west. A portion of the northern property line also has frontage along NW 18th Avenue, near the corner of NW 18th Avenue and NW Edgehill Street. The site contains a pump station and two concrete reservoirs with storage capacities of 0.5 MG and 1.5 MG. There is a permanent standby generator south of the 1.5 MG reservoir and a wireless antennae facility in the southern portion of the site. The parcel boundary, access road, and existing facilities for the site are displayed in Figure 1.

DRAFT

Figure 1 | Site Overview

The site topography generally slopes from higher elevations at the northwest corner to lower elevations at the southeast corner of the site. The northwest corner of the site contains a gently sloped area with elevations between 480 and 490 feet, prior to dropping 25 feet to the area around the 1.5 MG reservoir at an approximate slope of 2H:1V. The elevation across the developed portion of the site containing the existing reservoirs and pump station varies between approximately 430 feet and 455 feet. The undeveloped portions of the site are constrained by steep slopes down to NW 18th Loop, with slopes between ¾H:1V and 1½H:1V. This topography and the existing storm drain shows the drainage from adjacent properties is collected in a catch basin north of the site limits, then is conveyed through the site with an existing storm drain. The site ground cover generally consists of mowed grass and shrubs.

The site is considered a single threshold discharge area (TDA); all the flow eventually collects in an existing 12-inch storm drain running northeast along NW 18th Loop in the City of Camas' storm drain system. The western portions of the site generally drain to an existing catch basin located between the two existing reservoirs. This connects to the existing reservoir drain lines that run south through the site before connecting to the storm drain system. The remaining area sheet flows east across the site to NW 18th Loop, where it enters the storm drain system via two adjacent catch basins north of the site.

A critical areas survey indicated that geological hazards exist on the project site where slopes exceed 25 percent and there are mapped areas of potential instability. Exhibit 1 located in Appendix A shows critical areas and existing drainage facilities. A subsequent geotechnical analysis showed low risk of deep-seated slope failure and observed no indications of surficial sloughing.

The stormwater design will avoid any infiltration to promote slope stability. There were no other critical areas indicated in the project site or vicinity.

The stormwater design is restricted by the steep slopes and limited working area. The stormwater runoff will generally follow the existing flow patterns before entering the City of Camas storm drain system. Maintaining the existing flow patterns and discharge points avoid impacts to adjacent areas.

Section B - Minimum Requirements

The amount of existing and new surfaces for the project is quantified in **Table 1** and shown in **Exhibit 2** located in **Appendix A.**

Table 1 | Existing and Proposed Areas

Surface	Area (Acre)	Area (SF)
Existing Impervious Surface	0.0163	708
Existing Impervious Surface Converted to Lawn/Landscaping	0.0163	708
New Impervious Surface	0.1409	6,136
Replaced Impervious Surface[1]	0.0513	3,601
Exempt Replaced Impervious Surface[1]	0.0469	2,045
Native Vegetation Converted to Lawn/Landscaping	0.0000	0
Native Vegetation Converted to Pasture	0.0000	0
Total Amount of Land Disturbed	0.4105	17,880

Note:
1. Excludes replaced impervious area related to underground utility improvements per I-3.2 of the 2019 SWMMWW.

Since the project results in greater than 7,000 square feet (SF) of total land disturbing area and adds greater than 5,000 SF of new hard surfaces, Minimum Requirements (MR) 1 through 9 apply to all hard surfaces.

The project will replace 2,045 SF of the existing hard surface with asphalt pavement due to installation of the proposed water mains, electrical conduit, and storm drains. As the proposed asphalt pavement has similar runoff characteristics to the existing surface and the replacement is a result of underground utility installation, this hard surface area is considered exempt from all minimum requirements except MR2, as described in Section I-3.2 Exemptions of the Stormwater Management Manual for Western Washington (SWMMWW) published in July 2019.

MR 1 – Preparation of Stormwater Site Plans

The required elements of the Stormwater Site Plans are provided through the Project Report, Construction Plans, and this storm drainage report.

DRAFT

MR 2 – Construction Storm Water Pollution Prevention (CSWPP)

A Construction SWPP plan (CSWPPP) has been prepared for this project and all 13 elements have been addressed in accordance with 2019 SWMMWW, which is included in a separate document. The CSWPPP is included in **Appendix B**.

MR 3 – Source Control of Pollution

Source control best management practices (BMPs) are identified through the CSWPPP for construction activities. Source control BMPs will also be used for the protection of on-site material and operational practices.

MR 4 – Preservation of Natural Drainage Systems and Outfalls

Flow is either collected onsite or sheet flows off the site to the locations where runoff currently flows. All flow will ultimately enter the City's existing storm drain on NW 18th Loop in the same location as the existing flow.

MR 5 – On-site Stormwater Management

According to Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment in the 2019 SWMMWW, the proposed site improvements will trigger MRs #1-9. MR 5 requires the implementation of stormwater management BMPs to all new and replaced impervious surfaces to the maximum extent practicable. If the project is exempt from MR 7, BMPs do not need to meet LID performance standard and can utilize LID BMPs from List #3. Since the project is exempt from MR 7 (as shown in **MR 7** of this Section), the feasibility of LID BMPs from List #3 have been considered.

Lawn and Landscape Areas

Post-Construction Soil Quality and Depth (BMP T5.13)

Response: Post-construction soil quality and depth was deemed **feasible**. Per the design guidelines for BMP T5.13, the project will retain soil to the maximum extent practicable. All other disturbed lawn and landscaped areas will be amended per BMP T5.13.

Roofs

Downspout Full Infiltration Systems (BMP T5.10A)

Response: A downspout full infiltration system was deemed **infeasible** due to the steep slopes on the site. Due to project space constraints, BMP T5.10A would be within 50-feet from the top and bottom of slopes greater than 40 percent. Additionally, infiltration could impact the slope stability as much of the project site is also within an erosion or landslide hazard zone as shown in **Exhibit 1**

in **Appendix A**. The Geotechnical Report included as **Appendix F** indicates that infiltration is not recommended for this project.

Downspout Dispersion Systems (BMP T5.10B)

Response: A downspout dispersion system was deemed **infeasible** due to the site space constraints and proximity to steep slopes. The outlet would be within 25 feet of impervious area and within 50-feet from the top and bottom of slopes greater than 40 percent.

Perforated Stub-Out Connections (BMP T5.10C)

Response: Perforated stub-out connections were deemed **infeasible** due to the steep slopes on the site. BMP T5.10C would be within 50-feet from the top and bottom of slopes greater than 40 percent. Additionally, any infiltration could impact the slope stability as much of the project site is also within an erosion hazard zone as shown in **Exhibit 1** in **Appendix A**.

Other Hard Surfaces

Sheet Flow Dispersion (BMP T5.12) or Concentrated Flow Dispersion (BMP T5.11)

Response: Both sheet flow and concentrated flow dispersion are deemed **infeasible** due to the steep slopes on the site. There is not sufficient flat area adjacent to the project hard surfaces for the required vegetated buffers, flow paths, and dispersion trenches before the slopes increase to 40 percent or greater.

MR 6 – Runoff Treatment

The 2019 SWMMWW definition of vehicular use states the replaced maintenance and access roads are not considered subject to regular vehicular use by motor vehicle since the they have restricted access and are infrequently used. This definition exempts the maintenance and access roads from being quantified as a "pollution-generating impervious surfaces". Section I-3.4.6 of the 2019 SWMMWW states sites with less than 5,000 SF of pollution-generating hard surfaces are exempt from MR 6. Since the project is not adding any new pollution-generating hard surfaces, the project is exempt from water quality treatment requirement.

MR 7 – Flow Control

Exhibit 2 located in **Appendix A** shows the proposed site improvements will result in a total of 9,737 SF of new plus replaced hard surfaces. According to the MR 7 of the 2019 SWMMWW, the project site is exempt from flow control if:

1. The total of effective impervious surfaces is less than 10,000 SF, AND

2. The area of vegetation conversion to lawn/landscape is less than ¾ acres, AND

3. The increase of flow rate in the 100-year recurrence interval flow frequency is less than 0.15-cfs using 15-minute time steps according to the WWHM modeling program.

The project improvements meet the first two exemption requirements. To determine if the project improvements also meet the third exemption, the existing and proposed conditions were modeled in the WWHM modeling program as specified by 2019 SWMMWW. The existing condition is the land cover that existed at the site as of a date when the local jurisdiction first adopted Flow Control requirements into code or rules. The existing 0.5 MG reservoir and access road was constructed on the project site in 1931, well before Camas adopted Flow Control requirements. Therefore, the existing condition land uses are based on the existing development on the site as shown in **Exhibit 3A** located in **Appendix A.**

The land use areas modeled in WWHM are shown in existing **(Exhibit 3A)** and proposed **(Exhibit 3B)** condition maps located in **Appendix A.** The stormwater runoff flow rates of the existing condition and post-developed basins during each storm event are calculated with the WWHM modeling program and shown in **Table 2** below. WWHM modeling results are included in **Appendix C**.

