Final Stormwater Report

FOR

Puyallup Raising Cane's

at

43rd Avenue SE and S Meridian Street,

Puyallup, WA 98373

March 9, 2026

PREPARED FOR:

Raising Restaurants, LLC.

6800 Bishop Road

Plano, TX 75024

PREPARED BY:

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KHA PROJECT #: 090042022

Kimley»Horn

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Disclosure Statement:

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Contents

PROJECT NARRATIVE

The proposed **Raising Cane's Project** is located northwest of the 43rd Avenue SE and S Meridian Street intersection within APN 0419091073, in Puyallup, Pierce County, Washington. The proposed project consists of demolition of an existing commercial building and construction of a new commercial building with associated drive aisles, parking, utility infrastructure, and onsite stormwater management.

The purpose of this report is to provide an explanation of the proposed site improvements and to demonstrate how the project will meet stormwater requirements in accordance with the *City of Puyallup's Municipal Code 21.10 Storm Water Management, City of Puyallup - City Standards Section 200 Stormwater Management,* and the Department of Ecology's (DOE) *Stormwater Management Manual for Western Washington (SWMMWW), dated 2024*.

Flow control and runoff treatment calculations were performed using the Western Washington Hydrology Model 2012 (WWHM), an approved continuous simulation model by the DOE. WWHM uses the EPA Hydrologic Simulation Program Fortran (HSPF), which is a calibrated continuous simulation hydrologic model.

Water Quality, Quantity and Conveyance

The existing site consists of an asphalt parking lot with a restaurant located in the southern portion of the site. Existing runoff sheet flows to multiple catch basins onsite where it is collected and conveyed through a series of storm pipes and catch basins to the municipal storm system on the east side of the site along S Meridian Street.

The onsite improvements will include a new water quality vault, located west of the building footprint, to adequately treat stormwater runoff and an underground gravel infiltration facility, located downstream of the vault, to infiltrate stormwater runoff into native soils. During storm events exceeding the 100-year storm, emergency overflow will be discharged from the gravel infiltration facility into the existing municipal storm system along S Meridian Street.

Certificate of Engineer

The drainage report and data contained in this report was prepared under the direction and supervision of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

Prepared By: Liz Willmot, PE

1.0 – PROJECT OVERVIEW

1.1 – SITE LOCATION

The 0.89-acre site is located northwest of 43rd Avenue SE and S Meridian Street intersection in the City of Puyallup, Pierce County, Washington, as seen in Figure 1 below. The project site is located within APN 0419091073 and is bounded by S Meridian Street to the east and commercial properties to the north, south and west.

Figure 1 – Vicinity Map

1.2 – EXISTING CONDITIONS

The site contains an existing area of parking and pavement area of approximately 21,743 square feet, an existing building area of approximately 8,141 square feet, and approximately 10,364 square feet of landscaping. The site is bound by commercial parcels to the north, south, and west and S Meridian Street on the eastern frontage. There is an existing nail spa located north of the project area on the same parcel, an existing bank on the parcel to the south, as well as a commercial retail center on the parcel to the west that includes Best Buy, Mattress Depot, Men's Warehouse, and Ross Dress For Less.

The existing site has moderate slopes with a drop across the site of approximately 8 feet from the west to the east with an average slope of approximately 3.70%. Existing elevations onsite range from 455 feet to 447 feet. The project is located with Zone X, which is outside of the 100- or 500-year floodplain (See Appendix A-1).

The existing site soils have been classified via the United States Department of Agriculture (USDA) Soil survey as Everett very gravelly sandy loam, which is considered hydrologic soil group A. The USDA Soil Survey can be viewed in Appendix C-1.

A site geotechnical investigation was conducted by Terracon in April 2025 (See Appendix C-2). The geotechnical investigation consisted of seven (7) borings. The shallowest observed groundwater depth was 38 feet below ground surface. A summary of these borings can be viewed in Table 1 below.

Table 1 – Boring Log Summary

Boring (B) Designation	Boring Soil Description

B-01	• Fill –Silty Sand with Gravel (SM)
	  ○ To 13.5 feet BGS
	• Silty Gravel with Sand (GM)
	  ○ To 25.3 feet BGS

B-02	• Fill – Poorly Graded Sand with Gravel (SP)
	  ○ To 4.5 feet BGS
	• Silty Clayey Sand with Gravel (SC-SM)
	  ○ To 18.5 feet BGS
	• Silty Gravel with Sand (GM)
	  ○ To 25.4 feet BGS

B-03	• Fill – Silty Sand (SM)
	  ○ To 8.0 feet BGS
	• Silty Clayey Sand with Gravel (SC-SM)
	  ○ To 13.5 feet BGS
	• Silty Gravel with Sand (GM)
	  ○ To 25.3 feet BGS

B-04/MW-01	• Fill –Silty Sand with Gravel (SM)
	  ○ To 9.5 feet BGS
	• Silty Gravel with Sand (GM)
	  ○ To 48.0 feet BGS
	• Poorly Graded Sand with Silt and Gravel (SP-SM)
	  ○ To 50.8 feet BGS

B-05	• Silty Sand with Gravel (SM)
	  ○ To 7.0 feet BGS
	• Silty Gravel with Sand (GM)
	  ○ To 11.5 feet BGS

B-06	• Poorly Graded Sand with Silt and Gravel (SP-SM)
	  ○ To 4.5 feet BGS
	• Silty Gravel with Sand (GM)
	  ○ To 10.9 feet BGS

B-07	• Silty Sand (SM)
	  ○ To 10.4 feet BGS
	• Well Graded Gravel with Silt and Sand (GW-GM)
	  ○ To 11.5 feet BGS

In addition to the borings noted above, infiltration testing was performed by Terracon using one (1) small-scale pilot infiltration test (PIT). The measured infiltration rate was found to be 3.6 inches per hour resulting

in a design infiltration rate of 1.3 inches per hour. The infiltration addendum is provided with the associated site geotechnical report in Appendix C-2.

1.3 – EXISTING ON-SITE STORMWATER SYSTEM

Stormwater runoff from the existing site generally sheet flows to the northeast and southeast corners and is collected in catch basins located onsite and on neighboring properties. Collected runoff is then routed through the municipal stormwater drainage system along S Meridian Street and 39th Avenue SW, conveyed through open natural grass-lined channels, and ultimately outfalls into an unnamed perennial stream, publicly owned by the City of Puyallup Public Works, located west of the project site. The existing drainage basin area and surface summary can be seen in the Pre-Developed Drainage Area Map in Appendix A-2.

1.4 – PROPOSED SITE CONDITIONS

Stormwater runoff will be captured in several catch basins placed at low points onsite and routed to a water quality vault, a Contech Modular Wetland, which will treat stormwater runoff for both oil and metals. Once treated for water quality, stormwater runoff will be routed into the underground gravel infiltration facility where it will fully infiltrate into native soils. During storm events exceeding the 100-year storm, emergency overflow will discharge from the gravel infiltration trench via an overflow riser into the existing municipal stormwater system along S Meridian Street for further conveyance. The downstream existing catch basin will be replaced with site improvements, see the provided drainage plans in Appendix A-4.

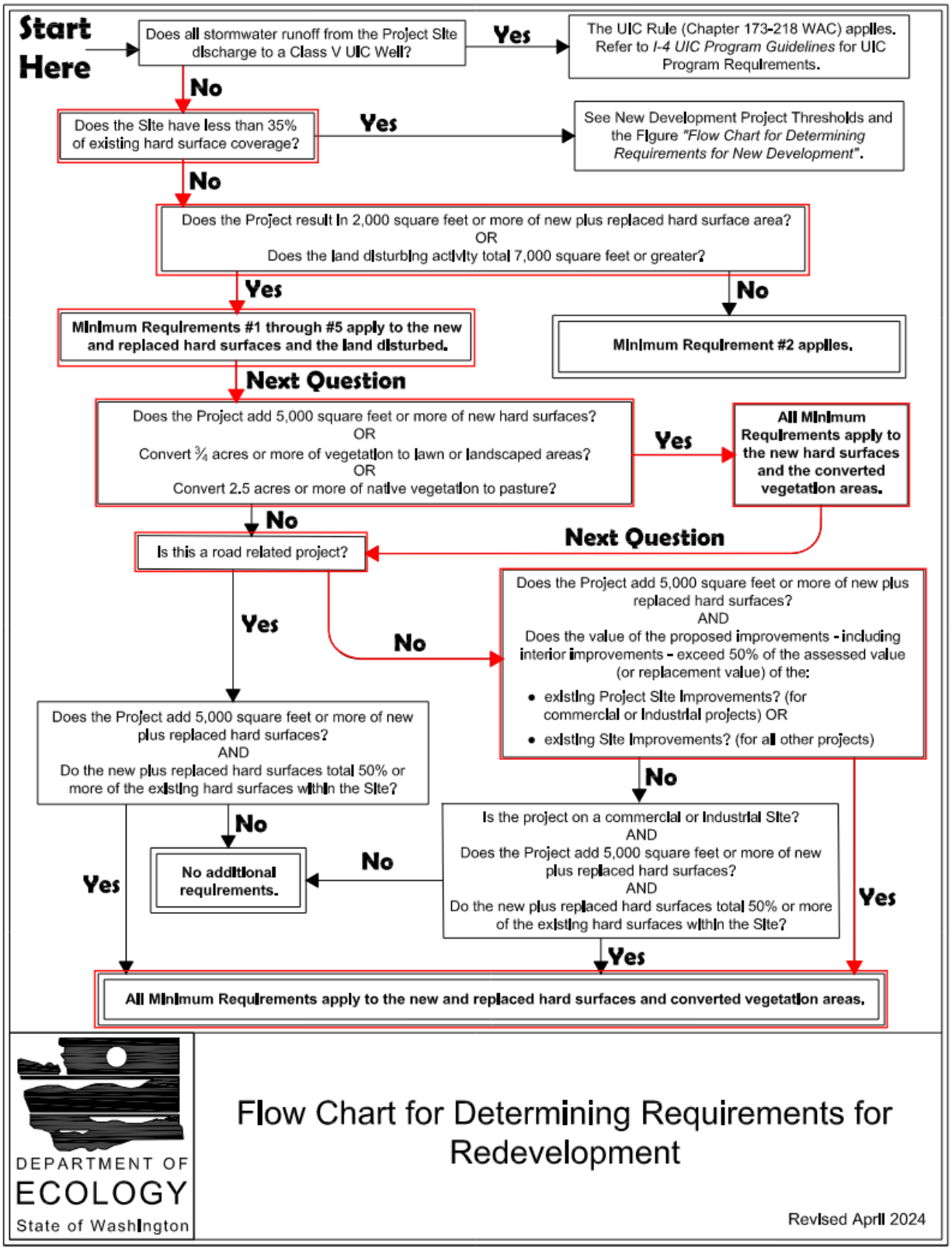
The underground gravel infiltration facility is sized to fully infiltrate all onsite surfaces, including the bypass area located primarily in the southern portion of the site. The disturbed bypass impervious surface area is larger than the undisturbed offsite impervious surface area flowing to the onsite basin, so the disturbed bypass impervious areas are used to conservatively size the gravel infiltration facility. The proposed drainage basin area and surface summary is provided in the Post-Developed Drainage Area Map in Appendix A-3.

2.0 – MINIMUM REQUIREMENTS (MRs)

2.1 – APPLICABLE MINIMUM REQUIREMENTS

The proposed project is a redevelopment project since the existing site has more than 35% impervious surface cover. To ensure stormwater meets the current SWMMWW requirements, the project site was evaluated using *Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment from Volume II of the SWMMWW* and can be seen in Figure 2 below. The project results in 2,000 square feet or more of new plus replaced hard surface area and adds more than 5,000 square feet of new plus replaced hard surface. Therefore, this project is required to meet all MRs for new and replaced hard surfaces and converted vegetated areas per the SWMMWW dated 2024. See the following sections below for a list of the MRs, the applicability of each to this project, and where additional information regarding compliance for each MR may be found in this report.

Figure 2 – Flow Chart for Determining Requirements for Redevelopment



A summary of the basin areas used for this project can be seen in Table 2 below.

Table 2 – Basin Area Summary

ONSITE BASIN	
POLLUTION GENERATING IMPERVOUS (ASPHALT/CONCRETE)	22,801 SF (0.52 AC)
NON-POLLUTION GENERATING IMPERVIOUS (ROOF)	3,598 SF (0.08 AC)
PERVIOUS (LANDSCAPING)	5,068 SF (0.12 AC)
POLLUTION GENERATING IMPERVIOUS AS BYPASS (ASPHALT)	4,233 SF (0.10 AC)
PERVIOUS AS BYPASS (LANDSCAPING)	4,492 SF (0.10 AC)
ONSITE BASIN TOTAL	**40,192 SF (0.92 AC)**

MR #1 – PREPARATION OF A STORMWATER SITE PLAN

The Grading and Drainage Plans and Erosion and Sediment Control Plans have been provided in Appendix A-4.

MR #2 –STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

As noted in SMMWW 1-3.4.2 MR2, projects which result in 2,000 square feet or more of new plus replaced hard surface area, or which disturb 7,000 square feet or more of land must prepare and submit a Construction Stormwater Pollution Prevention Plan (SWPPP). Refer to Appendix C-3 for the Construction Stormwater Pollution Prevention Plan (SWPPP).

MR #3 – SOURCE CONTROL OF POLLUTION

Water quality source control BMPs will be applied as applicable in accordance with the DOE's 2024 SWMMWW.

MR #4 – PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

The existing drainage patterns will be maintained and improved to be in accordance with the 2024 SWMMWW Minimum Requirements for Redevelopment, as determined within Section 2.1 of this report. Stormwater runoff will be collected in catch basins and routed to the water quality vault and underground gravel infiltration facility where it will infiltrate into the native soils. During storm events exceeding the 100-year storm, emergency overflow will discharge to the existing municipal stormwater system along S Meridian Street from the underground gravel infiltration facility via an overflow riser.

MR #5 – ON-SITE STORMWATER MANAGEMENT

The project site is inside the Urban Growth Area (UGA), so the on-site stormwater management can use the LID BMPs from List #2 for all surfaces within each type of surface in List #2 or use any flow control BMPs desired to achieve the LID Performance Standard and apply BMP T5.13: Post-Construction Soil

Quality and Depth. The project site will use Flow Control BMPs to achieve the LID Performance Standard and apply BMP T5.13: Post-Construction Soil Quality and Depth. See Section 5.0 for additional information.

MR #6 – RUNOFF TREATMENT

Runoff treatment will be provided via one onsite Contech Modular Wetland for oil control and metals treatment. See Section 6.0 of this report for additional information on runoff treatment.

MR #7 – FLOW CONTROL

Stormwater runoff will fully infiltrate into native soils via an underground gravel infiltration facility. During storm events exceeding the 100-year storm, emergency overflow will discharge to the existing municipal stormwater system along S Meridian Street from the gravel infiltration trench via an overflow riser. See Section 7.0 of this report for details on design and assumptions for these proposed facilities.

MR #8 – WETLAND PROTECTION

Runoff generated from the site does not discharge into a wetland (directly or indirectly).

MR #9 – OPERATIONS AND MAINTENANCE

An operations and maintenance (O&M) manual for the proposed stormwater management BMPs is included in Appendix C-4 of this report.

4.0 – PRESERVING NATURAL DRAINAGE SYSTEMS (MR#4)

No adjustments will be made to the existing natural discharge location. In the existing conditions, stormwater runoff is collected and routed to an unnamed perennial stream, publically owned by the City of Puyallup Public Works.

It is proposed that stormwater runoff will be infiltrated onsite to match forested conditions, as modeled in WWHM 2012. The proposed stormwater system preserves natural drainage patterns and improves the existing conditions by mitigating onsite runoff to the downstream municipal stormwater system through full infiltration up to the 100-year storm. During storm events exceeding the 100-year storm, emergency overflow will leave the site via an overflow riser and outfall into the municipal along S Meridian Street for further conveyance. Additionally, onsite runoff will be treated for water quality in accordance with MR#5 before being infiltrated into native soils for preservation of the underground aquifer.

A site visit was conducted on April 18th, 2025 to analyze the downstream conveyance system and existing onsite catch basin structures. Photos from this site visit have been provided below:

Photograph 1 – Existing Downstream Catch Basin Within South Access To Be Replaced – Discharge From Overflow Structure

Photograph 2 – Existing Downstream Catch Basin Within South Access – Upstream of S Meridian Tie-In

Photograph 3 – Existing Catch Basin Within S Meridian Street – Tie-In to Municipal System

Photograph 4 – Existing Catch Basin Within Proposed Landscaping Along Eastern Portion of the Site

5.0 – ON-SITE BMPS (MR#5)

As the proposed project site is not Flow Control exempt and is inside the Urban Growth Area (UGA), this project will use Flow Control BMPs to achieve the LID Performance Standard and apply BMP T5.13: Post-Construction Soil Quality and Depth.

The LID Performance Standard requires that stormwater discharges match developed durations to pre-developed duration for the range of pre-developed discharge rates from 8% of the 2-year peak flow to 50% of the 2-year peak flow.

The LID Performance Standard is met by the infiltration facility that will fully infiltrate the onsite stormwater runoff. During storm events exceeding the 100-year storm, emergency overflow will leave the site via an overflow riser and outfall into the municipal along S Meridian Street for further conveyance. See Appendix B-2 for the WWHM2012 calculation for the LID Performance Standard.

Lawn and landscaped areas will be managed using BMP T5.13: Post-Construction Soil Quality and Depth.

6.0 – WATER QUALITY FACILITIES (MR#6)

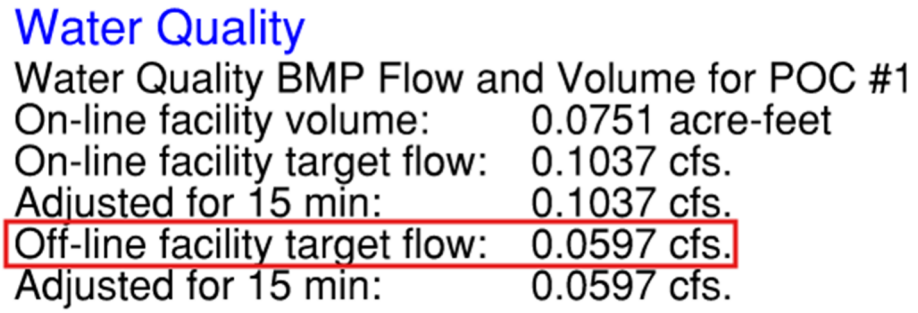
The project site has been evaluated based on the current edition of the SWMMWW and water quality treatment will be required since new plus replaced pollution generating impervious surfaces (PGIS) exceed 5,000 square feet (SF).

The flow chart for water quality treatment was utilized to evaluate what treatment needs to be provided. A summary of the flow chart can be viewed below:

- Oil Control: The onsite basin is deemed to be a commercial site which is anticipated to have more than 300 total trips per day meaning oil control will be required.
- Pretreatment: To avoid the cost of additional structures and site constraints it was deemed infeasible.
- Phosphorous: The site's ultimate discharge point when storm events exceed the 100-yr storm event and for bypass runoff is an unnamed perennial stream, publicly owned by the City of Puyallup Public Works, located west of the site which is not listed as a 303(d) body of water and therefore phosphorus treatment is not required.
- Metals: Due to the anticipated high number of trips generated, it was determined that metals treatment would be required.

To ensure sufficient stormwater treatment, a Contech Modular Wetland was selected, which treats all the above listed contaminates. As seen in Figure 3 below, the water quality off-line flow was calculated to be 0.0597 cfs which was used to calculate the required vault size. See Appendix B-1 for the WWHM2012 calculations for water quality flow rates.

Figure 3 – Water Quality Flowrates (Onsite)



7.0 – FLOW CONTROL (MR#7)

To ensure stormwater runoff is properly mitigated, an underground gravel infiltration facility is proposed to fully infiltrate runoff into native soils. During storm events exceeding the 100-year storm, emergency overflow from the gravel infiltration facility will outflow via an overflow riser into a proposed catch basin located within the access drive south of the property site before entering the municipal stormwater system within S Meridian Street and will ultimately outfall to an unnamed perennial stream owned by the City of Puyallup Public Works. A summary of the gravel infiltration trench can be seen in Table 3 below and can be viewed in Appendix B-3.

Table 3 – Gravel Infiltration Trench Summary

GRAVEL INFILTRATION TRENCH	AREA (SF)	DEPTH (FT)	[1]STORAGE (CF)	[2]BOTTOM ELEV.
Gravel Infiltration Trench	2,327	6	4,988	438.10

Notes:
[1]Storage includes void space and only accounts for the first 5 feet from bottom elevation with 1 foot freeboard. See Table 4 below and Appendix B-3 for additional information.
[2]Bottom elevation is considered bottom of gravel infiltration trench.

In WWHM, the gravel infiltration trenches were modeled using the gravel trench element, but since a series of 24-inch diameter pipes are being proposed, calculations to account for additional storage in these pipes and associated manifolds were done to provide a more realistic understanding of underground storage. An example calculation for the middle layer of Gravel Infiltration Trench was provided below to show how the pipe area was included to provide additional detention storage:

24" Perforated Pipe Storage Volume (cu-ft)

$$\frac{\pi}{4}(\text{Pipe Diameter})^2(\text{Pipe Length}) = \text{Pipe Volume}$$

$$\frac{\pi}{4}(2\text{ ft})^2\ (360\text{ ft}) = 1131\text{ cu-ft}$$

12" Manifold Storage Volume (cu-ft)

$$\frac{\pi}{4}(\text{Pipe Diameter})^2(\text{Pipe Length}) = \text{Pipe Volume}$$

$$\frac{\pi}{4}(1\text{ ft})^2\ (74\text{ ft}) = 58\text{ cu-ft}$$

Gravel Storage Volume (cu-ft)

$$((\text{Gravel Infiltration Trench Area})(\text{Depth}) - 24\text{" Pipe Volume} - 12\text{" Manifold Volume})(\text{Porosity}) = \text{Gravel Storage Volume}$$

$$(2{,}327\text{ sf})(2\text{ ft}) - 1131\text{ cu-ft} - 58\text{ cu-ft})(0.4) = 1386\text{ cu-ft}$$

Total Middle Layer Volume (cu-ft)

$$24\text{" Pipe Volume} + 12\text{" Manifold Volume} + \text{Gravel Storage Volume} = \text{Middle Layer Total Volume}$$

$$1131\text{ cu-ft} + 58\text{ cu-ft} + 1386\text{ cu-ft} = 2575\text{ cu-ft}$$

To ensure this storage volume was accurately represented for in WWHM, an adjustment to porosity was accounted for within the middle layer of the gravel infiltration trench. The calculations for the weighted porosity were as follows:

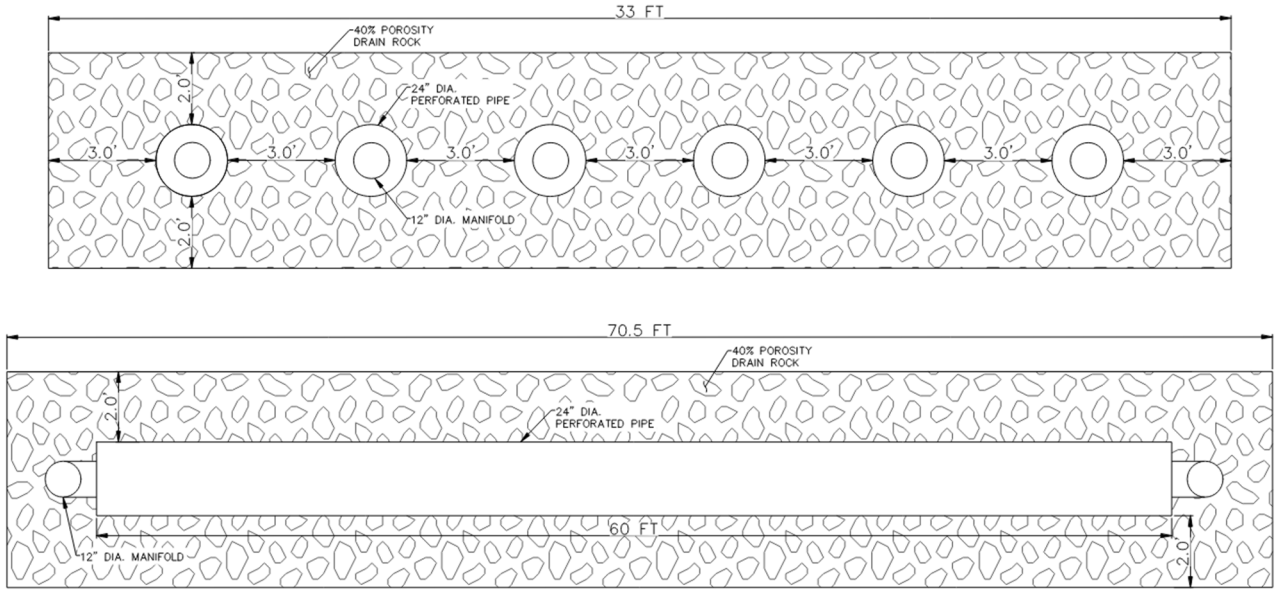
Total Middle Layer Porosity

$$\frac{(\text{Total Middle Layer Volume})}{(\text{Gravel Infiltration Trench Area})(\text{Depth})} = \text{Middle Layer Porosity}$$

$$\frac{(2575\text{ cu-ft})}{(2327\text{ sf})(2\text{ ft})} = 55.33\%$$

A cross section showing how the above-mentioned calculations were made, is shown in Figure 4 below.

Figure 4 – Gravel Infiltration Trench #1 Cross Section



A summary of the gravel infiltration trench storage volume calculations has been provided in Table 4 below.

Table 4 – Gravel Infiltration Trench Sizing Summary

GRAVEL INFILTRATION TRENCH #1 (ONSITE)						
DESCRIPTION	CAD			WWHM		
	POROSITY (%)	DEPTH (FT)	VOLUME (CF)	POROSITY (%)	DEPTH (FT)	VOLUME (CF)
TOP LAYER	**40%**	**2**	**1,861**	**40%**	**2**	**1,861**
GRAVEL MIDDLE	40%	2	1,386	**55.33%**	**2**	**2,575**
360 LF OF 24" DIA. CMP	100%	---	1,130			
54 LF OF 12" DIA. PVC	100%	---	58			
MIDDLE LAYER TOTAL	**---**	**---**	**2,575**			
BOTTOM LAYER	**40%**	**2**	**1,861**	**40%**	**2**	**1,861**

8.0 – CONVEYANCE SYSTEMS

To meet City of Puyallup Section 2-4.3 Pipe System Design Criteria, the minimum design velocity for full flow storm pipes of 3-feet per second was maintained.

Example Velocity Calculation

$$Velocity = \frac{1.486}{\mathrm{n}}(R)^{2/3}(S)^{1/2} = \frac{1.486}{0.012}(1/4)^{2/3}(0.005)^{1/2} = 3.47\ fps$$

The conveyance system was designed to fully convey the 25-year storm event to ensure pipes do not exceed pipe capacity. The 100-year storm event was also evaluated to ensure no overtopping in the system.

Conveyance calculations were done using StormCAD and the output has been provided in Appendix B-3.

9.0 – WETLAND PROTECTION (MR#8)

There are no existing wetlands on or adjacent to the proposed site.

10.0 – OPERATIONS AND MAINTENANCE MANUAL (MR#9)

Operations and maintenance procedures for stormwater management BMPs are included in Appendix C-4.

Beyond what is listed in the manufacturer operations and maintenance manuals, all facilities shall be inspected after the first major storm of the wet season and a minimum of twice per year. Clean any trash or debris from water quality facilities during the inspection and replace treatment media if conditions listed in the manufacturer maintenance manual are observed.

11.0 – OTHER PERMITS

Construction of this project and its stormwater facilities will require the following additional permits:

Construction Stormwater General Permit – Washington Department of Ecology (DOE)

12.0 – APPENDICES

Appendix A-1 – FEMA FIRMette

Appendix A-2 – Pre-Developed Drainage Area Map

Appendix A-3 – Post-Developed Drainage Area Map

Appendix A-4 – Drainage and TESC Plans

Appendix B-1 – Water Quality Modeling Output

Appendix B-2 – Flow Control Modeling Output

Appendix B-3 – Conveyance Calculations

Appendix C-1 – USGS Soil Survey

Appendix C-2 – Terracon Geotechnical Report

Appendix C-3 – Construction Stormwater Pollution Prevention Plan (SWPPP)

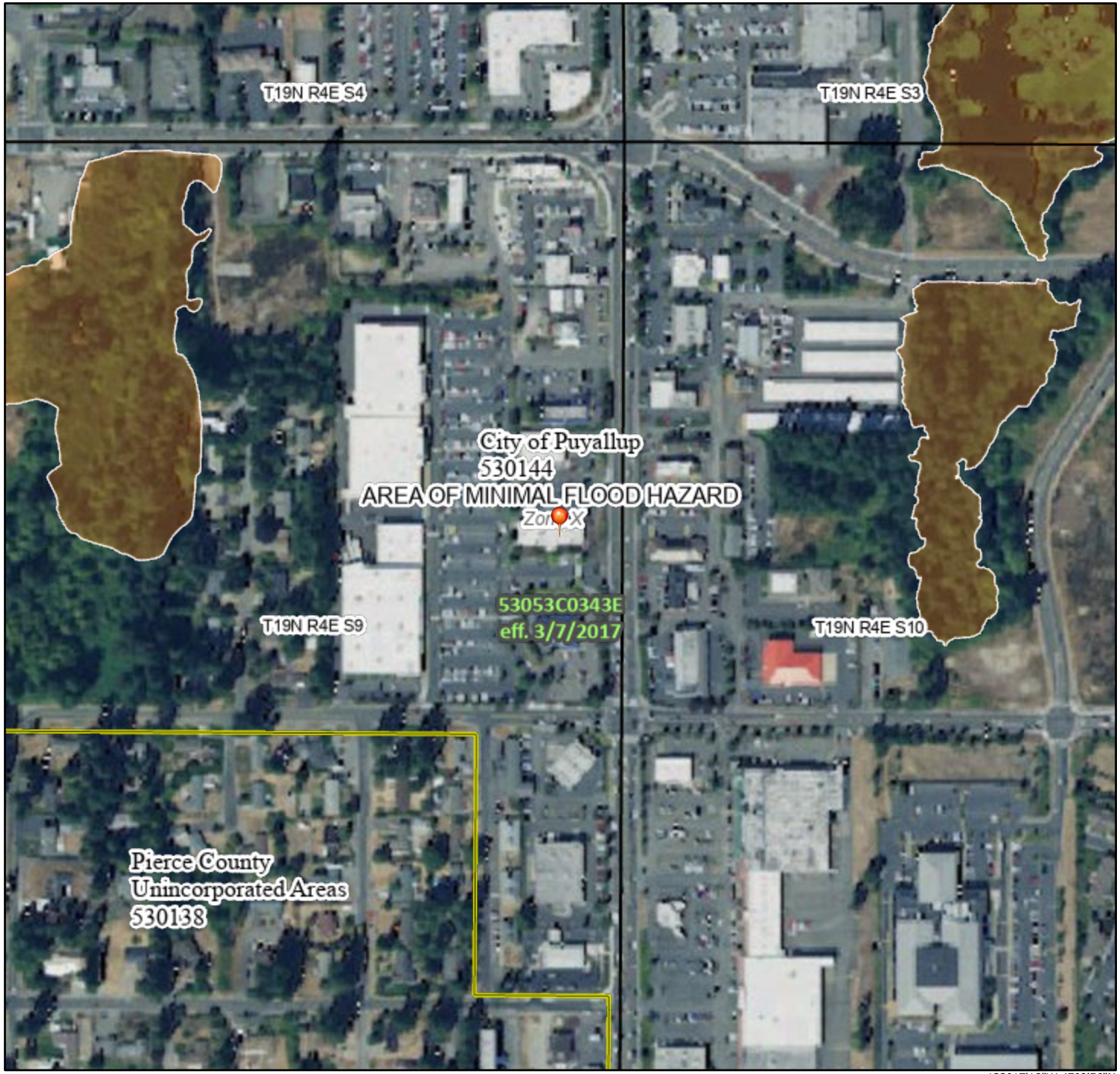
Appendix C-4 – Operations and Maintenance (O&M) Manual

Appendix A-1: FEMA FIRMette

National Flood Hazard Layer FIRMette

FEMA

122°17'56"W 47°9'21"N



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

1:6,000

122°17'18"W 47°8'56"N

Basemap Imagery Source: USGS National Map 2023

Legend

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

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

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

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

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

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

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

N

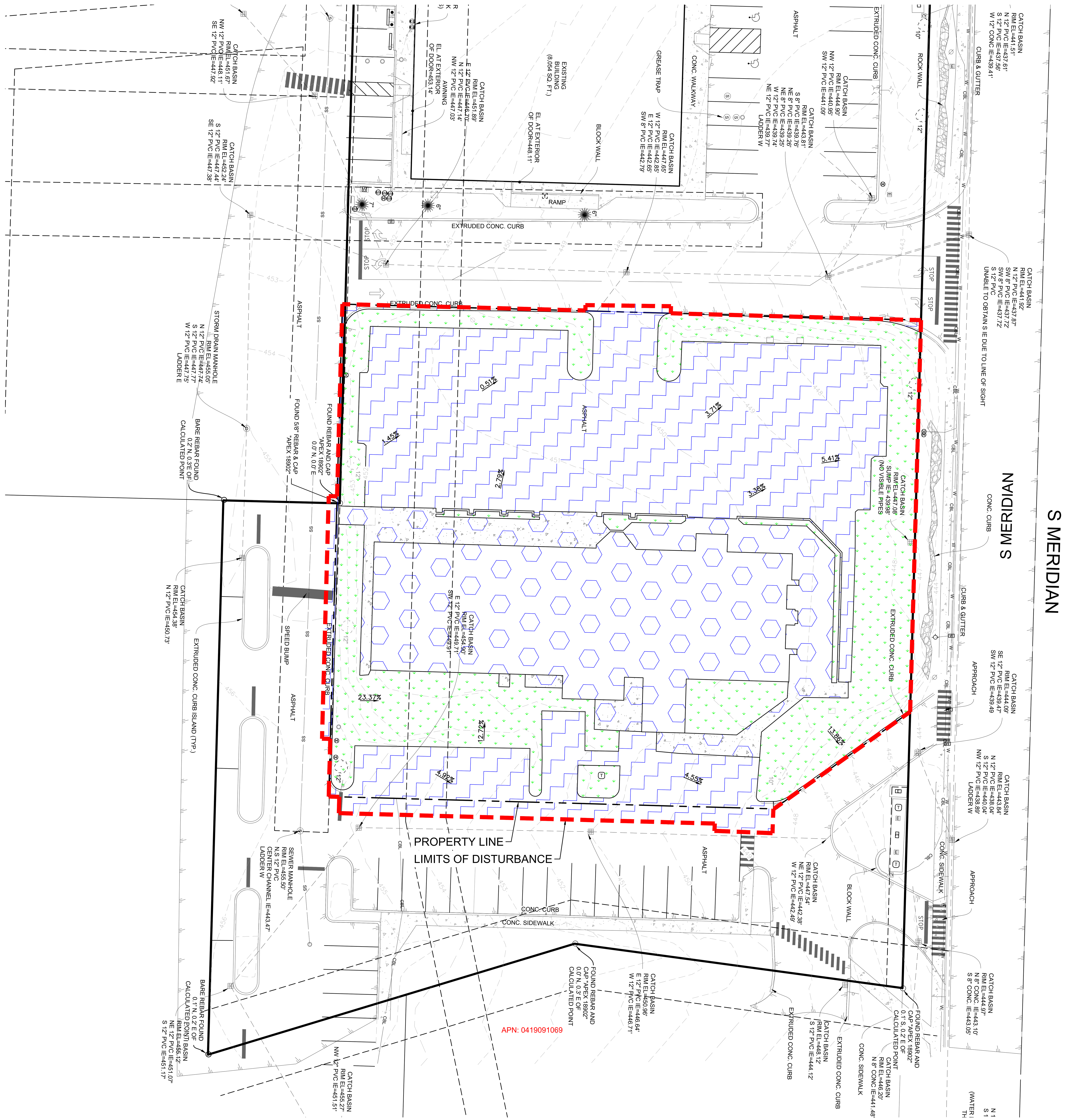
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/17/2025 at 7:22 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Appendix A-2: Pre-Developed Drainage Area Map



LEGEND:

PROPERTY LINE (0.89 AC)

LIMITS OF DISTURBANCE (0.92 AC)

EXISTING SURFACE SUMMARY TABLE		
	SURFACE	AREA
	POLLUTION GENERATING IMPERVIOUS (ASPHALT/CONCRETE)	17,901 SF (0.41 AC)
	NON–POLLUTION GENERATING IMPERVIOUS (SIDEWALK/ROOF)	11,927 SF (0.27 AC)
	PERVIOUS (LANDSCAPING)	10,364 SF (0.24 AC)
	TOTAL:	40,192 SF (0.92 AC.)

NOTES:

1. ALL EXISTING ONSITE RUNOFF IS COLLECTED IN CATCH BASINS AND ROUTED TO THE EXISTING MUNICIPAL SYSTEM ALONG S MERIDIAN STREET, LOCATED EAST OF THE PROJECT SITE, AND CONSIDERED ONE BASIN.
2. THE EXISTING BASIN EXTENTS IS LIMITED TO THE PROPOSED LIMITS OF DISTURBANCE.

PRE-DEVELOPED DRAINAGE AREA MAP

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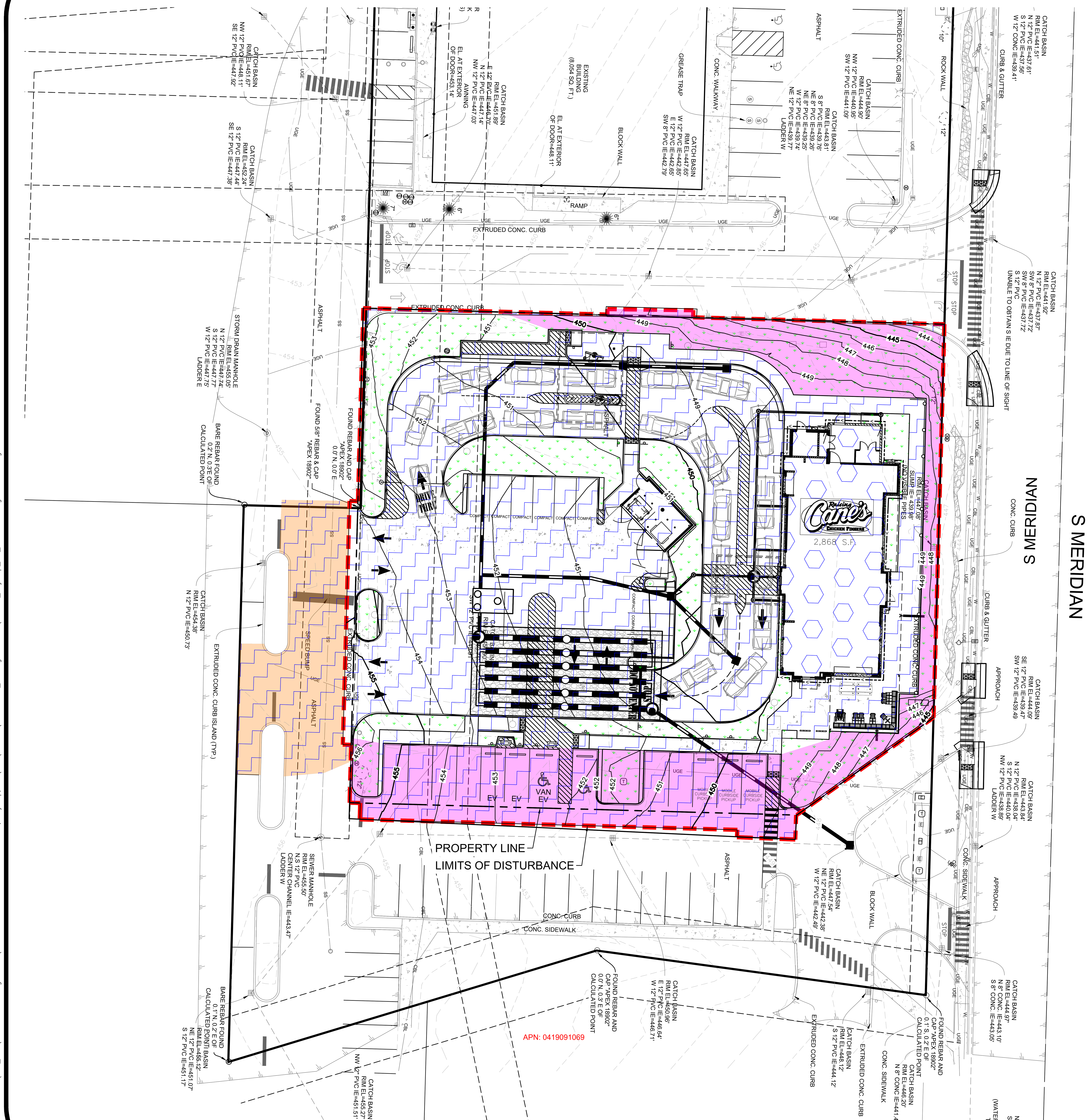
Appendix A-3: Post-Developed Drainage Area Map



LEGEND:

- PROPERTY LINE (0.89 AC)
- LIMITS OF DISTURBANCE (0.92 AC)

PROPOSED SURFACE SUMMARY TABLE		
	SURFACE	AREA
	POLLUTION GENERATING IMPERVIOUS (ASPHALT/CONCRETE)	22,801 SF (0.52 AC)
	NON-POLLUTION GENERATING IMPERVIOUS (ROOF)	3,598 SF (0.08 AC)
	PERVIOUS (LANDSCAPING)	5,068 SF (0.12 AC)
	BYPASS POLLUTION GENERATING IMPERVIOUS (ASPHALT/CONCRETE)	4,233 SF (0.10 AC)
	BYPASS PERVIOUS (LANDSCAPING)	4,492 SF (0.10 AC)
	TOTAL:	40,192 SF (0.92 AC.)

CONTRIBUTING OFFSITE SURFACE SUMMARY TABLE		
	SURFACE	AREA
	POLLUTION GENERATING IMPERVIOUS CONTRIBUTING TO ONSITE BASIN (ASPHALT/CONCRETE)	2,977 SF (0.07 AC)
	TOTAL:	2,977 SF (0.07 AC.)

NOTES:

1. SINCE THE PROPOSED BYPASS POLLUTION GENERATING IMPERVIOUS SURFACE AREA (0.10 AC) IS GREATER THAN THE OFFSITE POLLUTION GENERATING SURFACE AREA (0.07 AC) CONTRIBUTING TO THE ONSITE BASIN, THE PROPOSED ONSITE STORMWATER FACILITIES USED FOR WATER QUALITY AND FLOW CONTROL (FULL INFILTRATION) ARE SIZED USING THE BYPASS AREA AS A CONSERVATIVE APPROACH FOR MODELING RUNOFF.

