

TECHNICAL MEMORANDUM:  
LITERATURE REVIEW OF  
STORMWATER BMP  
MAINTENANCE STANDARDS  
SAM Effectiveness Study: BMP Maintenance  
Conditions Evaluation

Prepared for: City of Bellevue and Washington State  
Department of Ecology

Project No. 200203 ○ December 2023 FINAL

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A BMP Maintenance Standards Reviewed

B Question for Ecology about the SWMMWW BMP Maintenance Standards

# Acronyms

ASCE	American Society of Civil Engineers
Aspect	Aspect Consulting, LLC
BMP	Best Management Practice
Ecology	Washington Department of Ecology
EPA	Environmental Protection Agency
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
KCSWDM	King County Surface Design Manual
LID	low impact development
NPDES	National Pollutant Discharge Elimination System
OWS	Oil-water separator
O&M	Operations and Maintenance
SAM	Stormwater Action Monitoring
SMM	Stormwater Management Manual
Study	This SAM study
SWG	Stormwater Work Group
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TAC	Technical Advisory Committee
USACE	United States Army Corps of Engineers
WSDOT	Washington State Department of Transportation

## Executive Summary

This memorandum summarizes the findings from a literature review about municipal operations and maintenance (O&M or O-M) of stormwater best management practices (BMPs). This work is part of a Stormwater Action Monitoring (SAM) Effectiveness Study (Study) that is focused on supporting western Washington municipal stormwater permittees of the National Pollutant Discharge Elimination System (NPDES) with O&M requirements.

The Study goal is to evaluate the maintenance conditions, or standards, for BMPs in the 2019 Stormwater Management Manual for Western Washington (SWMMWW). The literature review findings presented here support the Study goal by collecting and comparing information about stormwater BMP maintenance standards and guidance used by municipal and governmental O&M programs especially in western Washington.

The SWMMWW BMP Maintenance Tables are provided by Ecology as guidance, and permittees are allowed to adjust the frequency of BMP maintenance and the conditions that trigger maintenance based on demonstrated BMP performance. The maintenance standards in the literature were compared to the BMP Maintenance Tables from the SWMMWW, and the differences and similarities are highlighted and discussed. The literature review also included an exploration of the origins of the standards with a review of historical stormwater manuals in the Puget Sound region.

Maintenance data were also sought to evaluate the BMP maintenance standards, including from several online databases with both national and international datasets (including the *International Stormwater BMP Database* and the *National Pollutant Removal Performance Database*). But data specifically associated with the maintenance standards were not found; instead, the online databases are focused on data associated with BMP performance, water quality data, and maintenance and capital costs.

The key outcomes of this literature review are as follows.

- The review focused on three groups of BMP: ponds (three types), trenches (two types), and vaults (three types).
- Most maintenance standards are the same among the stormwater manuals reviewed, which included manuals by Ecology, King County, the City of Seattle, the City of Tacoma, and the Washington State Department of Transportation.
- Some standards varied by manual and were covered in more detail or had different numeric criteria. These included the following standards, which vary from or are not included in Ecology's SWMMWW for the BMPs reviewed:
  - Grass cover height.
  - Liner integrity.
  - Sediment accumulation in ponds and in pipes.

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- Amount of standing water in wet ponds.
- The amount of blockage in pipes, air vents, treatment media, and filters.
- The size of cracks or potential structural issues in vaults and tanks.
- Using sludge versus oil accumulation in oil/water separators.
- Repetition of maintenance components, especially common ones for many BMPs (e.g., trash/debris, rodents, presence of pollution, etc.).

This memorandum also includes the summary of information gathered from follow-up questions asked of Ecology about the origins of the BMP Maintenance Tables in SWMMWW. Current Ecology staff are not familiar with the specific basis and origins of the maintenance standards, and they pointed the Study team to historical stormwater manuals. Based on our review of three key manuals in the Puget Sound Region, we have reached the following initial conclusions about the origins of the Ecology BMP Maintenance Tables:

- While the SWMMWW has a section of literature references for the manual overall, the BMP Maintenance Tables do not include citations specific to the maintenance standards for the BMP types reviewed. The lack of citations for specific standards makes it difficult to trace the origins of specific standards.
- The maintenance standards appear to be derived from a mix of engineering design details, hydraulic modeling and calculations, primary/academic research articles, textbook references, federal guidance publications from the EPA and USACE, and BMP performance observations. This is deduced based on the list of references provided for Volume V on Runoff Treatment BMPs in the 2001 Ecology SWMMWW, which appears to be the first instance of the comprehensive set of tables of maintenance standards as they are in the current SWMMWW.
- The “maintenance requirements” in the older stormwater manuals reviewed (from King County and Ecology, in 1990 and 1992, respectively), have early versions of the maintenance standards tables. King County’s is the most comprehensive and includes 12 BMP types, and the maintenance requirements are presented in tables with similar maintenance components as today’s standards and qualitative descriptions or quantitative values.
- The standards are also informed by local studies and controlled field tests, many of which appear to be decades old, especially for conventional BMPs, such as ponds, vaults, and trenches.

We provide the following recommendations based on the outcome of this review of BMP maintenance standards data and literature:

- Perform controlled field studies to evaluate and verify or update the BMP maintenance standards. Little to no literature was found that evaluates maintenance standards; rather, the focus is on BMP performance and cost of maintenance. Pairing these two research objectives may be challenging, and

based on this literature review, topics of interest include the following for controlled field studies to evaluate maintenance standards and BMP performance:

- Sediment accumulation in ponds, pipes, and filter bags.
  - Vegetation height and growth and potential benefits of growth (e.g., habitat)
  - Water ponding based on time versus percolation tests.
  - Algae coverage of open water.
  - Habitat versus stormwater benefits.
- Assess what O&M data are collected by current municipal stormwater permittees in western Washington that could be used to evaluate maintenance standards. This is planned in Task 5 of the Study.
  - Consider widening the audience for the questions that were prepared for Ecology. The questions could also be sent to others from different agencies or to those who are retired from Ecology but contributed to the 2001 Ecology SWMMWW.
  - Review and add the literature references from the 2001 SWMMWW back into the current stormwater manual (2019 SWMMWW), and carry them forward in subsequent manuals. If possible, add citations to specific standards in the BMP maintenance tables.



# 1 Introduction

This technical memorandum provides a summary of a literature review performed for a Stormwater Action Monitoring (SAM) study (Study). The SAM Study focuses on operations and maintenance (O&M or O-M) of stormwater best management practices (BMPs) and is being implemented by the City of Bellevue (City) and Aspect Consulting, LLC (Aspect). The SAM studies are administered by the Washington State Department of Ecology (Ecology) and funded cooperatively by municipal permittees of the National Pollutant Discharge Elimination System (NPDES) in Washington State.

## 1.1 Objectives for the Study and Literature Review

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The Study purpose is to evaluate the maintenance criteria for selected stormwater best management practices (BMPs) in the 2019 Stormwater Management Manual for Western Washington (SWMMWW, Ecology, 2019a). This Study topic was identified as a priority related to stormwater BMPs by the SAM Effectiveness Subgroup and the Stormwater Work Group (SWG) for Puget Sound, both administered by Ecology. In addition to evaluating BMP maintenance criteria, the Study also indirectly addresses two other priority study topics that included BMPs and wildlife habitat considerations and a controlled field study of BMP maintenance practices.

The maintenance criteria being evaluated are from the SWMMWW, specifically Appendix V-A: BMP Maintenance Tables of Volume V, which has the maintenance standards for BMPs for runoff treatment, flow control, and a library of the preferred low impact development (LID) BMPs (Ecology, 2019b). The BMP Maintenance Tables cover 23 distinct BMPs, which define the minimum maintenance requirements for permittees to follow. The SWMMWW BMP Maintenance Tables are included in Appendix A of this document for reference.

The goal of this literature review is to find and review maintenance standards for comparison to Ecology's BMP Maintenance Tables. The comparison will be used to characterize the variability in the standards used by permittees in western Washington.

For this Study, we are focused on four general types of BMPs that are in widespread use: ponds, trenches, vaults, and tanks. These cover most of the BMPs in the Ecology BMP Maintenance Tables (Ecology, 2019b), and vaults and tanks are grouped together with the same standards. For this literature review, we focused specifically on three types of ponds, two types of trenches, and three types of vaults. The reasons for focusing on these BMPs are explained below in Chapter 2.

## 1.2 NPDES Permit O&M Maintenance Standards

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The requirements for stormwater O&M for permittees are provided in section S5.C.7 (Ecology, 2019c). The minimum performance measures cover stormwater facilities that are regulated, owned, and/or operated by the permittee, and the need for maintenance standards is indicated in the first minimum performance measure of the section:

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- a. *Each Permittee shall implement maintenance standards that are as protective, or more protective, of facility function than those specified in the Stormwater Management Manual for Western Washington or a Phase I program approved by Ecology. For facilities which do not have maintenance standards, the Permittee shall develop a maintenance standard.*

As the permit notes, a permittee can develop their own maintenance standards or implement Ecology's or those of a Phase I permittee. Many Phase I permittees in western Washington have developed their own standards, and almost all Phase II permittees have adopted standards from Ecology or a Phase I permittee.

## 2 Literature Reviewed

The literature reviewed was a mix of sources intended to shed light on the current standards in the SWMMWW BMP Maintenance Tables. The literature sources were chosen due to their relevance to the origins of specific standards for the BMPs being evaluated, the relative variability of the standards, and as reference documents from other parts of the country.

The literature review focused on eight BMPs in total to represent maintenance standards for three common pond BMPs, two common trench BMPs, and three common vault BMPs. The focus on these common BMPs, many of which widely used conventional BMPs (rather than all 23 in the Ecology maintenance standards), was applied to the literature search for a few reasons:

1. The focus is consistent with the Study’s goals and an effort scaled to the task budget.
2. The focus was informed partly by the literature review effort itself, which showed well-documented information for some standards and little to no documentation behind others. Relatively newer BMPs—especially low impact development (LID) BMPs using infiltration, bioretention, and permeable pavement—have well-documented standards, but some common older and conventional BMPs—such as ponds, trenches, and vaults—have little or no documentation tied directly to individual standards.
3. Vaults and tanks were covered under the same standards in the literature (and in Ecology’s standards, too), which cover both of these types of small footprint structures that may be located above or below ground.

The literature reviewed included publications on maintenance standards from several sources chosen to complement a comparison to Ecology’s maintenance standards. This included local municipal government publications, regional and national-level guidance, and several online databases.

### 2.1 Municipal Government Stormwater Manuals

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The literature review focused on key local municipal stormwater manuals with an emphasis on those commonly used in western Washington. This includes city, county, and transportation agency stormwater manuals.

- *King County Surface Water Design Manual (King County, 2021)*
  - Specifically, the maintenance standards in *Appendix A: Maintenance Requirements for Flow Control, Conveyance, and Water Quality Facilities* (included in Appendix A here).
- *City of Seattle Stormwater Manual July 2021 (City of Seattle, 2021)*
  - Specifically, the maintenance standards in *Appendix G: Stormwater Control Operations and Maintenance Requirements* (included in Appendix A here).

- Also: *Green Stormwater Operations and Maintenance Manual*, August 2009 (Seattle Public Utilities, 2009).
- *City of Tacoma Stormwater Management Manual* (City of Tacoma, 2021)
  - Specifically, the maintenance standards in *Appendix C Operation and Maintenance* (included in Appendix A here)
- *Highway Runoff Manual* (HRM), Washington State Department of Transportation (WSDOT, 2019).
  - Specifically, the maintenance standards in *Management Practices Field Guide, for ESA 4(d) Habitat Protection, June 2018* (included in Appendix A here).

Consistent with the SWMMWW BMP Maintenance Tables, the other maintenance standards compared here do not typically provide citations or references identifying where the standards are derived. The exception is for LID BMPs, which were added to stormwater manuals more recently and include a few key citations (e.g., *LID Technical Guidance Manual for Puget Sound*, [WSU and PSP, 2012]).

To compare the maintenance standards from these stormwater manuals, the Study team created a working spreadsheet database that included values or brief descriptions of the standards. We developed standardized data fields and entries related to maintenance that could be used to describe all of the manuals reviewed.

## 2.2 Online Databases and Other Guidance

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Four online databases were reviewed to search for maintenance data as sources of comparison to the Ecology BMP maintenance standards. Unfortunately, no data were found related to evaluation of maintenance standards that could inform this literature review; rather the databases searched included extensive information on maintenance activities done, timing, and costs. The databases searched included:

1. *International BMP Database* of the Water Research Foundation, [LINK](#).
2. *Urban Stormwater BMP Database* of the Water Research Foundation, [LINK](#).
3. Water Quality Portal of the *National Water Quality Monitoring Council*, [LINK](#).
4. *National Pollutant Removal Performance Database for Stormwater Treatment Practices* of the Center for Watershed Protection, [LINK](#).

Searches were also made on Google Scholar for studies of BMP maintenance standards. As with the online databases, the studies that were found focused mostly on BMP maintenance costs and performance and for more recently developed BMPs, especially for bioinfiltration and bioretention; however, no studies were found that specifically focused on evaluation of maintenance standards.

Additional literature and guidance documents were reviewed from a few other cities and regions in the country, from the Center for Watershed Protection's Online Watershed Library (OWL), and from the American Society of Civil Engineers. These sources turned up the following three key documents that provided some helpful background and wider perspective on BMP maintenance standards.

- *Inspection and Maintenance of Stormwater Control Measures*, (ASCE, 2019).
- *Bioretention Illustrated: A Visual Guide for Constructing, Inspecting, Maintaining, and Verifying Bioretention Practices, version 2.0* (Chesapeake Stormwater Network, 2013).
- *Green City, Clean Waters: Green Infrastructure Maintenance Manual*, (Philadelphia Water Department, 2014).

## **2.3 Ecology Interviews and Historical Stormwater Manuals**

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Historical stormwater manuals for the Puget Sound region were reviewed during a second phase of the literature review. The need to explore further back in time became apparent during the review of the current stormwater manuals in western Washington. In addition, the need was made clear by Ecology, who indicated that present staff do not specifically know the origins of the current BMP maintenance standards.

Ecology staff were engaged in this Study, and interviews were planned as part of a separate task (Task 4). Questions were prepared about the BMP maintenance standards in SWMMWW and their origins (Appendix B). Upon review of the questions prior to scheduling the interviews, Ecology informed the Study team that current staff do not have information to answer most of the questions asked. Thus, limited answers were provided with information and historical knowledge as available, but no in-depth interviews occurred.

Ecology's limited answers to the questions about the BMP maintenance standards did, however, point the Study team to the 2001 version of the SWMMWW for the earliest version of the current standards. With further research, three additional publications were identified and stood out with having some of the earliest references to comprehensive maintenance standards for stormwater BMPs in western Washington. Those documents were reviewed and include.

- *Stormwater Management Manual for Western Washington* (Ecology, 2001).
- *Stormwater Management Manual for the Puget Sound Basin* (Ecology, 1992).
- *King County, Washington Surface Water Design Manual* (King County, 1990).

Given this additional step in the literature review and the redirection of task 4 of the Study, it made sense to include the outcomes of the Ecology "interview" questions in this memorandum since the intended interview process of task 4 resulted in additional literature reviewed under task 3. No separate memorandum will be prepared for task 4.

### 3 Stormwater BMP Maintenance Standards

The maintenance standards that were reviewed are summarized in this chapter. Of the publications identified and described in the earlier section, our review of maintenance standards focused on the four municipal government stormwater manuals in western Washington as they have the most parallel with this Study.

#### 3.1 BMP Types and Maintenance Descriptions

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The BMP types for which maintenance standards were evaluated included the following eight BMPs.

##### PONDS

- Detention Pond
- Infiltration Pond
- Wetpond

##### TRENCHES

- Infiltration Trench
- Dispersion Trench

##### VAULTS/TANKS

- Detention Vault
- Wetvault
- Baffle Oil/Water Separator (OWS)

As noted above, these BMPs were selected partly based on their wide use and partly to fill an analysis gap by representing BMPs that are not widely covered in the literature that was reviewed.

Maintenance standards for stormwater BMPs have been carried forward from one stormwater manual version within an agency to the next over time. This has led to a template table that is used in all of the standards publications that were reviewed and is based on the tables in Ecology's standards.

The table template of maintenance standards varies in places in different publications. Thus, for consistency when describing and comparing maintenance standards among BMP types and from different publications, a descriptive method was developed that follows the Ecology BMP Maintenance Tables. The maintenance standards were captured in this analysis by four key data fields.

1. **Maintenance Component:** specific part or area of the BMP.
2. **Maintenance Element:** what is being evaluated during maintenance ("defect" in the Ecology BMP Maintenance Tables).

3. **Maintenance Measure:** the type of measurement or assessment.
4. **Maintenance Criteria:** the criteria or condition for triggering maintenance (qualitative or quantitative).

## 3.2 Standards Comparisons

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The comparison of maintenance standards is summarized below by BMP. A summary table for each BMP is provided in the text here, and eight full comparison tables are attached to this memorandum. For Ponds, see Table 1, 2, and 3; for Trenches, see Tables 4 and 5; and for Vaults/Tanks, see Tables 6, 7, and 8.

As shown in the attached tables, there is some crossover among Maintenance Components and Maintenance Elements, and many of the Elements are captured in various Components in different standards publications. Thus, the key differences among the standards reviewed are highlighted below in this section.

In addition, a descriptive method was developed to succinctly show where differences exist among the maintenance standards publications reviewed. The method uses letter or symbol designations to indicate the relative consistency with Ecology's standards. Each section below begins with a summary table of each set of standards' relative consistency (or differences) with Ecology's standards.

- “=” (equals sign): the standards are identical or nearly identical to Ecology's.
- “D”: there are a few key differences from Ecology's standards.
- “DD”: there are several key differences from Ecology's standards.
- “NI”: standards for the BMP are “not included” in the publication.

### 3.2.1 Ponds

The comparison of maintenance standards to Ecology for ponds is summarized in the following table, and the detailed comparisons are provided in Tables 1 through 3.

<b>PONDS</b>	<b>KING COUNTY SWDM</b>	<b>SEATTLE SWM</b>	<b>TACOMA SWMM</b>	<b>WSDOT HRM</b>
Detention Pond	DD	DD	=	=
Infiltration Pond	DD	DD	D	D
Wetpond	D	D	=	=

Notes: = effectively identical; D a few key differences; DD several differences; NI not included

Key takeaways from the comparison of maintenance standards for ponds are as follows.

#### Detention Ponds

- Detention Ponds are the basis for the maintenance standards for many other BMPs. This may be the case simply because detention ponds are listed first in the publications, but it is also likely due to the pond being one of the earliest and most widely used stormwater BMPs. As such, it found its place at the beginning of maintenance standards as they were published.

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- For the most part, the maintenance standards for detention ponds are the same among those reviewed, and followed Ecology for most maintenance elements.
- King County and Seattle have one additional maintenance element for Pipes.
- Several key differences from the Ecology standards are present among Seattle’s, King County’s, Tacoma’s, and WSDOT’s maintenance standards for Detention Ponds. Table 1 (attached) has the full details of the comparison, and the following table summarizes the key differences.

**Table A: Summary of Key Differences between Maintenance Standards for Detention Ponds**

<b>Maintenance Component, Element, &amp; Measure</b>	<b>Ecology</b>	<b>King County</b>	<b>Seattle</b>	<b>Tacoma</b>	<b>WSDOT</b>
General, Trash, Accumulation	>1 cubic ft/1000 sq ft	>1 cubic ft/1000 sq ft	>1 cubic ft/1000 sq ft	>1 cubic ft/1000 sq ft	>5 cubic ft/1000 sq ft
General, Grass, Height	not included	>18 in	>18 in	>18 in	not included
Storage, Liner, Damage	>3 holes that are ≥1/4 in	Hold water?	Hold water?	>3 holes that are ≥1/4 in	>3 holes that are ≥1/4 in
Pipe, Sediment, Accumulation	not included	≥33%	≥20%	not included	not included
Pipe, Structure, Damage	not included	Joint cracks ≥1/2 in	Joint cracks ≥1/2 in	not included	not included

Abbreviations: ft, feet; sq, square; in, inch.

**Infiltration Ponds**

- All publications reviewed had from a few to several differences in Infiltration Pond maintenance standards compared to Ecology’s; none were completely the same as Ecology’s standards.
- Some of the same key differences in Infiltration Ponds standards are the same for Detention Ponds, including Grass Height and the inclusion of pipe-based standards.
- King County and Seattle have additional maintenance elements for Infiltration Structure, Pipes, Access, and Drain Rock.
- The key differences for Infiltration Ponds are summarized in the following table, and the full comparison is provided in Table 2 (attached).



**Table B: Summary of Key Differences between Maintenance Standards for Infiltration Ponds**

Maintenance Component, Element, & Measure	Ecology	King County	Seattle	Tacoma	WSDOT
Storage, Sediment, Water Ponding	any ponding 48 hrs after rain	≥2 in ponding or percolation test of 90%	≥2 in ponding or percolation test of 90%	≥2 in ponding or percolation test of 90%	≥2 in ponding or percolation test of 90%
Slopes and Berms/Dikes	same as for Detention Ponds (>2 in erosion)	same as for Detention Ponds (>2 in erosion)	same as for Detention Ponds (>2 in erosion)	same as for Detention Ponds (>2 in erosion)	>6 in erosion

Abbreviations: in, inch; hrs, hours.

**Wetponds**

- All publications reviewed had the same core general maintenance elements for Wetponds.
- Tacoma’s and WSDOT’s standards follow Ecology’s almost identically.
- King County and Seattle have additional maintenance elements for Slopes and Berms/Dikes, Pond Area, Gravity Drain, and Pipes.
- The key differences for Wetponds are summarized in the following table, and the full comparison is provided in Table 3 (attached).

**Table C: Summary of Key Differences between Maintenance Standards for Wetponds**

Maintenance Component, Element, & Measure	Ecology	King County	Seattle	Tacoma	WSDOT
General, Water Level, Absence	water absent in first cell	12 in drop in 7 days	Same as Ecology	Same as Ecology	Same as Ecology

Abbreviations: in, inch.

**3.2.2 Trenches**

The comparison of maintenance standards to Ecology for trenches is summarized in the following table, and the detailed comparisons are provided in Tables 4 and 5 (attached).

<b>TRENCHES</b>	<b>KING COUNTY SWDM</b>	<b>SEATTLE SWM</b>	<b>TACOMA SWMM</b>	<b>WSDOT HRM</b>
Infiltration Trench	DD	DD	DD	DD
Dispersion Trench	D	D	=	=

Notes: = effectively identical; D a few key differences; DD several differences; NI not included

Key takeaways from the comparison of maintenance standards for trenches are as follows.

**Infiltration trenches**

- The Ecology maintenance standards for infiltration trenches are minimal and cover just the storage and structural elements.
- Other standards variously included in other publications (except Ecology’s) have additional maintenance elements for infiltration trenches including Pipes, Structure, Presettling Areas, Media, Liner, and Emergency Overflow.
- Many general maintenance standards for infiltration trenches (mowing, pests, trash, etc.), which Ecology doesn’t include, are the same as for other facilities, especially Detention Ponds, Infiltration Ponds, or Wetponds.
- The key differences for Infiltration Trenches are summarized in the following table, and the full comparison is provided in Table 4.

**Table D: Summary of Key Differences between Maintenance Standards for Infiltration Trenches**

Maintenance Component, Element, & Measure	Ecology	King County	Seattle	Tacoma	WSDOT
Presettling, Sediment, Depth	not included	not included	≥6 in settling	Same as for Infiltration Ponds	Same as for Wetponds
Media, Sediment, Filter Bag	not included	not included	≥50% full	not included	not included
General, Sediment, Water Ponding	not included	not included	≤24 hrs after storm event	Same as for Infiltration Ponds	Same as for Wetponds
Storage, Rock Filters, Flow	not included	not included	not included	not included	Little or no flow
Emergency Overflow/Spillway	not included	not included	≥2 in flow	not included	not included

Abbreviations: in, inch; hrs, hours.

**Dispersion Trenches**

- Dispersion Trenches contain just a few maintenance elements, which are almost entirely the same among the publications reviewed compared to Ecology’s.
- King County and Tacoma have additional maintenance elements for Preventative (Trash) and Pipes.
- King County and Tacoma include a standard for blockage in inlet pipes, though King County’s is qualitative (any blockage), and Tacoma’s is quantitative (20 percent or more blocked).
- The key differences for Dispersion Trenches are summarized in the following table, and the full comparison is provided in Table 5.

**Table E: Summary of Key Differences between Maintenance Standards for Dispersion Trenches**

Maintenance Component, Element, & Measure	Ecology	King County	Seattle	Tacoma	WSDOT
Pipes, Inlet, Blockage	not included	Limiting flow	not included	≥20% blockage	not included
Energy Dissipators, Pipes, Blockage	>50% blockage	>25% perforations plugged	>25% perforations plugged	Same as Ecology	Same as Ecology

Abbreviations: in, inch.

### 3.2.3 Vaults/Tanks

The comparison of maintenance standards to Ecology for vaults and tanks is summarized in the following table, and the detailed comparisons are provided in Tables 6, 7, and 8 (attached).

<b>VAULTS/TANKS</b>	<b>KING COUNTY SWDM</b>	<b>SEATTLE SWM</b>	<b>TACOMA SWMM</b>	<b>WSDOT HRM</b>
Detention Vault	=	=	=	=
Wetvault	=	=	D	NI
Oil/Water Separator, baffle	=	=	D	NI

Notes: = effectively identical; **D** a few key differences; **DD** several differences; **NI** not included

Key takeaways from the comparison of maintenance standards for trenches are as follows: in general, a few of the same minor differences from Ecology’s standards exist in the King County and Seattle standards for all types of vaults and tanks reviewed here. The differences are consistently in the form of component sections that King County and Seattle include for each BMP, such as general site maintenance around the vault or tank or pipes adjoining it.

#### Detention Vaults

- The maintenance standards were effectively the same for detention vaults and tanks among the manuals compared.
- King County and Seattle have standards for Site-related elements (trash, pests, grass, etc.) and Pipe elements that Ecology and WSDOT do not have for Detention Vaults.
- See Table 6 for detail.

#### Wet Vaults

- The maintenance standards were mostly the same for wet vaults among the manuals compared with a couple of differences from Ecology in King County’s, Seattle’s, and Tacoma’s standards.
- King County, Seattle, and Tacoma have standards for Pipe elements and Gravity Drain valves that Ecology does not include for Wet Vaults.
- WSDOT does not include wet vaults in their standards for vaults.

- The key differences for Wet Vaults are summarized in the following table, and the full comparison is provided in Table 7.

**Table F: Summary of Key Differences between Maintenance Standards for Wet Vaults**

Maintenance Component, Element, & Measure	Ecology	King County	Seattle	Tacoma	WSDOT
General, Structure, Damage (cracks)	≥0.5 in	≥0.25 in	≥0.25 in	≥0.25 in	not included
General, Baffles, Damage	not included	Corrosion, cracking, or failure	Corrosion, cracking, or failure	Corrosion, cracking, or failure	not included

Abbreviations: in, inch.

**Oil/Water Separator Vaults**

- The maintenance standards were mostly the same for Oil/Water Separator Vaults among the manuals compared.
- King County and Seattle have standards for Pipe elements and Gravity Drain valve that Ecology and Tacoma do not include for Oil/Water Separator Vaults.
- WSDOT does not include oil/water separators in their standards.
- The key differences for Oil/Water Separator Vaults are summarized in the following table, and the full comparison is provided in Table 8.

**Table G: Summary of Key Differences between Maintenance Standards for Oil/Water Separator Vaults**

Maintenance Component, Element, & Measure	Ecology	King County	Seattle	Tacoma	WSDOT
General, Oil, Accumulation	>1 in. oil	Same as Ecology	Same as Ecology	>1 in. oil or 6 in. sludge	not included
General, Water Clarity, Presence	not included	Visible poor water clarity	Visible poor water clarity	Visible poor water clarity	not included

Abbreviations: in, inch.

## 4 Questions to Ecology About the Maintenance Standards

Following the initial literature review, questions were prepared for Ecology staff about the BMP maintenance standards and their origins. The questions are provided in Appendix B, and the answers received by Ecology are summarized in this section.

As noted above, the questions were originally intended for interviews with Ecology as part of Task 4 of the Study, and a separate memorandum was planned. But no interviews occurred due to the lack of documented history about the origins of some BMP maintenance standards. Instead, answers were sought via additional literature review of historical publications of the maintenance standards that Ecology pointed the Study team to. Instead of a separate memorandum, the follow-up questions are summarized here as part of the literature review memorandum.

### 4.1 Questions and Answers

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Questions were identified about the origins of some of the SWMMWW BMP maintenance standards. The Study team was interested especially in some of the quantitative numeric standards and how they were determined. The questions were grouped into five categories and were transmitted by the SAM coordinator to both permit writers and engineers at Ecology. The answers provided were minimal as the current staff does not know the specific historical sources or analyses that went into determining the current BMP maintenance standards.

#### 4.1.1 General Questions

Four general questions were asked regarding the standards overall.

- Is there a bibliography for Appendix V-A?
- How were ranges of numeric standards or conflicting values represented?
- Has Ecology considered adding recommended maintenance frequencies for BMPs other than the relatively newer LID BMPs?
- What other regulations besides for stormwater were considered?

#### 4.1.2 Questions about BMPs

Two general questions were asked about each of the four BMP categories being evaluated in this Study (ponds, trenches, vaults, and tanks).

- How were specific numeric maintenance criteria determined?
- What is the source for some of the best practices recommendations?

#### 4.1.3 Answers from Ecology

The questions were reviewed by several Ecology staff, including permit writers, engineers, and program coordinators. One engineer responded to the questions indicating that Ecology did not know the specific origins of the maintenance standards, but they

were derived from the 2001 stormwater manual (Ecology, 2001). The responses also indicated Ecology has not considered adding maintenance frequencies to the standards.

The Study team had a follow-up discussion with the SAM coordinator and King County staff to brainstorm other sources of information about the origins of the maintenance standards. Subsequently, the decision was made not to pursue interviews with Ecology staff at this time and instead focus on review of historical stormwater manuals and maintenance standards.

## 4.2 Historical Stormwater Manuals and Maintenance Standards

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Since Ecology did not know the specific origins of the BMP maintenance standards in the current SWMMWW, historical stormwater manuals were reviewed as part of this literature review to help fill in the picture of the basis for some of the standards.

Following Ecology's note about the 2001 stormwater manual being the source of the current standards, the Study team reviewed the following three historical stormwater manual publications.

### 4.2.1 2001 Ecology Stormwater Manual

The 2001 Ecology stormwater manual is the *Stormwater Management Manual for Western Washington* (Ecology, 2001). The BMP maintenance standards are in *Volume V Runoff Treatment BMPs*, which are laid out in tables just like in the current SWMMWW.

Unlike the 2019 SWMMWW, the 2001 version does provide a list of references specifically for Volume V where the BMP maintenance standards are provided. The list of references is extensive and sheds light on the likely origins of the BMP maintenance standards. No citations are noted in the tables themselves, however. The references include:

- Articles in academic journals, and local studies by University of Washington and Washington State University professors and students.
- Standard textbooks, such as *Open-Channel Hydraulics* (V.T. Chow, 1959).
- Government agency guidance, from local Puget Sound jurisdictions to the US Army Corps of Engineers (USACE) to the Environmental Protection Agency (EPA).
- Guidance and publications from non-governmental organizations, such as the Water Environment Federation, American Petroleum Institute, and the Center for Watershed Protection.
- Proprietary BMP maintenance instructions and guidance.
- Performance observations of BMPs.

### 4.2.2 1992 Stormwater Manual for Puget Sound

The stormwater manual from Ecology prior to 2001, *Stormwater Management Manual for the Puget Sound Basin* (Ecology, 1992), was also reviewed. There is no Volume V in

this version of the manual, and the maintenance standards are found dispersed in the topical BMP sections.

Two tables of “maintenance requirements” are provided, for detention ponds and detention vaults/tanks. The tables have a similar format and content as the current standards with several components covered, including general site, slopes, dikes, pond storage area, overflow spillway, and access.

One table is present (Table III-2.10) for *Maintenance of Control Structures and Catchbasins*, which has some of the same maintenance components and elements as the current BMP Maintenance Tables, including structural damage, obstructions, access, and more. A few references are provided, but as with subsequent versions of the standards tables, no citations are provided for specific standards.

In addition, one overall maintenance BMP is provided as *BMP S2.00 Maintenance for Storm Drainage Facilities*. The BMP includes some of the same components and elements as the current Ecology BMP maintenance standards, such as inspections, structural integrity, and debris removal. But the BMP is just one page and does not include any numeric standards except for catch basin sediment accumulation (1/3 depth to invert of pipe).

#### **4.2.3 1990 King County Surface Water Design Manual**

The 1990 *King County Surface Water Design Manual* (King County, 1990) was also reviewed as it was identified as a good early resource. Maintenance and operation is a core requirement for stormwater design in the 1990 King County SWDM, and private facility maintenance standards appear in Appendix A, *Maintenance Requirements for Privately Maintained Drainage Facilities*. Appendix A of the 1990 King County SWDM includes tables for 12 types of BMPs including ponds, energy dissipators (including trenches), and closed detention systems (pipes/tanks). The layout and contents of the tables are largely the same as in the Ecology manuals from 1992 and 2001.

## 5 Discussion

The outcomes from this stormwater BMP literature review and comparison of maintenance standards help advance the goals of this SAM Study with a better understanding of the background of Ecology’s BMP Maintenance Tables. The conclusions, which are summarized below, provide insights that benefit the remaining Study tasks, which include:

- Task 5: Pilot Data Analysis of Permittee O&M Data— literature review findings will be used as a basis to determine what information could be used or collected in a pilot study of BMP maintenance data
- Task 6: White Paper— literature review findings will help summarize the overall outcomes of the Study

### 5.1 Literature Review Conclusions

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Our conclusions from this literature review of stormwater BMP maintenance standards include the following:

- Maintenance data sought for evaluation of BMP maintenance standards was not found to be available. Several publications and online databases were reviewed, many of which include data and information on BMP performance and maintenance cost. But publications and online databases with maintenance data that could be related to standards were not found.
- Because of the requirement for stormwater permittees to adopt the stormwater manual from Ecology or a Phase I permittee (or develop their own equivalent version), the maintenance standards in the regional manuals reviewed here have a similar organization, i.e., tables of maintenance criteria for the same or similar BMPs.
- Most maintenance standards are the same among the stormwater manuals reviewed.
- Some standards varied by manual and were covered in more detail or had different numeric criteria in the city, county, and transportation agency manuals than in Ecology’s. These include the following key standards, which vary from or are not included in Ecology’s SWMMWW:
  - Grass cover height
  - Liner integrity
  - Sediment accumulation in ponds and in pipes
  - Amount of standing water in wet ponds
  - The amount of blockage tolerated in pipes, air vents, treatment media, and filters



- Inclusion of additional maintenance components, especially common ones for many BMPs (e.g., trash/debris, rodents, presence of pollution, etc.)
- The size of the cracks or potential structural issues
- Sludge versus oil accumulation in oil/water separators

## 5.2 Origins of the BMP Maintenance Standards

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Based on the historical stormwater manuals reviewed and the information provided by Ecology, we have the following conclusions about the origins of the Ecology BMP Maintenance Tables:

- Current Ecology staff are not familiar with the specific basis of the maintenance standards, and the current BMP Maintenance Tables do not include literature references specific to individual maintenance criteria. The lack of citations for specific standards in the tables makes it difficult to trace the origins of specific standards.
- References to earlier stormwater manuals (prior to 2001) and review of a 1992 Ecology manual and 1990 King County manual appear to provide some of the first instances of maintenance standards similar to today's. These older manuals cover a subset of current BMPs, and include detention ponds and tanks, among others.
- The BMP maintenance standards in these historical stormwater manuals appear to be derived from a mix of engineering design details, hydraulic modeling and calculations, primary/academic research articles, textbook references, federal guidance publications from the EPA and USACE, and BMP performance observations. This is deduced based on the list of references provided for Volume V on Runoff Treatment BMPs in the 2001 Ecology SWMMWW, which appears to be the first instance of the comprehensive set of tables of maintenance standards similar to the current (2019) SWMMWW. The references in the 2001 maintenance standards appear to have not been carried forward into subsequent manuals.
- The standards are also informed by local studies and controlled field tests, many of which are decades old, especially for conventional BMPs, such as ponds, vaults, and trenches.

## 5.3 Recommendations

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We provide the following recommendations based on the outcomes of this review of BMP maintenance standards data and literature:

- Assess what O&M data are collected by current municipal stormwater permittees in western Washington that could be used to evaluate maintenance standards. This is planned in Task 5 of the Study.

## ASPECT CONSULTING

- Perform controlled field studies to evaluate and verify or update the BMP maintenance standards. The literature found here focused on BMP performance and maintenance cost. Pairing the two research objectives of evaluating maintenance standards and BMP performance may be challenging due to potential need to allow BMPs to fail to test the standards.
- Controlled field testing would help fill an information gap, and topics of interest include the following based on this review:
  - Sediment accumulation in ponds, pipes, and filter bags.
  - Vegetation height and growth and potential benefits of growth (e.g., habitat)
  - Water ponding based on time versus percolation tests.
  - Algae coverage in open water.
  - Habitat versus stormwater benefits.
- Consider widening the audience for the questions that were prepared for Ecology. The questions could also be sent to others from different agencies or to those who are retired from Ecology but contributed to the 2001 Ecology SWMMWW.
- Check the list of literature references from the 2001 Ecology SWMMWW and add them back into the current stormwater manual as appropriate. Even better would be to add citations to those references in the BMP maintenance tables.