Table 2 | Flow Rates of Existing and Post-developed Basins

Storm Return Period (yrs)	Existing Condition Flow Rate (cfs)	Developed Flow Rate (cfs)	Difference (cfs)
2	0.120	0.176	0.057
5	0.167	0.234	0.068
10	0.204	0.278	0.074
25	0.257	0.340	0.082
50	0.303	0.390	0.087
100	0.353	0.445	0.092

The increase of the stormwater runoff flow rate from the post-developed basin compared to the existing basin *is 0.092-cfs,* which is less than 0.15-cfs using 15-minute time steps during the 100-year storm event. According to the MR 7 of the 2019 SWMMWW, the project site is exempt from flow control requirements as the project meets all three exemptions.

MR 8 – Wetlands Protection

This requirement is not applicable to the project since there are no wetlands on or in the vicinity of the project site.

MR 9 – Operation and Maintenance

Operations and maintenance information has been provided in **Appendix D** found at the end of this report.

DRAFT

Section C – Soils Evaluation

A geotechnical report was prepared by GRI on November 12, 2021 and is included in Appendix F. Geotechnical explorations performed included two Rotosonic borings (taken on September 10 and 11, 2020) and one mud-rotary boring (taken on July 7, 2021). Data from these borings along with a boring log from April 1971 were used to determine subsurface soil characteristics.

B-1 encountered sandy silt/silty sand to a depth of 3 feet, which was underlain by silty gravel to the maximum depth explored of 31.5 feet. B-2 encountered a mix of soil types to a depth of 20 feet that was primarily sandy silt/silty sand with thin layers of silty gravel. Below 20 feet in depth, B-2 consisted of silty gravel to the maximum depth explored. B-3 encountered sandy silt/silty sand to a depth of 12.5 feet, which was underlain by silty gravel to a depth of 40 feet. Below 40 feet in depth, B-3 consisted of soft conglomerate rock. Based on groundwater measurements made at the time of drilling (September 2020) and the historical geotechnical data, it is estimated that groundwater is present at depths of 25 feet below the ground surface in the vicinity of the proposed new reservoir, pump station, and retaining walls.

Due to the steep slopes present on the site, infiltration was not considered for any stormwater BMPs. Infiltration would increase risk of slope instability and is not suitable for this project site.

Section D – Source Control

As stated in Section B, a Construction SWPPP has been prepared which includes construction related source control measures and is included in Appendix B.

Section E – Onsite Stormwater Management BMPs

As stated in Section B, amended soils (BMP T5.13) will be used to meet MR 5.

Section F – Runoff Treatment Analysis and Design

As stated in Section B, this requirement is not applicable since projects with less than 5,000 SF of pollution-generating hard surfaces are exempt from MR 6.

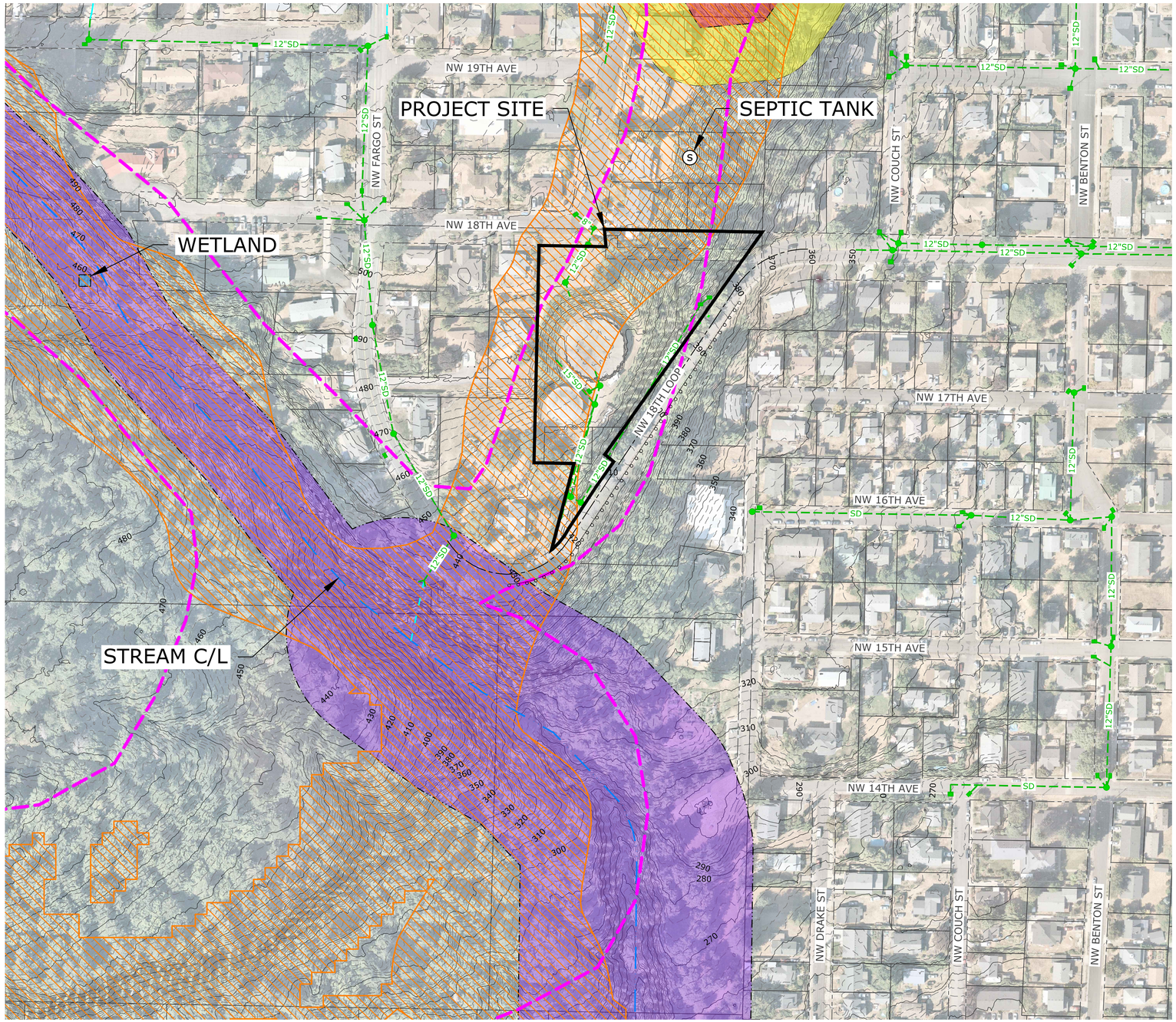
Section G – Flow Control Analysis and Design

As stated in Section B, this requirement is not applicable to since the project meets all three exemption requirements for MR 7 according to the 2019 SWMMWW.

Section H – Wetlands Protection

As stated in Section B, this requirement is not applicable to the project since there are no wetlands on or near the project site.

APPENDIX A



PLAN
SCALE: 1"=100'

LEGEND

- PROJECT SITE
- ADJACENT TO HABITAT AREA
- EROSION HAZARD AREA
- HABITAT AREA
- RIPARIAN HABITAT AREA
- WETLAND
- LANDSLIDE HAZARD
- STORM MANHOLE
- STORM CATCH BASIN/INLET
- STORM OUTFALL
- STORM PIPE — 12"SD
- SEPTIC TANK — S
- 2-FOOT CONTOUR
- 10-FOOT CONTOUR — 300
- DITCH
- STREAM
- EASEMENT
- RIGHT-OF-WAY
- TAX LOT

NOTES:

1. DATA SOURCES: CLARK COUNTY GIS, NEARMAP (AERIAL PHOTOS) AND WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES (LIDAR NAVD88).

2. PROJECT LOCATION LOCATED IN CATEGORY 2 AQUIFER RECHARGE AREA.

3. NO AGRICULTURAL DRAIN TILES, DRAIN FIELDS, FEMA FLOOD ZONE AREAS, SHORELINE MANAGEMENT AREAS, SINKS, SPRINGS, OR WELLS WITHIN EXHIBIT LIMITS.

4. ALL DATA SHOWN, OTHER THAN AERIAL PHOTOS, ELEVATION CONTOURS AND STREAMS, WERE DOWNLOADED FROM THE COUNTY OPEN DATA HUB IN SEPTEMBER 2021.

