Combined Stormwater Site Plan (SSP) and Construction Stormwater Pollution Prevention Plan Report

Walmart Store #2403-278 Pickup Expansion

Prepared For

The City of Puyallup
Permit Application No. PRCCP20220035

Project Location

310 31st Ave. SE, Puyallup Washington

Parcels: 0419033050 & 0419033051

Stormwater Site Plan Prepared By

Name	Organization	Contact Telephone Number	Email Address
Brandon Alley	Galloway & Company, Inc.	(303) 770-8884	BrandonAlley@GallowayUS.com

07/27/2023

Date Prepared

July 27, 2023

07/27/2023

Brandon Alley
Registered Professional Engineer
State of Washington No. 56606

Date

7/27/2023

1. Project Information

A. Project Contacts

See Title Page for Stormwater Site Plan Development Team

B. Property Owner

Name	Organization	Mailing Address	Contact Telephone Number	Email Address
Walmart	Wal-Mart Real Estate Business Trust	Sam M. Walton Development Complex, Mail Stop 5570, 2001 SE 10th Street	(479) 371-0429	Kristen.Dinger@Walmart.com

C. Applicant (if different than Property Owner)

Name	Organization	Mailing Address	Contact Telephone Number	Email Address
Brandon Alley	Galloway & Company Inc.	6162 S. Willow Drive, Greenwood Village, Colorado 80111	(303) 770-8884	BrandonAlley@GallowayUS.com

D. Associated Permits

i) Associated City of Puyallup Permit Number(s)

B-21-0905 & PRCCP20220035

E. References

i) Design Standards and Specifications

City of Puyallup City Standards – Section 200 Stormwater Management – Revised 10/2019

2019 Stormwater Management Manual for Western Washington

2. Project Overview

The Walmart Pickup Expansion project is located at 310 31st Avenue SE Puyallup, WA. The property is in the northeast corner of the northwest quarter of the southwest quarter of Section 3, Township 19 North, Range 4 East of the Willamette Meridian. The property parcels are 0419033050 and 0419033051. The property is bound to the north by 31st Avenue SE, and to the east by 5th St SE. The property is bound to the west and south by neighboring commercial developments.

The project area is approximately 37,957.6 SF (0.871 acres) of disturbance to accommodate for an expansion to the existing Walmart Supercenter that is on the property. The proposed building expansion calls for the demolition of approximately 37,957.6 SF of surface area. With the building expansion there is approximately 24,867 SF of proposed concrete sidewalk and curb chases and asphalt pavement, and 8,322.7 SF of landscaping area. The proposed building expansion will demolish 65 parking stalls to allow space for the building expansion and additional landscaped area requested by the City of Puyallup due to these construction activities. The proposed expansion will not change the existing drainage pattern and will utilize the existing storm sewer system.

The proposed scope of work does not provide any negative impacts to the existing site conditions or drainage system as will be described in this report. The onsite impervious areas have been reduced in the proposed condition which will cause less discharge to the existing storm system or any downstream areas.

Existing Surface Areas		
Surface Type	**Area (SF)**	**Area (acres)**
Pavement	36,072.4	0.828
Landscaping	1,885.2	0.043
Total	37,957.6	0.871

Proposed Surface Areas		
Surface Type	**Area (SF)**	**Area (acres)**
Roof	3,124.3	0.072
Pavement	24,867	0.571
Landscaping	8,322.7	0.228
Total	37,957.6	0.871

3. Existing Project Site Conditions

A. Existing Project Site Condition Description:

In the existing condition, the project site is a commercial use site for a Walmart Supercenter. See figure 1-0, section C - i, below for stormwater runoff patterns.

B. Existing Project Site Condition Basin Map

i. Existing Project Basin vs Modified Project Basin Comparison:

The following Basin Map in section C - ii depicts the existing condition at the Walmart Pickup area. The basin area was delineated per existing on-site conditions for the area within the LOD. There are three on-site basins for the existing condition that outfall to the existing inlets at the south side of the project area.

The Basin Map also depicts the modified condition of the site. This basin area was revised based on the proposed Walmart Pickup expansion area. Due to the bioretention area collecting the majority of on-site runoff, the area has been revised to one contributing basin to the storm system in the mitigated condition.

Water Quality:

Water quality impacts will be minimal. The pavement being removed and replaced will be removed to the basecourse material. The base course may encounter minor disturbance during pavement removal and will be recompacted before the proposed asphalt is laid. It is not anticipated that existing subgrade below replaced pavement will be disturbed. This project will make use of bioretention for water quality purposes. Refer to the end of this report for WWHM modelling results of the bioretention area. 99% of water is being retained for water quality which meets the minimum requirement of 91%.

C.

i) Downstream Flowpath

The following area map depicts the downstream flow path of drainage, from the project, offsite. In theory, if the stormwater does not infiltrate during a certain storm event, then it could potentially travel through the existing storm infrastructure and discharge offsite to the adjacent property, eventually into Bradley Lake.

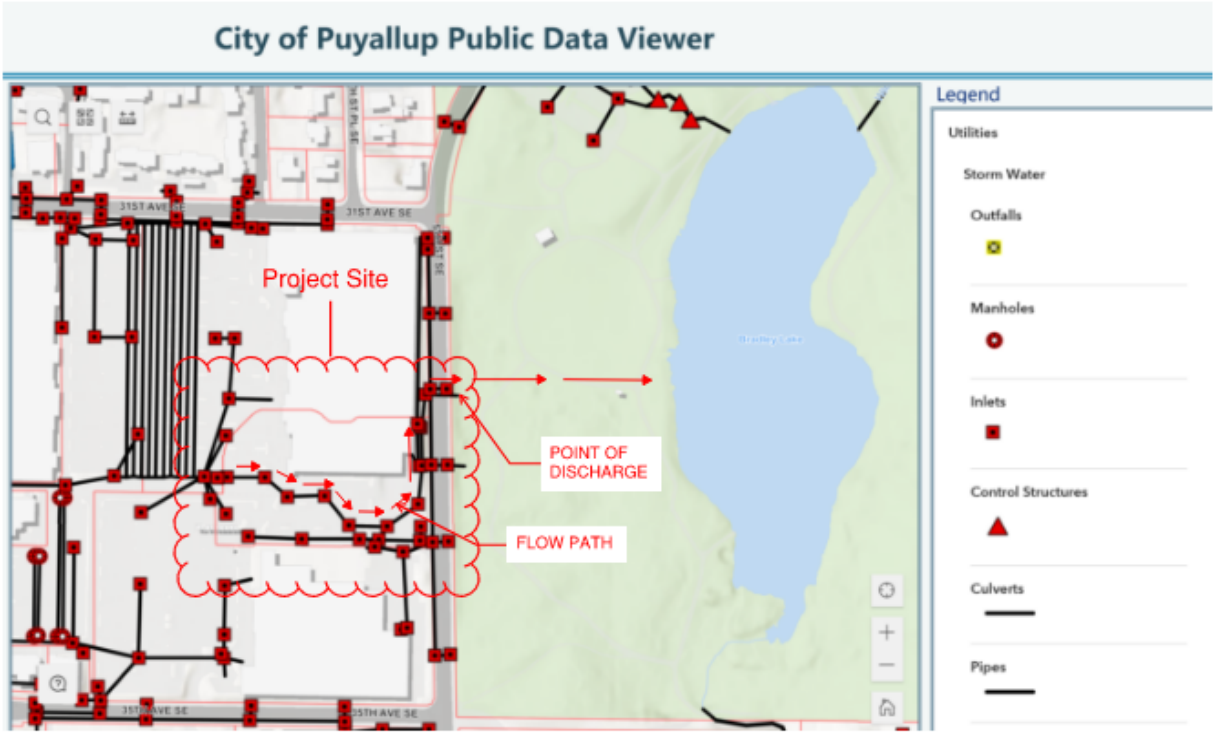
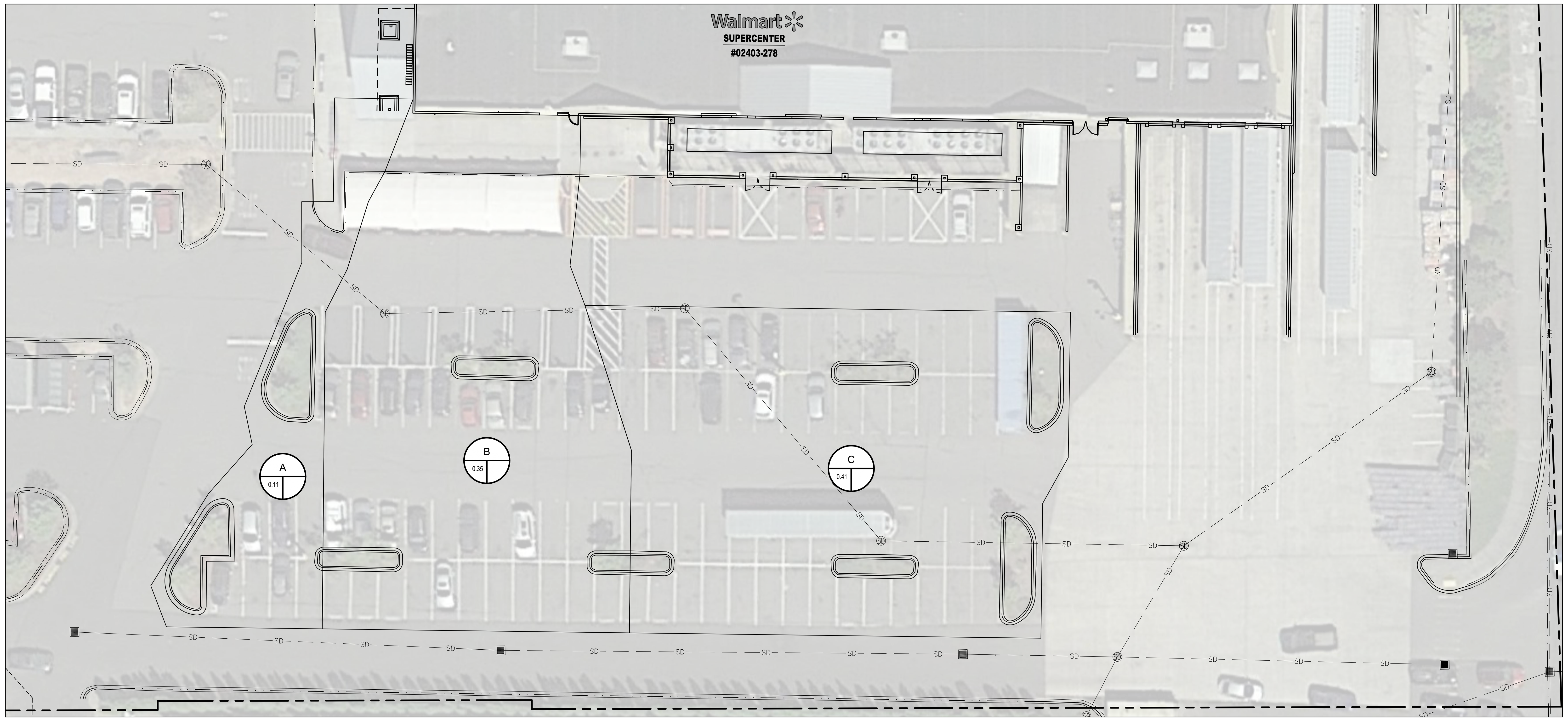