## 6 References

- ASCE, 2019, Inspection and Maintenance of Stormwater Control Measures, American Society of Civil Engineers, Stormwater BMP Maintenance Task Committee. [LINK](#)
- Chesapeake Stormwater Network, 2013, *Bioretention Illustrated: A Visual Guide for Constructing, Inspecting, Maintaining, and Verifying Bioretention Practices, version 2.0*. [LINK](#)
- Chow, V.T., 1959, Open-Channel Hydraulics, McGraw-Hill, New York, NY.
- City of Seattle, 2021, Stormwater Manual, updated July 2021, Seattle, Washington: [LINK](#)
- City of Tacoma, 2021, Stormwater Management Manual, July 2021, Tacoma, Washington: [LINK](#)
- King County, July 2021, Surface Water Design Manual, King County, Washington, Department of Natural Resources and Parks: [LINK](#)
- King County, November 1990, Surface Water Design Manual, Revised November 1995, King County, Washington, Department of Public Works: [LINK](#)
- Philadelphia Water Department, 2014, Green City, Clean Waters: Green Infrastructure Maintenance Manual, [LINK](#)
- Seattle Public Utilities, 2009, Green Stormwater Operations and Maintenance Manual, August 2009: [LINK](#).
- Washington State Department of Ecology (Ecology), 1992, Stormwater Management Manual for the Puget Sound Basin, February 2001, publication 91-75, online version: [LINK](#)
- Washington State Department of Ecology (Ecology), 2001, Stormwater Management Manual for Western Washington, Washington State Department of Ecology, publication 99-11 through 99-15, online version: [LINK](#)
- Washington State Department of Ecology (Ecology), 2019a, 2019 Stormwater Management Manual for Western Washington, Washington State Department of Ecology, online version: [LINK](#)
- Washington State Department of Ecology (Ecology), 2019b, SWMMWW Appendix V-A: BMP Maintenance Tables, Washington State Department of Ecology, online version: [LINK](#)
- Washington State Department of Ecology (Ecology), 2019c, Western Washington Phase II Municipal Stormwater Permit Washington State Department of Ecology, online version: [LINK](#)

**ASPECT CONSULTING**

Washington State Department of Transportation (WSDOT), 2019, Highway Runoff Manual, M31-16.05, April 2019. [LINK](#)

WSU and PSP, 2012, Low Impact Development Technical Guidance Manual for Puget Sound, Washington State University and Puget Sound Partnership, authors Hinman C. and B. Wulkan: [LINK](#)

## 7 Limitations

Work for this project was performed for the City of Bellevue and the Washington State Department of Ecology (Clients), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

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# Tables

**Table 1. Detention Pond Maintenance Standards**

Project No. 200203, Seattle, Washington

FINAL

PONDS, Detention				ECOLOGY 2019 SWMMWW			KING COUNTY 2021 SWDM		SEATTLE 2021 SWM		TACOMA 2021 SWMM		WSDOT 2019 HRM	
MAINTENANCE COMPONENT	MAINTENANCE ELEMENT	MAINTENANCE MEASURE	QUANTITATIVE/ QUALITATIVE	MAINTENANCE CRITERIA	UNITS	NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES
General	Trash	Accumulation	Quantitative	>1	cf trash/1000 sf area		x		x		x			>5 cf trash/1000 sf area
	Poisonous/Noxious weeds	Presence	Qualitative	any			x		x		x		x	
	Pollution	Evidence of pollution	Qualitative	any		Routine+Spill Response	x		x		x		x	
	Rodents	Evidence of holes	Qualitative	any			x	Under Slopes component	x		x		x	
	Beaver Dams	Change in function	Qualitative	any				not included	x		x	Specifies negative change	x	
	Insects	Interferes with maintenance	Qualitative	any				not included		not included	x		x	
	Tree Growth/Hazard Trees	Interferes with maintenance	Qualitative	any		dead, diseased, dying trees	x	Under Slopes component	x	Under Slopes component	x		x	
	Grass/groundcover	Height	Quantitative			not included		>18"		>18"		>18"		not included
Slopes and Berms/Dikes	Erosion	Erosion damage	Quantitative	>2	inches depth	areas of actual and potential erosion	x		x		x		x	
	Settlement	Compaction	Quantitative	>4	inches depth	unless otherwise specified	x		x		x		x	
	Piping	Evidence of flow	Qualitative	any		flow through berm		not included		not included	x		x	
	Tree Growth/Hazard Trees	Blockage	Quantitative	>4	feet of tree height		x	threaten slopes or hinder maintenance	x		x			not included
Storage	Sediment	Accumulated sediment	Quantitative	>10	% of design depth		x		x		x		x	
	Liner	Damage	Quantitative	>3	holes ≥1/4"	visible area of liner		Liner does not hold water		Liner does not hold water	x		x	
Overflow/Spillway	Tree Growth/Hazard Trees	Blockage	Qualitative	any		of failure of berm due to tree	x		x		x		x	
	Piping	Evidence of flow	Qualitative	any		flow through berm		not included		not included	x		x	
	Overflow/Spillway	Rock missing	Quantitative	≤1	rock layer	or exposure of native soil	x		x		x			1 rock layer but area >5sf
	Erosion	Erosion damage	Quantitative	>2	inches depth			not included		not included	x			not included
Inlet/Outlet Pipe	Sediment	Accumulation	Quantitative			not included		≥ 20% full of sediment		≥ 33% full of sediment		not included		not included
	Trash	Presence	Qualitative			not included		included		included		not included		not included
	Structure	Damage	Quantitative			not included		Joint cracks ≥1/2"		Joint cracks ≥1/2"		not included		not included

**Table 2. Infiltration Pond Maintenance Standards**

Project No. 200203, Seattle, Washington

FINAL

PONDS, Infiltration				ECOLOGY 2019 SWMMWW			KING COUNTY 2021 SWDM		SEATTLE 2021 SWM		TACOMA 2021 SWMM		WSDOT 2019 HRM	
MAINTENANCE COMPONENT	MAINTENANCE ELEMENT	MAINTENANCE MEASURE	QUANTITATIVE/ QUALITATIVE	MAINTENANCE CRITERIA	UNITS	NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES
General	Trash	Accumulation	Quantitative			same as for Detention Ponds	x		x		x		x	
	Poisonous/Noxious weeds	Presence	Qualitative			same as for Detention Ponds	x		x		x		x	
	Pollution	Evidence of pollution	Qualitative			same as for Detention Ponds	x		x		x		x	
	Rodents	Evidence of holes	Qualitative			same as for Detention Ponds	x	Under Slopes component	x		x		x	
	Beaver Dams	Change in function	Qualitative			not included		not included		not included		same as for Detention Ponds		not included
	Insects	Interferes with maintenance	Qualitative			not included		not included		not included		same as for Detention Ponds		not included
	Grass/groundcover	Height	Quantitative			not included		>18"		>18"		>18"		not included
Grass/groundcover	Presence	Qualitative			not included		not included		not included		Bare spots		not included	
Storage	Sediment	Water ponding	Qualitative	any		after 48 hours after rainfall		≥2" or percolation test 90%		≥2" or percolation test 90%		≥2" or percolation test 90%		≥2" or percolation test 90%
	Liner	Damage	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
Filter Bags	Sediment	Bag filled	Quantitative	>50	% full		x		x		not included		not included	
Rock Filters	Sediment	Blockage	Qualitative	any		after heavy rain storms	x		x		x		x	
Slopes and Berms/Dikes	Erosion	Erosion damage	Quantitative			same as for Detention Ponds		same as for Detention Ponds		same as for Detention Ponds		same as for Detention Ponds		≥6" erosion
	Tree Growth/Hazrad Trees	Blockage	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		≥4 ft growth		not included
	Settlement	Compaction	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		same as for Detention Ponds	x	
Overflow/Spillway	Tree Growth/Hazrad Trees	Blockage	Qualitative			same as for Detention Ponds	x		x		x			not included
	Piping	Evidence of flow	Qualitative			same as for Detention Ponds		not included		not included		x		not included
	Overflow/Spillway	Rock missing	Quantitative			same as for Detention Ponds	x		x		1 rock layer but area >5 sf		x	
	Erosion	Erosion damage	Quantitative			same as for Detention Ponds		not included		not included		x		not included
Presettling	Sediment	Pond or vault	Quantitative	>6	inches design depth		x		x		not included		x	
Infiltration Structure	Structure, tank	Damage	Quantitative			not included		≥10% bent		≥10% bent		not included		not included
	Air vent	Blockage	Qualitative			not included		Included		Included		not included		not included
	Gaps	Gap width	Quantitative			not included		≥1/2" cracks		≥1/2" cracks		not included		not included
	Structure, vault	Damage	Quantitative			not included		≥1/2" cracks		≥1/2" cracks		not included		not included
Inlet/Outlet Pipe	Sediment	Blockage	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		Included
	Trash	Presence	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Structure, pipe	Damage	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
Access	Cover/lid	Presence	Qualitative			not included		Included		Included		not included		not included
	Lock	Operable	Qualitative			not included		Included		Included		not included		not included
	Cover/lid	Operable	Qualitative			not included		Included		Included		not included		not included
	Ladder	Operable	Qualitative			not included		safe useable		safe useable		not included		not included
	Door	Operable	Qualitative			not included		Included		Included		not included		not included
	Door	Coverage	Qualitative			not included		Included		Included		not included		not included
Drain Rock	Sediment	Water ponding	Qualitative			not included		not included		Included		not included		not included



**Table 3. Wetpond Maintenance Standards**

Project No. 200203, Seattle, Washington

FINAL

PONDS, Wet				ECOLOGY 2019 SWMMWW			KING COUNTY 2021 SWDM		SEATTLE 2021 SWM		TACOMA 2021 SWMM		WSDOT 2019 HRM	
MAINTENANCE COMPONENT	MAINTENANCE ELEMENT	MAINTENANCE MEASURE	QUANTITATIVE/ QUALITATIVE	MAINTENANCE CRITERIA	UNITS	NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES
General	Water Level	Absence	Qualitative	any		First cell doesn't hold water		12" drop in 7 days	x		x		x	
	Trash	Accumulation	Quantitative	>1	cf trash/1000 sf area	same as for Detention Ponds	x		x		x		x	
	Inlet/Outlet Pipe	Blockage	Qualitative	any			x		x		x		x	
	Sediment	Accumulation	Quantitative	≥6	inches	above sediment zone	x		x		x		x	
	Oil Sheen on Water	Presence	Qualitative	any			x		x		x		x	
	Erosion	Damage	Quantitative	≥6	inches		x		x		x		x	
	Settlement	Compaction	Quantitative	≥4	inches		x		x		x		x	
	Internal Berm	Level	Qualitative				x		x		x		x	
	Overflow Spillway	Rock Missing	Qualitative	any		top of spillway or outside slope	x		x		x		x	
	Poisonous/Noxious weeds	Presence	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		same as for Detention Ponds		not included
Pollution	Evidence of pollution	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		same as for Detention Ponds		not included	
Grass/groundcover	Height	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		vegetation is overgrown		not included	
Slopes and Berms/Dikes	Rodents	Evidence of holes	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Erosion	Erosion damage	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Settlement	Compaction	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Tree Growth/Hazard Trees	Blockage	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Internal Berm	Settlement	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
Pond Area	Sediment	Accumulation	Qualitative			not included		>10% of design depth (except first cell)		>10% of design depth (except first cell)		not included		not included
	Liner	Damage	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Algae Mats	Presence	Quantitative			not included		>10% of water surface		>10% of water surface		not included		not included
	Vegetation	Survival	Quantitative			not included		>80% of design area		>80% of design area		not included		not included
Gravity Drain	Valve	Operable	Qualitative			not included		open/close and seal		open/close and seal		not included		not included
Inlet/Outlet Pipes	Sediment	Blockage	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Trash	Presence	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Structure, pipe	Damage	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included

**Table 4. Infiltration Trench Maintenance Standards**

Project No. 200203, Seattle, Washington

FINAL

TRENCHES, Infiltration				ECOLOGY 2019 SWMMWW			KING COUNTY 2021 SWDM		SEATTLE 2021 SWM		TACOMA 2021 SWMM		WSDOT 2019 HRM	
MAINTENANCE COMPONENT	MAINTENANCE ELEMENT	MAINTENANCE MEASURE	QUANTITATIVE/ QUALITATIVE	MAINTENANCE CRITERIA	UNITS	NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES
Preventative	Trash	Blockage	Qualitative			not included		limiting flow		not included		any		any
Pipes	Inlet	Blockage	Qualitative			not included		limiting flow		not included		not included		not included
	Vegetation	Blockage	Qualitative			not included		limiting flow, including roots		not included		not included		not included
	Sediment	Blockage	Qualitative			not included		limiting flow		same as for Infiltration Pond		not included		not included
	Structure, pipe	Damage	Qualitative			not included		pipe joints		not included		not included		not included
Structure	Conveyance	Presence	Qualitative			not included		flow reaching trench		not included		not included		not included
	Cleanout	Access	Qualitative			not included		cleanout not accessible		not included		included, observation well		not included
Presettling	Sediment	Depth	Quantitative			not included		not included		≥6" sediment		same as for Infiltration Ponds		same as for Wetponds
Media	Media	Blockage	Qualitative			not included		flow through media not normal		not included		not included		not included
	Sediment	Filter Bag	Quantitative			not included		not included		≥50% full		not included		not included
Inspection	Inspection	Frequency	Quantitative			not included		annual and before/after significant storms		not included		not included		not included
Liner	Liner	Damage	Qualitative			not included		not included		Same as for Detention Ponds		not included		not included
General	Poisonous/Noxious weeds	Presence	Qualitative			not included		not included		Same as for Detention Ponds		same as for Infiltration Ponds		same as for Wetponds
	Pollution	Evidence of pollution	Qualitative			not included		not included		Same as for Detention Ponds		same as for Infiltration Ponds		same as for Wetponds
	Rodents	Presence	Qualitative			not included		not included		Same as for Detention Ponds		same as for Infiltration Ponds		same as for Wetponds
	Sediment	Water ponding	Qualitative			not included		not included		≥24 hrs after storm event		same as for Infiltration Ponds		same as for Wetponds
	Tree Growth/Hazard Trees	Interferes with maintenance				not included		not included		not included		same as for Infiltration Ponds		same as for Wetponds
Storage/Structure	Ventilation	Blockage	Quantitative	≥50	% blockage		x		x		x		x	
	Sediment	Depth	Quantitative	≥10	% diameter	for 1/2 length of container; 15% max	x		x		x		x	
	Structure, voids	Presence	Qualitative	any		openings or voids		not included		not included		x		x
	Structure, bent	Damage	Quantitative	≥10	% bent		x		x		x		x	
	Structure, cracks	Damage	Quantitative	≥0.5	inches	cracks, gaps, tears, or soil intrusion	x		x		x		x	
	Cover/lid	Presence	Qualitative	any			x		x		x		x	
	Lock	Operable	Qualitative	any			x		x		x		x	
	Cover/lid	Operable	Qualitative	any		includes lifting rings	x		x		x		x	
	Ladder	Operable	Qualitative	any			x		x		x		x	
	Rock Filters	Flow	Qualitative			not included		not included		not included		not included		not included
Site	Trash	Accumulation	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Poisonous/Noxious weeds	Presence	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Pollution	Evidence of pollution	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Pests	Presence	Qualitative			not included		not included		not included		same as for Detention Ponds		not included
	Grass/groundcover	Height	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
Inlet/Outlet Pipes	Sediment	Accumulation	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Trash	Presence	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Structure, pipe	Damage	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
Emergency/Overflow Spillway	Erosion	Damage	Quantitative				not included		not included		≥2" deep		not included	

**Table 5. Dispersion Trench Maintenance Standards**

Project No. 200203, Seattle, Washington

FINAL

TRENCHES, Dispersion				ECOLOGY 2019 SWMMWW			KING COUNTY 2021 SWDM		SEATTLE 2021 SWM		TACOMA 2021 SWMM		WSDOT 2019 HRM	
MAINTENANCE COMPONENT	MAINTENANCE ELEMENT	MAINTENANCE MEASURE	QUANTITATIVE/ QUALITATIVE	MAINTENANCE CRITERIA	UNITS	NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES
Preventative	Trash	Blockage	Qualitative			not included		limiting flow		not included		any		not included
Pipes	Inlet	Blockage	Qualitative			not included		limiting flow		not included		20% or more		not included
	Vegetation	Blockage	Qualitative			not included		limiting flow, including roots		not included		not included		not included
Dispersion Trench (under Energy Dissipaters)	Pipe	Blockage	Quantitative	>20	% of design depth		x		x		x		x	
	Flow	Presence	Qualitative	any		concentrated flow (should be sheet flow)	x		x		x		x	
	Pipe	Blockage	Quantitative	>50	% of perforations blocked			>25% perforations plugged		>25% perforations plugged	x		x	
	Flow	Presence	Qualitative	any		flow from top of distributor catch basin	x		x		x		x	
	Flow	Saturation	Qualitative	any		potential for landslides	x		x		x		x	

**Table 6. Detention Vault Maintenance Standards**

Project No. 200203, Seattle, Washington

FINAL

VAULTS, Detention				ECOLOGY 2019 SWMMWW			KING COUNTY 2021 SWDM		SEATTLE 2021 SWM		TACOMA 2021 SWMM		WSDOT 2019 HRM	
MAINTENANCE COMPONENT	MAINTENANCE ELEMENT	MAINTENANCE MEASURE	QUANTITATIVE/ QUALITATIVE	MAINTENANCE CRITERIA	UNITS	NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES
Storage/Structure	Ventilation	Blockage	Quantitative	≥50	% blockage		x		x		x		x	
	Sediment	Depth	Quantitative	≥10	% diameter	for 1/2 length of container; 15% max	x		x		x		x	
	Structure, voids	Presence	Qualitative	any		openings or voids		not included		not included	x		x	
	Structure, bent	Damage	Quantitative	≥10	% bent		x		x		x		x	
	Structure, cracks	Damage	Quantitative	≥0.5	inches	cracks, gaps, tears, or soil intrusion	x		x		x		x	
	Cover/lid	Presence	Qualitative	any			x		x		x		x	
	Lock	Operable	Qualitative	any			x		x		x		x	
	Cover/lid	Operable	Qualitative	any		includes lifting rings	x		x		x		x	
Ladder	Operable	Qualitative	any			x		x		x		x		
Site	Trash	Presence	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Poisonous/Noxious weeds	Presence	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Pollution	Evidence of pollution	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Pests	Presence	Qualitative			not included		not included		not included		same as for Detention Ponds		not included
	Grass/groundcover	Height	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
Inlet/Outlet Pipes	Sediment	Accumulation	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Trash	Presence	Qualitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included
	Structure, pipe	Damage	Quantitative			not included		same as for Detention Ponds		same as for Detention Ponds		not included		not included

**Table 7. Wet Vault Maintenance Standards**

Project No. 200203, Seattle, Washington

FINAL

VAULTS, Wet				ECOLOGY 2019 SWMMWW			KING COUNTY 2021 SWDM		SEATTLE 2021 SWM		TACOMA 2021 SWMM		WSDOT 2019 HRM	
MAINTENANCE COMPONENT	MAINTENANCE ELEMENT	MAINTENANCE MEASURE	QUANTITATIVE/ QUALITATIVE	MAINTENANCE CRITERIA	UNITS	NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES
General	Trash	Presence	Qualitative	any			x		x		x			not included
	Sediment	Accumulation	Quantitative	≥6	inches	above sediment zone	x		x		x			not included
	Inlet/Outlet Pipes	Damage	Qualitative	any			x		x		x			not included
	Cover/lid	Presence	Qualitative	any			x		x		x			not included
	Cover/lid	Operable	Qualitative	any			x		x		x			not included
	Ventilation	Blockage	Qualitative	any			x		x		x			not included
	Structure, cracks	Damage	Quantitative	≥0.5	inches	same as for Detention Vault	x		x			≥0.25" cracks		not included
	Baffles	Damage	Qualitative	any		corrosion, cracking, failure	x		x		x			not included
	Ladder	Operable	Qualitative	any			x		x		x			not included
	Pollution	Presence	Qualitative			not included		same as for Detention Vault		same as for Detention Pond		same as for Detention Pond		
Baffles	Damage	Qualitative			not included		corrosion, cracking, failure		corrosion, cracking, failure		corrosion, cracking, failure			not included
Inlet/Outlet Pipes	Sediment, pipes	Accumulation	Quantitative			not included		same as for Detention Vault		same as for Detention Pond		same as for Detention Pond		not included
Gravity Drain	Valve	Operable	Qualitative			not included		same as for Wet Pond		same as for Wet Pond		same as for Wet Pond		not included

**Table 8. Oil/Water Separator Vault Maintenance Standards**

Project No. 200203, Seattle, Washington

FINAL

VAULTS, Baffle Oil-Water Separators				ECOLOGY 2019 SWMMWW			KING COUNTY 2021 SWDM		SEATTLE 2021 SWM		TACOMA 2021 SWMM		WSDOT 2019 HRM	
MAINTENANCE COMPONENT	MAINTENANCE ELEMENT	MAINTENANCE MEASURE	QUANTITATIVE/ QUALITATIVE	MAINTENANCE CRITERIA	UNITS	NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES	SAME AS ECOLOGY	DIFFERENCE/ NOTES
General	Pollution	Evidence of pollution	Qualitative	any			x		x		x			not included
	Sediment	Accumulation	Quantitative	>6	inches	bottom of vault	x		x		x			not included
	Trash	Presence	Qualitative	any			x		x		x			not included
	Oil	Accumulation	Quantitative	>1	inches	at water surface	x		x		x	1 in. oil or 6 in. sludge		not included
	Pipes	Damage	Qualitative	any			x		x		x			not included
	Cover/lid	Operable	Qualitative	any			x		x		x			not included
	Structure, cracks	Damage	Quantitative	≥0.5	inches	same as for Detention Vault	x		x		x			not included
	Baffles	Damage	Qualitative	any		corrosion, cracking, failure	x		x		x			not included
	Ladder	Operable	Qualitative	any			x		x		x			not included
	Insects	Interferes with maint	Qualitative			not included		not included		not included		insects interfere w maintenance		not included
	Water Clarity	Presence	Qualitative			not included		visible poor water clarity		visible poor water clarity		visible poor water clarity		not included
Gravity Drain	Valve	Operable	Qualitative			not included		same as for Wet Pond		same as for Detention Pond		not included		not included
Inlet/Outlet Pipes	Sediment, pipes	Accumulation	Quantitative			not included		same as for Detention Vault		same as for Wet Pond		not included		not included

## **APPENDIX A**

### **BMP Maintenance Standards**

- 1. Ecology SWMMWW, Appendix V-A BMP Maintenance Tables**
- 2. King County SWD, Appendix A Maintenance Requirements for Flow, Control, Conveyance, and Water Quality Facilities**
- 3. City of Seattle SWM, Appendix G Stormwater Control Operations and Maintenance Requirements**
- 4. City of Tacoma SWMM, Appendix C Operation and Maintenance**
- 5. WSDOT Highway Runoff Manual, Chapter 5 Stormwater Best Management Practices Maintenance Standards**

**APPENDIX A-1**  
**Ecology SWMMWW, Appendix**  
**V-A BMP Maintenance Tables**



You are here: [2019 SWMMWW](#) > [Volume V - Runoff Treatment, Flow Control, and LID BMP Library](#) > [Appendix V-A: BMP Maintenance Tables](#)

## Appendix V-A: BMP Maintenance Tables

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

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

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

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.  If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site
	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public.  Any evidence of noxious weeds as defined by State or local regulations.  (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department)  Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants  (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance and inspection access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove  If dead, diseased, or dying trees are identified  (Use a certified Arborist to determine health of tree or removal requirements)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).  Remove hazard Trees
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.  Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.  If erosion is occurring on compacted berms a licensed engineer in the state of Washington should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Ponds Berms (Dikes)	Settlements	<p>Any part of berm which has settled 4 inches lower than the design elevation</p> <p>If settlement is apparent, measure berm to determine amount of settlement</p> <p>Settling can be an indication of more severe problems with the berm or outlet works. A licensed engineer in the state of Washington should be consulted to determine the source of the settlement.</p>	Dike is built back to the design elevation.
	Piping	<p>Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue.</p> <p>(Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.</p>	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	<p>Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.</p> <p>Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.</p>	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed engineer in the state of Washington should be consulted for proper berm/spillway restoration.
	Piping	<p>Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue.</p> <p>(Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.</p>	Piping eliminated. Erosion potential resolved.
Emergency Overflow/Spillway	Emergency Overflow/Spillway	<p>Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway.</p> <p>(Rip-rap on inside slopes need not be replaced.)</p>	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	

**Table V-A.2: Maintenance Standards - Infiltration**

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>
	Poisonous/Noxious Vegetation	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>
	Contaminants and Pollution	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>
	Rodent Holes	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>
Storage Area	Sediment	<p>Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events.</p> <p>(A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).</p>	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>
	Piping	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Emergency Overflow Spillway	Rock Missing	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>
	Erosion	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

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

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

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See <a href="#">Table V-A.5: Maintenance Standards - Catch Basins</a>	See <a href="#">Table V-A.5: Maintenance Standards - Catch Basins</a>	See <a href="#">Table V-A.5: Maintenance Standards - Catch Basins</a>

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

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	<p>Structure is not securely attached to manhole wall.</p> <p>Structure is not in upright position (allow up to 10% from plumb).</p> <p>Connections to outlet pipe are not watertight and show signs of rust.</p> <p>Any holes - other than designed holes - in the structure.</p>	<p>Structure securely attached to wall and outlet pipe.</p> <p>Structure in correct position.</p> <p>Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.</p> <p>Structure has no holes other than designed holes.</p>

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See <a href="#">Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)</a>	See <a href="#">Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)</a>	See <a href="#">Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)</a>
Catch Basin	See <a href="#">Table V-A.5: Maintenance Standards - Catch Basins</a>	See <a href="#">Table V-A.5: Maintenance Standards - Catch Basins</a>	See <a href="#">Table V-A.5: Maintenance Standards - Catch Basins</a>

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

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.



Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

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

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

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

Maintenance Components	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
External:			

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

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

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing Water	When water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.	Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.
	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

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

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

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

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.

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

**Table V-A.11: Maintenance Standards - Wetponds**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per 1000-SF of pond area.	Trash and debris removed from pond.
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.	Sediment removed from pond bottom.

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vacor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as <i>Juncus effusus</i> (soft rush) which can uptake small concentrations of oil.
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	Settlement of Pond Dike/Berm	Any part of these components that has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

**Table V-A.12: Maintenance Standards - Wetvaults**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Remove trash and debris from vault.
	Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	Remove sediment from vault.
	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Cover repaired or replaced to proper working specifications.
	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	Maintenance/inspection personnel determine that the vault is not structurally sound.  Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.  Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Baffles repaired or replaced to specifications.
	Access Ladder Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements. Ladder and entry notification complies with OSHA standards.

**Table V-A.13: Maintenance Standards - Sand Filters (Above Ground/Open)**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Above Ground (open sand filter)	Sediment Accumulation on top layer	Sediment depth exceeds 1/2-inch.	No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.
	Trash and Debris Accumulations	Trash and debris accumulated on sand filter bed.	Trash and debris removed from sand filter bed.
	Sediment/ Debris in Clean-Outs	When the clean-outs become full or partially plugged with sediment and/or debris.	Sediment removed from clean-outs.
	Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently.	Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).
	Prolonged Flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities.	Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Short Circuiting	When flows become concentrated over one section of the sand filter rather than dispersed.	Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area.
	Erosion Damage to Slopes	Erosion over 2-inches deep where cause of damage is prevalent or potential for continued erosion is evident.	Slopes stabilized using proper erosion control measures.
	Rock Pad Missing or Out of Place	Soil beneath the rock is visible.	Rock pad replaced or rebuilt to design specifications.
	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter.	Spreader leveled and cleaned so that flows are spread evenly over sand filter.
	Damaged Pipes	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired or replaced.

**Table V-A.14: Maintenance Standards - Sand Filters (Below Ground/Enclosed)**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault.	Sediment Accumulation on Sand Media Section	Sediment depth exceeds 1/2-inch.	No sediment deposits on sand filter section that which would impede permeability of the filter section.
	Sediment Accumulation in Pre-Settling Portion of Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	No sediment deposits in first chamber of vault.
	Trash/Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault and inlet/outlet piping.
	Sediment in Drain Pipes/Cleanouts	When drain pipes, cleanouts become full with sediment and/or debris.	Sediment and debris removed.
	Short Circuiting	When seepage/flow occurs along the vault walls and corners. Sand eroding near inflow area.	Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.



Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover. Maintenance person cannot remove cover using normal lifting pressure.	Cover repaired to proper working specifications or replaced.
	Ventilation	Ventilation area blocked or plugged	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles/Internal walls	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.

**Table V-A.15: Maintenance Standards - Manufactured Media Filters**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault	Sediment Accumulation on Media.	Sediment depth exceeds 0.25-inches.	No sediment deposits which would impede permeability of the compost media.
	Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.	
Below Ground Cartridge Type	Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.

**Table V-A.16: Maintenance Standards - Baffle Oil/Water Separators (API Type)**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with out thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth.	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Oil Accumulation	Oil accumulations that exceed 1-inch, at the surface of the water.	Extract oil from vault by vactoring. Disposal in accordance with state and local rules and regulations.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	See <a href="#">Table V-A.5: Maintenance Standards - Catch Basins</a> Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

**Table V-A.17: Maintenance Standards - Coalescing Plate Oil/Water Separators**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with no thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth and/or visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Oil accumulation that exceeds 1-inch at the water surface.	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water.

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/or showing signs of failure.	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.  Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.  Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

**Table V-A.18: Maintenance Standards - Catch Basin Inserts**

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
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.	Remove and replace media insert
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

**Table V-A.19: Maintenance Standards - Media Filter Drain (MFD)**

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation zone/flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean to spread flows evenly over entire embankment width.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost; or, replant with plugs of grass from the upper slope.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation to not impede flow. Mow grass to a height of 6 inches.
	Media filter drain mix replacement	Water is seen on the surface of the media filter drain mix long after the storms have ceased. Typically, the 6-month, 24-hour precipitation event should drain within 48 hours. More common storms should drain within 24 hours. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.
	Excessive shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.
	Flooding of Media filter drain	When media filter drain is inundated by flood water	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.

**Table V-A.20: Maintenance Standards - Compost Amended Vegetated Filter Strip (CAVFS)**

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits. Relevel so slope is even and flows pass evenly through strip.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow grass and control nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Trash and debris	Trash and debris have accumulated on the vegetated filter strip.	Remove trash and debris from filter.
	Erosion/scouring	Areas have eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width

**Table V-A.21: Maintenance Standards - Bioretention Facilities**

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
<b>Facility Footprint</b>				

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Earthen side slopes and berms	B, S		Erosion (gullies/ rills) greater than 2 inches deep around inlets, outlet, and alongside slopes	<ul style="list-style-type: none"> <li>Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting)</li> <li>For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made.</li> <li>Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.</li> </ul>
	A		Erosion of sides causes slope to become a hazard	Take actions to eliminate the hazard and stabilize slopes
	A, S		Settlement greater than 3 inches (relative to undisturbed sections of berm)	Restore to design height
	A, S		Downstream face of berm wet, seeps or leaks evident	Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)
	A		Any evidence of rodent holes or water piping in berm	<ul style="list-style-type: none"> <li>Eradicate rodents (see "Pest control")</li> <li>Fill holes and compact (may require consultation with engineer, particularly for larger berms)</li> </ul>
Concrete sidewalls	A		Cracks or failure of concrete sidewalls	<ul style="list-style-type: none"> <li>Repair/ seal cracks</li> <li>Replace if repair is insufficient</li> </ul>
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility area		All maintenance visits (at least biannually)	Trash and debris present	Clean out trash and debris
Facility bottom area	A, S		Accumulated sediment to extent that infiltration rate is reduced (see "Ponded water") or surface storage capacity significantly impacted	<ul style="list-style-type: none"> <li>Remove excess sediment</li> <li>Replace any vegetation damaged or destroyed by sediment accumulation and removal</li> <li>Mulch newly planted vegetation</li> <li>Identify and control the sediment source (if feasible)</li> <li>If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet</li> </ul>
			During/after fall leaf drop	Accumulated leaves in facility
Low permeability check dams and weirs	A, S		Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice	Clear the blockage
			Erosion and/or undercutting present	Repair and take preventative measures to prevent future erosion and/or undercutting
			Grade board or top of weir damaged or not level	Restore to level position



Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Ponded water	B, S		Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	<p>Determine cause and resolve in the following order:</p> <ol style="list-style-type: none"> <li>1. Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris.</li> <li>2. Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain.</li> <li>3. Check for other water inputs (e.g., groundwater, illicit connections).</li> <li>4. Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. If steps #1-4 do not solve the problem, the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with an engineer is recommended.</li> </ol>

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Bioretention soil mix	As needed		Bioretention soil mix protection is needed when performing maintenance requiring entrance into the facility footprint	<ul style="list-style-type: none"> <li>Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils.</li> <li>Never drive equipment or apply heavy loads in facility footprint.</li> <li>Because the risk of compaction is higher during saturated soil conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions.</li> <li>Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction.</li> <li>If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.</li> </ul>
<b><i>Inlets/Outlets/Pipes</i></b>				
Splash block inlet	A		Water is not being directed properly to the facility and away from the inlet structure	Reconfigure/ repair blocks to direct water to facility and away from structure
Curb cut inlet/outlet	M during the wet season and before severe storm is forecasted	Weekly during fall leaf drop	Accumulated leaves at curb cuts	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
Pipe inlet/outlet	A		Pipe is damaged	Repair/ replace
	W		Pipe is clogged	Remove roots or debris
	A, S		Sediment, debris, trash, or mulch reducing capacity of inlet/outlet	<ul style="list-style-type: none"> <li>Clear the blockage</li> <li>Identify the source of the blockage and take actions to prevent future blockages</li> </ul>
		Weekly during fall leaf drop	Accumulated leaves at inlets/outlets	Clear leaves (particularly important for key inlets and low points along long, linear facilities)

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
		A	Maintain access for inspections	<ul style="list-style-type: none"> <li>• Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways</li> <li>• Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants</li> </ul>
Erosion control at inlet	A		Concentrated flows are causing erosion	Maintain a cover of rock or cobbles or other erosion protection measure (e.g., matting) to protect the ground where concentrated water enters the facility (e.g., a pipe, curb cut or swale)
Trash rack	S		Trash or other debris present on trash rack	Remove/dispose
	A		Bar screen damaged or missing	Repair/replace
Overflow	A, S		Capacity reduced by sediment or debris	Remove sediment or debris/dispose
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	<ul style="list-style-type: none"> <li>• Plant roots, sediment or debris reducing capacity of underdrain</li> <li>• Prolonged surface ponding (see "Ponded water")</li> </ul>	<ul style="list-style-type: none"> <li>• Jet clean or rotary cut debris/roots from underdrain(s)</li> <li>• If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.</li> </ul>
<b>Vegetation</b>				

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility bottom area and upland slope vegetation	Fall and Spring		Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more or less than 75% survival rate).	<ul style="list-style-type: none"> <li>Determine cause of poor vegetation growth and correct condition</li> <li>Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jurisdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the <i>LID Technical Guidance Manual for Puget Sound</i>, (<a href="#">Hinman and Wulkan, 2012</a>)).</li> <li>Confirm that plant selection is appropriate for site growing conditions</li> <li>Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants</li> </ul>
Vegetation (general)	As needed		Presence of diseased plants and plant material	<ul style="list-style-type: none"> <li>Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants</li> <li>Disinfect gardening tools after pruning to prevent the spread of disease</li> <li>See the <i>Pacific Northwest Plant Disease Management Handbook</i> (<a href="#">Pscheidt and Ocamb, 2016</a>) for information on disease recognition and for additional resources</li> <li>Replant as necessary according to recommendations provided for "facility bottom area and upland slope vegetation".</li> </ul>
Trees and shrubs		All pruning seasons (timing varies by species)	Pruning as needed	<ul style="list-style-type: none"> <li>Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques</li> <li>All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist</li> </ul>
	A		Large trees and shrubs interfere with operation of the facility or access for maintenance	<ul style="list-style-type: none"> <li>Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs.</li> <li>Remove trees and shrubs, if necessary.</li> </ul>

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	Fall and Spring		Standing dead vegetation is present	<ul style="list-style-type: none"> <li>Remove standing dead vegetation</li> <li>Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season)</li> <li>If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately.</li> <li>Determine cause of dead vegetation and address issue, if possible</li> <li>If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.</li> </ul>
	Fall and Spring		Planting beneath mature trees	<ul style="list-style-type: none"> <li>When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil).</li> <li>Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.</li> </ul>
	Fall and Spring		Presence of or need for stakes and guys (tree growth, maturation, and support needs)	<ul style="list-style-type: none"> <li>Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage</li> <li>Monitor tree support systems: Repair and adjust as needed to provide support and prevent damage to tree.</li> <li>Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year.</li> <li>Backfill stake holes after removal.</li> </ul>

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	A		Vegetation causes some visibility (line of sight) or driver safety issues	<ul style="list-style-type: none"> <li>• Maintain appropriate height for sight clearance</li> <li>• When continued, regular pruning (more than one time/ 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.</li> <li>• Remove or transplant if continual safety hazard</li> <li>• Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants</li> </ul>
Flowering plants		A	Dead or spent flowers present	Remove spent flowers (deadhead)
Perennials		Fall	Spent plants	Cut back dying or dead and fallen foliage and stems
Emergent vegetation		Spring	Vegetation compromises conveyance	Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning)
Ornamental grasses (perennial)		Winter and Spring	Dead material from previous year's growing cycle or dead collapsed foliage	<ul style="list-style-type: none"> <li>• Leave dry foliage for winter interest</li> <li>• Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow</li> </ul>
Ornamental grasses (evergreen)		Fall and Spring	Dead growth present in spring	<ul style="list-style-type: none"> <li>• Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring</li> <li>• Clean, rake, and comb grasses when they become too tall</li> <li>• Cut back to ground or thin every 2-3 years as needed</li> </ul>

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Noxious weeds		M (March - October, preceding seed dispersal)	Listed noxious vegetation is present (refer to current county noxious weed list)	<ul style="list-style-type: none"> <li>By law, class A &amp; B noxious weeds must be removed, bagged and disposed as garbage immediately</li> <li>Reasonable attempts must be made to remove and dispose of class C noxious weeds</li> <li>It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions</li> <li>Apply mulch after weed removal (see "Mulch")</li> </ul>
Weeds		M (March - October, preceding seed dispersal)	Weeds are present	<ul style="list-style-type: none"> <li>Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate</li> <li>Follow IPM protocols for weed management (see "Additional Maintenance Resources" section for more information on IPM protocols)</li> </ul>
Excessive vegetation		Once in early to mid- May and once in early- to mid- September	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil	<ul style="list-style-type: none"> <li>Edge or trim groundcovers and shrubs at facility edge</li> <li>Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks</li> <li>While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging</li> </ul>

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	As needed		Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety	<ul style="list-style-type: none"> <li>Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics</li> <li>Determine if planting type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow)</li> <li>Remove plants that are weak, broken or not true to form; replace in-kind</li> <li>Thin grass or plants impacting facility function without leaving visual holes or bare soil areas</li> <li>Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants</li> </ul>
	As needed		Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass	Remove vegetation and sediment buildup
<b>Mulch</b>				
Mulch		Following weeding	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	<ul style="list-style-type: none"> <li>Supplement mulch with hand tools to a depth of 2 to 3 inches</li> <li>Replenish mulch per O&amp;M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels)</li> <li>Keep all mulch away from woody stems</li> </ul>
<b>Watering</b>				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	Follow manufacturer's instructions for O&M
	A		Sprinklers or drip irrigation not directed/located to properly water plants	Redirect sprinklers or move drip irrigation to desired areas



Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in first year of establishment period	<ul style="list-style-type: none"> <li>• 10 to 15 gallons per tree</li> <li>• 3 to 5 gallons per shrub</li> <li>• 2 gallons water per square foot for groundcover areas</li> <li>• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist</li> <li>• Use soaker hoses or spot water with a shower type wand when irrigation system is not present <ul style="list-style-type: none"> <li>◦ Pulse water to enhance soil absorption, when feasible</li> <li>◦ 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</li> </ul> </li> <li>• 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</li> </ul>
Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in second or third year of establishment period	<ul style="list-style-type: none"> <li>• 10 to 15 gallons per tree</li> <li>• 3 to 5 gallons per shrub</li> <li>• 2 gallons water per square foot for groundcover areas</li> <li>• Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist</li> <li>• Use soaker hoses or spot water with a shower type wand when irrigation system is not present <ul style="list-style-type: none"> <li>◦ Pulse water to enhance soil absorption, when feasible</li> <li>◦ 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</li> </ul> </li> </ul>

Maintenance Component	Recommended Frequency a		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	<ul style="list-style-type: none"> <li>Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established</li> <li>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</li> <li>Water during drought conditions or more often if necessary to maintain plant cover</li> </ul>
<b><i>Pest Control</i></b>				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of a storm	<ul style="list-style-type: none"> <li>Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water")</li> <li>To facilitate maintenance, manually remove standing water and direct to the storm drainage system (if runoff is from non pollution-generating surfaces) or sanitary sewer system (if runoff is from pollution-generating surfaces) after getting approval from sanitary sewer authority.</li> <li>Use of pesticides or <i>Bacillus thuringiensis israelensis</i> (Bti) may be considered only as a temporary measure while addressing the standing water cause. If overflow to a surface water will occur within 2 weeks after pesticide use, apply for coverage under the Aquatic Mosquito Control NPDES General Permit.</li> </ul>

Maintenance Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	<ul style="list-style-type: none"> <li>• Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.)</li> <li>• Place predator decoys</li> <li>• Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols)</li> <li>• Remove pet waste regularly</li> <li>• For public and right-of-way sites consider adding garbage cans with dog bags for picking up pet waste.</li> </ul>
Insect pests	Every site visit associated with vegetation management		Signs of pests, such as wilting leaves, chewed leaves and bark, spotting or other indicators	<ul style="list-style-type: none"> <li>• Reduce hiding places for pests by removing diseased and dead plants</li> <li>• For infestations, follow IPM protocols (see "Additional Maintenance Resources" section for more information on IPM protocols)</li> </ul>

Note that the inspection and routine maintenance frequencies listed above are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".