Exhibit 1

City of Camas WASHINGTON

Lower Prune Hill Booster Station & Reservoir Improvements - Phase 2

Critical Areas and Existing Drainage Features

March 2022

murraysmith

DRAFT
20-2849.01

PROPERTY LINE

PROP 12' ASPHALT ACCESS RD

PROP CONCRETE DWY

PROP ASPHALT ACCESS RD

PROP GATE

12' ROAD ESMT #D55421

PROP 0.5 MG RESERVOIR INNER DIA = 65'

12'-0"

PROP PUMP STATION

PROP GENERATOR

1,500,00 GAL WATER RESERVOIR

EXIST CATCH BASINS

NW 18TH AVE

EXIST PUMP STATION

EXIST 12" STORM

NW 18TH LOOP

EXIST CATCH BASINS

LEGEND

TOTAL SF	TOTAL AC		
708 SF	0.0163 AC	EXISTING IMPERVIOUS SURFACE	
6,136 SF	0.1409 AC	NEW IMPERVIOUS SURFACE	
3,601 SF	0.0513 AC	REPLACED IMPERVIOUS SURFACE	
2,045 SF	0.0469 AC	REPLACED IMPERVIOUS SURFACE EXEMPT DUE TO UNDERGROUND UTILITIES PER DOE 2019 SWMMWW I-3.2	
17,880 SF	0.4105 AC	TOTAL LAND DISTURBING ACTIVITY	
		FLOW DIRECTION ARROW	

PLAN
SCALE: 1"=20'

Exhibit 2

City of Camas WASHINGTON

Lower Prune Hill Booster Station & Reservoir Improvements - Phase 2

Impervious Surface Quantities

March 2022

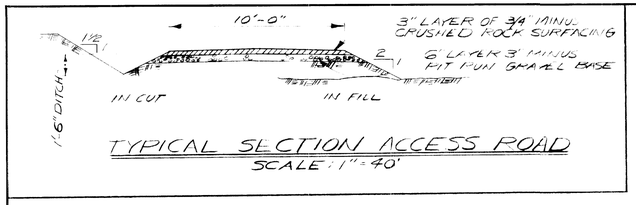
murraysmith

DRAFT

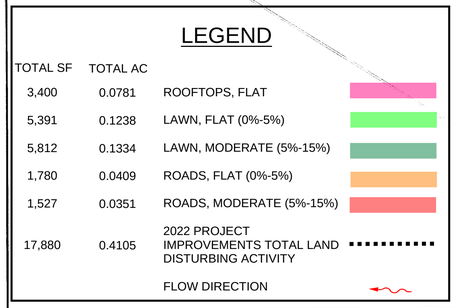
20-2849.01

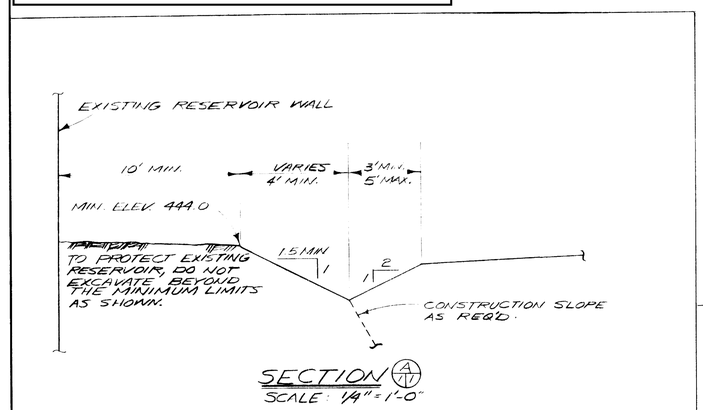
EXHIBIT 3A

Existing Conditions Pre-Flow Control Criteria

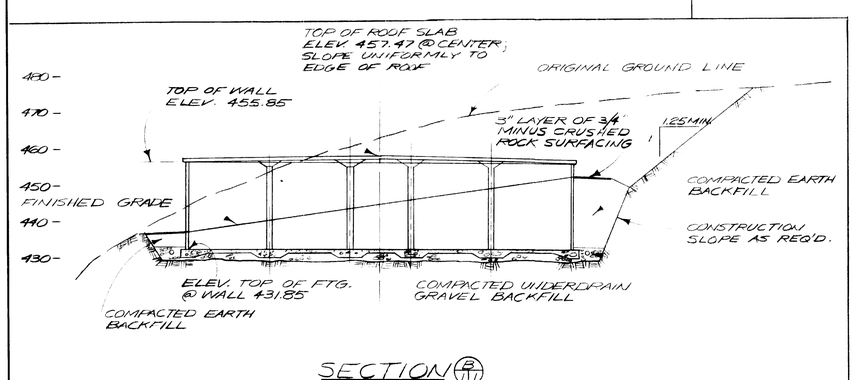


TYPICAL SECTION ACCESS ROAD
SCALE: 1" = 40'

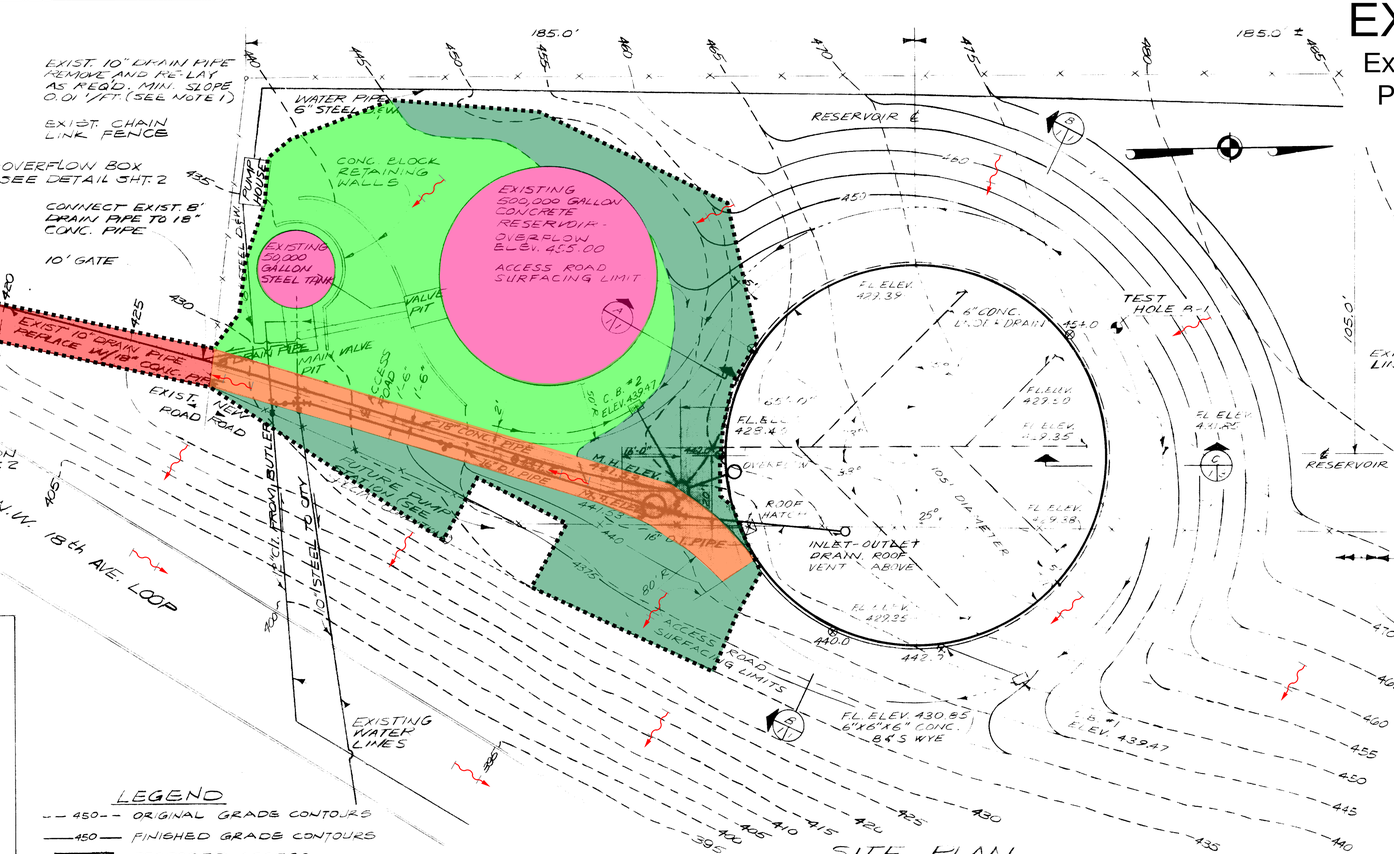




SECTION A/1
SCALE: 1/4" = 1'-0"



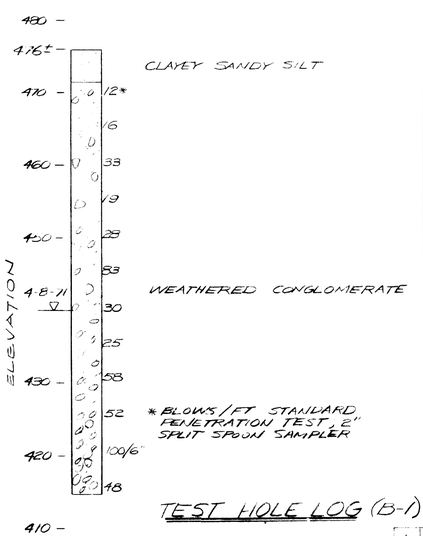
SECTION B/1
SCALE: 1" = 20'