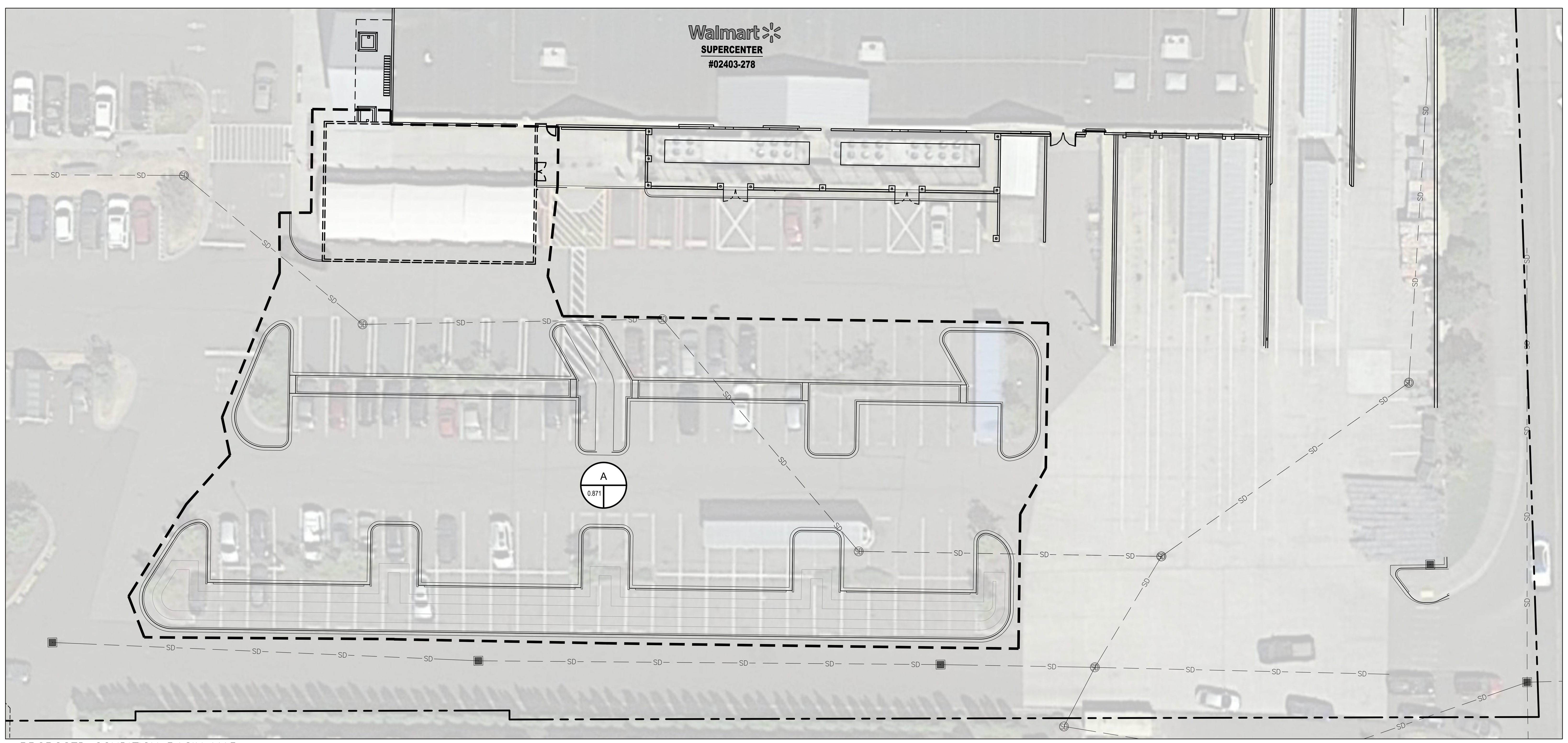
Figure 1-0

ii) Basin Map



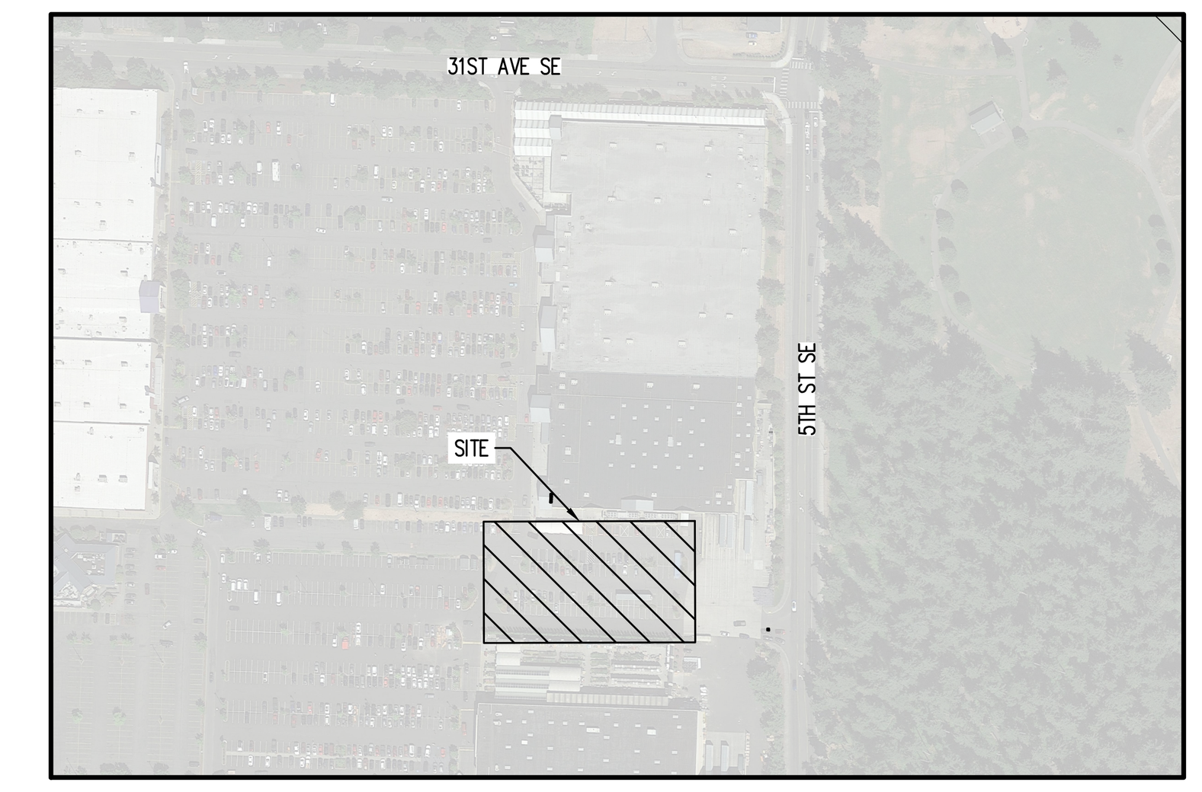
EXISTING CONDITION BASIN MAP

SCALE: 1"=20'



PROPOSED CONDITION BASIN MAP

SCALE: 1"=20'

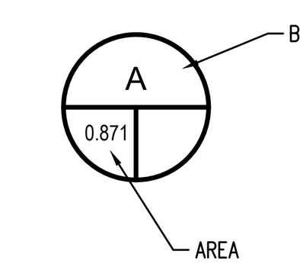


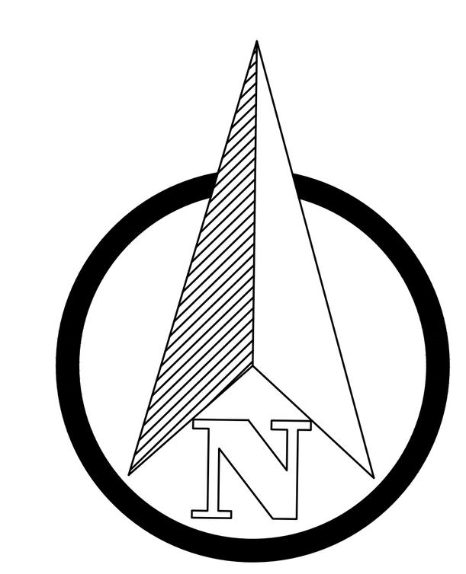
KEY MAP

APPROX. 1" = 300'

LEGEND

— - - —	EXISTING PROPERTY LINE
———	EXISTING BASIN BOUNDARY
— — —	MODIFIED BASIN BOUNDARY
- - - -	BUILDING EXPANSION
═══	PROPOSED CURB AND GUTTER





GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

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Walmart
PUYALLUP, WA
310 31ST AVE SE
STORE NO: 02403-278

JOB NUMBER: WDP002403.20 | PROTO: PICKUP ENHNCMNT

ISSUE BLOCK		
1	PR#1	01/25/22

CHECKED BY:	RCJ
DRAWN BY:	JRC
PROTO CYCLE:	–
DOCUMENT DATE:	09/08/21

NOT FOR CONSTRUCTION

BASIN MAP

SHEET:
1 OF 1

4. Proposed Project Site Conditions

The proposed site will demolish approximately 37957.6 SF of surface area to accommodate for a building expansion to the Walmart Supercenter. The project site use will remain commercial use as we are expanding on the existing commercial building on the property. In the proposed condition, the stormwater runoff will not increase from the existing condition. Please reference the Basin Map above for more information about the drainage patterns.

5. Minimum Requirement Determination

A. Flowcharts:

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

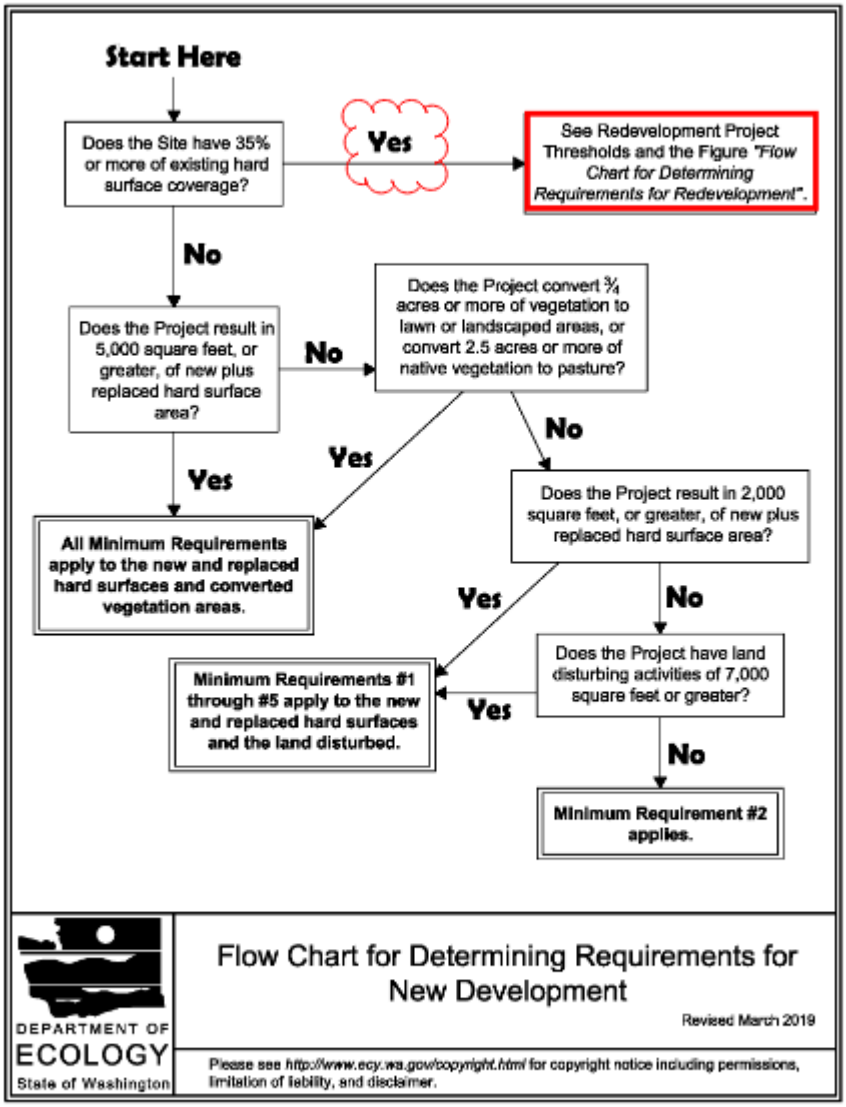
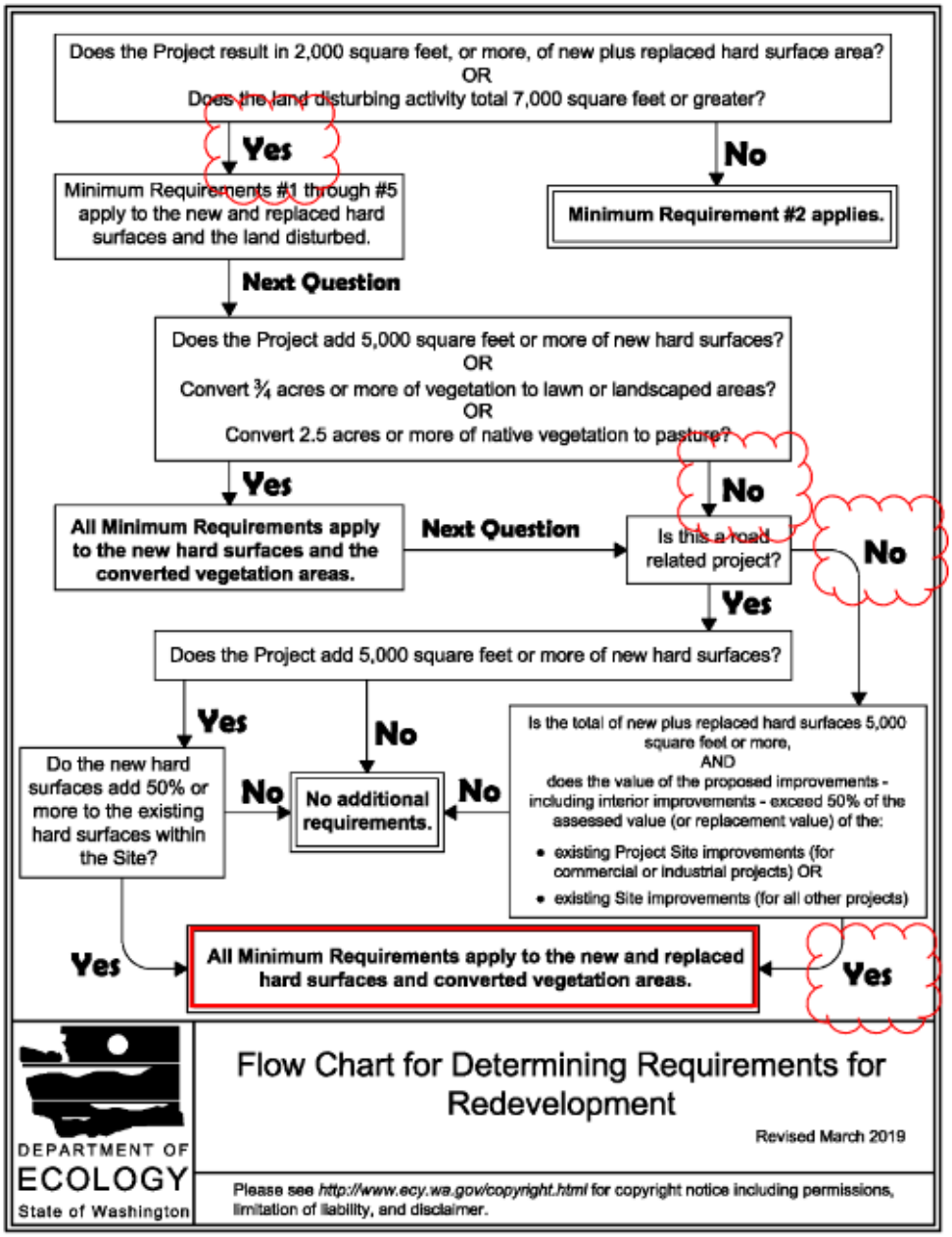


Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment



B. Minimum Requirements Required

Applicable Minimum Requirements	Applicable Surface Type Requiring Mitigation
1 through 9	New and Replaced Hard Surfaces and Converted Vegetation Areas and Land Disturbed

6. Western Washington Minimum Requirements 1-9

A. Minimum Requirement #1 – Preparation of a Stormwater Site Plan

This Stormwater Site Plan Report and the associated Walmart Pickup Expansion Plans are being used to meet Minimum Requirement #1.

B. Minimum Requirement #2 – Construction Stormwater Pollution Prevention Plan

The Construction Stormwater Pollution Prevention Plan addressing each BMP proposed per the 2019 Stormwater Management for Western Washington is available in this document before the appendices.

C. Minimum Requirement #3 – Source Control

i. Description of Final Site Use

The final project use will be a commercial use due to the project being a building expansion to accommodate the Walmart grocery pickup needs. The final condition will add improvements to the existing site use.

ii. Operational Source Control BMPs

Reference section 4 for more details associated with each Operational Source Control BMP listed.

Stormwater pollution will ne controlled at its source to the maximum extent possible. All known, available, and reasonable source control BMPs have been applied to the design and layout of the civil design plans.

BMP	Potential Pollutant(s) Associated with Activity or Pollutant that BMP is being used for.
BMP S410: Correcting Illicit Discharges to Storm Drains	Illicit discharges where unpermitted sanitary or unprocessed wastewater discharges to a storm sewer rather than appropriate treatment. This is not a feasible BMP because there are not foreseeable illicit discharges expected.
BMP S453: Formation of a Pollution Prevention Team	The formation of a pollution prevention plan that consists of people familiar with the facility shall be responsible for implementing and maintain all BMPs. The people of this team shall possess the knowledge and skills to assess the conditions and activities onsite that will impact stormwater. BMP S453 is feasible and the

	contractor shall appoint a person onsite to perform onsite maintenance and inspection.
BMP S454: Preventative Maintenance & Good Housekeeping	Preventative maintenance and good housekeeping practices reduce the potential for stormwater to meet pollutants and can reduce maintenance intervals for the drainage system. BMP S454 is feasible, and the contractor shall maintain good housekeeping, promptly contain pollutants and perform preventative maintenance.
BMP S455: Spill Prevention & Cleanup	Spills and leaks can damage public infrastructure, interfere with sewage treatment, and cause a threat to human health and environment. Spills are preventable with appropriate waste handling techniques being practiced effectively. The contractor shall contain and clean all spills and pollutants, and report all spills.
BMP S456: Employee Training	Employee training for people that will work in pollutant source areas to understand pollutant control measures, spill prevention, and emergency response procedures will assist in best management practices on site. Contactor shall train and identify proper response for all pollutant causing activities or items for all workers onsite.
BMP S457: Inspections	Qualified personnel shall conduct inspections monthly. Inspectors shall maintain record of each inspection on-site. Inspectors shall be familiar with the site, operations, and proposed BMPS. The inspector shall verify the accuracy of the pollutant sources described and shall assess all BMPs that have been implemented for effectiveness and needed maintenance.
BMP S458: Record Keeping	At a minimum the following record-keeping shall be retained for up to 5 years: Inspection reports that include time and date of inspection, locations inspected, statement on status od compliance with permit, summary of report and actions required, name/title/signature of person conducting inspections. All spill reports shall be maintained as well.

*BMP detailed descriptions for each source control BMP listed have been included in Section 6 of this document. These descriptions were pulled directly from the 2019 Stormwater Management Manual for Western Washington (Volume IV, Chapter 1)

D. Minimum Requirement #4 – Preserving Drainage Patterns and Outfalls

The existing drainage pattern shall be utilized and maintained to the maximum extent feasible. Discharge from the project site will occur at the existing location to the maximum amount feasible. The discharge from this project will not cause negative impacts to downstream properties or receiving waters due to the additional impervious area being added to the site and the maintained usage of the existing drainage patterns.