<sup>a</sup> Frequency: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

IPM - Integrated Pest Management

ISA - International Society of Arboriculture

**Table V-A.22: Maintenance Standards - Permeable Pavement**

Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
<b>Surface/Wearing Course</b>				

Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Permeable Pavements, all	A, S		Runoff from adjacent pervious areas deposits soil, mulch or sediment on paving	<ul style="list-style-type: none"> <li>• Clean deposited soil or other materials from permeable pavement or other adjacent surfacing</li> <li>• Check if surface elevation of planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place)</li> <li>• Mulch and/or plant all exposed soils that may erode to pavement surface</li> </ul>
Porous asphalt or pervious concrete		A or B	None (routine maintenance)	<p>Clean surface debris from pavement surface using one or a combination of the following methods:</p> <ul style="list-style-type: none"> <li>• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves)</li> <li>• Vacuum/sweep permeable paving installation using: <ul style="list-style-type: none"> <li>◦ Walk-behind vacuum (sidewalks)</li> <li>◦ High efficiency regenerative air or vacuum sweeper (roadways, parking lots)</li> <li>◦ ShopVac or brush brooms (small areas)</li> </ul> </li> <li>• Hand held pressure washer or power washer with rotating brushes Follow equipment manufacturer guidelines for when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.</li> </ul>

Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	Ab		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	<ul style="list-style-type: none"> <li>• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility)</li> <li>• Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet.</li> <li>• If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. To clean clogged pavement surfaces, use one or combination of the following methods:                             <ul style="list-style-type: none"> <li>◦ Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate.</li> <li>◦ Hand held pressure washer or power washer with rotating brushes</li> <li>◦ Pure vacuum sweepers</li> </ul> </li> </ul> <p>Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.</p>
	A		Sediment present at the surface of the pavement	<ul style="list-style-type: none"> <li>• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above.</li> <li>• Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).</li> </ul>

Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	<ul style="list-style-type: none"> <li>• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry</li> <li>• Parking lots and roadways: Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.</li> </ul>
	A		Major cracks or trip hazards and concrete spalling and raveling	<ul style="list-style-type: none"> <li>• Fill potholes or small cracks with patching mixes</li> <li>• Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible. Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function.</li> <li>• Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials</li> </ul>
Interlocking concrete paver blocks and aggregate pavers		A or B	None (routine maintenance)	<p>Clean pavement surface using one or a combination of the following methods:</p> <ul style="list-style-type: none"> <li>• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves)</li> <li>• Vacuum/sweep permeable paving installation using: <ul style="list-style-type: none"> <li>◦ Walk-behind vacuum (sidewalks)</li> <li>◦ High efficiency regenerative air or vacuum sweeper (roadways, parking lots)</li> <li>◦ ShopVac or brush brooms (small areas)</li> </ul> </li> </ul> <p>Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.</p>

Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	Ab		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	<ul style="list-style-type: none"> <li>Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility)</li> <li>Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet.</li> <li>If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability.</li> <li>Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper).</li> <li>Replace aggregate in paver cells, joints, or openings per manufacturer's recommendations</li> </ul>
	A		Sediment present at the surface of the pavement	<ul style="list-style-type: none"> <li>Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above.</li> <li>Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).</li> </ul>
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	<ul style="list-style-type: none"> <li>Sidewalks: Use a stiff broom to remove moss in the summer when it is dry</li> <li>Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface</li> </ul>
	A		Paver block missing or damaged	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations

Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
	A		Loss of aggregate material between paver blocks	Refill per manufacturer's recommendations for interlocking paver sections
	A		Settlement of surface	May require resetting
Open-celled paving grid with gravel		A or B	None (routine maintenance)	<ul style="list-style-type: none"> <li>Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves)</li> <li>Follow equipment manufacturer guidelines for cleaning surface.</li> </ul>
	A <sub>b</sub>		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	<ul style="list-style-type: none"> <li>Use vacuum truck to remove and replace top course aggregate</li> <li>Replace aggregate in paving grid per manufacturer's recommendations</li> </ul>
	A		Paving grid missing or damaged	<ul style="list-style-type: none"> <li>Remove pins, pry up grid segments, and replace gravel</li> <li>Replace grid segments where three or more adjacent rings are broken or damaged</li> <li>Follow manufacturer guidelines for repairing surface.</li> </ul>
	A		Settlement of surface	May require resetting
	A		Loss of aggregate material in paving grid	Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.
		A	Weeds present	<ul style="list-style-type: none"> <li>Manually remove weeds</li> <li>Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" <input type="checkbox"/> to address this issue)</li> </ul>



Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Open-celled paving grid with grass		A or B	None (routine maintenance)	<ul style="list-style-type: none"> <li>Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves)</li> <li>Follow equipment manufacturer guidelines for cleaning surface.</li> </ul>
	A <sub>b</sub>		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	Rehabilitate per manufacturer's recommendations.
	A		Paving grid missing or damaged	<ul style="list-style-type: none"> <li>Remove pins, pry up grid segments, and replace grass</li> <li>Replace grid segments where three or more adjacent rings are broken or damaged</li> <li>Follow manufacturer guidelines for repairing surface.</li> </ul>
	A		Settlement of surface	May require resetting
	A		Poor grass coverage in paving grid	<ul style="list-style-type: none"> <li>Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed</li> <li>Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible</li> </ul>
		As needed	None (routine maintenance)	Use a mulch mower to mow grass
		A	None (routine maintenance)	<ul style="list-style-type: none"> <li>Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in</li> <li>Do not use fertilizer</li> </ul>
		A	Weeds present	<ul style="list-style-type: none"> <li>Manually remove weeds</li> <li>Mow, torch, or inoculate and replace with preferred vegetation</li> </ul>
<b>Inlets/Outlets/Pipes</b>				

Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Inlet/outlet pipe	A		Pipe is damaged	Repair/replace
	A		Pipe is clogged	Remove roots or debris
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period)	<ul style="list-style-type: none"> <li>• Jet clean or rotary cut debris/roots from underdrain(s)</li> <li>• If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly</li> </ul>
Raised subsurface overflow pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain	<ul style="list-style-type: none"> <li>• Jet clean or rotary cut debris/roots from under-drain(s)</li> <li>• If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly</li> </ul>
Outlet structure	A, S		Sediment, vegetation, or debris reducing capacity of outlet structure	<ul style="list-style-type: none"> <li>• Clear the blockage</li> <li>• Identify the source of the blockage and take actions to prevent future blockages</li> </ul>
Overflow	B		Native soil is exposed or other signs of erosion damage are present at discharge point	Repair erosion and stabilize surface
<b>Aggregate Storage Reservoir</b>				
Observation port	A, S		Water remains in the storage aggregate longer than anticipated by design after the end of a storm	If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.
<b>Vegetation</b>				

Component	Recommended Frequency <sup>a</sup>		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Adjacent large shrubs or trees		As needed	Vegetation related fallout clogs or will potentially clog voids	<ul style="list-style-type: none"> <li>Sweep leaf litter and sediment to prevent surface clogging and ponding</li> <li>Prevent large root systems from damaging subsurface structural components</li> </ul>
		Once in May and Once in September	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge	Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.
Leaves, needles, and organic debris		In fall (October to December) after leaf drop (1-3 times, depending on canopy cover)	Accumulation of organic debris and leaf litter	Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement

Note that the inspection and routine maintenance frequencies listed above are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".

<sup>a</sup> Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

<sup>b</sup> Inspection should occur during storm event.

**Table V-A.23: Maintenance Standards - Vegetated Roofs**

Activity	Objective	Schedule	Notes
<b>Structural and Drainage Components</b>			
<b>Clear inlet pipes:</b> Remove soil substrate, vegetation or other debris.	Maintain free drainage of inlet pipes.	Twice annually.	
<b>Inspect drain pipe:</b> Check for cracks settling and proper alignment, and correct and re-compact soils or fill material surrounding pipe, if necessary.	Maintain free drainage of inlet pipes.	Twice annually.	

Activity	Objective	Schedule	Notes
<b>Inspect fire ventilation points for proper operation</b>	Fire and safety.	Twice annually.	
<b>Maintain egress and ingress:</b> Clear routes of obstructions and maintained to design standards.	Fire and safety.	Twice annually.	
<b>Insects:</b> (see note)			Roof garden design should provide drainage rates that do not allow pooling of water for periods that promote insect larvae development. If standing water is present for extended periods correct drainage problem. Chemical sprays should not be used.
<b>Prevent release of contaminants:</b> Identify activities (mechanical systems maintenance, pet access, etc.) that can potentially release pollutants to the roof garden and establish agreements to prevent release.	Water quality protection.	During construction of roof and then as determined by inspection.	Any cause of pollutant release should be corrected as soon as identified and the pollutant removed.
<b>Vegetation and Growth Medium</b>			
<b>Invasive or nuisance plants:</b> Remove manually and without herbicide applications.	Promote selected plant growth and survival, maintain aesthetics.	Twice annually.	At a minimum, schedule weeding with inspections to coincide with important horticultural cycles (e.g., prior to major weed varieties dispersing seeds).
<b>Removing and replacing dead material:</b> (see note)	See note.	Once annually.	Normally, dead plant material will be recycled on the roof; however specific plants or aesthetic considerations may warrant removing and replacing dead material (see manufacturer's recommendations).
<b>Fertilization:</b> If necessary apply by hand (see note)	Plant growth and survival.	Determined by inspection.	Extensive roof gardens should be designed to not require fertilization after plant establishment. If fertilization is necessary during plant establishment or for plant health and survivability after establishment, use an encapsulated, slow release fertilizer (excessive fertilization can contribute to increased nutrient loads in the stormwater system and receiving waters).
<b>Mulching:</b> (see note)			Avoid application of mulch on extensive roof gardens. Mulch should be used only in unusual situations and according to the roof garden provider guidelines. In conventional landscaping mulch enhances moisture retention; however, moisture control on a vegetated roof should be through proper soil/growth media design. Mulch will also increase establishment of weeds.

Activity	Objective	Schedule	Notes
<b>Irrigate:</b> Use subsurface or drip irrigation.		Determined by inspection and only when absolutely necessary for plant survival.	Surface irrigation systems on extensive roof gardens can promote weed establishment, root development near the drier surface layer of the soil substrate, and increase plant dependence on irrigation. Accordingly, subsurface irrigation methods are preferred. If surface irrigation is the only method available, use drip irrigation to deliver water to the base of the plant.
<i>Source: Eastern Washington LID Guidance Manual (June 2013)</i>			

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**APPENDIX A-2**  
**King County 2019 SWDM,**  
**Appendix A Maintenance**  
**Requirements for Flow**  
**Control, Conveyance, and**  
**Water Quality Facilities**

# APPENDIX A

## MAINTENANCE REQUIREMENTS FOR FLOW CONTROL, CONVEYANCE, AND WATER QUALITY FACILITIES

This appendix contains the maintenance requirements for the following typical stormwater control and water quality facilities and components (*ctrl/click ► to follow the link*):

- [▶ No. 1 – Detention Ponds \(p. A-2\)](#)
- [▶ No. 2 – Infiltration Facilities \(p. A-3\)](#)
- [▶ No. 3 – Detention Tanks and Vaults \(p. A-5\)](#)
- [▶ No. 4 – Control Structure/Flow Restrictor \(p. A-7\)](#)
- [▶ No. 5 – Catch Basins and Manholes \(p. A-9\)](#)
- [▶ No. 6 – Conveyance Pipes and Ditches \(p. A-11\)](#)
- [▶ No. 7 – Debris Barriers \(e.g., Trash Racks\) \(p. A-12\)](#)
- [▶ No. 8 – Energy Dissipaters \(p. A- 13\)](#)
- [▶ No. 9 – Fencing \(p. A-14\)](#)
- [▶ No. 10 – Gates/Bollards/Access Barriers \(p. A-15\)](#)
- [▶ No. 11 – Grounds \(Landscaping\) \(p. A-16\)](#)
- [▶ No. 12 – Access Roads \(p. A-17\)](#)
- [▶ No. 13 – Basic Bioswale \(grass\) \(p. A-18\)](#)
- [▶ No. 14 – Wet Bioswale \(p. A-19\)](#)
- [▶ No. 15 – Filter Strip \(p. A-20\)](#)
- [▶ No. 16 – Wetpond \(p. A-21\)](#)
- [▶ No. 17 – Wetvault \(p. A-23\)](#)
- [▶ No. 18 – Stormwater Wetland \(p. A-24\)](#)
- [▶ No. 19 – Sand Filter Pond \(p. A-26\)](#)
- [▶ No. 20 – Sand Filter Vault \(p. A-28\)](#)
- [▶ No. 21 – Stormfilter \(Cartridge Type\) \(p. A-30\)](#)
- [▶ No. 22 – Baffle Oil/Water Separator \(p. A-32\)](#)
- [▶ No. 23 – Coalescing Plate Oil/Water Separator \(p. A-33\)](#)
- [▶ No. 24 – Catch Basin Insert \(p. A-34\)](#)
- [▶ No. 25 – Drywell BMP \(p. A-35\)](#)
- [▶ No. 26 – Gravel Filled Infiltration Trench BMP \(p. A-35\)](#)
- [▶ No. 27 – Gravel Filled Dispersion Trench BMP \(p. A-36\)](#)
- [▶ No. 28 – Native Vegetated Surface / Native Vegetated Landscape BMP \(p. A-37\)](#)
- [▶ No. 29 – Perforated Pipe Connections BMP \(p. A-37\)](#)
- [▶ No. 30 – Permeable Pavement BMP \(p. A-38\)](#)
- [▶ No. 31 – Bioretention BMP \(p. A-39\)](#)
- [▶ No. 32 – RainWater Harvesting BMP \(p. A- 40\)](#)
- [▶ No. 33 – Rock Pad BMP \(p. A-40\)](#)
- [▶ No. 34 – Sheet Flow BMP \(p. A-40\)](#)
- [▶ No. 35 – Splash Block BMP \(p. A-41\)](#)
- [▶ No. 36 – Vegetated Roof BMP \(p. A-42\)](#)

<b>NO. 1 – DETENTION PONDS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	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.
Top or Side Slopes of Dam, Berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
Storage Area	Sediment accumulation	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
Inlet/Outlet Pipe.	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.
Emergency Overflow/Spillway	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.
	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil on the spillway.	Spillway restored to design standards.



<b>NO. 2 – INFILTRATION FACILITIES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	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.
Infiltration Pond, Top or Side Slopes of Dam, Berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Storage Area	Sediment accumulation	If two inches or more sediment is present or a percolation test indicates facility is working at or less than 90% of design.	Facility infiltrates as designed.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
Infiltration Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Infiltration Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.

<b>NO. 2 – INFILTRATION FACILITIES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	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.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat; covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Filter Bags	Plugged	Filter bag more than ½ full.	Replace filter bag or redesign system.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Pre-settling Ponds and Vaults	Sediment accumulation	6" or more of sediment has accumulated.	Pre-settling occurs as designed
Infiltration Pond, Rock Filter	Plugged	High water level on upstream side of filter remains for extended period of time or little or no water flows through filter during heavy rain storms.	Rock filter replaced evaluate need for filter and remove if not necessary.
Infiltration Pond Emergency Overflow Spillway	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced.	Spillway restored to design standards.
	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.

<b>NO. 3 – DETENTION TANKS AND VAULTS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	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.
Tank or Vault Storage Area	Trash and debris	Any trash and debris accumulated in vault or tank (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than ½ length of tank.	All sediment removed from storage area.
Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.

<b>NO. 3 – DETENTION TANKS AND VAULTS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	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.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat; covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

<b>NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
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	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		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 ¼ 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.
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.
Cleanout Gate	Damaged or missing	Cleanout gate is missing.	Replace cleanout gate.

<b>NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
		Cleanout 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	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/2-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 1/4-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. <b>Any open structure requires urgent maintenance.</b>	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.

<b>NO. 5 – CATCH BASINS AND MANHOLES</b>				
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>	
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.	
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.	
		Trash or debris in the catch basin 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 catch basin.	
		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 catch basin.	
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.	
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.	
		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 catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and is 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 catch basin through cracks.	No cracks more than 1/4 inch wide at the joint of inlet/outlet pipe.	
	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.	
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin 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.	
	Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
		Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
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.	

<b>NO. 5 – CATCH BASINS AND MANHOLES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $\frac{7}{8}$ 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. <b>Any open structure requires urgent maintenance.</b>	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. <b>Any open structure requires urgent maintenance.</b>	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.



<b>NO. 6 – CONVEYANCE PIPES AND DITCHES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through 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.
	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.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	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.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

<b>NO. 7 – DEBRIS BARRIERS (E.G., TRASH RACKS)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed.</b>
Site	Trash and debris	Trash or debris plugging more than 20% of the area of the barrier.	Barrier clear to receive capacity flow.
	Sediment accumulation	Sediment accumulation of greater than 20% of the area of the barrier	Barrier clear to receive capacity flow.
Structure	Cracked broken or loose	Structure which bars attached to is damaged - pipe is loose or cracked or concrete structure is cracked, broken or loose.	Structure barrier attached to is sound.
Bars	Bar spacing	Bar spacing exceeds 6 inches.	Bars have at most 6 inches spacing.
	Damaged or missing bars	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than ¼ inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Repair or replace barrier to design standards.

<b>NO. 8 – ENERGY DISSIPATERS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed.</b>
Site	Trash and debris	Trash and/or debris accumulation.	Dissipater clear of trash and/or debris.
	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.
Rock Pad	Missing or moved Rock	Only one layer of rock exists above native soil in area five square feet or larger or any exposure of native soil.	Rock pad prevents erosion.
Dispersion Trench	Pipe plugged with sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	Not discharging water properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench).	Water discharges from feature by sheet flow.
	Perforations plugged.	Over 1/4 of perforations in pipe are plugged with debris or sediment.	Perforations freely discharge flow.
	Water flows out top of "distributor" catch basin.	Water flows out of distributor catch basin during any storm less than the design storm.	No flow discharges from distributor catch basin.
	Receiving area over-saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Gabions	Damaged mesh	Mesh of gabion broken, twisted or deformed so structure is weakened or rock may fall out.	Mesh is intact, no rock missing.
	Corrosion	Gabion mesh shows corrosion through more than ¼ of its gage.	All gabion mesh capable of containing rock and retaining designed form.
	Collapsed or deformed baskets	Gabion basket shape deformed due to any cause.	All gabion baskets intact, structure stands as designed.
	Missing rock	Any rock missing that could cause gabion to loose structural integrity.	No rock missing.
Manhole/Chamber	Worn or damaged post, baffles or side of chamber	Structure dissipating flow deteriorates to ½ or original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure is in no danger of failing.
	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch or any evidence of soil entering the structure through cracks, or maintenance inspection personnel determines that the structure is not structurally sound.	Manhole/chamber is sealed and structurally sound.
	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 soil or water enters and no water discharges at the joint of inlet/outlet pipes.

<b>NO. 9 – FENCING</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Erosion or holes under fence	Erosion or holes more than 4 inches high and 12-18 inches wide permitting access through an opening under a fence.	No access under the fence.
Wood Posts, Boards and Cross Members	Missing or damaged parts	Missing or broken boards, post out of plumb by more than 6 inches or cross members broken	No gaps on fence due to missing or broken boards, post plumb to within 1½ inches, cross members sound.
	Weakened by rotting or insects	Any part showing structural deterioration due to rotting or insect damage	All parts of fence are structurally sound.
	Damaged or failed post foundation	Concrete or metal attachments deteriorated or unable to support posts.	Post foundation capable of supporting posts even in strong wind.
Metal Posts, Rails and Fabric	Damaged parts	Post out of plumb more than 6 inches.	Post plumb to within 1½ inches.
		Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.
		Any part of fence (including post, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
		Missing or loose tension wire.	Tension wire in place and holding fabric.
	Deteriorated paint or protective coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.

<b>NO. 10 – GATES/BOLLARDS/ACCESS BARRIERS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Chain Link Fencing Gate	Damaged or missing members	Missing gate.	Gates in place.
		Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person.	Hinges intact and lubed. Gate is working freely.
		Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment.	Gate is aligned and vertical.
		Missing stretcher bar, stretcher bands, and ties.	Stretcher bar, bands, and ties in place.
	Locking mechanism does not lock gate	Locking device missing, non-functioning or does not link to all parts.	Locking mechanism prevents opening of gate.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.
Bar Gate	Damaged or missing cross bar	Cross bar does not swing open or closed, is missing or is bent to where it does not prevent vehicle access.	Cross bar swings fully open and closed and prevents vehicle access.
	Locking mechanism does not lock gate	Locking device missing, non-functioning or does not link to all parts.	Locking mechanism prevents opening of gate.
	Support post damaged	Support post does not hold cross bar up.	Cross bar held up preventing vehicle access into facility.
Bollards	Damaged or missing	Bollard broken, missing, does not fit into support hole or hinge broken or missing.	No access for motorized vehicles to get into facility.
	Does not lock	Locking assembly or lock missing or cannot be attached to lock bollard in place.	No access for motorized vehicles to get into facility.
Boulders	Dislodged	Boulders not located to prevent motorized vehicle access.	No access for motorized vehicles to get into facility.
	Circumvented	Motorized vehicles going around or between boulders.	No access for motorized vehicles to get into facility.

<b>NO. 11 – GROUNDS (LANDSCAPING)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
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. <b>A hazard tree identified by a qualified arborist must be removed as soon as possible.</b>	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.

<b>NO. 12 – ACCESS ROADS</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet (i.e., trash and debris would fill up one standards size garbage can).	Roadway drivable by maintenance vehicles.
		Debris which could damage vehicle tires or prohibit use of road.	Roadway drivable by maintenance vehicles.
	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.
	Blocked roadway	Any obstruction which reduces clearance above road surface to less than 14 feet.	Roadway overhead clear to 14 feet high.
Any obstruction restricting the access to a 10- to 12 foot width for a distance of more than 12 feet or any point restricting access to less than a 10 foot width.		At least 12-foot of width on access road.	
Road Surface	Erosion, settlement, potholes, soft spots, ruts	Any surface defect which hinders or prevents maintenance access.	Road drivable by maintenance vehicles.
	Vegetation on road surface	Trees or other vegetation prevent access to facility by maintenance vehicles.	Maintenance vehicles can access facility.
Shoulders and Ditches	Erosion	Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.	Shoulder free of erosion and matching the surrounding road.
	Weeds and brush	Weeds and brush exceed 18 inches in height or hinder maintenance access.	Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access.
Modular Grid Pavement	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.
	Damaged or missing	Access surface compacted because of broken or missing modular block.	Access road surface restored so road infiltrates.

<b>NO. 13 – BASIC BIOSWALE (GRASS)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash and/or debris accumulated on the bioswale site.	No trash or debris on the bioswale site.
	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.
Swale Section	Sediment accumulation	Sediment depth exceeds 2 inches in 10% of the swale treatment area.	No sediment deposits in grass treatment area of the bioswale.
		Sediment inhibits grass growth over 10% of swale length.	Grass growth not inhibited by sediment.
		Sediment inhibits even spreading of flow.	Flow spreads evenly through swale
	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows.	No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.
	Poor vegetation coverage	Grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Swale has no bare spots and grass is thick and healthy.
	Grass too tall	Grass excessively tall (greater than 10 inches), grass is thin or nuisance weeds and other vegetation have taken over.	Grass is between 3 and 4 inches tall, thick and healthy. No clippings left in swale. No nuisance vegetation present.
	Excessive shade	Grass growth is poor because sunlight does not reach swale.	Health grass growth or swale converted to a wet bioswale.
	Constant baseflow	Continuous flow through the swale, even when it has been dry for weeks or an eroded, muddy channel has formed in the swale bottom.	Baseflow removed from swale by a low-flow pea-gravel drain or bypassed around the swale.
	Standing water	Water pools in the swale between storms or does not drain freely.	Swale freely drains and there is no standing water in swale between storms.
Channelization	Flow concentrates and erodes channel through swale.	No flow channels in swale.	
Flow Spreader	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width.	Flows are spread evenly over entire swale width.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.



<b>NO. 14 – WET BIOSWALE</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and/or debris accumulated at the site.	No trash or debris at the site.
	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.
Swale Section	Sediment accumulation	Sediment depth exceeds 2 inches in 10% of the swale treatment area.	No sediment deposits in treatment area.
	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows.	No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.
	Water depth	Water not retained to a depth of about 4 inches during the wet season.	Water depth of 4 inches through out swale for most of wet season.
	Vegetation ineffective	Vegetation sparse, does not provide adequate filtration or crowded out by very dense clumps of cattail or nuisance vegetation.	Wetland vegetation fully covers bottom of swale and no cattails or nuisance vegetation present.
	Insufficient water	Wetland vegetation dies due to lack of water.	Wetland vegetation remains healthy (may require converting to grass lined bioswale)
Flow Spreader	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width.	Flows are spread evenly over entire swale width.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.

<b>NO. 15 – FILTER STRIP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and debris accumulated on the filter strip site.	Filter strip site free of any trash or debris
	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 Strip	Sediment accumulation	Sediment accumulation on grass exceeds 2 inches depth.	No sediment deposits in treatment area.
	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows.	No eroded or scoured areas in bioswale. Cause of erosion or scour addressed.
	Grass too tall	Grass excessively tall (greater than 10 inches), grass is thin or nuisance weeds and other vegetation have taken over.	Grass is between 3 and 4 inches tall, thick and healthy. No clippings left in swale. No nuisance vegetation present.
	Vegetation ineffective	Grass has died out, become excessively tall (greater than 10 inches) or nuisance vegetation is taking over.	Grass is healthy, less than 9 inches high and no nuisance vegetation present.
Flow Spreader	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width.	Flows are spread evenly over entire swale width.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.

<b>NO. 16 – WETPOND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Any trash and debris accumulated on the wetpond site.	Wetpond site free of any trash or debris.
	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.
Side Slopes of Dam, Berm, internal berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm or embankment integrity, are not interfering with access or maintenance or leaves do not cause a plugging problem they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
Top or Side Slopes of Dam, Berm, internal berm or Embankment	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
	Irregular surface on internal berm	Top of berm not uniform and level.	Top of berm graded to design elevation.
Pond Areas	Sediment accumulation (except first wetpool cell)	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth.
	Sediment accumulation (first wetpool cell)	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.	Sediment storage contains no sediment.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
	Water level (all wetpool cells)	Cell level(s) drops more than 12 inches in any 7-day period.	Cell level(s) drops less than 12 inches in any 7-day period.
	Algae mats (first wetpool cell)	Algae mats develop over more than 10% of the water surface should be removed.	Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)

<b>NO. 16 – WETPOND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
	Design planting and vegetation survival and maintenance	Sparse or dying design planting, or when design plantings are not thriving across 80% or more of the design vegetated areas within the pond; invasive vegetation e.g., cattails	Design plantings and vegetation are thriving and appropriately spaced across 80% or more of the design vegetated areas within the pond; invasives removed including root clumps
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Emergency Overflow Spillway	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.
	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced.	Spillway restored to design standards.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.

<b>NO. 17 – WETVAULT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility site.
Treatment Area	Trash and debris	Any trash and debris accumulated in vault (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.	No sediment in vault.
	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.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks, vault does not retain water or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure or baffle cannot be removed.	Repair or replace baffles or walls to specifications.
	Ventilation	Ventilation area blocked or plugged.	No reduction of ventilation area exists.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Access Manhole	Access cover/lid damaged or difficult to open	Access cover/lid cannot be easily opened by one person. Corrosion/deformation of cover/lid.	Access cover/lid can be opened by one person.
	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.
	Access doors/plate has gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat; covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.

<b>NO. 18 – STORMWATER WETLAND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility 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.
Side Slopes of Dam, Berm, internal berm or Embankment	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.
Top or Side Slopes of Dam, Berm, internal berm or Embankment	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation.	Top or side slope restored to design dimensions. If settlement is significant, a licensed civil engineer should be consulted to determine the cause of the settlement.
	Irregular surface on internal berm	Top of berm not uniform and level.	Top of berm graded flat to design elevation.
Pond Areas	Sediment accumulation (first cell/forebay)	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.	Sediment storage contains no sediment.
	Sediment accumulation (wetland cell)	Accumulated sediment that exceeds 10% of the designed pond depth.	Sediment cleaned out to designed pond shape and depth.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
	Water level (first cell/forebay)	Cell level drops more than 12 inches in any 7-day period.	Cell level drops no more than 12 inches in any 7-day period.
	Water level (wetland cell)	Cell does not retain water for at least 10 months of the year or wetland plants are not surviving.	Water retained at least 10 months of the year or wetland plants are surviving.
	Algae mats (first cell/forebay)	Algae mats develop over more than 10% of the water surface should be removed.	Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)

<b>NO. 18 – STORMWATER WETLAND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
	Vegetation	Vegetation dead, dying, or overgrown (cattails) or not meeting original planting specifications across more than 20% of the entire design vegetated area within the pond.	Plants in wetland cell surviving across 80% or more of the entire design vegetated area within the pond and not interfering with wetland function.
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Emergency Overflow Spillway	Tree growth	Tree growth impedes flow or threatens stability of spillway.	Trees removed.
	Rock missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. Rip-rap on inside slopes need not be replaced.	Spillway restored to design standards.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than 1/2-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 1/4-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 19 – SAND FILTER POND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility 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 (not in the treatment area)	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Pre-Treatment (if applicable)	Sediment accumulation	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches.	Sediment storage contains no sediment.
	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed.	Liner repaired or replaced.
	Water level	Cell empty, doesn't hold water.	Water retained in first cell for most of the year.
	Algae mats	Algae mats develop over more than 10% of the water surface should be removed.	Algae mats removed (usually in the late summer before Fall rains, especially in Sensitive Lake Protection Areas.)
Pond Area	Sediment accumulation	Sediment or crust depth exceeds ½-inch over 10 % of surface area of sand filter.	No sediment or crust deposit on sand filter that would impede permeability of the filter section.
	Grass (if applicable)	Grass becomes excessively tall (greater than 6 inches) or when nuisance weeds and other vegetation start to take over or thatch build up occurs.	Mow vegetation and/or remove nuisance vegetation.
Side Slopes of Pond	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents removed or destroyed and dam or berm repaired.
	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity. If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted slope.	Slopes stabilized using appropriate erosion control measures. If erosion is occurring on compacted slope, a licensed civil engineer should be consulted to resolve source of erosion.



<b>NO. 19 – SAND FILTER POND</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Sand Filter Media	Plugging	Drawdown of water through the sand filter media, takes longer than 24 hours, and/or flow through the overflow pipes occurs frequently. A sieve analysis of >4% -100 or >2% -200 requires replacing sand filter media.	Sand filter media surface is aerated or the surface is scraped and replaced, and drawdown rate is normal.
	Prolonged flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities.	Excess flows bypassed or confined to small portion of filter media surface.
	Short circuiting	Flows become concentrated over one section of the sand filter rather than dispersed or drawdown rate of pool exceeds 12 inches per hour.	Flow and percolation of water through the sand filter is uniform and dispersed across the entire filter area and drawdown rate is normal.
	Media thickness	Sand thickness is less than 18 inches.	Rebuild sand thickness to a minimum of 18 inches.
Underdrains and Clean-Outs	Sediment/debris	Underdrains or clean-outs partially plugged or filled with sediment and/or debris. Junction box/cleanout wyes not watertight.	Underdrains and clean-outs free of sediment and debris and are watertight.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.
Rock Pad	Missing or out of place	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad restored to design standards.
Flow spreader	Concentrated flow	Flow from spreader not uniformly distributed across sand filter.	Flows spread evenly over sand filter.

<b>NO. 20 – SAND FILTER VAULT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Trash and debris accumulated on facility site.	Trash and debris removed from facility 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.
Pre-Treatment Chamber	Sediment accumulation	Sediment accumulation exceeds the depth of the sediment zone plus 6 inches.	Sediment storage contains no sediment.
Sand Filter Media	Sediment accumulation	Sediment depth exceeds ½-inch on sand filter media.	Sand filter freely drains at normal rate.
	Trash and debris	Trash and debris accumulated in vault (floatables and non-floatables).	No trash or debris in vault.
	Plugging	Drawdown of water through the sand filter media, takes longer than 24 hours, and/or flow through the overflow pipes occurs frequently. A sieve analysis of >4% -100 or >2% -200 requires replacing sand filter media.	Sand filter media drawdown rate is normal.
	Short circuiting	Seepage or flow occurs along the vault walls and corners. Sand eroding near inflow area. Cleanout wyes are not watertight.	Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion.
Vault Structure	Damaged to walls, frame, bottom and/or top slab.	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to provide complete sealing of the structure.
	Ventilation	Ventilation area blocked or plugged.	No reduction of ventilation area exists.
Underdrains and Cleanouts	Sediment/debris	Underdrains or clean-outs partially plugged, filled with sediment and/or debris or not watertight.	Underdrains and clean-outs free of sediment and debris and sealed.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.

<b>NO. 20 – SAND FILTER VAULT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Access Manhole	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.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat; covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

<b>NO. 21 – STORMFILTER (CARTRIDGE TYPE)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Facility	Documentation	Update facility inspection record after each inspection.	Maintenance records are up to date.
		Provide certification of replaced filter media.	Filter media is certified to meet Stormfilter® specifications.
Site	Trash and debris	Any trash or debris which impairs the function of the facility.	Trash and debris removed from facility.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oils, 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.
	Life cycle	System has not been inspected for three years.	Facility is re-inspected and any needed maintenance performed.
Vault Treatment Area	Sediment on vault floor	Greater than 2 inches of sediment.	Vault is free of sediment.
	Sediment on top of cartridges	Greater than ½ inch of sediment.	Vault is free of sediment.
	Multiple scum lines above top of cartridges	Thick or multiple scum lines above top of cartridges. Probably due to plugged canisters or underdrain manifold.	Cause of plugging corrected, canisters replaced if necessary.
Vault Structure	Damage to wall, Frame, Bottom, and/or Top Slab	Cracks wider than ½-inch and any evidence of soil particles entering the structure through the cracks, or qualified inspection personnel determines the vault is not structurally sound.	Vault replaced or repaired to design specifications.
	Baffles damaged	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Repair or replace baffles to specification.
Filter Media	Standing water in vault	9 inches or greater of static water in the vault for more than 24 hours following a rain event and/or overflow occurs frequently. Probably due to plugged filter media, underdrain or outlet pipe.	No standing water in vault 24 hours after a rain event.
	Short circuiting	Flows do not properly enter filter cartridges.	Flows go through filter media.
Underdrains and Clean-Outs	Sediment/debris	Underdrains or clean-outs partially plugged or filled with sediment and/or debris.	Underdrains and clean-outs free of sediment and debris.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	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.

<b>NO. 21 – STORMFILTER (CARTRIDGE TYPE)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.
Inspection	Frequency	<p>Maintenance conditions are site-specific, depending on pollutant loading.</p> <p>FIRST YEAR POST CONSTRUCTION: Monthly during wet season, every other month during dry season</p> <p>FOLLOWING FIRST YEAR: Continue monthly until site-specific frequency is established, then follow that schedule</p> <p>AT A MINIMUM, FOLLOWING FIRST YEAR: Annually (or quarterly if used as primary treatment) and following significant storms.</p>	Inspect Stormfilter facility for any maintenance deficiencies; maintain or replace as required per established site-specific schedule and manufacturer's requirements.

<b>NO. 22 – BAFFLE OIL/WATER SEPARATOR</b>			
<b>Maintenance Component</b>	<b>Defect</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash or debris which impairs the function of the facility.	Trash and debris removed from facility.
	Contaminants and pollution	Floating oil in excess of 1 inch in first chamber, any oil in other chambers or other contaminants of any type in any chamber.	No contaminants present other than a surface oil film.
Vault Treatment Area	Sediment accumulation	Sediment accumulates exceeds 6 inches in the vault.	No sediment in the vault.
	Discharge water not clear	Inspection of discharge water shows obvious signs of poor water quality- effluent discharge from vault shows thick visible sheen.	Effluent discharge is clear.
	Trash or debris accumulation	Any trash and debris accumulation in vault (floatables and non-floatables).	Vault is clear of trash and debris.
	Oil accumulation	Oil accumulations that exceed 1 inch, at the surface of the water in the oil/water separator chamber.	No visible oil depth on water.
Vault Structure	Damage to Wall, Frame, Bottom, and/or Top Slab	Cracks wider than ½-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications.
	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance inspection personnel.	Repair or replace baffles to specifications.
Gravity Drain	Inoperable valve	Valve will not open and close.	Valve opens and closes normally.
	Valve won't seal	Valve does not seal completely.	Valve completely seals closed.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	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.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or cover/lid.	Lifting rings sufficient to lift or remove cover/lid.