NORTH

GRAPHIC SCALE IN FEET
0 10 20 40

POST-DEVELOPED DRAINAGE AREA MAP

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Appendix A-4: Grading and Drainage Plan

(Provided Separately)

Appendix B-1: Water Quality Modeling Output

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: RC C1360 Puyallup WA - Water Quality

Site Name:	RC C1360 Puyallup WA
Site Address:	Meridian and 43rd
City:	Puyallup
Report Date:	3/9/2026
Gage:	38 IN CENTRAL
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2024/06/28
Version:	4.3.1

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

Existing Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	0.92
Pervious Total	0.92
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.92

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.22
Pervious Total	0.22

Impervious Land Use	acre
ROOF TOPS FLAT	0.08
PARKING FLAT	0.62
Impervious Total	0.7
Basin Total	0.92

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

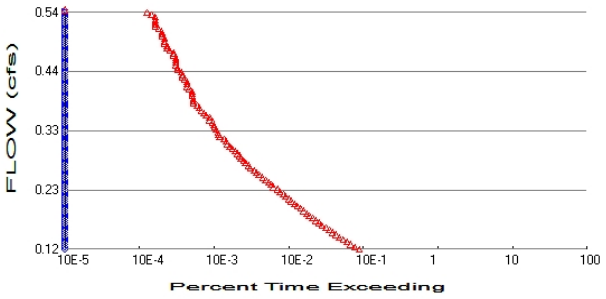
POC 1	POC 1

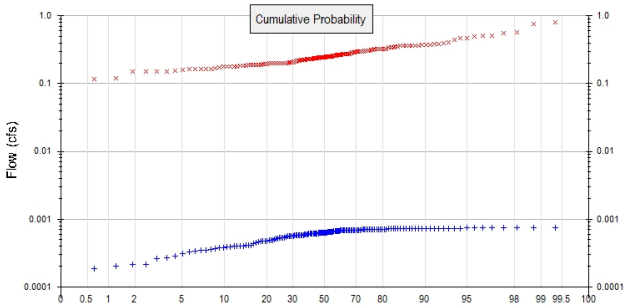
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.92
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.22
Total Impervious Area: 0.7

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000599
5 year	0.000739
10 year	0.000804
25 year	0.000864
50 year	0.000898
100 year	0.000925

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.245647
5 year	0.329967
10 year	0.391284
25 year	0.475241
50 year	0.542648
100 year	0.614358

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.001	0.290
1903	0.000	0.322
1904	0.001	0.364
1905	0.001	0.163
1906	0.000	0.183
1907	0.001	0.244
1908	0.001	0.201
1909	0.001	0.248
1910	0.001	0.237
1911	0.001	0.266

1912	0.001	0.474
1913	0.001	0.192
1914	0.001	0.805
1915	0.001	0.165
1916	0.001	0.309
1917	0.000	0.117
1918	0.001	0.247
1919	0.000	0.151
1920	0.001	0.201
1921	0.001	0.173
1922	0.001	0.271
1923	0.001	0.189
1924	0.000	0.357
1925	0.000	0.149
1926	0.001	0.291
1927	0.000	0.237
1928	0.001	0.176
1929	0.001	0.351
1930	0.001	0.367
1931	0.001	0.177
1932	0.001	0.191
1933	0.001	0.189
1934	0.001	0.308
1935	0.000	0.163
1936	0.001	0.228
1937	0.001	0.340
1938	0.001	0.166
1939	0.000	0.209
1940	0.001	0.368
1941	0.001	0.364
1942	0.000	0.274
1943	0.000	0.271
1944	0.001	0.390
1945	0.001	0.295
1946	0.001	0.229
1947	0.000	0.179
1948	0.001	0.246
1949	0.001	0.380
1950	0.000	0.215
1951	0.001	0.325
1952	0.001	0.367
1953	0.001	0.338
1954	0.001	0.200
1955	0.000	0.186
1956	0.000	0.183
1957	0.001	0.198
1958	0.001	0.248
1959	0.001	0.252
1960	0.001	0.195
1961	0.001	0.557
1962	0.001	0.240
1963	0.000	0.178
1964	0.000	0.516
1965	0.001	0.232
1966	0.001	0.194
1967	0.001	0.271
1968	0.001	0.229
1969	0.001	0.206

1970	0.001	0.235
1971	0.001	0.227
1972	0.001	0.752
1973	0.001	0.436
1974	0.001	0.316
1975	0.001	0.327
1976	0.001	0.348
1977	0.001	0.149
1978	0.001	0.258
1979	0.001	0.265
1980	0.001	0.261
1981	0.001	0.246
1982	0.000	0.200
1983	0.001	0.271
1984	0.001	0.270
1985	0.001	0.307
1986	0.001	0.156
1987	0.001	0.274
1988	0.000	0.163
1989	0.001	0.149
1990	0.001	0.197
1991	0.001	0.295
1992	0.001	0.280
1993	0.001	0.320
1994	0.001	0.219
1995	0.001	0.170
1996	0.001	0.229
1997	0.001	0.205
1998	0.001	0.243
1999	0.001	0.264
2000	0.001	0.232
2001	0.000	0.186
2002	0.001	0.338
2003	0.000	0.197
2004	0.001	0.296
2005	0.001	0.566
2006	0.001	0.265
2007	0.001	0.297
2008	0.001	0.245
2009	0.000	0.187
2010	0.000	0.240
2011	0.000	0.252
2012	0.001	0.234
2013	0.001	0.221
2014	0.001	0.214
2015	0.001	0.359
2016	0.000	0.224
2017	0.001	0.360
2018	0.001	0.224
2019	0.001	0.319
2020	0.001	0.261
2021	0.001	0.220
2022	0.000	0.375
2023	0.000	0.463
2024	0.001	0.497
2025	0.000	0.241
2026	0.001	0.265
2027	0.001	0.295

2028	0.000	0.116
2029	0.001	0.190
2030	0.001	0.380
2031	0.000	0.120
2032	0.000	0.202
2033	0.000	0.254
2034	0.001	0.199
2035	0.001	0.245
2036	0.000	0.199
2037	0.001	0.267
2038	0.001	0.254
2039	0.000	0.510
2040	0.001	0.199
2041	0.001	0.253
2042	0.001	0.292
2043	0.001	0.323
2044	0.001	0.222
2045	0.001	0.180
2046	0.001	0.199
2047	0.001	0.246
2048	0.001	0.203
2049	0.000	0.301
2050	0.001	0.224
2051	0.001	0.316
2052	0.001	0.241
2053	0.001	0.205
2054	0.001	0.407
2055	0.001	0.249
2056	0.000	0.321
2057	0.001	0.158
2058	0.001	0.302
2059	0.001	0.377

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0007	0.8050
2	0.0007	0.7515
3	0.0007	0.5658
4	0.0007	0.5574
5	0.0007	0.5162
6	0.0007	0.5096
7	0.0007	0.4969
8	0.0007	0.4741
9	0.0007	0.4627
10	0.0007	0.4365
11	0.0007	0.4067
12	0.0007	0.3897
13	0.0007	0.3801
14	0.0007	0.3797
15	0.0007	0.3771
16	0.0007	0.3745
17	0.0007	0.3683
18	0.0007	0.3673
19	0.0007	0.3673
20	0.0007	0.3640
21	0.0007	0.3639
22	0.0007	0.3599

23	0.0007	0.3589
24	0.0007	0.3572
25	0.0007	0.3509
26	0.0007	0.3477
27	0.0007	0.3396
28	0.0007	0.3384
29	0.0007	0.3382
30	0.0007	0.3266
31	0.0007	0.3250
32	0.0007	0.3229
33	0.0007	0.3215
34	0.0007	0.3213
35	0.0007	0.3203
36	0.0007	0.3193
37	0.0007	0.3159
38	0.0007	0.3156
39	0.0007	0.3088
40	0.0007	0.3078
41	0.0007	0.3069
42	0.0007	0.3024
43	0.0007	0.3007
44	0.0007	0.2969
45	0.0007	0.2961
46	0.0007	0.2953
47	0.0007	0.2951
48	0.0007	0.2948
49	0.0007	0.2920
50	0.0007	0.2910
51	0.0007	0.2901
52	0.0007	0.2803
53	0.0007	0.2737
54	0.0007	0.2737
55	0.0007	0.2715
56	0.0007	0.2714
57	0.0007	0.2714
58	0.0007	0.2710
59	0.0007	0.2698
60	0.0007	0.2673
61	0.0007	0.2655
62	0.0007	0.2654
63	0.0007	0.2647
64	0.0007	0.2645
65	0.0007	0.2644
66	0.0007	0.2613
67	0.0007	0.2610
68	0.0007	0.2584
69	0.0007	0.2542
70	0.0007	0.2536
71	0.0007	0.2531
72	0.0006	0.2523
73	0.0006	0.2516
74	0.0006	0.2490
75	0.0006	0.2484
76	0.0006	0.2477
77	0.0006	0.2474
78	0.0006	0.2459
79	0.0006	0.2459
80	0.0006	0.2456

81	0.0006	0.2449
82	0.0006	0.2447
83	0.0006	0.2441
84	0.0006	0.2431
85	0.0006	0.2412
86	0.0006	0.2410
87	0.0006	0.2398
88	0.0006	0.2396
89	0.0006	0.2370
90	0.0006	0.2366
91	0.0006	0.2346
92	0.0006	0.2341
93	0.0006	0.2323
94	0.0006	0.2320
95	0.0006	0.2292
96	0.0006	0.2289
97	0.0006	0.2288
98	0.0006	0.2283
99	0.0006	0.2275
100	0.0006	0.2243
101	0.0006	0.2240
102	0.0006	0.2237
103	0.0006	0.2219
104	0.0006	0.2208
105	0.0006	0.2203
106	0.0006	0.2191
107	0.0006	0.2149
108	0.0006	0.2135
109	0.0006	0.2089
110	0.0006	0.2063
111	0.0006	0.2049
112	0.0006	0.2046
113	0.0006	0.2027
114	0.0006	0.2023
115	0.0006	0.2013
116	0.0005	0.2007
117	0.0005	0.2001
118	0.0005	0.1997
119	0.0005	0.1994
120	0.0005	0.1991
121	0.0005	0.1990
122	0.0005	0.1987
123	0.0005	0.1981
124	0.0005	0.1974
125	0.0005	0.1973
126	0.0005	0.1953
127	0.0005	0.1937
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129	0.0005	0.1911
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131	0.0005	0.1894
132	0.0004	0.1891
133	0.0004	0.1868
134	0.0004	0.1863
135	0.0004	0.1857
136	0.0004	0.1831
137	0.0004	0.1826
138	0.0004	0.1796

139	0.0004	0.1788
140	0.0004	0.1781
141	0.0004	0.1771
142	0.0004	0.1758
143	0.0004	0.1727
144	0.0004	0.1703
145	0.0004	0.1660
146	0.0003	0.1651
147	0.0003	0.1633
148	0.0003	0.1633
149	0.0003	0.1632
150	0.0003	0.1580
151	0.0003	0.1559
152	0.0003	0.1513
153	0.0003	0.1493
154	0.0002	0.1493
155	0.0002	0.1492
156	0.0002	0.1195
157	0.0002	0.1167
158	0.0002	0.1156

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0003	0	4883	n/a	Fail
0.0003	0	4230	n/a	Fail
0.0003	0	3748	n/a	Fail
0.0003	0	3325	n/a	Fail
0.0003	0	2972	n/a	Fail
0.0003	0	2611	n/a	Fail
0.0003	0	2378	n/a	Fail
0.0003	0	2132	n/a	Fail
0.0003	0	1939	n/a	Fail
0.0004	0	1755	n/a	Fail
0.0004	0	1538	n/a	Fail
0.0004	0	1406	n/a	Fail
0.0004	0	1284	n/a	Fail
0.0004	0	1158	n/a	Fail
0.0004	0	1047	n/a	Fail
0.0004	0	963	n/a	Fail
0.0004	0	875	n/a	Fail
0.0004	0	805	n/a	Fail
0.0004	0	726	n/a	Fail
0.0004	0	656	n/a	Fail
0.0004	0	600	n/a	Fail
0.0004	0	552	n/a	Fail
0.0004	0	500	n/a	Fail
0.0004	0	470	n/a	Fail
0.0004	0	422	n/a	Fail
0.0005	0	394	n/a	Fail
0.0005	0	346	n/a	Fail
0.0005	0	324	n/a	Fail
0.0005	0	296	n/a	Fail
0.0005	0	270	n/a	Fail
0.0005	0	247	n/a	Fail
0.0005	0	221	n/a	Fail
0.0005	0	203	n/a	Fail
0.0005	0	189	n/a	Fail
0.0005	0	170	n/a	Fail
0.0005	0	159	n/a	Fail
0.0005	0	146	n/a	Fail
0.0005	0	137	n/a	Fail
0.0005	0	127	n/a	Fail
0.0005	0	122	n/a	Fail
0.0005	0	115	n/a	Fail
0.0005	0	106	n/a	Fail
0.0006	0	97	n/a	Fail
0.0006	0	90	n/a	Fail
0.0006	0	84	n/a	Fail
0.0006	0	80	n/a	Fail
0.0006	0	76	n/a	Fail
0.0006	0	66	n/a	Fail
0.0006	0	63	n/a	Fail
0.0006	0	62	n/a	Fail
0.0006	0	59	n/a	Fail
0.0006	0	56	n/a	Fail
0.0006	0	55	n/a	Fail

0.0006	0	53	n/a	Fail
0.0006	0	48	n/a	Fail
0.0006	0	48	n/a	Fail
0.0006	0	43	n/a	Fail
0.0006	0	40	n/a	Fail
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0.0007	0	29	n/a	Fail
0.0007	0	29	n/a	Fail
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0.0007	0	28	n/a	Fail
0.0007	0	28	n/a	Fail
0.0007	0	28	n/a	Fail
0.0007	0	26	n/a	Fail
0.0007	0	24	n/a	Fail
0.0007	0	24	n/a	Fail
0.0007	0	24	n/a	Fail
0.0007	0	22	n/a	Fail
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0.0007	0	20	n/a	Fail
0.0008	0	18	n/a	Fail
0.0008	0	18	n/a	Fail
0.0008	0	17	n/a	Fail
0.0008	0	17	n/a	Fail
0.0008	0	17	n/a	Fail
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0.0008	0	12	n/a	Fail
0.0008	0	12	n/a	Fail
0.0008	0	11	n/a	Fail
0.0008	0	11	n/a	Fail
0.0008	0	11	n/a	Fail
0.0009	0	10	n/a	Fail
0.0009	0	9	n/a	Fail
0.0009	0	9	n/a	Fail
0.0009	0	9	n/a	Fail
0.0009	0	9	n/a	Fail
0.0009	0	9	n/a	Fail
0.0009	0	8	n/a	Fail
0.0009	0	7	n/a	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0751 acre-feet
On-line facility target flow:	0.1037 cfs.
Adjusted for 15 min:	0.1037 cfs.
Off-line facility target flow:	0.0597 cfs.
Adjusted for 15 min:	0.0597 cfs.

Model Default Modifications

Total of 0 changes have been made.

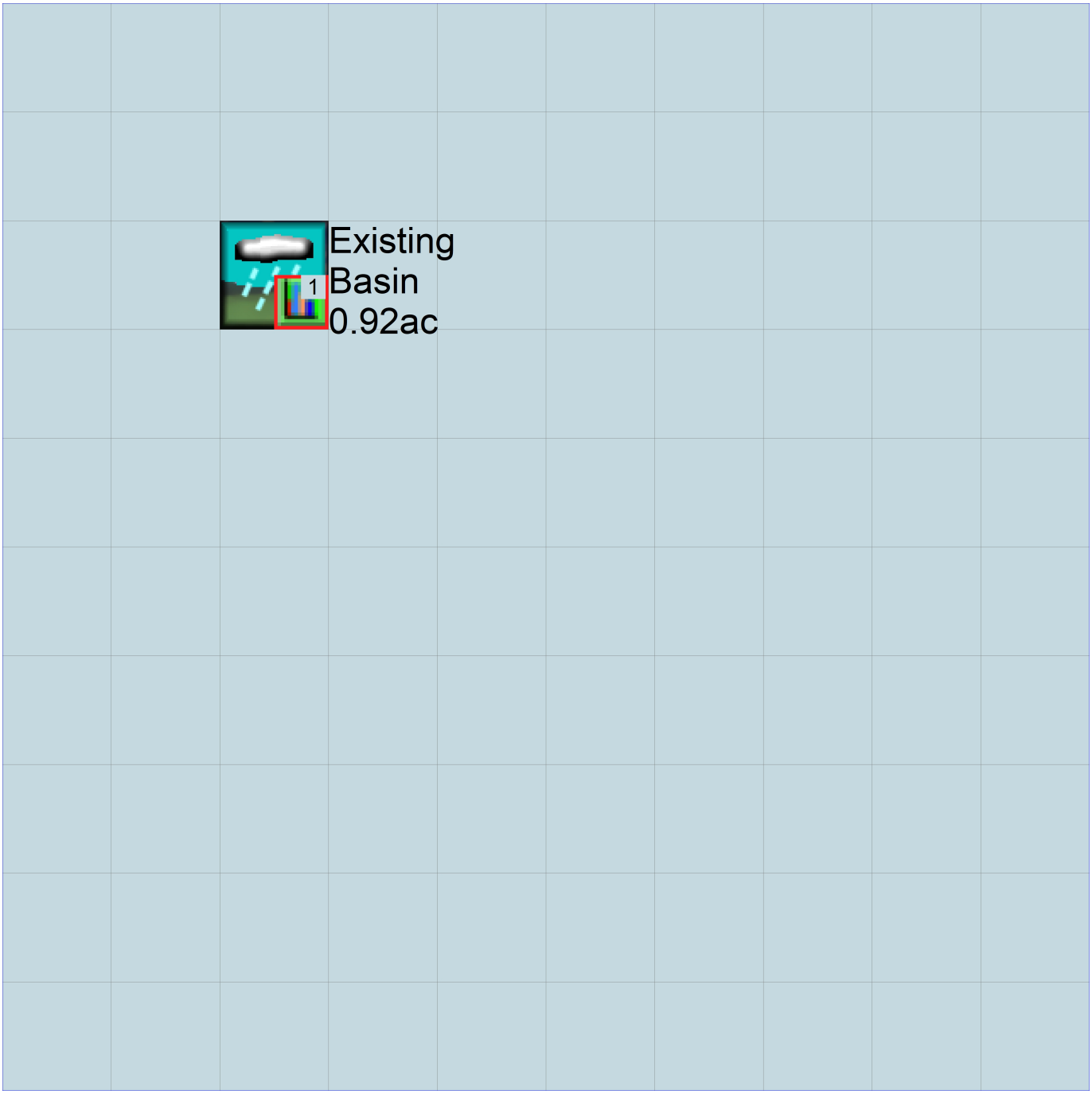
PERLND Changes

No PERLND changes have been made.

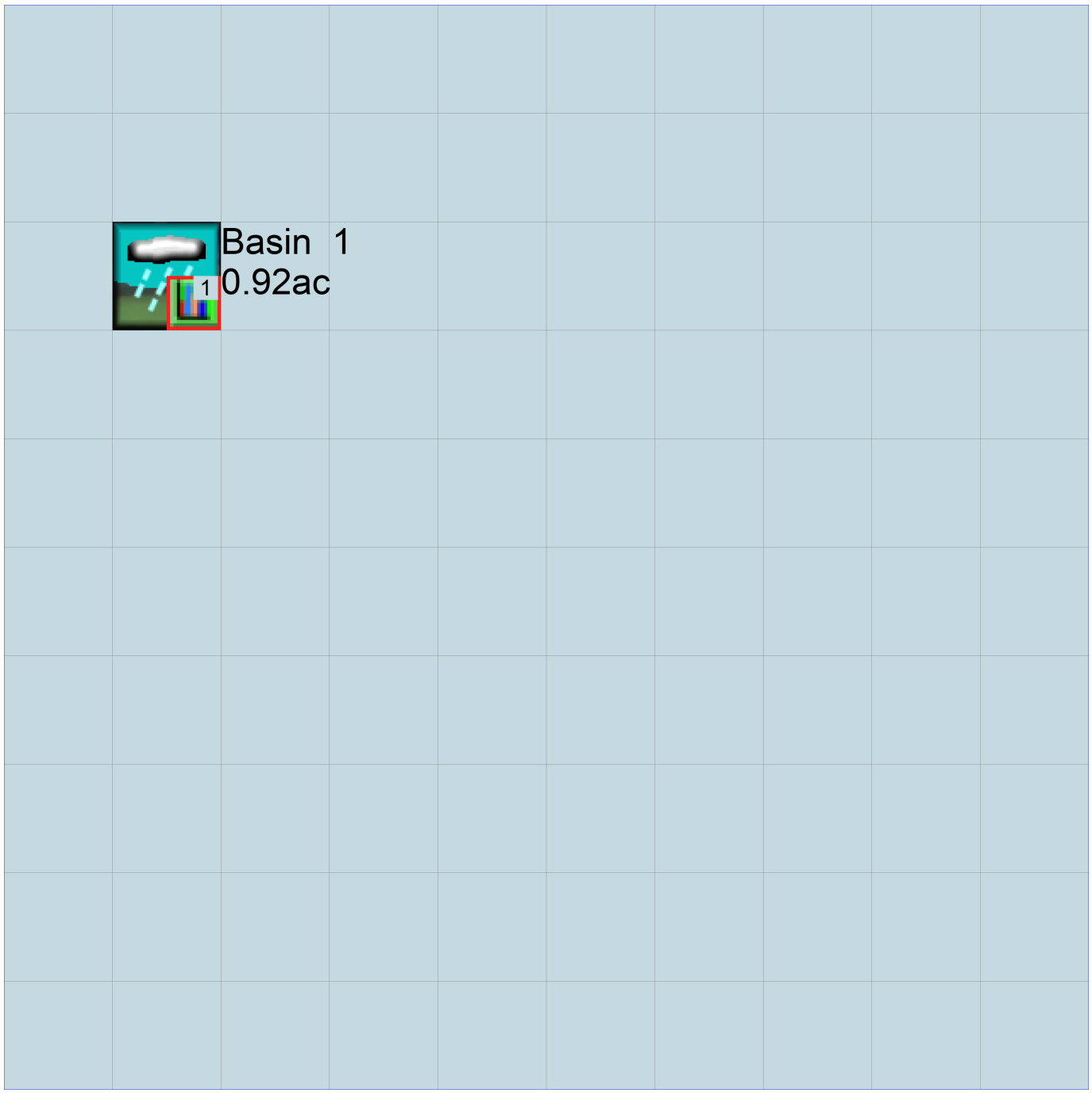
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   RC C1360 Puyallup WA - Water Quality.wdm
MESSU       25   PreRC C1360 Puyallup WA - Water Quality.MES
            27   PreRC C1360 Puyallup WA - Water Quality.L61
            28   PreRC C1360 Puyallup WA - Water Quality.L62
            30   POCRC C1360 Puyallup WA - Water Quality1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Existing Basin              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
  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
  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
  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
  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
  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
  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
  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
  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#   ***
Existing Basin***
PERLND   1                       0.92     COPY   501     12
PERLND   1                       0.92     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   RC C1360 Puyallup WA - Water Quality.wdm
MESSU       25   MitRC C1360 Puyallup WA - Water Quality.MES
            27   MitRC C1360 Puyallup WA - Water Quality.L61
            28   MitRC C1360 Puyallup WA - Water Quality.L62
            30   POCRC C1360 Puyallup WA - Water Quality1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      IMPLND       4
      IMPLND      11
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
    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           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
   11      PARKING/FLAT           1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
   11         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    4    1    9
   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     ***
    4         0    0    0    0    0
   11         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
   11            400      0.01       0.1       0.1
```

```
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
   11              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
   11              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   7                       0.22     COPY   501     12
PERLND   7                       0.22     COPY   501     13
IMPLND   4                       0.08     COPY   501     15
IMPLND  11                       0.62     COPY   501     15

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

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



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

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

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

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

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

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

```
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                        ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

END EXT SOURCES

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

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

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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Appendix B-2: Flow Control Modeling Output

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: RC C1360 Puyallup WA - Flow Control

Site Name:	RC C1360 Puyallup WA
Site Address:	Meridian and 43rd
City:	Puyallup
Report Date:	3/9/2026
Gage:	38 IN CENTRAL
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2024/06/28
Version:	4.3.1

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

Existing Basin

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	0.92
Pervious Total	0.92

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.92

Element Flow Componants:

Surface	Interflow	Groundwater

Componant Flows To:

POC 1	POC 1	

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.22
Pervious Total	0.22

Impervious Land Use	acre
ROOF TOPS FLAT	0.08
PARKING FLAT	0.62
Impervious Total	0.7
Basin Total	0.92

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
Gravel Trench Bed 1	Gravel Trench Bed 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	70.50 ft.
Bottom Width:	33.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	2
Pour Space of material for first layer:	0.4
Material thickness of second layer:	2
Pour Space of material for second layer:	0.5533
Material thickness of third layer:	2
Pour Space of material for third layer:	0.4
Infiltration On	
Infiltration rate:	1.3
Infiltration safety factor:	1
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	281.878
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	281.878
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	5 ft.
Riser Diameter:	18 in.
Element Outlets:	
Outlet 1	Outlet 2
Outlet Flows To:	

Gravel Trench Bed Hydraulic Table

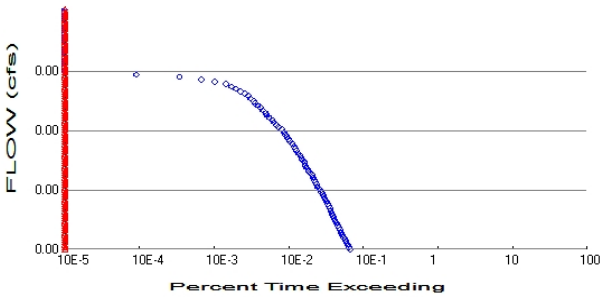
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.053	0.000	0.000	0.000
0.0667	0.053	0.001	0.000	0.070
0.1333	0.053	0.002	0.000	0.070
0.2000	0.053	0.004	0.000	0.070
0.2667	0.053	0.005	0.000	0.070
0.3333	0.053	0.007	0.000	0.070
0.4000	0.053	0.008	0.000	0.070
0.4667	0.053	0.010	0.000	0.070
0.5333	0.053	0.011	0.000	0.070
0.6000	0.053	0.012	0.000	0.070
0.6667	0.053	0.014	0.000	0.070
0.7333	0.053	0.015	0.000	0.070
0.8000	0.053	0.017	0.000	0.070
0.8667	0.053	0.018	0.000	0.070
0.9333	0.053	0.019	0.000	0.070
1.0000	0.053	0.021	0.000	0.070
1.0667	0.053	0.022	0.000	0.070
1.1333	0.053	0.024	0.000	0.070
1.2000	0.053	0.025	0.000	0.070
1.2667	0.053	0.027	0.000	0.070
1.3333	0.053	0.028	0.000	0.070
1.4000	0.053	0.029	0.000	0.070

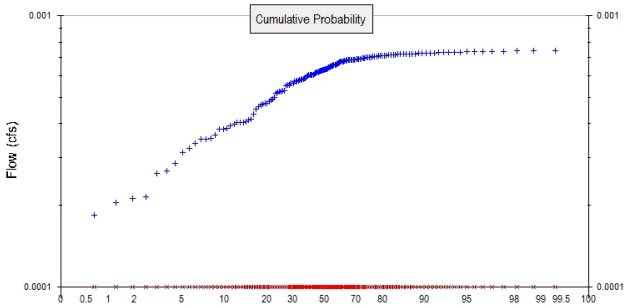
1.4667	0.053	0.031	0.000	0.070
1.5333	0.053	0.032	0.000	0.070
1.6000	0.053	0.034	0.000	0.070
1.6667	0.053	0.035	0.000	0.070
1.7333	0.053	0.037	0.000	0.070
1.8000	0.053	0.038	0.000	0.070
1.8667	0.053	0.039	0.000	0.070
1.9333	0.053	0.041	0.000	0.070
2.0000	0.053	0.042	0.000	0.070
2.0667	0.053	0.044	0.000	0.070
2.1333	0.053	0.046	0.000	0.070
2.2000	0.053	0.048	0.000	0.070
2.2667	0.053	0.050	0.000	0.070
2.3333	0.053	0.052	0.000	0.070
2.4000	0.053	0.054	0.000	0.070
2.4667	0.053	0.056	0.000	0.070
2.5333	0.053	0.058	0.000	0.070
2.6000	0.053	0.060	0.000	0.070
2.6667	0.053	0.062	0.000	0.070
2.7333	0.053	0.064	0.000	0.070
2.8000	0.053	0.066	0.000	0.070
2.8667	0.053	0.068	0.000	0.070
2.9333	0.053	0.070	0.000	0.070
3.0000	0.053	0.072	0.000	0.070
3.0667	0.053	0.074	0.000	0.070
3.1333	0.053	0.076	0.000	0.070
3.2000	0.053	0.078	0.000	0.070
3.2667	0.053	0.080	0.000	0.070
3.3333	0.053	0.082	0.000	0.070
3.4000	0.053	0.084	0.000	0.070
3.4667	0.053	0.086	0.000	0.070
3.5333	0.053	0.088	0.000	0.070
3.6000	0.053	0.090	0.000	0.070
3.6667	0.053	0.092	0.000	0.070
3.7333	0.053	0.093	0.000	0.070
3.8000	0.053	0.095	0.000	0.070
3.8667	0.053	0.097	0.000	0.070
3.9333	0.053	0.099	0.000	0.070
4.0000	0.053	0.101	0.000	0.070
4.0667	0.053	0.102	0.000	0.070
4.1333	0.053	0.104	0.000	0.070
4.2000	0.053	0.105	0.000	0.070
4.2667	0.053	0.107	0.000	0.070
4.3333	0.053	0.108	0.000	0.070
4.4000	0.053	0.109	0.000	0.070
4.4667	0.053	0.111	0.000	0.070
4.5333	0.053	0.112	0.000	0.070
4.6000	0.053	0.114	0.000	0.070
4.6667	0.053	0.115	0.000	0.070
4.7333	0.053	0.117	0.000	0.070
4.8000	0.053	0.118	0.000	0.070
4.8667	0.053	0.119	0.000	0.070
4.9333	0.053	0.121	0.000	0.070
5.0000	0.053	0.122	0.000	0.070
5.0667	0.053	0.124	0.273	0.070
5.1333	0.053	0.125	0.771	0.070
5.2000	0.053	0.126	1.404	0.070
5.2667	0.053	0.128	2.123	0.070

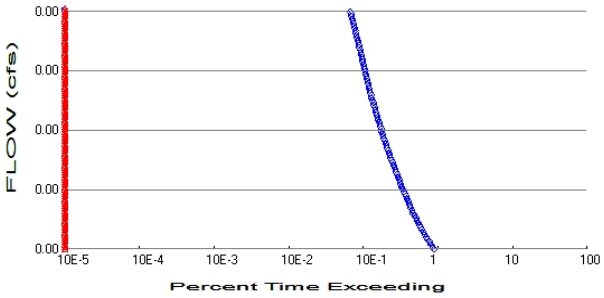
5.3333	0.053	0.129	2.882	0.070
5.4000	0.053	0.131	3.632	0.070
5.4667	0.053	0.132	4.326	0.070
5.5333	0.053	0.134	4.924	0.070
5.6000	0.053	0.135	5.401	0.070
5.6667	0.053	0.136	5.754	0.070
5.7333	0.053	0.138	6.014	0.070
5.8000	0.053	0.139	6.338	0.070
5.8667	0.053	0.141	6.597	0.070
5.9333	0.053	0.142	6.846	0.070
6.0000	0.053	0.144	7.086	0.070

Analysis Results

POC 1







\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.92
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.22
Total Impervious Area: 0.7

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.000599
5 year	0.000739
10 year	0.000804
25 year	0.000864
50 year	0.000898
100 year	0.000925

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	0.001	0.000
1903	0.000	0.000
1904	0.001	0.000
1905	0.001	0.000
1906	0.000	0.000
1907	0.001	0.000
1908	0.001	0.000
1909	0.001	0.000
1910	0.001	0.000
1911	0.001	0.000
1912	0.001	0.000
1913	0.001	0.000
1914	0.001	0.000
1915	0.001	0.000
1916	0.001	0.000
1917	0.000	0.000
1918	0.001	0.000
1919	0.000	0.000
1920	0.001	0.000
1921	0.001	0.000
1922	0.001	0.000
1923	0.001	0.000
1924	0.000	0.000
1925	0.000	0.000
1926	0.001	0.000
1927	0.000	0.000
1928	0.001	0.000
1929	0.001	0.000
1930	0.001	0.000
1931	0.001	0.000
1932	0.001	0.000
1933	0.001	0.000
1934	0.001	0.000
1935	0.000	0.000
1936	0.001	0.000
1937	0.001	0.000
1938	0.001	0.000
1939	0.000	0.000
1940	0.001	0.000
1941	0.001	0.000
1942	0.000	0.000
1943	0.000	0.000
1944	0.001	0.000
1945	0.001	0.000
1946	0.001	0.000
1947	0.000	0.000
1948	0.001	0.000
1949	0.001	0.000
1950	0.000	0.000
1951	0.001	0.000
1952	0.001	0.000
1953	0.001	0.000
1954	0.001	0.000
1955	0.000	0.000
1956	0.000	0.000
1957	0.001	0.000

1958	0.001	0.000
1959	0.001	0.000
1960	0.001	0.000
1961	0.001	0.000
1962	0.001	0.000
1963	0.000	0.000
1964	0.000	0.000
1965	0.001	0.000
1966	0.001	0.000
1967	0.001	0.000
1968	0.001	0.000
1969	0.001	0.000
1970	0.001	0.000
1971	0.001	0.000
1972	0.001	0.000
1973	0.001	0.000
1974	0.001	0.000
1975	0.001	0.000
1976	0.001	0.000
1977	0.001	0.000
1978	0.001	0.000
1979	0.001	0.000
1980	0.001	0.000
1981	0.001	0.000
1982	0.000	0.000
1983	0.001	0.000
1984	0.001	0.000
1985	0.001	0.000
1986	0.001	0.000
1987	0.001	0.000
1988	0.000	0.000
1989	0.001	0.000
1990	0.001	0.000
1991	0.001	0.000
1992	0.001	0.000
1993	0.001	0.000
1994	0.001	0.000
1995	0.001	0.000
1996	0.001	0.000
1997	0.001	0.000
1998	0.001	0.000
1999	0.001	0.000
2000	0.001	0.000
2001	0.000	0.000
2002	0.001	0.000
2003	0.000	0.000
2004	0.001	0.000
2005	0.001	0.000
2006	0.001	0.000
2007	0.001	0.000
2008	0.001	0.000
2009	0.000	0.000
2010	0.000	0.000
2011	0.000	0.000
2012	0.001	0.000
2013	0.001	0.000
2014	0.001	0.000
2015	0.001	0.000

2016	0.000	0.000
2017	0.001	0.000
2018	0.001	0.000
2019	0.001	0.000
2020	0.001	0.000
2021	0.001	0.000
2022	0.000	0.000
2023	0.000	0.000
2024	0.001	0.000
2025	0.000	0.000
2026	0.001	0.000
2027	0.001	0.000
2028	0.000	0.000
2029	0.001	0.000
2030	0.001	0.000
2031	0.000	0.000
2032	0.000	0.000
2033	0.000	0.000
2034	0.001	0.000
2035	0.001	0.000
2036	0.000	0.000
2037	0.001	0.000
2038	0.001	0.000
2039	0.000	0.000
2040	0.001	0.000
2041	0.001	0.000
2042	0.001	0.000
2043	0.001	0.000
2044	0.001	0.000
2045	0.001	0.000
2046	0.001	0.000
2047	0.001	0.000
2048	0.001	0.000
2049	0.000	0.000
2050	0.001	0.000
2051	0.001	0.000
2052	0.001	0.000
2053	0.001	0.000
2054	0.001	0.000
2055	0.001	0.000
2056	0.000	0.000
2057	0.001	0.000
2058	0.001	0.000
2059	0.001	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0007	0.0000
2	0.0007	0.0000
3	0.0007	0.0000
4	0.0007	0.0000
5	0.0007	0.0000
6	0.0007	0.0000
7	0.0007	0.0000
8	0.0007	0.0000
9	0.0007	0.0000
10	0.0007	0.0000

11	0.0007	0.0000
12	0.0007	0.0000
13	0.0007	0.0000
14	0.0007	0.0000
15	0.0007	0.0000
16	0.0007	0.0000
17	0.0007	0.0000
18	0.0007	0.0000
19	0.0007	0.0000
20	0.0007	0.0000
21	0.0007	0.0000
22	0.0007	0.0000
23	0.0007	0.0000
24	0.0007	0.0000
25	0.0007	0.0000
26	0.0007	0.0000
27	0.0007	0.0000
28	0.0007	0.0000
29	0.0007	0.0000
30	0.0007	0.0000
31	0.0007	0.0000
32	0.0007	0.0000
33	0.0007	0.0000
34	0.0007	0.0000
35	0.0007	0.0000
36	0.0007	0.0000
37	0.0007	0.0000
38	0.0007	0.0000
39	0.0007	0.0000
40	0.0007	0.0000
41	0.0007	0.0000
42	0.0007	0.0000
43	0.0007	0.0000
44	0.0007	0.0000
45	0.0007	0.0000
46	0.0007	0.0000
47	0.0007	0.0000
48	0.0007	0.0000
49	0.0007	0.0000
50	0.0007	0.0000
51	0.0007	0.0000
52	0.0007	0.0000
53	0.0007	0.0000
54	0.0007	0.0000
55	0.0007	0.0000
56	0.0007	0.0000
57	0.0007	0.0000
58	0.0007	0.0000
59	0.0007	0.0000
60	0.0007	0.0000
61	0.0007	0.0000
62	0.0007	0.0000
63	0.0007	0.0000
64	0.0007	0.0000
65	0.0007	0.0000
66	0.0007	0.0000
67	0.0007	0.0000
68	0.0007	0.0000

69	0.0007	0.0000
70	0.0007	0.0000
71	0.0007	0.0000
72	0.0006	0.0000
73	0.0006	0.0000
74	0.0006	0.0000
75	0.0006	0.0000
76	0.0006	0.0000
77	0.0006	0.0000
78	0.0006	0.0000
79	0.0006	0.0000
80	0.0006	0.0000
81	0.0006	0.0000
82	0.0006	0.0000
83	0.0006	0.0000
84	0.0006	0.0000
85	0.0006	0.0000
86	0.0006	0.0000
87	0.0006	0.0000
88	0.0006	0.0000
89	0.0006	0.0000
90	0.0006	0.0000
91	0.0006	0.0000
92	0.0006	0.0000
93	0.0006	0.0000
94	0.0006	0.0000
95	0.0006	0.0000
96	0.0006	0.0000
97	0.0006	0.0000
98	0.0006	0.0000
99	0.0006	0.0000
100	0.0006	0.0000
101	0.0006	0.0000
102	0.0006	0.0000
103	0.0006	0.0000
104	0.0006	0.0000
105	0.0006	0.0000
106	0.0006	0.0000
107	0.0006	0.0000
108	0.0006	0.0000
109	0.0006	0.0000
110	0.0006	0.0000
111	0.0006	0.0000
112	0.0006	0.0000
113	0.0006	0.0000
114	0.0006	0.0000
115	0.0006	0.0000
116	0.0005	0.0000
117	0.0005	0.0000
118	0.0005	0.0000
119	0.0005	0.0000
120	0.0005	0.0000
121	0.0005	0.0000
122	0.0005	0.0000
123	0.0005	0.0000
124	0.0005	0.0000
125	0.0005	0.0000
126	0.0005	0.0000

127	0.0005	0.0000
128	0.0005	0.0000
129	0.0005	0.0000
130	0.0005	0.0000
131	0.0005	0.0000
132	0.0004	0.0000
133	0.0004	0.0000
134	0.0004	0.0000
135	0.0004	0.0000
136	0.0004	0.0000
137	0.0004	0.0000
138	0.0004	0.0000
139	0.0004	0.0000
140	0.0004	0.0000
141	0.0004	0.0000
142	0.0004	0.0000
143	0.0004	0.0000
144	0.0004	0.0000
145	0.0004	0.0000
146	0.0003	0.0000
147	0.0003	0.0000
148	0.0003	0.0000
149	0.0003	0.0000
150	0.0003	0.0000
151	0.0003	0.0000
152	0.0003	0.0000
153	0.0003	0.0000
154	0.0002	0.0000
155	0.0002	0.0000
156	0.0002	0.0000
157	0.0002	0.0000
158	0.0002	0.0000

LID Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0000	49451	0	0	Pass
0.0001	46791	0	0	Pass
0.0001	44082	0	0	Pass
0.0001	42337	0	0	Pass
0.0001	40071	0	0	Pass
0.0001	38647	0	0	Pass
0.0001	36731	0	0	Pass
0.0001	35517	0	0	Pass
0.0001	33728	0	0	Pass
0.0001	32620	0	0	Pass
0.0001	31224	0	0	Pass
0.0001	30299	0	0	Pass
0.0001	28880	0	0	Pass
0.0001	28066	0	0	Pass
0.0001	26808	0	0	Pass
0.0001	25728	0	0	Pass
0.0001	25008	0	0	Pass
0.0001	23955	0	0	Pass
0.0001	23362	0	0	Pass
0.0001	22520	0	0	Pass
0.0001	21989	0	0	Pass
0.0001	21202	0	0	Pass
0.0001	20626	0	0	Pass
0.0001	19789	0	0	Pass
0.0001	19329	0	0	Pass
0.0001	18670	0	0	Pass
0.0001	18221	0	0	Pass
0.0001	17579	0	0	Pass
0.0001	17041	0	0	Pass
0.0001	16676	0	0	Pass
0.0001	16111	0	0	Pass
0.0001	15712	0	0	Pass
0.0001	15152	0	0	Pass
0.0001	14870	0	0	Pass
0.0001	14399	0	0	Pass
0.0001	14160	0	0	Pass
0.0001	13689	0	0	Pass
0.0001	13340	0	0	Pass
0.0001	12908	0	0	Pass
0.0001	12504	0	0	Pass
0.0001	12249	0	0	Pass
0.0002	11845	0	0	Pass
0.0002	11623	0	0	Pass
0.0002	11296	0	0	Pass
0.0002	11030	0	0	Pass
0.0002	10726	0	0	Pass
0.0002	10465	0	0	Pass
0.0002	10183	0	0	Pass
0.0002	10016	0	0	Pass
0.0002	9756	0	0	Pass
0.0002	9590	0	0	Pass
0.0002	9363	0	0	Pass
0.0002	9158	0	0	Pass

0.0002	9003	0	0	Pass
0.0002	8720	0	0	Pass
0.0002	8543	0	0	Pass
0.0002	8310	0	0	Pass
0.0002	8166	0	0	Pass
0.0002	7972	0	0	Pass
0.0002	7845	0	0	Pass
0.0002	7667	0	0	Pass
0.0002	7540	0	0	Pass
0.0002	7352	0	0	Pass
0.0002	7169	0	0	Pass
0.0002	7064	0	0	Pass
0.0002	6881	0	0	Pass
0.0002	6753	0	0	Pass
0.0002	6626	0	0	Pass
0.0002	6537	0	0	Pass
0.0002	6382	0	0	Pass
0.0002	6305	0	0	Pass
0.0002	6194	0	0	Pass
0.0002	6100	0	0	Pass
0.0002	5950	0	0	Pass
0.0002	5884	0	0	Pass
0.0002	5756	0	0	Pass
0.0002	5645	0	0	Pass
0.0002	5573	0	0	Pass
0.0002	5439	0	0	Pass
0.0002	5384	0	0	Pass
0.0003	5274	0	0	Pass
0.0003	5209	0	0	Pass
0.0003	5084	0	0	Pass
0.0003	5022	0	0	Pass
0.0003	4903	0	0	Pass
0.0003	4831	0	0	Pass
0.0003	4750	0	0	Pass
0.0003	4640	0	0	Pass
0.0003	4560	0	0	Pass
0.0003	4465	0	0	Pass
0.0003	4400	0	0	Pass
0.0003	4326	0	0	Pass
0.0003	4263	0	0	Pass
0.0003	4171	0	0	Pass
0.0003	4107	0	0	Pass
0.0003	4022	0	0	Pass
0.0003	3942	0	0	Pass
0.0003	3843	0	0	Pass
0.0003	3806	0	0	Pass
0.0003	3723	0	0	Pass

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0003	3723	0	0	Pass
0.0003	3558	0	0	Pass
0.0003	3407	0	0	Pass
0.0003	3264	0	0	Pass
0.0003	3144	0	0	Pass
0.0003	3021	0	0	Pass
0.0003	2904	0	0	Pass
0.0003	2792	0	0	Pass
0.0003	2692	0	0	Pass
0.0004	2607	0	0	Pass
0.0004	2501	0	0	Pass
0.0004	2413	0	0	Pass
0.0004	2317	0	0	Pass
0.0004	2230	0	0	Pass
0.0004	2156	0	0	Pass
0.0004	2080	0	0	Pass
0.0004	2023	0	0	Pass
0.0004	1956	0	0	Pass
0.0004	1893	0	0	Pass
0.0004	1831	0	0	Pass
0.0004	1765	0	0	Pass
0.0004	1700	0	0	Pass
0.0004	1638	0	0	Pass
0.0004	1586	0	0	Pass
0.0004	1504	0	0	Pass
0.0005	1453	0	0	Pass
0.0005	1361	0	0	Pass
0.0005	1308	0	0	Pass
0.0005	1259	0	0	Pass
0.0005	1213	0	0	Pass
0.0005	1169	0	0	Pass
0.0005	1127	0	0	Pass
0.0005	1064	0	0	Pass
0.0005	1009	0	0	Pass
0.0005	963	0	0	Pass
0.0005	922	0	0	Pass
0.0005	905	0	0	Pass
0.0005	866	0	0	Pass
0.0005	815	0	0	Pass
0.0005	792	0	0	Pass
0.0005	752	0	0	Pass
0.0005	701	0	0	Pass
0.0006	679	0	0	Pass
0.0006	653	0	0	Pass
0.0006	622	0	0	Pass
0.0006	570	0	0	Pass
0.0006	549	0	0	Pass
0.0006	523	0	0	Pass
0.0006	501	0	0	Pass
0.0006	475	0	0	Pass
0.0006	443	0	0	Pass
0.0006	401	0	0	Pass
0.0006	379	0	0	Pass

0.0006	354	0	0	Pass
0.0006	333	0	0	Pass
0.0006	302	0	0	Pass
0.0006	281	0	0	Pass
0.0006	270	0	0	Pass
0.0007	247	0	0	Pass
0.0007	231	0	0	Pass
0.0007	214	0	0	Pass
0.0007	197	0	0	Pass
0.0007	187	0	0	Pass
0.0007	172	0	0	Pass
0.0007	158	0	0	Pass
0.0007	143	0	0	Pass
0.0007	124	0	0	Pass
0.0007	109	0	0	Pass
0.0007	94	0	0	Pass
0.0007	80	0	0	Pass
0.0007	57	0	0	Pass
0.0007	37	0	0	Pass
0.0007	19	0	0	Pass
0.0007	5	0	0	Pass
0.0007	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
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0.0008	0	0	0	Pass
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0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0008	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass
0.0009	0	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Gravel Trench Bed 1 POC	☐	256.51			☐	100.00			
Total Volume Infiltrated		256.51	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

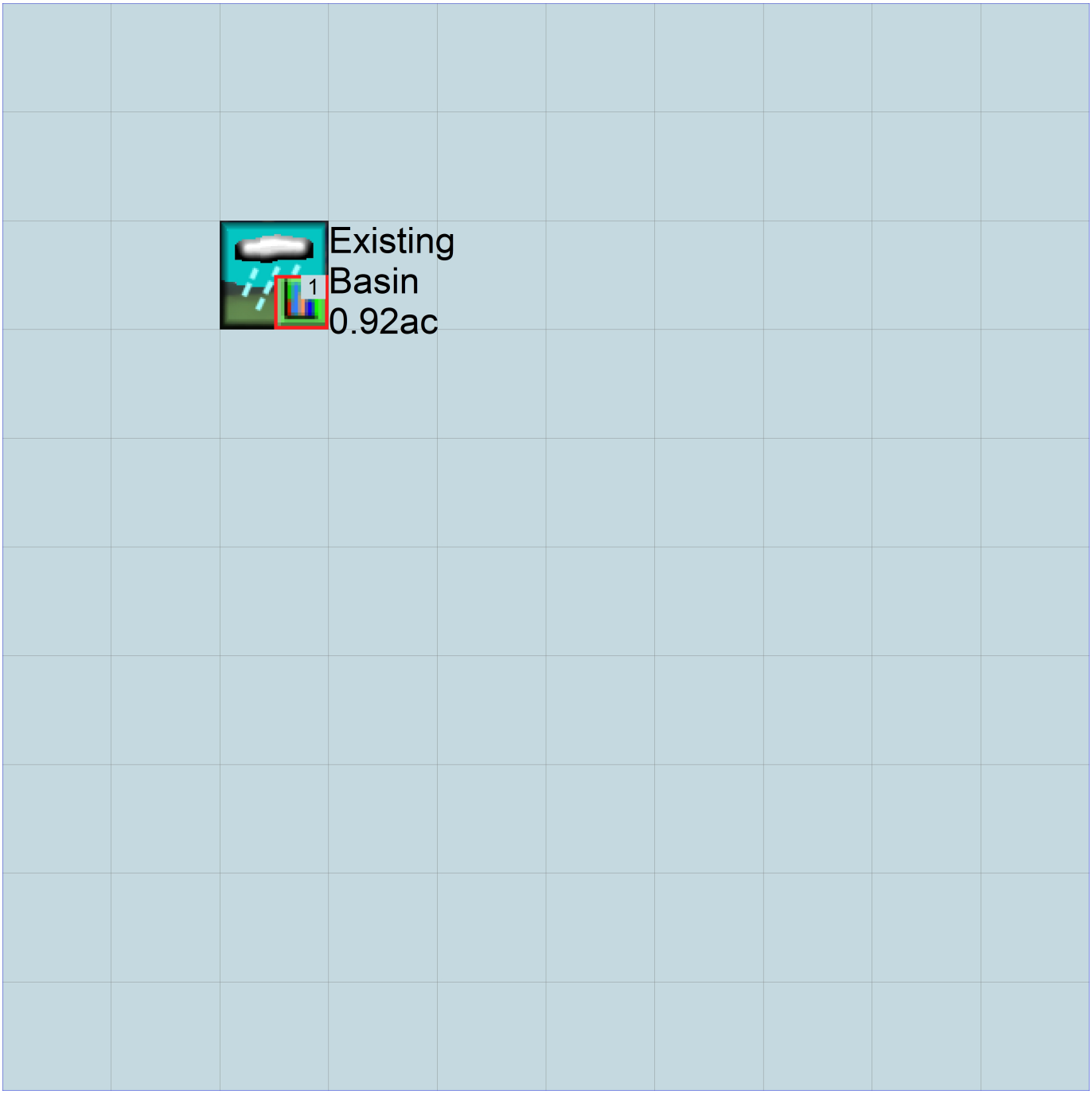
PERLND Changes

No PERLND changes have been made.

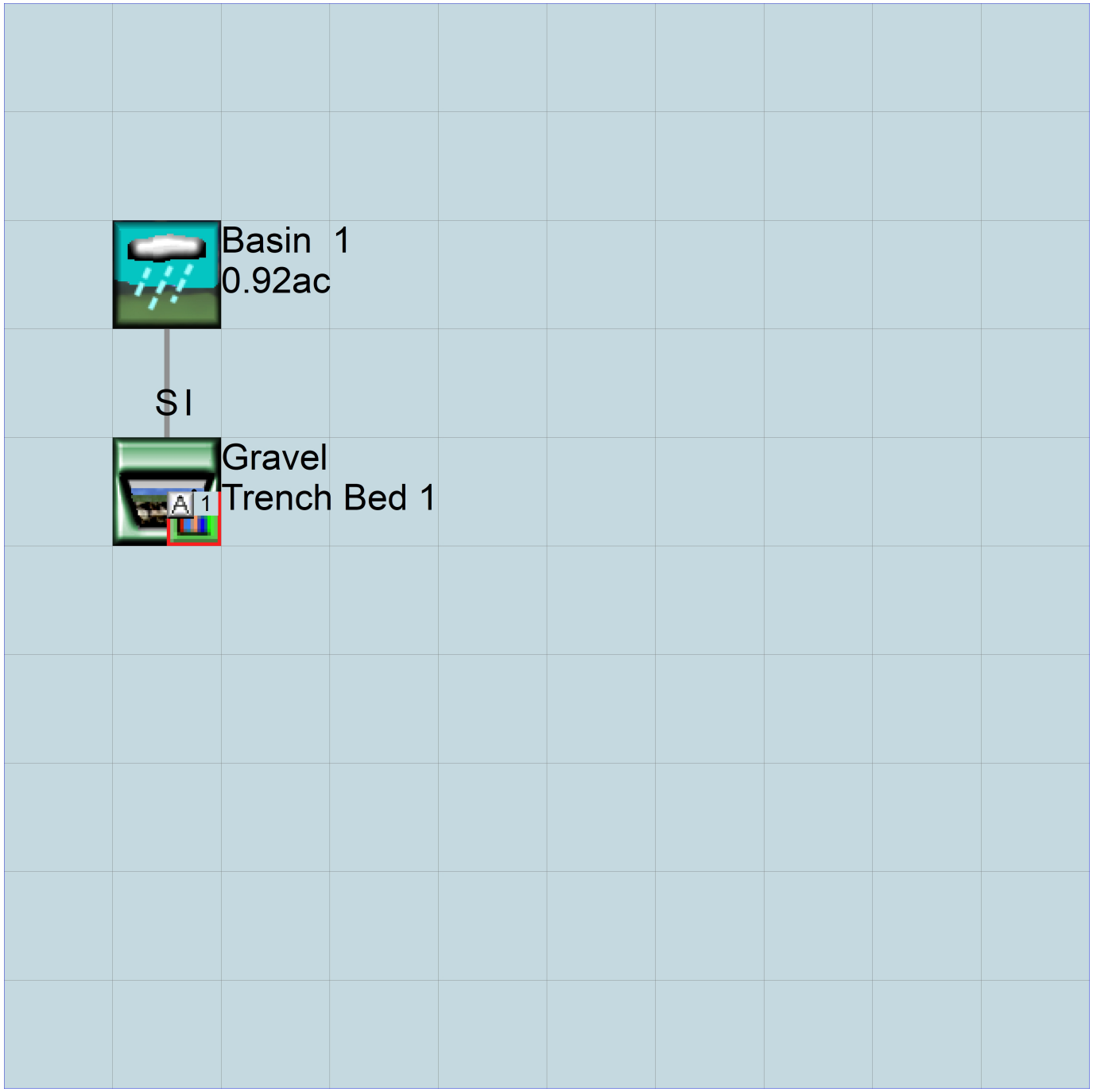
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   RC C1360 Puyallup WA - Flow Control.wdm
MESSU       25   PreRC C1360 Puyallup WA - Flow Control.MES
            27   PreRC C1360 Puyallup WA - Flow Control.L61
            28   PreRC C1360 Puyallup WA - Flow Control.L62
            30   POCRC C1360 Puyallup WA - Flow Control1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Existing Basin              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
  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
  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
  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
  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
  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
  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
  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
  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#   ***
Existing Basin***
PERLND   1                          0.92     COPY   501     12
PERLND   1                          0.92     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   RC C1360 Puyallup WA - Flow Control.wdm
MESSU       25   MitRC C1360 Puyallup WA - Flow Control.MES
            27   MitRC C1360 Puyallup WA - Flow Control.L61
            28   MitRC C1360 Puyallup WA - Flow Control.L62
            30   POCRC C1360 Puyallup WA - Flow Control1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      IMPLND       4
      IMPLND      11
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Gravel Trench Bed 1         MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
    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           ***
    4      ROOF TOPS/FLAT         1    1    1   27    0
   11      PARKING/FLAT           1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
   11         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    4    1    9
   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     ***
    4         0    0    0    0    0
   11         0    0    0    0    0
  END IWAT-PARM1

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

```
    4            400      0.01       0.1       0.1
   11            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
   11              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
   11              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND   7                        0.22     RCHRES   1      2
PERLND   7                        0.22     RCHRES   1      3
IMPLND   4                        0.08     RCHRES   1      5
IMPLND  11                        0.62     RCHRES   1      5

******Routing******
PERLND   7                        0.22     COPY     1     12
IMPLND   4                        0.08     COPY     1     15
IMPLND  11                        0.62     COPY     1     15
PERLND   7                        0.22     COPY     1     13
RCHRES   1                           1     COPY   501     17
END SCHEMATIC

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



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
    1     Gravel Trench Be-009    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