E. Minimum Requirement #5 – Onsite Stormwater Management

The List Approach.

Minimum Requirement #5 List Method for Not Flow Control Exempt Projects:

Surface Type: Lawn/Landscaped Areas	
Analyze the BMP below for feasibility. If the BMP is feasible if must be used.	Is BMP Feasible?
BMP T5.13: Post-Construction Soil Quality and Depth	☒ Yes ☐ No
Surface Type: Roofs	
The following BMPs have been analyzed for their necessity as a part of this project. Checkmarks will appear next to the feasible BMPs.	Is BMP Feasible?
☐ BMP T5.30: Full Dispersion or ☐ BMP T5.10A: Downspout Full Infiltration	☐ Yes ☒ No
☐ BMP T5.14: Rain Gardens or ☒ BMP T7.30: Bioretention	☒ Yes ☐ No
Surface Type: Other Hard Surfaces	
The following BMPs have been analyzed for their necessity as a part of this project. Checkmarks will appear next to the feasible BMPs.	Is BMP Feasible?
BMP T5.30: Full Dispersion	☐ Yes ☒ No
☐ BMP T5.15: Permeable Pavement, or ☐ BMP T5.14: Rain Gardens, or ☒ BMP T7.30: Bioretention	☒ Yes ☐ No

Among the presented Flow Control BMPs, there are 2 that are feasible for this project site. For BMP T5.13 the contractor shall retain, in an undisturbed state, the duff layer and native topsoil to the maximum extent possible. In areas requiring grading, the contractor shall remove and stockpile the duff layer and topsoil onsite within the stockpile area to be reapplied to the site where feasible. All areas subject to clearing and grading that have not been covered by impervious surface, incorporated into a drainage facility, or engineered as structural fill or slope shall be amended to meet organic matter or depth requirements to a preapproved rate. Also, BMP T7.30 Bioretention is feasible for this site because there is space within the landscaped area and existing storm infrastructure that can be connected to for stormwater management of runoff caused by the new building expansion and impervious surface area.

BMP T5.10A: Downspout Full Infiltration is not feasible because existing downspouts onsite are splash on grade and we are not proposing to alter those downspouts. The runoff from the new roof area will be captured within the proposed bioretention area.

BMP T5.30: Full Dispersion is not feasible because there is not a cleared, preserved, or forested area near the project that runoff can be directed to.

F. Minimum Requirement #6 – Stormwater Treatment

This project proposes more than 5,000 SF of replaced hard surface therefore basic treatment of stormwater runoff collected from pollution generating impervious surfaces. In accordance with this requirement, Bioretention shall be utilized for this project to provide stormwater treatment. Due to the infiltration rate measured onsite, and the size of the proposed bioretention area there is favorable water quality storm treatment achieved. WWHM modeling results attached at the end of this report depicts the amount of water quality being performed by the bioretention area.

G. Minimum Requirement #7 – Flow Control

This project proposes the implementation of a bioretention system with an outlet structure with strategically placed orifices to mitigate flow control. Impervious surface runoff is designed to ensure the mitigated condition site runoff release rates will meet the flow control thresholds outlined in the department of ecology manual. The bioretention was designed per a forested condition with about a 50/50 split between soil types. One hundred percent infiltration is achieved within the proposed bioretention area, reference WWHM modeling results at the end of this report.

H. Minimum Requirement #8 – Wetlands Protection

No wetlands have been identified on or adjacent to the property. Therefore, no additional wetland protection requirements will apply to this project.

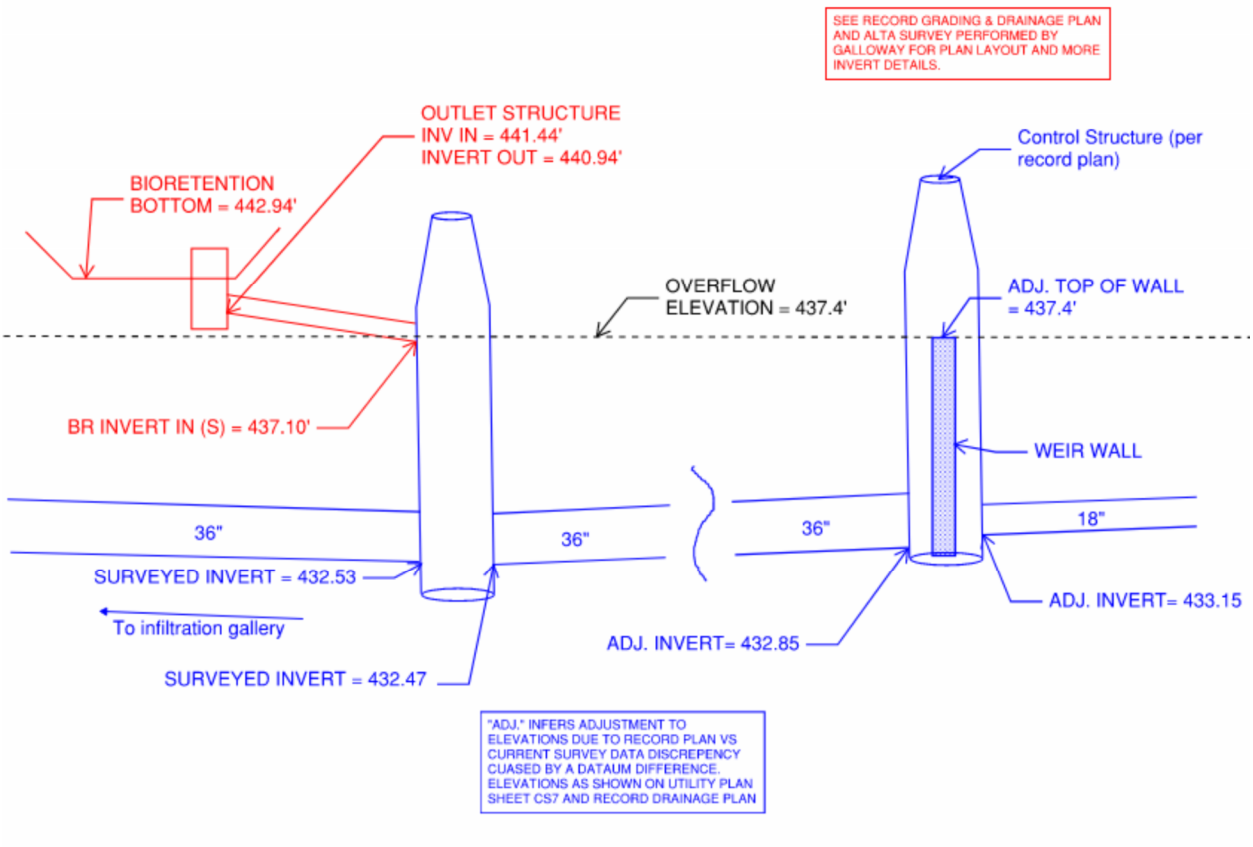
I. Minimum Requirement #9 – Operation and Maintenance

The contractor shall be responsible for maintenance and operation of BMPs onsite. A copy of the Operation and Maintenance BMPs, included at the end of this report, shall be kept onsite and accessible at all times during construction. A log of maintenance activity that indicates what actions were taken shall be kept and be available for inspection by local government.

Backflow Analysis:

Based on the flow direction and inverts highlighted in the record plan (included as a supplement reference to this submittal) as well as the adjustment based on our surveyed information (given we do not have survey data for all structures analyzed), we have inferred that generally water on this property will be collected and conveyed to the infiltration gallery within the parking area at the front of the Supercenter. There is a control structure that we have identified (Reference utility plan CS7) which has a wall within it acting as a weir for the infiltration gallery overflow should it back up. This top of wall elevation is what we have assumed as our overflow elevation in the sketch below for a quick backflow analysis (blue is existing, red is proposed).

The invert elevation where the proposed bioretention is to tie to the existing system on site is 437.1'. Since the top of wall elevation is 437.4' (reference record drainage plan included with submittal) it can be reasonably assumed that if the infiltration gallery were to fail, the stormwater would not back fill into the proposed bioretention given the 3.5' of fall from the outlet invert into the manhole upstream of the control structure. Overflows from the infiltration gallery and eventually the bioretention will eventually outfall to Lake Bradley, downstream of the control structure.



Construction Stormwater Pollution Prevention Plan (SWPPP) Report

Erosion and Sediment Control Lead

Name	Organization	Contact Telephone Number	Email Address	CESCL/CPESC Number (if applicable)
Brandon Alley	Galloway & Company, Inc.	(303) 770-8884	BrandonAlley@GallowayUS.com	N/A

1. 13 Elements of Construction Stormwater Pollution Prevention

The following SWPPP elements have been depicted in sheet CS-5 of the civil plan set that is being submitted as a part of this report for reference. See section 4 of this report for details of BMPs used in each of these elements.

iii. Source Control BMPs

BMP	SWPPP Element	Potential Pollutant(s) Associated with Activity or Pollutant that BMP is being used for.
BMP C103: High Visibility Fence	1	Loose dust and debris. Vehicle traffic and pollutants. Protect undisturbed areas.
Other BMP: Temporary Vehicle Track Out Mat	2	Loose debris from vehicles entering and exiting erosion-controlled area.
Other BMP: Silt Dike on Pavement	3	Reduced the transport of coarse sediment to storm system
BMP C220: Inlet Protection	4/7	Prevents coarse sediment from entering drainage system
BMP C120: Temporary and Permanent Seeding	5	Reduces erosion by stabilizing exposed soils.
BMP C152: Saw cutting and Surface Pollution Prevention	9	Minimize and eliminate process water and slurry produced.
BMP 150: Materials on Hand	11/12	Reduces time between repair and implementation of updated BMPs to protect against erosion and continue erosion control.

*BMP details have been included in Section 5 of this document. These details were pulled directly from the 2019 Stormwater Management Manual for Western Washington (Volume II, Chapter 3)

A. Element #1: Preserve Vegetation and Mark Clearing Limits

Before beginning any land disturbing activities, including clearing and grading, the contractor shall clearly mark all clearing limits to prevent damage and offsite impacts. On this site it is proposed that BMP C103 – High Visibility Fencing is to be used to clearly mark the construction disturbance limits. The use of High Visibility Fencing as a construction fence is an obvious barrier of construction limits. This will not only keep pedestrians out of the construction area, but it can also act as dust and debris mitigation when wind blows on site. Due to the nature of this commercial building expansion, it is not feasible to preserve native vegetation or topsoil. Any soil stockpiles shall be covered to mitigate dust control.

B. Element #2: Establish Construction Access

Construction Vehicle ingress and egress has been limited to one construction entrance. To act as stabilized access to the site it is proposed that a temporary track-out mat BMP be placed at the opening to the construction area. The proposed temporary track out mat is the FODS Trackout Control System which has been reviewed by the Washington Department of Ecology and approved for use throughout the state. The FODS system is an effective and environmentally friendly BMP that enables contractors to minimize sedimentation and stay compliant with NPDES requirements. The FODS system is a reusable construction entrance and exit system comprised of HDPE mats that have a pattern of pyramid shapes. The pyramids deform tires of vehicles as that drive over it to dislodge soil and sediment trapped in tires. If sediment is tracked offsite, offsite areas (including roadways) shall be thoroughly and immediately cleaned by shoveling or pickup sweeping. All sediment shall then be transported back to the sediment-controlled area.

C. Element #3: Control Flow Rates

Protection of downstream properties, receiving waters, and conveyance systems from erosion and other damage due to increases in the velocity and peak volumetric flowrate of stormwater from the project site shall be mitigated with the Silt Dike on Pavement BMP. The Silt Dike on Pavement shall be constructed as one of the first steps in grading. This BMP will act as flow control for any stormwater on site that may sheet flow offsite. The sediment shall be caught in the silk dike onsite to protect the existing storm sewer system from pollution due to sediment entering the storm system.

D. Element #4: Install Sediment Controls

Install and maintain effective inlet protection and silt dike on pavement to minimize the discharge of pollutants. In combination with BMP C220 Inlet Protection and the Silt Dike on Pavement BMP, sediment discharge from the site will be minimized. These sediment control BMPs shall be constructed as the first step in grading, and these BMPs will be in place prior to any land disturbing activities begin on site. Discharge from this site will pass through sediment removal BMPs before leaving the site or entering an infiltration system. Pollution to the stormwater system due to sediment or other onsite construction activities will be minimized to the greatest degree feasible using these BMPS

E. Element #5: Stabilize Soils

Stabilization of exposed and unworked soils shall use BMP C120 Temporary and Permanent Seeding to prevent erosion during and after construction. From October 1 through April 30, no soils shall remain exposed and unworked for more than 2 days. From May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days. This stabilization requirement applies to all soils onsite, whether at final grade or not. The pavement being removed and replaced will be removed to the basecourse material. The basecourse may encounter minor disturbance during pavement removal and will be recompacted before the proposed asphalt is laid. It is not anticipated that existing subgrade below replaced pavement will be disturbed. Should new base course be needed after re-compaction, contractor shall verify gravel base being used does not contain fines or sediment that may get caught in runoff. Contractor shall minimize the amount of soil exposed during construction activities as much as feasible.

Proposed Start Date: September 2023

Proposed End Date: September 2024

> Note: Per City of Puyallup Standards, section 501.5, Exposed areas and soil stockpiles must be stabilized according to the following schedule:
> 1. From April 1 to October 31 all disturbed areas at final grade and all exposed areas that are scheduled to remain unworked for more than 30 days shall be stabilized within 10 days.
> 2. From November 1 to March 31 all exposed soils at final grade shall be stabilized immediately using permanent or temporary measures. Exposed soils within an area greater than 5,000 SF that are scheduled for more than 24 hours and exposed areas of less than 5,000 SF that will remain unworked for more than 7 days shall be stabilized immediately.

F. Element #6: Protect Slopes

Element is #6 is not required for this project because there are not slopes that need to be stabilized on site as part of the disturbance caused by this project construction.

G. Element #7: Protect Stormwater System Inlets

Protect all stormwater system inlets that are operable during construction so that stormwater does not enter the conveyance system without first being filtered or treated to remove sediment using BMP C220. Clean or remove and replace inlet protection devices when sediment has filled 1/3 of the available storage (unless a different standard is specified by the product manufacturer). To verify inlets onsite are no being filled with sediment inlet inspections shall take place weekly. During storm events, inlets shall be inspected daily to verify sediment is not entering the storm system.

H. Element #8: Stabilize Channels and Outlets

This Element is not required because there will not be impacted channels or outlets that will need to be stabilized due to this construction.

I. Element #9: Control Pollutants

Due to the nature of this project, it will be pertinent that any pollutants produced due to demolition or construction are properly contained within the limits of disturbance. The contractor shall implement and maintain effective pollution prevention by handling and disposing of all pollutants, including waste materials and demolition debris to minimize the discharge of pollutants in such a way that does not contaminate stormwater leaving the site. The contractor shall 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 and the environment. Provide secondary containment for tanks holding pollutants including onsite fueling tanks. Secondary containment means placing tanks or containers within an impervious structure capable of containing 110% of the volume contained in the largest tank within the containment structure. Double-walled tanks do not require additional secondary containment. When performing the final seeding of landscaped areas, the contractor shall apply fertilizers and pesticides in a manner and at application rates that will not result in loss of chemicals to stormwater. Follow manufacturers' recommendations for application rates and procedures. The contractor shall use BMP 152 for Sawcutting and Surface Pollution Prevention. Sawcuttung and surface operations generate a slurry and process water that contains fine particles and a high pH that may impact the stormwater if it is not properly contained, so the contractor shall use this BMP to minimize and eliminate process water and slurry created when performing this construction activity. The contractor shall also clean contaminated surfaces immediately following any discharge or spill incident.