<b>NO. 23 – COALESCING PLATE OIL/WATER SEPARATOR</b>			
<b>Maintenance Component</b>	<b>Defect</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Any trash or debris which impairs the function of the facility.	Trash and debris removed from facility.
	Contaminants and pollution	Floating oil in excess of 1 inch in first chamber, any oil in other chambers or other contaminants of any type in any chamber.	No contaminants present other than a surface oil film.
Vault Treatment Area	Sediment accumulation in the forebay	Sediment accumulation of 6 inches or greater in the forebay.	No sediment in the forebay.
	Discharge water not clear	Inspection of discharge water shows obvious signs of poor water quality - effluent discharge from vault shows thick visible sheen.	Repair function of plates so effluent is clear.
	Trash or debris accumulation	Trash and debris accumulation in vault (floatables and non-floatables).	Trash and debris removed from vault.
	Oil accumulation	Oil accumulation that exceeds 1 inch at the water surface in the in the coalescing plate chamber.	No visible oil depth on water and coalescing plates clear of oil.
Coalescing Plates	Damaged	Plate media broken, deformed, cracked and/or showing signs of failure.	Replace that portion of media pack or entire plate pack depending on severity of failure.
	Sediment accumulation	Any sediment accumulation which interferes with the operation of the coalescing plates.	No sediment accumulation interfering with the coalescing plates.
Vault Structure	Damage to Wall, Frame, Bottom, and/or Top Slab	Cracks wider than ½-inch and any evidence of soil particles entering the structure through the cracks, or maintenance inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications.
	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Repair or replace baffles to specifications.
Ventilation Pipes	Plugged	Any obstruction to the ventilation pipes.	Ventilation pipes are clear.
Shutoff Valve	Damaged or inoperable	Shutoff valve cannot be opened or closed.	Shutoff valve operates normally.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	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.
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open manhole requires immediate maintenance.</b>	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.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.

<b>NO. 23 – COALESCING PLATE OIL/WATER SEPARATOR</b>			
<b>Maintenance Component</b>	<b>Defect</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

<b>NO. 24 – CATCH BASIN INSERT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Media Insert	Visible Oil	Visible oil sheen passing through media	Media inset replaced.
	Insert does not fit catch basin properly	Flow gets into catch basin without going through media.	All flow goes through media.
	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
	Oil absorbent media saturated	Media oil saturated.	Oil absorbent media replaced.
	Water saturated	Catch basin insert is saturated with water, which no longer has the capacity to absorb.	Insert replaced.
	Service life exceeded	Regular interval replacement due to typical average life of media insert product, typically one month.	Media replaced at manufacturer's recommended interval.
	Seasonal maintenance	When storms occur and during the wet season.	Remove, clean and replace or install new insert after major storms, monthly during the wet season or at manufacturer's recommended interval.



<b>NO. 25 – DRYWELL BMP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Preventative	Plugging, obstructions	Any cause limiting flow into drywell.	Drywell able to receive full flow prior to and during wet season.
Site	Trash and debris	Trash or debris that could end up in the drywell is evident.	No trash or debris that could get into the drywell can be found.
Pipes	Inlet is plugged	The entrance to the pipe is restricted due to sediment, trash, or debris.	The entrance to the pipe is not restricted.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Plugged	Sediment or other material prevents free flow of water through the pipe.	Water flows freely through pipes.
	Broken or joint leaks.	Damage to the pipe or pipe joints allowing water to seep out.	Pipe does not allow water to exit other than at the outlet.
Structure	Basin leaks	Holes or breaks in the basin allow water to leave the basin at locations other than per design.	Basin is sealed and allows water to exit only where designed.
Filter Media	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
Inspection	Frequency	Annually and prior to and following significant storms.	Inspect drywell system for any defects of deficiencies.

<b>NO. 26 – GRAVEL FILLED INFILTRATION TRENCH BMP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Preventative	Blocking, obstructions	Debris or trash limiting flow to infiltration trench.	Infiltration trench able to receive full flow prior to and during wet season.
Site	Trash and debris	Trash or debris that could end up in the infiltration trench is evident.	No trash or debris that could get into the infiltration trench can be found.
Pipes	Inlet is plugged	The entrance to the pipe is restricted due to sediment, trash, or debris.	The entrance to the pipe is not restricted.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Plugged	Sediment or other material prevents free flow of water through the pipe.	Water flows freely through pipes.
	Broken or joint leaks.	Damage to the pipe or pipe joints allowing water to seep out.	Pipe does not allow water to exit other than at the outlet to the trench.
Structure	Flow not reaching trench	Flows are not getting into the trench as designed.	Water enters and exits trench as designed.
	Cleanout/inspection access does not allow cleaning or inspection of trench	The cleanout/inspection access is not available.	Cleanout/inspection access is available.
Filter Media	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
Inspection	Frequency	Annually and prior to and following significant storms.	Inspect infiltration trench system for any defects of deficiencies.

<b>NO. 27 – GRAVEL FILLED DISPERSION TRENCH BMP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Preventative	Blocking, obstructions	Debris or trash limiting flow to dispersion trench or preventing spreader function.	Dispersion trench able to receive full flow prior to and during wet season.
Site	Trash and debris	Trash or debris that could end up in the dispersion trench is evident.	No trash or debris that could get into the dispersion trench can be found.
Pipes	Inlet is plugged	The entrance to the pipe is restricted due to sediment, trash, or debris.	The entrance to the pipe is not restricted.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Plugged	Sediment or other material prevents free flow of water through the pipe.	Water flows freely through pipes.
	Broken joint or joint leaks.	Damage to the pipe or pipe joints allowing water to seep out.	Pipe does not allow water to exit other than at the outlet to the trench.
	Cleanout caps	Cleanout caps are broken, missing, or buried.	Cleanout caps are accessible and intact.
Structure	Flow not reaching trench	Flows are not getting into the trench as designed.	Water enters and exits trench as designed.
	Perforated pipe plugged	Flow not able to enter or properly exit from perforated pipe.	Water freely enters and exits perforated pipe.
	Flow not spreading evenly at outlet of trench	Outlet flows channelizing or not spreading evenly from trench.	Sheet flow occurs at the outlet of the trench.
	Cleanout/inspection access does not allow cleaning or inspection of perforated pipe	The cleanout/inspection access is not available.	Cleanout/inspection access is available.
Filter Media	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
Inspection	Frequency	Annually and prior to and following significant storms.	Inspect dispersion trench system for any defects or deficiencies.

<b>NO. 28 – NATIVE VEGETATED SURFACE / NATIVE VEGETATED LANDSCAPE BMP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Site	Trash and debris	Trash and debris accumulated on the native vegetated surface/native vegetated landscape site.	Native vegetated surface site free of any trash or debris.
Vegetation	Native vegetation type	Less than two species each of native trees, shrubs, and groundcover occur in the design area.	A minimum of two species each of native trees, shrubs, and groundcover is established and healthy.
	Native vegetated area	Less than 90% if the required vegetated area has healthy growth.	A minimum of 90% of the required vegetated area has healthy growth.
	Undesirable vegetation	Weeds, blackberry, and other undesirable plants are invading more than 10% of vegetated area.	Less than 10% undesirable vegetation occurs in the required native vegetated surface area.
Vegetated Area	Soil compaction	Soil in the native vegetation area compacted.	Less than 8% of native vegetation area is compacted.
	Insufficient area	Less than 3.5 square feet of native vegetation area for every 1 square foot of impervious surface.	A minimum of 3.5 square feet of native vegetation area for every 1 square foot of impervious surface.
	Excess slope	Slope of native vegetation area greater than 15%.	Slope of native growth area does not exceed 15%.
Inspection	Frequency	Annually	Inspect native vegetation area for any defects or deficiencies

<b>NO. 29 – PERFORATED PIPE CONNECTIONS BMP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Preventative	Blocking, obstructions	Debris or trash limiting flow into perforated pipe system or outfall of BMP is plugged or otherwise nonfunctioning.	Outfall of BMP is receiving designed flows from perforated pipe connection.
Inflow	Inflow impeded	Inflow into the perforated pipe is partially or fully blocked or altered to prevent flow from getting into the pipe.	Inflow to the perforated pipe is unimpeded.
Pipe Trench Area	Surface compacted	Ground surface over the perforated pipe trench is compacted or covered with impermeable material.	Ground surface over the perforated pipe is not compacted and free of any impervious cover.
Outflow	Outflow impeded	Outflow from the perforated pipe into the public drainage system is blocked.	Outflow to the public drainage system is unimpeded.
Outfall Area	Erosion or landslides	Existence of the perforated pipe is causing or exasperating erosion or landslides.	Perforated pipe system is sealed off and an alternative BMP is implemented.
Inspection	Frequency	Annually and prior to and following significant storms.	Perforated pipe system is operating as designed.

<b>NO. 30 – PERMEABLE PAVEMENT BMP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Preventative	Surface cleaning/vegetation control	Media surface vacuumed or pressure washed annually, vegetation controlled to design maximum. Weed growth suggesting sediment accumulation.	No dirt, sediment, or debris clogging porous media, or vegetation limiting infiltration.
Porous Concrete, Porous Asphaltic Concrete, and Permeable Pavers	Trash and debris	Trash and debris on the pavement interfering with infiltration; leaf drop in fall season.	No trash or debris interfering with infiltration.
	Sediment accumulation	Sediment accumulation on the pavement interfering with infiltration; runoff from adjacent areas depositing sediment/debris on pavement.	Pavement infiltrates as designed; adjacent areas stabilized.
	Infiltration rate	Pavement does not infiltrate at a rate of 10 inches per hour.	Pavement infiltrates at a rate greater than 10 inches per hour.
	Ponding	Standing water for a long period of time on the surface of the pavement.	Standing water infiltrates at the desired rate.
	Broken or cracked pavement	Pavement is broken or cracked.	No broken pavement or cracks on the surface of the pavement.
	Settlement	Uneven pavement surface indicating settlement of the subsurface layer.	Pavement surface is uniformly level.
	Moss growth	Moss growing on pavement interfering with infiltration.	No moss interferes with infiltration.
	Inflow	Inflow to the pavement is diverted, restricted, or depositing sediment and debris on the pavement.	Inflow to pavement is unobstructed and not bringing sediment or debris to the pavement.
	Underdrain	Underdrain is not flowing when pavement has been infiltrating water.	Underdrain flows freely when water is present.
	Overflow	Overflow not controlling excess water to desired location; native soil is exposed or other signs of erosion damage are present.	Overflow permits excess water to leave the site at the desired location; Overflow is stabilized and appropriately armored.
Permeable Pavers	Broken or missing pavers	Broken or missing paving blocks on surface of pavement.	No missing or broken paving blocks interfering with infiltration.
	Level surface	Uneven surface due to settlement or scour of fill in the interstices of the paving blocks.	Pavement surface is uniformly level.
	Compaction	Poor infiltration due to soil compaction between paving blocks.	No soil compaction in the interstices of the paver blocks limiting infiltration.
	Dead grass	Grass in the interstices of the paving blocks is dead.	Healthy grass is growing in the interstices of the paver blocks.
Inspection	Frequency	Annually and after large storms, and as needed seasonally to control leaf drop, evergreen needles etc.	Permeable pavement is functioning normally.

<b>NO. 31 – BIORETENTION BMP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Preventative	Vegetation	Vegetation to be watered and pruned as needed and mulch applied to a minimum of 2 inches to maintain healthy growth.	Healthy vegetation growth with full coverage as designed.
Bioretention Area	Trash and debris	Trash and debris in the bioretention area; leaf drop in the fall season.	No trash or debris in the bioretention area.
	Sediment accumulation	Sediment accumulation in the bioretention area interfering with infiltration.	Water in the bioretention infiltrates as designed.
	Ponding	Standing water in the bioretention area for more than two days.	Standing water infiltrates at the desired rate.
	Inflow	Inflow not getting into bioretention; debris/sediment blockage at inlet features; native soil is exposed or other signs of erosion damage is present.	Unobstructed and properly routed inflow into bioretention area; inlet is stabilized and appropriately armored.
	Overflow outlet	Overflow water not controlled by outlet features; native soil is exposed or other signs of erosion damage is present.	Outlet features control overflow; overflow is stabilized and appropriately armored.
	Underdrain	Underdrain is not flowing when bioretention area has been infiltrating water.	Underdrain flows freely when water is present.
Vegetation	Plant health	Plants not thriving across at least 80% of the entire design vegetated area within the BMP; overly dense vegetation requiring pruning.	Healthy water tolerant plants in bioretention area, plants thriving across at least 80% of the entire design vegetated area within the facility.
	Plant species	Plants not water tolerant species.	Plants are water tolerant.
	Weeds	Weeds growing in bioretention area.	No weeds in bioretention area.
	Watering	Planting schedule requires frequent watering (approx. weekly Year 1, bimonthly Years 2 and 3) for new facilities, and as needed for established plantings or dry periods	Plants are established and thriving
	Pest Control	Signs of pests, such as wilting or chewed leaves or bark, spotting or other indicators; extended ponding period encouraging mosquitoes	Plant community is pest-free when following an approved Integrated Pest Management plan; bioretention functioning normally and ponding controlled as needed for pest control
Containment Berm and Earthen Slopes	Erosion;	Erosion occurring at earthen slopes or containment berm side slope.	Erosion on the containment berm and side slopes has been repaired and the cause of the erosion corrected.
	Voids created by nuisance animals (e.g., rodents) or tree roots	Voids affecting berm integrity or creating leaky pond condition	Voids have been repaired; facility is free of nuisance animals following an approved Integrated Pest Management plan.
	Settlement	Any part of the containment berm top has less than 6 inches of freeboard from the maximum pond level to the top of the berm.	A minimum of 6 inches freeboard from the maximum pond level to the top of the berm.
Amended Soil	Soil nutrients	Soil not providing plant nutrients.	Soil providing plant nutrients.
	Bare spots	Bare spots on soil in bioretention area.	No bare spots, bioretention area covered with vegetation or mulch mixed into the underlying soil.
	Compaction	Poor infiltration due to soil compaction in the bioretention area.	No soil compaction in the bioretention area.
Inspection	Frequency	Annually and after large storms, and as needed seasonally for pruning, plant maintenance, pest control and to control leaf drop, evergreen needles etc.	Bioretention facility is functioning normally; plant community is thriving and pest-free.

**NO. 32 – RAINWATER HARVESTING BMP**

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Preventative	Storage volume	No rain water in storage unit at the beginning of the rain season.	Maximum storage available at the beginning of the rain season (Oct. 1 <sup>st</sup> ).
Collection Area	Trash and debris	Trash of debris on collection area may plug filter system	Collection area clear of trash and debris.
Filter	Restricted or plugged	Filter is partially or fully plugged preventing water from getting in to the storage unit.	Filter is allowing collection water into storage unit.
Inspection	Frequency	Annually and after large storms	Rain harvesting equipment is functioning normally.
	Maintenance log	A Maintenance log must be kept and available for review by KC staff.	Maintenance log is kept and is available to KC staff.

**NO. 33 – ROCK PAD BMP**

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Trash and debris accumulated on rock pad site.	Rock pad site free of any trash or debris.
Rock Pad Area	Rock pad size	Rock pad is not 2 feet by 3 feet by 6 inches thick or as designed.	Rock pad is 2 feet by 3 feet by 6 inches thick or as designed.
	Vegetation	Vegetation is seen growing in or through rock pad.	No vegetation within rock pad area.
Rock	Exposed soil	Soil can be seen through the rock pad.	Full thickness of the rock pad is in place, no soil visible through rock pad.
Inspection	Frequency	Annually and after large storms	Rock pad is functioning normally.

**NO. 34 – SHEET FLOW BMP**

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Trash and debris accumulated on the sheet flow site.	Sheet flow site free of any trash or debris.
Sheet flow area	Erosion	Soil erosion occurring in sheet flow zone.	Soil erosion is not occurring and rills and channels have been repaired.
	Concentrated flow	Sheet flow is not occurring in the sheet flow zone.	Sheet flow area is regraded to provide sheet flow.
Inspection	Frequency	Annually and after large storms	Rain harvesting equipment is functioning normally.

<b>NO. 35 – SPLASH BLOCK BMP</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash and debris	Trash and debris accumulated on the splash block.	Splash block site free of any trash or debris.
Splash Block	Dislodged	Splash block moved from outlet of downspout.	Splash block correctly positioned to catch discharge from downspout.
	Channeling	Water coming off the splash block causing erosion.	No erosion occurs from the splash block.
	Downspout water misdirected	Water coming from the downspout is not discharging to the dispersal area.	Water is discharging normally to the dispersal area.
Inspection	Frequency	Annually and after large storms.	Rain harvesting equipment is functioning normally.

<b>NO. 36 – VEGETATED ROOF BMP (Retained from the 2009 SWDM for reference)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Preventative	Vegetation	Vegetation to be watered and pruned as needed to maintain healthy growth.	Healthy vegetation growth with full coverage as designed.
Site	Trash and debris	Trash and debris has accumulated on the vegetated roof.	Vegetated roof free of any trash or debris.
Waterproof Membrane	Leaking	Waterproof membrane breached.	Waterproof membrane has no tears or holes allowing water through it.
Drainage Layer	Drainage pathway	Drainage layer flow plugged or obstructed.	Drainage layer passing water with no obstruction.
Drainage	Overflow	Drainage of overflow is obstructed.	Overflow has no obstruction.
Growth Media	Compaction	Soil in the growth media area compacted.	No part of the growth media is compacted.
	Erosion	Growth media washed out.	Growth media is not being washed away.
	Nutrients	Plants are not thriving.	Growth media has proper nutrients to support plant growth.
Vegetation	Vegetation Type	Vegetation species not succulents, grass, herbs, and/or wildflowers adapted to harsh conditions.	Correct species of vegetation is used.
	Vegetation Area	Healthy vegetation covers less than 90% of vegetation area.	Healthy vegetation covers more than 90% of vegetation area.
	Undesirable Vegetation	Weeds and other undesirable plants are invading more than 10% of vegetated area.	No undesirable vegetation occurs in the vegetated area. No herbicides or pesticides used to control undesirable vegetation.
	Special Vegetation	Special vegetation not thriving.	Special vegetation is kept healthy and inspected on frequent schedule.
Border Zone	Access	Border zone limited by vegetation overgrowth or other means.	Border zone is kept open so vegetated area is accessible.
Gravel Stop	Containment	Gravel stop does not contain overflow or divert it to a designed outlet.	Overflow water is only exits from the designed outlet.
Inspection	Frequency	Annually and after large storms.	Rain harvesting equipment is functioning normally.
		Vegetation inspected monthly.	Vegetation is kept healthy and thriving.



**APPENDIX A-3**  
**City of Seattle 2021 SWM,**  
**Appendix G Stormwater Control**  
**Operations and Maintenance**  
**Requirements**



**City of Seattle**

## Appendix G - Stormwater Control Operations and Maintenance Requirements

**City of Seattle**  
**Stormwater Manual**  
July 2021

**Note:**

Some pages in this document have been purposely skipped or blank pages inserted so that this document will copy correctly when duplexed.

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Refer to the *Stormwater Management Manual for Western Washington (SWMMWW)* (Ecology 2019) for maintenance requirements for the following BMP:

- Media filter drain (MFD)

All stormwater facilities, best management practices (BMPs), and drainage systems shall be kept in continuous working order consistent with their design and permitting. All stormwater facilities, BMPs, and drainage systems shall be kept accessible for maintenance and inspection at all times.

Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint shall be immediately corrected. This includes removing the source of the contamination as well as any contaminants that have been collected or deposited into the facility or conveyance system.

Training/written guidance is required for the proper operation and maintenance of many of the BMPs contained in this manual. Provide proper training and copies of the Operations and Maintenance Manuals to property owners, tenants and responsible individuals.

<b>No. 1 - Detention Ponds</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Facility – General Requirements	A	Trash and debris	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)	Trash and debris cleared from site
	M (March – October)	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>● Noxious and nuisance vegetation removed according to applicable regulations</li> <li>● No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>● Materials removed and disposed of according to applicable regulations</li> <li>● Source control BMPs implemented if appropriate</li> <li>● No contaminants present other than a surface oil film</li> </ul>
Top or Side Slopes of Dam, Berm or Embankment	A	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes	Rodents removed or destroyed and dam or berm repaired
	A	Beaver dams	Dam results in change or function of the facility	Facility is returned to design function (coordinate trapping of beavers and removal of dams with appropriate permitting agencies)

<b>No. 1 - Detention Ponds</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Top or Side Slopes of Dam, Berm or Embankment (continued)	A	Tree growth	<ul style="list-style-type: none"> <li>• Tree growth threatens integrity of dams, berms, or slopes; does not allow maintenance access; or interferes with maintenance activity.</li> <li>• If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.</li> </ul>	Trees do not hinder facility performance or maintenance activities
	A	Erosion	<ul style="list-style-type: none"> <li>• Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion</li> <li>• Any erosion observed on a compacted slope</li> </ul>	Slopes stabilized using appropriate erosion control measures If erosion is occurring on compacted slope, a licensed engineer should be consulted to resolve source of erosion.
	A	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation	Top or side slope restored to design dimensions If settlement is significant, a licensed engineer should be consulted to determine the cause of the settlement.
Storage Area	A	Sediment accumulation	Accumulated sediment that exceeds 10 percent of the designed pond depth	<ul style="list-style-type: none"> <li>• Sediment cleaned out to designed pond shape and depth</li> <li>• Pond reseeded if necessary to control erosion</li> </ul>

No. 1 - Detention Ponds				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Storage Area (continued)	A	Liner damaged (if applicable)	Liner is visible or pond does not hold water as designed	Liner repaired or replaced
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe
Emergency Overflow/Spillway	A	Tree growth	Tree growth impedes flow or threatens stability of spillway	Trees removed
	A	Rock missing	Only one layer of rock exists above native soil in area 5 square feet or larger or any exposure of native soil on the spillway	Spillway restored to design standards

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves



<b>No. 2 - Infiltration BMPs</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Facility – General Requirements	A, W	Trash and debris	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)	Trash and debris cleared from site
	M (March – October)	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>● Noxious and nuisance vegetation removed according to applicable regulations</li> <li>● No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
	A, W, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>● Materials removed and disposed of according to applicable regulations</li> <li>● Source control BMPs implemented if appropriate</li> <li>● No contaminants present other than a surface oil film</li> </ul>
	A	Grass/groundcover	Grass or groundcover exceeds 18 inches in height	Grass or groundcover mowed to a height no greater than 6 inches
Infiltration Pond, Top or Side Slopes of Dam, Berm or Embankment	A	Rodent holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes	Rodents removed or destroyed and dam or berm repaired

No. 2 - Infiltration BMPs				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Infiltration Pond, Top or Side Slopes of Dam, Berm or Embankment (continued)	A	Tree growth	<ul style="list-style-type: none"> <li>• Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity</li> <li>• If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.</li> </ul>	Trees do not hinder facility performance or maintenance activities
	A	Erosion	<ul style="list-style-type: none"> <li>• Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion</li> <li>• Any erosion observed on a compacted slope</li> </ul>	Slopes stabilized using appropriate erosion control measures If erosion is occurring on compacted slope, a licensed engineer should be consulted to resolve source of erosion.
	A	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation	Top or side slope restored to design dimensions If settlement is significant, a licensed engineer should be consulted to determine the cause of the settlement.
Infiltration Pond, Tank, Vault, Trench, or Small Basin Storage Area	A	Sediment accumulation	If 2 inches or more sediment is present or a percolation test indicates facility is working at or less than 90 percent of design	Facility infiltrates as designed

<b>No. 2 - Infiltration BMPs</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Infiltration Pond, Tank, Vault, Trench, or Small Basin Storage Area (continued)	A	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed	Liner repaired or replaced
Infiltration Tank Structure	A	Plugged air vent	Any blockage of the vent	Tank or vault freely vents
	A	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10 percent of its design shape	Tank repaired or replaced to design
	A	Gaps between sections, damaged joints or cracks or tears in wall	<ul style="list-style-type: none"> <li>• A gap wider than ½ inch at the joint of any tank sections</li> <li>• Any evidence of soil particles entering the tank at a joint or through a wall</li> </ul>	No water or soil entering tank through joints or walls
Infiltration Vault Structure	A	Damage to wall, frame, bottom, and/or top slab	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch</li> <li>• Any evidence of soil entering the structure through cracks</li> <li>• Qualified inspection personnel determines that the vault is not structurally sound</li> </ul>	Vault is sealed and structurally sound
Inlet/Outlet Pipes	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes

No. 2 - Infiltration BMPs				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Inlet/Outlet Pipes (continued)	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe
Access Maintenance Hole	A	Cover/lid not in place	<ul style="list-style-type: none"> <li>Cover/lid is missing or only partially in place</li> <li><b>Any open maintenance hole requires immediate maintenance</b></li> </ul>	Maintenance hole access cover/lid in place and secure
	A	Locking mechanism not working	<ul style="list-style-type: none"> <li>Mechanism cannot be opened by one maintenance person with proper tools</li> <li>Bolts cannot be seated</li> <li>Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools
	A	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
	A	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks	Ladder meets design standards and allows maintenance person safe access
Large Access Doors/Plate	A	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment	Replace or repair access door so it can open as designed
	A	Gaps, does not cover completely	Large access doors not flat and/or access opening not completely covered	Doors close flat and covers access opening completely

<b>No. 2 - Infiltration BMPs</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Large Access Doors/Plate (continued)	A	Lifting rings missing, rusted	Lifting rings not capable of lifting weight of door or plate	Lifting rings sufficient to lift or remove door or plate
Infiltration Pond, Tank, Vault, Trench, or Small Basin Filter Bags	A	Plugged	Filter bag more than 1/2 full	Replace filter bag or redesign system
Infiltration Pond, Tank, Vault, Trench, or Small Basin Pre-Settling Ponds and Vaults	A, W	Sediment accumulation	6 inches or more of sediment has accumulated	Pre-settling occurs as designed
Infiltration Pond, Rock Filter	A	Plugged	High water level on upstream side of filter remains for extended period of time or little or no water flows through filter during heavy rain storms	Rock filter replaced; evaluate need for filter and remove if not necessary
Infiltration Pond Emergency Overflow Spillway	A	Rock missing	<ul style="list-style-type: none"> <li>• Only one layer of rock exists above native soil in area 5 square feet or larger, or any exposure of native soil at the top of out flow path of spillway</li> <li>• Rip-rap on inside slopes need not be replaced</li> </ul>	Spillway restored to design standards
	A	Tree growth	Tree growth impedes flow or threatens stability of spillway	Trees removed

No. 2 - Infiltration BMPs				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Drain Rock	A, W	Water ponding	<ul style="list-style-type: none"> <li>• If water enters the facility from the surface, inspect to see if water is ponding at the surface during storm events</li> <li>• If buried drain rock, observe drawdown through observation/ maintenance port or cleanout</li> </ul>	<ul style="list-style-type: none"> <li>• Clear piping through facility when ponding occurs</li> <li>• Replace rock material/sand reservoirs as necessary</li> <li>• Tilling of subgrade below reservoir may be necessary (for trenches) prior to backfill</li> </ul>

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 3 - Detention Pipes and Vaults</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Facility – General Requirements	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>• Materials removed and disposed of according to applicable regulations</li> <li>• Source control BMPs implemented if appropriate</li> <li>• No contaminants present other than a surface oil film</li> </ul>
Pipe or Vault Storage Area	B, W, E	Trash and debris	Any trash and debris accumulated in vault or pipe (includes floatables and non-floatables)	No trash or debris in vault or pipe
	A	Sediment accumulation	Accumulated sediment depth exceeds 10 percent of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15 percent of diameter	All sediment removed from storage area
Pipe or Vault Structure	A	Plugged air vent	Any blockage of the vent	Pipe or vault freely vents
	A	Pipe bent out of shape	Any part of vault/pipe is bent out of shape more than 10 percent of its design shape	Pipe or vault repaired or replaced to design
	A	Gaps between sections, damaged joints or cracks or tears in wall	<ul style="list-style-type: none"> <li>• A gap wider than ½ inch at the joint of any pipe or vault sections</li> <li>• Any evidence of soil particles entering the pipe or vault at a joint or through a wall</li> </ul>	No water or soil entering pipe or vault through joints or walls

No. 3 - Detention Pipes and Vaults				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Vault Structure	A	Damage to wall, frame, bottom, and/or top slab	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch</li> <li>Any evidence of soil entering the structure through cracks</li> <li>Qualified inspection personnel determines that the vault is not structurally sound</li> </ul>	Vault sealed and structurally sound
Inlet/Outlet Pipes	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe
Access Maintenance Hole	A	Cover/lid not in place	<ul style="list-style-type: none"> <li>Cover/lid is missing or only partially in place</li> <li><b>Any open maintenance hole requires immediate maintenance</b></li> </ul>	Maintenance hole access cover/lid in place and secure
	A	Locking mechanism not working	<ul style="list-style-type: none"> <li>Mechanism cannot be opened by one maintenance person with proper tools</li> <li>Bolts cannot be seated</li> <li>Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools



<b>No. 3 - Detention Pipes and Vaults</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Access Maintenance Hole (continued)	A	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
	A	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks	Ladder meets design standards and allows maintenance person safe access
Large Access Doors/Plate	A	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment	Replace or repair access door so it can open as designed
	A	Gaps, does not cover completely	Large access doors not flat and/or access opening not completely covered	Doors close flat and covers access opening completely
	A	Lifting rings missing, rusted	Lifting rings not capable of lifting weight of door or plate	Lifting rings sufficient to lift or remove door or plate

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 4 - Flow Control Structure &amp; Control Device</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
The Flow Control Structure and Control Device shall conform with design criteria shown upon the approved plans or the design standards in place at the time of construction. This includes but is not limited to, orifice diameter(s), orifice elevation(s) overflow elevation. Reference Standard Plans No. 270, 271, and 272.				
Structure	A	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 percent	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
	A	Sediment	Sediment exceeds 60 percent 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 control device section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the control device section	Sump of structure contains no sediment

No. 4 - Flow Control Structure & Control Device				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure (continued)	A	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable)	Frame is even with curb
			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
	A	Cracks in walls or bottom	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch and longer than 3 feet</li> <li>Any evidence of soil particles entering structure through cracks</li> <li>Maintenance person judges that structure is unsound</li> </ul>	Structure is sealed and structurally sound.
			<ul style="list-style-type: none"> <li>Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe</li> <li>Any evidence of soil particles entering structure through cracks</li> </ul>	No cracks more than ¼-inch wide at the joint of inlet/outlet pipe
	A	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

No. 4 - Flow Control Structure & Control Device				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure (continued)	A	Damaged pipe joints	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering the structure at the joint of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>Materials removed and disposed of according to applicable regulations</li> <li>Source control BMPs implemented if appropriate</li> <li>No contaminants present other than a surface oil film</li> </ul>
	A	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.
Control Device	A	Damaged or missing	Riser 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 percent 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

No. 4 - Flow Control Structure & Control Device				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Shear Gate (if applicable)	A	Damaged or missing	Cleanout gate is missing	Replace cleanout gate
			Cleanout 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	A	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.
	A	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate	Plate is free of all obstructions and works as designed
Overflow Pipe	A	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
	A	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	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>• Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe

No. 4 - Flow Control Structure & Control Device				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Metal Grates (If Applicable)	A	Unsafe grate opening	Grate with opening wider than 7/8 inch	Grate opening meets design standards
	B, W, E	Trash and debris	Trash and debris that is blocking more than 20 percent of grate surface	Grate free of trash and debris. footnote to guidelines for disposal
	A	Damaged or missing	Grate missing or broken member(s) of the grate	Grate is in place and meets design standards
Maintenance Hole Cover/Lid	A	Cover/lid not in place	<ul style="list-style-type: none"> <li>Cover/lid is missing or only partially in place</li> <li><b>Any open structure requires urgent maintenance</b></li> </ul>	Cover/lid protects opening to structure
	A	Locking mechanism Not Working	<ul style="list-style-type: none"> <li>Mechanism cannot be opened by one maintenance person with proper tools</li> <li>Bolts cannot be seated</li> <li>Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools
	A	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

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 5 - Catch Basins and Maintenance Holes</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Structure	A	Sediment	Sediment exceeds 60 percent of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin	Sump of catch basin contains no sediment
	B, W, E	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10 percent	No trash or debris blocking or potentially blocking entrance to catch basin
	A		Trash or debris in the catch basin 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 catch basin
	A		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 catch basin
	A		Deposits of garbage exceeding 1 cubic foot in volume	No condition present which would attract or support the breeding of insects or rodents

No. 5 - Catch Basins and Maintenance Holes				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure (continued)	A	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb
			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.
	A	Cracks in walls or bottom	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch and longer than 3 feet</li> <li>• Any evidence of soil particles entering catch basin through cracks</li> <li>• Maintenance person judges that catch basin is unsound</li> </ul>	Catch basin is sealed and structurally sound
			<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe</li> <li>• Any evidence of soil particles entering catch basin through cracks</li> </ul>	No cracks more than ¼-inch wide at the joint of inlet/outlet pipe
	A	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



<b>No. 5 - Catch Basins and Maintenance Holes</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Structure (continued)	A	Damaged pipe joints	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>Materials removed and disposed of according to applicable regulations</li> <li>Source control BMPs implemented if appropriate</li> <li>No contaminants present other than a surface oil film</li> </ul>
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe
Catch Basin Outlet Trap (Reference Standard Plan No. 267)	A	Missing	When the required outlet trap is not installed upon the outlet pipe	Outlet trap installed and prevents floatables from being discharged
	A	Permanently installed	When the trap is grouted to the outlet pipe and is not removable to allow for maintenance and inspection	Outlet trap removable for maintenance and inspection

No. 5 - Catch Basins and Maintenance Holes				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Catch Basin Outlet Trap (Reference Standard Plan No. 267) (continued)	A	Damaged	Cracks, broken welds, seams or any other conditions that allows water to be discharged from other than the submerged portion of the trap	Water will be discharged from the submerged portion of the trap.
Metal Grates (Catch Basins)	A	Unsafe grate opening	Grate with opening wider than 7/8 inch	Grate opening meets design standards
	B, W, E	Trash and debris	Trash and debris that is blocking more than 20 percent of grate surface	Grate free of trash and debris. footnote to guidelines for disposal
	A	Damaged or missing	<ul style="list-style-type: none"> <li>Grate missing or broken member(s) of the grate</li> <li><b>Any open structure requires urgent maintenance</b></li> </ul>	Grate is in place and meets design standards
Maintenance Hole Cover/Lid	A	Cover/lid not in place	<ul style="list-style-type: none"> <li>Cover/lid is missing or only partially in place</li> <li><b>Any open structure requires urgent maintenance</b></li> </ul>	Cover/lid protects opening to structure
	A	Locking mechanism Not Working	<ul style="list-style-type: none"> <li>Mechanism cannot be opened by one maintenance person with proper tools</li> <li>Bolts cannot be seated</li> <li>Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools
	A	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

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 6 - Reserved</b>			

No. 7 - Debris Barriers (e.g., Trash Racks)				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Facility – General Requirements	B, W, E	Trash and debris	Trash or debris plugging more than 20 percent of the area of the barrier	Barrier clear to receive capacity flow
	A	Sediment accumulation	Sediment accumulation of greater than 20 percent of the area of the barrier	Barrier clear to receive capacity flow
Structure	A	Cracked, broken, or loose	<ul style="list-style-type: none"> <li>• Structure which bars attach to is damaged</li> <li>• Pipe is loose or cracked</li> <li>• Concrete structure is cracked, broken, or loose</li> </ul>	Sound structure barrier
Bars	A	Bar spacing	Bar spacing exceeds 6 inches	Bars have at most 6-inch spacing
	A	Damaged or missing bars	Bars bent out of shape more than 3 inches	Bars in place with no bends more than ¾ inch
			Bars missing or entire barrier missing	Bars in place according to design
			Bars loose and rust is causing 50 percent deterioration to any part of barrier	Repair or replace barrier to design standards

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 8 - Energy Dissipaters</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Facility – General Requirements	B, W, E	Trash and debris	Trash and/or debris accumulation	Dissipater clear of trash and/or debris
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>• Materials removed and disposed of according to applicable regulations</li> <li>• Source control BMPs implemented if appropriate</li> <li>• No contaminants present other than a surface oil film</li> </ul>
Rock Pad	A	Missing or moved rock	<ul style="list-style-type: none"> <li>• One layer or less of rock exists above native soil area 5 square feet or more</li> <li>• Any exposed native soil</li> </ul>	Rock pad prevents erosion
Dispersion Trench	A	Pipe plugged with sediment	Accumulated sediment that exceeds 20 percent of the design depth	Pipe cleaned/flushed so that it matches design
	A	Not discharging water properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” of water along trench)	Water discharges from feature by sheet flow
	A	Perforations plugged	Over 1/4 of perforations in pipe are plugged with debris or sediment	Perforations freely discharge flow
	A	Water flows out top of “distributor” catch basin	Water flows out of distributor catch basin during any storm less than the design storm	No flow discharges from distributor catch basin
	A	Receiving area over-saturated	Water in receiving area is causing or has potential of causing landslide problems	No danger of landslides
Gabions	A	Damaged mesh	Mesh of gabion broken, twisted or deformed so structure is weakened or rock may fall out	Mesh is intact with no rock missing

<b>No. 8 - Energy Dissipaters</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Gabions (continued)	A	Corrosion	Gabion mesh shows corrosion through more than ¼ of its gage	All gabion mesh capable of containing rock and retaining designed form
	A	Collapsed or deformed baskets	Gabion basket shape deformed due to any cause	All gabion baskets intact, structure stands as designed
	A	Missing rock	Any rock missing that could cause gabion to lose structural integrity	No rock missing
Maintenance Hole/Chamber	A	Worn or damaged post, baffles, or side of chamber	Structure dissipating flow deteriorates to ½ or original size or any concentrated worn spot exceeding 1 square foot, which would make structure unsound	Structure in no danger of failing
	A	Damage to wall, frame, bottom, and/or top slab	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch</li> <li>• Any evidence of soil entering the structure through cracks</li> <li>• Maintenance inspection personnel determines that the structure is not structurally sound</li> </ul>	Maintenance hole/chamber sealed and structurally sound
	A	Damaged pipe joints	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>• Any evidence of soil entering the structure at the joint of the inlet/outlet pipes</li> </ul>	<ul style="list-style-type: none"> <li>• No soil or water enters</li> <li>• No water discharges at the joint of inlet/outlet pipes</li> </ul>