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

  HYDR-PARM1
```

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)     (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.053409  0.000000  0.000000  0.000000
  0.066667  0.053409  0.001424  0.000000  0.070010
  0.133333  0.053409  0.002848  0.000000  0.070010
  0.200000  0.053409  0.004273  0.000000  0.070010
  0.266667  0.053409  0.005697  0.000000  0.070010
  0.333333  0.053409  0.007121  0.000000  0.070010
  0.400000  0.053409  0.008545  0.000000  0.070010
  0.466667  0.053409  0.009970  0.000000  0.070010
  0.533333  0.053409  0.011394  0.000000  0.070010
  0.600000  0.053409  0.012818  0.000000  0.070010
  0.666667  0.053409  0.014242  0.000000  0.070010
  0.733333  0.053409  0.015667  0.000000  0.070010
  0.800000  0.053409  0.017091  0.000000  0.070010
  0.866667  0.053409  0.018515  0.000000  0.070010
  0.933333  0.053409  0.019939  0.000000  0.070010
  1.000000  0.053409  0.021364  0.000000  0.070010
  1.066667  0.053409  0.022788  0.000000  0.070010
  1.133333  0.053409  0.024212  0.000000  0.070010
  1.200000  0.053409  0.025636  0.000000  0.070010
  1.266667  0.053409  0.027061  0.000000  0.070010
  1.333333  0.053409  0.028485  0.000000  0.070010
  1.400000  0.053409  0.029909  0.000000  0.070010
  1.466667  0.053409  0.031333  0.000000  0.070010
  1.533333  0.053409  0.032758  0.000000  0.070010
  1.600000  0.053409  0.034182  0.000000  0.070010
  1.666667  0.053409  0.035606  0.000000  0.070010
  1.733333  0.053409  0.037030  0.000000  0.070010
  1.800000  0.053409  0.038455  0.000000  0.070010
  1.866667  0.053409  0.039879  0.000000  0.070010
  1.933333  0.053409  0.041303  0.000000  0.070010
  2.000000  0.053409  0.042727  0.000000  0.070010
  2.066667  0.053409  0.044697  0.000000  0.070010
  2.133333  0.053409  0.046667  0.000000  0.070010
  2.200000  0.053409  0.048638  0.000000  0.070010
  2.266667  0.053409  0.050608  0.000000  0.070010
  2.333333  0.053409  0.052578  0.000000  0.070010
  2.400000  0.053409  0.054548  0.000000  0.070010
  2.466667  0.053409  0.056518  0.000000  0.070010
  2.533333  0.053409  0.058488  0.000000  0.070010
  2.600000  0.053409  0.060458  0.000000  0.070010
  2.666667  0.053409  0.062428  0.000000  0.070010
  2.733333  0.053409  0.064398  0.000000  0.070010
```

```
  2.800000  0.053409  0.066368  0.000000  0.070010
  2.866667  0.053409  0.068338  0.000000  0.070010
  2.933333  0.053409  0.070308  0.000000  0.070010
  3.000000  0.053409  0.072279  0.000000  0.070010
  3.066667  0.053409  0.074249  0.000000  0.070010
  3.133333  0.053409  0.076219  0.000000  0.070010
  3.200000  0.053409  0.078189  0.000000  0.070010
  3.266667  0.053409  0.080159  0.000000  0.070010
  3.333333  0.053409  0.082129  0.000000  0.070010
  3.400000  0.053409  0.084099  0.000000  0.070010
  3.466667  0.053409  0.086069  0.000000  0.070010
  3.533333  0.053409  0.088039  0.000000  0.070010
  3.600000  0.053409  0.090009  0.000000  0.070010
  3.666667  0.053409  0.091979  0.000000  0.070010
  3.733333  0.053409  0.093949  0.000000  0.070010
  3.800000  0.053409  0.095920  0.000000  0.070010
  3.866667  0.053409  0.097890  0.000000  0.070010
  3.933333  0.053409  0.099860  0.000000  0.070010
  4.000000  0.053409  0.101284  0.000000  0.070010
  4.066667  0.053409  0.102708  0.000000  0.070010
  4.133333  0.053409  0.104132  0.000000  0.070010
  4.200000  0.053409  0.105557  0.000000  0.070010
  4.266667  0.053409  0.106981  0.000000  0.070010
  4.333333  0.053409  0.108405  0.000000  0.070010
  4.400000  0.053409  0.109829  0.000000  0.070010
  4.466667  0.053409  0.111254  0.000000  0.070010
  4.533333  0.053409  0.112678  0.000000  0.070010
  4.600000  0.053409  0.114102  0.000000  0.070010
  4.666667  0.053409  0.115526  0.000000  0.070010
  4.733333  0.053409  0.116951  0.000000  0.070010
  4.800000  0.053409  0.118375  0.000000  0.070010
  4.866667  0.053409  0.119799  0.000000  0.070010
  4.933333  0.053409  0.121223  0.000000  0.070010
  5.000000  0.053409  0.122648  0.000000  0.070010
  5.066667  0.053409  0.124072  0.273695  0.070010
  5.133333  0.053409  0.125496  0.771465  0.070010
  5.200000  0.053409  0.126920  1.404464  0.070010
  5.266667  0.053409  0.128345  2.123824  0.070010
  5.333333  0.053409  0.129769  2.882519  0.070010
  5.400000  0.053409  0.131193  3.632201  0.070010
  5.466667  0.053409  0.132617  4.326027  0.070010
  5.533333  0.053409  0.134042  4.924197  0.070010
  5.600000  0.053409  0.135466  5.401220  0.070010
  5.666667  0.053409  0.136890  5.754494  0.070010
  5.733333  0.053409  0.138314  6.013989  0.070010
  5.800000  0.053409  0.139738  6.338508  0.070010
  5.866667  0.053409  0.141163  6.597328  0.070010
  5.933333  0.053409  0.142587  6.846371  0.070010
  6.000000  0.053409  0.144011  7.086668  0.070010
  6.066667  0.053409  0.147572  7.319079  0.070010
  END FTABLE  1
END FTABLES

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

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
```

```
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

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

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

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

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

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

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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Appendix B-3: Conveyance Calculations

Showing like this due to pipe at 0% slope

Confirmed HGL for both 25 and 100 Year is within pipe

25 Year

FlexTable: Conduit Table

Start Node	Stop Node	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Manning's n
29 (oSTRM)	O-2	9.0	0.005	12.0	1.76	3.69	2.73	64.4	0.012
WQ-01 (oSTRM)	29 (oSTRM)	4.5	0.110	12.0	1.76	11.44	12.83	13.7	0.012
1 (oSTRM)	WQ-01 (oSTRM)	4.5	0.000	12.0	1.76	2.24	0.04	4,556.3	0.012
TEE-01 (oSTRM)	1 (oSTRM)	5.0	0.005	12.0	1.76	3.69	2.73	64.4	0.012
MH-02 (oSTRM)	CO-04 (oSTRM)	22.4	0.009	6.0	0.26	2.88	0.58	44.8	0.012
CO-04 (oSTRM)	CB-04 (oSTRM)	11.6	0.009	6.0	0.26	2.88	0.58	44.8	0.012
CO-05 (oSTRM)	MH-02 (oSTRM)	8.8	0.103	4.0	0.06	4.63	0.66	8.6	0.012
TEE-03 (oSTRM)	MH-02 (oSTRM)	10.0	0.009	6.0	0.15	2.47	0.58	25.2	0.012
C0-03 (oSTRM)	MH-02 (oSTRM)	8.7	0.054	6.0	0.06	3.50	1.41	4.1	0.012
MH-4	C0-03 (oSTRM)	9.9	0.054	6.0	0.06	3.50	1.41	4.1	0.012
MH-1	CO-01 (oSTRM)	2.9	0.009	6.0	0.03	1.58	0.58	5.5	0.012
CO-01 (oSTRM)	CO-02 (oSTRM)	45.5	0.009	6.0	0.03	1.58	0.58	5.5	0.012
CB-03 (oSTRM)	CB-04 (oSTRM)	34.0	0.013	8.0	0.35	3.47	1.48	23.7	0.012
CB-04 (oSTRM)	WYE-03 (oSTRM)	30.4	0.013	12.0	1.11	4.64	4.36	25.5	0.012
CB-01 (oSTRM)	CB-02 (oSTRM)	38.5	0.005	12.0	0.34	2.37	2.73	12.6	0.012
CB-02 (oSTRM)	WYE-01 (oSTRM)	40.7	0.005	12.0	0.65	2.85	2.73	23.7	0.012
CO-02 (oSTRM)	TEE-02 (oSTRM)	35.1	0.009	6.0	0.03	1.58	0.58	5.5	0.012
MH-3	TEE-03 (oSTRM)	9.9	0.092	6.0	0.06	4.25	1.84	3.1	0.012
MH-2	TEE-02 (oSTRM)	9.9	0.077	6.0	0.06	3.99	1.69	3.4	0.012
TEE-02 (oSTRM)	TEE-03 (oSTRM)	16.4	0.009	6.0	0.09	2.14	0.58	15.3	0.012
WYE-03 (oSTRM)	TEE-01 (oSTRM)	41.0	0.013	12.0	1.11	4.64	4.36	25.5	0.012
WYE-01 (oSTRM)	WYE-02 (oSTRM)	14.1	0.005	12.0	0.65	2.85	2.73	23.7	0.012
WYE-02 (oSTRM)	TEE-01 (oSTRM)	69.3	0.005	12.0	0.65	2.85	2.73	23.7	0.012

Showing like this due to pipe at 0% slope

Confirmed HGL for both 25 and 100 Year is within pipe

100 Year

FlexTable: Conduit Table

Start Node	Stop Node	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Manning's n
29 (oSTRM)	O-2	9.0	0.005	12.0	2.01	3.80	2.73	73.6	0.012
WQ-01 (oSTRM)	29 (oSTRM)	4.5	0.110	12.0	2.01	11.89	12.83	15.7	0.012
1 (oSTRM)	WQ-01 (oSTRM)	4.5	0.000	12.0	2.01	2.56	0.04	5,207.2	0.012
TEE-01 (oSTRM)	1 (oSTRM)	5.0	0.005	12.0	2.01	3.80	2.73	73.6	0.012
MH-02 (oSTRM)	CO-04 (oSTRM)	22.4	0.009	6.0	0.30	2.98	0.58	51.2	0.012
CO-04 (oSTRM)	CB-04 (oSTRM)	11.6	0.009	6.0	0.30	2.98	0.58	51.2	0.012
CO-05 (oSTRM)	MH-02 (oSTRM)	8.8	0.103	4.0	0.07	4.83	0.66	9.9	0.012
TEE-03 (oSTRM)	MH-02 (oSTRM)	10.0	0.009	6.0	0.17	2.56	0.58	28.7	0.012
C0-03 (oSTRM)	MH-02 (oSTRM)	8.7	0.054	6.0	0.07	3.65	1.41	4.6	0.012
MH-4	C0-03 (oSTRM)	9.9	0.054	6.0	0.07	3.65	1.41	4.6	0.012
MH-1	CO-01 (oSTRM)	2.9	0.009	6.0	0.04	1.65	0.58	6.2	0.012
CO-01 (oSTRM)	CO-02 (oSTRM)	45.5	0.009	6.0	0.04	1.65	0.58	6.2	0.012
CB-03 (oSTRM)	CB-04 (oSTRM)	34.0	0.013	8.0	0.40	3.60	1.48	27.1	0.012
CB-04 (oSTRM)	WYE-03 (oSTRM)	30.4	0.013	12.0	1.27	4.81	4.36	29.2	0.012
CB-01 (oSTRM)	CB-02 (oSTRM)	38.5	0.005	12.0	0.39	2.47	2.73	14.4	0.012
CB-02 (oSTRM)	WYE-01 (oSTRM)	40.7	0.005	12.0	0.74	2.95	2.73	27.1	0.012
CO-02 (oSTRM)	TEE-02 (oSTRM)	35.1	0.009	6.0	0.04	1.65	0.58	6.2	0.012
MH-3	TEE-03 (oSTRM)	9.9	0.092	6.0	0.07	4.42	1.84	3.5	0.012
MH-2	TEE-02 (oSTRM)	9.9	0.077	6.0	0.07	4.15	1.69	3.9	0.012
TEE-02 (oSTRM)	TEE-03 (oSTRM)	16.4	0.009	6.0	0.10	2.22	0.58	17.5	0.012
WYE-03 (oSTRM)	TEE-01 (oSTRM)	41.0	0.013	12.0	1.27	4.81	4.36	29.2	0.012
WYE-01 (oSTRM)	WYE-02 (oSTRM)	14.1	0.005	12.0	0.74	2.95	2.73	27.1	0.012
WYE-02 (oSTRM)	TEE-01 (oSTRM)	69.3	0.005	12.0	0.74	2.95	2.73	27.1	0.012

Appendix C-1: USGS Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Pierce County Area, Washington

RC C1360 Puyallup WA

October 27, 2025

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:690 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 30 60 120 180

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 21, Aug 28, 2025

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

Date(s) aerial images were photographed: Jul 31, 2022—Aug 8, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
13B	Everett very gravelly sandy loam, 0 to 8 percent slopes	1.9	100.0%
Totals for Area of Interest		**1.9**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Pierce County Area, Washington

13B—Everett very gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t629
Elevation: 30 to 900 feet
Mean annual precipitation: 35 to 91 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Everett and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Everett

Setting

Landform: Eskers, moraines, kames
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: very gravelly sandy loam
Bw - 3 to 24 inches: very gravelly sandy loam
C1 - 24 to 35 inches: very gravelly loamy sand
C2 - 35 to 60 inches: extremely cobbly coarse sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Droughty Soils (G002XS401WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XN402WA)
Other vegetative classification: Droughty Soils (G002XS401WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XN402WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 10 percent
Landform: Ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Indianola

Percent of map unit: 10 percent
Landform: Eskers, kames, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

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Appendix C-2: Terracon Geotechnical Report

(Provided Separately)

Appendix C-3: Construction Stormwater Pollution Prevention Plan (SWPPP)

(Provided Separately)

Appendix C-4: Operations and Maintenance (O&M) Manual

OPERATIONS AND MAINTENANCE MANUAL

FOR

Raising Cane's Restaurant # C1360

Puyallup, WA

February 2026

Owner Name: Raising Cane's Restaurants, L.L.C.
Owner Address: 6800 Bishop Rd Plano, TX 75024
Owner Telephone: (972) 769-3100

Project Engineer Name: Liz Willmot, P.E.
Project Engineer Address: 1201 Third Ave, Suite 2800, Seattle, WA 98101
Project Engineer Telephone: (206) 677-8610
Project Engineer Email: Liz.Willmot@kimley-horn.com

Kimley»Horn

Expect More. Experience Better.

PROJECT DESCRIPTION

This project proposes the development of a new restaurant with outdoor seating, two drive-thru lanes with canopies, and associated infrastructure in the City of Puyallup, WA. The site zoning is listed as Urban Center Mixed Use (UCX) and the parcel number for the proposed development is 0419091073. The land is situated in the county of Pierce, state of Washington.

The existing project site is currently one commercial building with an associated parking and pavement area. The site generally slopes east at average slope of 4% with approximately 8 feet total drop from the west to the east.

The site drains to proposed catch basins on site. The runoff then flows into a proposed water quality vault, before routing into a gravel infiltration trench onsite. From there, the runoff infiltrates into native soils. During storm events exceeding the 100-year storm, emergency overflow will be routed into the existing stormwater infrastructure offsite via an emergency overflow standpipe from the gravel infiltration trench.

MAINTENANCE IMPORTANCE AND INTENT

The importance of maintenance for the proper functioning of stormwater control facilities cannot be over-emphasized. A substantial portion of failure (clogging of filters, resuspension of sediments, loss of storage capacity, etc.) is due to inadequate maintenance. Stormwater BMP maintenance is essential to ensure that BMPs function as intended throughout their full life cycle.

The fundamental goals of maintenance activities are to ensure the entire flow regime and treatment train designed for the proposed stormwater facilities continue to function in their complete capacity. For this site, these include:

- Maintain ability to safely convey design stormwater flows
- Maintain ability to treat stormwater runoff quality
- Preserve soil and plant health, as well as stormwater flow contact with plant and soil systems
- Clearly identify systems so they can be protected
- Keep maintenance costs low
- Prevent large-scale or expensive stormwater system failures
- Prevent water quality violations or damage to downstream properties

The intent of this section and manual is to pass on to the party (or parties) responsible all the critical information to understand the design of the system, risks and considerations for proper use, suggestions for maintenance frequencies, and cost with the intent of establishing realistic budgets for such maintenance.

RESPONSIBLE PARTIES

Raising Cane's Restaurants, L.L.C. the current tenant, will be the party responsible for the operation and maintenance of the proposed storm facilities upon completion of construction.

Raising Cane's Restaurants, L.L.C.
10025 Lakewood Dr SW
Lakewood, WA 98499
972-769-3100

FACILITIES REQUIRING MAINTENANCE

The facilities requiring maintenance include catch basins, storm cleanouts, infiltration pipes, modular wetland, and storm drainpipes.

MAINTENANCE INSTRUCTIONS

The parties responsible for maintenance must review and apply the maintenance requirements contained herein. These maintenance instructions outline conditions for determining if maintenance actions are required, as identified through inspection. However, they are not intended to be measures of the facility's required condition at all times between inspections. Exceedance of these conditions at any time between inspections or maintenance activity does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance presented in the checklists shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action. A log of maintenance activity that indicates what actions were taken must be kept on site and be available for inspection by the City.

All facilities on the project site should be inspected at least twice per year at an interval of every six months with one inspection occurring after the first storm of the wet season. Catch basins should have the sediment removed when depth exceeds 60 percent of the sump depth, 2.4 feet, or if the accumulated sediment is equal to or exceeding the invert out elevation. During inspection, the storm system should be inspected for cracks or other damage in the pipes and structures, and trash and other debris shall be removed.

Determination of water not infiltrating as designed shall be observed after rainfall ceases and appropriate time allowed for infiltration to occur. Proper construction methods and sequencing play a significant role in reducing operations and maintenance problems.

The document also lists the action and procedures which should be taken. The document was pulled from the Department of Ecology's Stormwater Manual for Western Washington. The Maintenance Checklist is included for the following:

- Catch Basins
- Manholes
- Infiltration Trench
- Water Quality Vault
- Conveyance pipes
- Control Structures

VEGETATION MAINTENANCE

If landscaping and vegetation becomes sparse or dies, it should be replaced to match the design conditions of the site just after the initial construction was complete. Regular mowing and irrigation should occur as needed to maintain healthy vegetation.

APPENDIX A: GRADING AND DRAINAGE PLANS AND STORMWATER DETAILS

K:\SEA_Civil\090042 – Raising Cane's\090042022 – C1360 Meridian & 43rd, Puyallup, WA\CAD\PlanSheets\C5.0 GRADING & DRAINAGE PLAN.dwg Mar 10, 2026 2:30pm by: TarynOhlsholm

GRADING & DRAINAGE NOTES

1. ALL CONSTRUCTION TO BE IN ACCORDANCE WITH THESE PLANS AND THE CITY/AHJ STANDARDS AND SPECIFICATIONS.
2. PRIOR TO STARTING CONSTRUCTION, THE CONTRACTOR SHALL MAKE CERTAIN THAT ALL REQUIRED PERMITS AND APPROVALS HAVE BEEN OBTAINED. NO CONSTRUCTION OR FABRICATION SHALL BEGIN UNTIL THE CONTRACTOR HAS RECEIVED AND THOROUGHLY REVIEWED ALL PLANS AND OTHER DOCUMENTS APPROVED BY ALL OF THE PERMITTING AUTHORITIES.
3. THE GENERAL CONTRACTOR AND ALL SUB-CONTRACTORS SHALL VERIFY THE SUITABILITY OF ALL EXISTING AND PROPOSED SITE CONDITIONS INCLUDING GRADES AND DIMENSIONS BEFORE COMMENCEMENT OF ANY CONSTRUCTION. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES. MINOR ADJUSTMENTS TO FINISH GRADE TO ACCOMPLISH SPOT DRAINAGE ARE ACCEPTABLE, IF NECESSARY, UPON PRIOR APPROVAL OF ENGINEER. PAVING INSTALLED SHALL "FLUSH OUT" AT ANY JUNCTURE WITH EXISTING PAVING.
4. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES, AND WHERE POSSIBLE, MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED ON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANIES AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS.
5. ALL CUT OR FILL SLOPES SHALL BE 4:1 OR FLATTER UNLESS OTHERWISE NOTED.
6. CONTRACTOR SHALL ADJUST AND/OR CUT EXISTING PAVEMENT AS NECESSARY TO ASSURE A SMOOTH FIT AND CONTINUOUS GRADE.
7. CONTRACTOR SHALL ASSURE POSITIVE DRAINAGE AWAY FROM BUILDINGS FOR ALL NATURAL AND PAVED AREAS.
8. TOPOGRAPHIC INFORMATION IS TAKEN FROM A TOPOGRAPHIC SURVEY BY LAND SURVEYORS. IF THE CONTRACTOR DOES NOT ACCEPT EXISTING TOPOGRAPHY AS SHOWN ON THE PLANS, WITHOUT EXCEPTION, THEN THE CONTRACTOR SHALL SUPPLY, AT THEIR EXPENSE, A TOPOGRAPHIC SURVEY BY A REGISTERED LAND SURVEYOR TO THE OWNER FOR REVIEW.
9. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS FOR EXACT BUILDING FOOTPRINT DIMENSIONS.
10. CONTRACTOR SHALL REFER TO FINAL GEOTECH REPORT FOR BUILDING SUBGRADE AND SITE PREPARATION REQUIREMENTS.
11. CONTRACTOR SHALL ADJUST EXISTING VALVES, MANHOLE RIMS, ETC. AS NECESSARY TO MATCH FINISHED GRADE.
12. GRADING FOR ALL SIDEWALKS AND ACCESSIBLE ROUTES INCLUDING CROSSING DRIVEWAYS SHALL CONFORM TO ADA STANDARDS. SLOPES SHALL NOT EXCEED 5% LONGITUDINAL SLOPE OR 2% CROSS SLOPE. SIDEWALK ACCESS TO EXTERNAL BUILDING DOORS SHALL BE ADA COMPLIANT. CONTRACTOR SHALL NOTIFY ENGINEER IMMEDIATELY IF ADA CRITERIA CANNOT BE MET AT ANY LOCATION.
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14. ALL FILL TO BE PLACED SHALL BE IN ACCORDANCE WITH THE CURRENT APPLICABLE GEOTECHNICAL REPORT RECOMMENDATIONS.

GRADING SUMMARY TABLE

CUT: 131 CUBIC YARDS

FILL: 554 CUBIC YARDS

NET FILL: 422 CUBIC YARDS

NOTE: THE ABOVE QUANTITIES ARE APPROXIMATE IN PLACE VOLUMES CALCULATED FROM THE EXISTING GROUND TO THE PROPOSED FINISHED GRADE.

THE EARTHWORK QUANTITIES ABOVE ARE APPROXIMATE. THEY HAVE NOT BEEN FACTORED TO ACCOUNT FOR CHANGES IN VOLUME DUE TO BUILDING, CLEARING AND GRUBBING, SHRINKAGE, OVER-EXCAVATION AND RE-COMPACTION, AND CONSTRUCTION METHODS. NOR DO THEY ACCOUNT FOR THE THICKNESS OF PAVEMENT SECTIONS, FOOTINGS, SLABS, REUSE OF PULVERIZED MATERIALS THAT WILL UNERLIE NEW PAVEMENTS, ETC. THE CONTRACTOR SHALL RELY ON THEIR OWN EARTHWORK ESTIMATES FOR BIDDING PURPOSES.

APPROXIMATE AREAS OF EXCAVATION AND FILL HAVE BEEN NOTED IN THE PLANS AND LEGEND. AREAS OUTSIDE THESE LIMITS ARE AREAS OF LESS THAN ONE FOOT OR ZERO FILL AND EXCAVATION.

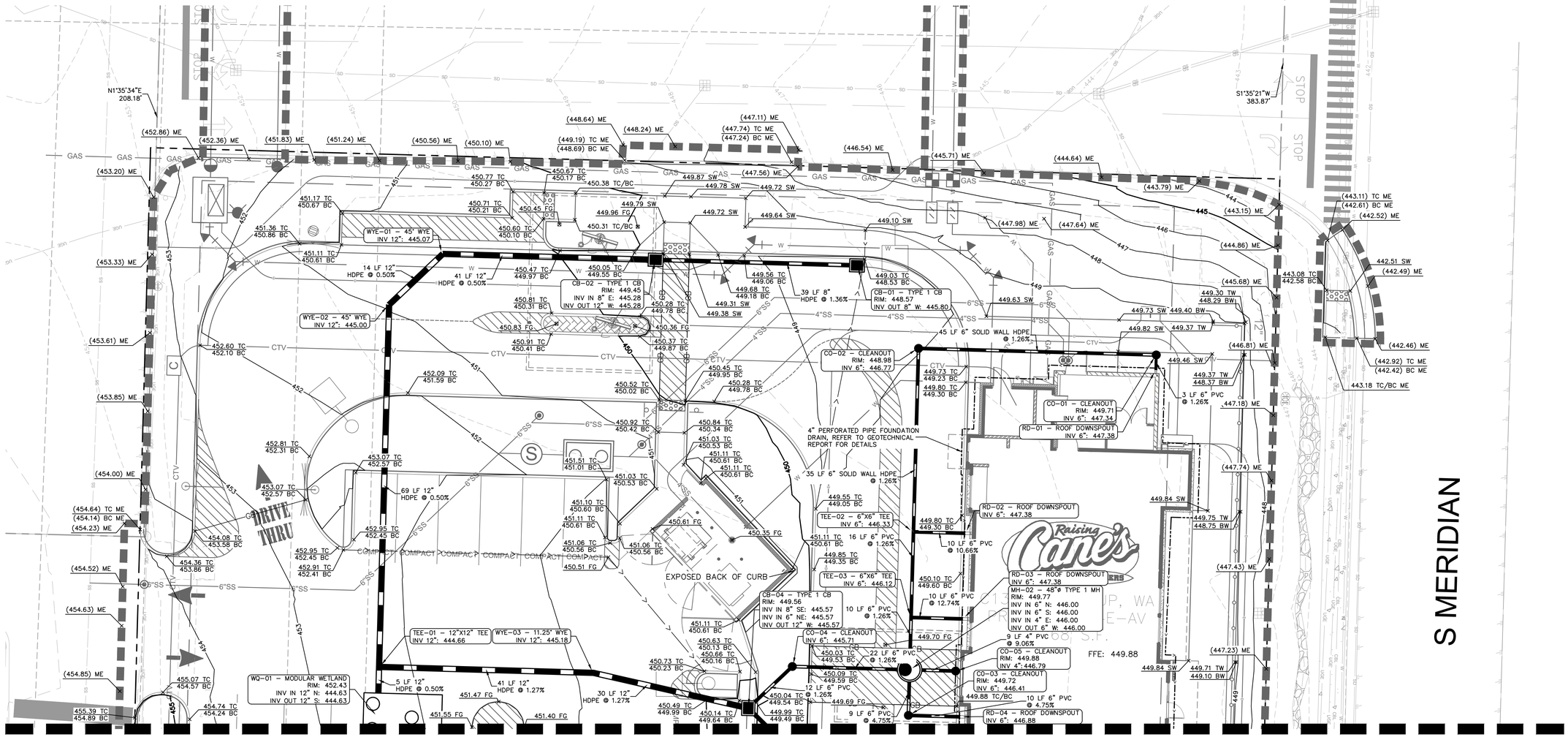
LEGEND

	PROPERTY LINE
	LEASE LINE
	EASEMENT LINE
	APPROXIMATE CIVIL LIMIT OF WORK LINE
XXX	EXISTING CONTOUR
XXX	PROPOSED CONTOUR
GB	GRADE BREAK LINE
< <	LOW POINT LINE
R	RIDGE LINE
XXX.XX	PROPOSED SPOT ELEVATION
(XXX.XX)	EXISTING SPOT ELEVATION
2.00%	PROPOSED FLOW (DIRECTION AND SLOPE)
FFE	FINISHED FLOOR ELEVATION
SW	TOP OF SIDEWALK
ME	MATCH EXISTING ELEVATION
BC	BOTTOM OF CURB
TC	TOP OF CURB
FG	FINISHED GRADE
TW	TOP OF WALL
BW	BOTTOM OF WALL

N

GRAPHIC SCALE IN FEET
10 0 5 10 20
1" = 10' @ 24X36

VICINITY MAP N.T.S



MATCHLINE - REFER TO SHEET C5.1

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21034213
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3-10-26

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Raising Cane's CHICKEN FINGERS

PROTOTYPE P4E-AV
SCHEME
VERSION 2025-1.0

RAISING CANE'S
RESTAURANT NO.: #C1360

4110 SOUTH MERIDIAN
PUYALLUP, WA 98373

REV	DATE	DESCRIPTION
	02/24/26	80% CLIENT REVIEW SET
	03/10/26	1ST CITY SUBMITTAL

DRAWN BY:
CHECKED BY:
ARCH. PROJECT NO.:
RAC25014.0
SHEET NAME:
GRADING & DRAINAGE PLAN
SHEET NUMBER:
C5.0

1ST CITY SUBMITTAL : 03/10/26

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XXX	PROPOSED CONTOUR
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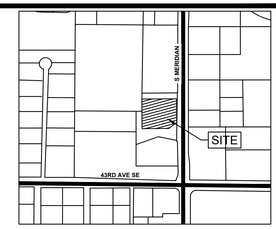
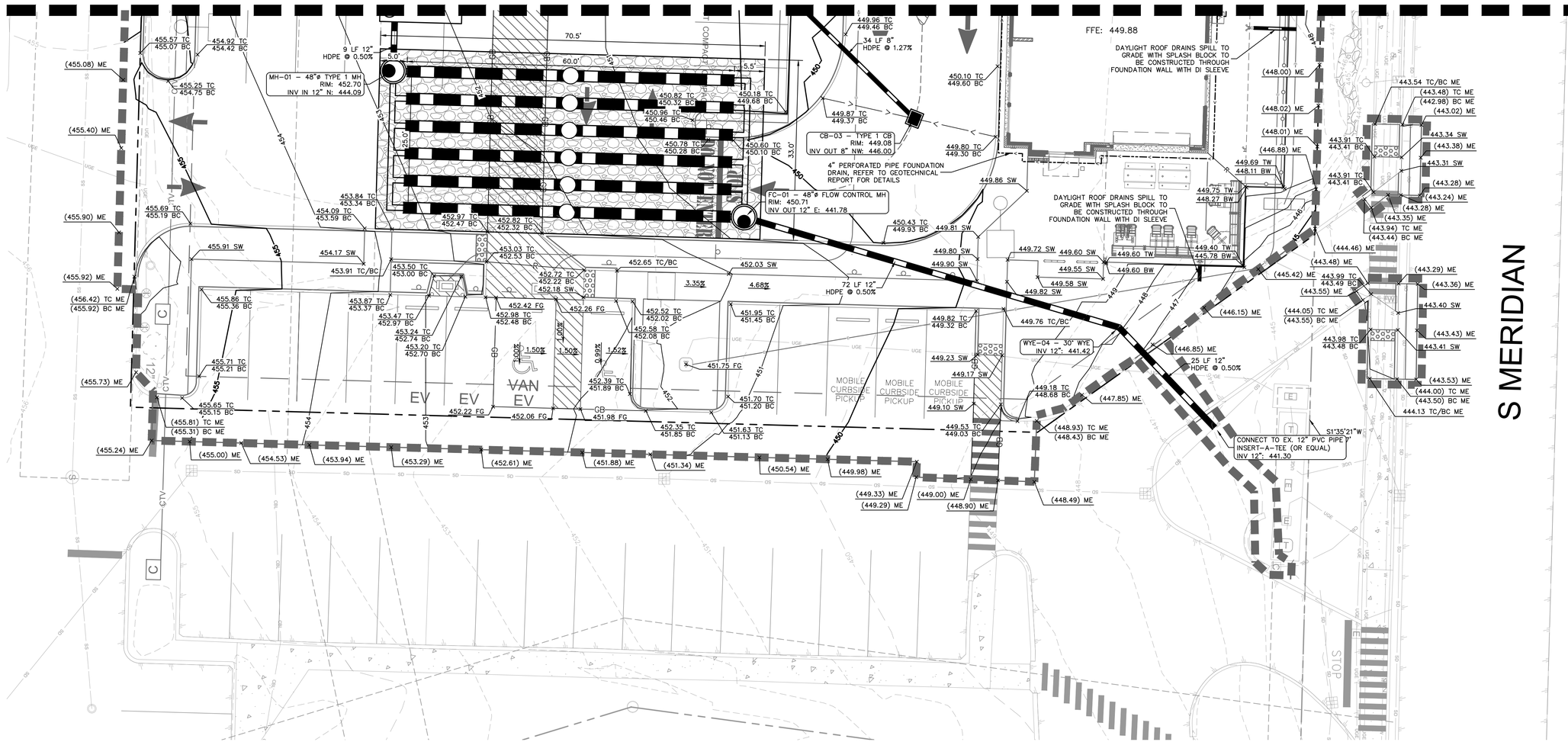


VICINITY MAP N.T.S

MATCHLINE - REFER TO SHEET C5.0



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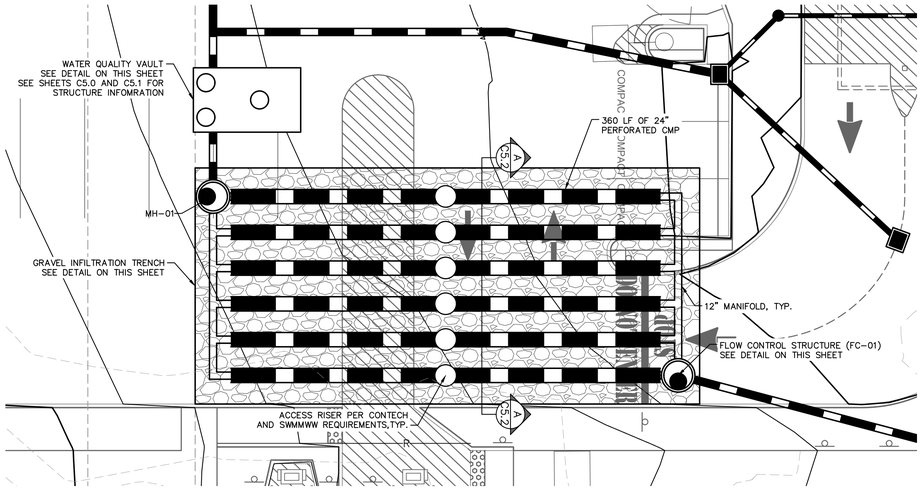
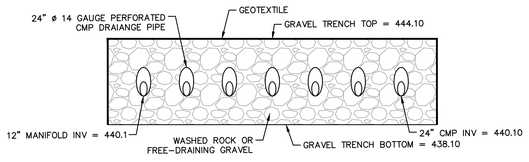
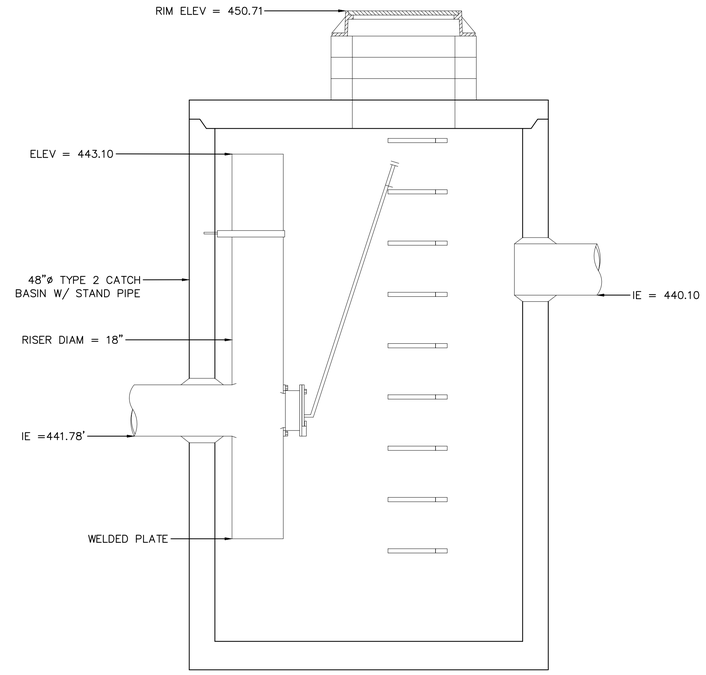


GRAVEL TRENCH – PLAN VIEW
SCALE: 1" = 10'



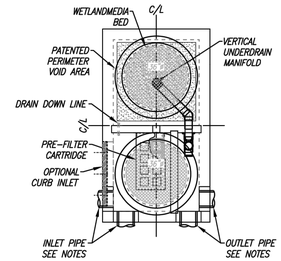
GRAVEL TRENCH – SECTION A–A
H: 1" = 10'
V: 1" = 5'



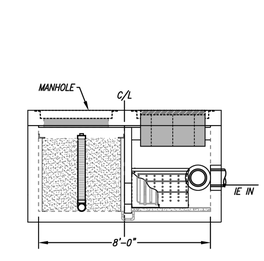
FLOW CONTROL STRUCTURE (FC–01) DETAIL
NTS

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
TREATMENT FLOW (CFS)			
PRETREATMENT LOADING RATE (GPM/SF)			2.1 GPM/SF
WETLAND MEDIA LOADING RATE (GPM/SF)			1.0
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			____ (CFS)
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2			
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
NOTES:			

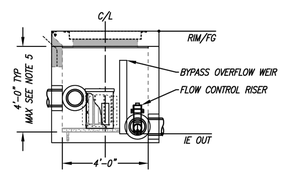
* PRELIMINARY ONLY - NOT FOR CONSTRUCTION



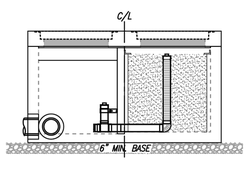
PLAN VIEW



LEFT END VIEW



ELEVATION VIEW



RIGHT END VIEW

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
3. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
4. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.
5. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.

MODULAR WETLAND (WQ–01) DETAIL
NTS

MWS-L-4-8-V-UG
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

PM DESIGN
211 GATEWAY RD W
SUITE 208
NAPA, CA 94558
CONTACT: CHET RUST
PHONE: 707.675.5670
EMAIL: CRUST@PMDGINC.COM

JEFF LIEDERMAN, ARCHITECT
PM DESIGN GROUP, INC.

SEAL:

ELIZABETH ANNE WILLMOT
STATE OF WASHINGTON
21034213
REGISTERED PROFESSIONAL ENGINEER
3-10-26

CONSULTANT:

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PROTOTYPE P4E-AV
SCHEME
VERSION 2025-1.0

RAISING CANE'S
RESTAURANT NO.: #C1360
4110 SOUTH MERIDIAN
PUYALLUP, WA 98373

REV	DATE	DESCRIPTION
	02/24/26	80% CLIENT REVIEW SET
	03/10/26	1ST CITY SUBMITTAL

DRAWN BY:
CHECKED BY:
ARCH. PROJECT NO.:
RAC25014.0
SHEET NAME:
DRAINAGE DETAILS
SHEET NUMBER:
C5.2

1ST CITY SUBMITTAL : 03/10/26

K:\SEA_Civil\090042 – Raising Cane's\090042022 – C1360 Meridian & 43rd, Puyallup, WA\CAD\PlanSheets\C5.2–DRAINAGE DETAILS.dwg Mar 10, 2026 2:30pm by: Taryn.Chisholm

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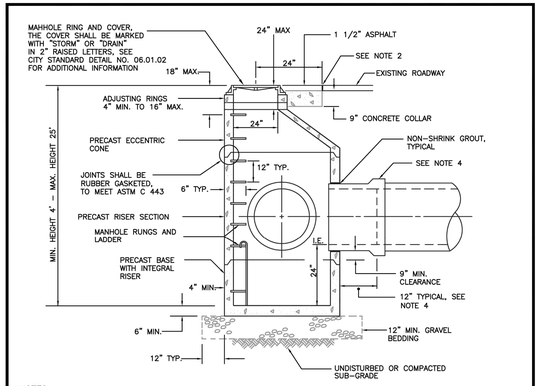


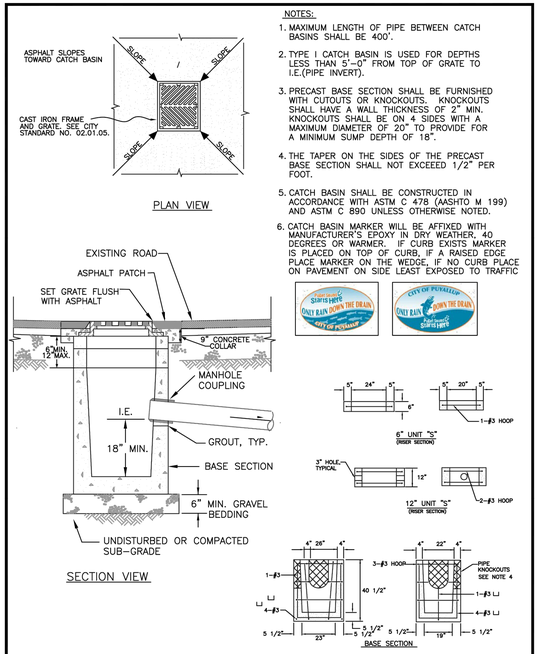
NOTES:

1. THE CONSTRUCTION AND INSTALLATION OF STORM SEWER MANHOLES SHALL CONFORM TO THE REQUIREMENTS OF WSDOT SPEC. SECTION 7-05 AND ASTM C 478.
2. THE FACE OF NEAT LINE CUTS IN EXISTING ASPHALT PAVEMENT SHALL BE TACK COATED AND THE TOP OF THE JOINT SHALL BE SEALED WITH A HOT PAVING GRADE ASPHALT.
3. PRECAST RISER SECTION OR PRECAST BASE WITH INTEGRAL RISER SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS WITH A MINIMUM WALL THICKNESS OF 2". THE SIZE OF THE KNOCKOUT SHALL BE EQUAL TO THE PIPE OUTER DIAMETER PLUS THE MANHOLE WALL THICKNESS. THE MAXIMUM HOLE SIZE IS 36" FOR A 48" MANHOLE, 42" FOR A 54" MANHOLE, 60" FOR A 72" MANHOLE, AND 84" FOR A 96" MANHOLE.
4. A FLEXIBLE GASKETED JOINT SHALL BE INSTALLED WITHIN 12" OF EACH CONNECTION TO A MANHOLE. THE CONNECTION OF CONCRETE OR DUCTILE IRON PIPE TO A MANHOLE SHALL BE CEMENT MORTARED. DUCTILE IRON PIPE SHALL BE SEALED WITH MASTIC AT THE CONNECTION POINT PRIOR TO BEING MORTARED. THE CONNECTION OF PVC PIPE TO A MANHOLE SHALL UTILIZE A MANHOLE COUPLING (SAND COLLAR) WITH A RUBBER GASKET.
5. THE MANHOLE COVER SHALL BE MARKED WITH "STORM" OR "DRAIN" IN 2 INCH RAISED LETTERS. MANHOLE RING AND COVER SHALL CONFORM TO CITY STANDARD DETAIL NO. 06.01.03
6. MANHOLE STEP AND LADDER SHALL CONFORM TO CITY STANDARD DETAILS NO. 06.01.04 AND 06.01.05

CITY OF PUYALLUP — DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

STORM SEWER MANHOLE

DRAWN BY	CHECKED BY	APPROVED BY	REVISED BY	CITY STANDARD
JIM IRWIN-SVOBODA	LINDA LIAN	COLLEEN HARRIS	Linda Lian	
FILE NAME: F:\DWG\COMMON\STDS\CITY\200902_SD02.01.01		DATE APPROVED: 09/01/1992	DATE REVISED: 08/21/2012	SCALE: NTS — 02.01.01



PLAN VIEW

SECTION VIEW

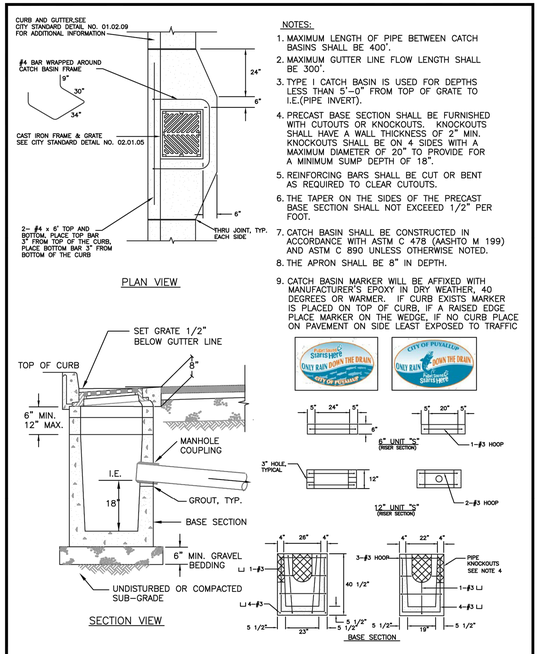
NOTES:

1. MAXIMUM LENGTH OF PIPE BETWEEN CATCH BASINS SHALL BE 400'.
2. TYPE I CATCH BASIN IS USED FOR DEPTHS LESS THAN 5'-0" FROM TOP OF GRATE TO I.E.(PIPE INVERT).
3. PRECAST BASE SECTION SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MIN. KNOCKOUTS SHALL BE ON 4 SIDES WITH A MAXIMUM DIAMETER OF 20" TO PROVIDE FOR A MINIMUM SUMP DEPTH OF 18".
4. THE TAPER ON THE SIDES OF THE PRECAST BASE SECTION SHALL NOT EXCEED 1/2" PER FOOT.
5. CATCH BASIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH ASTM C 478 (AASHTO M 199) AND ASTM C 890 UNLESS OTHERWISE NOTED.
6. CATCH BASIN MARKER WILL BE AFFIXED WITH MANUFACTURER'S EPOXY IN DRY WEATHER, 40 DEGREES OR WARMER. IF CURB EXISTS MARKER IS PLACED ON TOP OF CURB, IF A RAISED EDGE PLACE MARKER ON THE WEDGE, IF NO CURB PLACE ON PAVEMENT ON SIDE LEAST EXPOSED TO TRAFFIC

CITY OF PUYALLUP — DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

CATCH BASIN TYPE 1 (AREA DRAIN)

DRAWN BY	CHECKED BY	APPROVED BY	REVISED BY	CITY STANDARD
LINDA LANSING	LINDA LIAN	COLLEEN HARRIS	XXXX	
FILE NAME: F:\DWG\COMMON\STDS\CITY\200902_SD02.01.02		DATE APPROVED: 09/01/1992	DATE REVISED: 06/01/2003	SCALE: NTS — 02.01.02



PLAN VIEW

SECTION VIEW

NOTES:

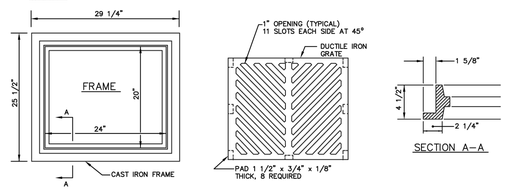
1. MAXIMUM LENGTH OF PIPE BETWEEN CATCH BASINS SHALL BE 400'.
2. MAXIMUM GUTTER LINE FLOW LENGTH SHALL BE 300'.
3. TYPE I CATCH BASIN IS USED FOR DEPTHS LESS THAN 5'-0" FROM TOP OF GRATE TO I.E.(PIPE INVERT).
4. PRECAST BASE SECTION SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE A WALL THICKNESS OF 2" MIN. KNOCKOUTS SHALL BE ON 4 SIDES WITH A MAXIMUM DIAMETER OF 20" TO PROVIDE FOR A MINIMUM SUMP DEPTH OF 18".
5. REINFORCING BARS SHALL BE CUT OR BENT AS REQUIRED TO CLEAR CUTOUTS.
6. THE TAPER ON THE SIDES OF THE PRECAST BASE SECTION SHALL NOT EXCEED 1/2" PER FOOT.
7. CATCH BASIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH ASTM C 478 (AASHTO M 199) AND ASTM C 890 UNLESS OTHERWISE NOTED.
8. THE APRON SHALL BE 8" IN DEPTH.
9. CATCH BASIN MARKER WILL BE AFFIXED WITH MANUFACTURER'S EPOXY IN DRY WEATHER, 40 DEGREES OR WARMER. IF CURB EXISTS MARKER IS PLACED ON TOP OF CURB, IF A RAISED EDGE PLACE MARKER ON THE WEDGE, IF NO CURB PLACE ON PAVEMENT ON SIDE LEAST EXPOSED TO TRAFFIC

CITY OF PUYALLUP — DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

CATCH BASIN TYPE 1 (GUTTER DRAIN)

DRAWN BY	CHECKED BY	APPROVED BY	REVISED BY	CITY STANDARD
LINDA LANSING	LINDA LIAN	COLLEEN HARRIS	XXXX	
FILE NAME: F:\DWG\COMMON\STDS\CITY\200902_SD02.01.03		DATE APPROVED: 09/01/1992	DATE REVISED: 06/01/2003	SCALE: NTS — 02.01.03

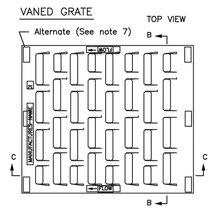
GRATE

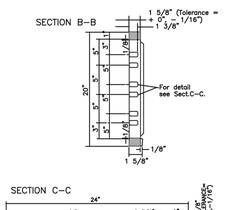


NOTES:

1. MATERIAL SHALL CONFORM TO SECTION 9-05.15 "METAL CASTINGS" OF THE "STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION" PUBLISHED BY THE STATE DEPARTMENT OF TRANSPORTATION AND AMERICAN PUBLIC WORKS ASSOCIATION, WASHINGTON STATE CHAPTER.
2. THE NAME OF THE MANUFACTURE AND DIRECTION OF FLOW SHALL BE EMBOSSED ON THE TOP SURFACE OF EACH GRATE. LETTERING TO BE RECESSED 1/16".
3. THE MATERIAL USED FOR THE GRATE SHALL BE DESIGNATED BY EMBASSING EITHER DI (FOR DUCTILE IRON) OR CS (FOR CAST STEEL) NEAR THE NAME OF THE MANUFACTURER.
4. DIMENSIONS SHALL HAVE A +/- 1/16" TOLERANCE, EXCEPT AS NOTED.
5. EDGES SHALL HAVE 1/8" RADIUS.
6. WELDING IS NOT PERMITTED.
7. AS AN ALTERNATE, 8 PADS 1 1/2" X 3/4" X 1/8", INTEGRALLY CAST WITH THE GRATE, MAY BE USED.

VANED GRATE



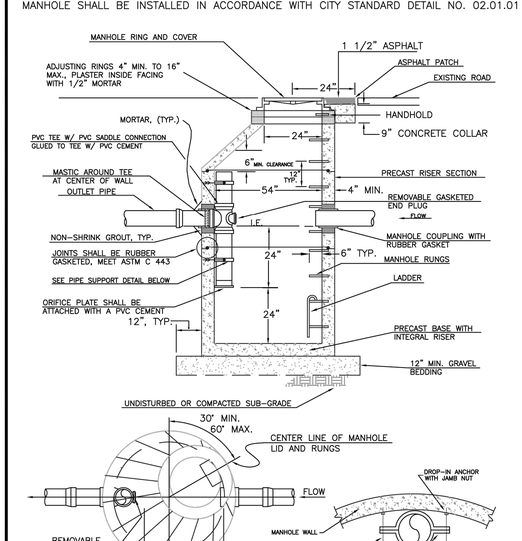


CITY OF PUYALLUP — DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

CATCH BASIN FRAME AND GRATE/VANED GRATE

DRAWN BY	CHECKED BY	APPROVED BY	REVISED BY	CITY STANDARD
LINDA LANSING	LINDA LIAN	COLLEEN HARRIS	LINDA LIAN	
FILE NAME: F:\DWG\COMMON\STDS\CITY\200902_SD02.01.05		DATE APPROVED: 07/01/2009	DATE REVISED: 03/21/11	SCALE: NTS — 02.01.05

MANHOLE SHALL BE INSTALLED IN ACCORDANCE WITH CITY STANDARD DETAIL NO. 02.01.01



CITY OF PUYALLUP — DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

FLOW CONTROL MANHOLE WITH CONE SECTION

DRAWN BY	CHECKED BY	APPROVED BY	REVISED BY	CITY STANDARD
LINDA LANSING	LINDA LIAN	COLLEEN HARRIS	XXXX	
FILE NAME: F:\DWG\COMMON\STDS\CITY\200902_SD02.01.06		DATE APPROVED: 09/01/1992	DATE REVISED: 06/01/2003	SCALE: NTS — 02.01.06

NOTES FOR FLOW CONTROL MANHOLE:

1. NEAT LINE CUTS SHALL BE AT TOP WITH A HOT PAVING GRADE ASPHALT AND FACE OF CUT TACKED.
2. FLOW CONTROL MANHOLES SHALL BE USED AS A SINGLE USE STRUCTURE.
3. MANHOLE RUNG SHALL CONFORM TO SECTION R, ASTM C 478 (ASSHTO M-199) AND MEET ALL WISHA REQUIREMENTS. MANHOLE RUNGS SHALL BE PARALLEL OR APPROXIMATELY RADIAL AT THE OPTION OF THE MANUFACTURER, EXCEPT THAT ALL STEPS IN ANY MANHOLE SHALL BE SIMILAR. PENETRATION OF OUTER WALL BY A RUNG LEG IS PROHIBITED. SEE MANHOLE STEP AND LADDER DETAIL, CITY STANDARD DETAIL NO. 06.01.04.
4. PRECAST RISER SECTION SHALL BE FURNISHED WITH CUTOUTS OR KNOCKOUTS. KNOCKOUTS SHALL HAVE WALL THICKNESS OF TWO (2) INCHES MINIMUM. KNOCKOUT OR CUTOUT HOLE SIZE IS EQUAL TO PIPE OUTER DIAMETER PLUS MANHOLE WALL THICKNESS. MINIMUM DISTANCE BETWEEN HOLES IS EIGHT (8) INCHES.
5. PRECAST CONCRETE MANHOLE COMPONENTS SHALL CONFORM TO ASTM C 478.
6. FLEXIBLE JOINTS SHALL BE RUBBER GASKETED IN ACCORDANCE WITH THE WSDOT STANDARD SPECIFICATIONS. MORTARED, DRY-PACKED, OR CAST-IN-PLACE JOINTS WILL BE PERMITTED FOR CONNECTIONS TO OR THROUGH MANHOLES. A FLEXIBLE GASKETED JOINT SHALL BE INSTALLED WITHIN ONE (1) FOOT OF EACH CONNECTION TO OR THROUGH SAID MANHOLES. CONNECTIONS TO MANHOLE WITH PVC PIPE SHALL UTILIZE A MANHOLE COUPLING AND RUBBER GASKET.
7. THE COVER ON THE MANHOLE SHALL BE MARKED WITH "STORM" OR "DRAIN" IN TWO (2) INCH RAISED LETTERS. SEE MANHOLE RING AND COVER DETAIL, CITY STANDARDS DETAIL NO. 06.01.02 AND 06.01.03.
8. STAINLESS STEEL PIPE CLAMP WITH 1/2" DIAMETER STAINLESS STEEL THREADED ROD WITH WASHER AND NUT EACH SIDE OF CLAMP. PROVIDE 1/2" DIAMETER DROP-IN ANCHOR WITH JAMB NUT AT WALL. PIPE CLAMPS SHALL BE PLACED AT SIXTEEN (16) INCHES ON CENTER.
9. FLOW CONTROL UNIT SHALL BE MADE FROM PVC PIPE AND SHALL CONFORM TO THE STANDARD PIPE SPECIFICATIONS.

CITY OF PUYALLUP — DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

FLOW CONTROL MANHOLE NOTES

DRAWN BY	CHECKED BY	APPROVED BY	REVISED BY	CITY STANDARD
LINDA LANSING	LINDA LIAN	COLLEEN HARRIS	XXXX	
FILE NAME: F:\DWG\COMMON\STDS\CITY\200902_SD02.01.08		DATE APPROVED: 09/01/1992	DATE REVISED: 06/01/2003	SCALE: NTS — 02.01.08

PM DESIGN
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3-10-26

CONSULTANT:

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Raising Cane's Chicken Fingers

PROTOTYPE P4E-AV
SCHEME
VERSION 2025-1.0

RAISING CANE'S
RESTAURANT NO.: #C1360

4110 SOUTH MERIDIAN
PUYALLUP, WA 98373

REV	DATE	DESCRIPTION
	02/24/26	80% CLIENT REVIEW SET
	03/10/26	1ST CITY SUBMITTAL

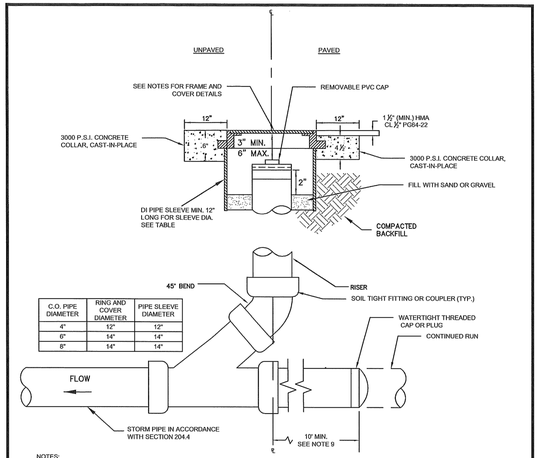
DRAWN BY:
CHECKED BY:

ARCH. PROJECT NO.:
RAC25014.0

SHEET NAME:
DRAINAGE DETAILS

SHEET NUMBER:
C5.3

1ST CITY SUBMITTAL : 03/10/26



C.O. PIPE DIAMETER	RING AND COVER DIAMETER	PIPE SLEEVE DIAMETER
4"	12"	12"
6"	14"	14"
8"	14"	14"

NOTES:

1. CAST IRON COVER MARKED "FDCO" FOR FOOTING DRAINS OR "SDCO" FOR STORM LINES.
2. CAST IRON FRAME AND COVER SHALL BE DRILLED AND TAPPED WITH ½"-11 NC STAINLESS STEEL TYPE 304 ALLEN HEAD BOLTS, 2" LONG.
3. BOLT-LOCKING CAST IRON FRAME AND COVER SHALL BE HS-20 RATED IF USED IN RIGHT-OF-WAY OR EASEMENTS.
4. 14" BOLT-LOCKING CAST IRON FRAME AND COVER SHALL BE EQUAL TO OLYMPIC FOUNDRY PART # M1060.
5. CAST IRON FRAME AND COVER SHALL BE FLUSH WITH FINISHED GRADE.
6. CLEANOUTS REQUIRED FOR EACH PIPE LENGTH GREATER THAN 100' AND FOR EACH 90 DEGREE BEND.
7. STORM PIPE BEDDING AND BACKFILL SHALL CONFORM TO STD DETAIL 06.01.01.
8. FINAL JOINTS SHALL BE SAW CUT, FACE OF CUT TACKED AND ALL JOINTS SEALED WITH SEALANT (AR4000W).
9. STORM DRAIN STUB SHALL EXTEND 10' BEYOND THE PROPERTY LINE OR EASEMENT LINE TO PREVENT DAMAGE AND MINIMIZE CONFLICT WITH FUTURE UTILITIES.
10. EACH CLEANOUT ASSEMBLY SHALL CONSIST OF: ONE CLEANOUT ADAPTOR, (HUB x FEMALE INSIDE PIPE THREAD, PVC SLIP IN), AND ONE CLEANOUT PLUG (MALE OUTSIDE THREAD WITH RAISED NUT, PVC).
11. FOR LANDSCAPED AREAS (OUTSIDE OF CITY ROW, EASEMENTS AND FACILITIES) A GREEN "CARSON" MODEL 910 YARD BOX MAY BE USED FOR C.O. PIPE DIA. LESS THAN OR EQUAL TO 6". YARD BOX SHALL BE FASTENED WITH ¾" HEX BOLTS, THE COVER MARKED "STORM" AND FLUSH WITH FINISHED GRADE.

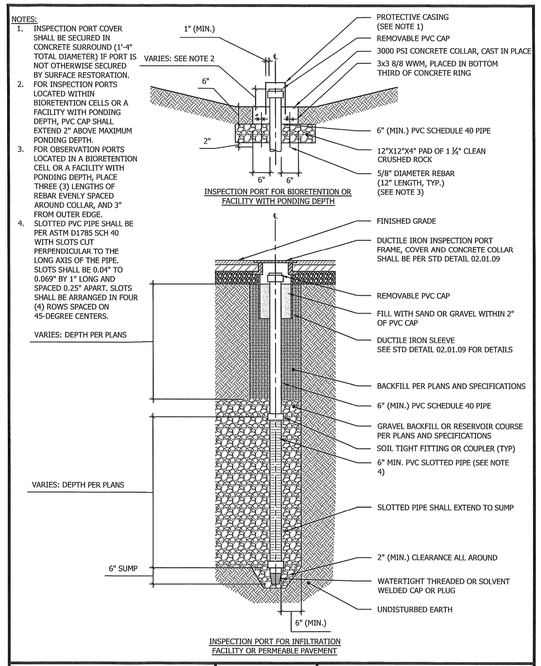
CITY OF PUYALLUP
PUBLIC WORKS AND DEVELOPMENT ENGINEERING

APPROVED FOR PUBLICATION — DATE SIGNED: 2/26/23

STORM DRAIN CLEANOUT

SCALE:	DATE REVISED:	CITY STANDARD
NTS	01/06/2023	02.01.09

FILE NAME: Y:\Shared\Drawings\City Standards\2018\02 - PART 2 - STANDARD DETAILS\CAD\20502.01.09



NOTES:

1. INSPECTION PORT COVER SHALL BE SECURED IN CONCRETE SURROUND (1'-4" TOTAL DIAMETER) IF PORT IS NOT OTHERWISE SECURED BY SURFACE RESTORATION.
2. FOR INSPECTION PORTS LOCATED WITHIN BIORETENTION CELLS OR A FACILITY WITH PONDING DEPTH, PVC CAP SHALL EXTEND 2" ABOVE MAXIMUM PONDING DEPTH.
3. FOR OBSERVATION PORTS LOCATED IN A BIORETENTION CELL OR A FACILITY WITH PONDING DEPTH, PLACE THREE (3) LENGTHS OF REBAR EVENLY SPACED AROUND COLLAR, AND 3" FROM OUTER EDGE.
4. SLOTTED PVC PIPE SHALL BE PER ASTM D1785 SCH 40 WITH SLOTS CUT PERPENDICULAR TO THE LONG AXIS OF THE PIPE. SLOTS SHALL BE 0.04" TO 0.060" BY 1" LONG AND SPACED 0.25" APART. SLOTS SHALL BE ARRANGED IN FOUR (4) ROWS SPACED ON 45-DEGREE CENTERS.

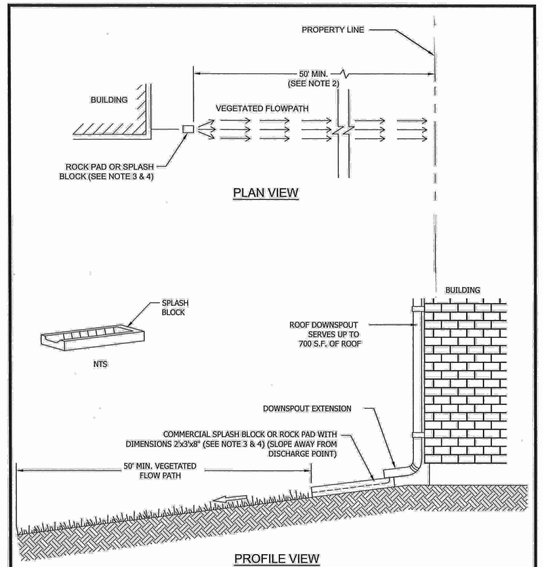
CITY OF PUYALLUP
PUBLIC WORKS AND DEVELOPMENT ENGINEERING

APPROVED FOR PUBLICATION — DATE SIGNED: 2/26/23

STORM DRAIN INSPECTION PORT

SCALE:	DATE REVISED:	CITY STANDARD
NTS	01/06/2023	02.01.10

FILE NAME: Y:\Shared\Drawings\City Standards\2018\02 - PART 2 - STANDARD DETAILS\CAD\20502.01.10



NOTES:

1. SPLASH BLOCKS SHALL DESIGNED BE IN ACCORDANCE WITH SECTION 210.4.
2. THE VEGETATED FLOW PATH SHALL BE MEASURED FROM THE SPLASH BLOCK (DISCHARGE POINT) AND MEASURED PERPENDICULAR TO SITE CONTOURS.
3. SPLASH BLOCKS SHALL BE CONCRETE, PLASTIC, OR SIMILAR MATERIAL. COMMERCIALLY AVAILABLE SPLASH BLOCKS GENERALLY MEET DESIGN CRITERIA.
4. ROCK PAD SHALL CONSIST OF 4" COBBLES PER WSDOT 9-03.11(2).

CITY OF PUYALLUP
PUBLIC WORKS AND DEVELOPMENT ENGINEERING

APPROVED FOR PUBLICATION — DATE SIGNED: 3/10/26

DOWNSPOUT SPLASHBLOCK

SCALE:	DATE REVISED:	CITY STANDARD
NTS	04/13/2023	02.05.05

FILE NAME: Y:\Shared\Drawings\City Standards\2018\02 - PART 2 - STANDARD DETAILS\CAD\20502.05.05

PM DESIGN
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PM DESIGN GROUP, INC.

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LIZ.WILLMOT@KIMLEY-HORN.COM

Raising Cane's CHICKEN FINGERS

PROTOTYPE P4E-AV
SCHEME
VERSION 2025-1.0

RAISING CANE'S
RESTAURANT NO.: #C1360
4110 SOUTH MERIDIAN
PUYALLUP, WA 98373

REV	DATE	DESCRIPTION
	02/24/26	80% CLIENT REVIEW SET
	03/10/26	1ST CITY SUBMITTAL

DRAWN BY:
CHECKED BY:
ARCH. PROJECT NO.:
RAC25014.0
SHEET NAME:
DRAINAGE DETAILS
SHEET NUMBER:
C5.4

1ST CITY SUBMITTAL : 03/10/26

K:\SEA_Civil\090042 – Raising Cane's\090042022 – C1360 Meridian & 43rd, Puyallup, WA\CAD\PlanSheets\C5.2–DRAINAGE DETAILS.dwg Mar 10, 2026 2:31pm by: Taryn.Chisholm

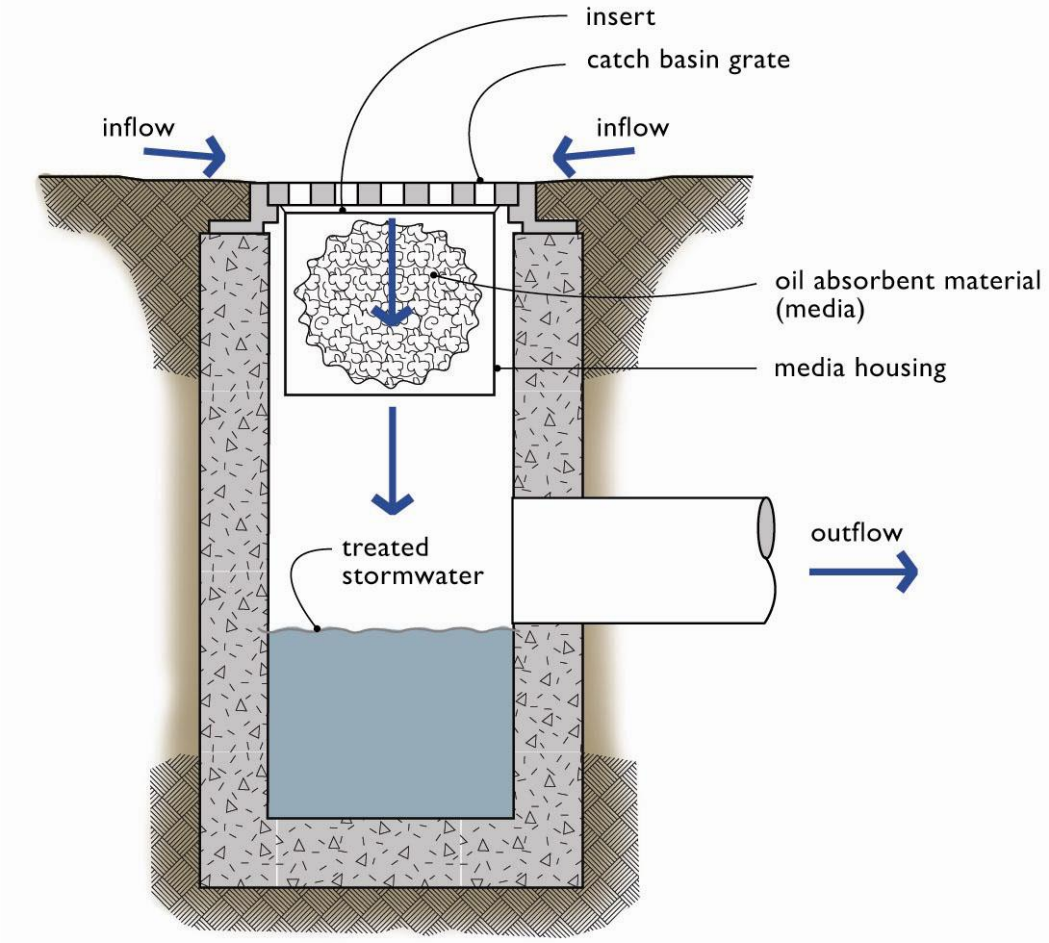
APPENDIX B: OPERATION & MAINTENANCE CHECKLISTS

Catch Basin Insert

Catch basin inserts are used to trap sediment and oil entering catch basins. Most involve some type of filter media and oil-absorbent pads. Filters avoid flooding by overflowing when they become clogged or when there are high storm flows.

Catch basin inserts typically consist of the following components:

- A structure (screened box, brackets, etc.) which contains a pollutant removal medium
- A means of suspending the structure in a catch basin
- A filter medium such as sand, carbon, fabric, etc.
- A primary inlet and outlet for the stormwater
- A secondary outlet for bypassing flows that exceed design flow



Key Operations and Maintenance Considerations

- Catch basin inserts are proprietary; refer to the manufacturer's instructions for inspection and maintenance.
- Some catch basin inserts do not require specialized tools and can be removed and replaced by hand.
- See Catch Basins for additional considerations.

Catch Basin Insert			
Drainage System Feature	**Potential Defect**	**Conditions When Maintenance Is Needed**	**Minimum Performance Standard**
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Media insert has been replaced.
	Media Insert Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Media insert has been replaced.
	Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.	Media removed and replaced at regular intervals (frequency depending on insert product).

Catch Basin

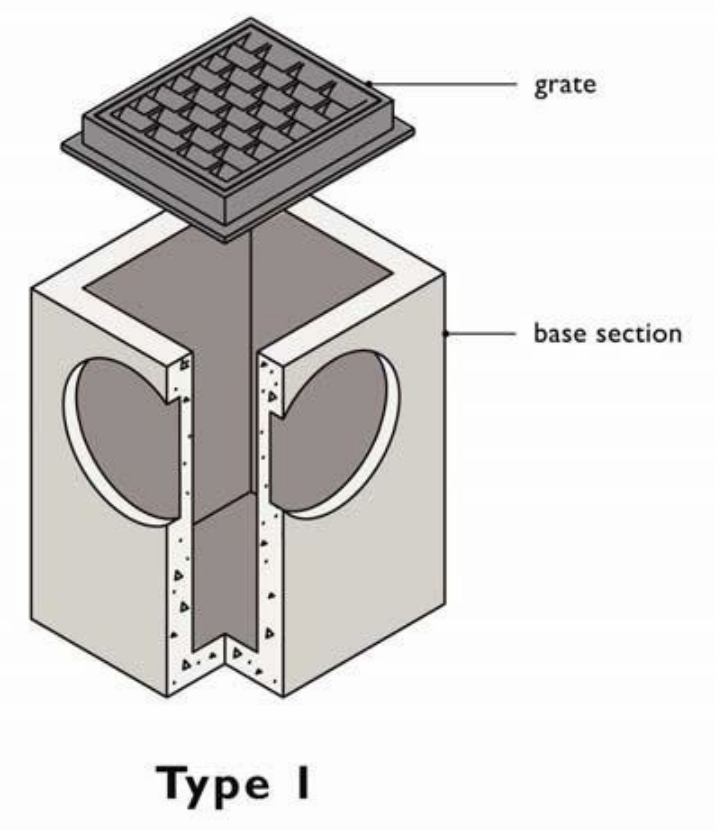
A catch basin is an underground concrete structure typically fitted with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two types.