SITE PLAN
SCALE: 1" = 20'

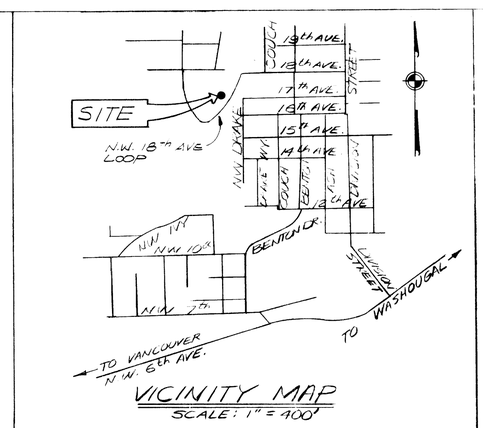
LEGEND
- 450 — ORIGINAL GRADE CONTOURS
- 450 — FINISHED GRADE CONTOURS
- PROPOSED ACCESS ROAD SURFACING
- EXIST. ACCESS ROAD TO BE RE-SURFACED

SECTION OR DETAIL DESIGNATION
SHEET WHERE SECTION OR DETAIL IS SHOWN
SHEET WHERE SECTION OR DETAIL IS TAKEN
SECTION DESIGNATION



* BLOWS/FT. STANDARD PENETRATION TEST, 2" SPLIT SPOON SAMPLER

TEST HOLE LOG (B-1)



VICINITY MAP
SCALE: 1" = 400'

NOTES:
1. ESTABLISH LOCATION AND ELEVATION OF EXIST. 10" DRAIN PIPE PRIOR TO GRADING, MATERIALS FOR CONSTRUCTION OF OVERFLOW DRAIN LINE AND APPURTENANCES.
2. FOR PIPE & DRAINAGE LAYOUT SEE SHT. 2.

INDEX TO DRAWINGS

NO.	DATE	REVISION	BY	APD.
1	SEPT 72	AS BUILT	PJC	RJA

WS-WASH-130

CORNELL, HOWLAND, HAYES & MERRYFIELD
ENGINEERS PLANNERS ECONOMISTS

CITY OF CAMAS, WASHINGTON
PRUNE HILL 1.5 MILLION GALLON RESERVOIR

VICINITY MAP, SITE PLAN, AND INDEX TO DRAWINGS

DES DRM	SHEET 1
DR DCM	OF 5
CK KFD	DATE JULY, 1971
BW P6551.1	SCALE AS SHOWN
DWG C 6551-1	

10105201

OWNER: VICTOR & TRICIA HARDING
602 NW 18TH LOOP

OWNER: STEVEN BARNETT
630 NW 18TH LOOP

OWNER: FRANK W MELLOWS TRUSTEE
624 NW 18TH AVE

LAWN, STEEP:
921 SF
0.0211 AC

LAWN, FLAT:
267 SF
0.0061 AC

ROOFTOPS:
360 SF
0.0083 AC

ROOFTOPS:
3,632 SF
0.0834 AC

PROJECT GRADING LIMITS

ROOFTOPS:
720 SF
0.0165 AC

OWNER: CITY OF CAMAS
NO SITE ADDRESS

LAWN, FLAT:
2,809 SF
0.0645 AC

LAWN, STEEP:
1,366 SF
0.0314 AC

ACCESS ROAD, MODERATE:
1,613 SF
0.0370 AC

LAWN, FLAT:
73 SF
0.0017 AC

LAWN, STEEP:
669 SF
0.0154 AC

ACCESS ROAD, FLAT:
4,516 SF
0.1037 AC

SIDEWALKS, FLAT:
57 SF
0.0013 AC

ACCESS ROAD, STEEP:
870 SF
0.0200 AC

NW 18TH LOOP

PLAN
SCALE: 1"=20'

LEGEND

TOTAL SF	TOTAL AC	
4,712 SF	0.1082 AC	ROOFTOPS, FLAT
58 SF	0.0013 AC	SIDEWALKS, FLAT
3,149 SF	0.0723 AC	LAWN, FLAT (0%-5%)
2,957 SF	0.0679 AC	LAWN, STEEP (>15%)
4,521 SF	0.1038 AC	ROADS, FLAT (0%-5%)
1,613 SF	0.0370 AC	ROADS, MODERATE (5%-15%)
870 SF	0.0200 AC	ROADS, STEEP (>15%)

Exhibit 3B

City of Camas WASHINGTON

Lower Prune Hill Booster Station & Reservoir Improvements - Phase 2

Proposed Land Use Types

March 2022

murraysmith

DRAFT

20-2849.01

APPENDIX B

Abbreviated Construction Stormwater Pollution Prevention Plan (SWPPP) For Single Family Home Builders

The Abbreviated Construction SWPPP may be used for projects that are required to submit a Construction SWPPP under Minimum Requirement #2 (MR#2) (**2,000 square feet or more of new plus replaced hard surface area, or which disturb 7,000 square feet or more**) for projects that disturb less than 1 acre. Hard surface areas include: footprint of single family residence and driveways.

Release of sediment, mud, and muddy stormwater from construction sites is prohibited. The SWPPP describes how erosion, sediment, and stormwater will be controlled during construction. The document lists and shows all erosion and sediment control (ESC) best management practices (BMPs) selected for the site. The SWPPP is a living document and must be updated if conditions or plans change or if the ESC BMPs are found to be ineffective.

Section 1 – Submittal Requirements

All projects falling under the requirements of MR #2, noted above, shall submit a SWPPP prior to building plan approval or building plan submittal. The following documents shall be submitted prior to issuance of building permits:

- Completed Abbreviated Construction SWPPP form
- Erosion and Sediment Control Site Plan
- Standard details of Best Management Practices (BMPs), when required
- Engineering drawings and calculations of BMPs, when required

Section 2 – Project Overview

Building Permit Number(s): _____

Property Information

Address: 600 NW 18th Loop, Camas, WA 98607

Parcel #: 85145001 & 85173001 Size of Parcel (acres or sq. ft.): 1.93

☒ New Structure/Building ☐ Building Addition ☒ Other Grading/Excavation, Paving, Utilities

Total Project Area (square feet)	17,631
Total Proposed Impervious Hard Area (square feet)	11,360
Total Existing Impervious and Hard Area (square feet)	6,707
Total Area to be Disturbed (square feet or acres)	17,631

☐ This project does not meet MR#2. SWPPP is not applicable. ESC measures still apply.

☒ This project meets MR#2. SWPPP is required prior to Building Permit approval.

Applicant Signature: _____ Date: _____

Applicant Information

Name: City of Camas

Address: 616 NE 4th Ave, Camas, WA 98607

Phone #: _____ Email: _____

Property Owner Information

Name: City of Camas

Address: 616 NE 4th Ave, Camas, WA 98607

Phone #: _____ Email: _____

Erosion Control Inspector: Designate an erosion control inspector who has the skills to assess the site conditions and construction activities that could impact stormwater quality and the effectiveness of ESC BMPs. The inspector musts be on-site or on-call at all time.

Name: _____

Phone #: _____ Email: _____

Section 3 – Project Narrative

The information required in this section is the project narrative. It describes the site and briefly summarizes the planned improvements. Complete Section A – F, below.

A. Project Description (check all that apply):

Brief Project Description:

This project consists of replacing the 0.5 MG concrete reservoir with a new 0.5 MG welded steel reservoir, a new pump station and associated onsite water mains, a new asphalt access road, stormwater improvements, and landscaping.

B. Existing Site Conditions – Describe existing site conditions. If there are multiple choices, check all that applies.

1. Describe the existing site conditions.
   ☒Landscaping ☒Brush ☒Trees ☒Other Pavement

2. Describe how surface water (stormwater) drainage flows across/from the site.
   ☒Overland ☐Gutter ☐Other _____
   ☒Storm sewer pipes ☒Catch Basin ☐Ditch/Swale

3. Are sensitive and/or critical areas present on the site?
   ☐Springs ☐Habitat ☒Steep Slopes/Geohazards

4. Existing utilities and underground objects?
   ☒Storm ☒Water ☐Sewer ☐Other_____

C. Adjacent Areas

1. Check any adjacent off-site areas that may be affected by site disturbance and describe (check all that apply):
   ☒Residential Areas ☒Roads ☒Ditches, pipes, culverts ☒Steep Slopes/Geohazards
   ☒Other Stream

2. Describe how and where surface water enters the site from upstream properties:
   Upstream of the site are residential properties that drain to two catch basins located on NW 18th Ave which is then conveyed through the site with an existing 12-inch storm drain.