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 9 - Basic and Compost-Amended Biofiltration Swales</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Facility – General Requirements	M	Trash and debris	Trash and/or debris accumulation	No trash or debris at the site
	B, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>Materials removed and disposed of according to applicable regulations</li> <li>Source control BMPs implemented if appropriate</li> <li>No contaminants present other than a surface oil film</li> </ul>
Swale Section	B, E	Sediment accumulation	Sediment depth exceeds 2 inches in 10 percent of the swale treatment area	No sediment deposits in treatment area of the biofiltration swale
			Sediment inhibits grass growth over 10 percent of swale length	Grass growth not inhibited by sediment
			Sediment inhibits even spreading of flow	Flows are spread evenly over entire swale width
	B, E	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows	<ul style="list-style-type: none"> <li>No eroded or scoured areas in biofiltration swale</li> <li>Cause of erosion or scour addressed</li> </ul>
	M	Poor vegetation coverage	Grass is sparse or bare or eroded patches occur in more than 10 percent of the swale bottom	<ul style="list-style-type: none"> <li>Swale has no bare spots</li> <li>Grass is thick and healthy</li> </ul>
	B	Grass too tall	<ul style="list-style-type: none"> <li>Grass is excessively tall (greater than 10 inches)</li> <li>Grass is thin</li> <li>Nuisance weeds and other vegetation has taken over</li> </ul>	<ul style="list-style-type: none"> <li>Grass between 3 and 4 inches tall, thick and healthy</li> <li>No clippings left in swale</li> <li>No nuisance vegetation present</li> </ul>

<b>No. 9 - Basic and Compost-Amended Biofiltration Swales</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Swale Section (continued)	B	Excessive shade	Grass growth is poor because sunlight does not reach swale	<ul style="list-style-type: none"> <li>• Healthy grass growth or</li> <li>• Swale converted to a wet biofiltration swale</li> </ul>
	B	Constant baseflow	<ul style="list-style-type: none"> <li>• Continuous flow through the swale, even when it has been dry for weeks or an eroded</li> <li>• Muddy channel has formed in the swale bottom</li> </ul>	Baseflow removed from swale by a low-flow pea-gravel drain or bypassed around the swale
	B	Standing water	Water pools in the swale between storms or does not drain freely	Swale drains freely and no standing water in swale between storms
	B	Channelization	Flow concentrates and erodes channel through swale	No flow channels in swale
Flow Spreader	B	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width	Flows are spread evenly over entire swale width
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>• Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves



<b>No. 10 - Wet and Continuous Inflow Biofiltration Swales</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Facility – General Requirements	M	Trash and debris	Any trash and/or debris accumulated at the site	No trash or debris at the site
	B, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>Materials removed and disposed of according to applicable regulations</li> <li>Source control BMPs implemented if appropriate</li> <li>No contaminants present other than a surface oil film</li> </ul>
Swale Section	B, E	Sediment accumulation	Sediment depth exceeds 2 inches in 10 percent of the swale treatment area	No sediment deposits in treatment area
	B, E	Erosion/scouring	Eroded or scoured swale bottom due to channelization or high flows	<ul style="list-style-type: none"> <li>No eroded or scoured areas in biofiltration swale</li> <li>Cause of erosion or scour addressed</li> </ul>
	B	Water depth	Water not retained to a depth of about 4 inches during the wet season	Water depth of 4 inches throughout swale for most of wet season
	B	Vegetation ineffective	<ul style="list-style-type: none"> <li>Vegetation sparse; does not provide adequate filtration</li> <li>Vegetation crowded out by very dense clumps of cattail or nuisance vegetation</li> </ul>	<ul style="list-style-type: none"> <li>Wetland vegetation fully covers bottom of swale</li> <li>No cattails or nuisance vegetation present</li> </ul>
	B	Insufficient water	Wetland vegetation dies due to lack of water	Wetland vegetation remains healthy (may require converting to grass-lined biofiltration swale)
Flow Spreader	B	Concentrated flow	Flow from spreader not uniformly distributed across entire swale width	Flows are spread evenly over entire swale width

No. 10 - Wet and Continuous Inflow Biofiltration Swales				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 11 - Filter Strips (Basic and CAVFS)</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Facility – General Requirements	M	Trash and debris	Any trash and/or debris accumulated at the site	No trash or debris at the site
	B, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>Materials removed and disposed of according to applicable regulations</li> <li>Source control BMPs implemented if appropriate</li> <li>No contaminants present other than a surface oil film</li> </ul>
Grass Strip	B, E	Sediment accumulation	Sediment accumulation exceeds 2 inches depth	No sediment deposits in treatment area
	B, E	Erosion/scouring	Eroded or scoured areas due to channelization or high flows	<ul style="list-style-type: none"> <li>No eroded or scoured areas</li> <li>Cause of erosion or scour addressed</li> </ul>
	B	Vegetation ineffective	<ul style="list-style-type: none"> <li>Grass has died out</li> <li>Grass has become excessively tall (greater than 10 inches)</li> <li>Nuisance vegetation is taking over</li> </ul>	<ul style="list-style-type: none"> <li>Grass is healthy; between 3 and 4 inches tall</li> <li>No nuisance vegetation present</li> </ul>
Flow Spreader	B	Concentrated flow	Flow from spreader not uniformly distributed across entire filter width	Flows are spread evenly over entire filter width
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes

No. 11 - Filter Strips (Basic and CAVFS)				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Inlet/Outlet Pipe (continued)	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 12 - Wet Ponds</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Facility – General Requirements	A	Trash and debris	Any trash and/or debris accumulated at the site	No trash or debris at the site
	M (March – October)	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>• Noxious and nuisance vegetation removed according to applicable regulations</li> <li>• No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>• Materials removed and disposed of according to applicable regulations</li> <li>• Source control BMPs implemented if appropriate</li> <li>• No contaminants present other than a surface oil film</li> </ul>
	2X: June – October	Grass/groundcover	Grass or groundcover exceeds 18 inches in height	Grass or groundcover mowed to a height no greater than 6 inches
Side Slopes of Dam, Berm, Internal Berm or Embankment	A	Rodent holes	<ul style="list-style-type: none"> <li>• Any evidence of rodent holes if facility is acting as a dam or berm</li> <li>• Any evidence of water piping through dam or berm via rodent holes</li> </ul>	<ul style="list-style-type: none"> <li>• Rodents removed or destroyed</li> <li>• Dam or berm repaired</li> </ul>

<b>No. 12 - Wet Ponds</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Side Slopes of Dam, Berm, Internal Berm or Embankment (continued)	A	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity.  If trees are not a threat to dam, berm or embankment integrity, are not interfering with access or maintenance, or leaves do not cause a plugging problem they do not need to be removed.	Trees do not hinder facility performance or maintenance activities
	A	Erosion	<ul style="list-style-type: none"> <li>• Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion</li> <li>• Any erosion observed on a compacted slope</li> </ul>	Slopes stabilized using appropriate erosion control measures  If erosion is occurring on compacted slope, a licensed engineer should be consulted to resolve source of erosion.
Top or Side Slopes of Dam, Berm, Internal Berm or Embankment	A	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation	Top or side slope restored to design dimensions  If settlement is significant, a licensed engineer should be consulted to determine the cause of the settlement.
	A	Irregular surface on internal berm	Top of berm not uniform and level	Top of berm graded to design elevation.
Pond Areas	A	Sediment accumulation (except first wet pool cell)	Accumulated sediment that exceeds 10 percent of the designed pond depth	Sediment cleaned out to designed pond shape and depth.

<b>No. 12 - Wet Ponds</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Pond Areas (continued)	A	Sediment accumulation (first wet pool cell)	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches	Sediment storage contains no sediment
	A	Liner damaged (if applicable)	<ul style="list-style-type: none"> <li>• Liner is visible</li> <li>• Pond does not hold water as designed</li> </ul>	Liner repaired or replaced.
	A, W	Water level (first wet pool cell)	First cell empty; does not hold water	Water retained in first cell for most of the year
	M (March – October)	Algae mats (first wet pool cell)	Algae mats develop over more than 10 percent of the water surface	Algae mats removed (usually in the late summer before fall rains)
Gravity Drain	A	Inoperable valve	Valve will not open and close	Valve opens and closes normally
	A	Valve will not seal	Valve does not seal completely	Valve completely seals closed
Emergency Overflow Spillway	A	Tree growth	Tree growth impedes flow or threatens stability of spillway	Trees removed
	A	Rock missing	<ul style="list-style-type: none"> <li>• Only one layer of rock exists above native soil in area 5 square feet or larger</li> <li>• Any exposure of native soil at the top of out flow path of spillway</li> </ul> (Rip-rap on inside slopes need not be replaced.)	Spillway restored to design standards
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes

No. 12 - Wet Ponds				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Inlet/Outlet Pipe (continued)	A	Damaged	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>• Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe

<sup>1</sup> Inspection frequency:

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<b>No. 13 - Wet Vaults</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Facility – General Requirements	A	Trash and debris	Trash and debris accumulation	Trash and debris removed from facility
Treatment Area	A	Trash and debris	Any trash and debris accumulated in vault (includes floatables and non-floatables)	No trash or debris in vault
	A	Sediment accumulation	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches	No sediment in vault
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>• Materials removed and disposed of according to applicable regulations</li> <li>• Source control BMPs implemented if appropriate</li> <li>• No contaminants present other than a surface oil film</li> </ul>
Vault Structure	A	Damage to wall, frame, bottom, and/or top slab	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch</li> <li>• Any evidence of soil entering the structure through cracks</li> <li>• Vault does not retain water</li> <li>• Qualified inspection personnel determines that the vault is not structurally sound</li> </ul>	Vault sealed and structurally sound
	A	Baffles damaged	<ul style="list-style-type: none"> <li>• Baffles corroding, cracking, warping, and/or showing signs of failure</li> <li>• Baffle cannot be removed</li> </ul>	Repair or replace baffles or walls to specifications
	A	Ventilation	Ventilation area blocked or plugged	No reduction of ventilation area exists

No. 13 - Wet Vaults				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe
Gravity Drain	A	Inoperable valve	Valve will not open and close	Valve opens and closes normally
	A	Valve will not seal	Valve does not seal completely	Valve completely seals closed
Access Maintenance Hole	A	Access cover/lid damaged or difficult to open	<ul style="list-style-type: none"> <li>Access cover/lid cannot be easily opened by one person</li> <li>Corrosion/deformation of cover/lid</li> </ul>	Access cover/lid can be opened by one person
	A	Locking mechanism not working	<ul style="list-style-type: none"> <li>Mechanism cannot be opened by one maintenance person with proper tools</li> <li>Bolts cannot be seated</li> <li>Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools
	A	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
	A	Access doors/plate has gaps, does not cover completely	Large access doors not flat and/or access opening not completely covered	Doors close flat and covers access opening completely

<b>No. 13 - Wet Vaults</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Access Maintenance Hole (continued)	A	Lifting rings missing, rusted	Lifting rings not capable of lifting weight of door or plate	Lifting rings sufficient to lift or remove door or plate
	A	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks	Ladder meets design standards and allows maintenance person safe access

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

No. 14 - Stormwater Treatment Wetlands				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Facility – General Requirements	A	Trash and debris	Trash and debris accumulation	Trash and debris removed from facility
	M (March – October)	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>• Noxious and nuisance vegetation removed according to applicable regulations</li> <li>• No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>• Materials removed and disposed of according to applicable regulations</li> <li>• Source control BMPs implemented if appropriate</li> <li>• No contaminants present other than a surface oil film</li> </ul>
	2X: June – October	Grass/groundcover	Grass or groundcover exceeds 18 inches in height	Grass or groundcover mowed to a height no greater than 6 inches
Side Slopes of Dam, Berm, Internal Berm, or Embankment	A	Rodent holes	<p>Any evidence of rodent holes if facility is acting as a dam or berm</p> <p>Any evidence of water piping through dam or berm via rodent holes</p>	<ul style="list-style-type: none"> <li>• Rodents removed or destroyed</li> <li>• Dam or berm repaired</li> </ul>

No. 14 - Stormwater Treatment Wetlands				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Side Slopes of Dam, Berm, Internal Berm, or Embankment (continued)	A	Tree growth	Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity.  If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.	Trees do not hinder facility performance or maintenance activities
	A	Erosion	<ul style="list-style-type: none"> <li>• Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion</li> <li>• Any erosion observed on a compacted slope</li> </ul>	<p>Slopes stabilized using appropriate erosion control measures</p> <p>If erosion is occurring on compacted slope, a licensed engineer should be consulted to resolve source of erosion.</p>
Top or Side Slopes of Dam, Berm, Internal Berm, or Embankment	A	Settlement	Any part of a dam, berm or embankment that has settled 4 inches lower than the design elevation	<p>Top or side slope restored to design dimensions</p> <p>If settlement is significant, a licensed engineer should be consulted to determine the cause of the settlement.</p>
	A	Irregular surface on internal berm	Top of berm not uniform and level	Top of berm graded flat to design elevation
Pond Areas	B	Sediment accumulation (first cell/forebay)	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches	Sediment storage contains no sediment

No. 14 - Stormwater Treatment Wetlands				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Pond Areas (continued)	B	Sediment accumulation (wetland cell)	Accumulated sediment that exceeds 10 percent of the designed pond depth	Sediment cleaned out to designed pond shape and depth
	A	Liner damaged (If Applicable)	Liner is visible or pond does not hold water as designed	Liner repaired or replaced
	A, W	Water level (first cell/forebay)	Cell does not hold 3 feet of water year round	3 feet of water retained year round
	A, W	Water level (wetland cell)	Cell does not retain water for at least 10 months of the year or wetland plants are not surviving.	Water retained at least 10 months of the year or wetland plants are surviving.
	M (March – October)	Algae mats (first cell/forebay)	Algae mats develop over more than 10 percent of the water	Algae mats removed (usually in the late summer before fall rains)
	B	Vegetation	Vegetation dead, dying, or overgrown (cattails) or not meeting original planting specifications	Plants in wetland cell surviving and not interfering with wetland function
Gravity Drain	A	Inoperable valve	Valve will not open and close	Valve opens and closes normally
	A	Valve will not seal	Valve does not seal completely	Valve completely seals closed
Emergency Overflow Spillway	A	Tree growth	Tree growth impedes flow or threatens stability of spillway	Trees removed
	A	Rock missing	<ul style="list-style-type: none"> <li>• Only one layer of rock exists above native soil in area 5 square feet or larger</li> <li>• Any exposure of native soil at the top of out flow path of spillway</li> </ul> (Rip-rap on inside slopes need not be replaced.)	Spillway restored to design standards
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment

No. 14 - Stormwater Treatment Wetlands				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance Is Performed
Inlet/Outlet Pipe (continued)	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 15 - Sand Filter Basins</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Facility – General Requirements	A, E	Trash and debris	Trash and debris accumulation	Trash and debris removed from facility
	M (March – October)	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>• Noxious and nuisance vegetation removed according to applicable regulations</li> <li>• No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>• Materials removed and disposed of according to applicable regulations</li> <li>• Source control BMPs implemented if appropriate</li> <li>• No contaminants present other than a surface oil film</li> </ul>
	A	Grass/groundcover (not in the treatment area)	Grass or groundcover exceeds 18 inches in height	Grass or groundcover mowed to a height no greater than 6 inches
Pre-Treatment (if applicable)	A	Sediment accumulation	Sediment accumulations in pond bottom that exceeds the depth of sediment storage (1 foot) plus 6 inches	Sediment storage contains no sediment
	A	Liner damaged (If Applicable)	Liner is visible Pond does not hold water as designed	Liner repaired or replaced
	A, W	Water level	Cell empty; does not hold water.	Water retained in first cell for most of the year
	M (March – October)	Algae mats	Algae mats develop over more than 10 percent of the water surface	Algae mats removed



<b>No. 15 - Sand Filter Basins</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Pond Area	B	Sediment accumulation	Sediment or crust depth exceeds ½ inch over 10 percent of surface area of sand filter	No sediment or crust deposit on sand filter that would impede permeability of the filter section
	2X: June – October	Grass (if applicable)	<ul style="list-style-type: none"> <li>• Grass becomes excessively tall (greater than 6 inches)</li> <li>• Nuisance weeds and other vegetation start to take over</li> <li>• Thatch build up occurs</li> </ul>	Mow vegetation and/or remove nuisance vegetation
Side Slopes of Pond	A	Rodent holes	<ul style="list-style-type: none"> <li>• Any evidence of rodent holes if facility is acting as a dam or berm</li> <li>• Any evidence of water piping through dam or berm via rodent holes</li> </ul>	Rodents removed or destroyed Dam or berm repaired
	A	Tree growth	<p>Tree growth threatens integrity of dams, berms or slopes, does not allow maintenance access, or interferes with maintenance activity.</p> <p>If trees are not a threat to dam, berm, or embankment integrity or not interfering with access or maintenance, they do not need to be removed.</p>	Trees do not hinder facility performance or maintenance activities

<b>No. 15 - Sand Filter Basins</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Side Slopes of Pond (continued)	A	Erosion	<ul style="list-style-type: none"> <li>• Eroded damage over 2 inches deep where cause of damage is still present</li> <li>• Where there is potential for continued erosion</li> <li>• Any erosion observed on a compacted slope</li> </ul>	<p>Slopes stabilized using appropriate erosion control measures</p> <p>If erosion is occurring on compacted slope, a licensed engineer should be consulted to resolve source of erosion.</p>
Sand Filter Media	A, E	Plugging	<ul style="list-style-type: none"> <li>• Drawdown of water through the sand filter media, takes longer than 24 hours</li> <li>• Flow through the overflow pipes occurs frequently</li> </ul>	<ul style="list-style-type: none"> <li>• Sand filter media surface is aerated</li> <li>• Drawdown rate is normal</li> </ul>
	A	Prolonged flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities	Excess flows bypassed or confined to small portion of filter media surface
	A	Short circuiting	<ul style="list-style-type: none"> <li>• Flows become concentrated over one section of the sand filter rather than dispersed</li> <li>• Drawdown rate of pool exceeds 12 inches per hour</li> </ul>	<ul style="list-style-type: none"> <li>• Flow and percolation of water through the sand filter is uniform and dispersed across the entire filter area</li> <li>• Drawdown rate is normal</li> </ul>
	A	Media thickness	Sand thickness is less than 6 inches	Rebuild sand thickness to a minimum of 6 inches and preferably to 18 inches

<b>No. 15 - Sand Filter Basins</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Underdrains and Clean-Outs	A	Sediment/debris	<ul style="list-style-type: none"> <li>• Underdrains or clean-outs partially plugged or filled with sediment and/or debris</li> <li>• Junction box/cleanout wyes not watertight</li> </ul>	Underdrains and clean-outs free of sediment and debris and are watertight
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>• Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe
Rock Pad	A	Missing or out of place	<ul style="list-style-type: none"> <li>• Only one layer of rock exists above native soil in area 5 square feet or larger</li> <li>• Any exposure of native soil</li> </ul>	Rock pad restored to design standards
Flow Spreader	A	Concentrated flow	Flow from spreader not uniformly distributed across sand filter	Flows spread evenly over sand filter

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 16 - Sand Filter Vaults</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Facility – General Requirements	A, E	Trash and debris	Trash and debris accumulation	Trash and debris removed from facility
	M (March – October)	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>• Noxious and nuisance vegetation removed according to applicable regulations</li> <li>• No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>• Materials removed and disposed of according to applicable regulations</li> <li>• Source control BMPs implemented if appropriate</li> <li>• No contaminants present other than a surface oil film</li> </ul>
	A	Grass/groundcover	Grass or groundcover exceeds 18 inches in height	Grass or groundcover mowed to a height no greater than 6 inches
Pre-Treatment Chamber	A	Sediment accumulation	Sediment accumulation exceeds the depth of the sediment zone plus 6 inches	Sediment storage contains no sediment
Sand Filter Media	A	Sediment accumulation	Sediment depth exceeds ½ inch on sand filter media	Sand filter freely drains at normal rate
	A	Trash and debris	Trash and debris accumulated in vault (floatables and non-floatables)	No trash or debris in vault

<b>No. 16 - Sand Filter Vaults</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Sand Filter Media (continued)	A, E	Plugging	<ul style="list-style-type: none"> <li>• Drawdown of water through the sand filter media, takes longer than 24 hours</li> <li>• Flow through the overflow pipes occurs frequently</li> </ul>	Sand filter media drawdown rate is normal
	A	Short circuiting	<ul style="list-style-type: none"> <li>• Seepage or flow occurs along the vault walls and corners</li> <li>• Sand eroding near inflow area</li> <li>• Cleanout wyes are not watertight</li> </ul>	<ul style="list-style-type: none"> <li>• Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal</li> <li>• Erosion protection added to dissipate force of incoming flow and curtail erosion</li> </ul>
Vault Structure	A	Damaged to walls, frame, bottom and/or top slab.	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch</li> <li>• Any evidence of soil entering the structure through cracks</li> <li>• Qualified inspection personnel determines that the vault is not structurally sound</li> </ul>	Vault replaced or repaired to provide complete sealing of the structure
	A	Ventilation	Ventilation area blocked or plugged	No reduction of ventilation area exists
Underdrains and Cleanouts	A	Sediment/debris	Underdrains or cleanouts partially plugged, filled with sediment and/or debris or not watertight	Underdrains and clean-outs free of sediment and debris and sealed
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes

No. 16 - Sand Filter Vaults				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Inlet/Outlet Pipe (continued)	A	Damaged	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe
Access Maintenance Hole	A	Cover/lid not in place	<ul style="list-style-type: none"> <li>Cover/lid is missing or only partially in place</li> <li><b>Any open maintenance hole requires immediate maintenance</b></li> </ul>	Maintenance hole access cover/lid in place and secure
	A	Locking mechanism not working	<ul style="list-style-type: none"> <li>Mechanism cannot be opened by one maintenance person with proper tools</li> <li>Bolts cannot be seated</li> <li>Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools
	A	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
	A	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks	Ladder meets design standards and allows maintenance person safe access
Large Access Doors/Plate	A	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment	Replace or repair access door so it can open as designed
	A	Gaps, does not cover completely	Large access doors not flat and/or access opening not completely covered	Doors close flat and covers access opening completely

<b>No. 16 - Sand Filter Vaults</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Large Access Doors/Plate (continued)	A	Lifting rings missing, rusted	Lifting rings not capable of lifting weight of door or plate	Lifting rings sufficient to lift or remove door or plate

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 17 - Proprietary Technology Filter Cartridge Systems (example: BayFilter, FloGard PerkFilter, StormFilter)</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
In addition to the specific maintenance criteria provided below, all manufacturers' requirements shall be followed.				
Facility – General Requirements	A, E	Trash and debris	Any trash or debris or organic material which impairs the function of the facility	<ul style="list-style-type: none"> <li>● Trash and debris removed from facility</li> <li>● Flow receives treatment instead of bypassing</li> </ul>
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>● Materials removed and disposed of according to applicable regulations</li> <li>● Source control BMPs implemented if appropriate</li> <li>● No contaminants present other than a surface oil film</li> </ul>
	A	Life cycle	Once per year	Facility is re-inspected and any needed maintenance performed
Vault Treatment Area	Varies – Refer to Manufacturer's requirements.	Sediment on vault floor	Varies – Refer to Manufacturer's requirements.	Vault is free of sediment
	Varies – Refer to Manufacturer's requirements.	Sediment on top of cartridges	Varies – Refer to Manufacturer's requirements.	Vault is free of sediment
	Varies – Refer to Manufacturer's requirements.	Multiple scum lines above top of cartridges	Thick or multiple scum lines above top of cartridges	Cause of plugging corrected and canisters replaced if necessary



<b>No. 17 - Proprietary Technology Filter Cartridge Systems (example: BayFilter, FloGard PerkFilter, StormFilter)</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Vault Structure	A	Damage to wall, frame, bottom, and/or top slab	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch</li> <li>• Any evidence of soil particles entering the structure through the cracks</li> <li>• Qualified inspection personnel determines the vault is not structurally sound</li> </ul>	Vault replaced or repaired to design specifications
	A	Baffles damaged	Baffles corroding, cracking warping, and/or showing signs of failure	Repair or replace baffles to specification
Filter Media	A, E	Standing water in vault	Varies – Refer to Manufacturer’s requirements.	No standing water in vault 24 hours after a rain event
	A	Short circuiting	Flows do not properly enter filter cartridges	Flows go through filter media
Underdrains and Clean-Outs	A	Sediment/debris	Underdrains or clean-outs partially plugged or filled with sediment and/or debris	Underdrains and clean-outs free of sediment and debris
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch at the joint of the inlet/outlet pipes</li> <li>• Any evidence of soil entering at the joints of the inlet/outlet pipes</li> </ul>	Cracks repaired, and no evidence of soil entering

<b>No. 17 - Proprietary Technology Filter Cartridge Systems (example: BayFilter, FloGard PerkFilter, StormFilter)</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Access Maintenance Hole	A	Cover/lid not in place	<ul style="list-style-type: none"> <li>• Cover/lid is missing or only partially in place</li> <li>• <b>Any open maintenance hole requires immediate maintenance</b></li> </ul>	Maintenance hole access cover/lid in place and secure
	A	Locking mechanism not working	<ul style="list-style-type: none"> <li>• Mechanism cannot be opened by one maintenance person with proper tools</li> <li>• Bolts cannot be seated</li> <li>• Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools
	A	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
	A	Cover/lid rocking or noisy	Lid rocking when driven over	Cover/lid not rocking
	A	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks	Ladder meets design standards and allows maintenance person safe access
Large Access Doors/Plate	A	Difficult to open	Large access doors or plates cannot be opened/removed using normal equipment	Replace or repair access door so it can open as designed.
	A	Damaged	Hatch doors show major dents and stress	Replace to support surface loading and uses
	A	Gaps, does not cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.

<b>No. 17 - Proprietary Technology Filter Cartridge Systems (example: BayFilter, FloGard PerkFilter, StormFilter)</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Large Access Doors/Plate (continued)	A	Lifting rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<sup>2</sup> Inspection frequencies provided are recommendations only. Proprietary technologies shall be inspected on a frequency as recommended by the manufacturer.

<b>No. 18 - API Oil/Water Separators</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Facility – General Requirements	A, E	Trash and debris	Any trash or debris which impairs the function of the facility	Trash and debris removed from facility
	A, E	Contaminants and pollution	Floating oil in excess of 1 inch in first chamber, any oil in other chambers or other contaminants of any type in any chamber	No contaminants present other than a surface oil film
Vault Treatment Area	A, E	Sediment accumulation	Sediment accumulates exceeds 6 inches in the vault	No sediment in the vault.
	A, E	Discharge water not clear	Inspection of discharge water shows obvious signs of poor water quality-effluent discharge from vault shows thick visible sheen	Effluent discharge is clear
	A, E	Trash or debris accumulation	Any trash and debris accumulation in vault (floatables and non-floatables)	Vault is clear of trash and debris
	A, E	Oil accumulation	Oil accumulations that exceed 1 inch, at the surface of the water in the oil/water separator chamber	No visible oil depth on water
Vault Structure	A	Damage to wall, frame, bottom, and/or top slab	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch</li> <li>• Any evidence of soil particles entering the structure through the cracks</li> <li>• Maintenance/inspection personnel determines that the vault is not structurally sound</li> </ul>	Vault replaced or repaired to design specifications
	A	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure	Repair or replace baffles to specifications

No. 18 - API Oil/Water Separators				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Gravity Drain	A	Inoperable valve	Valve will not open and close	Valve opens and closes normally
	A	Valve will not seal	Valve does not seal completely	Valve completely seals closed
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	Cracks, broken welds, seams or any other conditions that allows water to be discharged from other than the submerged portion of the tee	Water will be discharged from the submerged portion of the tee
	A	Missing	When the required inlet or outlet tee is not installed	Tees installed
	A	Permanently installed	When the tee is grouted to the inlet or outlet pipe and is not removable to allow for maintenance and inspection	Tee removable for maintenance and inspection
Access Maintenance Hole	A	Cover/lid not in place	<ul style="list-style-type: none"> <li>Cover/lid is missing or only partially in place</li> <li><b>Any open maintenance hole requires immediate maintenance</b></li> </ul>	Maintenance hole access cover/lid in place and secure
	A	Locking mechanism not working	<ul style="list-style-type: none"> <li>Mechanism cannot be opened by one maintenance person with proper tools</li> <li>Bolts cannot be seated</li> <li>Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools
	A	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

No. 18 - API Oil/Water Separators				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Access Maintenance Hole (continued)	A	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks	Ladder meets design standards and allows maintenance person safe access
Large Access Doors/Plate	A	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment	Replace or repair access door so it can open as designed
	A	Gaps, does not cover completely	Large access doors not flat and/or access opening not completely covered	Doors close flat and cover access opening completely
	A	Lifting rings missing, rusted	Lifting rings not capable of lifting weight of door or cover/lid	Lifting rings sufficient to lift or remove cover/lid

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 19 - Coalescing Plate Oil/Water Separators</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Facility – General Requirements	A, E	Trash and debris	Any trash or debris which impairs the function of the facility	Trash and debris removed from facility
	A, E	Contaminants and pollution	Floating oil in excess of 1 inch in first chamber, any oil in other chambers or other contaminants of any type in any chamber	No contaminants present other than a surface oil film
Vault Treatment Area	A, E	Sediment accumulation in the forebay	Sediment accumulation of 6 inches or greater in the forebay	No sediment in the forebay
	A, E	Discharge water not clear	Inspection of discharge water shows obvious signs of poor water quality – effluent discharge from vault shows thick visible sheen	Repair function of plates so effluent is clear
	A, E	Trash or debris accumulation	Trash and debris accumulation in vault (floatables and non-floatables)	Trash and debris removed from vault
	A, E	Oil accumulation	Oil accumulation that exceeds 1 inch at the water surface in the in the coalescing plate chamber	No visible oil depth on water and coalescing plates clear of oil
Coalescing Plates	A	Damaged	Plate media broken, deformed, cracked and/or showing signs of failure	Replace that portion of media pack or entire plate pack depending on severity of failure
	A, E	Sediment accumulation	Any sediment accumulation which interferes with the operation of the coalescing plates	No sediment accumulation interfering with the coalescing plates

No. 19 - Coalescing Plate Oil/Water Separators				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Vault Structure	A	Damage to wall, frame, bottom, and/or top slab	<ul style="list-style-type: none"> <li>Cracks wider than ½ inch</li> <li>Any evidence of soil particles entering the structure through the cracks</li> <li>Maintenance inspection personnel determines that the vault is not structurally sound</li> </ul>	Vault replaced or repaired to design specifications
	A	Baffles damaged	Baffles corroding, cracking, warping and/or showing signs of failure	Repair or replace baffles to specifications
Ventilation Pipes	A	Plugged	Any obstruction to the ventilation pipes	Ventilation pipes are clear
Shutoff Valve	A	Damaged or inoperable	Shutoff valve cannot be opened or closed	Shutoff valve operates normally
Inlet/Outlet Pipe	A	Sediment accumulation	Sediment filling 1/3 or more of the pipe	Inlet/outlet pipes clear of sediment
	B, W, E	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables)	No trash or debris in pipes
	A	Damaged	Cracks, broken welds, seams or any other conditions that allows water to be discharged from other than the submerged portion of the tee	Water will be discharged from the submerged portion of the tee
	A	Missing	When the required inlet or outlet tee is not installed	Tees installed
	A	Permanently installed	When the tee is grouted to the inlet or outlet pipe and is not removable to allow for maintenance and inspection	Tee removable for maintenance and inspection



No. 19 - Coalescing Plate Oil/Water Separators				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Access Maintenance Hole	A	Cover/lid not in place	<ul style="list-style-type: none"> <li>Cover/lid is missing or only partially in place</li> <li><b>Any open maintenance hole requires immediate maintenance</b></li> </ul>	Maintenance hole access cover/lid in place and secure
	A	Locking mechanism not working	<ul style="list-style-type: none"> <li>Mechanism cannot be opened by one maintenance person with proper tools</li> <li>Bolts cannot be seated</li> <li>Self-locking cover/lid does not work</li> </ul>	Mechanism opens with proper tools
	A	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
	A	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks	Ladder meets design standards and allows maintenance person safe access
Large Access Doors/Plate	A	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can be opened as designed
	A	Gaps, does not cover completely	Large access doors not flat and/or access opening not completely covered	Doors close flat and cover access opening completely
	A	Lifting rings missing, rusted	Lifting rings not capable of lifting weight of door or plate	Lifting rings sufficient to lift or remove door or plate

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 20 - Catch Basin Filter Socks</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Media Insert <sup>2</sup>	M	Visible oil	Visible oil sheen passing through media	Media insert replaced
	M	Insert does not fit catch basin properly	Flow gets into catch basin without going through media	All flow goes through media
	M	Filter media plugged	Filter media plugged	Flow through filter media is normal
	M	Oil absorbent media saturated	Media oil saturated	Oil absorbent media replaced
	M	Water saturated	Catch basin insert is saturated with water, which no longer has the capacity to absorb	Insert replaced
	M	Service life exceeded	Regular interval replacement due to typical average life of product	Media replaced at manufacturer's recommended interval

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<sup>2</sup> Inspection frequencies provided are recommendations only. Catch basin filter socks shall be inspected on a frequency as recommended by the manufacturer.

<b>No. 21 - Proprietary Technology Filterra System</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
In addition to the specific maintenance criteria provided below, all manufacturers' requirements shall be followed.				
Facility – General Requirements	A	Life cycle	Once per year, except mulch and trash removal twice per year	Facility is re-inspected and any needed maintenance performed
	B, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>Materials removed and disposed of according to applicable regulations</li> <li>Source control BMPs implemented if appropriate</li> <li>No contaminants present other than a surface oil film</li> </ul>
Inlet	B, E	Excessive sediment or trash accumulation	Accumulated sediments or trash impair free flow of water into system	Inlet should be free of obstructions allowing free distributed flow of water into system
Mulch Cover	B, E	Trash and floatable debris accumulation	Excessive trash and/or debris accumulation	<ul style="list-style-type: none"> <li>Minimal trash or other debris on mulch cover</li> <li>Mulch cover raked level</li> </ul>
	B, E	“Ponding” of water on mulch cover	“Ponding” in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils	Stormwater should drain freely and evenly through mulch cover
Proprietary Filter Media/ Vegetation Substrate	B, E	“Ponding” of water on mulch cover after mulch cover has been maintained	Excessive fine sediment passes the mulch cover and clogs the filter media/vegetative substrate	<ul style="list-style-type: none"> <li>Stormwater should drain freely and evenly through mulch cover</li> <li>Replace substrate and vegetation when needed</li> </ul>

No. 21 - Proprietary Technology Filterra System				
Maintenance Component	Recommended Inspection Frequency <sup>1,2</sup>	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Vegetation	B, E	Plants not growing or in poor condition	<ul style="list-style-type: none"> <li>• Soil/mulch too wet</li> <li>• Evidence of spill</li> <li>• Incorrect plant selection</li> <li>• Pest infestation</li> <li>• Vandalism to plants</li> </ul>	Plants should be healthy and pest free
			Media/mulch too dry	Irrigation is required
	B, E	Plants absent	Plants absent	Appropriate plants are present
	B, E	Excessive plant growth	Excessive plant growth inhibits facility function or becomes a hazard for pedestrian and vehicular circulation and safety	<ul style="list-style-type: none"> <li>• Pruning and/or thinning vegetation maintains proper plant density</li> <li>• Appropriate plants are present</li> </ul>
Structure, if used	B	Structure has visible cracks	<ul style="list-style-type: none"> <li>• Cracks wider than ½ inch</li> <li>• Evidence of soil particles entering the structure through the cracks</li> </ul>	Structure is sealed and structurally sound

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<sup>2</sup> Inspection frequencies provided are recommendations only. Proprietary technologies shall be inspected on a frequency as recommended by the manufacturer.

<b>No. 22 - Proprietary Technology Modular Wetland System</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
In addition to the specific maintenance criteria provided below, all manufacturers' requirements shall be followed.				
Facility – General Requirements	B	Trash and debris	Any trash or debris which impairs the function of the facility	Trash and debris removed from facility
	B	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>Materials removed and disposed of according to applicable regulations</li> <li>Source control BMPs implemented if appropriate</li> <li>No contaminants present other than a surface oil film</li> </ul>
	B	Odor	Septic or foul odor coming from inside the system	Odors are eliminated
	B	Standing water	Standing water observed after a prolonged dry period	No standing water
Inlet/Outlet Pipe	B	Excessive sediment or trash accumulation	Accumulated sediments or trash impair free flow of water into system	Inlet should be free of obstructions allowing free distributed flow of water into system
	B	Pipe damage or blockage	Pipe damaged or otherwise not functioning properly	Pipe is repaired and allowing free flow of water into system
Pre-Treatment Chamber	B	Sediment accumulation	Sediment accumulation in the pre-treatment chamber	Sediment removed from the pre-treatment chamber
	B	Access cover damage or difficulty opening	Access cover (manhole cover/grate) is damaged or cannot be opened using normal lifting pressure	Access cover is repaired and can be opened using normal lifting pressure.

<b>No. 22 - Proprietary Technology Modular Wetland System</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Pre-Treatment Chamber (continued)	B	Obstruction or clogging of screening device	Contaminants and pollutants collected by screen are obstructing flow of water into the system	<ul style="list-style-type: none"> <li>All pollutants removed and disposed of according to applicable regulations</li> <li>Screen is free of obstructions and allows free flow of water into system</li> </ul>
	B	Accumulated pollutants or debris in separation chamber	Accumulated pollutants or debris impedes function of unit	All pollutants removed and disposed of according to applicable regulations
Filter Media	A	Life cycle	Regular interval replacement due to typical average life of product or clogging	Old filter media is removed and new filter media is installed
Structure	A	Unit shows signs of structural deterioration	<ul style="list-style-type: none"> <li>Visible cracks wider than ½ inch</li> <li>Evidence of soil particles entering the structure through the cracks</li> <li>Damage to frame</li> </ul>	Structure is sealed and structurally sound
Access Cover	A	Hard to open	Cannot be easily opened	Access lid is repaired or replaced
	A	Buried	Buried	Access lid functions as designed (refer to record drawings for design intent)
	A	Missing cover	Cover missing	Cover replaced
Vegetation	B	Plants not growing or in poor condition	<ul style="list-style-type: none"> <li>Soil/mulch too wet</li> <li>Evidence of spill</li> <li>Incorrect plant selection</li> <li>Pest infestation</li> <li>Vandalism to plants</li> </ul>	Plants should be healthy and pest free.