J. Element #10: Dewatering

This Element is not required for this project because there will not be construction activities that will require dewatering practices as a part of the construction due to the building expansion.

K. Element #11: Maintain BMPs

Maintain and repair as needed all temporary and permanent erosion and sediment control BMPs to assure continued performance of their intended function. To maintain sediment control BMPs onsite the contractor shall use BMP C150, materials on hand. Contractor shall conduct maintenance and repairs in accordance with BMP specifications. The contractor shall remove temporary erosion and sediment control BMPs within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed. Trapped sediment shall be removed or stabilized onsite, and the contractor shall permanently stabilize disturbed soil resulting from removal of BMPs or vegetation.

L. Element #12: Manage the Project

Regular inspections of the BMPs being utilized onsite shall take place to ensure they are still being utilized as described in this report to prevent stormwater pollution. It is proposed that BMP C150 Materials on hand be utilized to aide in managing BMPs during construction. Site inspections shall be conducted by a person that is knowledgeable in the principles and practices of sediment and erosion control. The person inspecting the BMPs must have the skills to 1) assess the site conditions and construction activities that could impact the quality of storm water, and 2) assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges. Appropriate BMPs or design changes shall be implemented as soon as possible when inspection deems any BMP inadequate.

M. Element #13: Protect Permanent Stormwater BMPs

This Element is not required for this project because there are not permanent BMPs that will remain on site post construction.

City of Puyallup Construction Stormwater Site Inspection Form included at the end of this report.

2. Soils Report

(Submitted as a supplement document to this report)

3. Geotechnical Report

(Submitted as a supplement document to this report)

4. Source Control and SWPPP BMPs

- Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.
- Refer to BMP C252: Treating and Disposing of High pH Water for pH adjustment requirements.
- Refer to the Construction Stormwater General Permit (CSWGP) for pH monitoring requirements if the project involves one of the following activities:
    - Significant concrete work (as defined in the CSWGP).
    - The use of soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
    - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

Maintenance Standards

Check containers for holes in the liner daily during concrete pours and repair the same day.

BMP C152: Sawcutting and Surfacing Pollution Prevention

Purpose

Sawcutting and surfacing operations generate slurry and process water that contains fine particles and high pH (concrete cutting), both of which can violate the water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate process water and slurry created through sawcutting or surfacing from entering waters of the State.

Conditions of Use

Utilize these management practices anytime sawcutting or surfacing operations take place. Sawcutting and surfacing operations include, but are not limited to:

- Sawing
- Coring
- Grinding
- Roughening
- Hydro-demolition
- Bridge and road surfacing

Design and Installation Specifications

- Vacuum slurry and cuttings during cutting and surfacing operations.
- Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
- Slurry and cuttings shall not drain to any natural or constructed drainage conveyance including stormwater systems. This may require temporarily blocking catch basins.
- Dispose of collected slurry and cuttings in a manner that does not violate ground water or surface water quality standards.
- Do not allow process water generated during hydro-demolition, surface roughening or similar operations to drain to any natural or constructed drainage conveyance including stormwater systems. Dispose of process water in a manner that does not violate ground water or surface water quality standards.
- Handle and dispose of cleaning waste material and demolition debris in a manner that does not cause contamination of water. Dispose of sweeping material from a pick-up sweeper at an appropriate disposal site.

Maintenance Standards

Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and/or vacuum trucks.

BMP C153: Material Delivery, Storage, and Containment

Purpose

Prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage. Minimize the storage of hazardous materials on-site, store materials in a designated area, and install secondary containment.

Conditions of Use

Use at construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g., Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds

compliance with this BMP.

- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Techniques that can be used for unpaved roads and lots include:
    - Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
    - Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
    - Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
    - Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
    - Encourage the use of alternate, paved routes, if available.
    - Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
    - Limit dust-causing work on windy days.
    - Pave unpaved permanent roads and other trafficked areas.

Maintenance Standards

Respray area as necessary to keep dust to a minimum.

BMP C150: Materials on Hand

Purpose

Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy rains. Having these materials on-site reduces the time needed to replace existing or implement new BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

Conditions of Use

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible

pipe, sandbags, geotextile fabric and steel “T” posts.

- Materials should be stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or project proponent could keep a stockpile of materials that are available for use on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum list of items that will cover numerous situations includes:

- Clear Plastic, 6 mil
- Drainpipe, 6 or 8 inch diameter
- Sandbags, filled
- Straw Bales for mulching
- Quarry Spalls
- Washed Gravel
- Geotextile Fabric
- Catch Basin Inserts
- Steel "T" Posts
- Silt fence material
- Straw Wattles

Maintenance Standards

- All materials with the exception of the quarry spalls, steel “T” posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials as needed.

BMP C151: Concrete Handling

Purpose

Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the State.

Crushed rock, gravel base, etc., shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.

Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.

Perform street cleaning at the end of each day or more often if necessary.

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1.

Between July 1 and August 30 seeding requires irrigation until 75 percent grass cover is established.

Between October 1 and March 30 seeding requires a cover of mulch or an erosion control blanket until 75 percent grass cover is established.

Review all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.

Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.

Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See BMP T5.13: Post-Construction Soil Quality and Depth.

Design and Installation Specifications

General

- Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix. For vegetated channels that will have high flows, install erosion control blankets over the top of hydroseed. Before allowing water to flow in vegetated channels, establish 75 percent vegetation cover. If vegetated channels cannot be established by seed

before water flow; install sod in the channel bottom — over top of hydromulch and erosion control blankets.

- Confirm the installation of all required surface water control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. See BMP C121: Mulching for specifications.
- Areas that will have seeding only and not landscaping may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Re-install native topsoil on the disturbed soil surface before application. See BMP T5.13: Post-Construction Soil Quality and Depth.
- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. To overcome this, consider increasing seed quantities by up to 50 percent.
- Enhance vegetation establishment by dividing the hydromulch operation into two phases:
    - Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift.
    - Phase 2- Install the rest of the mulch and tackifier over the first lift.

  Or, enhance vegetation by:
    - Installing the mulch, seed, fertilizer, and tackifier in one lift.
    - Spread or blow straw over the top of the hydromulch at a rate of 800-1000 pounds per acre.
    - Hold straw in place with a standard tackifier.

  Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:
    - Irrigation.
    - Reapplication of mulch.
    - Repair of failed slope surfaces.

  This technique works with standard hydromulch (1,500 pounds per acre minimum) and Bonded Fiber Matrix/ Mechanically Bonded Fiber Matrix (BFM/MBFMs) (3,000 pounds per acre minimum).
- Seed may be installed by hand if:
    - Temporary and covered by straw, mulch, or topsoil.
    - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- The seed mixes listed in Table II-3.4: Temporary and Permanent Seed Mixes include

recommended mixes for both temporary and permanent seeding.

- Apply these mixes, with the exception of the wet area seed mix, at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Apply the wet area seed mix at a rate of 60 pounds per acre.
- Consult the local suppliers or the local conservation district for their recommendations. The appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used, depending on the soil type and hydrology of the area.

Table II-3.4: Temporary and Permanent Seed Mixes

Common Name	Latin Name	% Weight	% Purity	% Germination
Temporary Erosion Control Seed Mix A standard mix for areas requiring a temporary vegetative cover.				
Chewings or annual blue grass	*Festuca rubra var. commutata* or *Poa anna*	40	98	90
Perennial rye	*Lolium perenne*	50	98	90
Redtop or colonial bentgrass	*Agrostis alba* or *Agrostis tenuis*	5	92	85
White dutch clover	*Trifolium repens*	5	98	90
Landscaping Seed Mix A recommended mix for landscaping seed.				
Perennial rye blend	*Lolium perenne*	70	98	90
Chewings and red fescue blend	*Festuca rubra var. commutata* or *Festuca rubra*	30	98	90
Low-Growing Turf Seed Mix A turf seed mix for dry situations where there is no need for watering. This mix requires very little maintenance.				
Dwarf tall fescue (several varieties)	*Festuca arundinacea var.*	45	98	90
Dwarf perennial rye (Barclay)	*Lolium perenne var. barclay*	30	98	90
Red fescue	*Festuca rubra*	20	98	90
Colonial bentgrass	*Agrostis tenuis*	5	98	90
Bioswale Seed Mix A seed mix for bioswales and other intermittently wet areas.				
Tall or meadow fes-	*Festuca arundin-*	75-80	98	90

Table II-3.4: Temporary and Permanent Seed Mixes (continued)

Common Name	Latin Name	% Weight	% Purity	% Germination
cue	*acea* or *Festuca elatior*			
Seaside/Creeping bentgrass	*Agrostis palustris*	10-15	92	85
Redtop bentgrass	*Agrostis alba* or *Agrostis gigantea*	5-10	90	80
Wet Area Seed Mix A low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Consult Hydraulic Permit Authority (HPA) for seed mixes if applicable.				
Tall or meadow fescue	*Festuca arundinacea* or *Festuca elatior*	60-70	98	90
Seaside/Creeping bentgrass	*Agrostis palustris*	10-15	98	85
Meadow foxtail	*Alepocurus pratensis*	10-15	90	80
Alsike clover	*Trifolium hybridum*	1-6	98	90
Redtop bentgrass	*Agrostis alba*	1-6	92	85
Meadow Seed Mix A recommended meadow seed mix for infrequently maintained areas or non-maintained areas where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. Consider the appropriateness of clover, a fairly invasive species, in the mix. Amending the soil can reduce the need for clover.				
Redtop or Oregon bentgrass	*Agrostis alba* or *Agrostis oregonensis*	20	92	85
Red fescue	*Festuca rubra*	70	98	90
White dutch clover	*Trifolium repens*	10	98	90

Roughening and Rototilling

- The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Backblading or smoothing of slopes greater than 4H:1V is not allowed if they are to be seeded.
- Restoration-based landscape practices require deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum,

permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches complete the rototilling process in multiple lifts, or prepare the engineered soil system per specifications and place to achieve the specified depth.

Fertilizers

- Conducting soil tests to determine the exact type and quantity of fertilizer is recommended. This will prevent the over-application of fertilizer.
- Organic matter is the most appropriate form of fertilizer because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form.
- In general, use 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer at a rate of 90 pounds per acre. Always use slow-release fertilizers because they are more efficient and have fewer environmental impacts. Do not add fertilizer to the hydromulch machine, or agitate, more than 20 minutes before use. Too much agitation destroys the slow-release coating.
- There are numerous products available that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal provides a good source of long-term, slow-release, available nitrogen.

Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix

- On steep slopes use Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products. Apply BFM/MBFM products at a minimum rate of 3,000 pounds per acre with approximately 10 percent tackifier. Achieve a minimum of 95 percent soil coverage during application. Numerous products are available commercially. Most products require 24-36 hours to cure before rainfall and cannot be installed on wet or saturated soils. Generally, products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.
- Install products per manufacturer's instructions.
- BFMs and MBFMs provide good alternatives to blankets in most areas requiring vegetation establishment. Advantages over blankets include:
    - BFM and MBFMs do not require surface preparation.
    - Helicopters can assist in installing BFM and MBFMs in remote areas.
    - On slopes steeper than 2.5H:1V, blanket installers may require ropes and harnesses for safety.
    - Installing BFM and MBFMs can save at least $1,000 per acre compared to blankets.

Maintenance Standards

Reseed any seeded areas that fail to establish at least 75 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, nets, or blankets.

- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes run-off.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

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

BMP C121: Mulching

Purpose

Mulching soils provides immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There are a variety of mulches that can be used. This section discusses only the most common types of mulch.

Conditions of Use

As a temporary cover measure, mulch should be used:

- For less than 30 days on disturbed areas that require cover.
- At all times for seeded areas, especially during the wet season and during the hot summer months.
- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.

Mulch may be applied at any time of the year and must be refreshed periodically.

For seeded areas, mulch may be made up of 100 percent:

- cottonseed meal;
- fibers made of wood, recycled cellulose, hemp, or kenaf;

BMP C103: High-Visibility Fence

Purpose

High-visibility fencing is intended to:

- Restrict clearing to approved limits.
- Prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed.
- Limit construction traffic to designated construction entrances, exits, or internal roads.
- Protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits plastic, fabric, or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary to control vehicle access to and on the site.

Design and Installation Specifications

High-visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high-visibility orange. The fence tensile strength shall be 360 lbs/ft using the ASTM D4595 testing method.

If appropriate install fabric silt fence in accordance with BMP C233: Silt Fence to act as high-visibility fence. Silt fence shall be at least 3 feet high and must be highly visible to meet the requirements of this BMP.

Metal fences shall be designed and installed according to the manufacturer's specifications.

Metal fences shall be at least 3 feet high and must be highly visible.

Fences shall not be wired or stapled to trees.

Maintenance Standards

If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

thickness is 2 feet.

- For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), use an engineered energy dissipator.
- Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion. See BMP C122: Nets and Blankets.

- Bank stabilization, bioengineering, and habitat features may be required for disturbed areas. This work may require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife. See I-2.11 Hydraulic Project Approvals.

Maintenance Standards

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipator if sediment builds up.

BMP C220: Inlet Protection

Purpose

Inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Use inlet protection at inlets that are operational before permanent stabilization of the disturbed areas that contribute runoff to the inlet. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by a sediment trapping BMP.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters can add significant amounts of sediment into the roof drain system. If possible, delay installing lawn and yard drains until just before landscaping, or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

Table II-3.10: Storm Drain Inlet Protection lists several options for inlet protection. All of the methods for inlet protection tend to plug and require a high frequency of maintenance. Limit contributing drainage areas for an individual inlet to one acre or less. If possible, provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

Table II-3.10: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding may occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area requirement: 30'x30'/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No	Paved or Earthen	Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap	N/A	N/A	18 month expected life.

Design and Installation Specifications

Excavated Drop Inlet Protection

Excavated drop inlet protection consists of an excavated impoundment around the storm drain inlet. Sediment settles out of the stormwater prior to entering the storm drain. Design and installation specifications for excavated drop inlet protection include:

- Provide a depth of 1-2 ft as measured from the crest of the inlet structure.
- Slope sides of excavation should be no steeper than 2H:1V.
- Minimum volume of excavation is 35 cubic yards.
- Shape the excavation to fit the site, with the longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.