3. Describe the downstream drainage path leading from the site to adjacent property, drainage system, or water body. If water is held on-site, describe it:
   All flow from the site collects in an existing storm drain running northeast along NW 18th Loop in the City of Camas' storm drain system. The western portions of the site generally drain to an existing catch basin located between the two reservoirs. This connects to the existing reservoir drain lines that run south through the site before connecting to the City storm drain system. The remaining area sheet flows east across the site to NW 18th Loop, where it enters the storm drain system via two adjacent catch basins north of the site.

D. Soils Information

If the project is proposing construction on or near slopes 15% or greater, or proposing to infiltrate construction stormwater runoff; the City require soils information to be submitted before allowing construction on these sites. Permanent infiltration facilities shall not be used during construction unless approved in writing by the Responsible Official.

1. Does the project propose construction on or near slopes 15% or greater? ☒Yes ☐No
2. Does the project propose to infiltrate construction stormwater? ☐Yes ☒No

   ☐ If yes, provide soils information, obtain and attach approval letter from the Responsible Official.

E. Erosion and Sediment Control Site Plan

The erosion and sediment control site plan is a drawing which shows the location of the proposed BMPs. Provide an erosion and sediment control site plan per City's Design Standard Manual.

F. Construction Sequencing/Phasing

1. The standard construction sequence is as follows:
   - Mark clearing/grading limits.
   - Install initial erosion control practices (construction entrance, silt fence, catch basin inserts).
   - Clear and grade site as outlined in the site plan while implementing and maintaining temporary erosion and sediment control practices at the same time.
   - Install proposed site improvements (building, driveways, landscaping, etc.).
   - Remove erosion control methods as permitted by the inspector and repair permanent erosion protection as necessary.
   - Monitor and maintain permanent erosion protection until fully established.

   List any changes from the standard construction sequence outlined above.

   _____

   _____

2. Construction Schedule:
   Provide a proposed construction schedule (construction start and end dates).
   Start Date: March 2023 End Date: September 2024

   Wet Season Construction Activities:
   Describe any construction activities that will occur between October 1 and July 5.

   _____
   To be determined based upon schedule submitted by selected contractor
   _____

   _____

Section 4 – Thirteen Elements of a Construction SWPPP

The following 13 elements are required for each SWPPP. For each element that applies to the project, at least one BMP must be selected and used on the site. If an element does not apply to the project site describe why the element does not apply.

Instructions for using and installing each BMP are given in the latest Stormwater Manual for Western Washington (SWMMWW) and it is available on Ecology's website. BMPs listed below designated with a "C" will be found in the SWMMWW and designated with an "EC" will be found in the City's Design Standard Manual (IV. Engineering Details) located on the City's website.

Instructions:

1. Review the 13 elements of a construction SWPPP below.
2. Select at least one BMP for each element.
3. For any BMP selected, follow the instructions in the table for including the BMP in the Abbreviated Construction SWPPP.
   a. If instructed to draw the BMP on the site plan, see Section 3E for instructions.

b. If instructed to submit the standard detail, include detail with SWPPP.
c. If instructed to submit detailed drawing and/or calculations, have an engineer provide a detailed drawing of proposed BMP in plan and profile views with dimensions and calculates described in the design criteria.

4. If the element does not apply to the project, check "N/A" and describe why.

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e. hand-written notes and deletions). Update the SWPPP when the CESCL or Inspector has noted a deficiency in BMPs or deviation from original design.

Element #1 – Preserve Vegetation and Mark Clearing Limits

Retain the duff layer, native topsoil, and natural vegetation in an undisturbed state to the maximum extent practicable. If it is not practicable to retain the duff layer in place, it should be stockpiled onsite, covered to prevent erosion, and replaced immediately upon completion of the ground-disturbing activities.

All construction projects must clearly mark any clearing limits, sensitive areas and their buffers, and any trees that will be preserved prior to beginning any land disturbing activities. Clearly mark the limits both in the field and on the plans. Limits shall be marked in such a way that any trees or vegetation to remain will not be harmed.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing/Calcs*
☐ C101 Preserving Native Vegetation	x		
☐ C102 Buffer Zones	x		
☒ C103 High Visibility Fence	x		
☐ EC13 Silt Fence for Home Builders	x	x	

OR ☐ Element is N/A: _____

Element #2 – Establish Construction Access

All construction projects subject to vehicular traffic shall provide a means of preventing vehicle "tracking" of soil from the site onto streets or neighboring properties. Limit vehicle ingress and egress to one route. All access points shall be stabilized with a rock pad construction entrance in accordance with BMP EC6 and EC28. The applicant should consider placing the entrance in the area for future driveway(s), as it may be possible to use the rock as a driveway base material.

The entrance(s) must be inspected weekly, at a minimum, to ensure no excess sediment buildup or missing rock. If sediment is tracked offsite, it shall be swept or shoveled from the paved surface immediately. Keep streets clean at all times. **Street washing and the use of mechanical brooms and leaf blowers for sediment removal are not allowed.** Only vacuum sweeping may be used on public streets. The proposed construction entrance must be identified on the site plan.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing/Calcs*
☐ EC28 Construction Entrance for Home Builders	x	x	

OR ☐ Element is N/A: _____

☒ C105 Stabilized Construction Entrance × ×

Element #3 – Control Flow Rates
Protect properties and waterways downstream of the development site from erosion due to increases in volume, velocity, and peak flow of stormwater runoff from the project site.

Permanent infiltration facilities shall not be used for flow control during construction unless specifically approved in writing by Responsible Official. Sediment traps can provide flow control for small sites by allowing water to pool and allowing sediment to settle out of the water.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing/Calcs*
☐ EC22 Temporary Sediment Trap	x		x
☐ EC15 Straw Wattles Behind Curb	x	x	

OR ☒ Element is N/A: Project is exempt from flow control

Element #4 – Install Sediment Controls
Prior to leaving a construction site, runoff from disturbed areas must pass through a sediment removal device. Sediment barriers are used to slow sheet flow of stormwater and allow the sediment to settle out behind the barrier. Install/construct the sediment control BMPs before site grading.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing/Calcs*
☒ C231 Silt Fence ~~for Home Builders~~	x	x	
☐ C234 Vegetated Strip	x		
☐ EC15 Straw Wattles Behind Curb	x	x	
☐ EC22 Temporary Sediment Trap	x		x

OR ☐ Element is N/A: _____

Element #5 – Stabilize Soils
Stabilize exposed and unworked soils by applying BMPs that protect the soils from raindrop impact, flowing water, and wind. **During the wet season from October 1st through July 5th, no soils shall remain exposed or unworked for more than 2 days. From July 6th through September 30th, no soils shall remain exposed and unworked for more than 7 days**. This applies to all soils on site whether at final grade or not. Stabilized soil stockpiles from erosion, protected with sediment trapping measures, shall be located away from storm drain inlets, waterways and drainage channels. Minimize dust with the use of approved BMPs.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing/Calcs*
☒ C120 Temporary & Permanent Seeding	x		
☐ EC27 Stockpile Protection	x	x	
☐ C124 Sodding	x		
☐ C125 Compost	x		
☐ C125 Topsoiling	x		
☐ C140 Dust Control	x		

OR ☐ Element is N/A: _____

Element #6 – Protect Slopes

Protect slopes by diverting water away from the top of the slopes. Reduce slope velocities by minimizing the continuous length of the slope, which can be accomplished by terracing and roughening slope sides. Establishing vegetation on slopes will protect slopes as well.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing*
☐ EC24 Interceptor Swale and Dike	x		x
☐ EC21 Grass Lined Channel	x		x

OR ☒ Element is N/A: While there are steep slopes on site – work will be on relatively flat portion of the site and outside the steep slopes

Element #7 – Protect Drain Inlets

Protect all storm drain inlets during construction so that site runoff does not enter inlets without first being filtered to remove sediment. Install catch basin protection on all catch basins within 500 feet downstream of the project. Once the site is fully stabilized, catch basin protection must be removed.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing*
☒ EC8 Inlet Protection – Curb Sediment Trap	x		
☒ EC9 Inlet Protection – Catch Basin Insert	x		
☒ EC10 Inlet Protection – Combination Inlet	x		
☐ EC11 Inlet Protection - Biobags	x		

OR ☐ Element is N/A: _____

Element #8 – Stabilize Channels and Outlets

Stabilize all temporary and permanent conveyance channels and their outlets.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing*
☐ EC20 Erosion Control Blankets	x		
☐ C202 Channel Lining	x		
☐ EC23 Check Dams	x	x	
☐ C209 Outlet Protection	x		

OR ☒ Element is N/A: No channels or outlets exist on site

Element #9 – Control Pollutants

Handle and dispose of all pollutants, including demolition debris and other solid wastes, to keep them out of rain and stormwater. Provide cover and containment for all chemicals, liquid products (including paint), petroleum products, and other materials. Apply fertilizers and pesticides following manufacturers' instructions for application rates and procedures. Handle all concrete and concrete waste appropriately.