<b>No. 22 - Proprietary Technology Modular Wetland System</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1,2</sup></b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Vegetation (continued)	B	Excessive plant growth	Excessive plant growth inhibits facility function or becomes a hazard for pedestrian and vehicular circulation and safety	<ul style="list-style-type: none"> <li>• Pruning and/or thinning vegetation maintains proper plant density</li> <li>• Appropriate plants are present</li> </ul>

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<sup>2</sup> Inspection frequencies provided are recommendations only. Proprietary technologies shall be inspected on a frequency as recommended by the manufacturer.

No. 23 - Bioretention Facilities				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Facility – General Requirements	B, E	Pests: Insects/Rodents	Pest of concern is present and impacting facility function	<ul style="list-style-type: none"> <li>• Pests removed or destroyed and facility returned to original functionality</li> <li>• Do not use pesticides or <i>Bacillus thuringiensis israelensis (Bti)</i></li> </ul>
	A, E	Trash	Trash and debris present	No trash and debris present
	B, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>• Materials removed and disposed of according to applicable regulations</li> <li>• Source control BMPs implemented if appropriate</li> <li>• No contaminants present other than a surface oil film</li> </ul>
Earthen Side Slopes and Berms	B, E	Erosion	Erosion (gullies/rills) greater than 2 inches deep around inlets, outlet, and alongside slopes	<ul style="list-style-type: none"> <li>• Cause of erosion is eliminated</li> <li>• Damaged area is stabilized (regrade, rock, vegetation, erosion control blanket)</li> </ul> <p>For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures are in place until permanent repairs can be made.</p>
			Erosion of sides causes slope to become a hazard	The hazard is eliminated and slopes are stabilized
	A, E	Settlement	Settlement greater than 3 inches (relative to undisturbed sections of berm)	The design height is restored with additional mulch



No. 23 - Bioretention Facilities				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Earthen Side Slopes and Berms (continued)	A, E	Berm leakage	Downstream face of berm wet, seeps or leaks evident	Holes are plugged and berm is compacted (may require consultation with licensed engineer, particularly for larger berms)
			Any evidence of rodent holes or water piping in berm	<ul style="list-style-type: none"> <li>• Rodents (refer to "Pests: Insects/Rodents") removed or destroyed</li> <li>• Berm repaired/compact ed</li> </ul>
Concrete Sidewalls	A	Cracks	Rot, cracks, or failure of concrete sidewalls	Concrete is repaired or replaced
Rockery Sidewalls	A	Instable rockery	Rockery side walls are insecure	Rockery sidewalls are stable (may require consultation with licensed engineer, particularly for walls 4 feet or greater in height)
Facility Bottom Area	B	Sediment accumulation	Accumulated sediment to extent that infiltration rate is reduced (refer to "Bioretention Soil") or surface storage capacity significantly impacted	<ul style="list-style-type: none"> <li>• Sediment cleaned out to restore facility shape and depth</li> <li>• Damaged vegetation is replaced and mulched</li> <li>• Source of sediment identified and controlled (if feasible)</li> </ul>
	B	Leaf accumulation	Accumulated leaves in facility	No leaves clogging outlet structure or impeding water flow
Check Dams and Weirs	A, E	Sediment, vegetation, or debris accumulation	Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir, or orifice	Blockage is cleared

<b>No. 23 - Bioretention Facilities</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Check Dams and Weirs (continued)	A, E	Erosion	Erosion and/or undercutting present	<ul style="list-style-type: none"> <li>• No eroded or undercut areas in bioretention facility</li> <li>• Cause of erosion or undercutting addressed</li> <li>• Check dam or weir is repaired</li> </ul>
	A	Unlevel top of weir	Grade board or top of weir damaged or not level	Weir restored to level position
Bioretention Soil	As needed	Ponded water	Water remains in the basin 48 hours or longer after the end of a storm	Cause of ponded water is identified and addressed: <ol style="list-style-type: none"> <li>1) Leaf litter/debris is removed</li> <li>2) Underdrain is clear</li> <li>3) Other water inputs (e.g., groundwater, illicit connections) investigated</li> <li>4) Contributing area verified and facility size is evaluated</li> </ol> If items #1–4 do not solve the problem, imported bioretention soil is replaced and replanted.
	As needed	Protection of soil	Maintenance will occur requiring entrance into the facility footprint	Maintenance is performed without compacting bioretention soil media
Splash Block Inlet	B	Water not properly directed to facility	Water is not being directed properly to the facility and away from the inlet structure	Blocks are reconfigured to direct water to facility and away from structure
Curb Cut Inlet/Outlet	A, E	Accumulated debris	Accumulated leaves, sediment, debris or vegetation at curb cuts	<ul style="list-style-type: none"> <li>• Blockage is cleared</li> <li>• Source of the blockage is identified and action is taken to prevent future blockages</li> </ul>

No. 23 - Bioretention Facilities				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Inlet/Outlet Pipe	A	Damaged pipe	Pipe is damaged	<ul style="list-style-type: none"> <li>• Pipe is repaired/replaced</li> <li>• No cracks more than ¼-inch wide at the joint of inlet/outlet pipes exist</li> </ul>
	A	Clogged pipe	Pipe is clogged	Pipe is clear
	A, E	Accumulated debris	Accumulated leaves, sediment, debris or vegetation at inlet or outlet pipe	<ul style="list-style-type: none"> <li>• Pipe is clear of debris</li> <li>• Source of the blockage is identified and action is taken to prevent future blockages</li> </ul>
	A, E	Blocked access	Maintain access for inspections	<ul style="list-style-type: none"> <li>• Vegetation is cleared within 1 foot of inlets and outlets</li> <li>• Access pathways are maintained</li> </ul>
	B	Erosion	Water disrupts soil media	<ul style="list-style-type: none"> <li>• No eroded or scoured areas in bioretention facility</li> <li>• Cause of erosion or scour addressed.</li> <li>• Pipes or splash blocks are reconfigured or repaired</li> <li>• A cover of rock or cobbles or other erosion protection measure maintained (e.g., matting) to protect the ground where concentrated water enters or exits the facility (e.g., a pipe, curb cut or swale)</li> </ul>
Overflow	A, E	Blocked overflow	Capacity reduced by sediment or debris	No sediment or debris in overflow

No. 23 - Bioretention Facilities				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Underdrain Pipe	A	Blocked underdrain	<ul style="list-style-type: none"> <li>Plant roots, sediment or debris reducing capacity of underdrain</li> <li>Prolonged surface ponding (refer to "Bioretention Soil")</li> </ul>	Underdrains and orifice are free of sediment and debris
Facility Bottom Area and Upland Slope Vegetation	M	Lack of vegetation	Vegetation survival rate falls below 75 percent within first 2 years of establishment (unless project O&M manual or record drawing stipulates more or less than 75 percent survival rate)	<ul style="list-style-type: none"> <li>Plants are healthy and pest free</li> <li>Cause of poor vegetation growth addressed</li> <li>Bioretention facility is replanted as necessary to obtain 75 percent survival rate or greater</li> <li>Plant selection is appropriate for site growing conditions</li> </ul>
Trees and Shrubs	A	Causing problems for operation of facility	Large trees and shrubs interfere with operation of the facility or access for maintenance	Trees and shrubs do not hinder facility performance or maintenance activities
	A	Dead trees or shrubs	Standing dead vegetation is present	<ul style="list-style-type: none"> <li>Trees and shrubs do not hinder facility performance or maintenance activities</li> <li>Dead vegetation is removed</li> <li>Cause of dead vegetation is addressed</li> <li>Specific plants with high mortality rate are replaced with more appropriate species</li> </ul>

<b>No. 23 - Bioretention Facilities</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Trees and Shrubs Adjacent to Vehicle Travel Areas (or areas where visibility needs to be maintained)	A	Safety issues	Vegetation causes some visibility (line of sight) or driver safety issues	<ul style="list-style-type: none"> <li>• Appropriate height for sight clearance is maintained</li> <li>• Regular pruning maintains visual sight lines for safety or clearance along a walk or drive</li> <li>• Tree or shrub is removed or transplanted if presenting a continual safety hazard</li> </ul>
Emergent Vegetation	M	Conveyance blocked	Vegetation compromises conveyance	Sedges and rushes are clear of dead foliage
Noxious Weeds	M (March – October)	Presence of noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>• Noxious and nuisance vegetation removed according to applicable regulations</li> <li>• No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
Excessive Vegetation	M	Adjacent facilities compromised	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil	<ul style="list-style-type: none"> <li>• Vegetation does not impede function of adjacent facilities or pose as safety hazard</li> <li>• Groundcovers and shrubs trimmed at facility edge</li> <li>• Excessive leaf litter is removed.</li> </ul>

No. 23 - Bioretention Facilities				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Excessive Vegetation (continued)	M	Causes facility to not function properly	Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety	<ul style="list-style-type: none"> <li>Pruning and/or thinning vegetation maintains proper plant density and aesthetics</li> <li>Plants that are weak, broken, or not true to form are removed or replaced in-kind</li> <li>Appropriate plants are present</li> </ul>
Mulch	A	Lack of mulch	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	<ul style="list-style-type: none"> <li>Facility has a minimum 3-inch layer of an appropriate type of mulch</li> <li>Mulch is kept away from woody stems</li> </ul>
Plant Watering	Weekly or as required (May – September)	Plant establishment	Plant establishment period (1–3 years)	Plants are watered as necessary during periods of no rain to ensure plant establishment
Summer Watering (after establishment)	Weekly or as required (May – September)	Drought period	Established vegetation (after 3 years)	<ul style="list-style-type: none"> <li>Plants are watered as necessary during drought conditions</li> <li>Trees are watered up to 5 years after planting</li> </ul>

<sup>1</sup> Inspection frequency:

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<b>No. 24 - Cisterns</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Roof	B	Debris accumulation in cistern	Debris has accumulated	No debris in cistern
Gutter	B	Debris accumulation in cistern	Debris has accumulated	No debris in cistern or gutter
Screens at the Top of Downspout and Cistern Inlet	A	Debris accumulation in cistern	Screen has deteriorated or is missing	Screen is in place and functions as designed
	Monthly (October – April), E		Preventative maintenance	No debris in cistern or accumulated on screen
Overflow Pipe	B	Damaged	Pipe is cracked, joints and fittings not sealed	Overflow pipe is watertight and does not leak.
	B	Discharge is sporadic, cistern overtops	Debris has accumulated blocking flow	Overflow pipe can convey overflow to point of discharge.
Cistern	A	Accumulated debris and/or sediment	More than 6 inches of accumulation in bottom of cistern	Accumulation of debris and/or sediment removed
Low Flow Orifice (detention cistern)	M (October – April), E	Cistern overflows are too frequent	Debris or other obstruction of orifice	Orifice is clear
Delivery and Distribution System (harvesting)	Varies	None – ongoing maintenance activity	Ongoing maintenance (e.g., replacing and/or cleaning filters, removing sediment and other pollutants from storage systems)	Manufacturer's, installer's, or designer's instructions for O&M are followed
Access and Safety	Ongoing	None – ongoing maintenance activity	Access to cistern required for maintenance or cleaning	Any cistern opening that could allow the entry of people is marked: "DANGER—CONFINED SPACE"
Pests	B	Mosquito infestation	Standing water remains for more than 3 days following storms	<ul style="list-style-type: none"> <li>• All inlets, overflows and other openings are protected with mosquito screens</li> <li>• No mosquito infestation present</li> </ul>

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 25 - Downspout, Sheet Flow, and Concentrated Dispersion Systems</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Splash Block	B	Water directed toward building	Water is being directed towards building structure	Blocks direct water away from building structure
	B	Water causing erosion	Water disrupts soil media	Blocks are reconfigured/repared and media is restored
Transition Zone	B, E	Erosion	Adjacent soil erosion; uneven surface creating concentrated flow discharge; or less than 2 foot of width	No eroded or scoured areas Cause of erosion or scour is addressed
Dispersion Trench	B	Concentrated flow	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" from edge of trench; intent is to prevent erosion damage)	No debris on trench surface Notched grade board or other distributor type is aligned to prevent erosion Trench is rebuilt to standards, if necessary
Surface of Trench	A, E	Accumulated debris	Accumulated trash, debris, or sediment on drain rock surface impedes sheet flow from facility	Trash or debris is removed/disposed in accordance with local solid waste requirements
	A, E	Vegetation impeding flow	Vegetation/moss present on drain rock surface impedes sheet flow from facility	Freely draining drain rock surface
Pipe(s) to Trench	A	Accumulated debris in drains	Accumulation of trash, debris, or sediment in roof drains, gutters, driveway drains, area drains, etc.	No trash or debris in roof drains, gutters, driveway drains, or area drains
	A	Accumulated debris in inlet pipe	Pipe from sump to trench or drywell has accumulated sediment or is plugged	No sediment or debris in inlet/outlet pipe screen or inlet/outlet pipe
	A	Damaged pipes	Cracked, collapsed, broken, or misaligned drain pipes	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe



<b>No. 25 - Downspout, Sheet Flow, and Concentrated Dispersion Systems</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Rock Pad (concentrated flow dispersion)	A	Inadequate rock cover	Only one layer of rock exists above native soil in area 6 square feet or larger, or any exposure of native soil	Rock pad is repaired/replaced to meet design standards
	A	Erosion	Soil erosion in or adjacent to rock pad	Rock pad is repaired/replaced to meet design standards
Dispersal Area (general)	A	Erosion	Erosion (gullies/rills) greater than 2 inches deep in dispersal area	No eroded or scoured areas Cause of erosion or scour is addressed
	A	Accumulated sediment	Accumulated sediment or debris to extent that blocks or channelizes flow path	No excess sediment or debris in dispersal area. Sediment source is addressed (if feasible)
Ponded Water	As needed	Ponded water	Standing surface water in dispersion area remains for more than 3 days after the end of a storm event	<ul style="list-style-type: none"> <li>• System freely drains</li> <li>• Standing water in dispersion area does not persist for more than 3 days after a storm event</li> <li>• Cause of the standing water (e.g., grade depressions, compacted soil) addressed</li> </ul>
Vegetation	M	Plant survival	Dispersal area vegetation in establishment period (1–2 years, or additional 3rd year) during extreme dry weather)	Vegetation healthy and watered weekly during periods of no rain to ensure plant establishment

<b>No. 25 - Downspout, Sheet Flow, and Concentrated Dispersion Systems</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Vegetation (continued)	M	Lack of vegetation allowing erosion	Poor vegetation cover such that erosion is occurring	<ul style="list-style-type: none"> <li>• Vegetation healthy and watered.</li> <li>• No eroded or scoured areas present</li> <li>• Cause of erosion or scour addressed</li> <li>• Plant species appropriate for the soil and moisture conditions</li> </ul>
	M	Vegetation blocking flow	Vegetation inhibits dispersed flow along flow path	Vegetation is trimmed, weeded, or replanted to restore dispersed flow path
	M (March – October)	Presence of noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>• Noxious and nuisance vegetation removed according to applicable regulations</li> <li>• No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
Sump	A	Accumulated sediment	Accumulated sediment in the sump exceeds 30 percent of storage volume	No sediment in sump or inlet/outlet pipes
Access Lid	A	Hard to open	Cannot be easily opened	Access lid is repaired or replaced
	A	Buried	Buried	Access lid functions as designed (refer to record drawings for design intent)
	A	Missing cover	Cover missing	Cover replaced

<b>No. 25 - Downspout, Sheet Flow, and Concentrated Dispersion Systems</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Pest Control	B	Mosquito infestation	Standing surface water in dispersion area remains for more than 3 days after the end of a storm	<ul style="list-style-type: none"> <li>• System freely drains</li> <li>• Standing water in dispersion area does not persist for more than 3 days after a storm event</li> <li>• Cause of the standing water (e.g., grade depressions, compacted soil) addressed</li> </ul>
Rodents	As required	Presence of rodents	Rodent holes or mounds disturb dispersion flow paths	<ul style="list-style-type: none"> <li>• Rodents removed or destroyed</li> <li>• Holes filled</li> <li>• Flow path revegetated</li> </ul>

<sup>1</sup> Inspection frequency:

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No. 26 - Permeable Pavement <sup>1</sup>				
Maintenance Component	Recommended Inspection Frequency <sup>2</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Facility – General Requirements	A	Unstable adjacent area	Runoff from adjacent pervious areas deposits soil, mulch or sediment on paving	<ul style="list-style-type: none"> <li>No deposited soil or other materials on permeable pavement or other adjacent surfacing</li> <li>All exposed soils that may erode to pavement surface mulched and/or planted</li> </ul>
	A	Wearing course covered by adjacent vegetation	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge	<ul style="list-style-type: none"> <li>Vegetation does not impede function of adjacent facilities or pose as safety hazard</li> <li>Groundcovers and shrubs trimmed to avoid overreaching the sidewalks, paths and street edge</li> </ul>
	A, E	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries, or paint	<ul style="list-style-type: none"> <li>Materials removed and disposed of according to applicable regulations</li> <li>Source control BMPs implemented if appropriate</li> <li>No contaminants present other than a surface oil film</li> </ul>
Pavement Wearing Course (all types)	A	Accumulated sediment on surface	Sediment present at the surface of the pavement	Sediment at surface does not inhibit infiltration
	A	Surface clogged by moss	Moss growth inhibits infiltration or poses slip safety hazard	Moss growth on surface does not inhibit infiltration or present a slip safety hazard

<b>No. 26 - Permeable Pavement<sup>1</sup></b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>2</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Pavement Wearing Course (all types)	A	Surface is clogged	Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	<ul style="list-style-type: none"> <li>● System drains freely</li> <li>● No standing water on surface between storms</li> </ul>
	A	Settlement	When deviation from original grade impedes function.	Original grade re-established
Permeable Asphalt or Cement Concrete	A	Cracks	Major cracks or trip hazards and concrete spalling and raveling	<ul style="list-style-type: none"> <li>● Potholes or small cracks filled with patching mixes</li> <li>● Large cracks and settlement addressed by cutting and replacing the pavement section</li> </ul>
Permeable Paver or Open-Celled Paving Grid	A	Paver block missing or damaged	Paver block missing or damaged	Individual damaged paver blocks removed and replaced or repaired per manufacturer's recommendations
	A	Loss of aggregate material between paver blocks	Loss of aggregate material between paver blocks	Aggregate replaced per manufacturer's recommendations
Open-Celled Paving Grid	A	Paving grid missing or damaged	Three or more adjacent rings in paving grid missing or damaged	Grid segment replaced or repaired per manufacturer's recommendations
	A	Loss of aggregate material in paving grid	Loss of aggregate material in paving grid	Aggregate gravel level maintained at the same level as the plastic rings or no more than ¼ inch above the top of rings
	A	Lack of grass coverage	Poor grass coverage in paving grid	<ul style="list-style-type: none"> <li>● Growing medium restored</li> <li>● Facility reseeded or planted</li> <li>● Aerated</li> <li>● Vegetated area amended as needed</li> </ul>

No. 26 - Permeable Pavement <sup>1</sup>				
Maintenance Component	Recommended Inspection Frequency <sup>2</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Open-Celled Paving Grid (continued)	A	Weeds present	Weeds present	Weeds are removed if infiltration is hindered. Noxious weeds are removed.
Inlet/Outlet Pipe	A	Pipe is damaged	Pipe is damaged	Pipe is repaired/replaced
	A	Pipe is clogged	Pipe is clogged	Roots or debris is removed
	A, E	Erosion	Native soil exposed or other signs of erosion damage present	<ul style="list-style-type: none"> <li>• No eroded or scoured areas</li> <li>• Cause of erosion or scour is addressed</li> </ul>
Underdrain Pipe	B	Blocked underdrain	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period)	Underdrains and orifice free of sediment and debris

<sup>1</sup> Fog seal, chip seal and other impervious overlays are not permitted on top of permeable pavement.<sup>2</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

<b>No. 27 - Trees</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance Is Needed</b>	<b>Results Expected When Maintenance Is Performed</b>
Tree	As needed	Dead or declining	Dead, damaged, or declining	Tree replaced per planting plan or acceptable substitute

No. 28 - Vegetated Roof Systems				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Facility – General Requirements	A	Improper access and safety for maintenance	Insufficient egress/ingress routes and fall protection	<ul style="list-style-type: none"> <li>Egress and ingress routes maintained to design standards and fire codes</li> <li>Fall protection is appropriate</li> </ul>
	A	Border zone not defined	Vegetation is encroaching into border zone aggregate	<ul style="list-style-type: none"> <li>No weeds and undesirable vegetation present</li> <li>Desirable vegetation transplanted</li> </ul>
	A	Flashing, gravel stops, utilities, or other structures on roof	Flashing, utilities or other structures on roof are deteriorating (can serve as source of metal pollution in vegetated roof runoff)	Potential pollutant sources replaced or eliminated
	B	Mosquitoes	Standing water remains for more than 3 days after the end of a storm	<ul style="list-style-type: none"> <li>System freely drains</li> <li>Standing water on roof does not persist for more than 3 days after a storm event</li> </ul>
	As required	Nuisance animals	Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	Measures in place to deter nuisance species
Growth Medium	A	Water is not infiltrating properly	Water does not permeate growth media (runs off soil surface) or crusting is observed	Stormwater infiltrates freely through growth media
	A	Insufficient growth medium	Growth medium thickness is less than design thickness (due to erosion and plant uptake)	Growth medium is present at design thickness
	B, W	Fallen leaves/debris	Fallen leaves or debris are present	No leaves or debris present



No. 28 - Vegetated Roof Systems				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Growth Medium (continued)	A	Erosion	Growth media erosion/scour is visible (e.g., gullies)	<ul style="list-style-type: none"> <li>No eroded or scoured areas</li> <li>Cause of erosion or scour addressed</li> </ul>
Roof Drain	B, E	Not draining	Sediment, vegetation, or debris reducing capacity of inlet structure	<ul style="list-style-type: none"> <li>Inlet clear</li> <li>Cause of blockage addressed</li> </ul>
	A	Pipe is clogged	Pipe is clogged	Debris, roots, or other obstruction removed and pipe is free draining
Vegetation	B	Plant coverage	Vegetative coverage falls below 80 percent (unless design specifications stipulate less than 80 percent coverage)	<ul style="list-style-type: none"> <li>Bare areas planted with vegetation</li> <li>Erosion control measures installed until percent coverage goal attained</li> </ul>
			Summer watering – extensive vegetated roof system	Vegetation watered weekly during periods of no rain during vegetation establishment period (1–2 years)
				Vegetation watered during drought conditions or more often if necessary to maintain plant cover during post-establishment period (after 2 years)
		Summer watering – intensive vegetated roof system	Vegetation watered deeply, but infrequently, and the top 6 to 12 inches of the root zone is moist during vegetation establishment period (1–2 years)	

No. 28 - Vegetated Roof Systems				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Vegetation (continued)	B	Plant coverage (continued)	Summer watering – intensive vegetated roof system (continued)	Vegetation watered during drought conditions or more often if necessary to maintain plant cover during post-establishment period (after 2 years)
			Extensive roof with low density sedum population	Sedums are mulch mowed
	A	Poor plant establishment and possible nutrient deficiency in growth medium	Fertilization– extensive vegetated roof system	<ul style="list-style-type: none"> <li>• Organic debris replenished</li> <li>• Annual soil test conducted to assess need for fertilizer</li> <li>• Minimal amounts of slow-release fertilizer applied</li> </ul>
			Fertilization– intensive vegetated roof system	<ul style="list-style-type: none"> <li>• Annual soil test conducted to assess need for fertilizer</li> <li>• Minimal amounts of slow-release fertilizer applied</li> </ul>
			Dead vegetation is present	Dead plant material recycled on the roof or removed and replaced (see manufacturer’s recommendations)
	Q	Weeds	Weeds are present	<ul style="list-style-type: none"> <li>• Weeds removed (manual methods preferred)</li> <li>• IPM protocols followed</li> </ul>

No. 28 - Vegetated Roof Systems				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Vegetation (continued)	M (March – October)	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to City personnel or the public	<ul style="list-style-type: none"> <li>Noxious and nuisance vegetation removed according to applicable regulations</li> <li>No danger of noxious vegetation where City personnel or the public might normally be</li> </ul>
Irrigation System (if any)	Based on manufacturer's instructions	Not applicable	Irrigation system is not working or routine maintenance needed	Manufacturer's/installer's instructions are followed for operation and maintenance

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

No. 29 - Rain Gardens				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Facility – General Requirements	B, E	Mosquitoes	Standing water remains for more than 3 days after the end of a storm	<ul style="list-style-type: none"> <li>• Rain garden drains freely</li> <li>• Standing water in rain garden does not persist for more than 3 days after a storm event</li> <li>• Cause of the standing water addressed (see “Ponded water”)</li> </ul>
	A, E	Trash	Trash and debris present	No trash or debris present
Earthen Side Slopes and Berms	B, E	Erosion	Persistent soil erosion on slopes	<ul style="list-style-type: none"> <li>• No eroded or scoured areas</li> <li>• Cause of erosion or scour addressed</li> </ul>
Rockery Sidewalls	A	Unstable rockery	Rockery side walls are insecure	Stable rockery sidewalls (may require consultation with licensed engineer, particularly for walls 4 feet or greater in height)
Rain Garden Bottom Area	B	Sediment accumulation	Visible sediment deposition in the rain garden that reduces drawdown time of water in the rain garden	<ul style="list-style-type: none"> <li>• No sediment accumulation in rain garden</li> <li>• Source of sediment addressed</li> </ul>
	B	Debris accumulation	Accumulated leaves in facility	No leaves clogging outlet structure or impeding water flow
Mulch	A	Lack of mulch	Bare spots (without mulch cover) are present or mulch depth less than 2 inches	<ul style="list-style-type: none"> <li>• Facility has a minimum 2- to 3-inch layer of an appropriate type of mulch</li> <li>• Mulch kept away from woody stems</li> </ul>
Splash Block Inlet	B	Water not properly directed to rain garden	Water is being directed towards building structure	Blocks are reconfigured to direct water to rain garden and away from structure

<b>No. 29 - Rain Gardens</b>				
<b>Maintenance Component</b>	<b>Recommended Inspection Frequency<sup>1</sup></b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Pipe Inlet/Outlet	B	Erosion	Rock or cobble removed or missing and concentrated flows contacting soil	<ul style="list-style-type: none"> <li>• No eroded or scoured areas</li> <li>• Cause of erosion or scour addressed</li> <li>• Cover of rock or cobbles protects the ground where concentrated water flows into the rain garden</li> </ul>
	A	Accumulated debris	Accumulated leaves, sediment, debris or vegetation at curb cuts, inlet or outlet pipe	Blockage cleared
	A	Damaged pipe	Pipe is damaged	Pipe repaired/replaced
	A	Clogged pipe	Pipe is clogged	Pipe clear of roots and debris
	A	Blocked access	Maintain access for inspections	Vegetation cleared or transplanted within 1 foot of inlets and outlets
Ponded Water	As needed	Ponded water	Excessive ponding water: Ponded water remains in the rain garden more than 48 hours after the end of a storm	<ul style="list-style-type: none"> <li>• Rain garden drains freely</li> <li>• Standing water in rain garden does not persist for more than 48 hours after a storm event</li> <li>• Leaf litter/debris/sediment removed</li> </ul>
Overflow	A, E	Blocked overflow	Capacity reduced by sediment or debris	No sediment or debris in overflow
Vegetation	A	Blocked site distances and sidewalks	Vegetation inhibits sight distances and sidewalks	Sidewalks and sight distances along roadways and sidewalks are kept clear
	A	Blocked pipes	Vegetation is crowding inlets and outlets	Inlets and outlets in rain garden clear of vegetation

No. 29 - Rain Gardens				
Maintenance Component	Recommended Inspection Frequency <sup>1</sup>	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Vegetation (continued)	M	Unhealthy vegetation	<ul style="list-style-type: none"> <li>• Yellowing: possible Nitrogen (N) deficiency</li> <li>• Poor growth: possible Phosphorous (P) deficiency</li> <li>• Poor flowering, spotting or curled leaves, or weak roots or stems: possible Potassium (K) deficiency</li> </ul>	Plants are healthy and appropriate for site conditions
	M	Weeds	Presence of weeds	Weeds removed (manual methods preferred) and mulch applied
Summer Watering (years 1–3)	Weekly or as required (May – September)	Plant establishment	Tree, shrubs and groundcovers in first 3 years of establishment period	Plants are watered during plant establishment period (years 1–3)
Summer Watering (after establishment)	As needed	Drought conditions	Vegetation requires supplemental water	Plants are watered during drought conditions or more often if necessary during post-establishment period (after 2 years)

<sup>1</sup> Inspection frequency:

A = Annually; B = Biannually; M = Monthly; E = Recommend that additional inspections be performed as appropriate after major events (e.g., >1 inch of precipitation in 24 hours or environmental incident that causes contaminant release; Q = Quarterly (four times per year); W = Recommend that at least one inspection occur during the wet season, preferably after trees have lost their leaves

**APPENDIX A-4**  
**City of Tacoma 2021 SWMM,**  
**Appendix C Operation and**  
**Maintenance**

## **Appendix C Operation and Maintenance**

The following pages contain maintenance standards for typical stormwater facilities that may be required for stormwater mitigation. The maintenance standards should be included in the project Operations and Maintenance Manual. If the proposed stormwater system contains facilities or components that are not contained within this Volume, the applicant is responsible for developing additional maintenance standards for the proposed facility or component. If there are components listed on the maintenance standard that are not applicable to the proposed design, those components shall be removed. The operation and maintenance standards shall accurately reflect the proposed design. The Maintenance Standard includes recommended timeframes for inspection. Maintenance frequency is project site specific depending on factors such as use of the site and traffic volumes. Maintenance frequencies shall be based upon inspections. It is recommended to conduct monthly inspections during the first few years after installation to develop maintenance frequencies. At a minimum, inspections of all components of the stormwater system shall occur yearly.

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceeding these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

Note: Maintenance checklist #29 - General Maintenance Concerns for Stormwater Facilities contains maintenance concerns that may be applicable to any stormwater facility. This checklist must be included in all Operation and Maintenance manuals as applicable.



## Appendix C Contents

- #1 - Maintenance Standard for Detention Ponds
- #2 - Maintenance Standard for Infiltration Ponds/Basins
- #3 - Maintenance Standard for Infiltration Trenches
- #4 - Maintenance Standard for Closed Detention Systems (Tanks/Vaults)
- #5 - Maintenance Standard for Control Structure/Flow Restrictor
- #6 - Maintenance Standard for Catch Basins/Manholes
- #7 - Maintenance Standard for Debris Barriers (e.g., Trash Racks)
- #8 - Maintenance Standard for Energy Dissipaters
- #9 - Maintenance Standard for Typical Biofiltration Swales
- #10 - Maintenance Standard for Wet Biofiltration Swales
- #11 - Maintenance Standard for Filter Strips
- #12 - Maintenance Standard for Wet Ponds
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- #17 - Maintenance Standard for Baffle Oil/Water Separators - American Petroleum Institute (API)  
Type
- #18 - Maintenance Standard for Coalescing Plate Oil/Water Separators
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**#1 - Maintenance Standard for Detention Ponds**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Trash and Debris	Any trash and debris which exceeds 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
Annually (preferably Sept.)	General	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or Local Regulations (Apply requirements of adopted integrated pest management policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies required. (Coordinate with the Pierce County Noxious Weed Control Board.)
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. (Coordinate removal/cleanup with Environmental Services at 253.502.2222 and/or DOE Spill Response 800.424.8802.)
Monthly from Oct. – Apr.	General	Rodent Holes	If the facility is constructed with a dam or berm, look for rodent holes or any evidence of water piping through the dam or berm.	Rodents removed and dam or berm repaired. (Coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
Monthly from Oct. – Apr.	General	Beaver Dams	Beaver dam results in an adverse change in the functioning of the facility.	Facility is returned to design function. (Contact WDFW Region 6 to identify the appropriate Nuisance Wildlife Control Operator)

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site in compliance with adopted integrated pest management policies.
Annually (preferably Sept.)	General	Tree Growth and Dense Vegetation	Tree growth and dense vegetation which impedes inspection, maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements).	Trees and vegetation that do not hinder inspection or maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses.
Annually (preferably Sept.)	General	Hazard Trees	If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements).	Remove hazard trees
Monthly from Oct. – Apr.	Side Slopes of Pond	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Side Slopes of Pond	Erosion	Any erosion observed over 2" deep on a compacted berm embankment.	If erosion is occurring on compacted berms a Washington State Licensed Professional Engineer should be consulted to resolve source of erosion.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr.	Storage Area	Sediment	Accumulated sediment that exceeds 10 percent of the design pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to design pond shape and depth; pond reseeded if necessary to control erosion. (If sediment contamination is a potential problem, sediment should be tested regularly to determine leaching potential prior to disposal.)
Monthly from Oct. – Apr.	Storage Area	Liner (If Applicable)	Liner is visible and has more than three 1/4 inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Annually (preferably Sept.)	Pond Berms (Dikes)	Settlement	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A Washington State Licensed Professional Engineer should be consulted to determine the source of the settlement.	Dike is restored to the design elevation.
Annually (preferably Sept.)	Pond Berms Over 4 ft in height (Dikes)	Tree Growth	Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A Washington State Licensed Professional Engineer should be consulted for proper berm/spillway restoration.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Pond Berms (Dikes)	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Washington State Licensed Professional Engineer be called in to inspect and evaluate condition and recommend repair.)	Piping eliminated. Erosion potential eliminated.
Annually (preferably Sept.)	Emergency Overflow/ Spillway	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A Washington State Licensed Professional Engineer should be consulted for proper berm/spillway restoration.
Annually (preferably Sept.)	Emergency Overflow/ Spillway	Rock Missing	Only one layer of rock exists above native soil in area 5 square feet or larger, or any exposure of native soil at the top of outflow path of spillway. (Riprap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
Annually (preferably Sept.)	Emergency Overflow/ Spillway	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment over 2" deep.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a Washington State Licensed Professional Engineer should be consulted to resolve source of erosion.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#2 - Maintenance Standard for Infiltration Ponds/Basins**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris	Any trash and debris which exceeds 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
Annually (preferably Sept.)	General	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or Local Regulations. (Apply requirements of adopted integrated pest management policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with the Pierce County Noxious Weed Control Board) Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies required.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. (Coordinate removal/cleanup with Environmental Services at 253.502.2222 and/or DOE Spill Response 800.424.8802.)
Monthly from Oct. – Apr.	General	Rodent Holes	If the facility is constructed with a dam or berm, look for rodent holes or any evidence of water piping through the dam or berm.	Rodents removed and dam or berm repaired. (Coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
Monthly from Oct. – Apr.	General	Beaver Dams	Beaver dam results in an adverse change in the functioning of the facility.	Facility is returned to design function. (Contact WDFW to identify the appropriate Nuisance Wildlife Control Operator)

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.
Monthly from Oct. – Apr.	Storage Area	Water Not Infiltrating	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration (24 hours or design infiltration time).  (A percolation test pit or test of facility indicates facility is only working at 90 percent of its designed capabilities. If 2 inches or more sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Monthly from Oct. – Apr.	Ponds	Vegetation	Exceeds 18 inches.	Mow or remove vegetation as necessary. Remove all clippings.
Monthly from Oct. – Apr.	Ponds	Vegetation	Bare spots.	Revegetate and stabilize immediately. Do not apply fertilizers.
Monthly from Oct. – Apr.	Side Slopes of Pond	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or piping. A Washington State Licensed Professional Engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
Annually (preferably Sept.)	Pond Berms (Dikes)	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Washington State Licensed Professional Engineer be called in to inspect and evaluate condition and recommend repair.)	Piping eliminated. Erosion potential eliminated.
Annually (preferably Sept.)	General	Hazard Trees	If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)	Remove hazard trees
Annually (preferably Sept.)	General	Tree Growth and Dense Vegetation	Tree growth and dense vegetation which impedes inspection, maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements).	Trees and vegetation that do not hinder inspection or maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Pond Berms (Dikes)	Tree Growth	Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A Washington State Licensed Professional Engineer should be consulted for proper berm/spillway restoration.
Annually (preferably Sept.)	Emergency Overflow/ Spillway	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A Washington State Licensed Professional Engineer should be consulted for proper berm/spillway restoration.
Annually (preferably Sept.)	Emergency Overflow/ Spillway	Rock Missing	Only one layer of rock exists above native soil in area 5 square feet or larger, or any exposure of native soil at the top of out flowpath of spillway. (Riprap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Emergency Overflow/Spillway	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a Washington State Licensed Professional Engineer should be consulted to resolve source of erosion.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#3 - Maintenance Standard for Infiltration Trenches**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Trash and Debris	Trash and debris in presettling basin, sump, or observation well/port.	Trash and debris cleared from site.
Annually (preferably Sept.)	General	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or Local Regulations. (Apply requirements of adopted integrated pest management policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with the Pierce County Noxious Weed Control Board) Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies required.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants	No contaminants or pollutants present. (Coordinate removal/cleanup with Environmental Services at 253.502.2222 and/or DOE Spill Response 800.424.8802.)
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.
Monthly from Oct. – Apr.	General	Water Not Infiltrating	Water ponding on surface or visible in observation well 24 hours after storm event.	Sediment is removed and/or facility is cleaned so that infiltration system works according to design. Remove any sediment from surface inlet if applicable.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.) and after any major storm event (1" in 24 hours)	Trenches	Observation Well (Use surface of trench if well is not present)	Water ponds at surface during storm events. Water visible in observation well 48 hours after storm event.	Remove and Replace rock layer and geomembrane or clean rock and geomembrane. Check underdrain pipe for sediment accumulation and remove sediment.
Annually (preferably Sept.)	General	Tree Growth and Dense Vegetation	Tree growth and dense vegetation which impedes inspection, maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements).	Trees and vegetation that do not hinder inspection or maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses.
Annually (preferably Sept.)	Emergency Overflow/Spillway	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a Washington State Licensed Professional Engineer should be consulted to resolve source of erosion.
Monthly from Oct. – Apr.	Presettling Sump	Facility or sump filled with sediment and/or debris	6 inches or designed sediment trap depth of sediment.	Sediment is removed.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#4 - Maintenance Standard for Closed Detention Systems (Tanks/Vaults)**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Storage Area	Plugged Air Vents	One-half of the cross-section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Storage Area	Debris and Sediment	Accumulated sediment depth exceeds 10 percent of the diameter of the storage area for one-half length of storage vault or any point depth exceeds 15 percent of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than one-half length of tank.)	All sediment and debris removed from storage area.
Annually (preferably Sept.)	Storage Area	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability.)	All joints between tank/pipe sections are sealed.
Annually (preferably Sept.)	Storage Area	Tank/Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10 percent of its design shape. (Will require engineering analysis to determine structural stability.)	Tank/pipe repaired or replaced to design.
Annually (preferably Sept.)	Storage Area	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than one-half inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications and is structurally sound.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Storage Area	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than one-half inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	No cracks more than one-fourth inch wide at the joint of the inlet/outlet pipe.
Annually (preferably Sept.)	Maintenance Hole	Cover Not in Place	Cover is missing or only partially in place. Any open maintenance hole requires maintenance.	Maintenance hole cover is in place.
Annually (preferably Sept.)	Maintenance Hole	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
Annually (preferably Sept.)	Maintenance Hole	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
Annually (preferably Sept.)	Maintenance Hole	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Tanks and vaults are a confined space. Visual inspections should be performed aboveground. If entry is required it should be performed by qualified personnel.