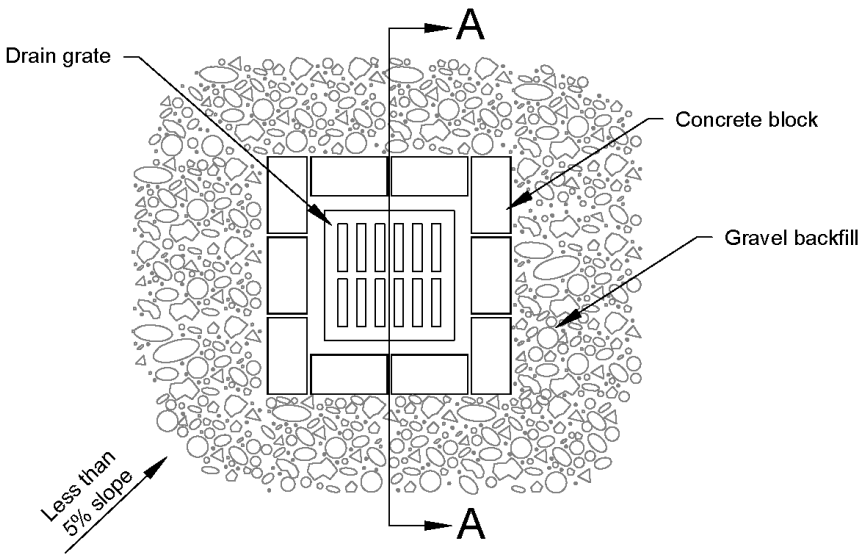
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter

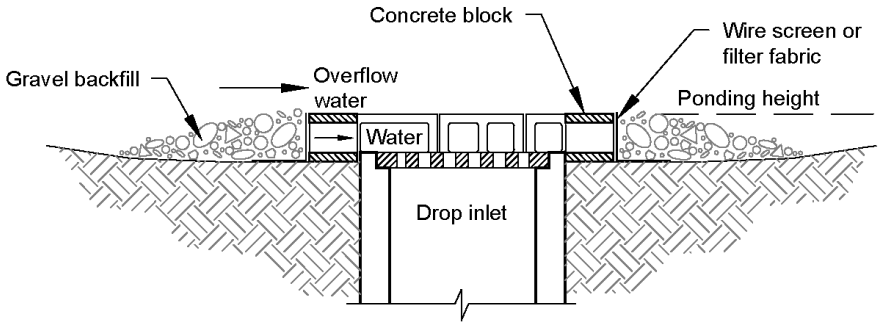
A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure II-3.17: Block and Gravel Filter. Design and installation specifications for block gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
- Place gravel to just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel berm surrounding the inlet, as follows:
    - Provide a slope of 3H:1V on the upstream side of the berm.
    - Provide a slope of 2H:1V on the downstream side of the berm.
    - Provide a 1-foot wide level stone area between the gravel berm and the inlet.
    - Use stones 3 inches in diameter or larger on the upstream slope of the berm.
    - Use gravel ½- to ¾-inch at a minimum thickness of 1-foot on the downstream slope of the berm.

Figure II-3.17: Block and Gravel Filter



Plan View



Section A-A

Notes:

1. Drop inlet sediment barriers are to be used for small, nearly level drainage areas. (less than 5%)
2. Excavate a basin of sufficient size adjacent to the drop inlet.
3. The top of the structure (ponding height) must be well below the ground elevation downslope to prevent runoff from bypassing the inlet. A temporary dike may be necessary on the downslope side of the structure.

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Block and Gravel Filter

Revised June 2016

Gravel and Wire Mesh Filter

Gravel and wire mesh filters are gravel barriers placed over the top of the inlet. This method does not provide an overflow. Design and installation specifications for gravel and wire mesh filters include:

- Use a hardware cloth or comparable wire mesh with ½-inch openings.
    - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
    - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.
    - Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

Catch Basin Filters

Catch basin filters are designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements, combine a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way. Design and installation specifications for catch basin filters include:

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catch basin filter in the catch basin just below the grating.

Curb Inlet Protection with Wooden Weir

Curb inlet protection with wooden weir is an option that consists of a barrier formed around a curb inlet with a wooden frame and gravel. Design and installation specifications for curb inlet protection with wooden weirs include:

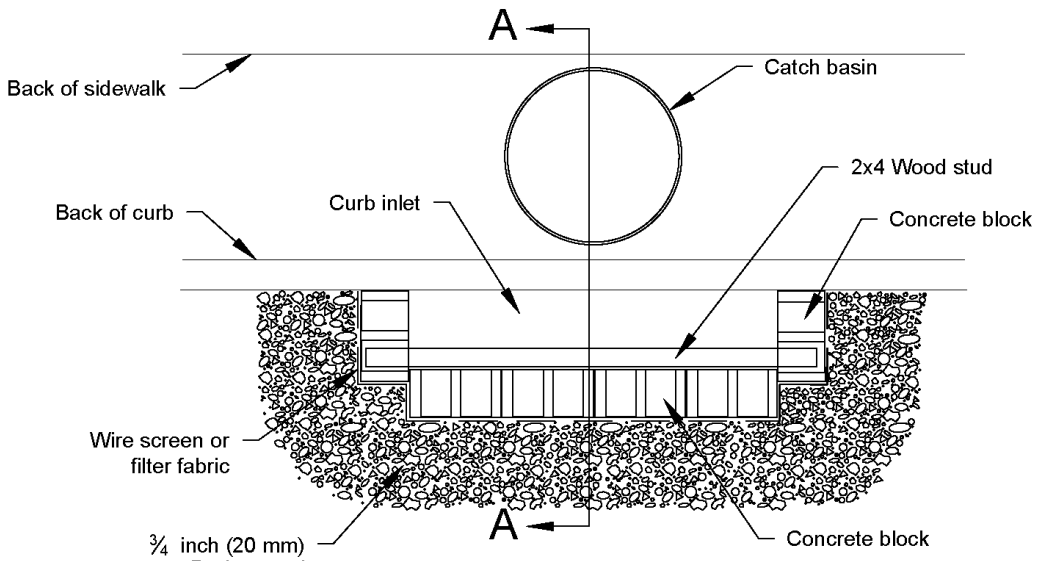
- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

Block and Gravel Curb Inlet Protection

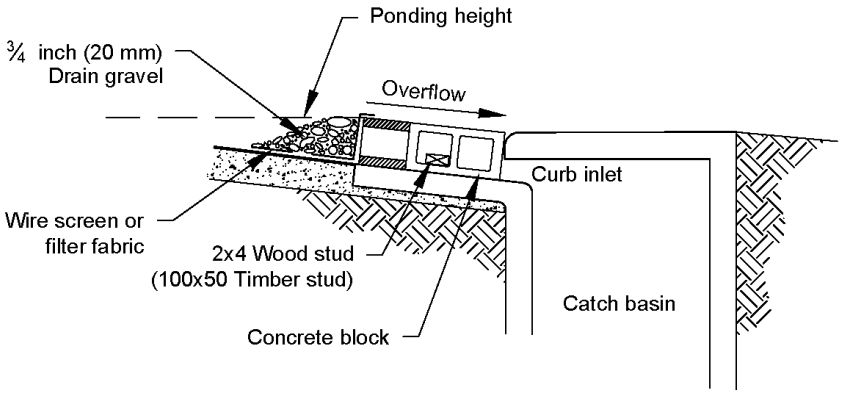
Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure II-3.18: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- Use wire mesh with ½-inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.

Figure II-3.18: Block and Gravel Curb Inlet Protection



Plan View



Section A-A

Notes:

1. Use block and gravel type sediment barrier when curb inlet is located in gently sloping street segment, where water can pond and allow sediment to separate from runoff.
2. Barrier shall allow for overflow from severe storm event.
3. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Block and Gravel Curb Inlet Protection

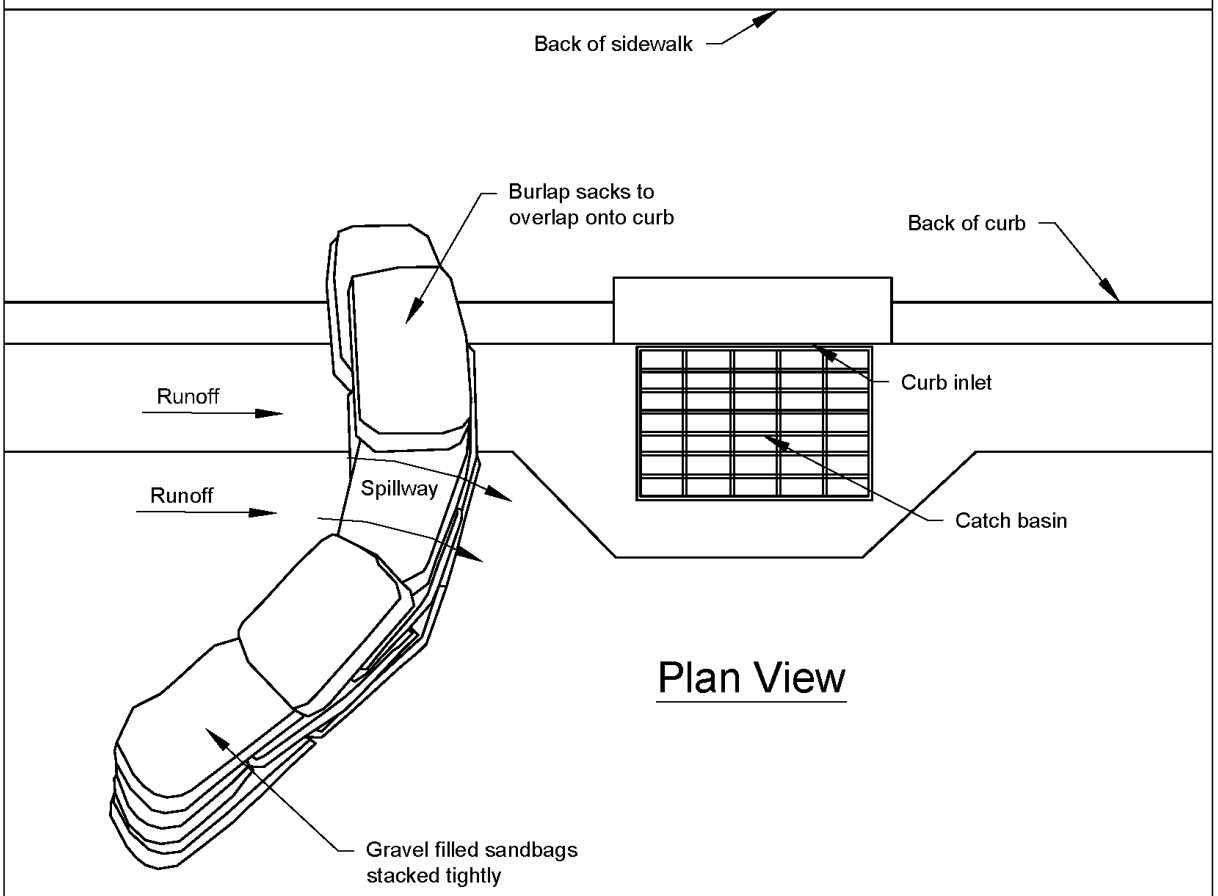
Revised June 2016

Curb and Gutter Sediment Barrier

Curb and gutter sediment barrier is a sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure II-3.19: Curb and Gutter Barrier. Design and installation specifications for curb and gutter sediment barrier include:

- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the upstream side of the berm. Size the trap to sediment trap standards for protecting a culvert inlet.

Figure II-3.19: Curb and Gutter Barrier



Notes:

1. Place curb type sediment barriers on gently sloping street segments, where water can pond and allow sediment to separate from runoff.
2. Sandbags of either burlap or woven 'geotextile' fabric, are filled with gravel, layered and packed tightly.
3. Leave a one sandbag gap in the top row to provide a spillway for overflow.
4. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Curb and Gutter Barrier

Revised June 2016

Maintenance Standards

- Inspect all forms of inlet protection frequently, especially after storm events. Clean and replace clogged catch basin filters. For rock and gravel filters, pull away the rocks from the inlet and clean or replace. An alternative approach would be to use the clogged rock as fill and put fresh rock around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

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

BMP C231: Brush Barrier

Purpose

The purpose of brush barriers is to reduce the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Brush barriers may be used downslope of disturbed areas that are less than one-quarter acre.
- Brush barriers are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be directed to a sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a brush barrier, rather than by a sediment trapping BMP, is when the area draining to the barrier is small.
- Brush barriers should only be installed on contours.

Design and Installation Specifications

- Height: 2 feet (minimum) to 5 feet (maximum).
- Width: 5 feet at base (minimum) to 15 feet (maximum).
- Filter fabric (geotextile) may be anchored over the brush berm to enhance the filtration ability of the barrier. Ten-ounce burlap is an adequate alternative to filter fabric.

5. Operational and Maintenance BMPs

Annual Inspection Report

City of Puyallup - Stormwater BMP Facilities Inspection and Maintenance Log

Facility Name _____

Address _____

Begin Date _____ End Date _____

Date	BMP ID#	BMP Facility Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Instructions:
Record all inspections and maintenance for all treatment BMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary. Submit a copy of the completed log with the Annual Independent Inspectors' Report to the City, and start a new log at that time.

BMP ID# — Always use ID# from the Operation and Maintenance Manual.
Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.
Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.
Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.
Comments and actions taken — Describe any maintenance done and need for follow-up.

Return Form to: Stormwater Engineer/City of Puyallup
333 South Meridian
Puyallup, WA 98371

Annual Inspection Report

City of Puyallup - Stormwater BMP Facilities Inspection and Maintenance Log

Facility Name _____

Date	BMP ID#	BMP Facility Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Appendix V-A: BMP Maintenance Tables

Ecology intends the facility-specific maintenance standards contained in this section to be conditions for determining if maintenance actions are required as identified through inspection. Recognizing that Permittees have limited maintenance funds and time, Ecology does not require that a Permittee perform all these maintenance activities on all their stormwater BMPs. We leave the determination of importance of each maintenance activity and its priority within the stormwater program to the Permittee. We do expect, however, that sufficient maintenance will occur to ensure that the BMPs continue to operate as designed to protect ground and surface waters.

Ecology doesn't intend that these measures identify the facility's required condition at all times between inspections. In other words, exceedance of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the Permittee shall adjust inspection and maintenance schedules to minimize the length of time that a facility is in a condition that requires a maintenance action.

Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site
	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 by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance and inspection access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees
Side Slopes of Pond	Erosion	Eroded 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 should be stabilized using appropriate erosion control measure(s); e.g.,rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed engineer in the state of Washington should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.

Table V-A.1: Maintenance Standards - Detention Ponds (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Ponds 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. A licensed engineer in the state of Washington should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. 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 should be 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 licensed engineer in the state of Washington should be consulted for proper berm/spillway restoration.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/Spillway	Emergency Overflow/Spillway	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. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	

Table V-A.2: Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Poisonous/Noxious Vegetation	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Contaminants and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Rodent Holes	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Storage Area	Sediment	Water ponding in infiltration pond 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.	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.

Table V-A.2: Maintenance Standards - Infiltration (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		(A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 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.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Piping	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway	Rock Missing	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	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 (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.4: Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)
Catch Basin	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

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.

Table V-A.6: Maintenance Standards - Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches. Bars are missing or entire barrier missing. Bars are loose and rust is causing 50% deterioration to any part of barrier.	Bars in place with no bends more than 3/4 inch. Bars in place according to design. Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

Table V-A.7: Maintenance Standards - Energy Dissipators

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
External:			
Rock Pad	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage.	Trench redesigned or rebuilt to standards.
	Perforations Plugged.	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
	Water Flows Out Top of "Distributor" Catch Basin.	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Facility rebuilt or redesigned to standards.
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Internal:			
Manhole/Chamber	Worn or Damaged Post, Baffles, Side of Chamber	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure replaced to design standards.
	Other Defects	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.8: Maintenance Standards - Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing Water	When water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.

Table V-A.8: Maintenance Standards - Typical Biofiltration Swale (continued)

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.
	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale.
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

Table V-A.9: Maintenance Standards - Wet Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Remove sediment deposits in treatment area.
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.
	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.
	Trash and Debris Accumulation	See Table V-A.1: Maintenance Standards - Detention Ponds	Remove trash and debris from wet swale.
	Erosion/Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.

Table V-A.10: Maintenance Standards - Filter Strips

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.
	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Remove trash and Debris from filter.
	Erosion/Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

Table V-A.11: Maintenance Standards - Wetponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per 1000-SF of pond area.	Trash and debris removed from pond.
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Sediment removed from pond bottom.
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	Settlement of Pond Dike/Berm	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Table V-A.12: Maintenance Standards - Wetvaults

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables	Remove trash and debris from vault.