Washout of concrete trucks must be performed off-site or in designated concrete washout areas only. Do not wash out concrete trucks, chutes, tools or equipment 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.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing*
☐ C150 Materials on Hand	x		
☒ C151 Concrete Handling	x		
☐ C153 Materials, Delivery, Storage, and Containment	x		
☒ C154 Concrete Washout Area	x		x

OR ☐ Element is N/A: _____

Element #10 – Control Dewatering

Clean, non-turbid dewatering water, such as groundwater, can be discharged to the stormwater system provided the dewatering flow does not cause erosion or flooding or downstream conveyances or receiving waters. Do not mix clean dewatering water with turbid or contaminated dewatering water. Treat or dispose of turbid or contaminated dewatering water through a sediment pond or trap or through approved treatment or disposal options.

Dewatering water must be managed to prevent the discharge of the contaminants to waters of the State, including dewatering water that has comingled with stormwater (i.e. treatment system, off-site disposal).

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing*
☒ EC22 Temporary Sediment Trap	x		x

OR ☐ Element is N/A: _____

Element #11 – Maintain BMPs

Maintain and repair ESC BMPs as needed. Inspect all BMPs at least weekly and after every ½" storm event. Keep an inspection log on site and available for review by the City inspector at all times.

Remove all temporary erosion and sediment control BMPs within 30 days after final site stabilization or if the BMP is no longer needed. Any trapped sediment should be removed or stabilized onsite. No sediment shall be discharged in to the storm drainage system or natural conveyance systems.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing*
☒ C150 Materials on Hand	x		
☒ C160 Certified Erosion and Sediment Control Lead			

OR ☐ Element is N/A: _____

Element #12 – Manage the Project

Coordinate all work before initial construction with subcontractors and other utilities to ensure no areas are prematurely worked.

Designate an erosion control inspector for the construction site. If land disturbing activity is undertaken by a licensed contractor, the erosion control inspector must possess a valid CESCL certification. The erosion control inspector must be on site or on-call 24 hours a day.

The erosion control inspector is responsible for:

- Ensuring that the ESC BMPs are appropriate for the site and are functioning.
- Updating the Abbreviated Construction SWPPP when site conditions warrant.
- Maintaining the inspection log on site.

The BMP(s) being proposed to meet this element are:

Check to Select	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Schedule
☒ C160 Certified Erosion and Sediment Control Lead			
☒ C162 Scheduling			x

OR ☐ Element is N/A: _____

Element #13 – Protect Low Impact Development BMPs

Protect LID BMPs from compaction, erosion, and sedimentation.

Bioretention and Rain Gardens

Prevent compaction of areas planned for bioretention and rain gardens by excluding construction equipment. Avoid unnecessary foot traffic, and allow necessary foot traffic only when soils are not wet.

Protect all bioretention and rain gardens from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain onto them.

If they accumulate sediment during construction, restore the BMPs to their fully functioning condition. Restoration must include removal of sediment and any sediment-laden bioretention/rain garden soils, and replacing the removed soils with soils meeting the design specification.

Permeable Pavement

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 on to permeable pavements.

Permeable pavements fouled with sediment or no longer passing an initial infiltration test must be cleaned in accordance to manufacturer's procedures.

Other LID BMPs

Keep all heavy equipment off areas where LID facilities will be located. Protect completed lawn and landscaped areas from compaction by construction equipment.

The BMP(s) being proposed to meet this element are:

Check to Select (*Requires Engineering)	If Selected		
	Draw Location(s) on Site Plan	Submit Standard Detail	Submit Detailed Drawing*
☐ C102 Buffer Zone	x		
☐ C103 High Visibility Fence	x		
☐ EC13 Silt Fence for Home Builders	x	x	
☐ C234 Vegetated Strip	x		
☐ Sand Bags	x		

OR ☒ Element is N/A: _____

APPENDIX C

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	WWHM2012_1931EC
Site Name:	Lower Prune Hill PS
Site Address:	600 NW 18th Loop
City:	Camas
Report Date:	3/3/2022
Gage:	Troutdale
Data Start:	1948/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	1.370
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Lawn, Flat	0.1243
SG3, Lawn, Mod	0.1323
Pervious Total	0.2566

Impervious Land Use	acre
ROADS FLAT	0.0409
ROADS MOD	0.035
ROOF TOPS FLAT	0.078
Impervious Total	0.1539
Basin Total	0.4105

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SG3, Lawn, Flat	0.0723
SG3, Lawn, Steep	0.0679
Pervious Total	0.1402

Impervious Land Use	acre
ROADS FLAT	0.1038
ROADS MOD	0.037
ROADS STEEP	0.02
ROOF TOPS FLAT	0.1082
SIDEWALKS FLAT	0.0013
Impervious Total	0.2703
Basin Total	0.4105

Element Flows To:

Surface	Interflow	Groundwater

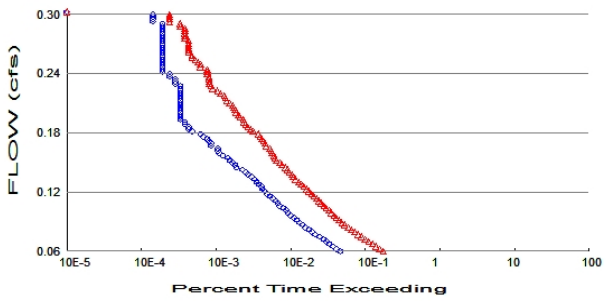
Routing Elements

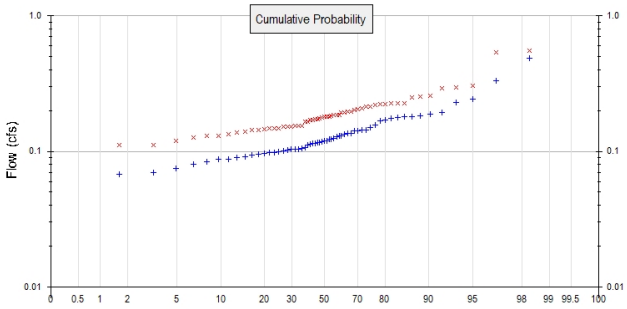
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.2566
Total Impervious Area: 0.1539

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.1402
Total Impervious Area: 0.2703

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.119583
5 year	0.166907
10 year	0.203829
25 year	0.257373
50 year	0.302634
100 year	0.352827

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.17635
5 year	0.23449
10 year	0.278161
25 year	0.339521
50 year	0.389935
100 year	0.444577

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.141	0.248
1950	0.087	0.149
1951	0.119	0.151
1952	0.167	0.225
1953	0.115	0.152
1954	0.130	0.209
1955	0.095	0.126
1956	0.172	0.213
1957	0.098	0.130
1958	0.117	0.170

1959	0.075	0.111
1960	0.092	0.155
1961	0.106	0.145
1962	0.105	0.148
1963	0.122	0.173
1964	0.128	0.176
1965	0.119	0.154
1966	0.129	0.166
1967	0.100	0.153
1968	0.179	0.303
1969	0.149	0.257
1970	0.486	0.551
1971	0.117	0.205
1972	0.103	0.180
1973	0.113	0.196
1974	0.144	0.184
1975	0.116	0.153
1976	0.189	0.224
1977	0.067	0.112
1978	0.124	0.186
1979	0.144	0.202
1980	0.089	0.131
1981	0.133	0.173
1982	0.157	0.195
1983	0.183	0.215
1984	0.137	0.179
1985	0.114	0.185
1986	0.103	0.172
1987	0.096	0.144
1988	0.125	0.219
1989	0.098	0.166
1990	0.080	0.140
1991	0.141	0.194
1992	0.093	0.135
1993	0.230	0.290
1994	0.084	0.147
1995	0.103	0.181
1996	0.243	0.295
1997	0.193	0.255
1998	0.175	0.226
1999	0.087	0.137
2000	0.061	0.108
2001	0.070	0.120
2002	0.181	0.223
2003	0.136	0.182
2004	0.112	0.196
2005	0.103	0.181
2006	0.177	0.226
2007	0.100	0.146
2008	0.330	0.540

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.4865	0.5508
2	0.3300	0.5401
3	0.2430	0.3033
4	0.2302	0.2950