Comments:

**#5 - Maintenance Standard for Control Structure/Flow Restrictor**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris (Includes Sediment)	Material exceeds 25 percent of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
Annually (preferably Sept.)	General	Structural Damage	Structure is not securely attached to maintenance hole wall.	Structure securely attached to wall and outlet pipe.
Annually (preferably Sept.)	General	Structural Damage	Structure is not in upright position (allow up to 10 percent from plumb).	Structure in correct position.
Annually (preferably Sept.)	General	Structural Damage	Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are watertight; structure repaired or replaced and works as designed.
Annually (preferably Sept.)	General	Structural Damage	Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.
Annually (preferably Sept.)	Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
Annually (preferably Sept.)	Cleanout Gate	Damaged or Missing	Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
Annually (preferably Sept.)	Cleanout Gate	Damaged or Missing	Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
Annually (preferably Sept.)	Cleanout Gate	Damaged or Missing	Gate is rusted over 50 percent of its surface area.	Gate is repaired or replaced to meet design standards.
Annually (preferably Sept.)	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.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Orifice Plate	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	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.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Maintenance Hole	Cover Not in Place	Cover is missing or only partially in place. Any open maintenance hole requires maintenance.	Maintenance hole is closed.
Annually (preferably Sept.)	Maintenance Hole	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
Annually (preferably Sept.)	Maintenance Hole	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
Annually (preferably Sept.)	Maintenance Hole	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Control structures are usually considered a confined space. Visual inspections should be performed aboveground. If entry is required it should be performed by qualified personnel.

Comments:

**#6 - Maintenance Standard for Catch Basins/Manholes**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	General	"Dump no pollutants" Stencil or stamp not visible	Stencil or stamp should be visible and easily read	Warning signs (e.g., "Dump No Waste-Drains to Stream") shall be painted or embossed on or adjacent to all storm drain inlets.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inlet capacity of the basin by more than 10 percent.	No trash or debris located immediately in front of catch basin or on grate opening.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris	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 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris	Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.	Inlet and outlet pipes free of trash or debris.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris	Dead animals or vegetation that could generate odors and cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	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.
Annually (preferably Sept.)	General	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than one-fourth inch (intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
Annually (preferably Sept.)	General	Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab, i.e., separation of more than three-fourth inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
Annually (preferably Sept.)	General	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
Annually (preferably Sept.)	General	Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than one-half-inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regouted and secure at basin wall.
Annually (preferably Sept.)	General	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Vegetation	Vegetation growing across and blocking more than 10 percent of the basin opening.	No vegetation blocking opening to basin.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Vegetation	Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth present.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. (Coordinate removal/cleanup with Environmental Services at 253.502.2222 and/or DOE Spill Response 800.424.8802.)
Annually (preferably Sept.)	Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place.	Catch basin cover is in place.
Annually (preferably Sept.)	Catch Basin Cover	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half-inch of thread.	Mechanism opens with proper tools.
Annually (preferably Sept.)	Catch Basin Cover	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Annually (preferably Sept.)	Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Annually (preferably Sept.)	Grates	Grate opening Unsafe	Grate with opening wider than seven-eighths of an inch.	Grate opening meets design standards.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Grates	Trash and Debris	Trash and debris that is blocking more than 20 percent of grate surface inletting capacity.	Grate free of trash and debris.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Grates	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place , meets design standards, and is installed and aligned with flowpath.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#7 - Maintenance Standard for Debris Barriers (e.g., Trash Racks)**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris	Trash or debris that is plugging more than 20 percent of the openings in the barrier.	Barrier cleared to design flow capacity.
Annually (preferably Sept.)	General	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than three-fourth inch.
Annually (preferably Sept.)	General	Damaged/ Missing Bars.	Bars are missing or entire barrier missing.	Bars in place according to design.
Annually (preferably Sept.)	General	Damaged/ Missing Bars.	Bars are loose and rust is causing 50 percent deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
Annually (preferably Sept.)	General	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe.	Barrier firmly attached to pipe.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#8 - Maintenance Standard for Energy Dissipaters**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Conditions When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
External:				
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Rock Pad	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
Monthly from Oct. - Apr. and after any major storm event (1" in 24 hours)	Rock Pad	Missing or Moved Rock	Only one layer of rock exists above soil in area 5 square feet or larger, or any soil exposure.	Rock pad replaced to design standards.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20 percent of the design depth.	Pipe cleaned/flushed so that it matches design.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Dispersion Trench	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage.	Trench redesigned or rebuilt to standards.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Dispersion Trench	Perforations Plugged	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Dispersion Trench	Water Flows Out Top of "Distributor" Catch Basin.	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or the trench is causing or appears likely to cause damage.	Facility rebuilt or redesigned to standards.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Dispersion Trench	Receiving Area Over-Saturated	Water in receiving area is causing or has potential to cause landslide problems.	No danger of landslides.
Spring and Summer	Flowpath	No or minimal vegetation	Vegetation removed or dead. Vegetation replaced by hard surface.	Design vegetated flowpath is restored.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Conditions When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Internal:				
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Maintenance Hole/ Chamber	Worn or Damaged Post, Baffles, Side of Chamber	Structure dissipating flow deteriorates to one-half of original size or any concentrated worn spot exceeding 1 square foot which would make structure unsound	Structure replaced to design standards.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Maintenance Hole/ Chamber	Trash and Debris	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 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Maintenance Hole/ Chamber	Trash and Debris	Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.	Inlet and outlet pipes free of trash or debris.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Maintenance Hole/ Chamber	Trash and Debris	Dead animals, trash or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals, trash or vegetation present within the catch basin.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Maintenance Hole/ Chamber	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.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Conditions When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Maintenance Hole/ Chamber	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than one-fourth inch (intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
Annually (preferably Sept.)	Maintenance Hole/ Chamber	Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab, i.e., separation of more than three-fourth inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
Annually (preferably Sept.)	Maintenance Hole/ Chamber	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
Annually (preferably Sept.)	Maintenance Hole/ Chamber	Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than one-half-inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regouted and secure at basin wall.
Annually (preferably Sept.)	Maintenance Hole/ Chamber	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Maintenance Hole/ Chamber	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. (Coordinate removal/ cleanup with Environmental Services at 253.502.2222 and/or DOE Spill Response 800-424-8802.)
Annually (preferably Sept.)	Catch Basin/ Maintenance Hole Cover	Cover Not in Place	Cover is missing or only partially in place.	Any open catch basin/ maintenance hole requires maintenance. Catch basin cover is closed.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Conditions When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Catch Basin/ Maintenance Hole Cover	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half-inch of thread.	Mechanism opens with proper tools.
Annually (preferably Sept.)	Catch Basin/ Maintenance Hole Cover	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#9 - Maintenance Standard for Typical Biofiltration Swales**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bioswale. When finished, swale should be level from side to side and drain freely toward outlet.  There should be no areas of standing water once inflow has ceased.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Standing Water	Water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale. Consult the design engineer if underdrains are proposed to be removed or conversion is proposed.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10 percent of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals or re-seed into loosened, fertile soil.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Vegetation	When the grass becomes excessively tall (greater than 10 inches); when nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 8 inches, but not below design flow level. Remove grass clippings.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Inlet/Outlet/Underdrain	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.  If underdrain, avoid vehicular traffic on swale bottom.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris Accumulation	Trash and debris accumulated in the bioswale.	Remove leaves, litter, and oily materials, and re-seed or resod, and regrade, as needed. Clean curb cuts and level spreaders as needed.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Erosion/ Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#10 - Maintenance Standard for Wet Biofiltration Swales**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Sediment Accumulation	Sediment depth exceeds 2 inches in 10 percent of the swale treatment area.	Remove sediment deposits in treatment area.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.	Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost offsite. Dig out roots as necessary. Note: Normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters. Fall harvesting of Juncus species is not recommended.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Trash and Debris Accumulation	Any trash and debris which exceeds 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Remove trash and debris from wet swale.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Erosion/ Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as <i>Juncus effusus</i> (soft rush) in wet areas or snowberry ( <i>Symphoricarpos albus</i> ) in drier areas, or as recommended by a wetland specialist.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#11 - Maintenance Standard for Filter Strips**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Conditions When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Vegetation	When the grass becomes excessively tall (greater than 10 inches); when nuisance weeds and other vegetation start to take over.	Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Remove trash and Debris from filter.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Erosion/ Scouring	Eroded or scoured areas due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width



Recommended Inspection Frequency	Stormwater System Feature	Problem	Conditions When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#12 - Maintenance Standard for Wet Ponds**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)		Trash and Debris	Accumulation that exceeds 1 cubic foot per 1000 square feet of pond area.	Trash and debris removed from pond
Biannually (Spring & Fall)	General	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined in State and Local Regulations. (Apply requirements of adopted integrated vegetation management (IVM) policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with the Pierce County Noxious Weed Control Board). Complete eradication of noxious weeds may not be possible, however compliance with state or local eradication policies are required.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)		Inlet/Outlet Pipe	Inlet and/or outlet pipe clogged with sediment and/or debris material	No clogging or blockage in the inlet and outlet piping.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)		Sediment Accumulation in Pond Bottom	Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6 inches, usually in the first cell.	Sediment removed from pond bottom.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly		Vegetation	Vegetation is overgrown or sparse.	Trim vegetation as necessary to keep pond free of leaves and maintain aesthetic appearance. Revegetate bare sloped areas. Regrade before revegetation as needed.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)		Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vacator truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as <i>Juncus effusus</i> (soft rush) which can uptake small concentrations of oil.
Annually (preferably Sept.)		Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom that exceeds 6 inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
Annually (preferably Sept.)		Settlement of Pond Dike/ Berm	Any part of these components that has settled 4 inches or lower than the design elevation, or inspector determines dike/berm is unsound.	Dike/berm is repaired to specifications
Annually (preferably Sept.)		Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
Annually (preferably Sept.)		Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#13 - Maintenance Standard for Treatment Wetlands**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (Spring & Fall)	General	Trash and Debris	Any trash and debris accumulations which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If there is less than the threshold, remove all trash and debris as part of the next scheduled maintenance.	Trash and debris cleared from site.
Biannually (Spring & Fall)	General	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined in State and Local Regulations. (Apply requirements of adopted integrated vegetation management (IVM) policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with the Pierce County Noxious Weed Control Board). Complete eradication of noxious weeds may not be possible, however compliance with state or local eradication policies are required.
Biannually (Spring & Fall)	General	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant emergent wetland plants such as <i>Juncus effusus</i> (soft rush) which can assist filtering small concentrations of oil.
Biannually (Spring & Fall) and after any major storm event (1" in 24 hours)	General	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material or damaged.	No clogging or blockage in the inlet and outlet piping.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (Spring & Fall)	General	Rodent Holes	If the facility is constructed with a dam or berm, look for rodent holes or any evidence of water piping through the dam or berm.	Rodents removed and dam or berm repaired. (Coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
Biannually (Spring & Fall)	General	Beaver Dams	Beaver dam results in an adverse change in the functioning of the facility.	Facility is returned to design function. Contact WDFW to identify the appropriate Nuisance Wildlife Control Operator.
Biannually (Spring & Fall)	General	Tree Growth and Hazard Trees	Tree growth that impedes maintenance access.	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses.
Biannually (Spring & Fall)	General	Tree Growth and Hazard Trees	If dead, diseased, or dying trees are identified, use a Certified Arborist to determine the health of tree and whether removal is required.	Remove hazard trees.
Biannually (Spring & Fall)	General	Liner	Liner is visible and has more than three one-fourth inch holes in it.	Liner is repaired or replaced. Liner is fully covered.
Biannually (Spring & Fall)	Forebay	Sediment Accumulation	Sediment accumulation in forebay exceeds the design depth of the sediment zone plus 6 inches.	Accumulated sediment is removed from forebay bottom to the design depth of the sediment zone.
Biannually (Spring & Fall)	Side Slopes of Wetland	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes should be stabilized using appropriate erosion control measure(s) such as rock reinforcement, planting of grass, or additional compaction.
Biannually (Spring & Fall) and after any major storm event (1" in 24 hours)	Side Slopes of Wetland	Erosion	Any erosion observed on a compacted berm embankment over 2" deep.	If erosion is occurring on compacted berms a Washington State Licensed Professional Engineer should be consulted to resolve source of erosion.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (Spring & Fall)	Wetland Cell	Wetland Vegetation	20 percent or more of the constructed wetland area has dead or dying vegetation, as measured by stem counts relative to the design plant coverage.	Dead or dying vegetation is replaced by like species, unless recommended otherwise by the Wetlands Consultant and approved by the City. (Watering, physical support, mulching, and weed removal may be required on a regular basis especially during the first 3 years.)
Biannually (Spring & Fall)	Wetland Cell	Wetland Vegetation	Percent vegetated cover of constructed wetland bottom area, excluding exotic and invasive species, is less than 50 percent after 2 years.	Remove exotic/ invasive species, additional plantings may be required.
Biannually (Spring & Fall)	Wetland Cell	Wetland Vegetation	Decaying vegetation produces foul odors.	Decaying vegetation is removed, preferably in late summer.
Once in mid summer (July or August)	Wetland Cell	Wetland Vegetation	Wetland vegetation is blocking flowpaths causing flow back-up and flooding.	Areas of blocking vegetation are cut back sufficient to allow design flows and prevent flooding.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Wetland Cell	Wetland Vegetation	Water quality monitoring indicates that wetland vegetation is contributing phosphorus and metals to downstream waters rather than sequestering them. Environmental Services will determine when water quality monitoring is required.	To maximize removal of wetland pollutants, vegetation must be periodically harvested, particularly with respect to phosphorus and metals removal. Harvesting should occur by mid-summer before plants begin to transfer phosphorus from the aboveground foliage to subsurface roots, or begin to lose metals that desorb during plant die off. Every 3 to 5 years the entire plant mass including roots should be harvested because the below ground biomass constitutes a significant reservoir (as much as half) of the nutrients and metals that are removed from stormwater by plants.
Biannually (Spring & Fall)	Wetland Cell	Sediment Accumulation	Sediment accumulation inhibits growth of wetland plants or reduces wetland volume (greater than 1 foot of sediment accumulation).	Dredge to design depth.
Annually (preferably Sept.)	Wetland Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A Washington State Licensed Professional Engineer should be consulted to determine the source of the settlement.	Dike restored to the design elevation.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Wetland Berms (Dikes)	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Washington State Licensed Professional Engineer be called in to inspect and evaluate condition and recommend repairs.	Piping eliminated. Erosion potential eliminated.
Annually (preferably Sept.)	Wetland Berms over 4 ft in height (Dikes)	Tree Growth	Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A Washington State Licensed Professional Engineer should be consulted for proper berm/spillway restoration.
Annually (preferably Sept.)	Emergency Overflow/ Spillway	Obstruction	Tree growth or other blockage on emergency spillways may cause failure of the berm due to uncontrolled overtopping.	Obstruction should be removed. A Washington State Licensed Professional Engineer should be consulted for proper berm/spillway restoration.
Annually (preferably Sept.)	Emergency Overflow/ Spillway	Rock Missing	Only one layer of rock exists above native soil in an area 5 square feet or larger, or any exposure of native soil at the top of outflow path of spillway. (Riprap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Emergency Overflow/ Spillway	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a Washington State Licensed Professional Engineer should be consulted to resolve source of erosion.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#14 - Maintenance Standard for Wetvaults**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Remove trash and debris from vault.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.	Remove sediment from vault. (If sediment contamination is a potential problem, sediment should be tested regularly to determine leaching potential prior to disposal.)
Annually (preferably Sept.)	General	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
Annually (preferably Sept.)	General	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Pipe repaired or replaced to proper working specifications.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified percentage of the vault surface area must provide ventilation to the vault interior (see design specifications).
Annually (preferably Sept.)	Vault Structure	Damage - Includes Cracks in Walls/Bottom, Damage to Frame and/or Top Slab	Maintenance/inspection personnel determine that the vault is not structurally sound	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
Annually (preferably Sept.)	Vault Structure	Damage - Includes Cracks in Walls/Bottom, Damage to Frame and/or Top Slab	Cracks wider than one-half-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than one-fourth inch at the joint of the inlet/outlet pipe.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Vault Structure	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Baffles repaired or replaced to specifications.
Annually (preferably Sept.)	Access Ladder	Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

A vault is a confined space. Visual inspections should be performed aboveground. If entry is required it should be performed by qualified personnel.

Comments:

**#15 - Maintenance Standard for Sand Filters (above ground/open)**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Above ground (open sand filter)	Sediment Accumulation on top layer	Sediment depth exceeds one-half inch.	No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Above ground (open sand filter)	Trash and Debris Accumulations	Trash and debris accumulated on sand filter bed.	Trash and debris removed from sand filter bed.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Above ground (open sand filter)	Sediment/ Debris in Clean-Outs	When the clean-outs become full or partially plugged with sediment and/or debris.	Sediment removed from clean-outs.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Above ground (open sand filter)	Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently.	Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Above ground (open sand filter)	Prolonged Flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities. (Consider 4-8 hour drawdown tests)	Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Above ground (open sand filter)	Short Circuiting	Drawdown greater than 12 inches per hour. When flows become concentrated over one section of the sand filter rather than dispersed. (Consider 4-8 hour drawdown tests)	Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area. Inspect periphery and cleanouts for leakage.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Above ground (open sand filter)	Erosion Damage to Slopes	Erosion over 2 inches deep where cause of damage is prevalent or potential for continued erosion is evident.	Slopes stabilized using proper erosion control measures.
Annually (preferably Sept.)	Above ground (open sand filter)	Rock Pad Missing or Out of Place	Soil beneath the rock is visible.	Rock pad replaced or rebuilt to design specifications.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Above ground (open sand filter)	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter. Rills and gullies on the surface of the filter can indicate improper function of the inlet flow spreader.	Spreader leveled and cleaned so that flows are spread evenly over sand filter. Refill rills and gullies with sand.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Above ground (open sand filter)	Damaged Pipes	Any part of the piping that is crushed or deformed more than 20 percent or any other failure to the piping.	Pipe repaired or replaced.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.
Every other year	General	Drawdown		Every two years conduct a drawdown test by filling the filter with water and measuring the decline in water level over a 4 - 8 hour period.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#16 - Maintenance Standard for Sand Filters (below ground/enclosed)**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Below Ground Vault	Sediment Accumulation on Sand Media Section	Sediment depth exceeds one-half inch.	No sediment deposits on sand filter section that would impede permeability of the filter section.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Below Ground Vault	Sediment Accumulation in Presettling Portion of Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.	No sediment deposits in first chamber of vault.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Below Ground Vault	Trash/Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault and inlet/outlet piping.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Below Ground Vault	Sediment in Drain Pipes/Cleanouts	When drain pipes, cleanouts become full with sediment and/or debris.	Sediment and debris removed.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Below Ground Vault	Clogged Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently. (Consider 4-8 hour drawdown tests.)	Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	Below Ground Vault	Short Circuiting	Drawdown greater than 12 inches per hour. When seepage/flow occurs along the vault walls and corners. Sand eroding near inflow area. (Consider 4-8 hour drawdown tests.)	Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion.
Annually (preferably Sept.)	Below Ground Vault	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Below Ground Vault	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter.	Spreader leveled and cleaned so that flows are spread evenly over sand filter.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Below Ground Vault	Ventilation	Ventilation area blocked or plugged	Blocking material removed or cleared from ventilation area. A specified percentage of the vault surface area must provide ventilation to the vault interior (see design specifications).
Annually (preferably Sept.)	Below Ground Vault	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/ deformation of cover. Maintenance person cannot remove cover using normal lifting pressure.	Cover repaired to proper working specifications or replaced.
Annually (preferably Sept.)	Below Ground Vault	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than one-half inch or evidence of soil particles entering the structure through the cracks, or maintenance/ inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
Annually (preferably Sept.)	Below Ground Vault	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than one-half inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than one-fourth inch at the joint of the inlet/ outlet pipe.
Annually (preferably Sept.)	Below Ground Vault	Baffles/ Internal walls	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Below Ground Vault	Access Ladder	Damaged ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

A below ground enclosed sand filter is a confined space. Visual inspections should be performed aboveground. If entry is required it should be performed by qualified personnel.

Comments:

**#17 - Maintenance Standard for Baffle Oil/Water Separators - American Petroleum Institute (API) Type**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Sheen, obvious oil present in discharge.	Effluent discharge from vault should be clear without visible sheen.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Monitoring	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6 inches in depth.	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Monitoring	Trash and Debris Accumulation	Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	Monitoring	Oil Accumulation	Oil accumulations that exceed 1 inch, at the surface of the water or 6 inches of sludge in the sump.	Extract oil/sludge from vault by vactoring. Dispose of in accordance with state and local rules and regulations. Clean separators after spills. Replace wash water with clean water before returning to service.
Annually (preferably Sept.)	Structure	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired or replaced.
Annually (preferably Sept.)	Structure	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/ deformation of cover.	Cover repaired to proper working specifications or replaced.
Annually (preferably Sept.)	Structure	Vault Structure Damage Includes Cracks in Walls/Bottom, Damage to Frame and/or Top Slab	Maintenance person judges that structure is unsound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Structure	Vault Structure Damage Includes Cracks in Walls/Bottom, Damage to Frame and/or Top Slab	Cracks wider than one-half inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than one-fourth inch at the joint of the inlet/outlet pipe.
Annually (preferably Sept.)	Structure	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
Annually (preferably Sept.)	Structure	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

An oil/water separator vault is a confined space. Visual inspections should be performed aboveground. If entry is required it should be performed by qualified personnel.

Comments:

**#18 - Maintenance Standard for Coalescing Plate Oil/Water Separators**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Inspection of discharge water for obvious signs of poor water quality.	Sheen, obvious oil present in discharge.	Effluent discharge from vault should be clear with no visible sheen.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6 inches in depth and/or visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Trash and Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
Monthly from Oct. – Apr. and after any major storm event (1” in 24 hours)	General	Oil Accumulation	Oil accumulation that exceeds 1 inch at the water surface.	<p>Oil is extracted from vault using vactoring methods. Dispose of in accordance with state and local rules and regulations.</p> <p>Coalescing plates are cleaned by thoroughly rinsing and flushing. Direct wash-down effluent to the sanitary sewer system where permitted. Should be no visible oil depth on water. Clean separators by October 15 to remove material accumulated during the dry season. Clean separators after spills. Replace wash water with clean water before returning to service.</p>
Annually (preferably Sept.)	Structure	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/ or showing signs of failure.	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Structure	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
Annually (preferably Sept.)	Structure	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced per specifications.
Annually (preferably Sept.)	Structure	Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than one-half inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
Annually (preferably Sept.)	Structure	Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than one-half inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than one-fourth inch at the joint of the inlet/outlet pipe.
Annually (preferably Sept.)	Structure	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

An oil/water separator vault is a confined space. Visual inspections should be performed aboveground. If entry is required it should be performed by qualified personnel.

Comments:

**#19 - Maintenance Standard for Fencing/Shrubbery Screen/Other Landscaping**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr.	General	Missing or broken parts/ dead shrubbery	Any defect in the fence or screen that permits easy entry to a facility.	Fence is mended or shrubs replaced to form a solid barrier to entry.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Erosion	Erosion has resulted in an opening under a fence that allows entry by people or pets.	Replace soil under fence so that no opening exceeds 4 inches in height.
Monthly from Oct. – Apr.	General	Unruly Vegetation	Shrubbery is growing out of control or is infested with weeds.	Shrubbery is trimmed and weeded to provide appealing aesthetics. Do not use chemicals to control weeds.
Annually (preferably Sept.)	Fences	Damaged Parts	Posts out of plumb more than 6 inches.	Posts are within 1.5 inches of plumb.
Annually (preferably Sept.)	Fences	Damaged Parts	Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.
Annually (preferably Sept.)	Fences	Damaged Parts	Any part of fence (including posts, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
Annually (preferably Sept.)	Fences	Damaged Parts	Missing or loose tension wire.	Tension wire in place and holding fabric.
Annually (preferably Sept.)	Fences	Damaged Parts	Missing or loose barbed wire that is sagging more than 2.5 inches between posts.	Barbed wire in place with less than three-fourth inch sag between posts.
Annually (preferably Sept.)	Fences	Damaged Parts	Extension arm missing, broken, or bent out of shape more than 1.5 inches.	Extension arm in place with no bends larger than three-fourth inch.
Annually (preferably Sept.)	Fences	Deteriorated Paint or Protective Coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#20 - Maintenance Standard for Gates**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr.	General	Damaged or Missing Components	Gate is broken, jammed, or missing.	Pond has a functioning gate to allow entry of people and maintenance equipment such as mowers and backhoe. If a lock is used, make sure the City field staff have a key.
Monthly from Oct. – Apr.	General	Damaged or Missing Components	Broken or missing hinges such that gate cannot be easily opened and closed by one maintenance person.	Hinges intact and lubed. Gate is working freely.
Annually (preferably Sept.)	General	Damaged or Missing Components	Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment.	Gate is aligned and vertical.
Annually (preferably Sept.)	General	Damaged or Missing Components	Missing stretcher bands, and ties.	Stretcher bar, bands, and ties in place.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:



**#21 - Maintenance Standard for Grounds (Landscaping)**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr.	General	Weeds (non-poisonous)	Weeds growing in more than 20 percent of the landscaped area (trees and shrubs only).	Weeds present in less than 5 percent of the landscaped area.
Biannually (Spring & Fall)	General	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined in State and Local Regulations. (Apply requirements of adopted integrated vegetation management (IVM) policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with the Pierce County Noxious Weed Control Board). Complete eradication of noxious weeds may not be possible, however compliance with state or local eradication policies are required.
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Trash and Debris	Any trash and debris which exceeds 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)	General	Erosion of Ground Surface	Noticeable rills are seen in landscaped areas.	Causes of erosion are identified and steps taken to slow down/ spread out the water. Eroded areas are filled, contoured, and seeded.
Annually (preferably Sept.)	Trees and shrubs	Damage	Limbs or parts of trees or shrubs that are split or broken which affect more than 25 percent of the total foliage of the tree or shrub.	Trim trees/shrubs to restore shape. Replace severely damaged trees/shrubs.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly from Oct. – Apr.	Trees and shrubs	Damage	Trees or shrubs that have been blown down or knocked over.	Replant tree, inspecting for injury to stem or roots. Replace if severely damaged.
Annually (preferably Sept.)	Trees and shrubs	Damage	Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Place stakes and rubber-coated ties around young trees/shrubs for support.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#22 - Maintenance Standard for Bioretention Facilities**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually and After Major Storm Events	Earthen side slopes and berms	Failure in earthen reservoir	Erosion (gullies/rills) greater than 2 inches deep around inlets, outlet and alongside slopes.	<p>Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting).</p> <p>For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made.</p> <p>Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.</p>
Annually	Earthen side slopes and berms	Failure in earthen reservoir	Erosion of sides causes slope to become a hazard.	Take actions to eliminate the hazard and stabilize slopes.
Annually and After Major Storm Events	Earthen side slopes and berms	Failure in earthen reservoir	Settlement greater than 3 inches (relative to undisturbed sections of the berm).	Restore to design height.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually and After Major Storm Events	Earthen side slopes and berms	Failure in earthen reservoir	Downstream face of berm wet, seeps or leaks evident.	Plug any holes and compact berm (may require consultation with a Washington State Licensed Professional Engineer, particularly for larger berms).
Annually	Earthen side slopes and berms	Failure in earthen reservoir	Any evidence of rodent holes or water piping in berm.	Eradicate rodents (see "Pest control"). Fill holes and compact (may require consultation with a Washington State Licensed Professional Engineer, particularly for larger berms).
Annually	Concrete sidewalls	Failure in sidewalls	Cracks or failure of concrete sidewalls.	Repair/seal cracks. Replace if repair is insufficient.
Annually	Rockery sidewalls	Failure in sidewalls	Rockery side walls are insecure.	Stabilize rockery sidewalls (may require consultation with a Washington State Licensed Professional Engineer particularly for walls 4 feet or greater in height).
As Needed	Facility area	Accumulation of sediment or debris	Trash and debris present.	Clean out trash and debris.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually and After Major Storm Events	Facility bottom area	Accumulation of sediment or debris	Accumulated sediment to the extent that infiltration rate is reduced (See "Ponded water") or surface storage capacity significantly impacted.	Remove excess sediment. Replace any vegetation damaged or destroyed by sediment accumulation and removal. Mulch newly planted vegetation. Identify and control the sediment source (if feasible). If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet.
As Needed During and After Fall Leaf Drop	Facility bottom area	Accumulation of sediment or debris	Accumulated leaves in facility.	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded.
Annually and After Major Storm Events	Low permeability check dams and weirs	Accumulation of sediment or debris	Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice.	Clear the blockage.
Annually and After Major Storm Events	Low permeability check dams and weirs	Failure of check dams and weirs	Erosion and/or undercutting present.	Repair and take preventative measures to prevent future erosion and/or undercutting.
Annually	Low permeability check dams and weirs	Failure of check dams and weirs	Grade board or top of weir damaged and not level.	Restore to level position.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually and After Major Storm Events	Ponded water	Water remains in bioretention facility after storm event	Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	<p>Determine cause and resolve in the following order:</p> <ol style="list-style-type: none"> <li>1) Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris.</li> <li>2) Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain.</li> <li>3) Check for other water inputs (e.g., groundwater, illicit connections).</li> <li>4) Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased.</li> </ol> <p>If steps #1-4 do not solve the problem, the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with a Washington State Licensed Professional Engineer is recommended.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
As needed	Bioretention soil media		Bioretention soil media protection is needed when performing maintenance requiring entrance into the facility footprint.	<p>Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils.</p> <p>Never drive equipment or apply heavy loads in facility footprint.</p> <p>Because the risk of compaction is higher during saturated soil conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions.</p> <p>Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction.</p> <p>If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.</p>
Annually	Splash block inlet	Inlet Failure	Water is not being directed properly to the facility and away from the inlet structure.	Reconfigure/repair blocks to direct water to facility and away from structure.
Monthly during the wet season and before severe storm is forecasted	Curb cut inlet/outlet	Inlet Clogged	Accumulated leaves at curb cuts.	Clear leaves (particularly important for key inlet and low points along long, linear facilities).
Annually	Pipe inlet/outlet	Inlet Pipe Structure Failure	Pipe is damaged.	Repair/replace.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually During the Wet Season	Pipe inlet/outlet	Inlet Pipe Clogged	Pipe is clogged.	Remove roots or debris.
Annually and After Major Storm Events	Pipe inlet/outlet	Inlet Pipe Clogged	Sediment, debris, trash or mulch reducing capacity of inlet/outlet.	Clear the blockage. Identify the source of the blockage and take actions to prevent future blockages.
Weekly During Fall Leaf Drop	Pipe inlet/outlet	Inlet Clogged	Accumulated leaves at the inlets/outlets.	Clear leaves (particularly important for key inlets and low points along long, linear facilities).
Annually	Pipe inlet/outlet	Inlet Blocked	Maintain access for inspections.	Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways. Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.
After Major Storm Events	Trash rack	Trash Rack clogged	Trash or other debris present on trash rack.	Remove/dispose.
Annually	Trash rack	Trash Rack Damaged	Bar screen damaged or missing.	Repair/replace.
Annually and After Major Storm Events	Overflow	Overflow clogged	Capacity reduced by sediment or debris.	Remove sediment or debris/dispose.
As Needed Clean Orifice as Needed, At Least Biannually	Underdrain pipe	Prolonged surface ponding (see "Ponded water")	Plant roots, sediment or debris reducing capacity of underdrain.	Jet clean or rotary cut debris/roots from underdrain(s). If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (Fall and Spring)	Facility bottom area and upland slope vegetation	Dead vegetation	Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more or less than 75% survival rate).	<p>Determine cause of poor vegetation growth and correct condition. Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jurisdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the LID Technical Guidance Manual for Puget Sound).</p> <p>Confirm that plant selection is appropriate for site growing conditions.</p> <p>Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
As needed	Vegetation (general)	Diseased Vegetation	Presence of diseased plants and plant material.	<p>Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants.</p> <p>Disinfect gardening tools after pruning to prevent the spread of disease.</p> <p>See Pacific Northwest Plant Disease Management Handbook for information on disease recognition and for additional resources.</p> <p>Replant as necessary according to recommendations provided for “facility bottom area and upland slope vegetation”.</p>
All Pruning Seasons	Trees and shrubs	Oversized trees and shrubs	Pruning as needed.	<p>Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques.</p> <p>All pruning of mature trees should be performed by or under the direct guidance of an ISA Certified Arborist.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Trees and Shrubs	Oversized trees and shrubs	Large trees and shrubs interfere with operation of the facility or access for maintenance.	<p>Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs.</p> <p>Remove trees and shrubs, if necessary.</p>
Biannually (Fall and Spring)	Trees and shrubs	Dead trees or shrubs	Standing dead vegetation is present.	<p>Remove standing dead vegetation.</p> <p>Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season).</p> <p>If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately.</p> <p>Determine cause of dead vegetation and address issue, if possible.</p> <p>If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (Fall and Spring)	Trees and shrubs		Planting beneath mature trees.	<p>When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil).</p> <p>Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.</p>
Biannually (Fall and Spring)	Trees and shrubs	Tree support	Presence of or need for stakes and guys (tree growth, maturation, and support needs).	<p>Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage.</p> <p>Monitor tree support systems: Repair and adjust as needed to provide support and prevent damage to tree.</p> <p>Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year.</p> <p>Backfill stake holes after removal.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	Line of sight	Vegetation causes some visibility (line of sight) or driver safety issues.	<p>Maintain appropriate height for sight clearance.</p> <p>Regular pruning (more than one time/ 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.</p> <p>Remove or transplant if continual safety hazard.</p> <p>Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.</p>
Annually	Flower plants	Dead flowers	Dead or spent flowers present.	Remove spent flowers (deadhead).
Annually (Fall)	Perennials	Dead plants	Spent plants.	Cut back dying or dead and fallen foliage and stems.
Annually (Spring)	Emergent vegetation	Slow moving or ponded water	Vegetation compromises conveyance.	Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning).