6. WWHM Modelling Results

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: WalMart Puyallup

Site Name:	Walmart 2403
Site Address:	
City:	
Report Date:	7/31/2023
Gage:	38 IN CENTRAL
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
Version:	4.2.19

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, Forest, Flat	0.42
C, Forest, Flat	0.42
Pervious Total	0.84
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.84

Mitigated Land Use

Basin c1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.04
Pervious Total	0.04

Impervious Land Use	acre
PARKING FLAT	0.73
Impervious Total	0.73
Basin Total	0.77

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention 1

Bottom Length: 329.00 ft.
Bottom Width: 3.47 ft.
Material thickness of first layer: 1.5
Material type for first layer: SMMWW
Material thickness of second layer: 2
Material type for second layer: GRAVEL
Material thickness of third layer: 0
Material type for third layer: GRAVEL
Infiltration On
Infiltration rate: 0.7
Infiltration safety factor: 1
Wetted surface area On
Total Volume Infiltrated (ac-ft.): 299.294
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 299.294
Percent Infiltrated: 100
Total Precip Applied to Facility: 27.548
Total Evap From Facility: 22.159
Underdrain not used
Discharge Structure
Riser Height: 1 ft.
Riser Diameter: 24 in.
Element Flows To:
Outlet 1 Outlet 2
SSD Table 1

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.1966	0.0000	0.0000	0.0000
0.0659	0.1963	0.0007	0.0000	0.0000
0.1319	0.1929	0.0015	0.0000	0.0000
0.1978	0.1895	0.0024	0.0000	0.0002
0.2637	0.1862	0.0034	0.0000	0.0005
0.3297	0.1828	0.0045	0.0000	0.0010
0.3956	0.1794	0.0056	0.0000	0.0018
0.4615	0.1761	0.0068	0.0000	0.0020
0.5275	0.1727	0.0081	0.0000	0.0032
0.5934	0.1694	0.0095	0.0000	0.0048
0.6593	0.1660	0.0110	0.0000	0.0069
0.7253	0.1627	0.0125	0.0000	0.0096
0.7912	0.1594	0.0141	0.0000	0.0117
0.8571	0.1560	0.0158	0.0000	0.0137
0.9231	0.1527	0.0176	0.0000	0.0180
0.9890	0.1494	0.0195	0.0000	0.0232
1.0549	0.1461	0.0215	0.0000	0.0293
1.1209	0.1428	0.0235	0.0000	0.0366
1.1868	0.1396	0.0256	0.0000	0.0381
1.2527	0.1363	0.0278	0.0000	0.0467
1.3187	0.1330	0.0301	0.0000	0.0568
1.3846	0.1298	0.0325	0.0000	0.0644
1.4505	0.1265	0.0349	0.0000	0.0666
1.5165	0.1233	0.0376	0.0000	0.0689
1.5824	0.1200	0.0403	0.0000	0.0711

1.6484	0.1168	0.0431	0.0000	0.0734
1.7143	0.1136	0.0460	0.0000	0.0756
1.7802	0.1104	0.0489	0.0000	0.0779
1.8462	0.1071	0.0520	0.0000	0.0802
1.9121	0.1039	0.0552	0.0000	0.0824
1.9780	0.1007	0.0584	0.0000	0.0847
2.0440	0.0976	0.0617	0.0000	0.0870
2.1099	0.0944	0.0651	0.0000	0.0893
2.1758	0.0912	0.0687	0.0000	0.0916
2.2418	0.0880	0.0723	0.0000	0.0939
2.3077	0.0849	0.0759	0.0000	0.0962
2.3736	0.0817	0.0797	0.0000	0.0985
2.4396	0.0786	0.0836	0.0000	0.1008
2.5055	0.0754	0.0875	0.0000	0.1031
2.5714	0.0723	0.0916	0.0000	0.1055
2.6374	0.0692	0.0957	0.0000	0.1078
2.7033	0.0661	0.0999	0.0000	0.1101
2.7692	0.0630	0.1042	0.0000	0.1125
2.8352	0.0599	0.1086	0.0000	0.1148
2.9011	0.0568	0.1131	0.0000	0.1172
2.9670	0.0537	0.1177	0.0000	0.1195
3.0330	0.0506	0.1224	0.0000	0.1219
3.0989	0.0475	0.1272	0.0000	0.1243
3.1648	0.0445	0.1320	0.0000	0.1266
3.2308	0.0414	0.1370	0.0000	0.1290
3.2967	0.0383	0.1421	0.0000	0.1314
3.3626	0.0353	0.1472	0.0000	0.1338
3.4286	0.0323	0.1524	0.0000	0.1362
3.4945	0.0292	0.1578	0.0000	0.1386
3.5000	0.0262	0.1582	0.0000	0.1388

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
3.5000	0.1966	0.1582	0.0000	0.3025	0.0024
3.5659	0.2000	0.1713	0.0000	0.3025	0.0048
3.6319	0.2034	0.1846	0.0000	0.3347	0.0072
3.6978	0.2068	0.1981	0.0000	0.3541	0.0096
3.7637	0.2103	0.2119	0.0000	0.3740	0.0121
3.8297	0.2137	0.2258	0.0000	0.3943	0.0145
3.8956	0.2171	0.2400	0.0000	0.4151	0.0169
3.9615	0.2206	0.2545	0.0000	0.4363	0.0194
4.0275	0.2241	0.2691	0.0000	0.4580	0.0218
4.0934	0.2275	0.2840	0.0000	0.4802	0.0243
4.1593	0.2310	0.2991	0.0000	0.5029	0.0267
4.2253	0.2345	0.3145	0.0000	0.5261	0.0292
4.2912	0.2379	0.3300	0.0000	0.5497	0.0316
4.3571	0.2414	0.3458	0.0000	0.5738	0.0341
4.4231	0.2449	0.3619	0.0000	0.5984	0.0366
4.4890	0.2484	0.3781	0.0000	0.6235	0.0391
4.5549	0.2519	0.3946	0.2732	0.6491	0.0415
4.6209	0.2555	0.4114	0.8902	0.6751	0.0440
4.6868	0.2590	0.4283	1.7049	0.7017	0.0465
4.7527	0.2625	0.4455	2.6655	0.7287	0.0490
4.8187	0.2661	0.4629	3.7318	0.7562	0.0515
4.8846	0.2696	0.4806	4.8649	0.7842	0.0540
4.9505	0.2732	0.4985	6.0247	0.8127	0.0566
5.0165	0.2767	0.5166	7.1705	0.8417	0.0591
5.0824	0.2803	0.5350	8.2626	0.8712	0.0616

5.1484	0.2839	0.5536	9.2649	0.9012	0.0641
5.2143	0.2875	0.5724	10.148	0.9317	0.0667
5.2802	0.2911	0.5915	10.892	0.9627	0.0692
5.3462	0.2947	0.6108	11.494	0.9942	0.0717
5.4121	0.2983	0.6304	11.966	1.0262	0.0743
5.4780	0.3019	0.6501	12.347	1.0587	0.0769
5.5440	0.3055	0.6702	12.872	1.0917	0.0794
5.6099	0.3091	0.6904	13.273	1.1252	0.0820
5.6758	0.3128	0.7109	13.661	1.1592	0.0845
5.7418	0.3164	0.7317	14.039	1.1937	0.0871
5.8077	0.3200	0.7527	14.407	1.2288	0.0897
5.8736	0.3237	0.7739	14.766	1.2643	0.0923
5.9396	0.3274	0.7953	15.116	1.3004	0.0947
6.0000	0.3307	0.8152	15.458	1.3339	0.0000

Surface retention 1

SSD Table 1

Depth: 5.5 ft.
Discharge Structure: 1
Riser Height: 5 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.500 in. Elevation:0 ft.
Orifice 2 Diameter: 1.000 in. Elevation:0.95 ft.
Element Flows To:
Outlet 1 Outlet 2

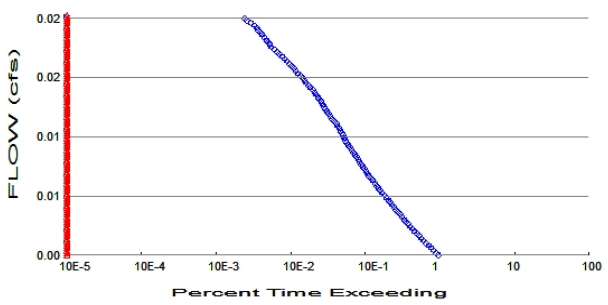
SSD Table Hydraulic Table

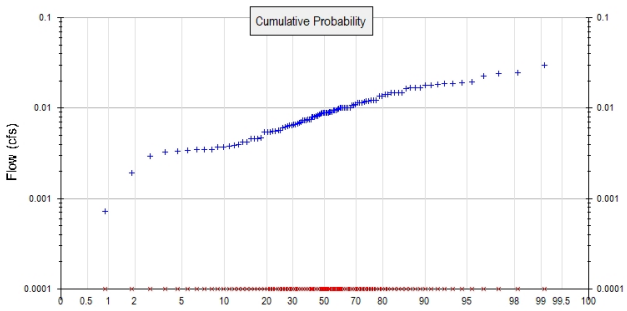
Stage (feet)	Area (ac.)	Volume (ac-ft.)	Outlet Struct	Infilt/ Recharge	NotUsed	NotUsed	NotUsed
0.000	0.057	0.000	0.000	0.010	0.000	0.000	0.000
0.083	0.057	0.002	0.002	0.010	0.000	0.000	0.000
0.167	0.057	0.004	0.003	0.010	0.000	0.000	0.000
0.250	0.057	0.006	0.003	0.010	0.000	0.000	0.000
0.333	0.057	0.008	0.004	0.010	0.000	0.000	0.000
0.417	0.057	0.009	0.004	0.010	0.010	0.000	0.000
0.500	0.057	0.011	0.005	0.010	0.000	0.000	0.000
0.583	0.057	0.013	0.005	0.010	0.000	0.000	0.000
0.667	0.057	0.015	0.006	0.010	0.000	0.000	0.000
0.750	0.057	0.017	0.006	0.010	0.000	0.000	0.000
0.833	0.057	0.021	0.006	0.010	0.000	0.000	0.000
0.917	0.057	0.024	0.006	0.010	0.000	0.000	0.000
1.000	0.057	0.028	0.013	0.010	0.000	0.000	0.000
1.083	0.057	0.031	0.017	0.010	0.000	0.000	0.000
1.167	0.057	0.035	0.020	0.010	0.000	0.000	0.000
1.250	0.057	0.038	0.022	0.010	0.000	0.000	0.000
1.333	0.057	0.041	0.025	0.010	0.000	0.000	0.000
1.417	0.057	0.045	0.027	0.010	0.000	0.000	0.000
1.500	0.057	0.048	0.028	0.010	0.000	0.000	0.000
1.583	0.057	0.052	0.030	0.010	0.000	0.000	0.000
1.667	0.057	0.055	0.032	0.010	0.000	0.000	0.000
1.750	0.057	0.058	0.033	0.010	0.000	0.000	0.000
1.833	0.057	0.062	0.035	0.010	0.000	0.000	0.000
1.917	0.057	0.065	0.036	0.010	0.000	0.000	0.000
2.000	0.057	0.068	0.037	0.010	0.010	0.000	0.000
2.083	0.057	0.072	0.039	0.010	0.000	0.000	0.000
2.167	0.057	0.075	0.040	0.010	0.000	0.000	0.000
2.250	0.057	0.078	0.041	0.010	0.000	0.000	0.000
2.333	0.057	0.082	0.042	0.010	0.000	0.000	0.000
2.417	0.057	0.085	0.043	0.010	0.000	0.000	0.000
2.500	0.057	0.088	0.045	0.010	0.000	0.000	0.000
2.583	0.057	0.091	0.046	0.010	0.000	0.000	0.000
2.667	0.057	0.094	0.047	0.010	0.000	0.000	0.000
2.750	0.057	0.098	0.048	0.010	0.000	0.000	0.000
2.833	0.057	0.101	0.049	0.010	0.000	0.000	0.000
2.917	0.057	0.104	0.050	0.010	0.000	0.000	0.000
3.000	0.057	0.107	0.051	0.010	0.000	0.000	0.000
3.083	0.057	0.110	0.052	0.010	0.000	0.000	0.000
3.167	0.057	0.113	0.052	0.010	0.000	0.000	0.000
3.250	0.057	0.116	0.053	0.010	0.000	0.000	0.000
3.333	0.057	0.119	0.054	0.010	0.000	0.000	0.000
3.417	0.057	0.121	0.055	0.010	0.000	0.000	0.000

3.500	0.057	0.124	0.056	0.010	0.000	0.000	0.000
3.583	0.057	0.127	0.057	0.010	0.000	0.000	0.000
3.667	0.057	0.130	0.058	0.010	0.000	0.000	0.000
3.750	0.057	0.132	0.059	0.010	0.000	0.000	0.000
3.833	0.057	0.135	0.059	0.010	0.010	0.000	0.000
3.917	0.057	0.138	0.060	0.010	0.000	0.000	0.000
4.000	0.057	0.140	0.061	0.010	0.000	0.000	0.000
4.083	0.057	0.142	0.062	0.010	0.000	0.000	0.000
4.167	0.057	0.145	0.063	0.010	0.000	0.000	0.000
4.250	0.057	0.147	0.063	0.010	0.000	0.000	0.000
4.333	0.057	0.149	0.064	0.010	0.000	0.000	0.000
4.417	0.057	0.151	0.065	0.010	0.000	0.000	0.000
4.500	0.057	0.153	0.066	0.010	0.000	0.000	0.000
4.583	0.057	0.154	0.066	0.010	0.000	0.000	0.000
4.667	0.057	0.156	0.067	0.010	0.000	0.000	0.000
4.750	0.057	0.158	0.068	0.010	0.000	0.000	0.000
4.833	0.057	0.160	0.068	0.010	0.000	0.000	0.000
4.917	0.057	0.162	0.069	0.010	0.000	0.000	0.000
5.000	0.057	0.164	0.070	0.010	0.000	0.000	0.000
5.083	0.057	0.166	0.323	0.010	0.000	0.000	0.000
5.167	0.057	0.168	0.777	0.010	0.000	0.000	0.000
5.250	0.057	0.170	1.289	0.010	0.000	0.000	0.000
5.333	0.057	0.171	1.754	0.010	0.000	0.000	0.000
5.417	0.057	0.173	2.087	0.010	0.000	0.000	0.000
5.500	0.057	0.175	2.277	0.010	0.000	0.000	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.84
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.04
Total Impervious Area: 0.73

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.008999
5 year	0.014058
10 year	0.016815
25 year	0.019625
50 year	0.021297
100 year	0.022673

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**
1902	0.006	0.000
1903	0.005	0.000
1904	0.009	0.000
1905	0.004	0.000
1906	0.002	0.000
1907	0.014	0.000
1908	0.010	0.000
1909	0.010	0.000
1910	0.014	0.000
1911	0.009	0.000

1912	0.030	0.000
1913	0.014	0.000
1914	0.003	0.000
1915	0.006	0.000
1916	0.009	0.000
1917	0.003	0.000
1918	0.009	0.000
1919	0.007	0.000
1920	0.009	0.000
1921	0.010	0.000
1922	0.010	0.000
1923	0.008	0.000
1924	0.004	0.000
1925	0.005	0.000
1926	0.009	0.000
1927	0.006	0.000
1928	0.007	0.000
1929	0.014	0.000
1930	0.009	0.000
1931	0.008	0.000
1932	0.007	0.000
1933	0.006	0.000
1934	0.019	0.000
1935	0.009	0.000
1936	0.008	0.000
1937	0.012	0.000
1938	0.007	0.000
1939	0.000	0.000
1940	0.008	0.000
1941	0.004	0.000
1942	0.012	0.000
1943	0.006	0.000
1944	0.011	0.000
1945	0.010	0.000
1946	0.005	0.000
1947	0.003	0.000
1948	0.019	0.000
1949	0.016	0.000
1950	0.005	0.000
1951	0.006	0.000
1952	0.025	0.000
1953	0.023	0.000
1954	0.008	0.000
1955	0.007	0.000
1956	0.003	0.000
1957	0.011	0.000
1958	0.024	0.000
1959	0.015	0.000
1960	0.004	0.000
1961	0.015	0.000
1962	0.008	0.000
1963	0.004	0.000
1964	0.004	0.000
1965	0.017	0.000
1966	0.005	0.000
1967	0.007	0.000
1968	0.007	0.000
1969	0.007	0.000