5	0.1930	0.2901
6	0.1886	0.2571
7	0.1829	0.2547
8	0.1812	0.2484
9	0.1793	0.2262
10	0.1774	0.2256
11	0.1751	0.2252
12	0.1715	0.2235
13	0.1675	0.2234
14	0.1566	0.2185
15	0.1494	0.2147
16	0.1441	0.2135
17	0.1437	0.2086
18	0.1414	0.2054
19	0.1411	0.2019
20	0.1366	0.1964
21	0.1357	0.1963
22	0.1331	0.1948
23	0.1299	0.1939
24	0.1295	0.1863
25	0.1280	0.1849
26	0.1248	0.1844
27	0.1238	0.1819
28	0.1223	0.1814
29	0.1194	0.1810
30	0.1187	0.1798
31	0.1171	0.1787
32	0.1169	0.1762
33	0.1158	0.1735
34	0.1150	0.1727
35	0.1138	0.1715
36	0.1132	0.1702
37	0.1121	0.1663
38	0.1062	0.1661
39	0.1049	0.1553
40	0.1034	0.1545
41	0.1033	0.1532
42	0.1033	0.1529
43	0.1025	0.1520
44	0.1004	0.1510
45	0.0997	0.1488
46	0.0985	0.1482
47	0.0976	0.1475
48	0.0959	0.1464
49	0.0951	0.1445
50	0.0934	0.1435
51	0.0918	0.1402
52	0.0895	0.1372
53	0.0873	0.1346
54	0.0871	0.1308
55	0.0841	0.1299
56	0.0804	0.1263
57	0.0746	0.1201
58	0.0696	0.1120
59	0.0674	0.1115
60	0.0613	0.1076

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0598	973	3675	377	Fail
0.0622	860	3261	379	Fail
0.0647	773	2916	377	Fail
0.0672	692	2611	377	Fail
0.0696	628	2325	370	Fail
0.0721	577	2091	362	Fail
0.0745	517	1877	363	Fail
0.0770	451	1692	375	Fail
0.0794	407	1504	369	Fail
0.0819	368	1353	367	Fail
0.0843	329	1233	374	Fail
0.0868	303	1105	364	Fail
0.0892	278	1021	367	Fail
0.0917	254	928	365	Fail
0.0941	231	855	370	Fail
0.0966	207	801	386	Fail
0.0990	192	738	384	Fail
0.1015	181	686	379	Fail
0.1039	168	630	375	Fail
0.1064	149	589	395	Fail
0.1089	140	542	387	Fail
0.1113	133	505	379	Fail
0.1138	121	465	384	Fail
0.1162	111	429	386	Fail
0.1187	102	403	395	Fail
0.1211	94	369	392	Fail
0.1236	89	345	387	Fail
0.1260	86	315	366	Fail
0.1285	78	290	371	Fail
0.1309	73	269	368	Fail
0.1334	70	244	348	Fail
0.1358	62	228	367	Fail
0.1383	56	218	389	Fail
0.1407	53	202	381	Fail
0.1432	47	192	408	Fail
0.1456	39	177	453	Fail
0.1481	38	160	421	Fail
0.1506	35	150	428	Fail
0.1530	32	134	418	Fail
0.1555	30	129	430	Fail
0.1579	26	124	476	Fail
0.1604	23	118	513	Fail
0.1628	22	115	522	Fail
0.1653	22	111	504	Fail
0.1677	18	98	544	Fail
0.1702	18	95	527	Fail
0.1726	17	91	535	Fail
0.1751	16	86	537	Fail
0.1775	14	82	585	Fail
0.1800	13	78	600	Fail
0.1824	10	66	660	Fail
0.1849	9	61	677	Fail
0.1873	9	56	622	Fail
0.1898	8	52	650	Fail

0.1923	8	50	625	Fail
0.1947	7	49	700	Fail
0.1972	7	44	628	Fail
0.1996	7	42	600	Fail
0.2021	7	39	557	Fail
0.2045	7	38	542	Fail
0.2070	7	36	514	Fail
0.2094	7	35	500	Fail
0.2119	7	32	457	Fail
0.2143	7	29	414	Fail
0.2168	7	28	400	Fail
0.2192	7	27	385	Fail
0.2217	7	24	342	Fail
0.2241	7	22	314	Fail
0.2266	7	19	271	Fail
0.2290	7	18	257	Fail
0.2315	6	17	283	Fail
0.2340	6	17	283	Fail
0.2364	6	17	283	Fail
0.2389	5	17	340	Fail
0.2413	5	16	320	Fail
0.2438	4	16	400	Fail
0.2462	4	16	400	Fail
0.2487	4	13	325	Fail
0.2511	4	13	325	Fail
0.2536	4	12	300	Fail
0.2560	4	11	275	Fail
0.2585	4	10	250	Fail
0.2609	4	10	250	Fail
0.2634	4	9	225	Fail
0.2658	4	9	225	Fail
0.2683	4	9	225	Fail
0.2707	4	9	225	Fail
0.2732	4	9	225	Fail
0.2757	4	9	225	Fail
0.2781	4	8	200	Fail
0.2806	4	8	200	Fail
0.2830	4	8	200	Fail
0.2855	4	8	200	Fail
0.2879	4	8	200	Fail
0.2904	4	7	175	Fail
0.2928	4	7	175	Fail
0.2953	3	5	166	Fail
0.2977	3	5	166	Fail
0.3002	3	5	166	Fail
0.3026	3	5	166	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

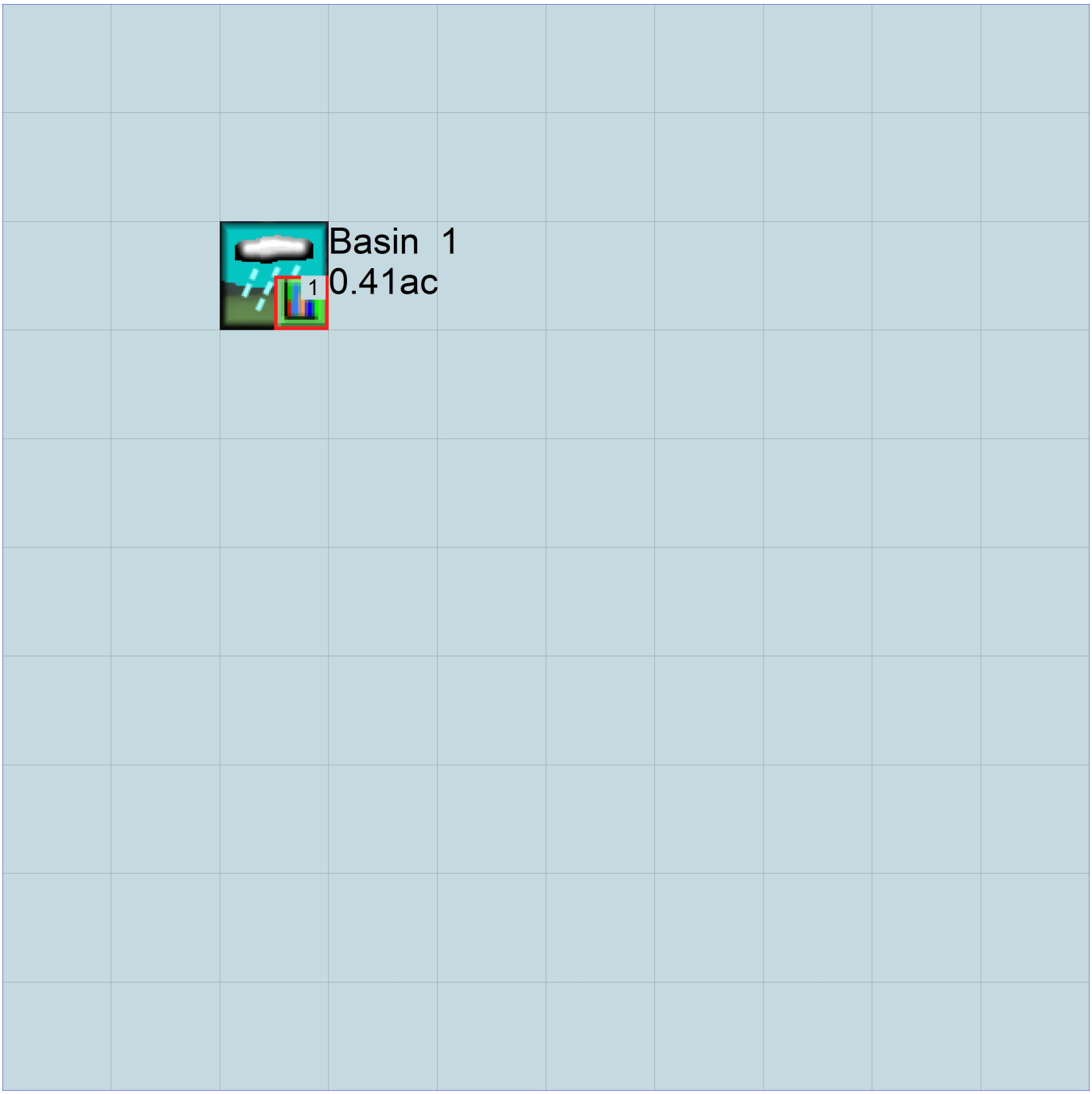
PERLND Changes

No PERLND changes have been made.