A Type 1 catch basin is a rectangular box with approximate dimensions of 3'x2'x5'. Type 1 catch basins are utilized when the connected conveyance pipes are less than 18 inches in diameter and the depth from the gate to the bottom of the pipe is less than 5 feet.

A Type 2 catch basin, also commonly referred to as a storm manhole, is listed separately under "Manhole" in this book.

Catch basins typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some catch basins are also fitted with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or debris.

Catch basins are frequently associated with all stormwater facilities.



Key Operations and Maintenance Considerations

- The most common tool for cleaning catch basins is an industrial vacuum truck with a tank and vacuum hose (e.g. Vactor® truck) to remove sediment and debris from the sump.
- A catch basin may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a catch basin, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Catch Basin			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Trash and 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%.	No trash or debris located immediately in front of catch basin or on grate opening.
		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.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	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.)	Top slab is free of holes and cracks.
		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.	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.

	Basin Walls/ Bottom	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.	Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Vegetation Inhibiting System	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source	No contaminants or pollutants present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is 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. One or more bolts are missing.	Mechanism opens with proper tools. All bolts are seated and no bolts are missing. Cover is secure.
	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 by one maintenance person.
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 and meets design standards.
Oil/Debris Trap (If Applicable)	Dislodged	Oil or debris trap is misaligned with or dislodged from the outlet pipe.	Trap is connected to and aligned with outlet pipe.

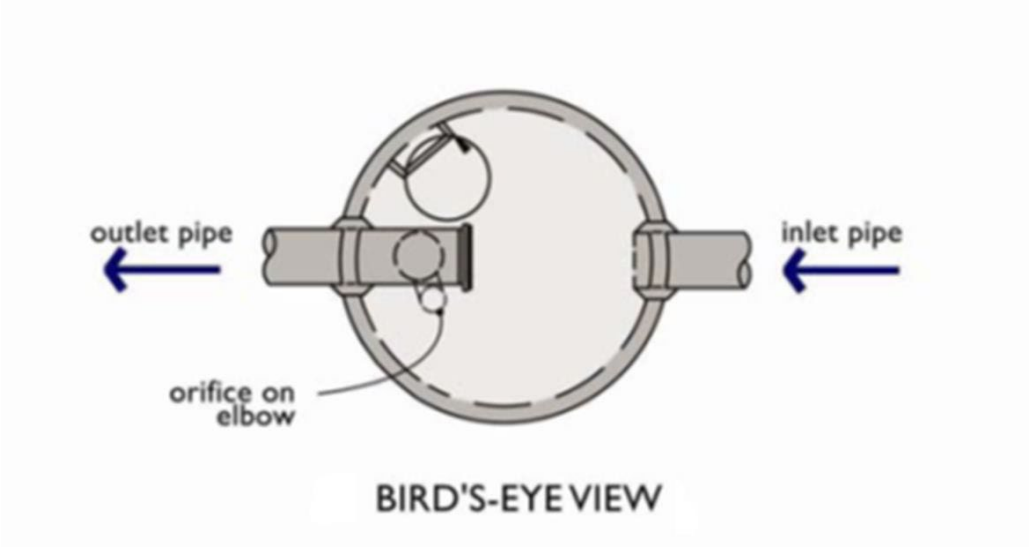
Control Structure/Flow Restrictor

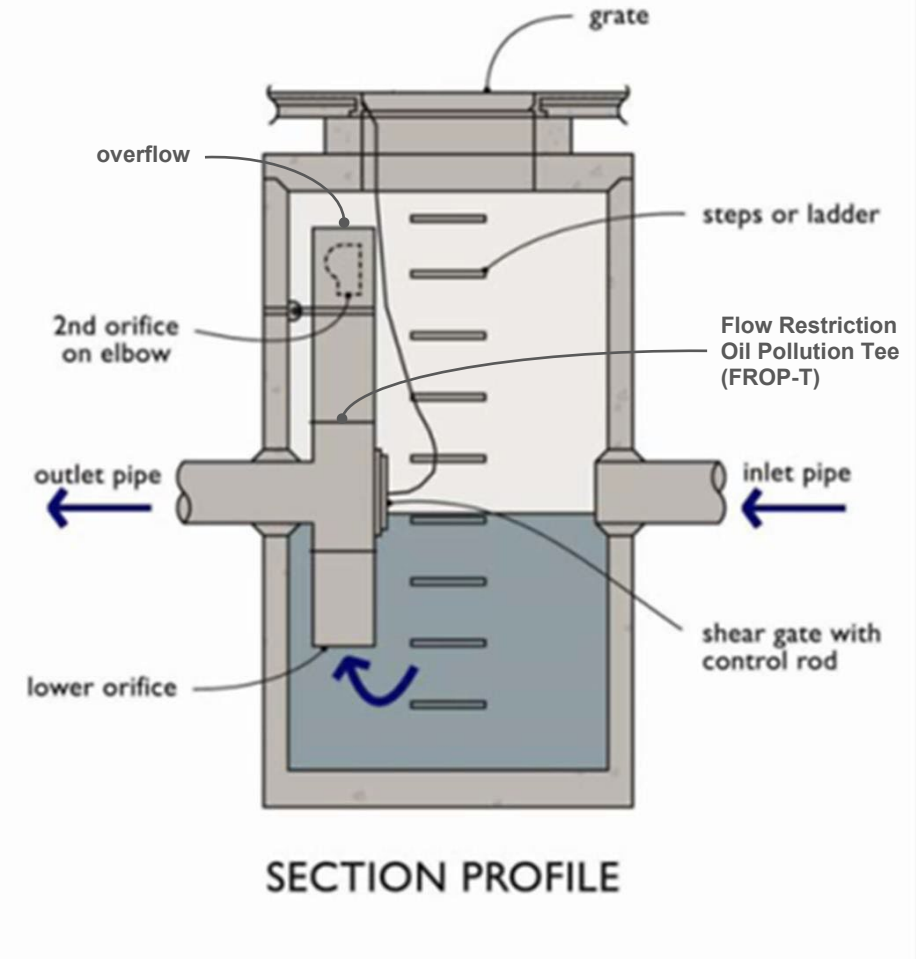
Flow control structures and flow restrictors direct or restrict flow in or out of facility components. Outflow controls on detention facilities are a common example where flow control structures slowly release stormwater at a specific rate. The flow is regulated by a combination of orifices (holes with specifically sized diameters) and weirs (plates with rectangular or "V" shaped notch). Lack of maintenance of the control structure can result in the plugging of an orifice. If these flow controls are damaged, plugged, bypassed, or not working properly, the facility could overtop or release water too quickly.

Control structures have a history of maintenance-related problems and it is imperative to establish a good maintenance program for them to function properly. Sediment typically builds up inside the structure, which blocks or restricts flow to the outlet. To prevent this problem, routinely clean out these structures and conduct regular inspections to detect the need for non-routine cleanout.

Facility objects that are typically associated with a control structure/flow restrictor include:

- detention ponds
- media cartridge filters
- closed detention system
- conveyance stormwater pipe





Key Operations and Maintenance Considerations

- Conduct regular inspections of control structures to detect the need for non-routine cleanout, especially if construction or land-disturbing activities occur in the contributing drainage area.
- The most common tool for cleaning control structures/flow restrictors is a truck with a tank and vacuum hose (Vactor® truck) to remove sediment and debris from the sump.
- A control structure is an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a control structure, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Control Structure/Flow Restrictor			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
Structure	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the structure opening or is blocking capacity of the structure by more than 10%.	No Trash or debris blocking or potentially blocking entrance to structure.
		Trash or debris in the structure that exceeds 1/3 the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the structure.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Sediment	Sediment exceeds 60% of the depth from the bottom of the structure to the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section.	Sump of structure contains no sediment.
	Damage to frame and/or top slab	Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering structure through cracks, or maintenance person judges that structure is unsound.	Structure is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering structure through cracks.	No cracks more than 1/4 inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Structure has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Ladder rungs missing or unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
FROP-T Section	Damage	T section is not securely attached to structure wall and outlet pipe structure should support at least 1,000 lbs of up or down pressure.	T section securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight or show signs of deteriorated grout.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.
Shear Gate	Damaged or missing	Shear gate is missing.	Replace shear gate.
		Shear gate is not watertight.	Gate is watertight and works as designed.

		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
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.
	Deformed or damaged lip	Lip of overflow pipe is bent or deformed.	Overflow pipe does not allow overflow at an elevation lower than design
Inlet/Outlet Pipe	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Metal Grates (If Applicable)	Unsafe grate opening	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.	Grate free of trash and debris.
	Damaged or missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. Any open structure requires urgent maintenance.	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

Conveyance Pipe

Storm sewer pipes convey stormwater. Inlet and outlet stormwater pipes convey stormwater in, through, and out of stormwater facilities.

Pipes are built from many materials. Pipes are cleaned to remove sediment or blockages when problems are identified. Stormwater pipes must be clear of obstructions and breaks to prevent localized flooding. All stormwater pipes should be in proper working order and free of the possible defects listed below.

Key Operations and Maintenance Considerations

- The most common tool for cleaning stormwater conveyance pipes is a truck with a tank, vacuum hose, and a jet hose (Vactor® truck) to flush sediment and debris from the pipes.

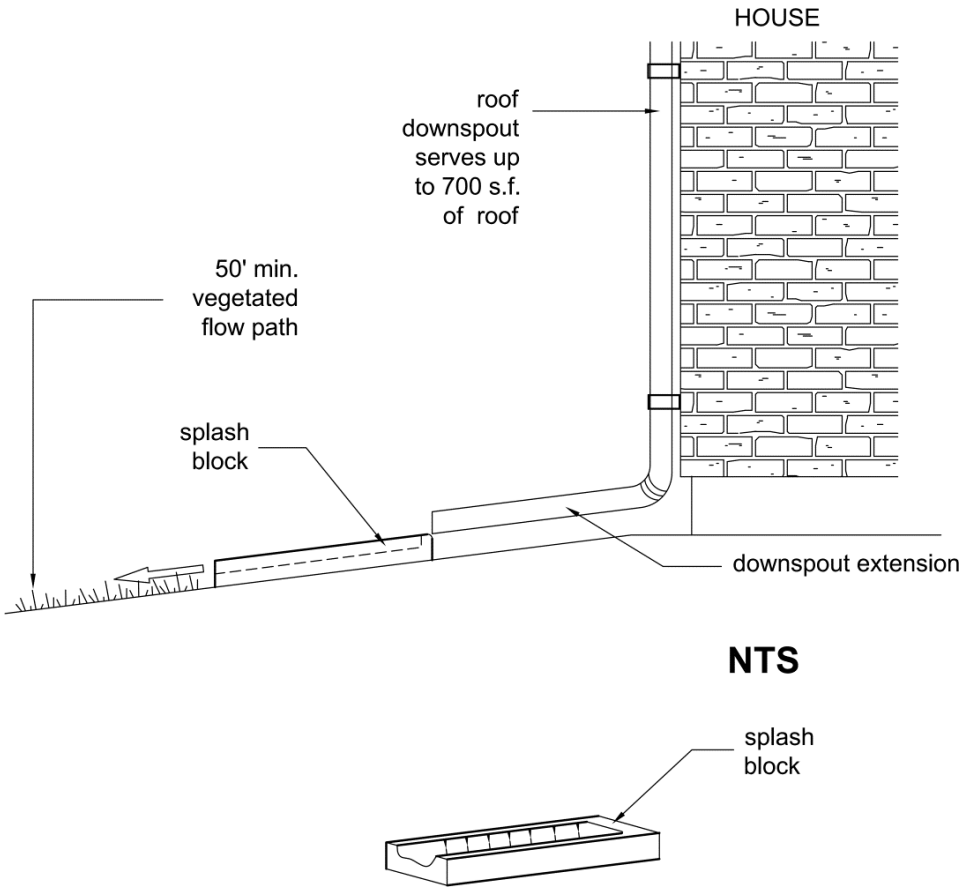
Conveyance Pipe			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source.	No contaminants or pollutants present.
	Obstructions, Including Roots	Root enters or deforms pipe, reducing flow.	Roots have been removed from pipe (using mechanical methods; do not put root-dissolving chemicals in storm sewer pipes). If necessary, vegetation over the line removed.
	Sediment and Debris	Sediment depth is greater than 20% of pipe diameter.	Pipe has been cleaned and is free of sediment/ debris. (Upstream debris traps installed where applicable.)
	Debris Barrier or Trash Rack Missing	Stormwater pipes > than 18 inches need debris barrier.	Debris barrier present on all stormwater pipes 18 inches and greater.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.

Downspout Splash Block

Downspout splash block dispersion systems consist of splash blocks, which serve to spread roof runoff over vegetated pervious areas.

Facility objects that are typically associated with downspout splash block include:

- Splash block
- Downspout extension
- Dispersal area: Stormwater is dispersed to an area vegetated with well-established lawn or pasture, landscaping with well-established groundcover, or native vegetation with natural groundcover. The required vegetated flow path is 50 feet for splash blocks and concentrated dispersion.



Downspout Dispersion using Splash Blocks

Key Operations and Maintenance Considerations

- For dispersion practices to be effective, the dispersion area must remain covered with dense, well-established vegetation. Site uses should protect vegetation and avoid compaction.
- The groundcover for the extent of the flow in any dispersal area must be maintained to be dense enough to help disperse and infiltrate flows and to prevent erosion.
- The most common tools for cleaning these systems are hand tools to redistribute material disturbed by concentrated flows and a hose to flush downspouts.

Downspout Splash Block			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Pests	Signs of pest infestations (IPM protocol threshold(s) are exceeded), including rodent holes or mounds that disturb dispersion flow paths.	Pests are not present or engaged in activities that present a significant public health risk or compromise to the intended design function of the facility. Pests that have exceeded acceptable thresholds have been addressed using appropriate IPM measures.
	Inspection Frequency	Annually and after large storms.	Rain harvesting equipment is functioning normally.
Splash Block	Water Directed Towards Building	Water is being directed towards building structure.	Water is directed away from foundations and other building structures.
	Downspout water misdirected	Water coming from the downspout is not discharging to the dispersal area.	Water is discharging normally to the dispersal area.
	Dislodged	Splash block moved from outlet of downspout.	Splash block correctly positioned to catch discharge from downspout.
	Trash and Debris	Trash and debris accumulated on the splash block.	Splash block site free of any trash or debris.
	Erosion	Water coming off the splash block causing erosion.	No erosion occurs from the splash block.
		Water disrupts soil media.	Water is dispersed into soil/mulch/plantings in a manner that does not create erosion or other issues due to concentrated flows.

Dispersal Area	Erosion or Sediment Accumulation	Erosion (gullies/ rills) greater than 2 inches deep in dispersal area. Accumulated sediment or debris to extent that blocks or channelizes flow path.	Cause of erosion has been eliminated and the damaged area has been repaired and stabilized.
	Standing Water After Storm Event	Standing surface water in dispersion area remains for more than 3 days after the end of a storm event.	Standing water drains within 72 hours of a storm event.
	Transition Zone Erosion and Sizing	Adjacent soil erosion; uneven surface creating concentrated flow discharge; or less than two feet of width.	Transition zone meets design criteria and does not exhibit erosion or other evidence of concentrated flows.
	Poor Vegetation Cover	Poor vegetation cover such that erosion is occurring.	Vegetation has been properly watered and established to meet facility design specifications.
	Excessive Vegetation Cover	Vegetation inhibits dispersed flow along flow path.	Vegetation has been weeded, trimmed, pruned, or thinned to meet facility design criteria.

Grounds

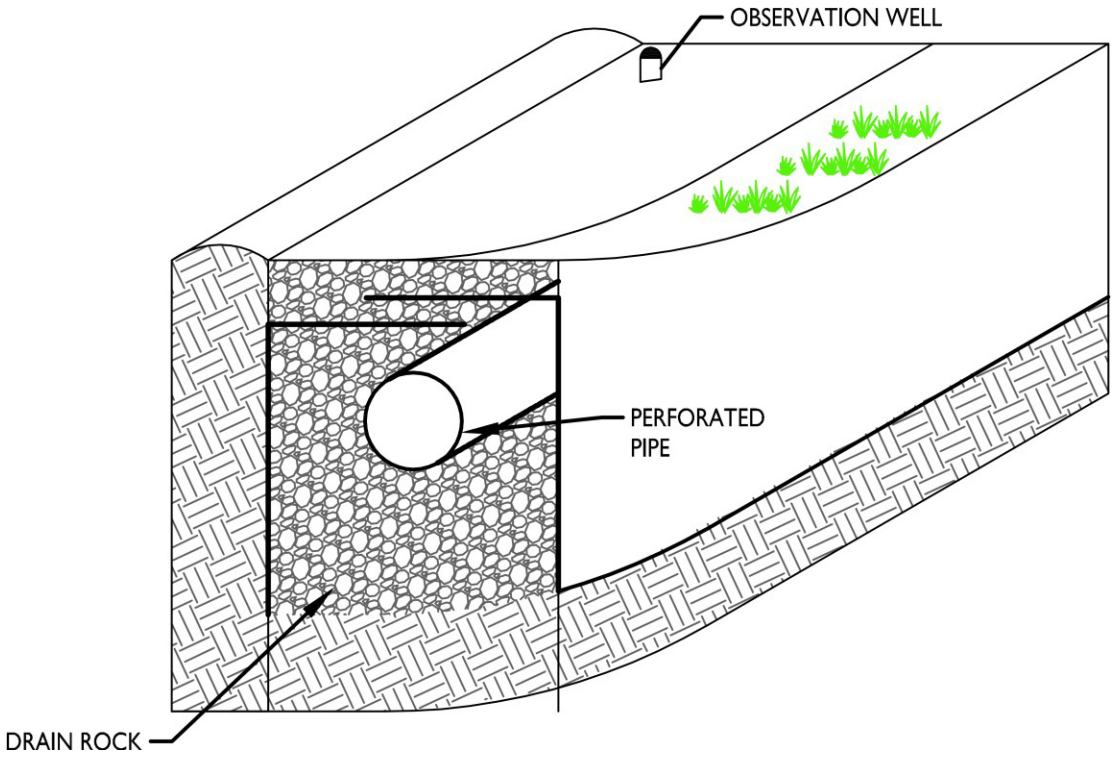
Grounds (Landscaping)			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
Site	Trash or litter	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Trees and Shrubs	Hazard	Any tree or limb of a tree identified as having a potential to fall and cause property damage or threaten human life. A hazard tree identified by a qualified arborist must be removed as soon as possible.	No hazard trees in facility.
	Damaged	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trees and shrubs with less than 5% of total foliage with split or broken limbs.
		Trees or shrubs that have been blown down or knocked over.	No blown down vegetation or knocked over vegetation. Trees or shrubs free of injury.
		Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Tree or shrub in place and adequately supported; dead or diseased trees removed.

Infiltration Trench

A stormwater infiltration trench is a closed basin or an open-topped trench built by excavating below existing ground. Infiltration trenches temporarily store stormwater runoff during rain events. Infiltration trenches do not discharge to a downstream conveyance system or nearby surface water. Instead, infiltration trenches rely on the ability of the site's soils to infiltrate the stormwater into the ground.

Facility objects that are typically associated with an infiltration trench include:

- access road or easement
- fence, gate, and water quality sign
- bioswale
- sediment trap
- field inlet
- drywell



Key Operations and Maintenance Considerations

- Maintenance should be performed as indicated by routine inspections. The principal maintenance objective is to prevent clogging, which may lead to trench failure.
- Infiltration trenches and any pretreatment BMPs should be inspected after large storm events and any accumulated debris or material removed. A more thorough inspection of the trench should be conducted at least annually. Annual inspection should include monitoring the observation well (if one exists) to confirm that the trench is draining within the specified time.
- Monitor sediment buildup in the top foot of stone aggregate or the surface inlet on the same schedule as the observation well.
- Trenches with filter fabric should be inspected for sediment deposits by removing a small section of the top layer. If inspection indicates that the trench is partially or completely clogged, it should be restored to its design condition.
- The most common tools for cleaning infiltration trenches are hand tools to remove built-up sediments and the tops layers of clogged infiltration media from the trench.

Infiltration Trench			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source.	No contaminants or pollutants present.
	Sediment Depth (via Surface/ Observation Well Inspection)	Sediment depth greater than one foot above stone aggregate or the surface inlet or 20% of the pipe diameter.	No sediment in infiltration trench.
	Drainage Slow	Decreased capacity that indicates slow drainage. Does not meet facility design infiltration rate. The Water Quality Design Storm Volume does not infiltrate within 48 hours. Water remains in the trench for greater than 24 hours after the end of most moderate rainfall events.	Perforated drain pipe has been cleaned and drainage rates are per design specifications. (Do not allow removed sediment and water to discharge back into the storm sewer.)
	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%.	No trash or debris located immediately in front of catch basin or on grate opening.

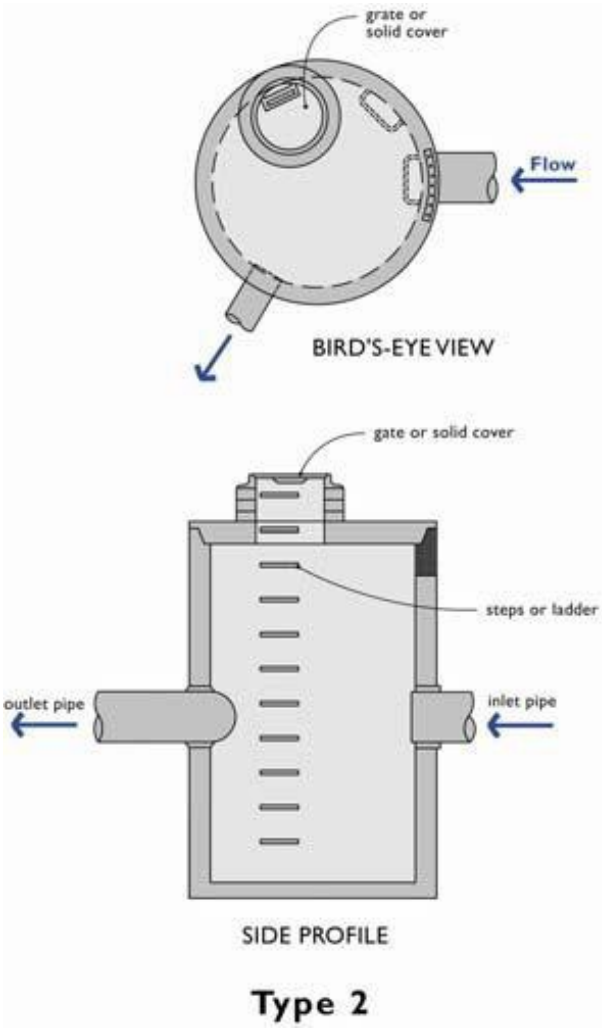
Manhole

A manhole is an underground concrete structure typically fitted with a slotted grate to collect stormwater runoff and route it through underground pipes. Manholes can also be used as a junction in a pipe system and may have a solid lid. A manhole is also known as a Type 2 catch basin.

Manholes are round concrete structures ranging in diameter from 4 feet to 8 feet. They are used when the connecting conveyance pipe is 18 inches or greater or the depth from grate to pipe bottom exceeds 5 feet. Manholes typically have steps mounted on the side of the structure to allow access.

Manholes typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some manholes are also fitted with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or oils.

Manholes are often associated with other stormwater facilities.



Key Operations and Maintenance Considerations

- The most common tool for cleaning manholes is a truck with a tank and vacuum hose (Vactor® truck) to remove sediment and debris from the sump.
- A manhole may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a manhole, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

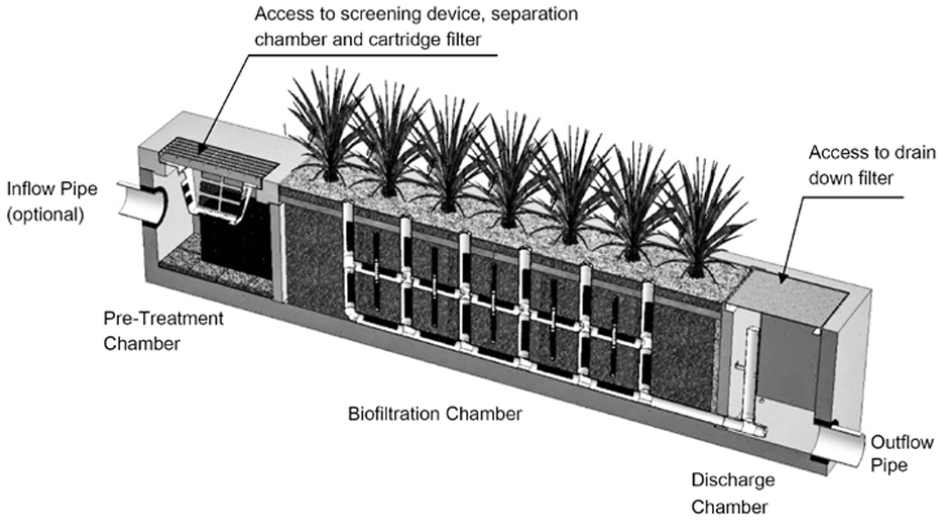
Manhole			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Trash and Debris	Trash or debris which is located immediately in front of the opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris located immediately in front of manhole or on grate opening.
		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.	No trash or debris in the basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	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 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 manhole.)	Top slab is free of holes and cracks.
		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.	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.	Basin replaced or repaired to design standards.
		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 manhole through cracks.	Pipe is regrouted and secure at basin wall.

	Settlement/ Misalignment	Manhole has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Manhole replaced or repaired to design standards.
	Vegetation Inhibiting System	Vegetation growing across and blocking more than 10% of the opening.	No vegetation blocking opening to manhole.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source.	No contaminants or pollutants present.
Manhole Cover	Cover Not in Place	Cover is missing or only partially in place. Any open manhole is a safety hazard and requires immediate maintenance.	Manhole cover 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. One or more bolts are missing.	Mechanism opens with proper tools. All bolts are seated and no bolts are missing. Cover is secure.
	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 by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to manhole 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 and meets design standards.

Modular Wetland Systems

Modular wetland systems are multi-stage, stormwater treatment systems that incorporate screening, sedimentation, filtration, adsorption, and biological remediation for removal of trash, floating and neutrally buoyant debris, suspended sediments, nutrients, heavy metals, and hydrocarbons from stormwater. Modular wetland systems typically consist of a settling chamber, a cartridge-based media pre-filter, a wetland filtration chamber, and an outlet chamber all housed in a precast concrete vault.

Example Modular Wetland System
(Source: Contech Engineered Solutions)



System Diagram
(Source: Contech Engineered Solutions)

Key Operations and Maintenance Considerations

- The most common tool for cleaning manufactured modular detention systems is a truck with a tank, vacuum hose, and pressure washer to remove sediment and debris.
- Modular wetland systems are enclosed spaces where harmful chemicals and vapors can accumulate. Therefore, the inspection and maintenance of these facilities should be conducted by an individual trained and certified to work in hazardous confined spaces.
- Cartridges require replacement when the individual cartridges no longer meet the specifications for pollutant removal.
- Periodic inspections of the inlet and outlet areas to ascertain correct operation of the system.
- Access and maintenance requirements and methods vary by type of system; some maintenance activities may be accomplished without human entry into the system. Check the manufacturer's publications and the site's maintenance plan for details.

Modular Wetland Systems			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
General	Missing or damaged internal component or cartridges	Missing or damaged internal component or cartridges	Internal components and cartridges installed properly and free from damage.
	Obstructed inlet or outlet	Accumulated of sediment and/or debris at inlet and/or outlet preventing the flow of stormwater.	Inlet and outlet free of sediment and debris.
	Poor Water Quality	Inspection of discharge water for obvious signs of poor water quality (i.e., obvious oil or other contaminants present).	Effluent discharge from outlet clear, without thick visible sheen.
	Damage – Includes Cracks in Walls and/or Bottom, Damage to Frame and/or Top Slab	Maintenance/inspection personnel determine that the unit is not structurally sound.	Unit replaced or repairs made such that unit meets design specifications and is structurally sound.
		Cracks wider than 1/2 inch at the joint of any inlet/outlet pipe or drain down pipe or evidence of soil particles entering through the cracks.	Unit repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe or drain down pipe.
	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 unit.)	Top slab is free of holes and cracks.
		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.	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Other Defects Listed in Manufacturer Specifications or Maintenance Literature	Other damage or defects that prevent the system from functioning to design specifications.	Defects repaired/ corrected per manufacturer's documentation and/ or design specifications.
Pre-Treatment Chamber	Floatables	Accumulation of floatables in which the length and width of the chamber is fully impacted more than 18 inches.	Pre-treatment chamber free of floatables.
	Debris and Sediment	Accumulated sediment depth exceeds 6 inches in the pre-treatment chamber.	Storage area free of sediment and debris.
		Accumulation of sediment on the media housed within the pre-filter cartridges, when media is more than 85% clogged.	Media in pre-filter cartridges is free of sediment.

Modular Wetland Systems			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
Discharge Chamber	Poor water level discharging	Water level in discharge chamber during full operating capacity (pre-treatment chamber water level at max height) is 20% lower or more than the highest discharge rate the system achieves.	Media in pre-filter cartridges is free of sediment.
Biofiltration Chamber	Vegetation	Vegetation dies or becomes unhealthy. Vegetation is overgrown or sparse.	Vegetation coverage restored and healthy.
		Nuisance plant species becomes abundant.	Nuisance plant species have been removed and desirable species should be planted in their place.
	Sediment and Debris in Wetland Media	Accumulation of sediment and debris in the wetland media.	Wetland media is free of sediment and debris.
Access Covers	Cover/lid not in place	Cover/lid is missing or only partially in place. Any open manhole requires immediate maintenance.	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

BMP C105: Stabilized Construction Access

Purpose

Stabilized construction accesses are established to reduce the amount of sediment transported onto paved roads outside the project site by vehicles or equipment. This is done by constructing a stabilized pad of quarry spalls at entrances and exits for project sites.

Conditions of Use

Construction accesses shall be stabilized wherever traffic will be entering or leaving a construction site if paved roads or other paved areas are within 1,000 feet of the site.

For residential subdivision construction sites, provide a stabilized construction access for each residence, rather than only at the main subdivision entrance. Stabilized surfaces shall be of sufficient length/width to provide vehicle access/parking, based on lot size and configuration.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized accesses not shown in the initial Construction SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

Design and Installation Specifications

See Figure II-3.1: Stabilized Construction Access for details. Note: the 100’ minimum length of the access shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100’).

Construct stabilized construction accesses with a 12-inch thick pad of 4-inch to 8-inch quarry spalls, a 4-inch course of asphalt treated base (ATB), or use existing pavement. Do not use crushed concrete, cement, or calcium chloride for construction access stabilization because these products raise pH levels in stormwater and concrete discharge to waters of the State is prohibited.

A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the standards listed in Table II-3.2: Stabilized Construction Access Geotextile Standards.

Table II-3.2: Stabilized Construction Access Geotextile Standards

Geotextile Property	Required Value
Grab Tensile Strength (ASTM D4751)	200 psi min.
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will be paved; this can be used as a stabilized access. Also consider the installation of excess concrete as a stabilized access. During large concrete pours, excess concrete is often available for this purpose.
- Fencing (see BMP C103: High-Visibility Fence) shall be installed as necessary to restrict traffic to the construction access.
- Whenever possible, the access shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Construction accesses should avoid crossing existing sidewalks and back of walk drains if at all possible. If a construction access must cross a sidewalk or back of walk drain, the full length of the sidewalk and back of walk drain must be covered and protected from sediment leaving the site.

Alternative Material Specification

WSDOT has raised safety concerns about the Quarry Spall rock specified above. WSDOT observes that the 4-inch to 8-inch rock sizes can become trapped between Dually truck tires, and then released off-site at highway speeds. WSDOT has chosen to use a modified specification for the rock while continuously verifying that the Stabilized Construction Access remains effective. To remain effective, the BMP must prevent

sediment from migrating off site. To date, there has been no performance testing to verify operation of this new specification. Jurisdictions may use the alternative specification, but must perform increased off-site inspection if they use, or allow others to use, it.

Stabilized Construction Accesses may use material that meets the requirements of WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Section 9-03.9(1) (WSDOT, 2016) for ballast except for the following special requirements.

The grading and quality requirements are listed in Table II-3.3: Stabilized Construction Access Alternative Material Requirements.

Table II-3.3: Stabilized Construction Access Alternative Material Requirements

Sieve Size	Percent Passing
2½″	99-100
2″	65-100
¾″	40-80
No. 4	5 max.
No. 100	0-2
% Fracture	75 min.

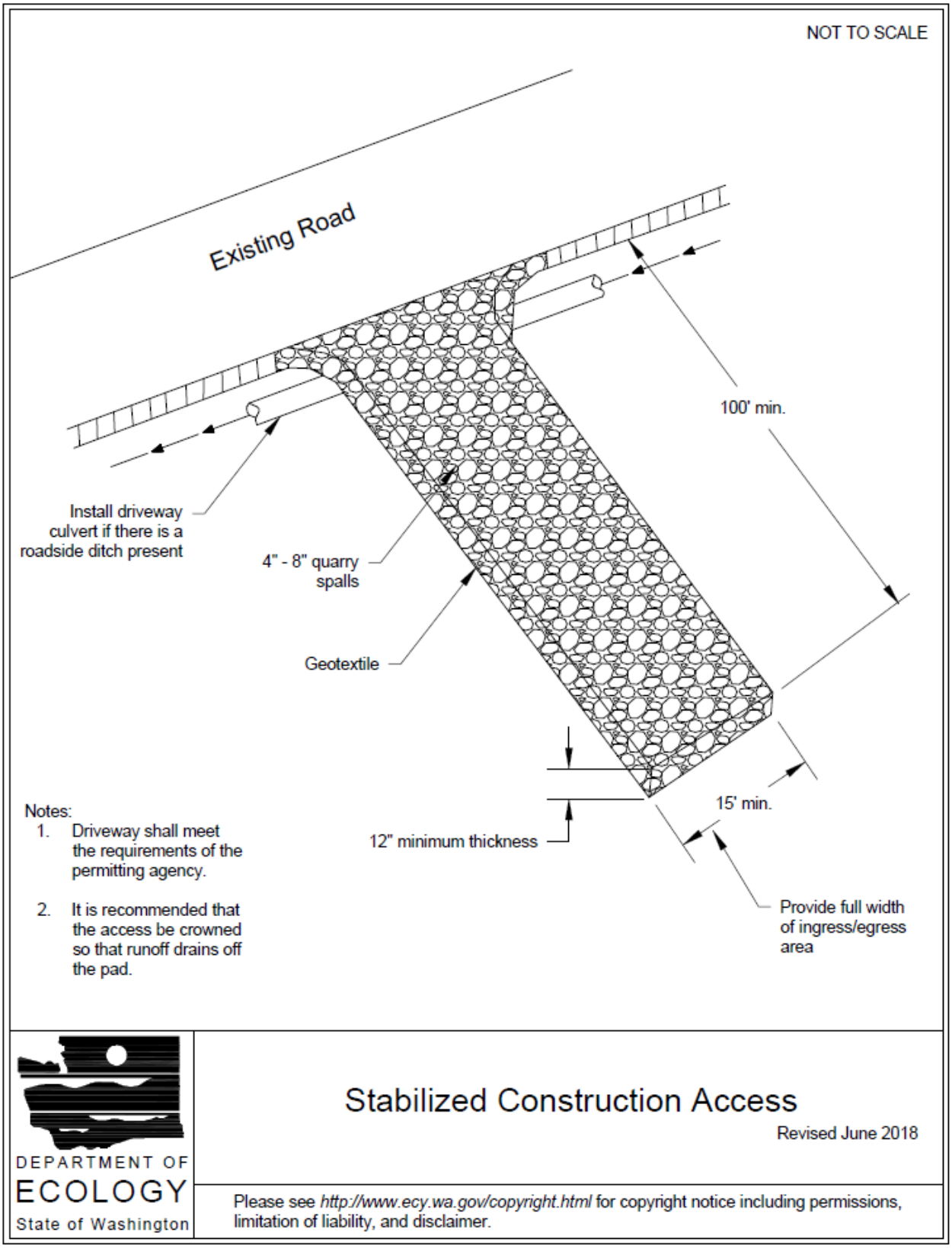
- All percentages are by weight.
- The sand equivalent value and dust ratio requirements do not apply.
- The fracture requirement shall be at least one fractured face and will apply the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.

Maintenance Standards

Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- If the access is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the access, or the installation of BMP C106: Wheel Wash.
- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when high efficiency sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump to contain the wash water shall be considered. The sediment would then be washed into the sump where it can be controlled.
- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper because this creates dust and throws soils into storm systems or conveyance ditches.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction access(es), BMP C103: High-Visibility Fence shall be installed to control traffic.
- Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

Figure II-3.1: Stabilized Construction Access



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;
- compost;
- or blends of these.

Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers.

Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

Recycled cellulose may contain polychlorinated biphenyl (PCBs). Ecology recommends that products should be evaluated for PCBs prior to use.

Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.

Any mulch or tackifier product used shall be installed per the manufacturer's instructions.

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table II-3.6: Mulch Standards and Guidelines. Consult with the local supplier or the local conservation district for their recommendations. Increase the application rate until the ground is 95% covered (i.e. not visible under the mulch layer). Note: Thickness may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Where the option of "Compost" is selected, it should be a coarse compost that meets the size gradations listed in Table II-3.5: Size Gradations of Compost as Mulch Material when tested in accordance with Test Method 02.02-B found in *Test Methods for the Examination of Composting and Compost* (Thompson, 2001).

Table II-3.5: Size Gradations of Compost as Mulch Material

Sieve Size	Percent Passing
3"	100%
1"	90% - 100%
3/4"	70% - 100%
1/4"	40% - 100%

Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Composted organic materials have higher specific gravities (densities) than straw, wood, or chipped material. Consult the Hydraulic Permit Authority (HPA) for mulch mixes if applicable.

Maintenance Standards

The thickness of the mulch cover must be maintained.

Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

Table II-3.6: Mulch Standards and Guidelines

Mulch Material	Guideline	Description
Straw	**Quality Standards**	Air-dried; free from undesirable seed and coarse material.
	Application Rates	2"-3" thick; 5 bales per 1,000 sf or 2-3 tons per acre
	Remarks	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier as even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species and it has no significant long-term benefits It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	**Quality Standards**	No growth inhibiting factors.
	Application Rates	Approx. 35-45 lbs per 1,000 sf or 1,500 - 2,000 lbs per acre
	Remarks	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at

Table II-3.6: Mulch Standards and Guidelines

Mulch Material	Guideline	Description
		least doubled. Fibers longer than about 3/4 - 1 inch clog hydromulch equipment. Fibers should be kept to less than 3/4 inch.
Compost	**Quality Standards**	No visible water or dust during handling. Must be produced per WAC 173-350, Solid Waste Handling Standards, but may have up to 35% biosolids.
	Application Rates	2" thick min.; approx. 100 tons per acre (approx. 750 lbs per cubic yard)
	Remarks	More effective control can be obtained by increasing thickness to 3". Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Compost used for mulch has a coarser size gradation than compost used for BMP C125: Topsoiling / Composting or BMP T5.13: Post-Construction Soil Quality and Depth. It is more stable and practical to use in wet areas and during rainy weather conditions. Do not use near wetlands or near phosphorous impaired water bodies.
Chipped Site Vegetation	**Quality Standards**	Gradations from fines to 6 inches in length for texture, variation, and interlocking properties. Include a mix of various sizes so that the average size is between 2- and 4-inches.
	Application Rates	2" thick min.;
	Remarks	This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approx. 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If permanent seeding or planting is expected shortly after mulch, the decomposition of the

Table II-3.6: Mulch Standards and Guidelines

Mulch Material	Guideline	Description
		chipped vegetation may tie up nutrients important to grass establishment. Note: thick application of this material over existing grass, herbaceous species, and some groundcovers could smother and kill vegetation.
Wood-Based Mulch	**Quality Standards**	No visible water or dust during handling. Must be purchased from a supplier with a Solid Waste Handling Permit or one exempt from solid waste regulations.
	Application Rates	2" thick min.; approx. 100 tons per acre (approx. 750 lbs. per cubic yard)
	Remarks	This material is often called "wood straw" or "hog fuel". The use of mulch ultimately improves the organic matter in the soil. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so evidence of residual vegetation in its composition or known inclusion of weed plants or seeds should be monitored and prevented (or minimized).
Wood Strand Mulch	**Quality Standards**	A blend of loose, long, thin wood pieces derived from native conifer or deciduous trees with high length-to-width ratio.
	Application Rates	2" thick min.
	Remarks	Cost-effective protection when applied with adequate thickness. A minimum of 95-percent of the wood strand shall have lengths between 2 and 10-inches, with a width and thickness between 1/16 and 1/2-inches. The mulch shall not contain resin, tannin, or other compounds in quantities that would be detrimental to plant life. Sawdust or wood shavings shall not be used as mulch. [Specification 9-14.4(4) from

Table II-3.6: Mulch Standards and Guidelines

Mulch Material	Guideline	Description
		the *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT, 2016)

BMP C122: Nets and Blankets

Purpose

Erosion control nets and blankets are intended to prevent erosion and hold seed and mulch in place on steep slopes and in channels so that vegetation can become well established. In addition, some nets and blankets can be used to permanently reinforce turf to protect drainage ways during high flows.

Nets (commonly called matting) are strands of material woven into an open, but high-tensile strength net (for example, coconut fiber matting). Blankets are strands of material that are not tightly woven, but instead form a layer of interlocking fibers, typically held together by a biodegradable or photodegradable netting (for example, excelsior or straw blankets). They generally have lower tensile strength than nets, but cover the ground more completely. Coir (coconut fiber) fabric comes as both nets and blankets.

Conditions of Use

Erosion control netting and blankets shall be made of natural plant fibers unaltered by synthetic materials.

Erosion control nets and blankets should be used:

- To aid permanent vegetated stabilization of slopes 2H:1V or greater and with more than 10 feet of vertical relief.
- For drainage ditches and swales (highly recommended). The application of appropriate netting or blanket to drainage ditches and swales can protect bare soil from channelized runoff while vegetation is established. Nets and blankets also can capture a great deal of sediment due to their open, porous structure. Nets and blankets can be used to permanently stabilize channels and may provide a cost-effective, environmentally preferable alternative to riprap.

Disadvantages of nets and blankets include:

- Surface preparation is required.

- On slopes steeper than 2.5H:1V, net and blanket installers may need to be roped and harnessed for safety.
- They cost at least $4,000-6,000 per acre installed.

Advantages of nets and blankets include:

- Installation without mobilizing special equipment.
- Installation by anyone with minimal training
- Installation in stages or phases as the project progresses.
- Installers can hand place seed and fertilizer as they progress down the slope.
- Installation in any weather.
- There are numerous types of nets and blankets that can be designed with various parameters in mind. Those parameters include: fiber blend, mesh strength, longevity, biodegradability, cost, and availability.

An alternative to nets and blankets in some limited conditions is BMP C202: Riprap Channel Lining. Ensure that BMP C202: Riprap Channel Lining is appropriate before using it as a substitute for nets and blankets.

Design and Installation Specifications

- See Figure II-3.3: Channel Installation (Clackamas County et al., 2008) and Figure II-3.4: Slope Installation for typical orientation and installation of nets and blankets used in channels and as slope protection. Note: these are typical only; all nets and blankets must be installed per manufacturer's installation instructions.
- Installation is critical to the effectiveness of these products. If good ground contact is not achieved, runoff can concentrate under the product, resulting in significant erosion.
- Installation of nets and blankets on slopes:
    1. Complete final grade and track walk up and down the slope.
    2. Install hydromulch with seed and fertilizer.
    3. Dig a small trench, approximately 12 inches wide by 6 inches deep along the top of the slope.
    4. Install the leading edge of the net/blanket into the small trench and staple approximately every 18 inches. NOTE: Staples are metal, "U"-

shaped, and a minimum of 6 inches long. Longer staples are used in sandy soils. Biodegradable stakes are also available.

5. Roll the net/blanket slowly down the slope as the installer walks backward. NOTE: The net/blanket rests against the installer's legs. Staples are installed as the net/blanket is unrolled. It is critical that the proper staple pattern is used for the net/blanket being installed. The net/blanket is not to be allowed to roll down the slope on its own as this stretches the net/blanket, making it impossible to maintain soil contact. In addition, no one is allowed to walk on the net/blanket after it is in place.
6. If the net/blanket is not long enough to cover the entire slope length, the trailing edge of the upper net/blanket should overlap the leading edge of the lower net/blanket and be stapled. On steeper slopes, this overlap should be installed in a small trench, stapled, and covered with soil.

- With the variety of products available, it is impossible to cover all the details of appropriate use and installation. Therefore, it is critical that the designer consult the manufacturer's information and that a site visit takes place in order to ensure that the product specified is appropriate. Information is also available in WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Division 8-01 and Division 9-14 (WSDOT, 2016).