1970	0.011	0.000
1971	0.018	0.000
1972	0.012	0.000
1973	0.015	0.000
1974	0.008	0.000
1975	0.019	0.000
1976	0.010	0.000
1977	0.003	0.000
1978	0.017	0.000
1979	0.005	0.000
1980	0.010	0.000
1981	0.009	0.000
1982	0.004	0.000
1983	0.015	0.000
1984	0.006	0.000
1985	0.010	0.000
1986	0.009	0.000
1987	0.017	0.000
1988	0.011	0.000
1989	0.010	0.000
1990	0.011	0.000
1991	0.009	0.000
1992	0.012	0.000
1993	0.012	0.000
1994	0.018	0.000
1995	0.003	0.000
1996	0.019	0.000
1997	0.007	0.000
1998	0.009	0.000
1999	0.001	0.000
2000	0.007	0.000
2001	0.003	0.000
2002	0.012	0.000
2003	0.011	0.000
2004	0.010	0.000
2005	0.018	0.000
2006	0.006	0.000
2007	0.006	0.000
2008	0.009	0.000
2009	0.006	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0296	0.0000
2	0.0248	0.0000
3	0.0240	0.0000
4	0.0225	0.0000
5	0.0195	0.0000
6	0.0191	0.0000
7	0.0189	0.0000
8	0.0187	0.0000
9	0.0182	0.0000
10	0.0180	0.0000
11	0.0179	0.0000
12	0.0170	0.0000
13	0.0168	0.0000
14	0.0167	0.0000

15	0.0163	0.0000
16	0.0149	0.0000
17	0.0149	0.0000
18	0.0149	0.0000
19	0.0149	0.0000
20	0.0143	0.0000
21	0.0141	0.0000
22	0.0137	0.0000
23	0.0136	0.0000
24	0.0123	0.0000
25	0.0122	0.0000
26	0.0121	0.0000
27	0.0119	0.0000
28	0.0119	0.0000
29	0.0117	0.0000
30	0.0115	0.0000
31	0.0114	0.0000
32	0.0114	0.0000
33	0.0109	0.0000
34	0.0107	0.0000
35	0.0107	0.0000
36	0.0101	0.0000
37	0.0101	0.0000
38	0.0101	0.0000
39	0.0101	0.0000
40	0.0101	0.0000
41	0.0100	0.0000
42	0.0100	0.0000
43	0.0099	0.0000
44	0.0096	0.0000
45	0.0095	0.0000
46	0.0095	0.0000
47	0.0094	0.0000
48	0.0091	0.0000
49	0.0091	0.0000
50	0.0090	0.0000
51	0.0089	0.0000
52	0.0089	0.0000
53	0.0089	0.0000
54	0.0089	0.0000
55	0.0088	0.0000
56	0.0088	0.0000
57	0.0086	0.0000
58	0.0085	0.0000
59	0.0084	0.0000
60	0.0081	0.0000
61	0.0081	0.0000
62	0.0081	0.0000
63	0.0080	0.0000
64	0.0080	0.0000
65	0.0075	0.0000
66	0.0075	0.0000
67	0.0074	0.0000
68	0.0073	0.0000
69	0.0073	0.0000
70	0.0073	0.0000
71	0.0070	0.0000
72	0.0069	0.0000

73	0.0068	0.0000
74	0.0066	0.0000
75	0.0065	0.0000
76	0.0065	0.0000
77	0.0065	0.0000
78	0.0064	0.0000
79	0.0063	0.0000
80	0.0061	0.0000
81	0.0057	0.0000
82	0.0057	0.0000
83	0.0056	0.0000
84	0.0055	0.0000
85	0.0055	0.0000
86	0.0055	0.0000
87	0.0054	0.0000
88	0.0047	0.0000
89	0.0046	0.0000
90	0.0046	0.0000
91	0.0046	0.0000
92	0.0043	0.0000
93	0.0042	0.0000
94	0.0039	0.0000
95	0.0038	0.0000
96	0.0038	0.0000
97	0.0037	0.0000
98	0.0037	0.0000
99	0.0035	0.0000
100	0.0035	0.0000
101	0.0035	0.0000
102	0.0034	0.0000
103	0.0034	0.0000
104	0.0032	0.0000
105	0.0029	0.0000
106	0.0019	0.0000
107	0.0007	0.0000
108	0.0005	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0045	36180	0	0	Pass
0.0047	33435	0	0	Pass
0.0048	31015	0	0	Pass
0.0050	28837	0	0	Pass
0.0052	26789	0	0	Pass
0.0053	24876	0	0	Pass
0.0055	23093	0	0	Pass
0.0057	21415	0	0	Pass
0.0059	19859	0	0	Pass
0.0060	18457	0	0	Pass
0.0062	17196	0	0	Pass
0.0064	16094	0	0	Pass
0.0065	15136	0	0	Pass
0.0067	14197	0	0	Pass
0.0069	13338	0	0	Pass
0.0070	12535	0	0	Pass
0.0072	11770	0	0	Pass
0.0074	11058	0	0	Pass
0.0076	10342	0	0	Pass
0.0077	9770	0	0	Pass
0.0079	9229	0	0	Pass
0.0081	8683	0	0	Pass
0.0082	8187	0	0	Pass
0.0084	7695	0	0	Pass
0.0086	7199	0	0	Pass
0.0087	6790	0	0	Pass
0.0089	6400	0	0	Pass
0.0091	6021	0	0	Pass
0.0093	5669	0	0	Pass
0.0094	5366	0	0	Pass
0.0096	5093	0	0	Pass
0.0098	4790	0	0	Pass
0.0099	4499	0	0	Pass
0.0101	4268	0	0	Pass
0.0103	4067	0	0	Pass
0.0104	3870	0	0	Pass
0.0106	3673	0	0	Pass
0.0108	3493	0	0	Pass
0.0109	3311	0	0	Pass
0.0111	3164	0	0	Pass
0.0113	3030	0	0	Pass
0.0115	2900	0	0	Pass
0.0116	2755	0	0	Pass
0.0118	2610	0	0	Pass
0.0120	2466	0	0	Pass
0.0121	2336	0	0	Pass
0.0123	2230	0	0	Pass
0.0125	2116	0	0	Pass
0.0126	2039	0	0	Pass
0.0128	1970	0	0	Pass
0.0130	1906	0	0	Pass
0.0132	1832	0	0	Pass
0.0133	1759	0	0	Pass

0.0135	1689	0	0	Pass
0.0137	1616	0	0	Pass
0.0138	1546	0	0	Pass
0.0140	1435	0	0	Pass
0.0142	1344	0	0	Pass
0.0143	1283	0	0	Pass
0.0145	1212	0	0	Pass
0.0147	1159	0	0	Pass
0.0148	1102	0	0	Pass
0.0150	1054	0	0	Pass
0.0152	1016	0	0	Pass
0.0154	972	0	0	Pass
0.0155	929	0	0	Pass
0.0157	873	0	0	Pass
0.0159	830	0	0	Pass
0.0160	788	0	0	Pass
0.0162	744	0	0	Pass
0.0164	690	0	0	Pass
0.0165	653	0	0	Pass
0.0167	610	0	0	Pass
0.0169	583	0	0	Pass
0.0171	554	0	0	Pass
0.0172	515	0	0	Pass
0.0174	473	0	0	Pass
0.0176	441	0	0	Pass
0.0177	416	0	0	Pass
0.0179	390	0	0	Pass
0.0181	361	0	0	Pass
0.0182	337	0	0	Pass
0.0184	317	0	0	Pass
0.0186	291	0	0	Pass
0.0188	264	0	0	Pass
0.0189	246	0	0	Pass
0.0191	229	0	0	Pass
0.0193	210	0	0	Pass
0.0194	198	0	0	Pass
0.0196	189	0	0	Pass
0.0198	179	0	0	Pass
0.0199	167	0	0	Pass
0.0201	156	0	0	Pass
0.0203	148	0	0	Pass
0.0204	138	0	0	Pass
0.0206	133	0	0	Pass
0.0208	125	0	0	Pass
0.0210	110	0	0	Pass
0.0211	97	0	0	Pass
0.0213	91	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0063 acre-feet
On-line facility target flow:	0.004 cfs.
Adjusted for 15 min:	0.004 cfs.
Off-line facility target flow:	0.0023 cfs.
Adjusted for 15 min:	0.0023 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
SSD Table 1 POC	☐	0.00			☐	0.00			
retention 1	☐	272.36			☐	100.00			
Total Volume Infiltrated		272.36	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

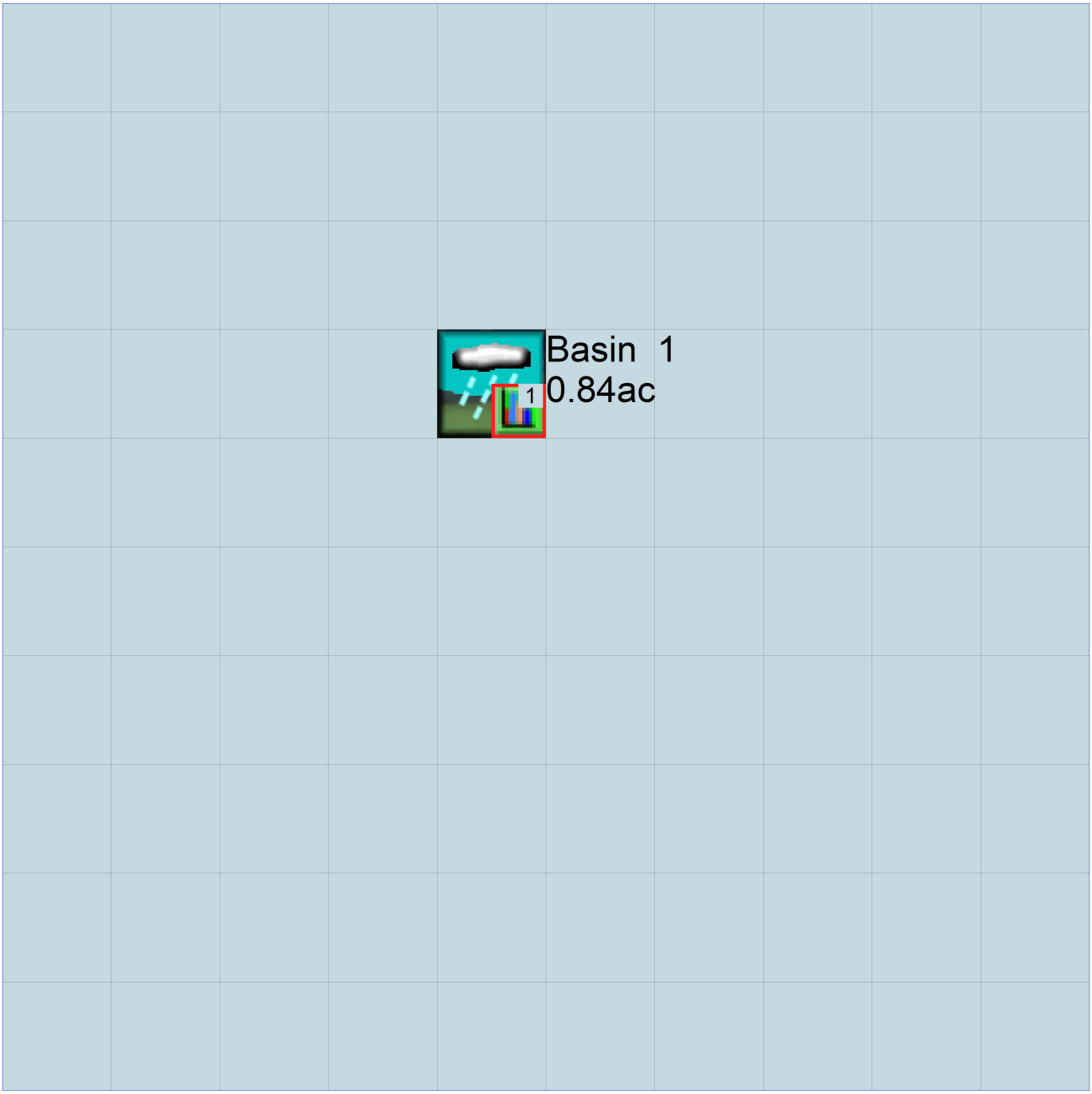
PERLND Changes

No PERLND changes have been made.

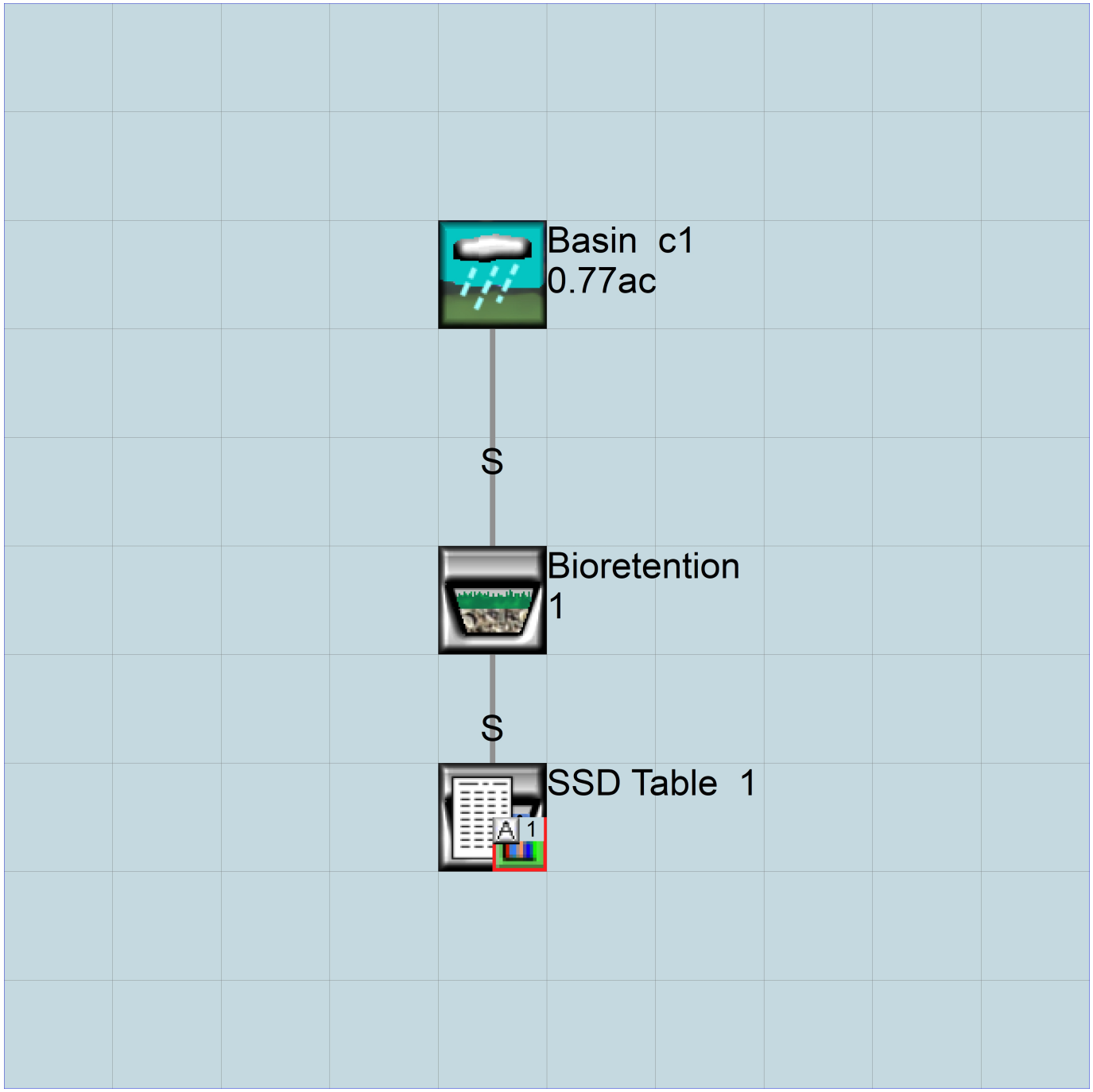
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1901 10 01        END    2009 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   WalMart Puyallup.wdm
MESSU       25   PreWalMart Puyallup.MES
            27   PreWalMart Puyallup.L61
            28   PreWalMart Puyallup.L62
            30   POCWalMart Puyallup1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       1
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
    1     A/B, Forest, Flat       1    1    1    1   27    0
   10     C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1         0    0    1    0    0    0    0    0    0    0    0    0
   10         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