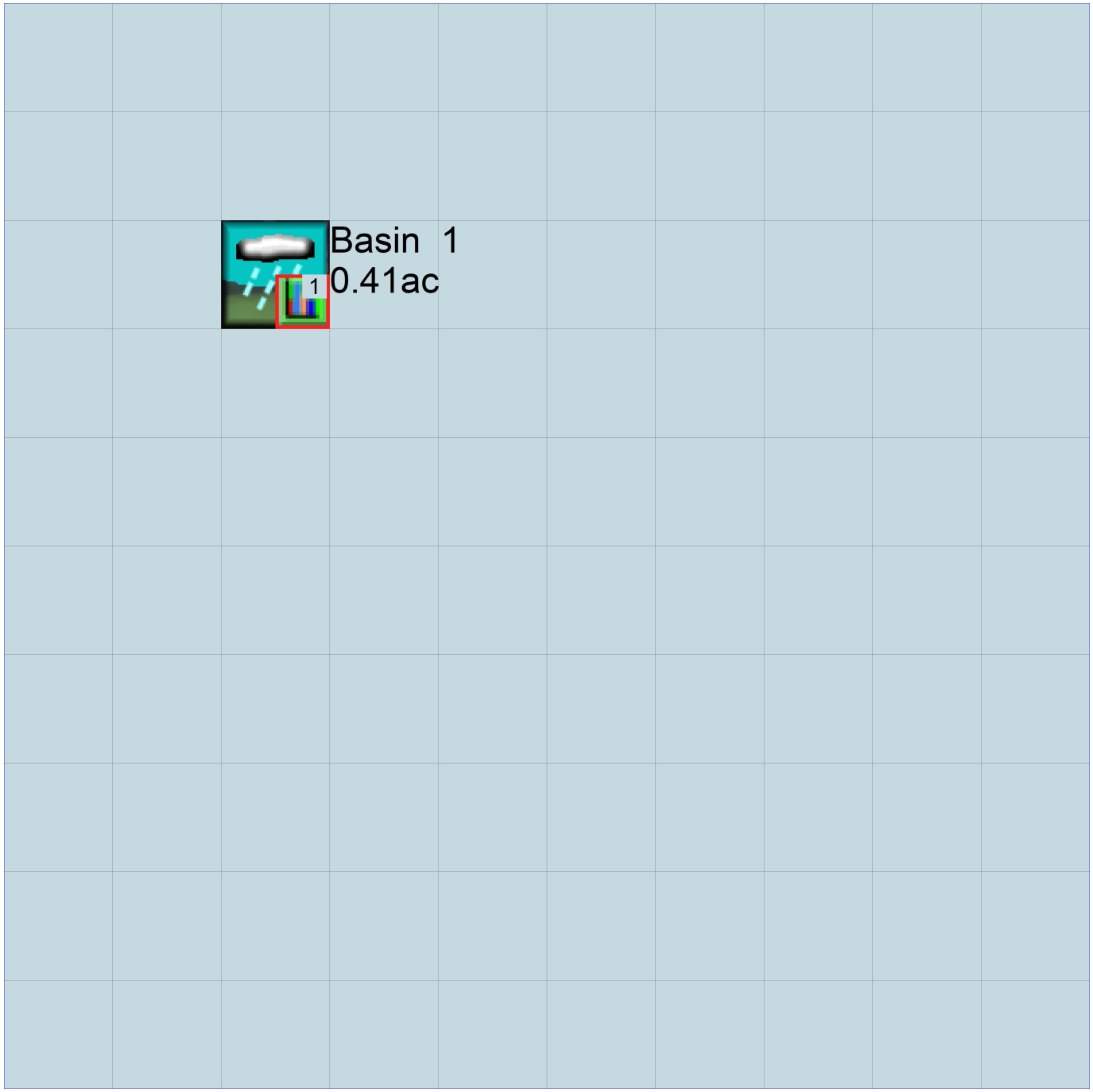
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2008 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   WWHM2012_1931EC.wdm
MESSU       25   PreWWHM2012_1931EC.MES
            27   PreWWHM2012_1931EC.L61
            28   PreWWHM2012_1931EC.L62
            30   POCWWHM2012_1931EC1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      25
      PERLND      26
      IMPLND       1
      IMPLND       2
      IMPLND       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            ***
   25     SG3, Lawn, Flat         1    1    1    1   27    0
   26     SG3, Lawn, Mod          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   25         0    0    1    0    0    0    0    0    0    0    0    0
   26         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  *********
   25         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   26         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 ***
   25         0    0    0    0    0    0    0    0    0    0    0
   26         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
   25              0         9      0.05       400      0.05         0      0.96
   26              0         9      0.05       400       0.1         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   25              0         0       2.5         2         0         0         0
   26              0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                          ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   25            0.1       0.8      0.25         4       0.4      0.25
   26            0.1       0.8      0.25         4       0.4      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   25              0         0         0         0         3         1         0
   26              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
    2      ROADS/MOD              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
    2         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
    2         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
    2         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
    2            400      0.05       0.1      0.08
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    2              0         0
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    2              0         0
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  25                     0.1243     COPY   501     12
PERLND  25                     0.1243     COPY   501     13
PERLND  26                     0.1323     COPY   501     12
PERLND  26                     0.1323     COPY   501     13
IMPLND   1                     0.0409     COPY   501     15
IMPLND   2                      0.035     COPY   501     15
IMPLND   4                      0.078     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    1.37           PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.37           IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            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       1948 10 01        END    2008 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   WWHM2012_1931EC.wdm
MESSU       25   MitWWHM2012_1931EC.MES
            27   MitWWHM2012_1931EC.L61
            28   MitWWHM2012_1931EC.L62
            30   POCWWHM2012_1931EC1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      25
      PERLND      27
      IMPLND       1
      IMPLND       2
      IMPLND       3
      IMPLND       4
      IMPLND       8
      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           ***
   25     SG3, Lawn, Flat         1    1    1    1   27    0
   27     SG3, Lawn, Steep        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 ***
   25         0    0    1    0    0    0    0    0    0    0    0    0
   27         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  *********
   25         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   27         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 ***
   25         0    0    0    0    0    0    0    0    0    0    0
   27         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
   25              0         9      0.05       400      0.05         0      0.96
   27              0         9      0.05       400      0.15         0      0.96
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   25              0         0       2.5         2         0         0         0
   27              0         0       2.5         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                          ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   25            0.1       0.8      0.25         4       0.4      0.25
   27            0.1       0.8      0.25         4       0.4      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS       AGWS      GWVS
   25              0         0         0         0         3          1         0
   27              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
    2      ROADS/MOD               1    1    1   27    0
    3      ROADS/STEEP             1    1    1   27    0
    4      ROOF TOPS/FLAT          1    1    1   27    0
    8      SIDEWALKS/FLAT          1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    2         0    0    1    0    0    0
    3         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
```

```
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    2         0    0    4    0    0    0    1    9
    3         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    2         0    0    0    0    0
    3         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    2            400      0.05       0.1      0.08
    3            400       0.1       0.1      0.05
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    2              0         0
    3              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1             0         0
    2             0         0
    3             0         0
    4             0         0
    8             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  25                     0.0723     COPY   501     12
PERLND  25                     0.0723     COPY   501     13
PERLND  27                     0.0679     COPY   501     12
PERLND  27                     0.0679     COPY   501     13
IMPLND   1                     0.1038     COPY   501     15
IMPLND   2                      0.037     COPY   501     15
IMPLND   3                       0.02     COPY   501     15
IMPLND   4                     0.1082     COPY   501     15
IMPLND   8                     0.0013     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    1.37           PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.37           IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.8            PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.8            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
```

```
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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

APPENDIX D

Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent 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 six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent 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
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 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.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	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.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

APPENDIX E

Custom Soil Resource Report
Soil Map

Map Scale: 1:845 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 40 80 160 240

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Clark County, Washington
Survey Area Data: Version 18, 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: Oct 15, 2018—Oct 18, 2018

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
OlF	Olympic clay loam, 30 to 60 percent slopes	1.2	59.1%
VaC	Vader silt loam, 8 to 15 percent slopes	0.8	40.9%
Totals for Area of Interest		**2.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Clark County, Washington

OlF—Olympic clay loam, 30 to 60 percent slopes

Map Unit Setting

National map unit symbol: 2dz1
Elevation: 200 to 2,000 feet
Mean annual precipitation: 40 to 70 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Olympic

Setting

Landform: Mountain slopes
Parent material: Residuum and colluvium from igneous rock

Typical profile

H1 - 0 to 10 inches: clay loam
H2 - 10 to 41 inches: clay loam
H3 - 41 to 60 inches: gravelly clay loam

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

VaC—Vader silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2dzz
Elevation: 50 to 1,800 feet
Mean annual precipitation: 50 to 70 inches
Mean annual air temperature: 48 to 50 degrees F

Frost-free period: 170 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Vader

Setting

Parent material: Residuum and colluvium from sandstone with a mixture of volcanic ash in the upper part

Typical profile

H1 - 0 to 6 inches: ashy silt loam
H2 - 6 to 30 inches: ashy loam
H3 - 30 to 34 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XV302WA)
Other vegetative classification: Limited Depth Soils (G002XV302WA)
Hydric soil rating: No

APPENDIX F