- Use jute matting in conjunction with mulch (BMP C121: Mulching). Excelsior, woven straw blankets and coir (coconut fiber) blankets may be installed without mulch. There are many other types of erosion control nets and blankets on the market that may be appropriate in certain circumstances.
- In general, most nets (e.g., jute matting) require mulch in order to prevent erosion because they have a fairly open structure. Blankets typically do not require mulch because they usually provide complete protection of the surface.
- Extremely steep, unstable, wet, or rocky slopes are often appropriate candidates for use of synthetic blankets, as are riverbanks, beaches and other high-energy environments. If synthetic blankets are used, the soil should be hydromulched first.
- 100-percent biodegradable blankets are available for use in sensitive areas. These organic blankets are usually held together with a paper or fiber mesh and stitching which may last up to a year.

- Most netting used with blankets is photodegradable, meaning it breaks down under sunlight (not UV stabilized). However, this process can take months or years even under bright sun. Once vegetation is established, sunlight does not reach the mesh. It is not uncommon to find non-degraded netting still in place several years after installation. This can be a problem if maintenance requires the use of mowers or ditch cleaning equipment. In addition, birds and small animals can become trapped in the netting.

Maintenance Standards

- Maintain good contact with the ground. Erosion must not occur beneath the net or blanket.
- Repair and staple any areas of the net or blanket that are damaged or not in close contact with the ground.
- Fix and protect eroded areas if erosion occurs due to poorly controlled drainage.

Figure II-3.3: Channel Installation

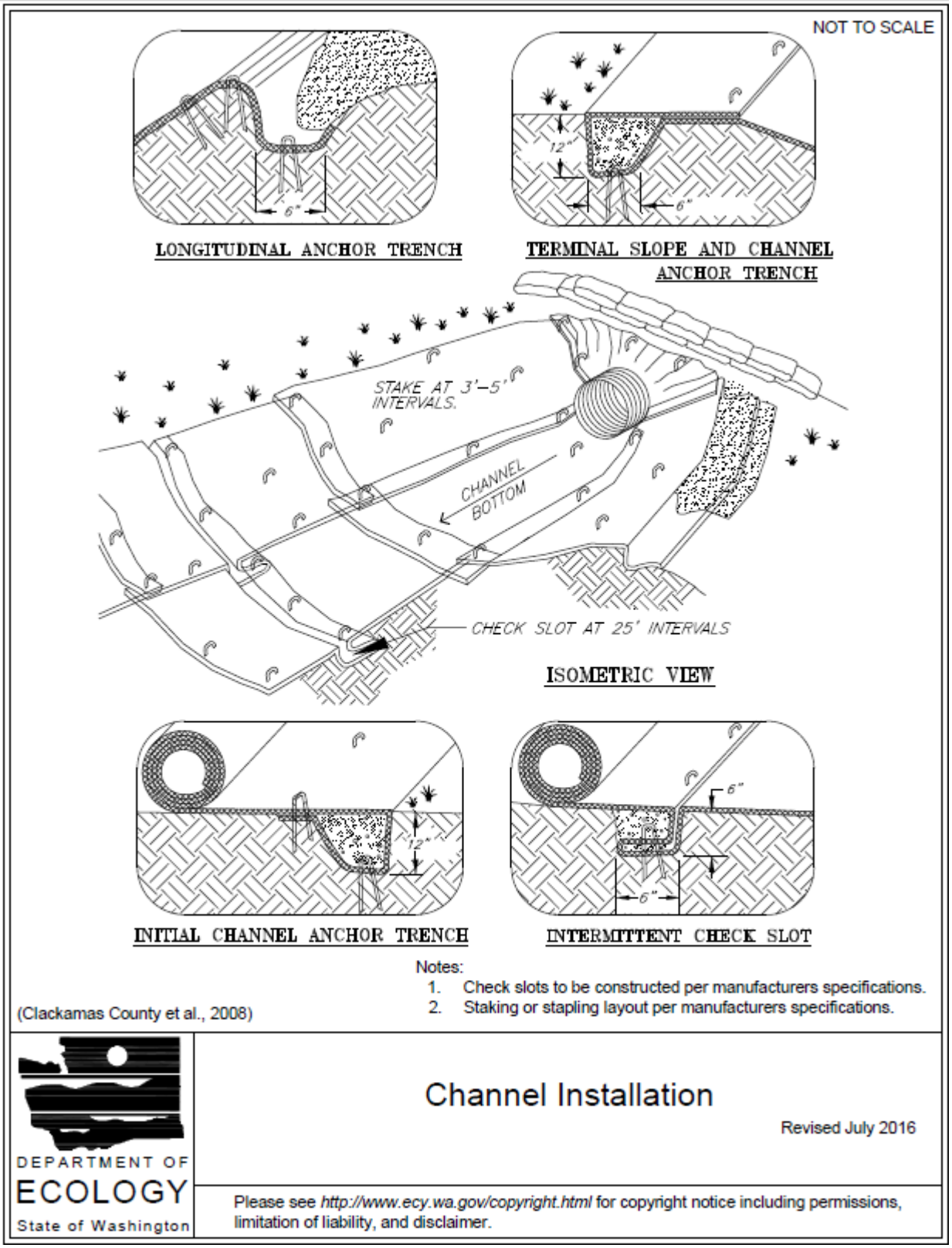
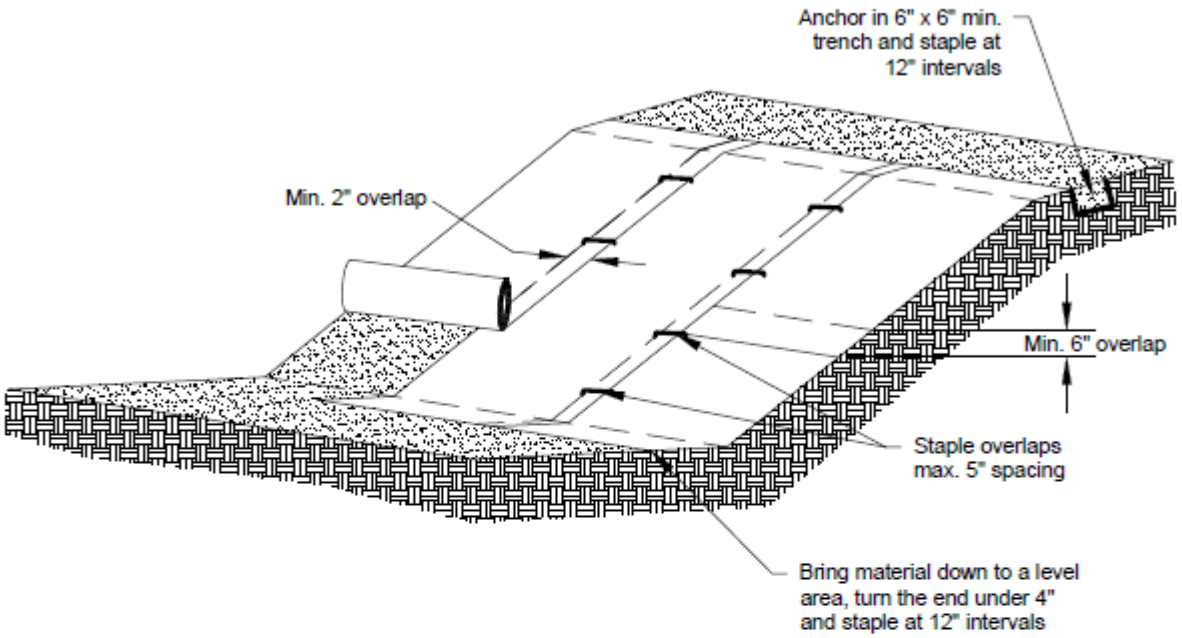


Figure II-3.4: Slope Installation



Notes:

1. Slope surface shall be smooth before placement for proper soil contact.
2. Stapling pattern as per manufacturer's recommendations.
3. Do not stretch blankets/mattings tight - allow the rolls to mold to any irregularities.
4. For slopes less than 3H:1V, rolls may be placed in horizontal strips.
5. If there is a berm at the top of the slope, anchor upslope of the berm.
6. Lime, fertilize, and seed before installation. Planting of shrubs, trees, etc. should occur after installation.

NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Slope Installation

Revised June 2016

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.

- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. However, the relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for applications greater than six months.
- Due to rapid runoff caused by plastic covering, do not use this method upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Plastic sheeting may result in increased runoff volumes and velocities, requiring additional on-site measures to counteract the increases. Creating a trough with wattles or other material can convey clean water away from these areas.
- To prevent undercutting, trench and backfill rolled plastic covering products.
- Although the plastic material is inexpensive to purchase, the cost of installation, maintenance, removal, and disposal add to the total costs of this BMP.
- Whenever plastic is used to protect slopes, install water collection measures at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to convey clean rainwater away from bare soil and disturbed areas. Do not mix clean runoff from a plastic covered slope with dirty runoff from a project.
- Other uses for plastic include:
    - Temporary ditch liner.
    - Pond liner in temporary sediment pond.
    - Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored.
    - Emergency slope protection during heavy rains.
    - Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    1. Run plastic up and down the slope, not across the slope.
    2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.
    3. Provide a minimum of 8-inch overlap at the seams.
    4. On long or wide slopes, or slopes subject to wind, tape all seams.
    5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
    6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
    7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
    8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.
- Plastic sheeting shall have a minimum thickness of 6 mil.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

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 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.

Conditions of Use

Any time concrete is used, utilize these management practices. Concrete construction project components include, but are not limited to:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways

Disposal options for concrete, in order of preference are:

1. Off-site disposal
2. Concrete wash-out areas (see BMP C154: Concrete Washout Area)
3. De minimus washout to formed areas awaiting concrete

Design and Installation Specifications

- Wash concrete truck drums at an approved off-site location or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground (including formed areas awaiting concrete), or into storm drains, open ditches, streets, or streams. Refer to BMP C154: Concrete Washout Area for information on concrete washout areas.

    - Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas as allowed in BMP C154: Concrete Washout Area.
- Wash small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) into designated concrete washout areas or into formed areas awaiting concrete pour.
- At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow washwater from areas, such as concrete aggregate driveways, to drain directly (without detention or treatment) to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no designated concrete washout areas (or formed areas, allowed as described above) are available. Dispose of contained concrete and concrete washwater (process water) properly.
- 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
- Hazardous chemicals such as acids, lime, adhesives, paints, solvents, and curing compounds
- Any other material that may be detrimental if released to the environment

Design and Installation Specifications

- The temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as an earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.

- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, within secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.

- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:
    - 1-Water Resistant Nylon Bag
    - 3-Oil Absorbent Socks 3”x 4’
    - 2-Oil Absorbent Socks 3”x 10’
    - 12-Oil Absorbent Pads 17”x19”
    - 1-Pair Splash Resistant Goggles
    - 3-Pair Nitrile Gloves
    - 10-Disposable Bags with Ties
    - Instructions

Maintenance Standards

- Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and

spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.

- Re-stock spill kit materials as needed.

BMP C154: Concrete Washout Area

Purpose

Prevent or reduce the discharge of pollutants from concrete waste to stormwater by conducting washout off-site, or performing on-site washout in a designated area.

Conditions of Use

Concrete washout areas are implemented on construction projects where:

- Concrete is used as a construction material
- It is not possible to dispose of all concrete wastewater and washout off-site (ready mix plant, etc.).
- Concrete truck drums are washed on-site.

  Note that auxiliary concrete truck components (e.g. chutes and hoses) and small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) may be washed into formed areas awaiting concrete pour.

At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.

Design and Installation Specifications

Implementation

- Perform washout of concrete truck drums at an approved off-site location or in designated concrete washout areas only.
- Do not wash out concrete onto non-formed areas, or into storm drains, open ditches, streets, or streams.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow excess concrete to be dumped on-site, except in designated concrete washout areas as allowed above.

- Concrete washout areas may be prefabricated concrete washout containers, or self-installed structures (above-grade or below-grade).
- Prefabricated containers are most resistant to damage and protect against spills and leaks. Companies may offer delivery service and provide regular maintenance and disposal of solid and liquid waste.
- If self-installed concrete washout areas are used, below-grade structures are preferred over above-grade structures because they are less prone to spills and leaks.
- Self-installed above-grade structures should only be used if excavation is not practical.
- Concrete washout areas shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

Education

- Discuss the concrete management techniques described in this BMP with the ready-mix concrete supplier before any deliveries are made.
- Educate employees and subcontractors on the concrete waste management techniques described in this BMP.
- Arrange for the contractor's superintendent or Certified Erosion and Sediment Control Lead (CESCL) to oversee and enforce concrete waste management procedures.
- A sign should be installed adjacent to each concrete washout area to inform concrete equipment operators to utilize the proper facilities.

Contracts

Incorporate requirements for concrete waste management into concrete supplier and subcontractor agreements.

Location and Placement

- Locate concrete washout areas at least 50 feet from sensitive areas such as storm drains, open ditches, water bodies, or wetlands.
- Allow convenient access to the concrete washout area for concrete trucks, preferably near the area where the concrete is being poured.

- If trucks need to leave a paved area to access the concrete washout area, prevent track-out with a pad of rock or quarry spalls (see BMP C105: Stabilized Construction Access). These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills.
- The number of concrete washout areas you install should depend on the expected demand for storage capacity.
- On large sites with extensive concrete work, concrete washout areas should be placed in multiple locations for ease of use by concrete truck drivers.

Concrete Truck Washout Procedures

- Washout of concrete truck drums shall be performed in designated concrete washout areas only.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated concrete washout areas or properly disposed of off-site.

Concrete Washout Area Installation

- Concrete washout areas should be constructed as shown in the figures below, with a recommended minimum length and minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
- Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.

- Lath and flagging should be commercial type.
- Liner seams shall be installed in accordance with manufacturers' recommendations.
- Soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.

Maintenance Standards

Inspection and Maintenance

- Inspect and verify that concrete washout areas are in place prior to the commencement of concrete work.
- Once concrete wastes are washed into the designated washout area and allowed to harden, the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis.
- During periods of concrete work, inspect the concrete washout areas daily to verify continued performance.
    - Check overall condition and performance.
    - Check remaining capacity (% full).
    - If using self-installed concrete washout areas, verify plastic liners are intact and sidewalls are not damaged.
    - If using prefabricated containers, check for leaks.
- Maintain the concrete washout areas to provide adequate holding capacity with a minimum freeboard of 12 inches.
- Concrete washout areas must be cleaned, or new concrete washout areas must be constructed and ready for use once the concrete washout area is 75% full.
- If the concrete washout area is nearing capacity, vacuum and dispose of the waste material in an approved manner.
    - Do not discharge liquid or slurry to waterways, storm drains or directly onto ground.
    - Do not discharge to the sanitary sewer without local approval.
    - Place a secure, non-collapsing, non-water collecting cover over the concrete washout area prior to predicted wet weather to prevent accumulation and overflow of precipitation.
    - Remove and dispose of hardened concrete and return the structure to a functional condition. Concrete may be reused on-site or hauled away for disposal or recycling.
- When you remove materials from a self-installed concrete washout area, build a new structure; or, if the previous structure is still intact, inspect for signs of weakening or damage, and make any necessary repairs. Re-line the structure with new plastic after each cleaning.

Removal of Concrete Washout Areas

- When concrete washout areas are no longer required for the work, the hardened concrete, slurries and liquids shall be removed and properly disposed of.
- Materials used to construct concrete washout areas shall be removed from the site of the work and disposed of or recycled.
- Holes, depressions or other ground disturbance caused by the removal of the concrete washout areas shall be backfilled, repaired, and stabilized to prevent erosion.

Figure II-3.7: Concrete Washout Area with Wood Planks

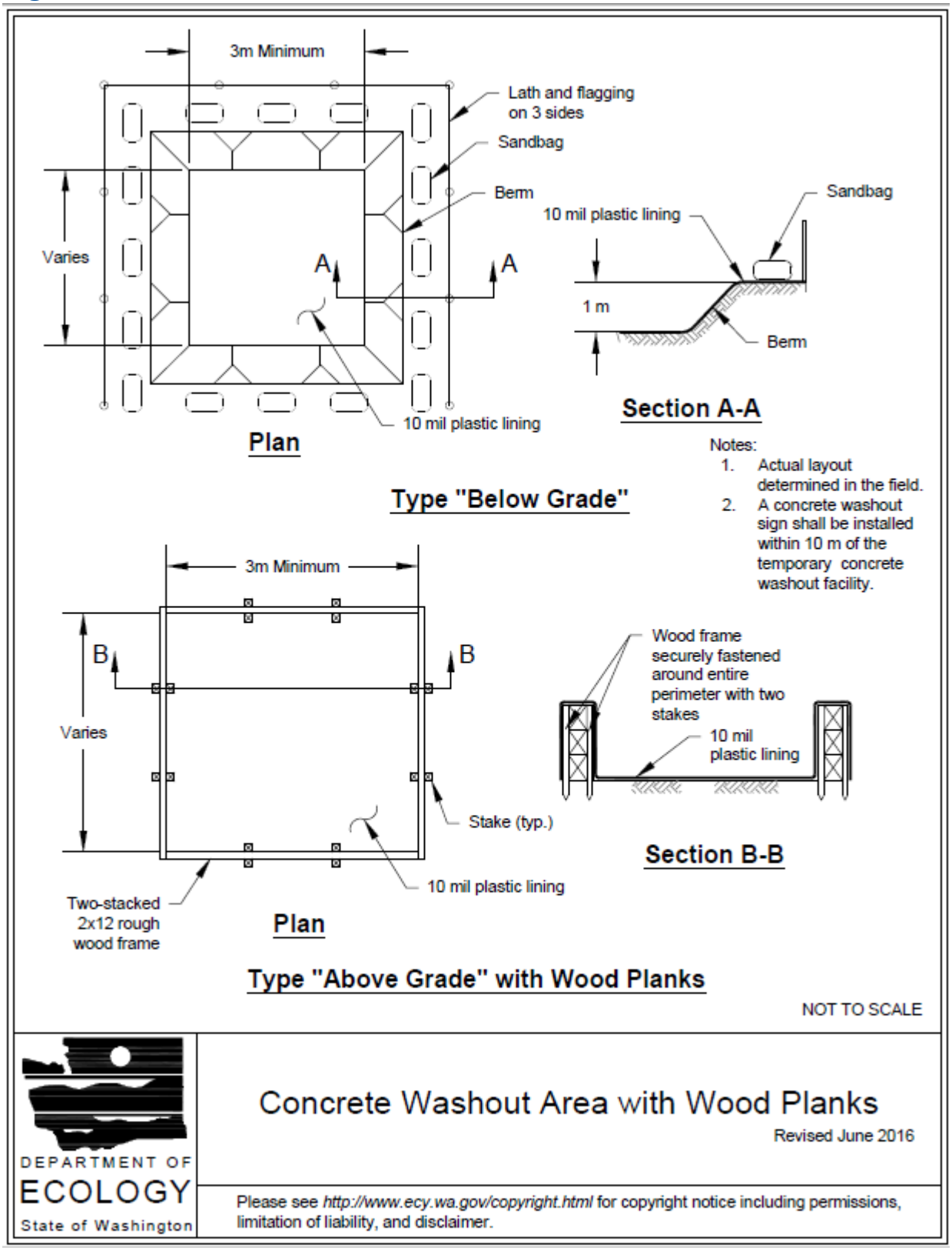


Figure II-3.8: Concrete Washout Area with Straw Bales

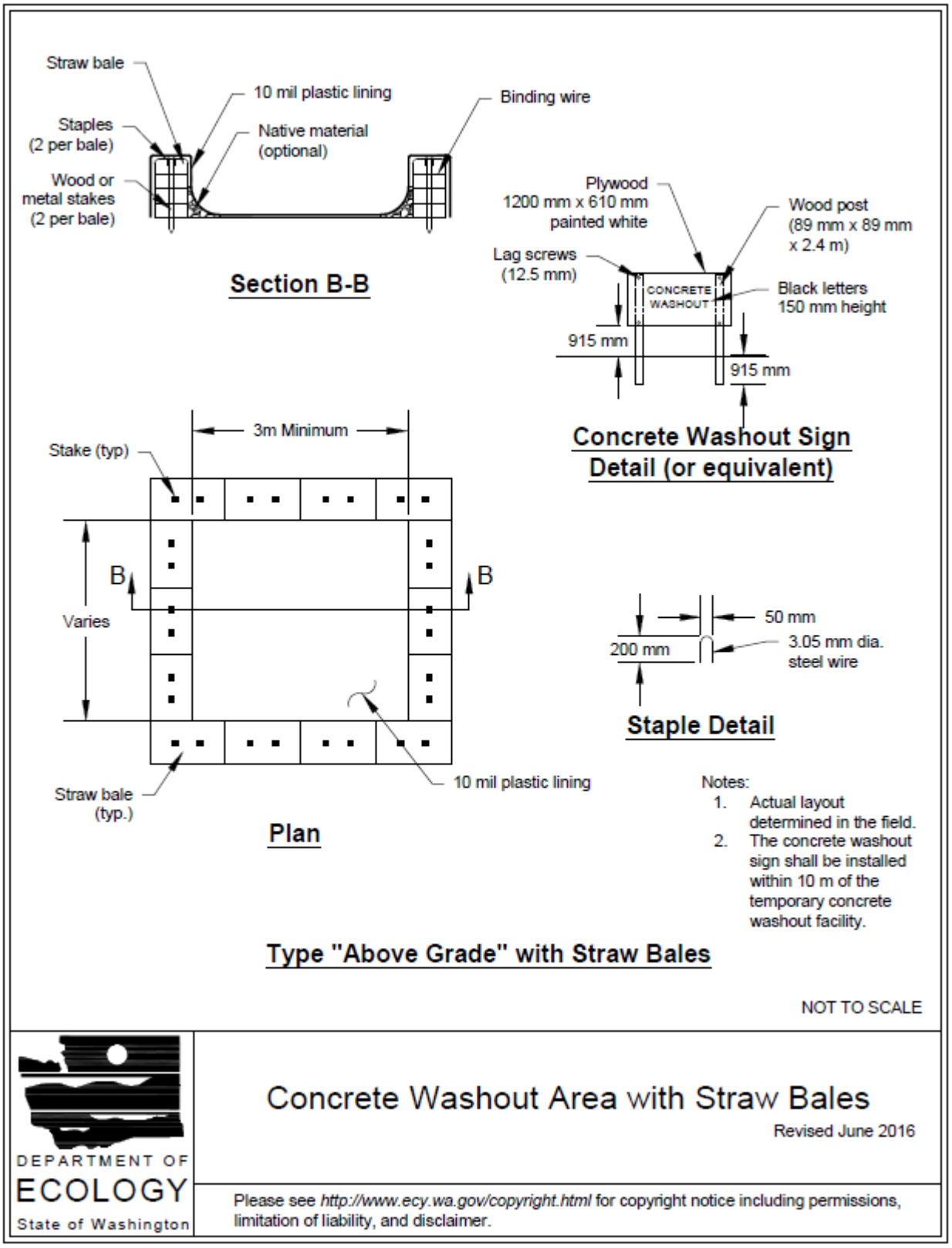
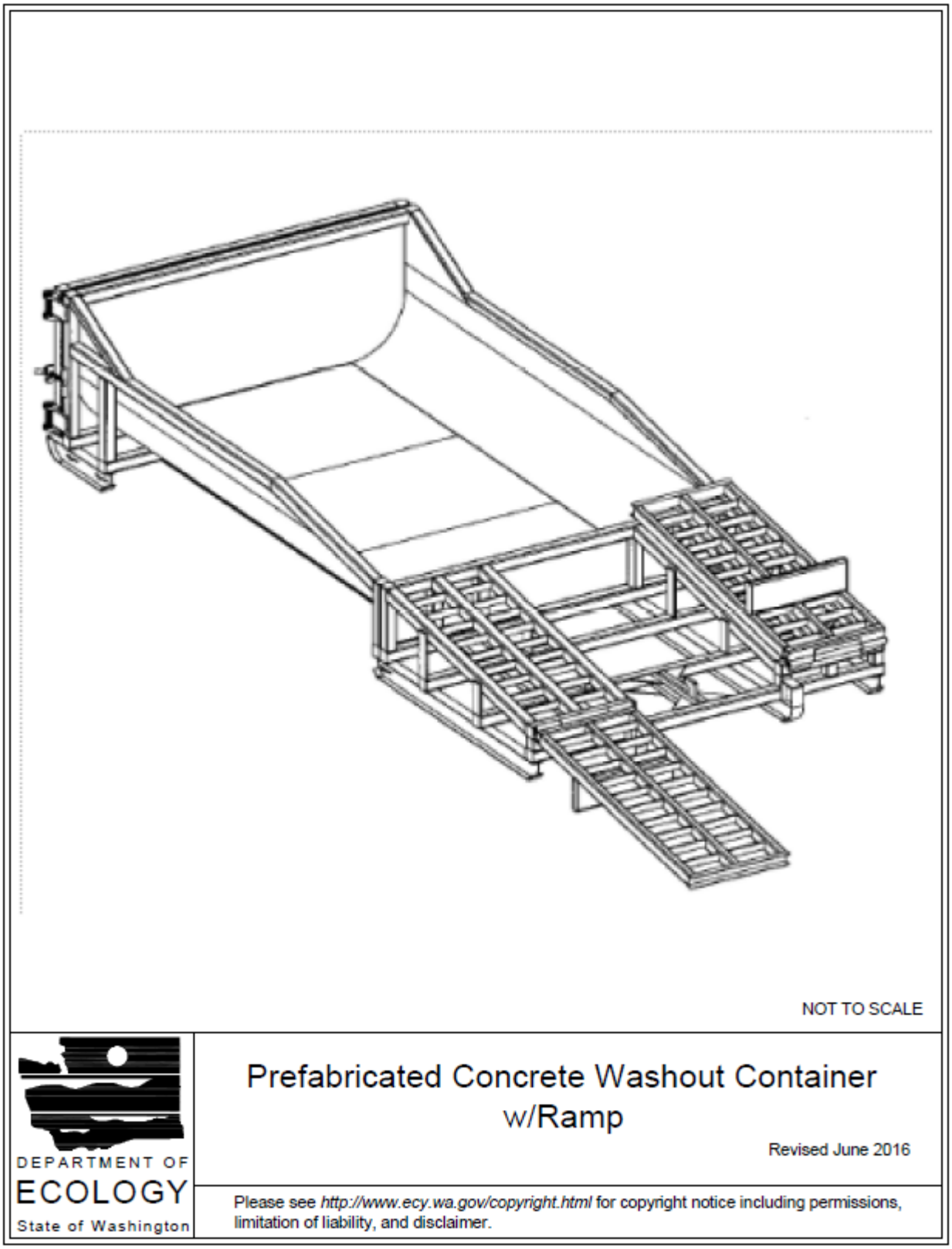


Figure II-3.9: Prefabricated Concrete Washout Container w/Ramp



BMP C160: Certified Erosion and Sediment Control Lead

Purpose

The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC), and water quality protection. The designated person shall be responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements. Construction sites one acre or larger that discharge to waters of the State must designate a Certified Erosion and Sediment Control Lead (CESCL) as the responsible representative.

Conditions of Use

A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state. Sites less than one acre may have a person without CESCL certification conduct inspections.

The CESCL shall:

- Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology.

  Ecology has provided the minimum requirements for CESCL course training, as well as a list of ESC training and certification providers at:

  https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Certified-erosion-sediment-control

  OR

- Be a Certified Professional in Erosion and Sediment Control (CPESC). For additional information go to:

  http://www.envirocertintl.org/cpesc/

Specifications

- CESCL certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or project proponent and shall be available, or on-call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL. See II-2 Construction Stormwater Pollution Prevention Plans (Construction SWPPPs).
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region, but must be on site whenever earthwork activities are occurring that could generate release of turbid water.
- Duties and responsibilities of the CESCL shall include, but are not limited to the following:
    - Maintaining a permit file on site at all times which includes the Construction SWPPP and any associated permits and plans.
    - Directing BMP installation, inspection, maintenance, modification, and removal.
    - Updating all project drawings and the Construction SWPPP with changes made.
    - Completing any sampling requirements including reporting results using electronic Discharge Monitoring Reports (WebDMR).
    - Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.
    - Keeping daily logs, and inspection reports. Inspection reports should include:
        - Inspection date/time.
        - Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
        - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
        - Any water quality monitoring performed during inspection.

- General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
- A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:
    1. Locations of BMPs inspected.
    2. Locations of BMPs that need maintenance.
    3. Locations of BMPs that failed to operate as designed or intended.
    4. Locations of where additional or different BMPs are required.

BMP C162: Scheduling

Purpose

Sequencing a construction project reduces the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

Conditions of Use

The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for the project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of ground cover leaves a site vulnerable to erosion. Construction sequencing that limits land clearing, provides timely installation of erosion and sedimentation controls, and restores protective cover quickly can significantly reduce the erosion potential of a site.

Design Considerations

- Minimize construction during rainy periods.
- Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.

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

Table II-3.10: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Surfaces	Conditions of Use
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.

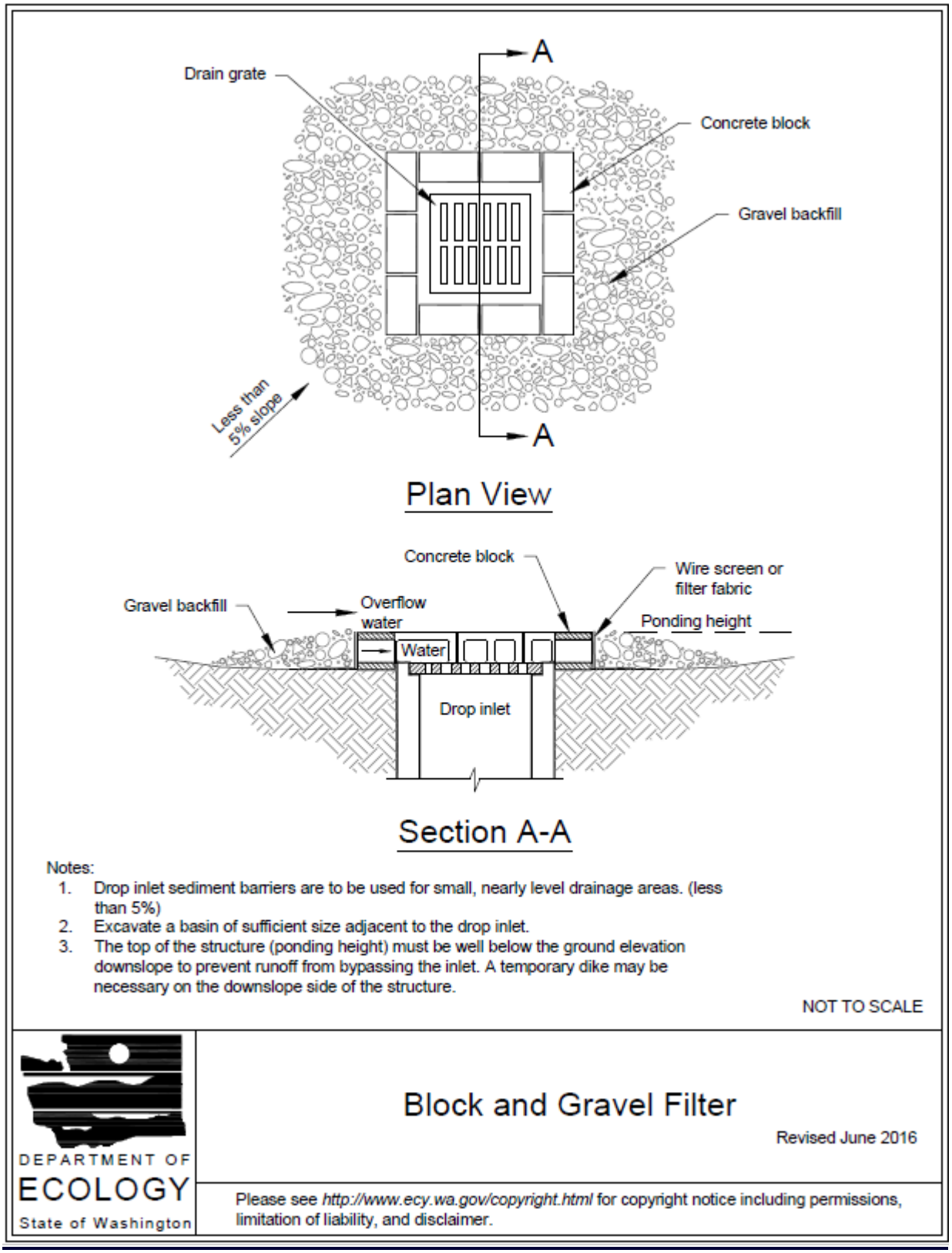
Block and Gravel Filter

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



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

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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.

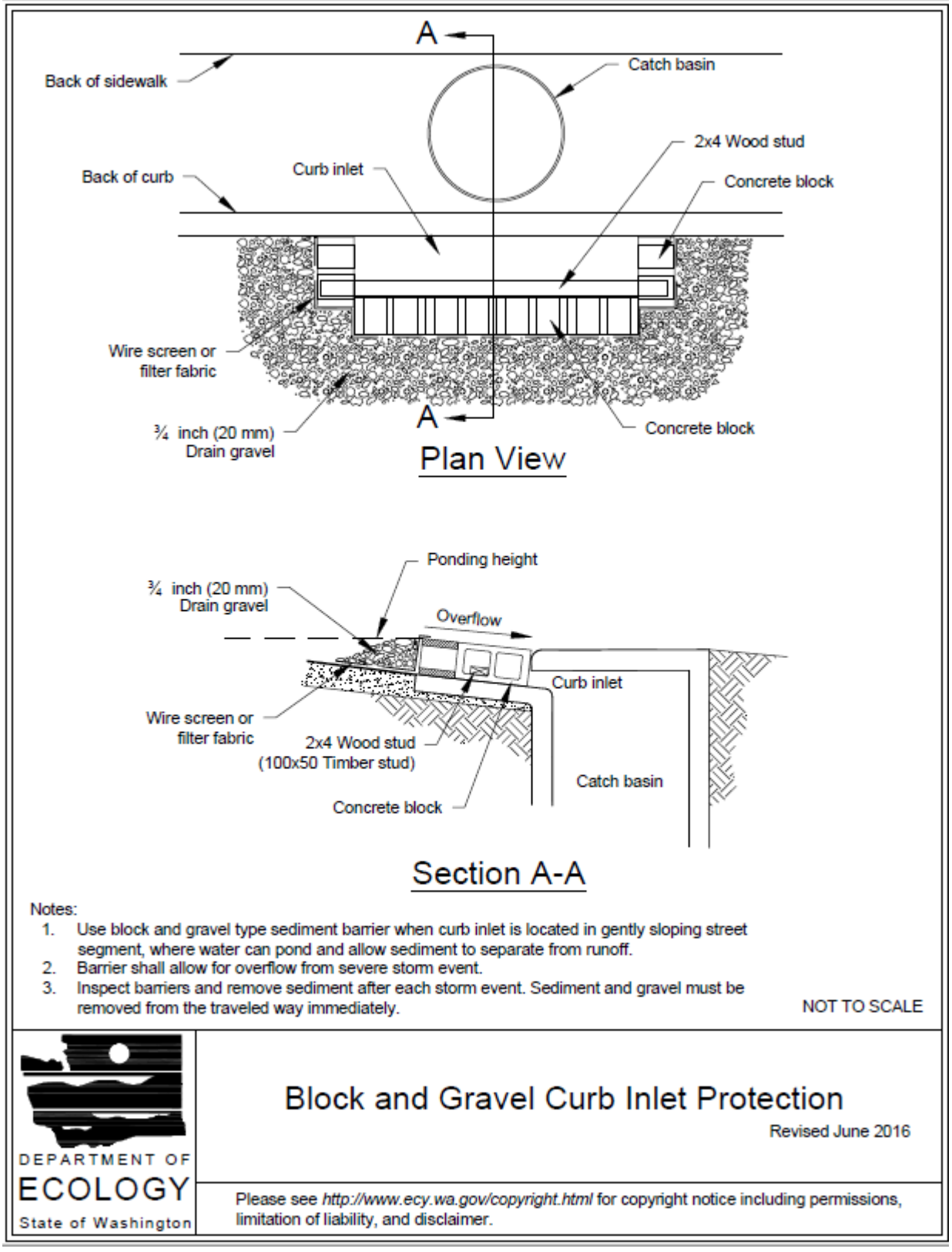
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

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



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

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State of Washington

Block and Gravel Curb Inlet Protection

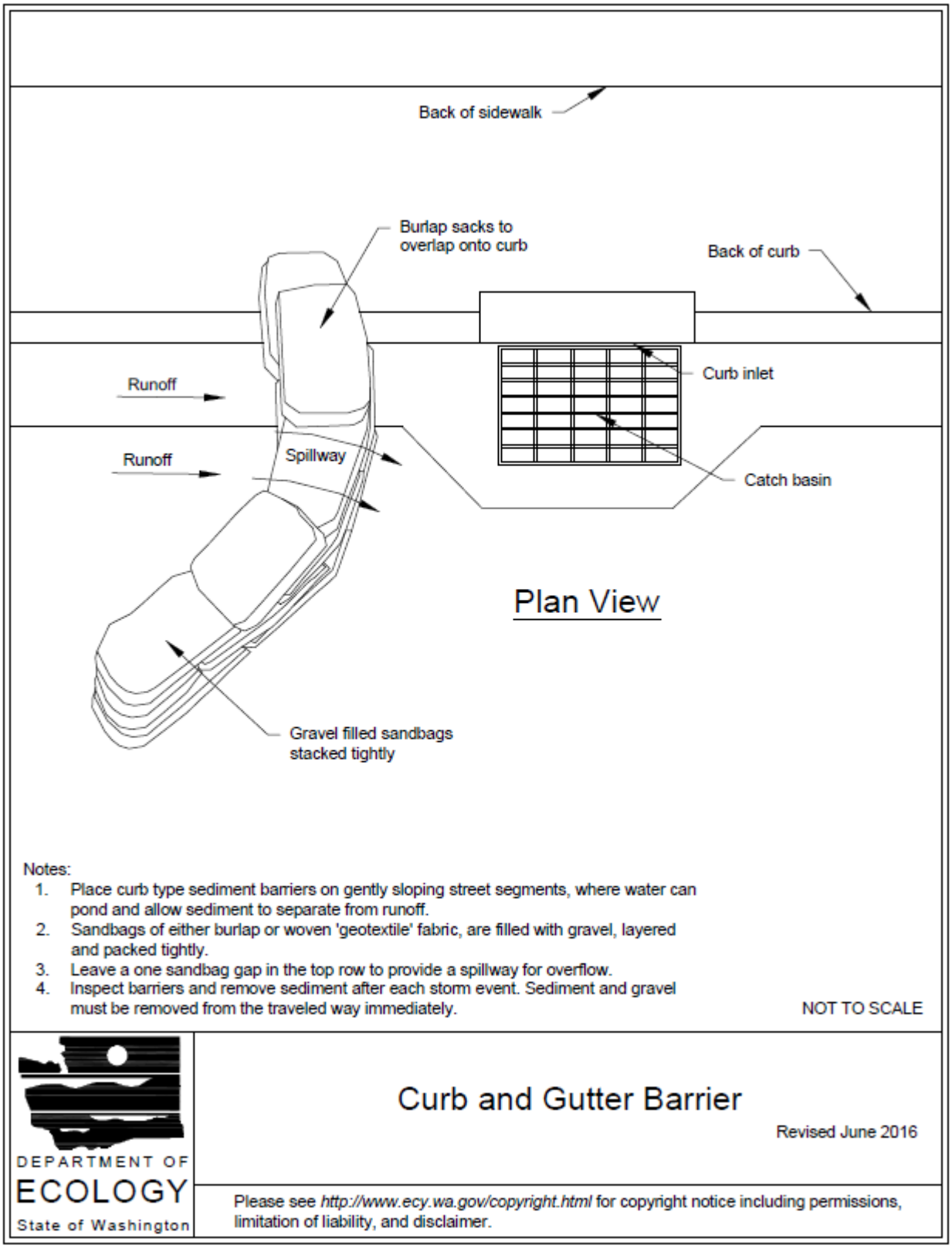
Revised June 2016

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 C233: Silt Fence

Purpose

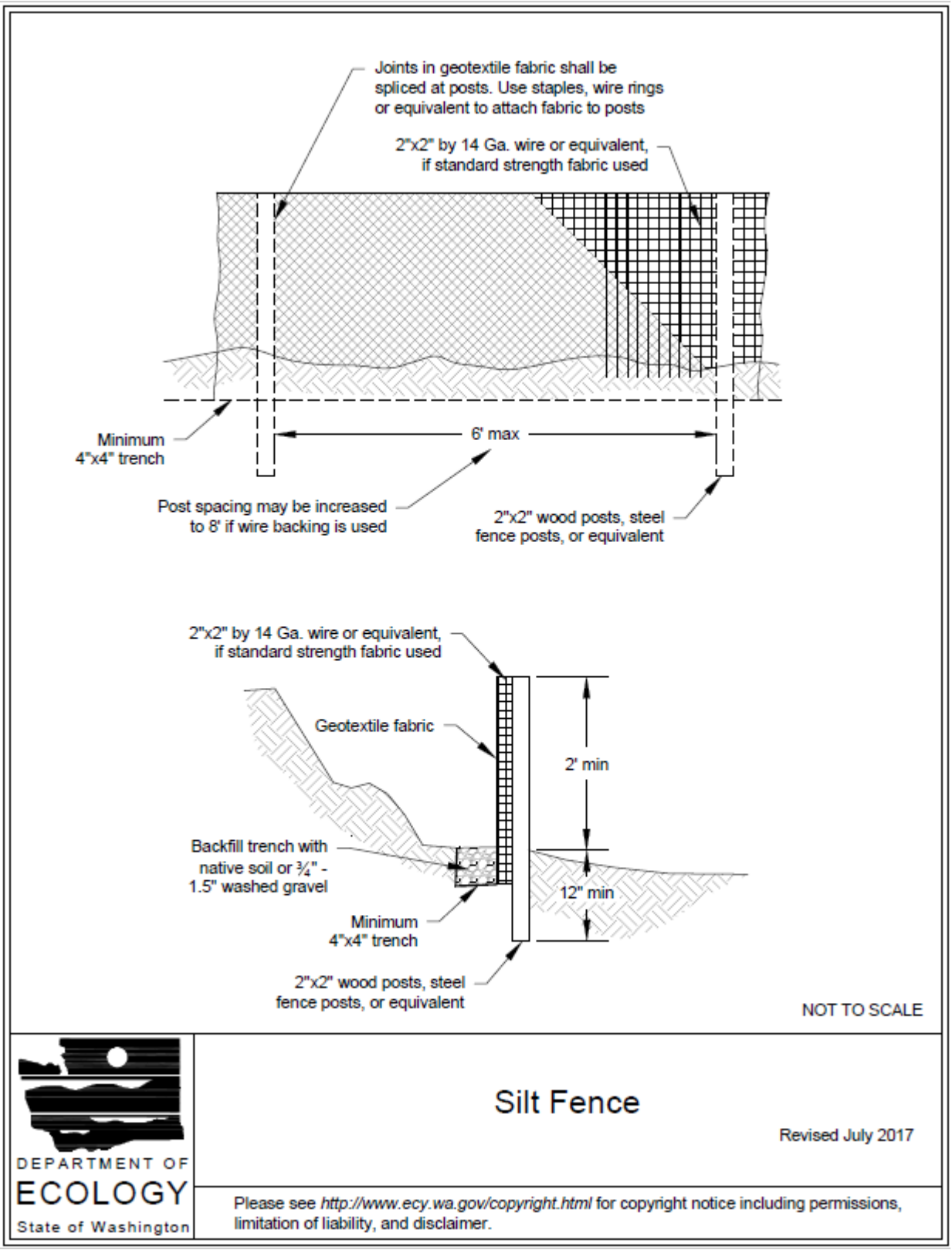
Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

Silt fence may be used downslope of all disturbed areas.

- Silt fence shall prevent sediment carried by runoff from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment trapping BMP.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

Figure II-3.22: Silt Fence



Design and Installation Specifications

- Use in combination with other construction stormwater BMPs.
- Maximum slope steepness (perpendicular to the silt fence line) 1H:1V.
- Maximum sheet or overland flow path length to the silt fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- Use geotextile fabric that meets the following standards. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in Table II-3.11: Geotextile Fabric Standards for Silt Fence):

Table II-3.11: Geotextile Fabric Standards for Silt Fence

Geotextile Property	Minimum Average Roll Value
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. Minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Support standard strength geotextiles with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the geotextile. Silt fence materials are available that have synthetic mesh backing attached.

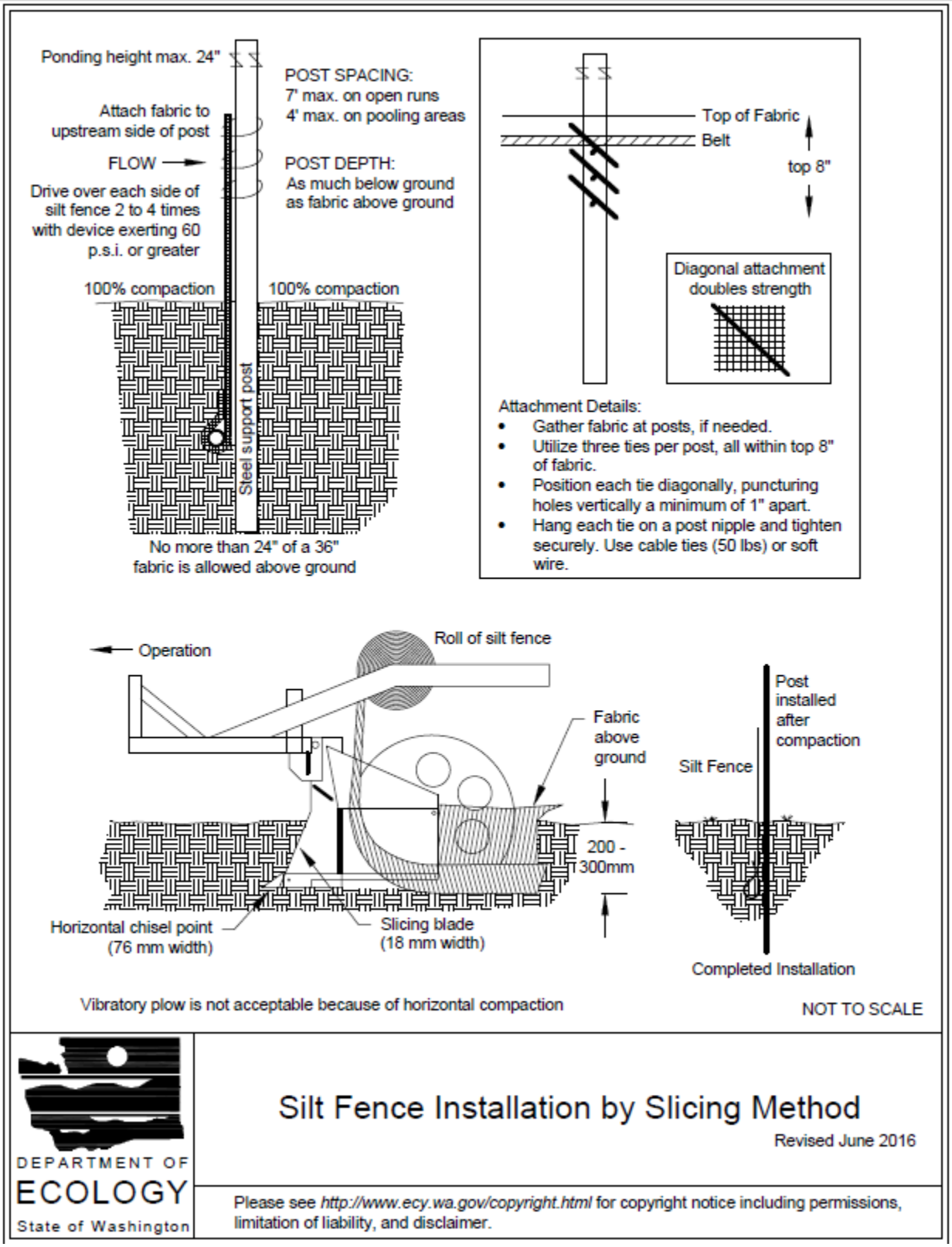
- Silt fence material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.
- One-hundred percent biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by the local jurisdiction.
- Refer to Figure II-3.22: Silt Fence for standard silt fence details. Include the following Standard Notes for silt fence on construction plans and specifications:
    1. The Contractor shall install and maintain temporary silt fences at the locations shown in the Plans.
    2. Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.
    3. The silt fence shall have a 2-feet min. and a 2½-feet max. height above the original ground surface.
    4. The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided that the overlap is long enough and that the adjacent silt fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
    5. Attach the geotextile fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the geotextile fabric to the posts in a manner that reduces the potential for tearing.
    6. Support the geotextile fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the geotextile fabric up-slope of the mesh.
    7. Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs. grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the geotextile fabric it supports.
    8. Bury the bottom of the geotextile fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried

portion of the geotextile fabric, so that no flow can pass beneath the silt fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min.

9. Drive or place the silt fence posts into the ground 18-inches min. A 12–inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.
10. Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6-feet. Posts shall consist of either:
    - Wood with minimum dimensions of 2 inches by 2 inches by 3 feet. Wood shall be free of defects such as knots, splits, or gouges.
    - No. 6 steel rebar or larger.
    - ASTM A 120 steel pipe with a minimum diameter of 1-inch.
    - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft.
    - Other steel posts having equivalent strength and bending resistance to the post sizes listed above.
11. Locate silt fences on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.
12. If the fence must cross contours, with the exception of the ends of the fence, place check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.
    - Check dams shall be approximately 1-foot deep at the back of the fence. Check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.

        - Check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Check dams shall be located every 10 feet along the fence where the fence must cross contours.
- Refer to Figure II-3.23: Silt Fence Installation by Slicing Method for slicing method details. The following are specifications for silt fence installation using the slicing method:
    1. The base of both end posts must be at least 2- to 4-inches above the top of the geotextile fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
    2. Install posts 3- to 4-feet apart in critical retention areas and 6- to 7-feet apart in standard applications.
    3. Install posts 24-inches deep on the downstream side of the silt fence, and as close as possible to the geotextile fabric, enabling posts to support the geotextile fabric from upstream water pressure.
    4. Install posts with the nipples facing away from the geotextile fabric.
    5. Attach the geotextile fabric to each post with three ties, all spaced within the top 8-inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1-inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
    6. Wrap approximately 6-inches of the geotextile fabric around the end posts and secure with 3 ties.
    7. No more than 24-inches of a 36-inch geotextile fabric is allowed above ground level.
    8. Compact the soil immediately next to the geotextile fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips. Check and correct the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck the fabric deeper into the ground if necessary.

Figure II-3.23: Silt Fence Installation by Slicing Method



Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment trapping BMP.
- Check the uphill side of the silt fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence and remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

S453 BMPs for Formation of a Pollution Prevention Team

The pollution prevention team should be responsible for implementing and maintaining all BMPs and treatment for the site. This team should be able to address any corrective actions needed on site to mitigate potential stormwater contamination. The team members should:

- Consist of those people who are familiar with the facility and its operations.
- Possess the knowledge and skills to assess conditions and activities that could impact stormwater quality at your facility, and who can evaluate the effectiveness of control measures.
- Assign pollution prevention team staff to be on duty on a daily basis to cover applicable permittee facilities when those facilities are in operation.
- Have the primary responsibility for developing and overseeing facility activities necessary to comply with stormwater requirements.
- Have access to all applicable permit, monitoring, SWPPP, and other records.
- Be trained in the operation, maintenance and inspections of all BMPs and reporting procedures.
- Establish responsibilities for inspections, operation, maintenance, and emergencies.
- Regularly meet to review overall facility operations and BMP effectiveness.

S454 BMPs for Preventive Maintenance / Good Housekeeping

Preventative maintenance and good housekeeping practices reduce the potential for stormwater to come into contact with pollutants and can reduce maintenance intervals for the drainage system and sewer system.

Applicable BMPs:

- Prevent the discharge of unpermitted liquid or solid wastes, process wastewater, and sewage to ground or surface water, or to storm drains that discharge to surface water, or to the ground. Conduct all oily parts cleaning, steam cleaning, or pressure washing of equipment or containers inside a building, or on an impervious contained area, such as a concrete pad. Direct contaminated stormwater from such an area to a sanitary sewer where allowed by local sewer authority, or to other approved treatment.
- Promptly contain and clean up solid and liquid pollutant leaks and spills including oils, solvents, fuels, and dust from manufacturing operations on an exposed soil, vegetation, or paved area.
- If a contaminated surface must be pressure washed, collect the resulting washwater for proper disposal (usually involves plugging storm drains, or otherwise preventing discharge and pumping or vactoring up washwater, for discharge to sanitary sewer or for vactor truck transport to a waste water treatment plant for disposal).
- Do not hose down pollutants from any area to the ground, storm drains, conveyance ditches, or receiving water. Convey pollutants before discharge to a treatment system approved by the local jurisdiction.
- Sweep all appropriate surfaces with vacuum sweepers quarterly, or more frequently as needed, for the collection and disposal of dust and debris that could contaminate stormwater. Use mechanical sweepers, and manual sweeping as necessary to access areas that a vacuum sweeper can't reach to ensure that all surface contaminants are routinely removed.
- Do not pave over contaminated soil unless it has been determined that ground water has not been and will not be contaminated by the soil. Call Ecology for assistance.

- Construct impervious areas that are compatible with the materials handled. Portland cement concrete, asphalt, or equivalent material may be considered.
- Use drip pans to collect leaks and spills from industrial/commercial equipment such as cranes at ship/boat building and repair facilities, log stackers, industrial parts, trucks and other vehicles stored outside.
- At industrial and commercial facilities, drain oil and fuel filters before disposal. Discard empty oil and fuel filters, oily rags, and other oily solid waste into appropriately closed and properly labeled containers, and in compliance with the Uniform Fire Code or International Building Code.
- For the storage of liquids use containers, such as steel and plastic drums, that are rigid and durable, corrosion resistant to the weather and fluid content, non-absorbent, water tight, rodent-proof, and equipped with a close fitting cover.
- For the temporary storage of solid wastes contaminated with liquids or other potential polluted materials use dumpsters, garbage cans, drums, and comparable containers, which are durable, corrosion resistant, non-absorbent, non-leaking, and equipped with either a solid cover or screen cover to prevent littering. If covered with a screen, the container must be stored under a roof or other form of adequate cover.
- Where exposed to stormwater, use containers, piping, tubing, pumps, fittings, and valves that are appropriate for their intended use and for the contained liquid.
- Clean oils, debris, sludge, etc. from all stormwater facilities regularly, including catch basins, settling/detention basins, oil/water separators, boomed areas, and conveyance systems to prevent the contamination of stormwater. Refer to Ecology Requirements for Generators of Dangerous Wastes in I-2.15 Other Requirements for references to assist in handling potentially dangerous waste.
- Promptly repair or replace all substantially cracked or otherwise damaged paved secondary containment, high-intensity parking, and any other drainage areas, subjected to pollutant material leaks or spills. Promptly repair or replace all leaking connections, pipes, hoses, valves, etc., which can contaminate stormwater.
- Do not connect floor drains in potential pollutant source areas to storm drains, surface water, or to the ground.

Recommended BMPs:

- Where feasible, store potential stormwater pollutant materials inside a building or under a cover and/or containment.
- Minimize use of toxic cleaning solvents, such as chlorinated solvents, and other toxic chemicals.
- Use environmentally safe raw materials, products, additives, etc. such as substitutes for zinc used in rubber production.
- Recycle waste materials such as solvents, coolants, oils, degreasers, and batteries to the maximum extent feasible. Contact Ecology's *Hazardous Waste & Toxics Reduction Program* at https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Hazardous-Waste-Toxics-Reduction for recommendations on recycling or disposal of vehicle waste liquids and other waste materials.
- Empty drip pans immediately after a spill or leak is collected in an uncovered area.
- Stencil warning signs at stormwater catch basins and drains, e.g., “Dump no waste – Drains to waterbody”.
- Use solid absorbents, e.g., clay and peat absorbents and rags for cleanup of liquid spills/leaks, where practicable.
- Promptly repair/replace/reseal damaged paved areas at industrial facilities.
- Recycle materials, such as oils, solvents, and wood waste, to the maximum extent practicable.

Note: Evidence of stormwater contamination by oils and grease can include the presence of visible sheen, color, or turbidity in the runoff, or present or historical operational problems at the facility. Operators can use simple pH tests, for example with litmus or pH paper. These tests can screen for high or low pH levels (anything outside a 6.5-8.5 range) due to contamination in stormwater.

S455 BMPs for Spill Prevention and Cleanup

Description of Pollutant Sources: Spills and leaks can damage public infrastructure, interfere with sewage treatment, and cause a threat to human health or the environment. Spills are often preventable if appropriate chemical and waste handling techniques are practiced effectively and the spill response plan is immediately implemented. Additional spill control requirements may be required based on the specific activity occurring on site.

Applicable BMPs:

Spill Prevention

- Clearly label or mark all containers that contain potential pollutants.
- Store and transport liquid materials in appropriate containers with tight-fitting lids.
- Place drip pans underneath all containers, fittings, valves, and where materials are likely to spill or leak.
- Use tarpaulins, ground cloths, or drip pans in areas where materials are mixed, carried, and applied to capture any spilled materials.
- Train employees on the safe techniques for handling materials used on the site and to check for leaks and spills.

Spill Plan

- Develop and implement a spill plan and update it annually or whenever there is a change in activities or staff responsible for spill cleanup. Post a written summary of the plan at areas with a high potential for spills, such as loading docks, product storage areas, waste storage areas, and near a phone. The spill plan may need to be posted at multiple locations. Describe the facility, including the owner's name, address, and telephone number; the nature of the facility activity; and the general types of chemicals used at the facility.
- Designate spill response employees to be on-site during business activities. Provide a current list of the names and telephone numbers (home and office) of designated spill response employees who are responsible for implementing the spill plan.

- Provide a site plan showing the locations of storage areas for chemicals, inlets/catch basins, spill kits and other relevant infrastructure or materials information.
- Describe the emergency cleanup and disposal procedures. Note the location of all spill kits in the spill plan.
- List the names and telephone numbers of public agencies to contact in the event of a spill.

Spill Cleanup Kits

- Store all cleanup kits near areas with a high potential for spills so that they are easily accessible in the event of a spill. The contents of the spill kit must be appropriate to the types and quantities of materials stored or otherwise used at the facility, and refilled when the materials are used. Spill kits must be located within 25 feet of all fueling/fuel transfer areas, including on-board mobile fuel trucks.

  Note: Ecology recommends that the kit(s) include salvage drums or containers, such as high density polyethylene, polypropylene or polyethylene sheet-lined steel; polyethylene or equivalent disposal bags; an emergency response guidebook; safety gloves/clothes/equipment; shovels or other soil removal equipment; and oil containment booms and absorbent pads; all stored in an impervious container.

Spill Cleanup and Proper Disposal of Waste

- Stop, contain, and clean up all spills immediately upon discovery.
- Implement the spill plan immediately.
- Contact the designated spill response employees.
- Block off and seal nearby inlets/catch basins to prevent materials from entering the drainage system or combined sewer.
- Use the appropriate material to clean up the spill.
- Do not use emulsifiers or dispersants such as liquid detergents or degreasers unless disposed of proplerly. Emulsifiers and dispersants are not allowed to be used on surface water, or in a place where they may enter storm drains, surface waters, treatments systems, or sanitary sewers.

- Immediately notify Ecology and the local jurisdiction if a spill has reached or may reach a sanitary or storm sewer, ground water, or surface water. Notification must comply with state and federal spill reporting requirements.
- Do not wash absorbent material into interior floor drains or inlets/catch basins.
- Place used spill control materials in appropriate containers and dispose of according to regulations.

S456 BMPs for Employee Training

Train all employees that work in pollutant source areas about the following topics:

- Identifying Pollution Prevention Team Members.
- Identifying pollutant sources.
- Understanding pollutant control measures.
- Spill prevention and response.
- Emergency response procedures.
- Handling practices that are environmentally acceptable. Particularly those related to vehicle/equipment liquids such as fuels, and vehicle/equipment cleaning.

Additional specialized training may be needed for staff who will be responsible for handling hazardous materials.

S457 BMPS for Inspections

Qualified personnel shall conduct inspections monthly. Make and maintain a record of each inspection on-site. The following requirements apply to inspections:

- Be conducted by someone familiar with the facility's site, operations, and BMPs.
- Verify the accuracy of the pollutant source descriptions in the SWPPP.
- Assess all BMPs that have been implemented for effectiveness and needed maintenance and locate areas where additional BMPs are needed.
- Reflect current conditions on the site.
- Include written observations of the presence of floating materials, suspended solids, oil and grease, discoloration, turbidity and odor in the stormwater discharges; in outside vehicle maintenance/repair; and liquid handling, and storage areas. In areas where acid or alkaline materials are handled or stored use a simple litmus or pH paper to identify those types of stormwater contaminants where needed.
- Eliminate or obtain a permit for unpermitted non-stormwater discharges to storm drains or receiving waters, such as process wastewater and vehicle/equipment washwater.
- Identify actions to address inspection deficiencies.

S458 BMPs for Record Keeping

See the applicable permit for specific record-keeping requirements and retention schedules for the following reports. At a minimum, retain the following reports for five years:

- Inspection reports which should include:
  - Time and date of the inspection
  - Locations inspected
  - Statement on status of compliance with the permit
  - Summary report of any remediation activities required
  - Name, title, and signature of person conducting the inspection
- Reports on spills of oil or hazardous substances in greater than Reportable Quantities (Code of Federal Regulations Title 40 Parts 302.4 and 117). Report spills of the following: antifreeze, oil, gasoline, or diesel fuel, that cause:
  - A violation of the State of Washington's Water Quality Standards.
  - A film or sheen upon or discoloration of the waters of the State or adjoining shorelines.
  - A sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

  To report a spill or to determine if a spill is a substance of a Reportable Quantity, call the Ecology regional office and ask for an oil spill operations or a dangerous waste specialist:

  - Northwest Region (425)649-7000
  - Southwest Region (360)407-6300
  - Eastern Region (509)329-3400
  - Central Region (509) 575-2490

  In addition, call the Washington Emergency Management Division at 1-800-258-5990 or 1-800-OILS-911 AND the National Response Center at 1-800-424-8802.

  Also, refer to *Focus on Emergency Spill Response* (Ecology, 2009).

The following is additional recommended record keeping:

Maintain records of all related pollutant control and pollutant generating activities such as training, materials purchased, material use and disposal, maintenance performed, etc.