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

```
    1         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   10         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    1         0    0    0    0    0    0    0    0    0    0    0
   10         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    1              0         5         2       400      0.05       0.3     0.996
   10              0       4.5      0.08       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    1              0         0         2         2         0         0         0
   10              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    1            0.2       0.5      0.35         0       0.7       0.7
   10            0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    1              0         0         0         0         3         1         0
   10              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

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

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

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

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

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

  IWAT-PARM3
```

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

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   1                        0.42     COPY   501     12
PERLND   1                        0.42     COPY   501     13
PERLND  10                        0.42     COPY   501     12
PERLND  10                        0.42     COPY   501     13

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

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



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

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

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

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

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

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

```
SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

END EXT SOURCES

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   WalMart Puyallup.wdm
MESSU       25   MitWalMart Puyallup.MES
            27   MitWalMart Puyallup.L61
            28   MitWalMart Puyallup.L62
            30   POCWalMart Puyallup1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      IMPLND      11
      GENER        2
      RCHRES       1
      RCHRES       2
      RCHRES       3
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        SSD Table  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 ***
    2        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         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  *********
    7         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 ***
    7         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
    7              0         5       0.8       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
    7              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7           0.1       0.5      0.25         0       0.7      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
    7              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           ***
   11      PARKING/FLAT           1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

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

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   11         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   11         0    0    0    0    0
  END IWAT-PARM1

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

```
   11            400      0.01       0.1       0.1
  END IWAT-PARM2

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

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  c1***
PERLND   7                        0.04     RCHRES   1      2
IMPLND  11                        0.73     RCHRES   1      5

******Routing******
RCHRES   2                           1     RCHRES   3      7
RCHRES   2                                 COPY     1     17
RCHRES   1                           1     RCHRES   3      7
RCHRES   1                                 COPY     1     17
RCHRES   1                           1     RCHRES   2      8
RCHRES   3                           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
GENER    2 OUTPUT TIMSER      .0011111     RCHRES   1     EXTNL  OUTDGT 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     Surface retentio-011    3    1    1    1   28    0    1
    2     Bioretention  1         2    1    1    1   28    0    1
    3     SSD Table  1            2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
    3         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
    2         4    0    0    0    0    0    0    0    0    0    1    9
    3         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  6  0  0       0  1  0  0  0        2  1  2  2  2
    2       0  1  0  0    4  5  0  0  0       0  0  0  0  0        2  2  2  2  2
    3       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       0.0       0.0
    2             2      0.06       0.0       0.0       0.0       0.0
    3             3      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  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    3            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
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL              4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Target Variable Names
***                  addr or                       addr or
***                 <------>                      <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                               v2m2           =  7016.07
*** Compute remaining available pore space
  GENER   2                               vpo2           =  v2m2
  GENER   2                               vpo2          -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2           =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2           =  vpo2
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   55    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.196614  0.000000  0.000000  0.000000
  0.065934  0.196330  0.000734  0.000000  0.000000
  0.131868  0.192934  0.001548  0.000000  0.000000
  0.197802  0.189544  0.002442  0.000000  0.000224
```

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  0.263736  0.186162  0.003417  0.000000  0.000531
  0.329670  0.182787  0.004472  0.000000  0.001046
  0.395604  0.179419  0.005609  0.000000  0.001834
  0.461538  0.176058  0.006826  0.000000  0.002023
  0.527473  0.172705  0.008125  0.000000  0.003154
  0.593407  0.169358  0.009505  0.000000  0.004777
  0.659341  0.166019  0.010966  0.000000  0.006906
  0.725275  0.162687  0.012510  0.000000  0.009624
  0.791209  0.159362  0.014136  0.000000  0.011731
  0.857143  0.156045  0.015843  0.000000  0.013657
  0.923077  0.152734  0.017634  0.000000  0.017976
  0.989011  0.149431  0.019507  0.000000  0.023174
  1.054945  0.146135  0.021462  0.000000  0.029345
  1.120879  0.142846  0.023501  0.000000  0.036591
  1.186813  0.139564  0.025623  0.000000  0.038125
  1.252747  0.136290  0.027828  0.000000  0.046749
  1.318681  0.133022  0.030116  0.000000  0.056754
  1.384615  0.129762  0.032489  0.000000  0.064373
  1.450549  0.126509  0.034945  0.000000  0.066613
  1.516484  0.123263  0.037571  0.000000  0.068858
  1.582418  0.120025  0.040284  0.000000  0.071109
  1.648352  0.116793  0.043084  0.000000  0.073364
  1.714286  0.113569  0.045972  0.000000  0.075625
  1.780220  0.110352  0.048948  0.000000  0.077890
  1.846154  0.107142  0.052011  0.000000  0.080161
  1.912088  0.103940  0.055163  0.000000  0.082437
  1.978022  0.100744  0.058403  0.000000  0.084718
  2.043956  0.097556  0.061731  0.000000  0.087003
  2.109890  0.094375  0.065149  0.000000  0.089294
  2.175824  0.091201  0.068655  0.000000  0.091590
  2.241758  0.088034  0.072250  0.000000  0.093892
  2.307692  0.084874  0.075935  0.000000  0.096198
  2.373626  0.081722  0.079709  0.000000  0.098509
  2.439560  0.078577  0.083572  0.000000  0.100825
  2.505495  0.075439  0.087526  0.000000  0.103147
  2.571429  0.072308  0.091570  0.000000  0.105473
  2.637363  0.069185  0.095704  0.000000  0.107805
  2.703297  0.066068  0.099928  0.000000  0.110141
  2.769231  0.062959  0.104243  0.000000  0.112483
  2.835165  0.059857  0.108649  0.000000  0.114830
  2.901099  0.056762  0.113147  0.000000  0.117182
  2.967033  0.053674  0.117735  0.000000  0.119539
  3.032967  0.050594  0.122415  0.000000  0.121901
  3.098901  0.047520  0.127186  0.000000  0.124268
  3.164835  0.044454  0.132050  0.000000  0.126640
  3.230769  0.041395  0.137005  0.000000  0.129017
  3.296703  0.038343  0.142053  0.000000  0.131399
  3.362637  0.035299  0.147193  0.000000  0.133787
  3.428571  0.032261  0.152426  0.000000  0.136179
  3.494505  0.029231  0.157752  0.000000  0.138577
  3.500000  0.026208  0.161067  0.000000  0.138777
  END FTABLE  2
  FTABLE      1
   39    6
     Depth      Area    Volume  Outflow1  Outflow2  Outflow3  Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.026208  0.000000  0.000000  0.000000  0.002403
  0.065934  0.200018  0.013076  0.000000  0.302528  0.002403
  0.131868  0.203430  0.026376  0.000000  0.334738  0.004811
  0.197802  0.206849  0.039902  0.000000  0.354115  0.007224
  0.263736  0.210275  0.053653  0.000000  0.373960  0.009642
  0.329670  0.213708  0.067631  0.000000  0.394274  0.012066
  0.395604  0.217148  0.081835  0.000000  0.415058  0.014494
  0.461538  0.220596  0.096266  0.000000  0.436314  0.016927
  0.527473  0.224051  0.110925  0.000000  0.458043  0.019366
  0.593407  0.227513  0.125811  0.000000  0.480246  0.021809
  0.659341  0.230982  0.140927  0.000000  0.502925  0.024258
  0.725275  0.234458  0.156271  0.000000  0.526082  0.026712
```

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0.791209  0.237942  0.171844  0.000000  0.549718  0.029171
0.857143  0.241432  0.187648  0.000000  0.573834  0.031634
0.923077  0.244930  0.203682  0.000000  0.598431  0.034103
0.989011  0.248435  0.219947  0.000000  0.623512  0.036577
1.054945  0.251948  0.236443  0.273233  0.649077  0.039056
1.120879  0.255467  0.253171  0.890240  0.675128  0.041541
1.186813  0.258994  0.270131  1.704888  0.701667  0.044030
1.252747  0.262527  0.287324  2.665476  0.728695  0.046524
1.318681  0.266068  0.304750  3.731796  0.756212  0.049023
1.384615  0.269617  0.322410  4.864869  0.784222  0.051528
1.450549  0.273172  0.340304  6.024661  0.812725  0.054037
1.516484  0.276735  0.358433  7.170460  0.841722  0.056552
1.582418  0.280304  0.376797  8.262573  0.871216  0.059071
1.648352  0.283881  0.395396  9.264852  0.901206  0.061596
1.714286  0.287465  0.414232  10.14784  0.931696  0.064126
1.780220  0.291057  0.433304  10.89241  0.962686  0.066661
1.846154  0.294655  0.452613  11.49381  0.994178  0.069201
1.912088  0.298261  0.472160  11.96608  1.026173  0.071746
1.978022  0.301874  0.491945  12.34684  1.058673  0.074296
2.043956  0.305494  0.511968  12.87243  1.091679  0.076851
2.109890  0.309121  0.532230  13.27271  1.125192  0.079411
2.175824  0.312755  0.552731  13.66126  1.159214  0.081976
2.241758  0.316397  0.573473  14.03906  1.193747  0.084547
2.307692  0.320046  0.594454  14.40696  1.228791  0.087122
2.373626  0.323702  0.615677  14.76569  1.264349  0.089703
2.439560  0.327365  0.637140  15.11592  1.300421  0.092288
2.500000  0.330729  0.657028  15.45821  1.333941  0.094663
END FTABLE  1
FTABLE      3
 67    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)     (cfs)   (ft/sec)    (Minutes)***
0.000000  0.056818  0.000000  0.000000  0.000000
0.083000  0.056818  0.001893  0.001955  0.010026
0.167000  0.056818  0.003787  0.002772  0.010026
0.250000  0.056818  0.005681  0.003392  0.010026
0.333000  0.056818  0.007575  0.003915  0.010026
0.417000  0.056818  0.009469  0.004381  0.010026
0.500000  0.056818  0.011363  0.004797  0.010026
0.583000  0.056818  0.013257  0.005180  0.010026
0.667000  0.056818  0.015151  0.005541  0.010026
0.750000  0.056818  0.017045  0.005875  0.010026
0.833000  0.056818  0.020567  0.006192  0.010026
0.917000  0.056818  0.024068  0.006497  0.010026
1.000000  0.056818  0.027560  0.012852  0.010026
1.083000  0.056818  0.031041  0.016957  0.010026
1.167000  0.056818  0.034511  0.019970  0.010026
1.250000  0.056818  0.037971  0.022448  0.010026
1.333000  0.056818  0.041418  0.024627  0.010026
1.417000  0.056818  0.044853  0.026620  0.010026
1.500000  0.056818  0.048275  0.028434  0.010026
1.583000  0.056818  0.051684  0.030126  0.010026
1.667000  0.056818  0.055079  0.031738  0.010026
1.750000  0.056818  0.058458  0.033247  0.010026
1.833000  0.056818  0.061822  0.034685  0.010026
1.917000  0.056818  0.065169  0.036078  0.010026
2.000000  0.056818  0.068499  0.037401  0.010026
2.083000  0.056818  0.071811  0.038676  0.010026
2.167000  0.056818  0.075104  0.039924  0.010026
2.250000  0.056818  0.078376  0.041117  0.010026
2.333000  0.056818  0.081628  0.042275  0.010026
2.417000  0.056818  0.084858  0.043415  0.010026
2.500000  0.056818  0.088064  0.044512  0.010026
2.583000  0.056818  0.091246  0.045581  0.010026
2.667000  0.056818  0.094403  0.046638  0.010026
2.750000  0.056818  0.097533  0.047658  0.010026
2.833000  0.056818  0.100635  0.048657  0.010026
2.917000  0.056818  0.103707  0.049646  0.010026
3.000000  0.056818  0.106748  0.050605  0.010026
3.083000  0.056818  0.109757  0.051545  0.010026
```

```
  3.167000  0.056818  0.112731  0.052479  0.010026
  3.250000  0.056818  0.115668  0.053385  0.010026
  3.333000  0.056818  0.118567  0.054277  0.010026
  3.417000  0.056818  0.121424  0.055164  0.010026
  3.500000  0.056818  0.124238  0.056026  0.010026
  3.583000  0.056818  0.127003  0.056875  0.010026
  3.667000  0.056818  0.129718  0.057722  0.010026
  3.750000  0.056818  0.132377  0.058546  0.010026
  3.833000  0.056818  0.134974  0.059359  0.010026
  3.917000  0.056818  0.137503  0.060170  0.010026
  4.000000  0.056818  0.139955  0.060961  0.010026
  4.083000  0.056818  0.142307  0.061741  0.010026
  4.167000  0.056818  0.144509  0.062521  0.010026
  4.250000  0.056818  0.146587  0.063282  0.010026
  4.333000  0.056818  0.148615  0.064034  0.010026
  4.417000  0.056818  0.150597  0.064787  0.010026
  4.500000  0.056818  0.152516  0.065521  0.010026
  4.583000  0.056818  0.154410  0.066247  0.010026
  4.667000  0.056818  0.156303  0.066975  0.010026
  4.750000  0.056818  0.158197  0.067685  0.010026
  4.833000  0.056818  0.160091  0.068388  0.010026
  4.917000  0.056818  0.161985  0.069093  0.010026
  5.000000  0.056818  0.163879  0.069782  0.010026
  5.083000  0.056818  0.165773  0.323241  0.010026
  5.167000  0.056818  0.167667  0.776582  0.010026
  5.250000  0.056818  0.169561  1.289372  0.010026
  5.333000  0.056818  0.171455  1.754315  0.010026
  5.417000  0.056818  0.173349  2.087226  0.010026
  5.500000  0.056818  0.175243  2.277130  0.010026
  END FTABLE  3
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM      2 PREC     ENGL    1              RCHRES   1     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    1              RCHRES   2     EXTNL  POTEV

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   3 HYDR   RO     1 1        1      WDM   1016 FLOW     ENGL      REPL
RCHRES   3 HYDR   O      1 1        1      WDM   1018 FLOW     ENGL      REPL
RCHRES   3 HYDR   O      2 1        1      WDM   1019 FLOW     ENGL      REPL
RCHRES   3 HYDR   STAGE  1 1        1      WDM   1017 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        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        7
RCHRES     OFLOW  OVOL   1                 RCHRES         INFLOW IVOL
  END MASS-LINK    7
```

```
  MASS-LINK        8
RCHRES     OFLOW  OVOL   2                RCHRES          INFLOW IVOL
  END MASS-LINK    8

  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

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