S431 BMPs for Washing and Steam Cleaning Vehicles / Equipment / Building Structures

Description of Pollutant Sources: Pollutant sources include the commercial cleaning of vehicles, aircraft, vessels, and other transportation, restaurant kitchens, carpets, and industrial equipment, and large buildings with low- or high-pressure water or steam. This includes “charity” car washes at gas stations and commercial parking lots. The cleaning can include hand washing, scrubbing, sanding, etc. Washwater from cleaning activities can contain oil and grease, suspended solids, heavy metals, soluble organics, soaps, and detergents that can contaminate stormwater.

Permitting Requirements: Obtain all necessary permits for installing, altering, or repairing onsite drainage and side sewers. Restrictions on certain types of discharges may require pretreatment before they enter the sanitary sewer.

Pollutant Control Approach: The preferred approach is to cover and/or contain the cleaning activity, or conduct the activity inside a building, to separate the uncontaminated stormwater from the washwater sources. Convey washwater to a sanitary sewer after approval by the local sewer authority. Provide temporary storage before proper disposal, or recycling. Under this preferred approach, no discharge to the ground, to a storm drain, or to surface water should occur.

The Industrial Stormwater General Permit prohibits the discharge of process wastewater (e.g., vehicle washing wastewater) to ground water or surface water. Stormwater that commingles with process wastewater is considered process wastewater.

Facilities not covered under the Industrial Stormwater General Permit that are unable to follow one of the preferred approaches listed above may discharge washwater to the ground only after proper treatment in accordance with *Vehicle and Equipment Washwater Discharges Best Management Practices Manual* (Ecology, 2012).

The quality of any discharge to the ground after proper treatment must comply with Ecology’s Ground Water Quality Standards, Chapter 173-200 WAC.

Facilities not covered under the Industrial Stormwater General Permit that are unable to comply with one of the preferred approaches and want to discharge to storm sewer, must meet their local stormwater requirements. Local authorities may require treatment prior to discharge.

Contact the local Ecology Regional Office to discuss permitting options for discharge of washwater to surface water or to a storm drain after on-site treatment.

Applicable Structural Source Control BMPs:

Conduct vehicle/equipment washing in one of the following locations:

- At a commercial washing facility in which the washing occurs in an enclosure and drains to the sanitary sewer, or
- In a building constructed specifically for washing of vehicles and equipment, which drains to a sanitary sewer.

Conduct outside washing operations in a designated wash area with the following features:

- In a paved area, construct a spill containment pad to prevent the run-on of stormwater from adjacent areas. Slope the spill containment area to collect washwater in a containment pad drain system with perimeter drains, trench drains or catchment drains. Size the containment pad to extend out a minimum of four feet on all sides of the washed vehicles and/or equipment.
- Convey the washwater to a sump (like a grit separator) and then to a sanitary sewer (if allowed by the local Sewer Authority), or other appropriate wastewater treatment or recycle system. The containment sump must have a positive control outlet valve for spill control with live containment volume, and oil/water separation. Size the minimum live storage volume to contain the maximum expected daily washwater flow plus the sludge storage volume below the outlet pipe. Shut the outlet valve during the washing cycle to collect the washwater in the sump. The valve should remain shut for at least two hours following the washing operation to allow the oil and solids to separate before discharge to a sanitary sewer.
- Use a two way valve for discharges from the containment pad. This valve should be normally switched to direct water to treatment, but may be switched to the

drainage system after that pad is clean to handle stormwater runoff. The stormwater can then drain into the conveyance/discharge system outside of the wash pad (essentially bypassing the sanitary sewer or recycle system). Post signs to inform people of the operation and purpose of the valve. Clean the concrete pad thoroughly until there is no foam or visible sheen in the washwater prior to closing the inlet valve and allowing uncontaminated stormwater to overflow and drain off the pad.

Note that the purpose of the valve is to convey only washwater and contaminated stormwater to a treatment system.

- Collect the washwater from building structures and convey it to appropriate treatment such as a sanitary sewer system if it contains oils, soaps, or detergents. If the washwater does not contain oils, soaps, or detergents (in this case only a low pressure, clean, cold water rinse is allowed) then it could drain to soils that have sufficient natural attenuation capacity for dust and sediment.
- Sweep surfaces prior to cleaning/washing to remove excess sediment and other pollutants.
- If roof equipment or hood vents are cleaned, ensure that no washwater or process water is discharged to the roof drains or drainage systems.
- Label all mobile cleaning equipment as follows: "Properly dispose of all wastewater. Do not discharge to an inlet/catch basin, ditch, stream, or on the ground."

Recommended Additional BMPs:

- Mark the wash area at gas stations, multifamily residences and any other business where non-employees wash vehicles.
- Operators may use a manually operated positive control valve for uncovered wash pads, but a pneumatic or electric valve system is preferable. The valve may be on a timer circuit and opened upon completion of a wash cycle. After draining the sump or separator, the timer would then close the valve.
- Minimize use of water and detergents in washing operations when practicable.
- Use phosphate-free biodegradable detergents when practicable.
- Use the least hazardous cleaning products available.
- Consider recycling the washwater.

Operators may use soluble/emulsifiable detergents in the wash medium and should use it with care and the appropriate treatment. Carefully consider the selection of soaps and detergents and treatment BMPs. Oil/water separators are ineffective in removing emulsified or water soluble detergents. Another treatment appropriate for emulsified and water soluble detergents may be required.

Exceptions:

- At gas stations (for charity car washes) or commercial parking lots, where it is not possible to discharge the washwater to a sanitary sewer, a temporary plug or a temporary sump pump can be used at the storm drain to collect the washwater for off-site disposal such as to a nearby sanitary sewer.
- New and used car dealerships may wash vehicles in the parking stalls as long as employees use a temporary plug system to collect the washwater for disposal as stated above, or an approved treatment system for the washwater is in place.

At industrial sites, contact Ecology for NPDES Permit requirements even when not using soaps, detergents, and/or other chemical cleaners in washing trucks.

S441 BMPs for Potable Water Line Flushing, Water Tank Maintenance, and Hydrant Testing

Description of Pollutant Sources: Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in systems. Flushing done improperly can result in the discharge of solids to receiving waters. Hydrant testing may result in the discharge of rust particles.

Chemicals used in line flushing and tank maintenance are highly toxic to aquatic organisms and can degrade receiving waters.

Pollutant Control Approach: Dechlorinate and pH adjust water used for flushing, tank maintenance, or hydrant testing. Dispose of the water to the sanitary sewer if possible.

Applicable Operational BMPs:

- Remove solids from associated curbs and gutters before flushing water. Use erosion and sediment control BMPs such as BMP C235: Wattles, BMP C220: Inlet Protection, etc. to collect any solids resulting from flushing activities.
- If using super chlorination or chemical treatment as part of flushing, discharge water to the sanitary sewer. If sanitary sewer is not available, the water may be infiltrated to the ground as long as all of the following are met:
    - The water is dechlorinated to a total residual chlorine of 0.1 ppm or less.
    - Water quality standards are met.
    - A diffuser is used to prevent erosion.
    - The water does not cross property lines.
- Discharging water to a drainage system requires approval from the local jurisdiction. Check with the local jurisdiction to determine their requirements for approval. Most jurisdictions will require the water to be dechlorinated to a total residual chlorine concentration of 0.1 ppm or less and pH adjusted if necessary. Water must be volumetrically and velocity controlled to prevent resuspension of sediments or pollutants in the Municipal Separate Storm Sewer System (MS4).
- Do not over apply dechlorination agents. This can deplete the dissolved oxygen concentration and reduce the pH in discharge / receiving waters.

Optional Operational BMPs:

- If possible, design flushing to convey accumulated material to strategic locations, such as to the sanitary sewer or to a treatment facility; thus, preventing re-suspension and overflow of a portion of the solids during storm events.
- If possible, conduct flushing and tank maintenance activities on non-rainy days and during the time of year that poses the least risk to aquatic biota.

Optional Treatment BMPs:

- Treatment for dechlorinating can include an application of a stoichiometric quantity of:
    - Ascorbic Acid, Sodium Ascorbate (Vitamin C)
    - Calcium Thiosulfate
    - Sodium Sulfite tablets
    - Sodium Thiosulfate
    - Sodium Bisulfite
    - Alternate Dechlorination Solutions

S406 BMPs for Streets and Highways

Description of Pollutant Sources: These BMPs apply to the maintenance and deicing/anti-icing of streets and highways. Deicing products can be conveyed during storm events to inlets/catch basins or to receiving waters after application. Leaks and spills of these products can also occur during their handling and storage. Equipment and processes using during maintenance can contribute pollutants such as oil and grease, suspended solids, turbidity, high pH, and metals.

Pollutant Control Approach: Apply good housekeeping practices, preventative maintenance, properly train employees, and use materials that cause less adverse effects on the environment.

Applicable BMPs:

Deicing and Anti-Icing Operations

- Adhere to manufacturer's guidelines and industry standards of use and application.
- Store and transfer de and anti-icing materials on impervious containment pads, or an equivalent spill/leak containment area in accordance with S429 BMPs for Storage or Transfer (Outside) of Solid Raw Materials, Byproducts, or Finished Products.
- Sweep/clean up accumulated de and anti-icing materials and grit from roads as soon as possible after the road surface clears.
- Minimize use in areas where runoff or spray from the roadway immediately enters sensitive areas such as fish-bearing streams.

Maintenance Operations

- Use drip pans or absorbents wherever concrete, asphalt, asphalt emulsion, paint product, and drips are likely to spill, such as beneath discharge points from equipment.
- Cover and contain nearby storm drains to keep runoff from entering the drainage system.

- Collect and contain all solids, slurry, and rinse water. Do not allow these to enter gutters, storm drains, or drainage ditches or onto the paved surface of a roadway or driveway.
- Designate an area onsite for washing hand tools and collect that water for disposal.
- Conduct all fueling of equipment in accordance with S419 BMPs for Mobile Fueling of Vehicles and Heavy Equipment.
- Do not use diesel fuel for cleaning or prepping asphalt tools and equipment.
- Sweep areas as frequently as needed. Collect all loose aggregate and dust for disposal. Do not hose down areas into storm drains.
- Store all fuel, paint, and other products on secondary containment.
- Conduct paint striping operations during dry weather.

Recommended Additional BMPs:

- Where feasible and practicable, use roadway deicing chemicals that cause the least adverse environmental impact. Apply only as needed using minimum quantities. Consider the Pacific Northwest Snowfighters Qualified Products List when selecting roadway de-icers and anti-icers.
- Intensify roadway and drainage structure cleaning in early spring to help remove particulates from road surfaces.
- Include limits on toxic metals in the specifications for de/anti-icers.
- Install catch basin inserts to collect excess sediment and debris as necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.
- Research admixtures (e.g. corrosion inhibitors, surfactants) to determine what additional pollutants may be an issue. Verify with the local jurisdiction if there are any restrictions on admixtures.

S415 BMPs for Maintenance of Public and Private Utility Corridors and Facilities

Description of Pollutant Sources: Corridors and facilities at petroleum product pipelines, natural gas pipelines, water pipelines, electrical power transmission corridors, and rights-of-way can be sources of pollutants such as herbicides used for vegetation management, and eroded soil particles from unpaved access roads. At pump stations, waste materials generated during maintenance activities may be temporarily stored outside. Additional potential pollutant sources include the leaching of preservatives from wood utility poles, PCBs in older transformers, water removed from underground transformer vaults, and leaks/spills from petroleum pipelines. The following are potential pollutants: oil and grease, TSS, BOD, organics, PCBs, pesticides, and heavy metals.

Pollutant Control Approach: Implementation of spill control plans as well as control of fertilizer and pesticide applications, soil erosion, and site debris that can contaminate stormwater.

Applicable Operational BMPs:

- Minimize the amount of herbicides and other pesticides used to maintain access roads and facilities.
- Implement S411 BMPs for Landscaping and Lawn / Vegetation Management.
- Comply with WSDA Pesticide Regulations (see I-2.15 Other Requirements).
- When removing water or sediments from electric transformer vaults, determine the presence of contaminants before disposing of the water and sediments.
    - This includes inspecting for the presence of oil or sheen, and determining from records or testing if the transformers contain PCBs.
    - If records or tests indicate that the sediments or water are contaminated above applicable levels, manage these media in accordance with applicable federal and state regulations, including the federal PCB rules (40 CFR 761) and the state MTCA cleanup regulations (Chapter 173-340 WAC).
    - Water removed from the vaults can be discharged in accordance with the federal 40 CFR 761.79, and state regulations (Chapter 173-201A WAC and Chapter 173-200 WAC), or via the sanitary sewer if the requirements, including applicable permits, for such a discharge are met.

(See also Requirements for Stormwater Discharges to Public Sanitary Sewers, Septic Systems, Dead-End Sumps, and Industrial Waste Treatment Systems and Ecology Requirements for Generators of Dangerous Wastes in I-2.15 Other Requirements).

- Stabilize access roads or areas of bare ground with gravel, crushed rock, or another method to prevent erosion. Use and manage vegetation to minimize bare ground/soils that may be susceptible to erosion.
- Provide maintenance practices to prevent stormwater from accumulating and draining across and/or onto roadways. Convey stormwater through roadside ditches and culverts. The road should be crowned, outsloped, water barred, or otherwise left in a condition not conducive to erosion. Appropriately maintaining grassy roadside ditches discharging to surface waters is an effective way of removing some pollutants associated with sediments carried by stormwater.
- Maintain ditches and culverts at an appropriate frequency to ensure that plugging and flooding across the roadbed, with resulting overflow erosion, does not occur.
- Apply the appropriate BMPs in this Volume for the storage of waste materials that can contaminate stormwater.

Recommended Operational BMPs:

- When selecting utility poles for a specific location, consider the potential environmental effects of the pole or poles during storage, handling, and end-use, as well as its cost, safety, efficacy, and expected life. Use wood products treated with chemical preservatives made in accordance with generally accepted industry standards such as the American Wood Preservers Association Standards (see http://www.awpa.com/standards/). Consider alternative materials or technologies if placing poles in or near an environmentally sensitive area, such as a wetland or a drinking water well. Alternative technologies include poles constructed with material(s) other than wood such as fiberglass composites, metal, or concrete. Consider other technologies and materials, such as sleeves or caissons for wood poles, when they are determined to be practicable and available.
- As soon as practicable remove all litter from wire cutting/replacing operations.
- Implement temporary erosion and sediment control in areas cleared of trees and vegetation and during the construction of new roads.

S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems

Description of Pollutant Sources: Facilities include roadside catch basins on arterials and within residential areas, conveyance systems, detention facilities such as ponds and vaults, oil/water separators, biofilters, settling basins, infiltration systems, and all other types of stormwater treatment systems presented in Volume V. Oil and grease, hydrocarbons, debris, heavy metals, sediments and contaminated water are found in catch basins, oil and water separators, settling basins, etc.

Pollutant Control Approach: Provide maintenance and cleaning of debris, sediments, and other pollutants from stormwater collection, conveyance, and treatment systems to maintain proper operation.

Applicable Operational BMPs:

Maintain stormwater treatment facilities per the operations and maintenance (O&M) procedures presented in Appendix V-A: BMP Maintenance Tables in addition to the following BMPs:

- Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O&M improvements.
- Promptly repair any deterioration threatening the structural integrity of stormwater facilities. These include replacement of clean-out gates, catch basin lids, and rock in emergency spillways.
- Ensure adequacy of storm sewer capacities and prevent heavy sediment discharges to the sewer system.
- Regularly remove debris and sludge from BMPs used for peak-rate control, treatment, etc. and discharge to a sanitary sewer if approved by the sewer authority, or truck to an appropriate local or state government approved disposal site.
- Clean catch basins when the depth of deposits reaches 60 percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin. However, in no case should there be less than six inches clearance from the debris surface to the invert of the lowest pipe. Some catch basins (for example, WSDOT's *Catch Basin Type 1L* (WSDOT, 2011)) may have

as little as 12 inches sediment storage below the invert. These catch basins need frequent inspection and cleaning to prevent scouring. Where these catch basins are part of a stormwater collection and treatment system, the system owner/operator may choose to concentrate maintenance efforts on downstream control devices as part of a systems approach.

- Properly dispose of all solids, polluted material, and stagnant water collected through system cleaning. Do not decant water back into the drainage system from eductor trucks or vacuum equipment since there may be residual contaminants in the cleaning equipment. Do not jet material downstream into the public drainage system.
- Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catch basin.
- Post warning signs; “Dump No Waste - Drains to Ground Water,” “Streams,” “Lakes,” or emboss on or adjacent to all storm drain inlets where possible.
- Disposal of sediments and liquids from the catch basins must comply with Appendix IV-B: Management of Street Waste Solids and Liquids.

S421 BMPs for Parking and Storage of Vehicles and Equipment

Description of Pollutant Sources: Public and commercial parking lots such as retail store, fleet vehicle (including rent-a-car lots and car dealerships), equipment sale and rental parking lots, and parking lot driveways, can be sources of toxic hydrocarbons and other organic compounds, including oils and greases, metals, and suspended solids.

Pollutant Control Approach: If the parking lot meets the site use thresholds to determine if the site is expected to generate high concentrations of oil, as defined in Step 2: Determine if an Oil Control BMP is Required in III-1.2 Choosing Your Runoff Treatment BMPs, provide oil removal equipment for the contaminated stormwater runoff.

Applicable Operational BMPs:

- If a parking lot must be washed, discharge the washwater to a sanitary sewer, if allowed by the local sewer authority, or other approved wastewater treatment system, or collect washwater for off-site disposal.
- Do not hose down the area to a storm sewer or receiving water. Vacuum sweep parking lots, storage areas, and driveways regularly to collect dirt, waste, and debris. Mechanical or hand sweeping may be necessary for areas where a vacuum sweeper cannot reach.
- Clean up vehicle and equipment fluid drips and spills immediately.
- Place drip pans below leaking vehicles (including inoperative vehicles and equipment) in a manner that catches leaks or spills, including employee vehicles. Drip pans must be managed to prevent overfilling and the contents disposed of properly.

Recommended Operational BMPs:

- Encourage employees to repair leaking personal vehicles.
- Encourage employees to carpool or use public transit through incentives.
- Encourage customers to use public transit by rewarding valid transit pass holders with discounts.

- Install catch basin inserts to collect excess sediment and oil if necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.

Applicable Treatment BMPs:

Establishments subject to high-use intensity are significant sources of oil contamination of stormwater. Examples of potential high use areas include customer parking lots at fast food stores, grocery stores, taverns, restaurants, large shopping malls, discount warehouse stores, quick-lube shops, and banks.

Refer to Step 2: Determine if an Oil Control BMP is Required in III-1.2 Choosing Your Runoff Treatment BMPs for the site use thresholds that determine if an oil control BMP is required, and for a list of oil control BMPs.

S407 BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots

Note: Contact the local air quality authority for appropriate and required BMPs for dust control to implement at your project site. Use the following website to determine the air quality authority for the project site:

https://ecology.wa.gov/About-us/Our-role-in-the-community/Partnerships-committees/Clean-air-agencies

Description of Pollutant Sources: Dust can cause air and water pollution problems particularly at demolition sites and in arid areas where reduced rainfall exposes soil particles to transport by air.

Pollutant Control Approach: Minimize dust generation and apply environmentally friendly and government approved dust suppressant chemicals, if necessary.

Applicable Operational BMPs:

- Sprinkle or wet down soil or dust with water as long as it does not result in a wastewater discharge.
- Use only dust suppressant chemicals that are approved by the local jurisdiction and/or state government approved dust suppressant chemicals such as those listed in *Alternatives to Hazardous Materials: Techniques for Dust Prevention and Suppression* (Ecology, 2016b).
- Avoid excessive and repeated applications of dust suppressant chemicals. Time the application of dust suppressants to avoid or minimize their wash-off by rainfall or human activity such as irrigation.
- Apply stormwater containment to prevent the conveyance of sediment into storm drains or receiving waters.
- Protect inlets/catch basins during application of dust suppressants.
- Ecology prohibits the use of motor oil for dust control. Take care when using lignin derivatives and other high BOD chemicals in areas susceptible to contaminating surface water or ground water.

- Consult with Ecology and the local permitting authority on discharge permit requirements if the dust suppression process results in a wastewater discharge to the ground, ground water, storm drain, or surface water.
- Street gutters, sidewalks, driveways, and other paved surfaces in the immediate area of the activity must be swept regularly to collect and properly dispose of dust, dirt, loose debris, and garbage.
- Install catch basin filter socks on site and in surrounding catch basins to collect sediment and debris. Maintain the filters regularly to prevent plugging.

Recommended Additional Operational BMPs for Roadways and Other Trafficked Areas:

- Consider limiting use of off-road recreational vehicles on dust generating land.
- Consider graveling or paving unpaved permanent roads and other trafficked areas at municipal, commercial, and industrial areas.
- Consider paving or stabilizing shoulders of paved roads with gravel, vegetation, or local government approved chemicals.
- Encourage use of alternate paved routes, if available.
- Vacuum sweep fine dirt and skid control materials from paved roads soon after winter weather ends or when needed.
- Consider using pre-washed traction sand to reduce dust emissions.

Additional Recommended Operational BMPs for Dust Generating Areas:

- Prepare a dust control plan. Helpful references include: *Control of Open Fugitive Dust Sources* (Cowherd et al., 1988) and *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures* (USEPA, 1992).
- Limit exposure of soil (dust source) as much as feasible.
- Stabilize dust-generating soil by growing and maintaining vegetation, mulching, topsoiling, and/or applying stone, sand, or gravel.
- Apply windbreaks in the soil such as trees, board fences, tarp curtains, bales of hay, etc.

Note: Construction site dust control is covered in BMP C140: Dust Control.

S411 BMPs for Landscaping and Lawn / Vegetation Management

Description of Pollutant Sources: Landscaping can include grading, soil transfer, vegetation planting, and vegetation removal. Examples include weed control on golf course lawns, access roads, and utility corridors and during landscaping; and residential lawn/plant care. Proper management of vegetation can minimize excess nutrients and pesticides.

Pollutant Control Approach: Maintain appropriate vegetation to control erosion and the discharge of stormwater pollutants. Prevent debris contamination of stormwater. Where practicable, grow plant species appropriate for the site, or adjust the soil properties of the site to grow desired plant species.

Applicable BMPs:

- Install engineered soil/landscape systems to improve the infiltration and regulation of stormwater in landscaped areas.
- Select the right plants for the planting location based on proposed use, available maintenance,soil conditions, sun exposure, water availability, height, sight factors, and space available.
- Ensure that plants selected for planting are not on the noxious weed list. For example, butterfly bush often gets planted as an ornamental but is actually on the noxious weed list.

  The Washington State Noxious Weed List can be found at the following webpage:

  https://www.nwcb.wa.gov/printable-noxious-weed-list

- Do not dispose of collected vegetation into waterways or storm sewer systems.
- Do not blow vegetation or other debris into the drainage system.
- Dispose of collected vegetation such as grass clippings, leaves, sticks by composting or recycling.
- Remove, bag, and dispose of class A & B noxious weeds in the garbage immediately.

- Do not compost noxious weeds as it may lead to spreading through seed or fragment if the composting process is not hot enough.
- Use manual and/or mechanical methods of vegetation removal (pincer-type weeding tools, flame weeders, or hot water weeders as appropriate) rather than applying herbicides, where practical.
- Use at least an eight-inch "topsoil" layer with at least 8 percent organic matter to provide a sufficient vegetation-growing medium.
    - Organic matter is the least water-soluble form of nutrients that can be added to the soil. Composted organic matter generally releases only between 2 and 10 percent of its total nitrogen annually, and this release corresponds closely to the plant growth cycle. Return natural plant debris and mulch to the soil, to continue recycling nutrients indefinitely.
- Select the appropriate turfgrass mixture for the climate and soil type.
    - Certain tall fescues and rye grasses resist insect attack because the symbiotic endophytic fungi found naturally in their tissues repel or kill common leaf and stem-eating lawn insects.
        - The fungus causes no known adverse effects to the host plant or to humans.
        - Tall fescues and rye grasses do not repel root-feeding lawn pests such as Crane Fly larvae.
        - Tall fescues and rye grasses are toxic to ruminants such as cattle and sheep
    - Endophytic grasses are commercially available; use them in areas such as parks or golf courses where grazing does not occur.
    - Local agricultural or gardening resources such as Washington State University Extension office can offer advice on which types of grass are best suited to the area and soil type.

- Use the following seeding and planting BMPs, or equivalent BMPs, to obtain information on grass mixtures, temporary and permanent seeding procedures, maintenance of a recently planted area, and fertilizer application rates: BMP C120: Temporary and Permanent Seeding, BMP C121: Mulching, BMP C123: Plastic Covering, and BMP C124: Sodding.
- Adjusting the soil properties of the subject site can assist in selection of desired plant species. Consult a soil restoration specialist for site-specific conditions.

Recommended Additional BMPs:

- Conduct mulch-mowing whenever practicable.
- Use native plants in landscaping. Native plants do not require extensive fertilizer or pesticide applications. Native plants may also require less watering.
- Use mulch or other erosion control measures on soils exposed for more than one week during the dry season (May 1 to September 30) or two days during the rainy season (October 1 to April 30).
- Till a topsoil mix or composted organic material into the soil to create a well-mixed transition layer that encourages deeper root systems and drought-resistant plants.
- Apply an annual topdressing application of 3/8" compost. Amending existing landscapes and turf systems by increasing the percent organic matter and depth of topsoil can:
    - Substantially improve the permeability of the soil.
    - Increase the disease and drought resistance of the vegetation.
    - Reduces the demand for fertilizers and pesticides.
- Disinfect gardening tools after pruning diseased plants to prevent the spread of disease.
- Prune trees and shrubs in a manner appropriate for each species.
- If specific plants have a high mortality rate, assess the cause and replace with another more appropriate species.
- When working around and below mature trees, follow the most current American National Standards Institute (ANSI) ANSI A300 standards (see http://www.tcia.org/TCIA/BUSINESS/ANSI_A300_Standards_/TCIA/BUSINESS/A300_Standards/A300_Standards.aspx?hkey=202ff566-4364-4686-b7c1-2a365af59669) and International Society of Arboriculture BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil).
- Monitor tree support systems (stakes, guys, etc.).
    - Repair and adjust as needed to provide support and prevent tree damage.
    - Remove tree supports after one growing season or maximum of 1 year.
    - Backfill stake holes after removal.
- When continued, regular pruning (more than one time during the growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location.

- Make reasonable attempts to remove and dispose of class C noxious weeds.
- Re-seed bare turf areas until the vegetation fully covers the ground surface.
- Watch for and respond to new occurrences of especially aggressive weeds such as Himalayan blackberry, Japanese knotweed, morning glory, English ivy, and reed canary grass to avoid invasions.
- Plant and protect trees per BMP T5.16: Tree Retention and Tree Planting.
- Aerate lawns regularly in areas of heavy use where the soil tends to become compacted. Conduct aeration while the grasses in the lawn are growing most vigorously. Remove layers of thatch greater than ¾-inch deep.
- Set the mowing height at the highest acceptable level and mow at times and intervals designed to minimize stress on the turf. Generally mowing only 1/3 of the grass blade height will prevent stressing the turf.
    - Mowing is a stress-creating activity for turfgrass.
    - Grass decreases its productivity when mowed too short and there is less growth of roots and rhizomes. The turf becomes less tolerant of environmental stresses, more disease prone and more reliant on outside means such as pesticides, fertilizers, and irrigation to remain healthy.

Additional BMP Information:

- King County's *Best Management Practices for Golf Course Development and Operation* (King County, 1993) has additional BMPs for Turfgrass Maintenance and Operation.
- King County, Seattle Public Utilities, and the Saving Water Partnership have created the following natural lawn and garden care resources that include guidance on building healthy soil with compost and mulch, selecting appropriate plants, watering, using alternatives to pesticides, and implementing natural lawn care techniques.
    - *Natural Yard Care - Five steps to make your piece of the planet a healthier place to live* (King County and SPU, 2008)
    - *The Natural Lawn & Garden Series: Smart Watering* (Saving Water Partnership, 2006)
    - *Natural Lawn Care for Western Washington* (Saving Water Partnership, 2007)

    - *The Natural Lawn & Garden Series: Growing Healthy Soil; Choosing the Right Plants; and Natural Pest, Weed and Disease Control* (Saving Water Partnership, 2012)
- The International Society of Arboriculture (ISA) is a group that promotes the professional practice of arboriculture and fosters a greater worldwide awareness of the benefits of trees through research, technology, and education. ISA standards used for managing trees, shrubs, and other woody plants are the American National Standards Institute (ANSI) A300 standards. The ANSI A300 standards are voluntary industry consensus standards developed by the Tree Care Industry Association (TCIA) and written by the Accredited Standards Committee (ASC). The ANSI standards can be found on the ISA website: www.isa-arbor.com/education/publications/index.aspx
- Washington State University's *Gardening in Washington State* website at http://gardening.wsu.edu contains Washington State specific information about vegetation management based on the type of landscape.
- See the *Pacific Northwest Plant Disease Management Handbook* (Pscheidt and Ocamb, 2016) for information on disease recognition and for additional resources.

S435 BMPs for Pesticides and an Integrated Pest Management Program

Description of Pollutant Sources: Pesticides include herbicides, rodenticides, insecticides, fungicides, etc. Examples of pesticide uses include:

- Weed control on golf course lawns, access roads, utility corridors and landscaping.
- Sap stain and insect control on lumber and logs.
- Rooftop moss removal.
- Killing nuisance rodents.
- Fungicide application to patio decks.

It is possible to release toxic pesticides such as pentachlorophenol, carbamates, and organometallics to the environment by leaching and dripping from treated parts, container leaks, product misuse, and outside storage of pesticide contaminated materials and equipment. Poor management of pesticides can cause appreciable stormwater contamination and unintended impacts to non-targeted organisms.

Pollutant Control Approach: Control of pesticide applications to prevent contamination of stormwater. Develop and implement an Integrated Pest Management (IPM) Plan. Carefully apply pesticides, in accordance with label requirements.

Applicable Operational BMPs:

- Train employees on proper application of pesticides and disposal practices.
- Follow manufacturers' application guidelines and label requirements.
- Do not apply pesticides in quantities that exceed the limits on the product the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) label. Avoid excessive application of chemical.
- Conduct spray applications during weather conditions as specified in the label requirements and applicable local and state regulations. Do not apply during rain or immediately before expected rain (unless the label directs such timing).
- Clean up any spilled pesticides immediately. Do not hose down to a storm drain, conveyance ditch, or water body.

- Remove weeds/vegetation in stormwater ditches, stormwater facilities, and drainage systems by hand or other mechanical means and only use pesticides as a last resort.
- Flag all sensitive areas including wells, creeks, and wetlands prior to spraying.
- Post notices and delineate the spray area prior to the application, as required by the local jurisdiction, or by Ecology.
- Refer to S411 BMPs for Landscaping and Lawn / Vegetation Management and use pesticides only as a last resort.
- Conduct any pest control activity at the life stage when the pest is most vulnerable. For example, if it is necessary to use a Bacillus thuringiens application to control tent caterpillars, apply it to the material before the caterpillars cocoon or it will be ineffective. Any method used should be site-specific and not used wholesale over a wide area.
- Mix pesticides and clean the application equipment under cover in an area where accidental spills will not enter surface or ground waters, and will not contaminate the soil.
- The pesticide application equipment must be capable of immediate shutoff in the event of an emergency.
- Implement a pesticide-use plan and include at a minimum:
    - A list of selected pesticides and their specific uses.
    - Brands and formulations of the pesticides.
    - Application methods and quantities to be used.
    - Equipment use and maintenance procedures.
    - Safety, storage, and disposal methods.
    - Monitoring, record keeping, and public notice procedures. All procedures shall conform to the requirements of Chapter 17.21 RCW and Chapter 16-228 WAC.
- Develop and implement an Integrated Pest Management (IPM) program if pests are present. The following steps are adapted from (Daar, 1992).
    - **Step One:** Correctly identify problem pests and understand their life cycle.
        - Learn more about the pest.
        - Observe it and pay attention to any damage that may be occurring.
        - Learn about the life cycle.
        - Many pests are only a problem during certain seasons, or can only be treated effectively in certain phases of the life cycle.
    - **Step Two:** Establish tolerance thresholds for pests.

        - Decide on the level of infestation that must be exceeded before treatment needs to be considered. Pest populations under this threshold should be monitored but don't need treatment.
    - **Step Three:** Monitor to detect and prevent pest problems.
        - Monitor regularly to anticipate and prevent major pest outbreaks.
        - Conduct a visual evaluation of the lawn or landscape's condition. Take a few minutes before mowing to walk around and look for problems.
        - Keep a notebook, record when and where a problem occurs, then monitor for it at about the same time in future years.
        - Specific monitoring techniques can be used in the appropriate season for some potential problem pests, such as European crane fly.
    - **Step Four:** Modify the maintenance program to promote healthy plants and discourage pests.
        - Review your landscape maintenance practices to see if they can be modified to prevent or reduce the problem.
        - A healthy landscape is resistant to most pest problems. Lawn aeration and overseeding along with proper mowing height, fertilization, and irrigation will help the grass out-compete weeds.
        - Correcting drainage problems and letting soil dry out between waterings in the summer may reduce the number of crane-fly larvae that survive.
    - **Step Five:** If pests exceed the tolerance thresholds:
        - Consider the most effective management options concurrent with reducing impacts to the environment. This may mean chemical pesticides are the best option in some circumstances.
        - Consider the use of physical, mechanical, or biological controls.
        - Study to determine what products are available and choose a product that is the least toxic and has the least non-target impact.
    - **Step Six:** Evaluate and record the effectiveness of the control, and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.
        - Keep records!
        - Note when, where, and what symptoms occurred, or when monitoring revealed a potential pest problem.

        - Note what controls were applied and when, and the effectiveness of the control.
        - Monitor next year for the same problems.

Recommended Additional Operational BMPs:

- Choose the least toxic pesticide available that is capable of reducing the infestation to acceptable levels. The pesticide should readily degrade in the environment and/or have properties that strongly bind it to the soil.
- Choose pesticides categorized by EPA as reduced risk. For example, the herbicide imazamox.
- When possible, apply pesticides during the dry season so that the pesticide residue is degraded prior to the next rain event.
- If possible, do not spray pesticides within 100 feet of water bodies. Spraying pesticides within 100 feet of water bodies including any drainage ditch or channel that leads to open water may have additional regulatory requirements beyond just following the pesticide product label. Additional requirements may include:
    - Obtaining a discharge permit from Ecology.
    - Obtaining a permit from the local jurisdiction.
    - Using an aquatic labeled pesticide and adjuvant.
- Use manual pest control strategies such as physically scraping moss from rooftops, high-pressure sprayers to remove moss, and rodent traps.
- Consider alternatives to the use of pesticides such as covering or harvesting weeds, substitute vegetative growth, and manual weed control/moss removal.
- Consider the use of soil amendments, such as compost, that are known to control some common diseases in plants, such as Pythium root rot, ashy stem blight, and parasitic nematodes.
- Once a pesticide is applied, evaluate its effectiveness for possible improvement. Records should be kept showing the effectiveness of the pesticides applied.
- Follow the FIFRA label requirements for disposal. If the FIFRA label does not have disposal requirements the rinseate from equipment cleaning and/or triple-rinsing of pesticide containers should be used as product or recycled into product.
- Develop an and adaptive management plan and annual evaluation procedure including: (adapted from (Daar, 1992))
    - A review of the effectiveness of pesticide applications.

- Impact on buffers and sensitive areas, including potable wells. If individual or public potable wells are located in the proximity of commercial pesticide applications, contact the regional Ecology hydrogeologist to determine if additional pesticide application control measures are necessary.
- Public concerns.
- Recent toxicological information on pesticides used/proposed for use.

Additional Information

For more information, refer to the Pesticide Information Center Online (PICOL) Databases at http://cru66.cahe.wsu.edu/LabelTolerance.html.

Washington pesticide law requires most businesses that commercially apply pesticides to the property of another to be licensed as a Commercial Applicator from the Washington State Department of Agriculture.

S444 BMPs for the Storage of Dry Pesticides and Fertilizers

Description of Pollutant Sources: Pesticides such as pentachlorophenol, carbamates, and organometallics can be released to the environment as a result of container leaks and outside storage of pesticide-contaminated materials and equipment. Inappropriate management of pesticides or fertilizers can result in stormwater contamination. Runoff contaminated by pesticides and fertilizers can severely degrade streams and lakes and adversely affect fish and other aquatic life.

Pollutant Control Approach: Store fertilizer and pesticide properly to prevent stormwater contamination.

Applicable Structural BMPs:

Store pesticides and fertilizers in enclosed impervious containment areas that prevent precipitation or unauthorized personnel from coming into contact with the materials..

Applicable Operational BMPs:

- Containers and bags must be covered, intact, and off the ground.
- Store all material so that it cannot come into contact with water.
- Immediately clean up any spilled fertilizer or pesticides.
- Keep pesticide and fertilizer contaminated waste materials in designated covered and contained areas, and dispose of properly.
- Store and maintain spill cleanup materials near the storage area.
- Sweep paved storage areas as needed. Collect and dispose of spilled materials. Do not hose down the area.
- Do not discharge pesticide contaminated stormwater or spills/leaks of pesticides to storm sewers or to the sanitary sewer. Contaminated stormwater must be collected and disposed of properly. Unused or spilled/leaked pesticides must be disposed of according to the label.
- Comply with WAC 16-228-1220 and Chapter 16-229 WAC.

S450 BMPs for Irrigation

Description of Pollutant Sources: Irrigation consists of discharges from irrigation water lines, landscape irrigation, and lawn or garden watering. Excessive watering can lead to discharges of chlorinated potable water runoff into drainage systems; it can also cause erosion; and negatively affect plant health. Improper irrigation can encourage pest problems, leach nutrients, and make a lawn completely dependent on artificial watering. Mosquito breeding habitats may form through excessive watering.

Pollutant Control Approach: Limit the amount and location of watering to prevent runoff and discharges to drainage systems.

Applicable Operational BMPs:

- Irrigate with the minimum amount of water needed. Never water at rates that exceed the infiltration rate of the soil.
- Maintain all irrigation systems so that irrigation water is applied evenly and where it is needed.
- Ensure sprinkler systems do not overspray vegetated areas resulting in excess water discharging into the drainage system.
- Inspect irrigated areas for excess watering. Adjust watering times and schedules to ensure that the appropriate amount of water is being used to minimize runoff. Consider factors such as soil structure, grade, time of year, and type of plant material in determining the proper amounts of water for a specific area.
- Inspect irrigated areas regularly for signs of erosion and / or discharge.
- Place sprinkler systems appropriately so that water is not being sprayed on impervious surfaces instead of vegetation.
- Repair broken or leaking sprinkler nozzles as soon as possible.
- Appropriately irrigate lawns based on the species planted, the available water holding capacity of the soil, and the efficiency of the irrigation system.
    - The depth from which a plant normally extracts water depends on the rooting depth of the plant. Appropriately irrigated lawn grasses normally root in the top 6 to 12 inches of soil; lawns irrigated on a daily basis often root only in the top 1 inch of soil.

- Do not irrigate plants during or immediately after fertilizer application. The longer the period between fertilizer application and irrigation, the less fertilizer runoff occurs.
- Do not irrigate plants during or immediately after pesticide application (unless the pesticide label directs such timing).
- Reduce frequency and / or intensity of watering as appropriate for the wet season (October 1 to April 30).
- Place irrigation systems to ensure that plants receive water where they need it. For example, do not place irrigation systems downgradient of plant's root zones on hillsides.

Recommended Operational BMPs:

- Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present.
- Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist.
- Use soaker hoses or spot water with a shower type wand when an irrigation system is not present.
    - Pulse water to enhance soil absorption, when feasible.
    - Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method, each pass increases soil absorption and allows more water to infiltrate prior to runoff.
- Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear.
- Water during drought conditions or more often if necessary to maintain plant cover.
- Adjust irrigation frequency / intensity as appropriate after plant establishment.
- Annually inspect irrigation systems to ensure:
    - That there are no blockages of sprayer nozzles.
    - Sprayer nozzles are rotating as appropriate.
    - Sprayer systems are still aligned with the plant locations and root zones.
- Consult with the local water utility, Conservation District, or Cooperative Extension office to help determine optimum irrigation practices.

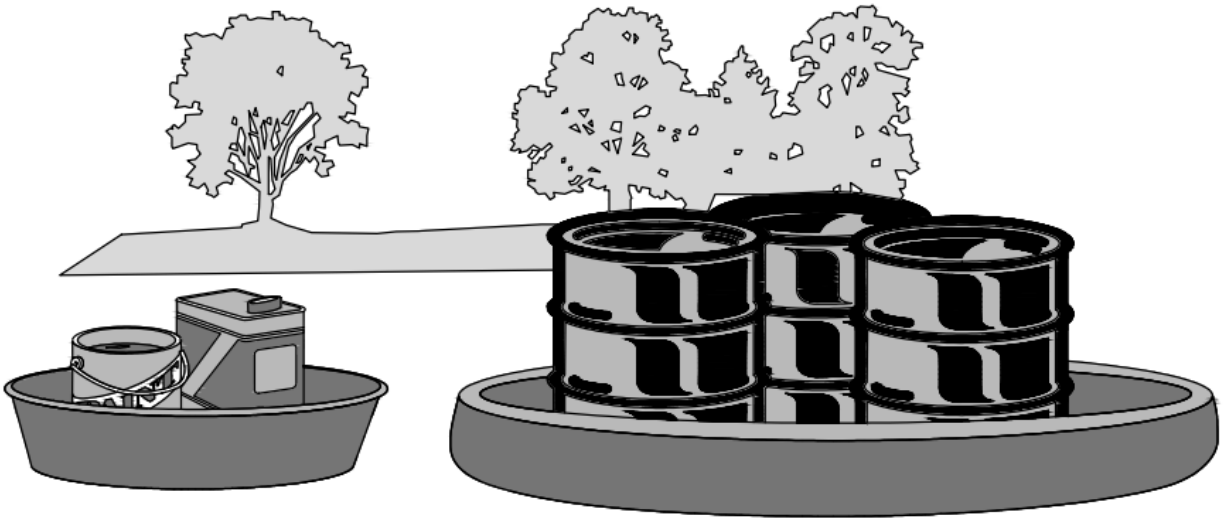
- Do not use chemigation and fertigation in irrigation systems. This will help avoid over application of pesticides and fertilizers.

S427 BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers

Description of Pollutant Sources: Steel and plastic drums with volumetric capacities of 55 gallons or less are typically used at industrial facilities for container storage of liquids and powders. The BMPs specified below apply to container(s) located outside a building. Use these BMPs when temporarily storing potential pollution generating materials or wastes. These BMPs do not apply when Ecology has permitted the business to store the wastes (see Standards for Solid Waste Containers in I-2.15 Other Requirements). Leaks and spills of pollutant materials during handling and storage are the primary sources of pollutants. Oil and grease, acid/alkali pH, BOD, COD are potential pollutant constituents.

Pollutant Control Approach: Store containers in impervious containment under a roof, or other appropriate cover, or in a building. For storage areas on-site for less than 30 days, consider using a portable temporary secondary system like that shown in Figure IV-5.1: Secondary Containment System in lieu of a permanent system as described above.

Figure IV-5.1: Secondary Containment System



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Secondary Containment System

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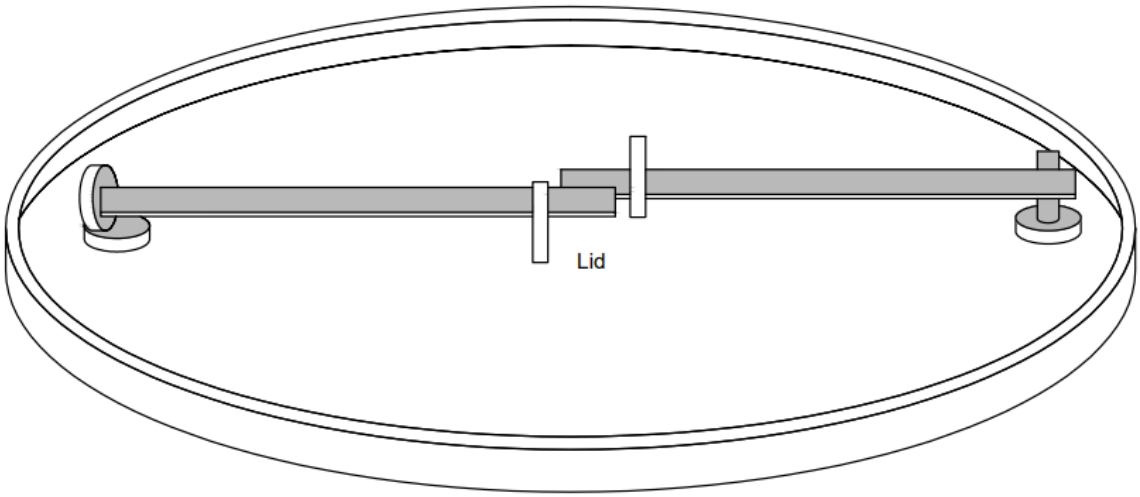
Applicable Operational BMPs:

- Place tight-fitting lids on all containers.
- Label all containers appropriately. Store containers so that the labels are clearly visible..
- Place drip pans beneath all mounted container taps and at all potential drip and spill locations during filling and unloading of containers.
- Inspect container storage areas regularly for corrosion, structural failure, spills, leaks, overfills, and failure of piping systems. Check containers daily for leaks/spills. Replace containers, and replace and tighten bungs in drums as needed.
- Empty drums containing residues should be stored to prevent stormwater from entering drum closures. Cover or tilt drums to prevent stormwater from accumulating on the top of empty drums and around drum closures.
- Store containers that do not contain free liquids in a designated sloped area with the containers elevated or otherwise protected from stormwater run-on. Comply with local fire code.
- Secure drums when stored in an area where unauthorized persons may gain access in a manner that prevents accidental spillage, pilferage, or any unauthorized use (see Figure IV-5.2: Locking System for Drum Lid).
- If the material is a Dangerous Waste, the business owner must comply with any additional Ecology requirements as specified in Ecology Requirements for Generators of Dangerous Wastes within I-2.15 Other Requirements.
- Storage of flammable, ignitable, and reactive chemicals and materials must comply with the stricter of local zoning codes, local fire codes, the Uniform Fire Code (UFC), UFC standards, or the National Electric Code
- Have spill kits or cleanup materials near container storage areas.
- Clean up all spills immediately.
- Cover dumpsters, or keep them under cover such as a lean-to, to prevent the entry of stormwater. Keep dumpster lids closed.
- Replace or repair leaking garbage dumpsters, or install waterproof liners.
- Drain dumpsters and/or dumpster pads to sanitary sewer where approved by the sewer authority.
- When collection trucks directly pick up roll-containers, ensure a filet is on both sides of the curb to facilitate moving the dumpster.

Figure IV-5.2: Locking System for Drum Lid



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Locking System for Drum Lid

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Applicable Structural Source Control BMPs:

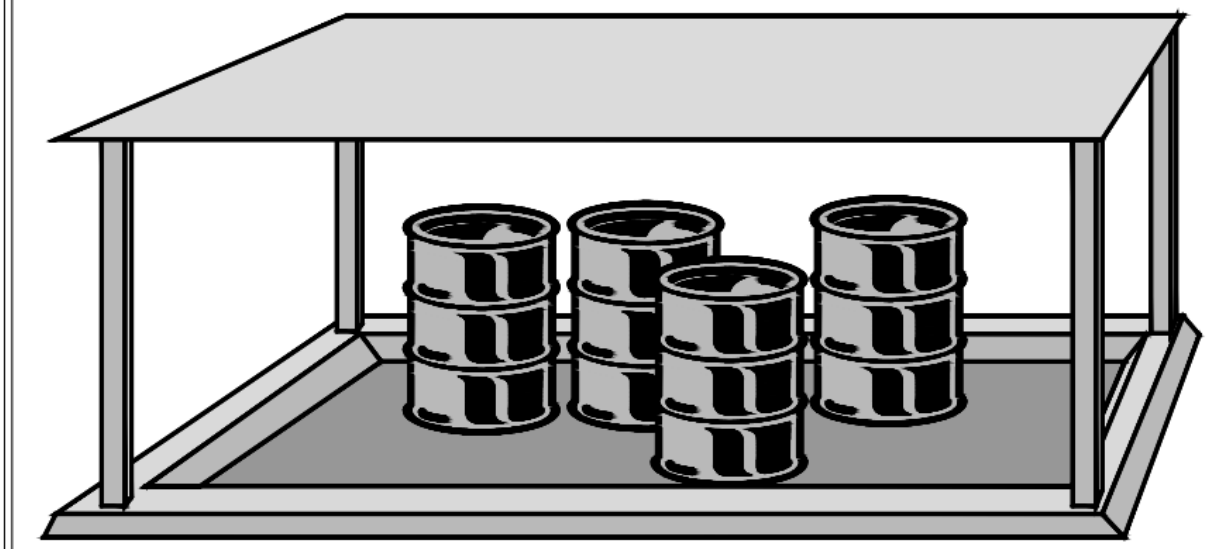
- Keep containers with Dangerous Waste, food waste, or other potential pollutant liquids inside a building unless this is not feasible due to site constraints or Uniform/International Fire Code requirements.
- Store containers in a designated area, which is covered, bermed or diked, paved and impervious in order to contain leaks and spills (see Figure IV-5.3: Covered and Bermed Containment Area). Slope the secondary containment to drain into a dead-end sump for the collection of leaks and small spills.
- For liquid materials, surround the containers with a dike as illustrated in Figure IV-5.3: Covered and Bermed Containment Area. The dike must be of sufficient height to provide a volume of either 10 percent of the total enclosed container volume or 110 percent of the volume contained in the largest container, whichever is greater.
- Where material is temporarily stored in drums, use a containment system as illustrated, in lieu of the above system (see Figure IV-5.1: Secondary Containment System).
- Place containers mounted for direct removal of a liquid chemical for use by employees inside a containment area as described above. Use a drip pan during liquid transfer (see Figure IV-5.4: Mounted Container - With Drip Pan).

Applicable Treatment BMP:

Note this treatment BMP is for contaminated stormwater from drum storage areas.

- To discharge contaminated stormwater, pump it from a dead-end sump or catchment and dispose of appropriately.

Figure IV-5.3: Covered and Bermed Containment Area



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Covered and Bermed Containment Area

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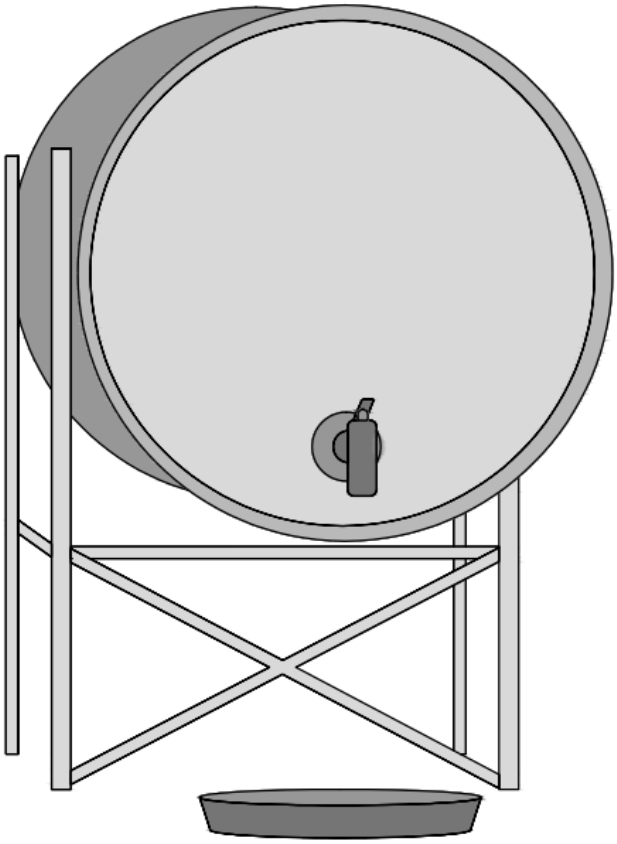
Figure IV-5.4: Mounted Container - With Drip Pan



*Note that the secondary containment is not shown in this figure

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Mounted Container - with Drip Pan

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S412 BMPs for Loading and Unloading Areas for Liquid or Solid Material

Description of Pollutant Sources: Operators typically conduct loading/unloading of liquid and solid materials at industrial and commercial facilities at shipping and receiving, outside storage, fueling areas, etc. Materials transferred can include products, raw materials, intermediate products, waste materials, fuels, scrap metals, etc. Leaks and spills of fuels, oils, powders, organics, heavy metals, salts, acids, alkalis, etc. during transfer may cause stormwater contamination. Spills from hydraulic line breaks are a common problem at loading docks.

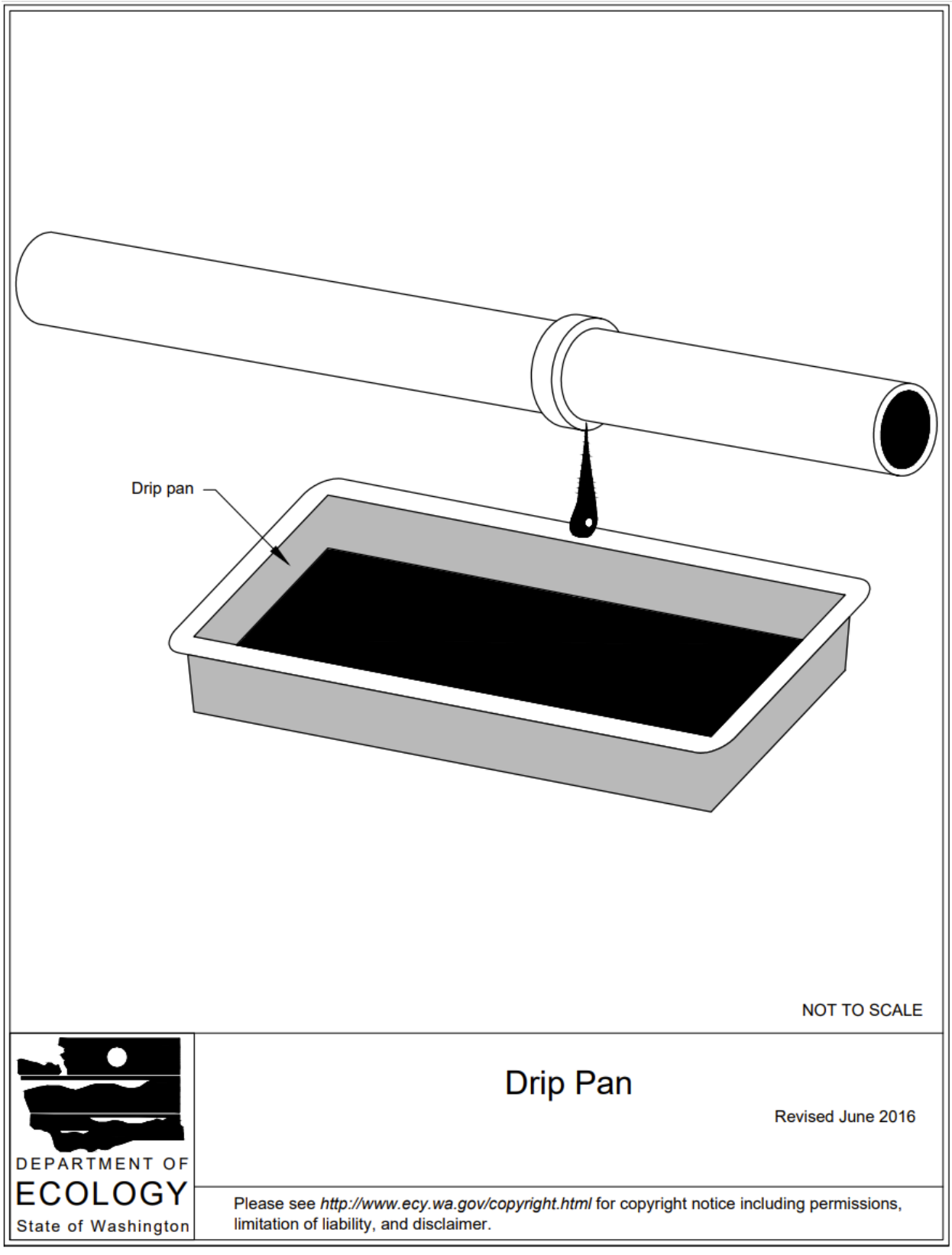
Pollutant Control Approach: Cover and contain the loading/unloading area where necessary to prevent run-on of stormwater and runoff of contaminated stormwater.

Applicable Operational BMPs:

At All Loading/ Unloading Areas

- A significant amount of debris can accumulate at outside, uncovered loading/unloading areas. Sweep these surfaces frequently to remove loose material that could contaminate stormwater. Sweep areas temporarily covered after removal of the containers, logs, or other material covering the ground.
- Place drip pans, or other appropriate temporary containment device, at locations where leaks or spills may occur such as hose connections, hose reels and filler nozzles. Always use drip pans when making and breaking connections (see Figure IV-6.2: Drip Pan). Check loading/unloading equipment such as valves, pumps, flanges, and connections regularly for leaks and repair as needed.

Figure IV-6.2: Drip Pan



At Tanker Truck and Rail Transfer Areas to Above/Below-ground Storage Tanks

- To minimize the risk of accidental spillage, prepare an "Operations Plan" that describes procedures for loading/unloading. Train employees in its execution and post it or otherwise have it readily available to all employees.
- Report spills of reportable quantities to Ecology.
- Prepare and implement an Emergency Spill Cleanup Plan for the facility (See S426 BMPs for Spills of Oil and Hazardous Substances) which includes the following BMPs:
    - Ensure the cleanup of liquid/solid spills in the loading/unloading area immediately, if a significant spill occurs, and, upon completion of the loading/unloading activity, or, at the end of the working day.
    - Retain and maintain an appropriate oil spill cleanup kit on-site for rapid cleanup of material spills. (See S426 BMPs for Spills of Oil and Hazardous Substances).
    - Ensure that an employee trained in spill containment and cleanup is present during loading/unloading.

Transfer of Small Quantities from Tanks and Containers

Refer to S428 BMPs for Storage of Liquids in Permanent Aboveground Tanks and S427 BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers for requirements on the transfer of small quantities from tanks and containers, respectively.

Applicable Structural Source Control BMPs:

At All Loading/ Unloading Areas

- Consistent with Uniform Fire Code requirements (see Uniform Fire Code Requirements within I-2.15 Other Requirements) and to the extent practicable, conduct unloading or loading of solids and liquids in a manufactured building, under a roof, or lean-to, or other appropriate cover.
- Berm, dike, and/or slope the loading/unloading area to prevent run-on of stormwater and to prevent the runoff or loss of any spilled material from the area.
- Place curbs along the edge of the shoreline, or slope the edge such that the stormwater can flow to an internal storm sewer system that leads to an approved treatment BMP. Avoid draining directly to the surface water from loading areas.

- Pave and slope loading/unloading areas to prevent the pooling of water. Minimize the use of catch basins and drain lines within the interior of the paved area or place catch basins in designated “alleyways” that are not covered by material, containers, or equipment.
- Retain on-site the necessary materials for rapid cleanup of spills.

Recommended Structural Source Control BMPs:

For the transfer of pollutant liquids in areas that cannot contain a catastrophic spill, install an automatic shutoff system in case of unanticipated off-loading interruption (e.g. coupling break, hose rupture, overfill, etc.).

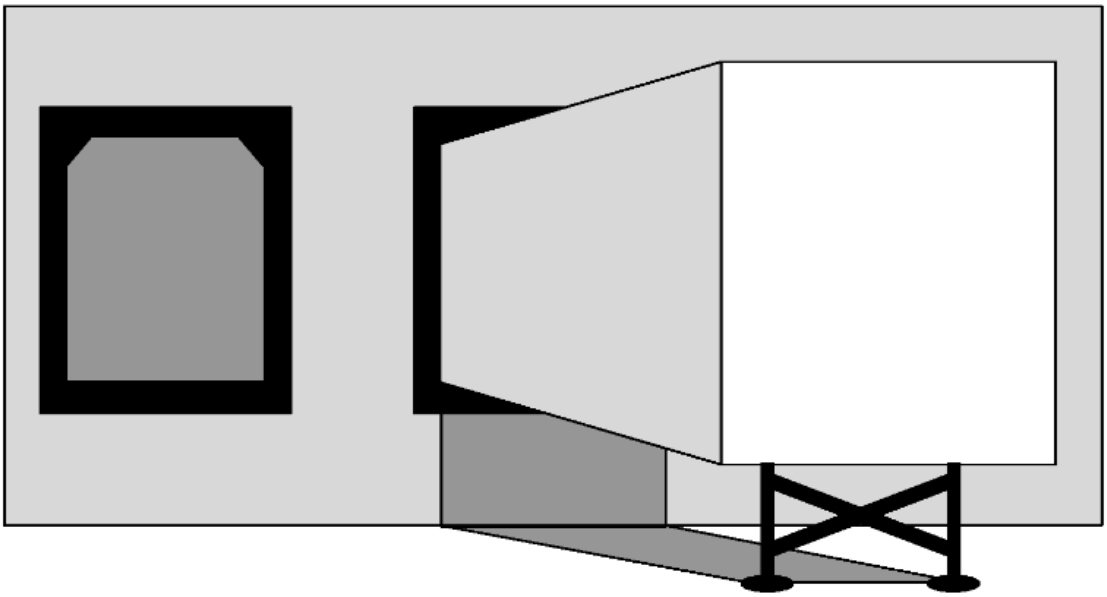
At Loading and Unloading Docks

- Install/maintain overhangs, or door skirts that enclose the trailer end (see Figure IV-6.4: Loading Dock with Door Skirt and Figure IV-6.5: Loading Dock with Overhang) to prevent contact with rainwater.
- Design the loading/unloading area with berms, sloping, etc., to prevent the run-on of stormwater.

At Tanker Truck Transfer Areas to Above/Below-Ground Storage Tanks

- Pave the area on which the transfer takes place. If any transferred liquid, such as gasoline, is reactive with asphalt, pave the area with Portland cement concrete.
- Slope, berm, or dike the transfer area to a dead-end sump, spill containment sump, a spill control oil/water separator, or other spill control device. The minimum spill retention time should be 15 minutes at the greater flow rate of the highest fuel dispenser nozzle through-put rate, or the peak flow rate of the 6-month, 24-hour storm event over the surface of the containment pad, whichever is greater. The capacity of the spill containment sump should be a minimum of 50 gallons with adequate additional capacity provided for grit sedimentation.

Figure IV-6.4: Loading Dock with Door Skirt



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Loading Dock with Door Skirt

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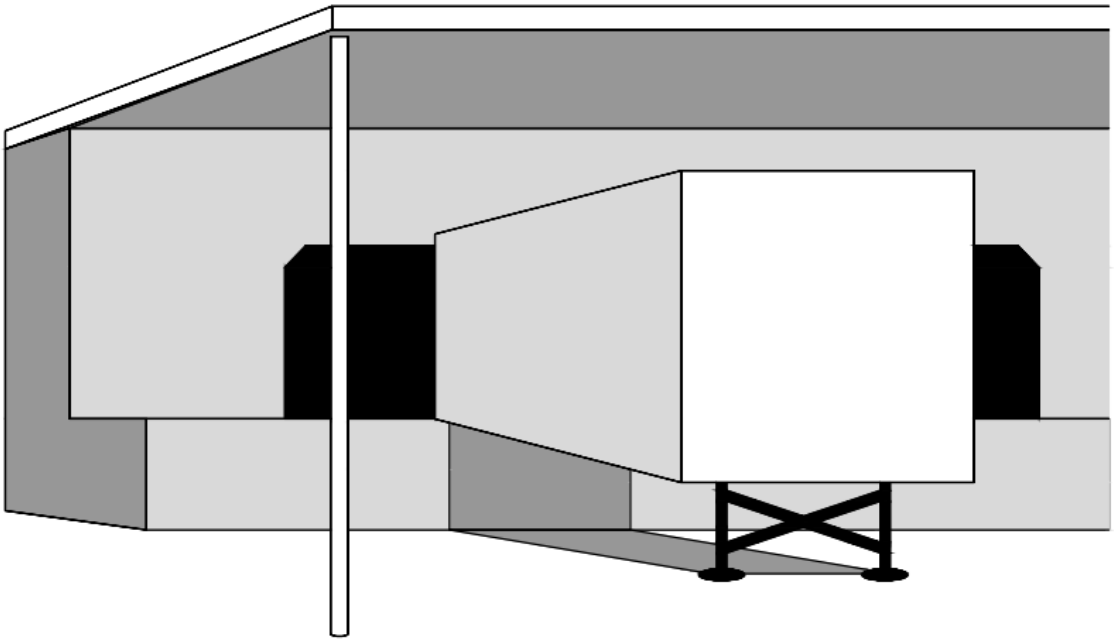
Figure IV-6.5: Loading Dock with Overhang



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Loading Dock with Overhang

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S424 BMPs for Roof / Building Drains at Manufacturing and Commercial Buildings

Description of Pollutant Sources: Stormwater runoff from roofs and sides of manufacturing and commercial buildings can be sources of pollutants caused by leaching of roofing materials, paints, caulking, building vents, and other air emission sources. Research has identified vapors and entrained liquid and solid droplets/particles as potential pollutants in roof/building runoff. Metals, solvents, acidic/alkaline pH, BOD, PCBs, and organics are some of the pollutant constituents identified.

Ecology has performed a study on zinc in industrial stormwater. The study is presented in *Suggested Practices to Reduce Zinc Concentrations in Industrial Stormwater Discharges* (Ecology, 2008). The user should refer to this document for more details on addressing zinc in stormwater.

Pollutant Control Approach: Evaluate the potential sources of stormwater pollutants and apply source control BMPs where feasible.

Applicable Operational Source Control BMPs:

- If leachates and/or emissions from buildings are suspected sources of stormwater pollutants, then sample and analyze the stormwater draining from the building.
- Sweep the area routinely to remove any residual pollutants.
- If a roof/building stormwater pollutant source is identified, implement appropriate source control measures such as air pollution control equipment, selection of materials, operational changes, material recycle, process changes, etc.

Applicable Structural Source Control BMPs:

- Paint/coat the galvanized surfaces as described in *Suggested Practices to Reduce Zinc Concentrations in Industrial Stormwater Discharges* (Ecology, 2008).

Applicable Treatment BMPs:

Treat runoff from roofs to the appropriate level. The facility may use Enhanced Treatment BMPs as described in III-1.2 Choosing Your Runoff Treatment BMPs. Some facilities regulated by the Industrial Stormwater General Permit, or local jurisdiction, may have requirements than cannot be achieved with Enhanced Treatment BMPs. In these cases, additional treatment measures may be required. A treatment method for meeting stringent requirements such as Chitosan-Enhanced Sand Filtration may be appropriate.

S442 BMPs for Labeling Storm Drain Inlets On Your Property

Description of Pollutant Sources: Waste materials dumped into storm drain inlets can have severe impacts on receiving waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Pollutant Control Approach: The stencil, affixed sign, or metal grate contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Applicable Operational BMPs:

- Label storm drain inlets in residential, commercial, industrial areas, and any other areas where contributions or dumping to storm drains is likely.
- Stencil or apply storm drain markers adjacent to storm drain inlets to help prevent the improper disposal of pollutants. Or, use a storm drain grate stamped with warnings against polluting.
- Place the marker in clear sight facing toward anyone approaching the inlet from either side.
- Use a brief statement and / or graphical icons to discourage illegal dumping. Examples include:
    - “No Dumping – Drains to Stream”
    - “No Pollutants – Drains to Puget Sound”
    - “Dump No Waste – Drains to Lake”
    - “No Dumping – Puget Sound Starts Here”
- Check with your local government agency to find out if they have approved specific signage and / or storm drain message placards for use. Consult the local agency stormwater staff to determine specific requirements for placard types and methods of application.
- Maintain the legibility of markers and signs. Signage on top of curbs tends to weather and fade. Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

- When painting stencils or installing markers, temporarily block the storm drain inlet so that no pollutants are discharged from the labeling activities.

Optional Operational BMPs:

Use a stencil in addition to a storm drain marker or grate to increase visibility of the message.

Reference for this BMP: (CASQA, 2003)

Figure IV-7.6: Storm Drain Inlet Labels

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State of Washington

Storm Drain Inlet Labels

Revised October 2017

S451 BMPs for Building, Repair, Remodeling, Painting, and Construction

Description of Pollutant Sources: This activity refers to:

- The construction of buildings and other structures.
- Remodeling of existing buildings and houses.
- General exterior building repair work.

Pollutants of concern include toxic hydrocarbons, hazardous wastes, toxic organics, suspended solids, heavy metals, pH, oils, and greases.

Pollutant Control Approach: Educate employees about the need to control site activities. Control leaks, spills, and loose material. Utilize good housekeeping practices. Regularly clean up debris that can contaminate stormwater. Protect the drainage system from dirty runoff and loose particles.

Applicable Operational BMPs:

- Identify, remove, and properly dispose of hazardous substances from the building before beginning repairing or remodeling activities that could expose them to stormwater. Such substances could include PCBs, asbestos, lead paint, mercury switches, and electronic waste.
- Educate employees about the need to control site activities to prevent stormwater pollution, and also train them in spill cleanup procedures.
- At all times, have available at the work site spill cleanup materials appropriate to the chemicals used on site.
- Clean up the work site at the end of each work day. Put away materials (such as solvents) indoors or cover and secure them, so that unauthorized personnal will not have access to them.
- Sweep the area daily to collect loose litter, paint chips, grit, and dirt.
- Do not dump any substance on pavement, on the ground, in the storm drain, or toward the storm drain, regardless of its content, unless it is clean water only.
- Place a drop cloth, where space and access permits, before beginning wood treating activities. Use drip pans in areas where drips are likely to occur if the area cannot be protected with a drop cloth.

- Use ground or drop cloths underneath scraping and sandblasting work. Use ground cloths, buckets, or tubs anywhere that work materials are laid down.
- Clean paint brushes and other tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can subsequently be dumped into a sanitary sewer drain.
- Clean brushes and tools covered with non-water-based finishes or other materials in a manner that enables collection of used solvents for recycling or proper disposal. Do not discharge non-water-based finishes or paints or used solvents into the sanitary sewer, or any other drain.
- Use storm drain covers, or similarly effective devices, to prevent dust, grit, washwater, or other pollutants from escaping the work area. Place the cover or containment device over the storm drain at the beginning of the work day. Collect and properly dispose of accumulated dirty runoff and solids before removing the cover or device at the end of each work day.
- Refer to S431 BMPs for Washing and Steam Cleaning Vehicles / Equipment / Building Structures for best management practices associated with power washing buildings.

Suggested Operational BMPs:

- Lightly spray water on the work site to control dust and grit that could blow away. Do not use oils for dust control. Never spray to the point of water runoff from the site.
- Clean tools over a ground cloth or within a containment device such as a tub.
- Consider using filtered vacuuming to collect waste that may be hard to sweep, such as dust on a drop cloth.
- If conducting work in wet weather conditions, consider setting up temporary cover when scraping or pressure-washing lead-based paint.

A-8: Storage of Solid Waste and Food Wastes (Including Cooking Grease)

The following best management practices (BMPs) apply to garbage dumpsters, trash compactors and outdoor waste containers (e.g., cooking oil/grease receptacles).

Potential pollutants include but are not limited to fecal coliform bacteria, hydrocarbons, metals, nutrients, oil and grease, oxygen demanding substances, PCBs, pH, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- Store wastes in leak-proof containers with solid lids (e.g., dumpsters and trash compactors). No rainwater should be able to enter the container and no fluids should be leaking out.
- Keep all waste receptacles (e.g., dumpsters, garbage cans, used cooking oil/grease containers) closed except when adding waste.
- Leaking outdoor waste containers must be repaired or replaced. Contact your waste hauler for replacements if the container is leased.
- Trash compactor wastewater must be discharged to the sanitary sewer, septic system or collected and hauled off-site for proper disposal. It must not be discharged to ground, stormwater drainage systems, surface waters or groundwater.
- Trash compactor drain lines should be connected to the sanitary sewer or septic system. If a connection is not possible, collect the wastewater in a dead-end sump or similar device. The wastewater containment must be easily inspected, maintained, and pumped out for proper disposal.
- Used cooking oil/grease containers should be labeled with their contents and have a secured lid.
- While oil/grease containers are not required to have secondary containment, they should be located and/or secured such that they can't be tipped over.
- Clean up any spills immediately using absorbent material or scraping it up. Grease cannot be left on the ground.
- Have spill cleanup materials nearby.
- Use a lid or cover when transporting cooking oil/grease containers from kitchens to outside grease containers to prevent contents from spilling.
- Ensure that drip pans or absorbent materials are used whenever grease containers are emptied by vacuum trucks or other means.

- Dispose of collected cooking oil/grease as garbage if it is not being recycled. Do not dispose of fats, oils, or grease (FOG) into the sanitary sewer, septic system, or stormwater drainage system.

Required Routine Maintenance

- Keep the area around the grease container clean and free of debris.
- Check storage containers frequently for leaks and to ensure that lids are secure.
- Regularly check for loose debris in the waste container storage area and sweep if the area is paved. After sweeping, the waste storage area may be hosed down—without the use of soaps, detergents, or other chemicals—if there are no accumulations of oil and grease present and the rinse water is not discharged to a stormwater drainage system or surface water. The rinse water can infiltrate to ground or be discharged to a sanitary sewer.
- Do not hose down or apply soaps, detergents, or other chemicals to waste storage areas with accumulated oil and grease. Oily wastewater can clog stormwater drainage systems and sanitary sewer lines. Contact a service provider to remove and properly dispose of oil and grease accumulations.
- If cleaning or rinsing waste containers, dispose of all wastewater into the sanitary sewer. If sanitary sewer is not available, then store the wastewater in a holding tank, dead-end sump, or truck it off-site to an approved disposal location.

Additional Information

- *Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs
    - A-31: Parking Lots, Driveways and Outside Storage Areas
- *Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Disposal
    - Drainage Maintenance Contractors

A-8: Storage of Solid Waste and Food Wastes (Including Cooking Grease)

The following best management practices (BMPs) apply to garbage dumpsters, trash compactors and outdoor waste containers (e.g., cooking oil/grease receptacles).

Potential pollutants include but are not limited to fecal coliform bacteria, hydrocarbons, metals, nutrients, oil and grease, oxygen demanding substances, PCBs, pH, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- Store wastes in leak-proof containers with solid lids (e.g., dumpsters and trash compactors). No rainwater should be able to enter the container and no fluids should be leaking out.
- Keep all waste receptacles (e.g., dumpsters, garbage cans, used cooking oil/grease containers) closed except when adding waste.
- Leaking outdoor waste containers must be repaired or replaced. Contact your waste hauler for replacements if the container is leased.
- Trash compactor wastewater must be discharged to the sanitary sewer, septic system or collected and hauled off-site for proper disposal. It must not be discharged to ground, stormwater drainage systems, surface waters or groundwater.
- Trash compactor drain lines should be connected to the sanitary sewer or septic system. If a connection is not possible, collect the wastewater in a dead-end sump or similar device. The wastewater containment must be easily inspected, maintained, and pumped out for proper disposal.
- Used cooking oil/grease containers should be labeled with their contents and have a secured lid.
- While oil/grease containers are not required to have secondary containment, they should be located and/or secured such that they can't be tipped over.
- Clean up any spills immediately using absorbent material or scraping it up. Grease cannot be left on the ground.
- Have spill cleanup materials nearby.
- Use a lid or cover when transporting cooking oil/grease containers from kitchens to outside grease containers to prevent contents from spilling.
- Ensure that drip pans or absorbent materials are used whenever grease containers are emptied by vacuum trucks or other means.

- Dispose of collected cooking oil/grease as garbage if it is not being recycled. Do not dispose of fats, oils, or grease (FOG) into the sanitary sewer, septic system, or stormwater drainage system.

Required Routine Maintenance

- Keep the area around the grease container clean and free of debris.
- Check storage containers frequently for leaks and to ensure that lids are secure.
- Regularly check for loose debris in the waste container storage area and sweep if the area is paved. After sweeping, the waste storage area may be hosed down—without the use of soaps, detergents, or other chemicals—if there are no accumulations of oil and grease present and the rinse water is not discharged to a stormwater drainage system or surface water. The rinse water can infiltrate to ground or be discharged to a sanitary sewer.
- Do not hose down or apply soaps, detergents, or other chemicals to waste storage areas with accumulated oil and grease. Oily wastewater can clog stormwater drainage systems and sanitary sewer lines. Contact a service provider to remove and properly dispose of oil and grease accumulations.
- If cleaning or rinsing waste containers, dispose of all wastewater into the sanitary sewer. If sanitary sewer is not available, then store the wastewater in a holding tank, dead-end sump, or truck it off-site to an approved disposal location.

Additional Information

- *Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs
    - A-31: Parking Lots, Driveways and Outside Storage Areas
- *Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Disposal
    - Drainage Maintenance Contractors

A-9: Storage of Scrap and Recycling Materials (Including Auto Recycling Facilities)

The following best management practices (BMPs) apply to the salvaging and storage of scrap metal, scrapped equipment, junked appliance and vehicles, empty metal drums, and recyclable materials such as cans, bottle, plastic, and paper products.

Potential pollutants can include but are not limited to hydrocarbons, metals, oil and grease, oxygen demanding substances, PCBs, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- Check incoming scrap materials, vehicles, and equipment for potential fluid contents and batteries.
- Drain and transfer fluids from vehicles and other equipment only in a designated area with a waste collection system or over drip pans.
- Cover and contain vehicle and equipment dismantling areas to prevent rainwater contact.
- Remove batteries and store off the ground in a leak proof container and under cover.
- Cover and raise any materials that may contaminate stormwater. A tarp and a pallet are acceptable.
- Cover and contain stockpiles of any material that has the potential to contaminate stormwater runoff.
- All containers used to store fluids must comply with activity sheets A-2: Outdoor Storage of Liquid Materials in Stationary Tanks and A-3: Outdoor Storage of Liquid Materials in Portable Containers regarding secondary containment. Storage of gasoline must comply with the appropriate Fire Codes.

Required Routine Maintenance

- Inspect storage areas regularly and promptly clean up any leaks, spills, or contamination.
- Sweep scrap storage areas as needed. Do not hose down anything to the stormwater drainage system.
- Keep spill cleanup materials in a location known to all. Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- If you are involved in transporting any of these materials you must carry spill cleanup material in the vehicle to capture any spilled liquids, and have an impermeable liner in the bed of your truck to capture any spilled or leaked materials. Properly dispose of or reuse any collected fluids.

Supplemental BMPs

- Install catch basin inserts to collect excess sediment and debris if necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.

Additional Information

- *Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs
    - A-2: Outdoor Storage of Liquid Materials in Stationary Tanks
    - A-3: Outdoor Storage of Liquid Materials in Portable Containers
- *Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Catch Basin Inserts
    - Containment
    - Covering

A-11: Cleaning or Washing of Tools and Equipment

The following best management practices (BMPs) apply to the cleaning of tools and equipment such as lawn mowers, edgers and grass trimmers, tools used at equipment repair shops, and manufacturing equipment such as saws, grinders, and screens.

Potential pollutants include but are not limited to hydrocarbons, metals, nutrients, oil and grease, oxygen demanding substances, PCBs, pH, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- Discharge tool and equipment wash water to the sanitary sewer (with approval from the sewer authority) or a holding tank for offsite disposal. The discharge of wash water to the stormwater drain system is not allowed without treatment and an Individual Wastewater Discharge permit from the Washington State Department of Ecology.
- Rinse lawnmowers with water only on a lawn or similar area where grass clippings will not get into the stormwater drainage system or surface waters when it rains.
- Oily, soapy, or otherwise dirty water is not allowed to discharge to any stormwater drainage system or surface water.

Supplemental BMPs

- Recycle your wash water with an enclosed loop system or use self-contained parts washers. Numerous products are commercially available that recycle and contain wash water and cleaning solvents.

Additional Information

- *Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs
    - A-13: Vehicle Washing and Steam Cleaning
    - A-18: Vehicle and Equipment Repair and Maintenance
- *Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Containment
    - Disposal
    - Oil/Water Separator
    - Water Quality Treatment BMP
- Washington State Department of Ecology's Vehicle and Equipment Washwater Discharges/Best Management Practices Manual https://fortress.wa.gov/ecy/publications/summarypages/95056.html

A-12: Cleaning of Washing of Food Service Areas and Equipment

The following best management practices (BMPs) apply to stationary and mobile operations.

Potential pollutants can include but are not limited to nutrients, oil and grease, oxygen demanding substances, pH, and sediment.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- The cleaning of food service equipment—such as cooking equipment, filter screens, and floor mats—must be done indoors.
- All wash and rinse water (including mop water) must be discharged to the sanitary sewer or the septic system. It may not be discharged outdoors or into the stormwater drainage system.
- Floor mop water must not be poured outside. Instead pour mop water into a mop sink, utility sink or toilet.
- Wash and rinse water containing fats, oils, or grease (FOG) may require pretreatment to remove FOG prior to disposal to the sanitary sewer or septic system. Check with your local sewer authority.
- Do not dispose of wash or rinse waster containing floor stripping or disinfectant chemicals into the septic system as they can seriously inhibit wastewater treatment and cause the system to fail. The wash or rinse water should be collected and hauled offsite for proper disposal (e.g., taken to a wastewater treatment facility).
- The use of “environmentally friendly”, "nontoxic" or “biodegradable” soaps and detergents does NOT make it acceptable to discharge to any stormwater drain system or surface waters. All soaps and detergents are harmful to aquatic organisms.

Additional Information

- Contact the local sewer authority for more information on disposal to the sanitary sewer system.
- Interagency Resource for Achieving Cooperation’s *A Guide to Restaurant Grease Management* https://apps.lhwmp.org/IRAC/eDoc.ashx?DocID=Xb9va1HRGBg%3d

A-14: Interior Washing Operations (Including Mobile Contractors)

Potential pollutants can include but are not limited to nutrients, oil and grease, pH, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- All wash and rinse water (including floor mop water) must be discharged to the sanitary sewer or septic system. It may not be discharged outdoors or into the stormwater drainage system.
- Do not dispose of wash or rinse waster containing floor stripping or disinfectant chemicals into the septic system as they can seriously inhibit wastewater treatment and cause the system to fail. The wash or rinse water should be collected and hauled offsite for proper disposal (e.g., taken to a wastewater treatment facility).
- The use of “environmentally friendly”, "nontoxic" or “biodegradable” soaps and detergents does NOT make it acceptable to discharge to any stormwater drain system or surface waters. All soaps are harmful to aquatic organisms.
- Do not dispose of sludge (thick, wet, viscous mixture; e.g., accumulated food debris cleaned from surface of equipment) outdoors or into the stormwater drainage system.

Additional Information

- *King County Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
  - Disposal
- Contact the local sewer authority for more information on disposal to the sanitary sewer system.

A-15: Washing of Buildings, Rooftops, and Other Large Surfaces

The following best management practices (BMPs) apply to the washing of objects not associated with the operation or storage of automotive equipment or machinery.

For washing of parking lots, driveways, or other areas where automotive fluid (e.g., oil, gasoline) are present, see activity sheet A-31: Parking Lots, Driveways, and Outside Storage Areas. For washing of docks, wharves, piers, floats, and boat ramps, see activity sheet A-30: Marine Activities.

Potential pollutants can include but are not limited to hydrocarbons, metals, nutrients, oil and grease, oxygen demanding substances, pH, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- If soaps, detergents, or any other chemicals are used, use a sump pump, wet vacuum or similar device that enables collection of wash water and associated solids so they can be disposed of properly. The wash water must not go to the stormwater drainage system, groundwater, or surface water. This may require temporarily blocking or disconnecting downspouts from the stormwater drainage system in order to prevent illicit discharges.
- Wash water runoff does not have to be collected if:
    - No soaps, detergents, or any other chemical (including pesticides) are used;
    - Only cold water is used. Heated water cannot be discharged to the stormwater drainage system; and
        - the wash water can be diverted to a nearby vegetated area to infiltrate into the ground, or
        - the wash water is filtered through media (e.g., filter fabric) to trap solid materials, prior to entering a stormwater drainage system. The area must be swept prior to washing, in order to remove all fines (e.g., silts and clay) that may otherwise clog or bypass the filtering process.
- Oil stains must be removed with absorbent materials prior to washing
- Wash water is not allowed to flow off-site.
- If the surface being washed has lead or other heavy metal-bearing paint or dust (such as chromium or cadmium), you must use a commercial washing service that will collect, test, and properly dispose of the wash water.

- Block or disconnect all rooftop downspouts when washing roofs. The wash water must be directed to pervious areas such as landscaping or gravel for infiltration, collected and disposed of to the sanitary sewer, or taken off-site for proper disposal.

Additional Information

- *Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs
    - A-30: Marine Activities
    - A-31: Parking Lots, Driveways and Outside Storage Areas
- *Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Catch Basin Insert
    - Disposal

Note: Washing of boats in boat yards, marinas, and dry dock areas is covered by a National Pollutant Discharge Elimination System (NPDES) permit, administered by the Washington State Department of Ecology, so the BMPs listed above may not apply to washing in these locations.

A-20: Concrete and Asphalt Application

The following best management practices (BMPs) apply to sites where asphalt is applied or small amounts of concrete that is hand mixed on site.

Potential pollutants can include but are not limited to hydrocarbons, metals, oil and grease, pH, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- Use drip pans, ground cloths, heavy cardboard, or plywood wherever concrete, asphalt, asphalt emulsion and drips are likely to spill, such as beneath discharge points from equipment.
- Cover and contain all nearby storm drains at the beginning of the workday. Drain covers and other containment devices are commercially available to keep runoff out of the storm drainage system. All solids collected must be disposed of properly at the end of the workday (or more frequently) prior to removing the containment or cover device(s).
- Contain and collect the slurry from exposed aggregate washing. Never allow the slurry to get into a storm drain, ditch, roadway shoulder or gutter. Use a catch basin cover, inlet protection or other containment device, such as a hand-dug, lined sump to direct and contain slurry. All collected runoff must be disposed of properly.
- Do not discharge concrete, slurry, or rinse water into gutters, storm drains, or drainage ditches or onto the paved surface of a roadway or driveway.
- Designate an area onsite where hand tools will be cleaned and the water collected for disposal. Commercial products and services are also available for concrete, slurry, and rinse water containment and disposal.
- Do not use diesel fuel for cleaning or prepping asphalt tools and equipment.

Required Routine Maintenance

- Sweep the pouring area at the end of the job or more frequently if needed. Collect loose aggregate chunks and dust. Do not hose down the area to the stormwater drainage system.

Supplemental BMPs

- A catch basin insert may be necessary for sediment removal. Catch basin inserts require frequent maintenance to be effective.

Additional Information

- *King County Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs

    - A-11: Cleaning or Washing of Tools and Equipment
    - A-19: Concrete and Asphalt Production and Recycling
- *King County Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Catch Basin Insert
    - Containment
    - Covering
    - Disposal
- *King County Surface Water Design Manual*
    - Appendix D – Concrete Handling
    - Appendix D – Concrete Washout Area

A-27: Clearing and Grading of Land for Small Construction Projects

Potential pollutants can include but are not limited to hydrocarbons, metals, nutrients, oil and grease, oxygen demanding substances, PCBs, and sediment.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- The City coordinates the clearing, grading, and erosion control requirements on individual sites. Contact the City prior to clearing, grading, and preparation activities for construction-sites greater than 2,000 square feet.
- Even if your site does not require a permit, erosion control measures are still required to prevent turbid water from entering stormwater drainage systems or surface waters.
- Follow the procedures for construction-site erosion and sediment control outlined in the *King County Surface Water Design Manual*:
    - Appendix C: Small Project Drainage Requirements
    - Appendix D: Erosion and Sediment Control Standards

Additional Information

- *King County Surface Water Design Manual*

A-29: Building Repair, Remodeling and Construction

The following best management practices (BMPs) apply to the construction of buildings and other structures, remodeling of existing buildings, houses and other structures, and general exterior building repair work.

Potential pollutants can include but are not limited to hydrocarbons, metals, nutrients, pH, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- Train employees about the need to prevent stormwater pollution.
- Keep spill cleanup materials in a common location onsite at all times. Train employees on spill prevention and clean up measures.
- Identify, remove, and properly dispose of hazardous substances from the building before beginning repairing or remodeling activities that could expose them to stormwater. Such substances could include PCBs, asbestos, lead paint, mercury switches, and electronic waste.
- Use a catch basin cover, filter fabric, or other runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area.
    - Place the cover or containment device over the catch basin at the beginning of the workday.
    - Collect and properly dispose of accumulated dirty runoff and solids before removing the cover or device at the end of each workday.
    - Check runoff control mechanisms and replace as necessary.
- Do not dump any substance, wash water or liquid waste on the pavement, ground, or into the stormwater drainage system
- Use drop cloths when painting, scraping, and sandblasting and properly dispose of collected material daily. Use drip pans in areas where drips are likely to occur if the area cannot be protected with a drop cloth.
- Cleaning paint brushes and tools:
    - Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer.
    - Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal. Solvents may not be disposed of to the sanitary sewer.
    - Never dispose of any wash water to a storm drain.

- Refer to activity sheet A-15: Washing of Buildings, Rooftops, and Other Large Surfaces for best management practices associated with pressure washing buildings.
- Control windblown dust and fine materials by applying water or dust suppression products, avoiding excessive application to prevent runoff. Do not use oils for dust control.
- Cover trash bins and dumpsters and ensure they are not leaking.
- Follow BMPs for dewatering activities.

Required Routine (Daily) Maintenance

- Sweep paved areas to collect loose particles for proper disposal. Consider using filtered vacuuming to collect waste that may be hard to sweep, such as dust on a drop cloth.
- Wipe up spills with rags or other absorbent material immediately. Do not hose down the area to the stormwater drainage system.
- Store materials, such as solvents, indoors or under cover and secures so that unauthorized personnel will not have access to them.

Supplemental BMPs

- Recycle or reuse leftover materials.
- Set up temporary cover in wet weather conditions.
- Install temporary wheel wash facilities if track out occurs.

Additional Information

- *Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs
    - A-11: Cleaning or Washing of Tools and Equipment
    - A-15: Washing of Buildings, Rooftops, and Other Large Surfaces
    - A-20: Concrete and Asphalt Application
    - A-41: Wheel Wash and Tire Bath Track Out Control
- *Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Catch Basin Insert
- *King County Surface Water Design Manual*, Appendix D: Construction Stormwater Pollution Prevention Standards

A-31: Parking Lots, Driveways and Outside Storage Areas

Potential pollutants can include but are not limited to hydrocarbons, metals, oil and grease, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of surface water and stormwater, you will be required to take additional measures.

Required BMPs

- Sweep areas as needed to collect dirt, waste, debris, and spilled material. Do not hose down areas to the stormwater drainage system or surface waters.
- Clean up vehicle and equipment fluid drips and spills immediately using absorbent materials.
- Place drip pans under leaking vehicles and equipment, including employee vehicles, until the vehicle/equipment no longer leaks. Properly dispose of accumulated leaked fluids.
- Pressure wash water from paved areas must be collected and disposed of to the sanitary sewer or hauled for offsite disposal, even if soaps, detergents, or cleaners are not used. If the surface to be pressure washed is not utilized by automotive equipment or machinery, see activity sheet A-15: Washing of Building, Rooftops and Other Large Surfaces.
- There are businesses that will clean parking lots and collect water for off-site disposal. Never drain wash water to the stormwater drainage system.
- Follow basic sediment controls as outlined in Appendix D ("Erosion and Sediment Control Standards") of the *King County Surface Water Design Manual* for gravel and dirt lots. These types of parking lots may require additional BMPs to prevent sediment-laden water from leaving your site.

Supplemental BMPs

- Encourage employees to repair leaking personal vehicles.
- Install catch basin inserts to collect excess sediment and oil, if necessary. Inspect and maintain catch basin inserts regularly to ensure they are working correctly.

Additional Information

- *King County Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs
    - A-3: Storage of Liquid Materials in Portable Containers
    - A-15: Washing of Buildings, Rooftops, and Other Large Surfaces
- *King County Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Catch Basin Insert
    - Disposal

A-32: Sidewalk Maintenance

Potential pollutants can include but are not limited to fecal coliform bacteria, hydrocarbons, metals, oil and grease, oxygen demanding substances, PCBs, pH, and sediment.

If the BMPs included here are not enough to prevent contamination of surface water and stormwater, you will be required to take additional measures.

Required BMPs

- Sweep sidewalks as needed to collect loose dirt and debris rather than blowing or pushing it into the street or gutter or hosing it down. Collected materials must be disposed of as solid waste.
- Clean individual stains instead of washing the entire sidewalk, if possible.
- Collect wash water and dispose of into the sanitary sewer or take off-site for appropriate disposal if soaps or other cleaners are used. If only water is used, then install a catch basin insert or filter cloth in order to collect all solids and debris.
- Use a minimum amount of sand or deicing salts and sweep up any remaining granules when the snow and ice have melted.

Additional Information

- *King County Stormwater Pollution Prevention Manual*, Chapter 3: Commercial and Multifamily BMPs
    - A-3: Storage of Liquid Materials in Portable Containers
    - A-15: Washing of Buildings, Rooftops, and Other Large Surfaces
    - A-31: Parking Lots, Driveways and Outside Storage Areas
- *King County Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Containment
    - Disposal

A-44: Dust Control for Commercial Operations

The following best management practices (BMPs) apply to existing manufacturing and commercial operations as opposed to new construction or land development. Material handling activities may include concrete crushing, cement mixing, commercial composting, stone grinding, and wood milling.

Potential pollutants can include but are not limited to hydrocarbons, metals, oxygen demanding substances, PCBs, pH, sediment, and other pollutants.

If the BMPs included here are not enough to prevent contamination of stormwater, you will be required to take additional measures.

Required BMPs

- Sweep paved areas where dust and erodible materials accumulate. Use vacuum sweepers to minimize generation of airborne dust and for more efficient dust removal.
- Clean equipment and vehicles that leave the property to prevent dust and track out of material. Create a designated wash area to collect and properly dispose of the wash water. Never wash down equipment or vehicles to the stormwater drainage system or to surface waters.
- Train employees in the proper operating procedures to minimize dust accumulation.

Supplemental BMPs

- Use dust filtration and collection systems such as bag house filters.
- Use water spray to flush dust accumulations to an approved treatment system or the sanitary sewer where available and allowed by the local sewer authority and the King County Industrial Waste Program.
- Use approved dust suppressants such as those listed in the *King County Surface Water Design Manual*, Appendix D: Erosion and Sediment Control Standards.
- When pH levels in stormwater rise above 8.5, the pH must be adjusted to the acceptable range of 6.5 to 8.5. Refer to the *King County Surface Water Design Manual*, Appendix D, Sections D.2.2.7 and D.2.2.8 for information on pH adjustment.

Additional Information

- *Stormwater Pollution Prevention Manual*, Chapter 5: Information Sheets
    - Catch Basin Insert
    - Controlling and Collecting Contaminated Runoff
    - Water Quality Treatment BMPs
- Washington State Department of Ecology's *Techniques for Dust Prevention and Suppression, #96-433* https://p2infohouse.org/ref/14/13215.pdf. Note that not all

dust suppressants are appropriate for use near storm drainage systems or surface waters.

- Contact Puget Sound Clean Air Agency and/or the Washington State Department of Ecology for air pollution control regulations.

BMP
DUST CONTROL

DESCRIPTION

Dust control is the use of water, products, and/or measures for reducing wind erosion. Particles moved by wind may cause air pollution, soil loss and/or water quality degradation.

PURPOSE

The purpose of this BMP includes, but is not limited to:

- Reducing soil particle travel by wind due to construction or maintenance operation activities.
- Reducing air and water pollution.

APPLICATIONS

This BMP may be used on construction sites, roads, shoulders, operating headquarters or pit/quarry sites. It may be used in combination with other BMPs. Protecting the soil surface is accomplished through measures such as roughening the soil to reduce the surface wind velocity, applying straw/mulch, water, matting, hydroseeding, plastic covering, Lignum derivative, or Magnesium Chloride.

LIMITATIONS

This BMP should not be used:

- With straw in locations where compaction is required (for example, roadway shoulders or road bases).
- If a chemical suppressant could enter watercourses or streams.

CONSTRUCTION GUIDELINES

- Water, Lignum derivative, or Magnesium Chloride can be applied by mechanical means.
- A temporary straw covering may be applied by hand to a small area of exposed soil where compaction is not required.
- Surface roughening may be accomplished by using a machine.
- Create a berm downslope to control possible runoff from watering.

BMP MAINTENANCE

- During the construction period, inspect BMPs daily during the workweek. Make any required repairs.
- Reapply BMP as needed.

BMP REMOVAL

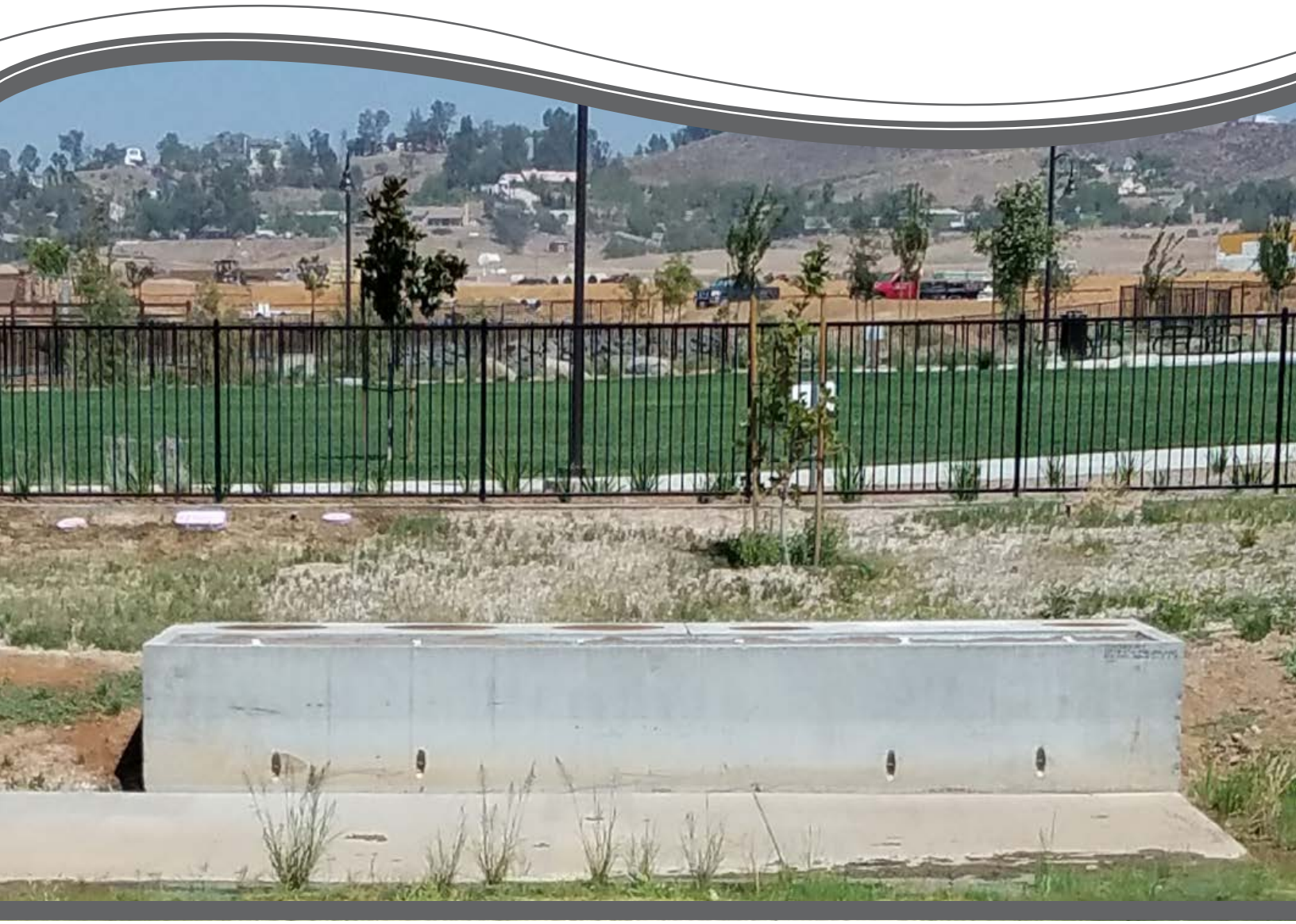
- Evaluate site to determine BMP is no longer needed (the area has stabilized—potential of wind erosion has passed).
- Straw removal may be necessary if the area is to be re-vegetated.
- Re-vegetate area disturbed by BMP removal.

Water wagon wetting down field for dust control

Wetting down stockpiles to reduce airborne soil particles

CONTECH®
ENGINEERED SOLUTIONS

Modular Wetlands® Linear Operations & Maintenance Manual



MODULAR WETLANDS®

MODULAR WETLANDS LINEAR
OPERATION & MAINTENANCE MANUAL

TABLE OF CONTENTS

OVERVIEW

This operation and maintenance (O&M) manual is for the Modular Wetlands Linear Biofilter (MWL). Please read the instructions and equipment lists closely prior to starting. It is important to follow all necessary safety procedures associated with state and local regulations. Please contact Contech for more information on pre-authorized third-party service providers who can provide inspection and maintenance services in your area. For a list of service providers in your area, please visit www.conteches.com/maintenance.

WARNING

Confined space entry may be required. Contractor to obtain all equipment and training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to always proceed safely.

SAFETY NOTICE & PERSONAL SAFETY EQUIPMENT

Job site safety is a topic and a practice addressed comprehensively by others. The inclusions here are merely reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s), and Service Provider(s). OSHA and Canadian OSH, Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Service Provider's responsibility and outside the scope of Contech Engineered Solutions.

Safety Boots

Gloves

Hard Hat

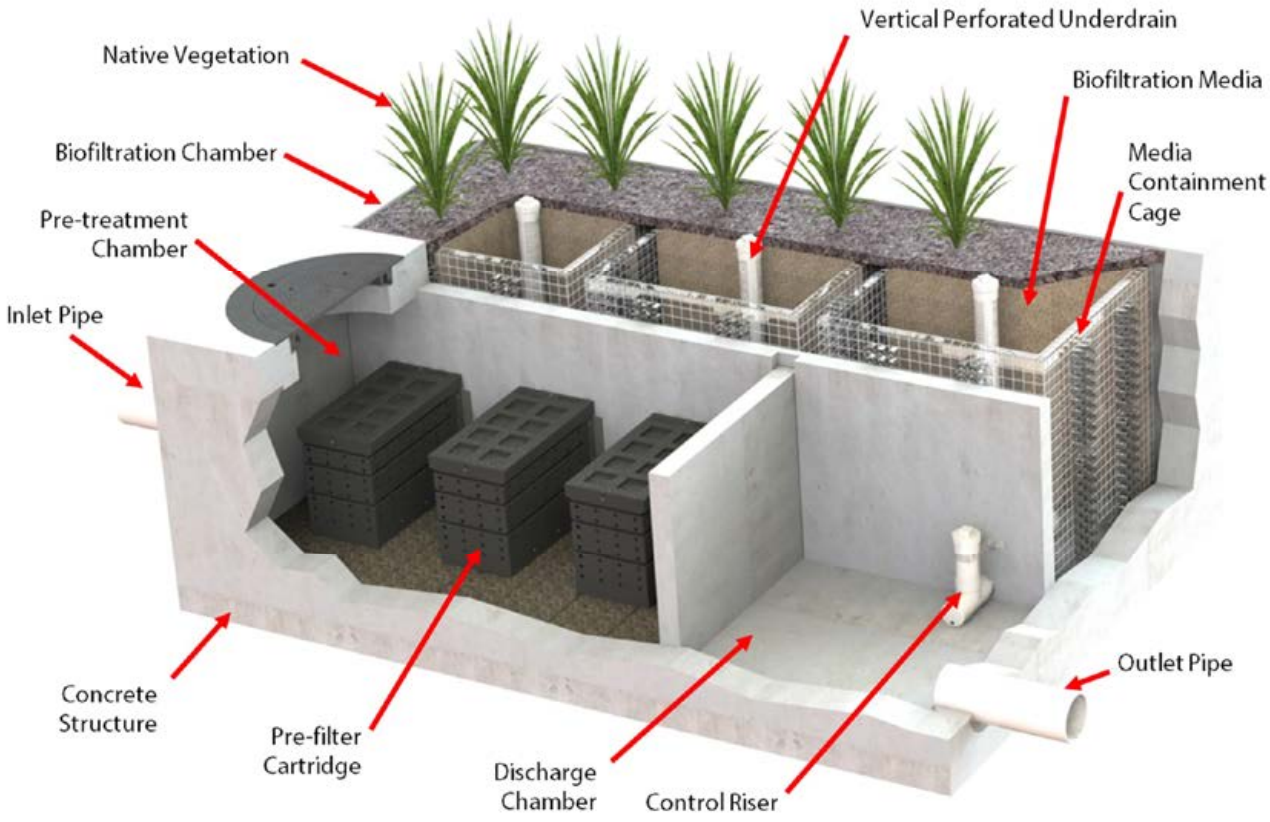
Eye Protection

Maintenance and Protection of Traffic Plan

MODULAR WETLANDS LINEAR COMPONENTS LIST

The MWL system comes in multiple sizes and configurations, including side by side or end to end layouts, both as open planters or underground systems. See shop drawings (plans) for project specific details.

The standard MWL system is comprised of the following components:



INSPECTION SUMMARY & EQUIPMENT LIST

Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site-specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the MWL:

Modular Wetlands Linear Inspection Form

Flashlight

Tape Measure

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

INSPECTION & MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics, and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the biofiltration chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

INSPECTION PROCESS

1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The pre-filter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and in need of replacement.

6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.

7. The discharge chamber houses the control riser (if applicable), drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating condition and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above.

8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.

MAINTENANCE INDICATORS

Based upon the observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components or cartridges.
- Obstructions in the system or its inlet and/or outlet pipes.
- Excessive accumulation of floatables in the pre-treatment chamber in which the length and width of the chamber is fully impacted more than 18".
- Excessive accumulation of sediment in the pre-treatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models).
- Overgrown vegetation.

MAINTENANCE SUMMARY & EQUIPMENT LIST

The time has come to maintain your MWL. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and maintenance equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.
    - A gas meter should be used to detect the presence of any hazardous gases prior to entering the system. If hazardous gases are present, do not enter the vault. Following appropriate confined space procedures, take steps such as utilizing a venting system to address the hazard. Once it is determined to be safe, enter the system utilizing appropriate entry equipment such as a ladder and tripod with harness.

The following is a list of equipment required for maintenance of the MWL:

Modular Wetlands Linear Maintenance Form

Flashlight

Access Cover Hook

Ratchet
& 7/16" Socket
(if required for older pre-filter cartridges that have two bolts holding the lids on)

Vacuum Assisted Truck with Pressure Washer

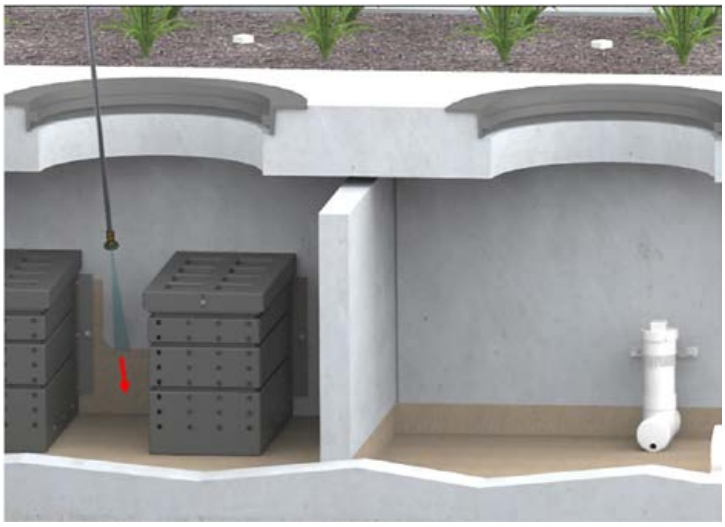
Replacement
BioMediaGREEN
(If Required)

(order BioMediaGREEN from Contech's Maintenance Team members at https://www.conteches.com/maintenance)

MAINTENANCE INSTRUCTIONS

1. ACCESS COVER REMOVAL

Upon determining that the vault is safe for entry, remove all access cover(s) and position the vacuum truck accordingly.



2. PRESSURE WASH SYSTEM CHAMBERS

With the pressure washer, spray down pollutants accumulated on the walls and floors of the pre-treatment and discharge chambers. Then wash any accumulated sediment from the pre-filter cartridge(s).

3. VACUUM SYSTEM CHAMBERS

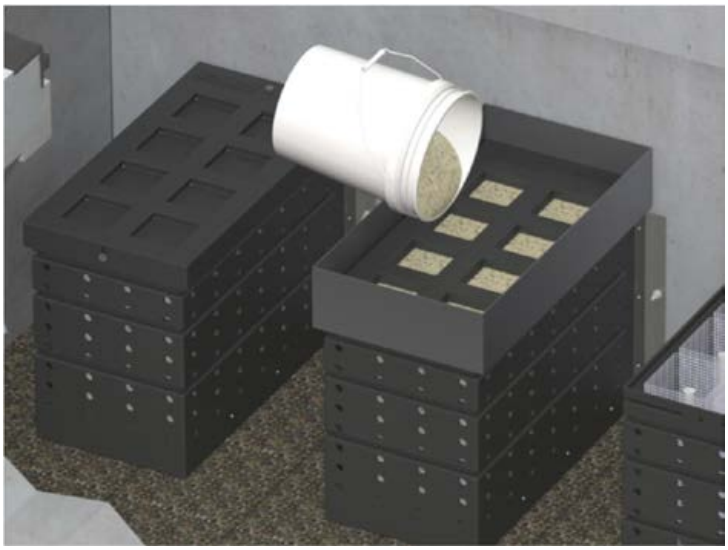
Vacuum out pre-treatment and discharge chambers and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the pre-treatment floor until the pervious pavers are visible and clean. **(MWL systems outside of California may or may not have pervious pavers on the floor in the pre-treatment chamber)** If pre-filter cartridges require media replacement, proceed to **Step 4**. If not, replace the access cover(s) and proceed to **Step 7**.

4. PRE-FILTER CARTRIDGE LID REMOVAL

After successfully cleaning out the pre-treatment chamber, enter the chamber and remove the lid(s) from the pre-filter cartridge(s) by removing the two thumb screws. (Older pre-filter cartridges have two bolts holding the lids on that require a 7/16" socket to remove)

5. VACUUM EXISTING PRE-FILTER MEDIA

Utilize the vacuum truck hose or hose extension to remove the filter media from each of the individual media cages. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and its media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.



6. PRE-FILTER MEDIA REPLACEMENT

Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. The easiest way to fill the media cages is to utilize a refilling tray that can also be sourced from the manufacturer. Place the refilling tray on top of the cartridge and fill with new bulk media shaking it down into the cages. Using your hands, lightly compact the media into each filter cage. Once the cages are full (each cartridge will hold five heaping 5gal buckets of bulk media), remove the refilling tray and replace the cartridge top, ensuring fasteners are properly tightened.

7. MAINTAINING VEGETATION

In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The MWL utilizes vegetation similar to surrounding landscape areas, therefore, trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.

8. INSPECT UNDERDRAIN SYSTEM

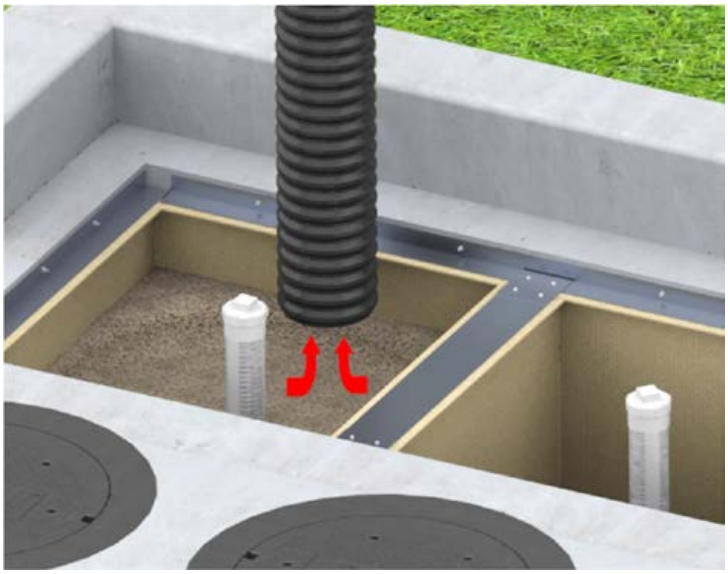
Each vertical under drain on the biofiltration chamber has a removable threaded cap that can be taken off to check for any blockages or root growth. Once removed, a jetting attachment to the pressure washer can be used to clean out the under drain and orifice riser if needed.

9. REPLACE ACCESS COVERS

Once maintenance is complete, replace all access cover(s)

REPLACING BIOFILTRATION MEDIA IF REQUIRED

As with all biofilter systems, at some point the biofiltration media will need to be replaced, either due to physical clogging or sorptive exhaustion (for dissolved pollutants) of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading, so replacing the biofiltration media should not be a common occurrence. In the event that the biofiltration media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new biofiltration media. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1,000 and 2,000 lbs. Biofiltration media replacement can be done following the steps below:



1. VACUUM EXISTING BIOFILTRATION MEDIA

Remove the mulch and vegetation to access the biofiltration media, and then position the vacuum truck accordingly. Utilize the vacuum truck to vacuum out all the media. Once all media is removed, use the pressure washer to spray down all the netting and underdrain systems on the inside of the media containment cage. Vacuum out any remaining debris after spraying down netting. Inspect the netting for any damage or holes. If the netting is damaged, it can be repaired or replaced with guidance by the manufacturer.

2. INSTALLING NEW BIOFILTRATION MEDIA

Ensure that the chamber is fully cleaned prior to installation of new media into the media containment cage(s). Media will be provided in super sacks for easy installation. A lifting apparatus (forklift, backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Add media in lifts to ensure that the riser pipes remain vertical. Be sure to only fill the media cage(s) up to the same level as the old media.

3. REPLANT VEGETATION

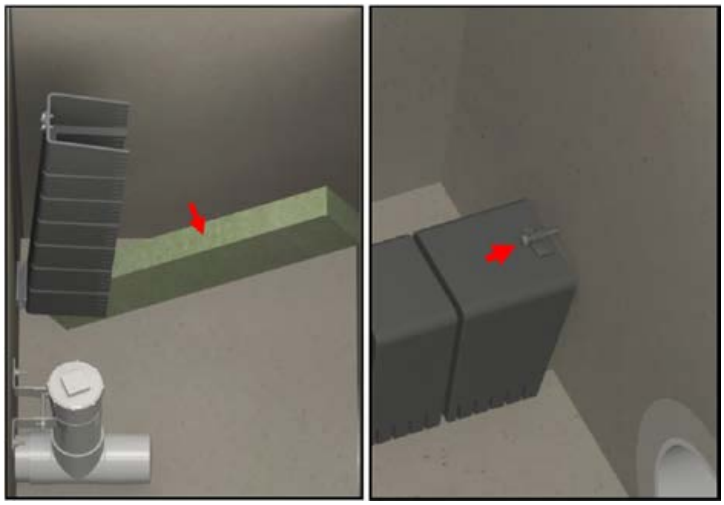
Once the media has been replaced, replant the vegetation and cover biofiltration chamber with approved mulch (if applicable). If the existing vegetation is not being reused, and new vegetation is being planted, you will need to acquire new plant establishment media that will be installed just below the mulch layer at each plant location. (see plan drawings for details). Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new plant establishment media.

REPLACING DRAIN DOWN FILTER MEDIA (ONLY ON OLDER CALIFORNIA MODELS)

NOTE: The drain down filter is only found on units installed in California prior to 2023
If during inspection it was determined that the drain down filter media requires replacement, contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new media.

1. REMOVE EXISTING DRAIN DOWN MEDIA

Pull knob back to unlock the locking mechanism and lift the drain down filter housing to remove the used BioMediaGREEN filter block.



2. INSTALL NEW DRAIN DOWN MEDIA

Ensure that the chamber and housing are fully cleaned prior to installation of new media, and then insert the new BioMediaGREEN filter block. The media filter block should fit snugly between the chamber walls and be centered under the filter housing. Lower the housing over the filter block and secure the locking mechanism.

NOTES

CONTECH® ENGINEERED SOLUTIONS

Inspection Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____

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Cleaning and Maintenance Report
Modular Wetlands Linear

Project Name _____

Project Address _____
(city) (Zip Code)

Owner / Management Company _____

Contact _____ Phone ( ) –

Inspector Name _____ Date ____/____/____ Time _____ AM / PM

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition _____ Additional Notes _____

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

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CONTECH ENGINEERED SOLUTIONS LLC PROVIDES SITE SOLUTIONS FOR THE CIVIL ENGINEERING INDUSTRY. CONTECH'S PORTFOLIO INCLUDES BRIDGES, DRAINAGE, SANITARY SEWER, STORMWATER AND EARTH STABILIZATION PRODUCTS. FOR INFORMATION ON OTHER CONTECH DIVISION OFFERINGS, VISIT CONTECHES.COM OR CALL 800-338-1122.

SUPPORT

DRAWINGS AND SPECIFICATIONS ARE AVAILABLE AT WWW.CONTECHES.COM

ModWetLinear OM Manual 03/24

Contech® CMP Detention Inspection and Maintenance Guide

Underground stormwater detention and infiltration systems must be inspected and maintained at regular intervals for purposes of performance and longevity.

Inspection

Inspection is the key to effective maintenance of CMP detention systems and is easily performed. Contech recommends ongoing, annual inspections. Sites with high trash load or small outlet control orifices may need more frequent inspections. The rate at which the system collects pollutants will depend more on-site specific activities rather than the size or configuration of the system.

Inspections should be performed more often in equipment washdown areas, in climates where sanding and/or salting operations take place, and in other various instances in which one would expect higher accumulations of sediment or abrasive/corrosive conditions. A record of each inspection is to be maintained for the life of the system.

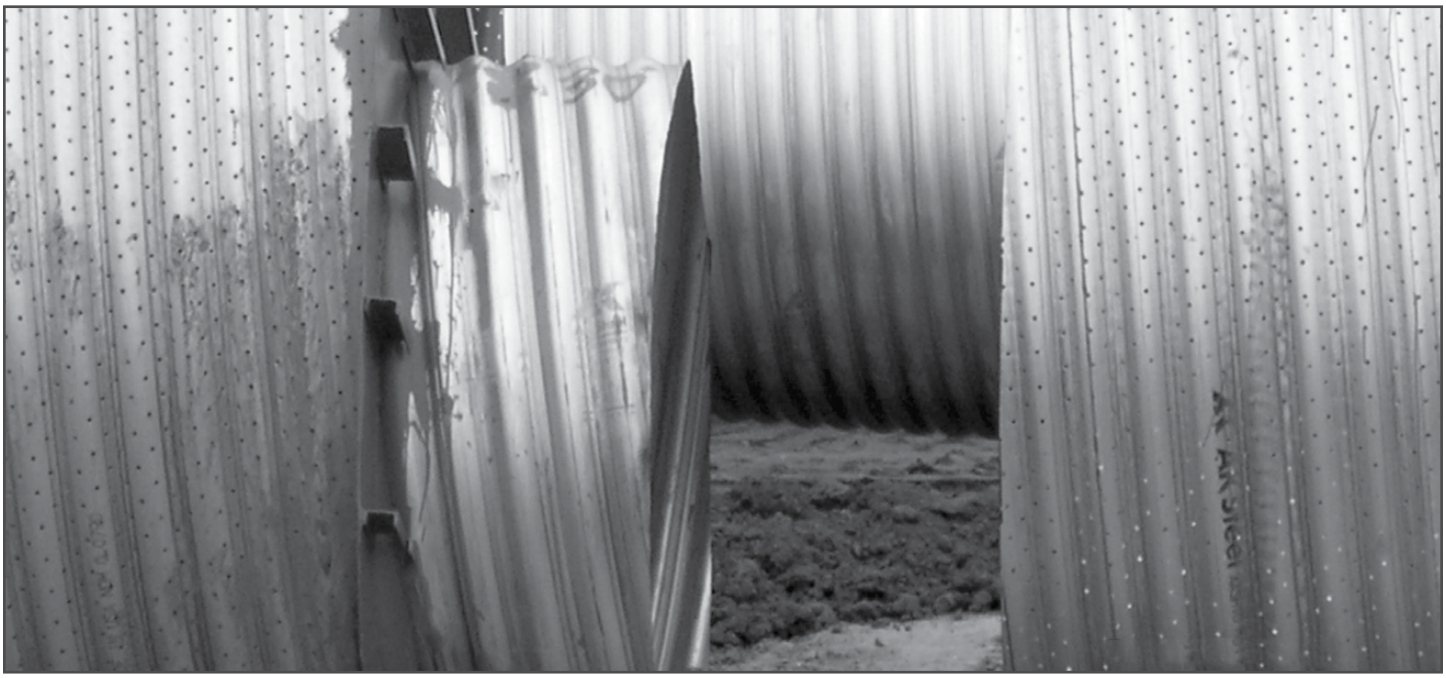
Maintenance

CMP detention systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice. Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Annual inspections are best practice for all underground systems. During this inspection if evidence of salting/de-icing agents is observed within the system, it is best practice for the system to be rinsed, including above the spring line soon after the spring thaw as part of the maintenance program for the system.

Maintaining an underground detention or infiltration system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

The foregoing inspection and maintenance efforts help ensure underground pipe systems used for stormwater storage continue to function as intended by identifying recommended regular inspection and maintenance practices. Inspection and maintenance related to the structural integrity of the pipe or the soundness of pipe joint connections is beyond the scope of this guide.



CONTECH®
CMP DETENTION SYSTEMS

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