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (Winter and Spring)	Ornamental grasses (perennial)	Dead plant material	Dead material from previous year's growing cycle or dead collapsed foliage.	<p>Leave dry foliage for winter interest.</p> <p>Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow.</p>
Biannually (Winter and Spring)	Ornamental grasses (evergreen)	Dead plant material	Dead growth present in spring.	<p>Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring.</p> <p>Clean, rake, and comb grasses when they become too tall.</p> <p>Cut back to ground or thin every 2-3 years as needed.</p>
Monthly (March - October, preceding seed dispersal)	Vegetation	Noxious weeds	Listed noxious vegetation is present (refer to current Pierce County Noxious Weed Control Board noxious weed list).	<p>By law, class A &amp; B noxious weeds must be removed, bagged and disposed as garbage immediately. Reasonable attempts must be made to remove and dispose of class C noxious weeds.</p> <p>It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions.</p> <p>Apply mulch after weed removal (see "Mulch").</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly (March - October, preceding seed dispersal)	Vegetation	Weeds	Weeds are present.	Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate. Follow IPM protocols for weed management.
Once in early to mid-May and once in early to mid-September	Vegetation	Excessive vegetation	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil.	Edge or trim groundcovers and shrubs at facility edge. Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks. While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
As needed	Vegetation	Excessive vegetation	Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety.	<p>Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics.</p> <p>Determine if plant type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow) .</p> <p>Remove plants that are weak, broken or not true to form; replace in-kind.</p> <p>Thin grass or plants impacting facility function without leaving visual holes or bare soil areas.</p> <p>Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.</p>
As needed	Vegetation	Excessive Vegetation	Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass.	Remove vegetation and sediment buildup.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Following weeding	Vegetation	Mulch	Bare spots (without mulch cover) are present or mulch depth less than 2 inches.	<p>Supplement mulch with hand tools to a depth of 2 to 3 inches.</p> <p>Replenish mulch per O&amp;M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels).</p> <p>Keep all mulch away from woody stems.</p>
Based on manufacturer instructions	Irrigation system (if any)	Plant Watering	Irrigation system present.	Follow manufacturer's instructions for O&M.
Annually	Irrigation system (if any)	Plant Watering	Sprinklers or drip irrigation not directed/ located to properly water plants.	Redirect sprinklers or move drip irrigation to desired areas.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Once every 1-2 weeks or as needed during prolonged dry periods	summer watering (first year)	Plant Watering	Trees, shrubs and ground cover in the first year of establishment period.	<p>10 to 15 gallons per tree.                      3 to 5 gallons per shrub.                      2 gallons water per square foot for groundcover areas.                      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 irrigation system is not present.</p> <ul style="list-style-type: none"> <li>• Pulse water to enhance soil absorption, when feasible.</li> <li>• 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.</li> </ul> <p>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.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Once every 2 -4 weeks or as needed during prolonged dry periods	Summer watering (second and third years)	Plant Watering	Trees, shrubs and groundcovers in the second or third year of establishment period.	<p>10 to 15 gallons per tree.                      3 to 5 gallons per shrub.                      2 gallons water per square foot for groundcover areas.                      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 irrigation system is not present.</p> <ul style="list-style-type: none"> <li>• Pulse water to enhance soil absorption, when feasible.</li> <li>• 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.</li> </ul>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
As needed	Summer watering (after establishment)	Plant Watering	Established vegetation (after 3 years).	Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established. 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.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually and After Major Storm Events	Pest Control	Mosquitoes	Standing water remains for more than 3 days after the end of a storm.	<p>Identify the cause of the standing water and take appropriate actions to address the problem (see “Ponded water”).</p> <p>To facilitate maintenance, manually remove standing water and direct to the stormwater system (if runoff is from non pollution-generating surfaces) or wastewater (if runoff is from pollution-generating surfaces) after getting approval from The City of Tacoma.</p> <p>Use of pesticides or <i>Bacillus thuringiensis israelensis</i> (Bti) may be considered as a temporary measure only. Obtain Aquatic Mosquito Control NPDES General Permit as necessary.</p>
As needed	Pest Control	Nuisance animals	Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces.	<p>Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.).</p> <p>Place predator decoys.</p> <p>Follow IPM protocols for specific nuisance animal issues .</p> <p>Remove pet waste regularly.</p> <p>For public and right-of-way sites consider adding garbage cans with dog bags for picking up pet waste.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Every site visited associated with vegetation management	Pest Control	Insect pests	Signs of pests, such as wilting leaves, chewed leaves, and bark spotting or other indicators.	Reduce hiding places for pests by removing diseased and dead plants. For infestations, follow IPM protocols.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#23 - Maintenance Standard for Rain Gardens**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (During Wet Season)	Earthen side slopes and berms	Failure in earthen reservoir	Persistent soil erosion on slopes.	If erosion persists, water may be flowing into the garden too rapidly. In this case, the slope of the pipe or swale directing water to the garden, or the amount of water may need to be reduced (see "Erosion control at inlet").
Annually	Rockery sidewalls	Failure in sidewalls	Rockery sidewalls are insecure.	Stabilize rockery sidewalls (may require consultation with a Washington State Licensed Professional Engineer particularly for walls 4 feet or greater in height.
Biannually	Rain Garden Footprint	Accumulation of sediment or debris	Trash and debris present.	Clean out trash and debris.
Annually	Facility bottom area	Accumulation of sediment or debris	Visible sediment deposition in the rain garden that reduces drawdown time of water in the rain garden.	Remove sediment accumulation. If sediment is deposited from water entering the rain garden, determine the source and stabilize the area or provide pretreatment.
As Needed, During and After Fall Leaf Drop	Facility Bottom Area	Accumulation of leaves	Accumulated leaves in rain garden may reduce infiltration capacity of rain garden or clog overflow.	Remove Leaves.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually and After Major Storm Events	Ponded Water	Water remains in bioretention facility 3 days after storm event	Excessive ponding water. Ponded water remains in the basin more than 3 days after the end of a storm.	<p>Confirm leaf, debris or sediment buildup in the bottom of the rain garden is not impeding infiltration. If necessary, remove leaf litter/debris/sediment.</p> <p>If this does not solve the problem, consultation with a professional with rain garden expertise is recommended to evaluate the following:</p> <ul style="list-style-type: none"> <li>• Check for other water inputs (e.g., groundwater, illicit connections).</li> <li>• Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased.</li> <li>• Determine if the soil is clogged by sediment accumulation at the surface or if the soil has become overly compacted.</li> </ul>
Annually	Splash Block Inlet	Inlet Failure	Water is not being directed properly to the rain garden and away from the building.	Reconfigure/repair splash blocks to direct water to the rain garden and away from the building.
Annually	Pipe inlet/outlet	Inlet Pipe Structure Failure	Damaged/cracked pipes.	Repair/seal cracks. Replace when repair is insufficient.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Pipe inlet/outlet	Inlet Pipe Clogged	Pipe capacity is reduced by sediment or debris (can cause backups and flooding).	Clear pipes of sediment and debris.
Annually	Erosion control at inlet	Excessive Sedimentation	Rock or cobble is removed or missing and concentrated flows are contacting soil.	Maintain a cover of rock or cobbles to protect the ground where concentrated water flows into the rain garden from a pipe or swale.
As needed	Vegetation	Diseased Vegetation	Dying, dead, or unhealthy plants.	Maintain a healthy cover of plants. Remove any diseased plants or plant parts and dispose of in commercial landfill to avoid risk of spreading the disease to other plants. Disinfect gardening tools after pruning to prevent the spread of disease. Re-stake trees if they need more support, but plan to remove stakes and ties after the first year. Cars can damage roots – protect root areas of trees and plants from vehicle traffic.
As needed	Vegetation	Line of Sight	Vegetation inhibits sight distances and sidewalks.	Keep sidewalks and sight distances on roadways clear.
As needed	Vegetation	Dead Vegetation	Broken, dead, or sucker vegetation is present.	Remove broken or dead branches and suckers.
As needed	Vegetation	Localized Ponding or Obstruction of flow	Vegetation is crowding inlets and outlets.	Keep water inlets and outlines in the rain garden clear or vegetation.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
One time March through June	Vegetation	Dead/ diseased plants	Yellowing: possible Nitrogen (N) deficiency. Poor growth: possible Phosphorous (P) deficiency. Poor flowering, spotting or curled leaves, or weak roots or stems: possible Potassium (K) deficiency.	Test soil to identify specific nutrient deficiencies. Consult with a professional knowledgeable in the area of natural amendments or refer to Natural Lawn and Garden Care resources and avoid synthetic fertilizers. Consider selecting different plants for soil conditions.
As needed, Preceding seed dispersal	Vegetation	Weeds Present	Problem weeds are present.	Remove weeds by hand, especially in spring when the soil is moist and the weeds are small. Dig or pull weeds out by the roots before they go to seed. Apply mulch after weeding (see "Mulch").
Monthly March - October, preceding seed dispersal	Vegetation	Noxious Weeds	Listed noxious vegetation is present (refer to current Pierce County Noxious Weed Control Board noxious weed list).	By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately. Reasonable attempts must be made to remove and dispose of class C noxious weeds. It is strongly encouraged that herbicides not be used in order to protect water quality; use of herbicides may be prohibited in some jurisdictions. Apply mulch after weed removal (see "Mulch").

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Following weeding	Vegetation	Mulch	Bare spots (without mulch cover) are present or mulch depth less than 2 inches.	Supplement mulch, using hand tools, to a depth of 2 to 3 inches. Use coarse compost in the bottom of the rain garden and arborist wood chips on side slopes and rim (above typical water levels). Keep all mulch from being in contact with woody stems.
Once every 1-2 weeks or as needed during prolong dry periods	Summer watering (first year)	Plant Watering	Tree, shrubs and groundcovers in first year of establishment.	10 to 15 gallons per tree. 3 to 5 gallons per shrub. 2 gallons water per square foot for groundcover areas. 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 irrigation system is not present. 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.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Once every 2-4 weeks or as needed during prolonged dry periods	Summer watering (second and third years)	Plant Watering	Tree shrubs and groundcovers in the second or third year of establishment.	<p>10 to 15 gallons per tree.                      3 to 5 gallons per shrub.                      2 gallons water per square foot for groundcover areas.                      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 irrigation system is not present.</p>
As needed	Summer watering (after establishment)	Plant Watering	Established vegetation (after 3 years).	<p>Water during drought conditions or more often if necessary to maintain plant cover. Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different rain garden species and water immediately after initial signs of stress appear.</p>
Biannually and After Major Storm Events	Pest Control	Mosquitoes	Standing water remains for more than 3 days after the end of a storm.	<p>Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water").                      Use of pesticides or <i>Bacillus thuringiensis israelensis</i> (Bti) may be considered as a temporary measure only. Obtain Aquatic Mosquito Control General Permit as necessary.</p>

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#24 - Maintenance Standard for Cisterns**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (Spring & Fall)	Roof	Low flow into cistern or excessive overflow	Debris has accumulated.	Remove debris.
Biannually (Spring & Fall)	Gutter	Low flow into cistern or excessive overflow	Debris has accumulated.	Clean gutters (the most critical cleaning is in mid- to late-spring to flush the pollen deposits from surrounding trees).
Annually (preferably Sept.)	Screens	Excessive sediment accumulation in cistern	Screen has deteriorated.	Replace.
Monthly from Oct. – Apr.	Screens	Low flow into cistern or excessive overflow	Accumulation of material on screen.	Clear screen of any accumulated debris.
Monthly from Oct. – Apr.	Low Flow Orifice	Low or no flow out of cistern.	Material clogging orifice.	Clean low flow orifice.
Biannually (Spring & Fall)	Overflow pipe	Low or no flow out of cistern.	Pipe is damaged.	Repair/replace.
Biannually (Spring & Fall)	Overflow pipe	Low or no flow out of cistern.	Pipe is clogged.	Remove debris.
Annually (preferably Sept.)	Cistern	Excess overflow	Debris has accumulated at bottom of tank.	Remove debris.
At startup	Training and Documentation	Training / written guidance	Training / written guidance is required for proper O&M.	Provide property owners and tenants with proper training and a copy of the O&M manual.
Ongoing	Safety	Access and Safety	Access to cistern required for maintenance or cleaning.	Any cistern detention system opening that could allow the entry of people must be marked: "DANGER—CONFINED SPACE".
Ongoing	Cistern	Leaking Cistern	Excess water around cistern. Damage to cistern.	Disconnect inlets. Contact design engineer.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#25 - Maintenance Standard for Compost Amended Soil**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Soil Media (maintain high organic soil content)	Potential Erosion	Vegetation not fully covering ground surface or vegetation health is poor.	Maintain 2 to 3 inches of mulch over bare areas in landscape beds. Add plants if sufficient space. Re-seed bare turf areas until the vegetation fully covers ground surface.
Ongoing	Soil media (maintain high organic soil content)	Routine Maintenance	None. (routine maintenance)	Return leaf fall and shredded woody materials from the landscape to the site when possible in order to replenish soil nutrients and structure.
Ongoing	Soil media (maintain high organic soil content)	Routine Maintenance	None. (routine maintenance)	On turf areas, "grasscycle" (mulch-mow or leave the clippings) to improve turf health.
Ongoing	Soil media (maintain high organic soil content)	Routine Maintenance	None. (routine maintenance)	Avoid use of pesticides (bug and weed killers) and herbicides, like "weed & feed", which damage the soil.
Annually	Soil media (maintain high organic soil content)	Routine Maintenance	None. (routine maintenance)	Where fertilization is needed (mainly turf and annual flower beds), a moderate fertilization program should be used which relies on compost, natural fertilizers or slow-release synthetic balanced fertilizers. Follow IPM protocols for fertilization procedures.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (inspect during storm event)	Soil media (maintain infiltration)	Wet Soils Ponding	Soils become waterlogged, do not appear to be infiltrating.	<p>To remediate compaction, aerate soil, till to at least 8-inch depth, or further amend soil with compost and re-till.</p> <p>If areas are turf, aerate compacted areas and topdress them with 1/4 to 1/2 inch of compost to renovate them.</p> <p>If drainage is still slow, consider investigating alternative causes (e.g., high wet season groundwater levels, low permeability soils). Also consider site use and protection from compacting activities.</p>
Annually (at least once during the wet season) and after major storm events)	Erosion/ Scouring	Visible Erosion	Areas of potential erosion are visible.	<p>Identify and address cause of erosion (e.g., concentrated flow entering area, channelization of runoff) and stabilize damaged area (regrade, rock, vegetation, erosion control matting).</p> <p>For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Grass/vegetation	Unhealthy Vegetation	Less than 75% of planted vegetation is healthy with a generally good appearance.	Take appropriate maintenance actions (e.g., remove/replace plants). If problem persists, evaluate if vegetation is appropriate for the location (e.g., exposure, soil, soil moisture).
Monthly (March - October, preceding seed dispersal)	Vegetation	Noxious weeds	Listed noxious vegetation is present (refer to current Pierce County Noxious Weed Control Board noxious weed list).	By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately. Reasonable attempts must be made to remove and dispose of class C noxious weeds. 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. It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly (March - October, preceding seed dispersal)	Vegetation	Weeds	Weeds are present.	Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate. Follow IPM protocols for weed management.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#26 - Maintenance Standard for Vegetated Roofs**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (Inspect During Rain Event)	Growth Medium	Ponding or slow infiltration	Water does not permeate growth media (runs off soil surface) or crusting is observed.	Aerate (e.g., rake) or replace medium taking care not to damage the waterproof membrane.
Annually	Growth Medium	Thin growth medium	Growth medium thickness is less than design thickness (due to erosion and plant uptake).	Supplement growth medium to design thickness.
Biannually (at least once during wet season)	Growth Medium	Leaf/Debris Buildup	Fallen leaves or debris are present.	Remove/dispose of debris and fallen leaves.
Annually (at least once during the wet season and after major storm events)	Growth Medium	Erosion and sedimentation	Growth media erosion/ scour is visible (e.g., gullies).	Take steps to repair or prevent erosion. Fill, hand tamp, or lightly compact, and stabilize with additional soil substrate/growth medium (similar in nature to the original material) and additional plants.
Biannually (inspect during plant establishment)	Erosion Control Measures	Erosion	Mat or other erosion control is damaged or depleted during plant establishment period.	Repair/replace erosion control measures until 90% vegetation coverage attained. Avoid application of mulch on extensive vegetated roofs.
Biannually and after major storm events	Roof Drain	Water Flow Issues	Sediment, vegetation, or debris reducing capacity of inlet structure.	Clear blockage. Identify and correct any problems that led to blockage.
Annually	Roof Drain	Water Flow Issues	Pipe is clogged.	Remove roots or debris.
Annually	Roof Drain	Damaged roof drain	Inlet pipe is in poor condition.	Repair/replace.
Annually	Border Zone	Aesthetics	Vegetation is encroaching into border zone aggregate.	Remove and dispose of weeds and transplant desirable vegetation to growth medium area.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Flashing, gravel, stops, utilities, or other structures on roof	Deteriorating roof components	Flashing, utilities or other structures on roof are deteriorating (can serve as source of metal pollution in vegetated roof runoff).	Repair (e.g., recoat) or replace to eliminate potential pollutant source. Note that any work done around flashings and drains should be done with care to protect the waterproof membrane.
Biannually	Access and Safety	Access Concerns	Insufficient egress/ingress routes and fall protection.	Maintain egress and ingress routes to design standards and fire codes. Ensure appropriate fall protection.
Biannually	Vegetation	Plant Coverage	Vegetative coverage falls below 90% (unless design specifications stipulate less than 90% coverage).	Plant bare areas with vegetation. If necessary, install erosion control measures until percent coverage goal is attained.
Annually (first 2 years in spring, as needed thereafter)	Vegetation	Sedum Coverage	Extensive roof with low density sedum population.	Mulch mow sedums-creating cuttings from existing plants to encourage colonization.
Biannually (Fall and Spring)	Dead Plants	Dead Vegetation	Dead vegetation is present.	Normally dead plant material can be recycled on the roof; however, specific plants or aesthetic considerations may warrant removing and replacing dead material (see manufacturer's recommendations).
All pruning seasons (timing varies by species)	Trees and shrubs - intensive vegetated roof	Plants Overgrown	Pruning as needed.	All pruning of mature trees should be performed by or under the direct guidance of an ISA Certified Arborist.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Vegetation - extensive vegetated roof	Fertilization	Poor plant establishment and possible nutrient deficiency in growth medium.	<p>Allow organic debris to replenish and maintain long-term nutrient balance and growth medium structure. Conduct annual soil test 2-3 weeks prior to the spring growth flush to assess need for fertilizer. Utilize test results to adjust fertilizer type and quantity appropriately. Apply minimum amount slow-release fertilizer necessary to achieve successful plant establishment. Apply fertilizer only after acquiring required approval from facility owner and operator. Note that extensive vegetated roofs are designed to require zero to minimal fertilization after establishment (excess fertilization can contribute to nutrient export).</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Vegetation	Fertilization - intensive vegetated roof	Fertilization may be necessary during establishment period or for plant health and survivability after establishment.	Conduct annual soil test 2-3 weeks prior to the spring growth flush to assess need for fertilizer. Utilize test results to adjust fertilizer type and quantity appropriately. Apply minimum amount slow-release fertilizer necessary to achieve successful plant establishment. Apply fertilizer only after acquiring required approval from facility owner and operator. Intensive vegetated roofs may require more fertilization than extensive vegetated roofs.
Monthly (March-October) Preceding Seed Dispersal	Vegetation	Weeds	Weeds are present.	Remove weeds with their roots manually with pincer-type weeding tools or hot water weeders as appropriate. Follow IPM protocols for weed management.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Monthly (March-October Preceding Seed Dispersal)	Vegetation - intensive vegetated roof	Noxious Weeds	Listed Noxious vegetation is present (refer to the Pierce County Noxious Control Board noxious weed list).	By law, class A & B noxious weeds must be removed, bagged and disposed as garbage immediately. Reasonable attempts must be made to remove and dispose of class C noxious weeds. It is strongly encouraged that herbicides and pesticides not be used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions.
Based on manufacturer's Instructions	Irrigation System (if any)	Irrigation	Irrigation system present and functioning.	Follow manufacturer's instructions for operation and maintenance.
Once every 1-2 weeks as needed during prolonged dry periods	Summer watering - extensive vegetated roof	Watering	Vegetation in establishment period (1-2 years).	Water weekly during periods of no rain to ensure establishment (30 to 50 gallons per 100 square feet).
Once every 1-2 weeks as needed during prolonged dry periods	Summer watering - intensive vegetated roof	Watering	Vegetation in establishment period (1-2 years).	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 irrigation system not present.
As needed	Summer watering - intensive vegetated roof	Watering	Established vegetation (after 2 years).	Water during drought conditions or more often if necessary to maintain plant cover.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually and After Major Storm Events	Pests	Mosquito	Standing water remains for more than 3 days after the end of a storm.	Identify the cause of the standing water and take appropriate actions to address the problem (e.g., aerate or replace medium, unplug drainage). Manually remove standing water and direct to stormwater system. Use of pesticides or Bacillus thuringiensis israelensis (Bti) may be considered as a temporary measure only. Obtain Aquatic Mosquito Control General Permit as necessary..
As Needed	Pests	Nuisance Animals	Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces.	Reduce site conditions that attract nuisance species. Place predator decoys. Follow IPM protocols for specific nuisance animal issues.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#27 - Maintenance Standard for Pervious Pavement**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually and After Major Storm Events	Permeable Pavements, All	Excessive Sedimentation	Runon from adjacent areas deposits soil, mulch or sediment on paving.	Clean deposited soil or other materials. Check if surface elevation of adjacent planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place). Mulch and/or plant all exposed soils that may erode to pavement surface.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually or Biannually	Porous asphalt or pervious concrete	Routine Maintenance	None (routine maintenance)	<p>Clean surface debris from pavement surface using one or a combination of the following methods: Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves).</p> <p>Vacuum/sweep permeable paving installation using:</p> <ul style="list-style-type: none"> <li>• Walk-behind vacuum (sidewalks)</li> <li>• High efficiency regenerative air or vacuum sweeper (roadways, parking lots)</li> <li>• ShopVac or brush brooms (small areas)</li> <li>• Hand held pressure washer or power washer with rotating brushes</li> </ul> <p>Follow equipment manufacturer guidelines for determining when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (inspect during rain event)	Porous asphalt or pervious concrete	Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	Surface is clogged.	<p>Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility).                      Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability.                      To clean clogged pavement surfaces, use one or combination of the following methods:</p> <ul style="list-style-type: none"> <li>• Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate. Hand held pressure washer or power washer with rotating brushes.</li> <li>• Pure vacuum sweepers.</li> </ul>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Porous asphalt or pervious concrete	Sedimentation	Sediment present at the surface of the pavement.	Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above. Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
Annually (Summer)	Porous Asphalt or pervious concrete	Moss Growth	Moss growth inhibits infiltration or poses slip/safety hazard.	Sidewalks: Use a stiff broom to remove moss in the summer when it is dry. Parking lots and roadways: Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Porous Asphalt or pervious concrete	Damaged Pavement	Major cracks or trip hazards and concrete spalling and raveling.	<p>Fill potholes or small cracks with patching mixes.</p> <p>Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible.</p> <p>Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function.</p> <p>Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually or Biannually	Interlocking concrete paver blocks and aggregate pavers	Routine Maintenance	None (routine maintenance)	<p>Clean pavement surface using one or a combination of the following methods: Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves).</p> <p>Vacuum/sweep permeable paving installation using:</p> <ul style="list-style-type: none"> <li>• Walk-behind vacuum (sidewalks)</li> <li>• High efficiency regenerative air or vacuum sweeper (roadways, parking lots)</li> <li>• ShopVac or brush brooms (small areas)</li> </ul> <p>Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.</p>

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (inspect during rain event)	Interlocking concrete paver blocks and aggregate pavers	Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate).	Surface is clogged.	<p>Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility).</p> <p>Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet.</p> <p>If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability.</p> <p>Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper). Replace aggregate in paver cells, joints, or openings per manufacturer's recommendations.</p>



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Interlocking concrete paver blocks and aggregate pavers	Sedimentation	Sediment present at the surface of the pavement.	Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above. Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
Annually	Interlocking concrete paver blocks and aggregate pavers	Moss Growth	Moss growth inhibits infiltration or poses slip/safety hazard.	Sidewalks: Use a stiff broom to remove moss in the summer when it is dry. Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface.
Annually	Interlocking concrete paver blocks and aggregate pavers	Damaged Surface	Paver block missing or damaged.	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations.
Annually	Interlocking Concrete paver blocks and aggregate pavers	Damaged Surface	Loss of aggregate material between paver blocks.	Refill per manufacturer's recommendations for interlocking paver sections.
Annually	Interlocking concrete paver blocks and aggregate pavers	Damaged Surface	Settlement of surface.	May require resetting.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually or Biannually	Open-celled paving grid with gravel	Routine Maintenance	None (routine maintenance).	Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves). Follow equipment manufacturer guidelines for cleaning surface.
Annually (inspect during rain event)	Open-celled paving grid with gravel	Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	Aggregate is clogged.	Use vacuum truck to remove and replace top course aggregate. Replace aggregate in paving grid per manufacturer's recommendations.
Annually	Open-celled paving grid with gravel	Damaged Surface	Paving grid missing or damaged.	Remove pins, pry up grid segments, and replace gravel. Replace grid segments where three or more adjacent rings are broken or damaged. Follow manufacturer guidelines for repairing surface.
Annually	Open-celled paving grid with gravel	Damaged Surface	Settlement of surface.	May require resetting.
Annually	Open-celled paving grid with gravel	Damaged Surface	Loss of aggregate material in paving grid.	Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Open-celled paving grid with gravel	Weeds	Weeds present.	Manually remove weeds. Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue).
Annually or Biannually	Open-celled paving grid with grass	Routine Maintenance	None (routine maintenance).	Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves). Follow equipment manufacturer guidelines for cleaning surface.
Annually (inspect during rain event)	Open-celled paving grid with grass	Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	Aggregate is clogged.	Rehabilitate per manufacturer's recommendations.
Annually	Open-celled paving grid with grass	Damaged Surface	Paving grid missing or damaged.	Remove pins, pry up grid segments, and replace grass. Replace grid segments where three or more adjacent rings are broken or damaged. Follow manufacturer guidelines for repairing surface.
Annually	Open-celled paving grid with grass	Damaged Surface	Settlement of surface.	May require resetting.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Open-celled paving grid with grass	Aesthetics, erosion potential	Poor grass coverage in paving grid.	Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed. Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible.
As Needed	Open-celled paving grid with grass	Routine Maintenance	None (routine maintenance).	Use a mulch mower to mow grass.
Annually	Open-celled paving grid with grass	Routine Maintenance	None (routine maintenance).	Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in. Do not use fertilizer.
Annually	Open-celled paving grid with grass	Weeds	Weeds present.	Manually remove weeds. Mow, torch, or inoculate and replace with preferred vegetation.
Annually	Inlet/outlet pipe	Water Flow	Pipe is damaged.	Repair/replace.
Annually	Inlet/outlet pipe	Water Flow	Pipe is clogged.	Remove roots or debris.
As needed, clean orifice at least biannually	Underdrain pipe	Water Flow	Plant roots, sediment, or debris is reducing capacity of underdrain (may cause prolonged drawdown period).	Jet clean or rotary cut debris/roots from underdrain(s). If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
As needed, clean orifice at least biannually	Raised subsurface overflow pipe	Water Flow	Plant roots, sediment, or debris is reducing capacity of underdrain.	Jet clean or rotary cut debris/roots from under-drain(s). If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.
Annually and After Major Storm Events	Outlet structure	Water Flow	Sediment vegetation, or debris reducing capacity of outlet structure.	Clear the blockage. Identify the source of the blockage and take actions to prevent future blockages.
Biannually	Overflow	Erosion Potential	Native soil is exposed or other signs of erosion damage are present at discharge location.	Repair erosion and stabilize surface.
Annually and After Major Storm Events	Observation port	Water ponding or infiltrating slowly	Water remains in the storage aggregate longer than anticipated by design after the end of the storm.	If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.
As needed	Adjacent large shrubs or trees	Water ponding or infiltrating slowly	Vegetation related fallout clogs or will potentially clog voids.	Sweep leaf litter and sediment to prevent surface clogging and ponding. Prevent large root systems from damaging subsurface structural components.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Once in May and Once in September	Adjacent large shrubs or trees	Aesthetics	Vegetation growing beyond facility edge onto sidewalks, paths and street edge.	Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.
In fall (October to December) after leaf drop (1-3 times, depending on canopy cover)	Leaves, needles, and organic debris	Clog Potential	Accumulation of organic debris and leaf litter.	Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

## **#28 - Emerging Technologies**

At a minimum all stormwater devices must be inspected every six months and after every major storm event. Use the manufacturer's recommendations as tailored to the use of the site and as outlined in the Operation and Maintenance Manual. Operations and Maintenance shall conform to any Ecology issued use level designation as applicable.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#29 - General Maintenance Concerns for Stormwater Facilities**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Based on manufacturers instructions	Irrigation	Irrigation system (if any)	Irrigation system present.	Follow manufacturer's instructions for O&M.
Weekly (May – September)	Irrigation	Plant watering	Plant establishment period (1-3 years).	Water weekly during periods of no rain to ensure plant establishment.
As Needed	Irrigation	Plant watering	Longer term period (3+ years).	Water during drought conditions or more often if necessary to maintain plant cover.
Ongoing	Spill Prevention and Response	Spill prevention	Storage or use of potential contaminants in the vicinity of facility.	Exercise spill prevention measures whenever handling or storing potential contaminants.
As needed	Spill Prevention and Response	Spill response	Release of pollutants. Call to report any spill to City of Tacoma Source Control 253.502.2222.	Cleanup spills as soon as possible to prevent contamination of stormwater.
At startup	Training and Documentation	Training / written guidance	Training / written guidance is required for proper O&M.	Provide property owners and tenants with proper training and a copy of the O&M manual.
Annually (preferably Sept.)	Safety	Safety (slopes)	Erosion of sides causes slope to exceed 1:4 or otherwise becomes a hazard.	Restore to design slope.
Annually (preferably Sept.)	Safety	Safety (hydraulic structures)	Hydraulic structures (pipes, culverts, vaults, etc.) become a hazard to children playing in and around the facility.	Take actions to eliminate the hazard (such as covering and securing any openings).
Annually (preferably Sept.)	Safety	Line of sight	Vegetation causes some visibility (line of sight) or driver safety issues.	Prune or replace plants as necessary.
Annually (preferably Sept.)	Aesthetics	Aesthetics	Damage/vandalism/debris accumulation.	Clean, repair, and restore facility to original aesthetic conditions.



Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (preferably Sept.)	Aesthetics	Grass/vegetation	Less than 75% of planted vegetation is healthy with a generally good appearance.	Take appropriate maintenance actions. (e.g., remove/replace plants, amend soil, etc.).
Annually (preferably Sept.)	Aesthetics	Edging	Grass is starting to encroach on facility.	Repair edging. Remove encroaching grass. Install additional measures to prevent encroachment.
Annually (preferably Sept.)	General	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation may constitute a hazard to maintenance personnel or to the public. Any evidence of noxious weeds as defined by the State or local regulations. The Washington State Noxious Weed Control Board has a list of common noxious weeds at <a href="http://www.nwcb.wa.gov">www.nwcb.wa.gov</a> .	No danger of poisonous vegetation. Compliance with state or local eradication policies is required. Apply requirements of adopted integrated pest management plan as necessary.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#30 - Maintenance Standard for Trees**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Once a year for the first three years	Trees	Future failure	Weak branch attachments; co-dominant stems.	Structural Pruning <sup>a</sup> .
As needed	Trees	Threat to public safety	Low branches that may cause safety concerns if they remain.	Crown Raising <sup>a</sup> .
As needed, for safety	Trees	Threat to public safety	Dead, diseased and/or broken branches.	Pruning to remove dead, diseased and/or broken branches.
As needed	Trees	Threat to public safety	Dead, severely damaged or declining.	Replace per planting plan or acceptable substitute.

- a. Trees shall be pruned according to industry standards, ANSI A300 Part 1 and the International Society of Arboriculture’s Best Management Practices - Tree Pruning.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

Comments:

**#31 - Maintenance Standard for Downspout Infiltration Trench or Drywell**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually (Fall and Spring)	Surface of trench/well (i.e., water enters through exposed aggregate)	Water not reaching facility	Accumulated trash, debris, or sediment on drain rock surface impedes sheet flow into facility.	Remove/dispose in accordance with local solid waste requirements.
Annually (At least one visit during the wet season)	Surface of trench/well (i.e., water enters through exposed aggregate)	Water not reaching facility	Vegetation/moss present on drain rock surface impedes sheet flow into facility.	Maintain open, freely draining drain rock surface.
Biannually (Fall and Spring)	Drain Rock	Ponding	If water enters the facility from the surface, inspect to see if water is ponding at the surface during storm events. If buried drain rock, observe drawdown through observation port or cleanout.	Clear piping through facility when ponding occurs. Replace rock/sand reservoirs as necessary. Tilling of subgrade below reservoir may be necessary (for trenches) prior to backfill.
Annually (at least once during the wet season)	Pipe(s)	Water flow issues	Accumulation of trash, debris, or sediment in roof drains, gutters, driveway drains, area drains, etc.	Remove/ dispose.
Annually (at least once during the wet season)	Pipe(s)	Sedimentation	Pipe from sump to trench or drywell has accumulated sediment or is plugged.	Clear sediment from inlet/outlet pipe screen and inlet/outlet pipe. Cleaning operation should not move sediment into rock layer. Remove and dispose of sediment.
Annually (at least once during the wet season)	Pipe(s)	Damaged piping, water flow impeded	Cracked, collapsed, broken, or misaligned drain pipes.	Repair/seal cracks. Replace when repair is insufficient.
Biannually (at least once during the wet season)	Roof Downspout	Erosion Potential	Splash pad missing or damaged.	Repair/ replace.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (at least once during the wet season)	Roof Downspout	Water flow impeded	Leaves or other debris plugging downspout.	Remove/ dispose.
Annually	Sump	Water flow impeded	Sediment in the sump.	Remove/ dispose in accordance with local solid waste requirements.
Annually	Access Lid	Damaged Lid	Cannot be easily opened.	Repair/ replace.
Annually	Access Lid	No lid	Buried.	Refer to record drawings for design intent. If the access lid was designed to be exposed, expose and restore to surface grade.
Annually	Access Lid	Missing lid	Lid not present.	Replace.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588.

**#32 - Maintenance Standard for Downspout Dispersion**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
<b>Splashblocks</b>				
Biannually	Splash Block	Water flow incorrect	Water is being directed towards building structure.	Reconfigure/ repair splash blocks to direct water away from building structure.
Biannually	Splash Block	Erosion Potential	Water disrupts soil media.	Reconfigure/ repair blocks, repair eroded soil, replant as necessary.
<b>Sheet Flow Dispersion</b>				
Annually	Transition Zone	Erosion Potential	Adjacent soil erosion; uneven surface creating concentrated flow discharge; or less than 2 feet of width.	Repair/replace transition zone to meet design criteria and eliminate concentrated flows.
<b>Downspout Dispersion – Dispersion Trench</b>				
Annually	Dispersion trench	Water flow issues	Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” from edge of trench; intent is to prevent erosion damage).	Remove debris from trench surface, if necessary. Realign notched grade board or other distributor type, if possible. Rebuild trench to standards, if necessary.
Biannually (Fall and Spring)	Surface of Dispersion Trench	Flow impeded	Accumulated trash, debris, or sediment on drain rock surface impedes sheet flow from facility.	Remove/dispose in accordance with local solid waste requirements.
Annually (at least once during the wet season)	Surface of Dispersion Trench	Sheet flow impeded	Vegetation/moss present on drain rock surface impedes sheet flow from facility.	Maintain open, freely draining drain rock surface.
Annually (at least once during the wet season)	Pipe to dispersion trench	Flow impeded	Accumulation of trash, debris, or sediment in roof drains, gutters, driveway drains, area drains, etc.	Remove/ dispose.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually (at least once during the wet season)	Pipe to dispersion trench	Flow Impeded	Pipe from sump to trench or drywell has accumulated sediment or is plugged.	Clear sediment from inlet/outlet pipe screen and inlet/outlet pipe.
Annually (at least once during the wet season)	Pipe to dispersion trench	Flow Impeded	Cracked, collapsed, broken, or misaligned drain pipes.	Repair/seal cracks. Replace when repair is insufficient.
Annually	Sump	Sediment Buildup	Sediment in the sump.	Remove/ dispose in accordance with local solid waste requirements. Clear sediment from inlet/outlet pipe screen and/or inlet/outlet pipe. Do not flush sediment downstream.
Annually	Access Lid	Damaged Cover	Cannot be easily opened.	Repair/replace.
Annually	Access Lid	No Cover	Buried.	Refer to record drawings for design intent. If the access lid was designed to be exposed, expose and restore to surface grade.
Annually	Access Lid	Missing Cover	Cover missing.	Replace.
<b>Rock Pad (Concentrated Flow Dispersion)</b>				
Annually	Rock pad	Erosion Potential	Only one layer of rock exists above native soil in area 6 square feet or larger, or any exposure of native soil.	Replace/ repair rock pad to meet design standards. Enlarge pad size or add additional courses of rock, if necessary.
Annually	Rock pad	Erosion	Soil erosion in or adjacent to rock pad.	Repair/replace rock pad to meet design standards.
<b>Dispersal Area</b>				
Biannually and After Major Storm Events	Dispersal area (general)	Erosion	Erosion (gullies/ rills) greater than 2 inches deep in dispersal area.	Eliminate cause of erosion and stabilize damaged area (regrade, rock, revegetate).

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Biannually and After Major Storm Events	Dispersal area (general)	Flow impeded	Accumulated sediment or debris to extent that blocks or channelizes flowpath.	Remove excess sediment or debris. Identify and control the sediment source (if feasible).
Biannually and After Major Storm Events	Ponded water	Standing water	Standing surface water in dispersion area remains for more than 3 days after the end of a storm event.	Identify the cause of the standing water (e.g., grade depressions, compacted soil) and take appropriate actions to address the problem (e.g., regrade to eliminate depressions or aerate/amend soils).
Biannually	Plant establishment		Dispersal area vegetation in establishment period (1-2 years, or additional 3rd year during extreme dry weather).	Water weekly during periods of no rain to ensure plant establishment.
As Needed	Vegetation	Vegetation cover inadequate	Poor vegetation cover such that erosion is occurring.	Ensure proper care (e.g., watering). Assess for nutrient deficiencies. Replant as needed with appropriate plant species for the soil and moisture conditions. Consider amending soils to promote plant health.
Biannually and After Major Storm Events	Vegetation	Flow impeded.	Vegetation inhibits dispersed flow along flowpath.	Trim, weed or replant to restore dispersed flowpath.
<b>Storage Sump</b>				
Annually	Sump	Sediment	Accumulated sediment in the sump.	Remove/ dispose in accordance with local solid waste requirements. Clear sediment from inlet/outlet pipe screen and/or inlet/outlet pipe.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
Annually	Access Lid	Lid Broken	Cannot be easily opened.	Repair/replace.
Annually	Access Lid	Cannot find lid.	Buried.	Expose and restore to surface grade.
Annually	Access Lid	Lid Missing	Lid missing.	Replace.
<b>Pest Control</b>				
As Needed	Pest Control	General Pests	Signs of pest infestations (IPM protocol threshold(s) are exceeded).	Follow IPM protocols for weed and pest management.
Biannually and After Major Storm Events	Pest Control	Mosquitoes	Standing surface water in dispersion area remains for more than 3 days after the end of a storm.	Identify the cause of the standing water and take appropriate actions to address the problem. Use of pesticides or <i>Bacillus thuringiensis israelensis</i> (Bti) may be considered as a temporary measure only. Obtain Aquatic Mosquito Control General Permit as necessary.
As Needed	Pest Control	Rodents	Rodent holes or mounds disturb dispersion flowpaths.	Fill and compact soil around the holes and vegetate to restore flowpath.

If you are unsure whether a problem exists, please contact Environmental Services at 253.591.5588



**#33 - Maintenance Standard for Media Filter Drains**

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
	General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	General	No-vegetation zone/flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean to spread flows evenly over entire embankment width.
	General	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost; or, replant with plugs of grass from the upper slope.
	General	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation to not impede flow. Mow grass to a height of 6 inches.
	General	Media filter drain mix replacement	Water is seen on the surface of the media filter drain mix long after the storms have ceased. Typically, the 6-month, 24-hour precipitation event should drain within 48 hours. More common storms should drain within 24 hours. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.

Recommended Inspection Frequency	Stormwater System Feature	Problem	Condition When Maintenance is Required	Maintenance Activities and Conditions that Should Exist
	General	Excessive shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	General	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.
	General	Flooding of Media filter drain	When media filter drain is inundated by flood water	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.

**APPENDIX A-5**  
**WSDOT 2019 Highway Runoff**  
**Manual, Chapter 5 Stormwater Best**  
**Management Practices Maintenance**  
**Standards**

Table 5-10 Maintenance standards for detention ponds.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and debris	Accumulations exceed 5 cubic feet (about equal to the amount of trash needed to fill one standard-size garbage can) per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of the next scheduled maintenance.	Trash and debris are cleared from site.
	Poisonous vegetation and noxious weeds	Poisonous or nuisance vegetation may constitute a hazard to maintenance personnel or the public. Noxious weeds as defined by state or local regulations are evident. (Apply requirements of adopted integrated pest management [IPM] policies for the use of herbicides).	No danger is posed by poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department.) Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies is required.
	Contaminants and pollution	Oil, gasoline, contaminants, or other pollutants are evident. (Coordinate removal/cleanup with local water quality response agency.)	No contaminants or pollutants are present.
	Rodent holes	For facilities acting as a dam or berm: rodent holes are evident or there is evidence of water piping through dam or berm via rodent holes.	Rodents are destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)
	Beaver dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies.)
	Insects	Insects such as wasps and hornets interfere with maintenance activities.	Insects are destroyed or removed from site. Insecticides are applied in compliance with adopted IPM policies.
	Tree growth and hazard trees	Tree growth does not allow maintenance access or interferes with maintenance activity (slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove. Dead, diseased, or dying trees are observed. (Use a certified arborist to determine health of tree or removal requirements.)	Trees do not hinder maintenance activities. Harvested trees can be processed or converted to mulch and either kept on site where it can be used as needed around the BMP, or taken off site. Hazard trees are removed.
Side slopes of pond	Erosion	Eroded damage is over 2 inches deep and cause of damage is still present, or there is potential for continued erosion. Erosion is observed on a compacted berm embankment.	Slopes are stabilized using appropriate erosion control measures (such as rock reinforcement, planting of grass, and compaction). If erosion is occurring on compacted berms, a licensed civil engineer should be consulted to resolve source of erosion.

Table 5-10 Maintenance standards for detention ponds (continued).

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage area	Sediment	Accumulated sediment exceeds 10% of the designed pond depth, unless otherwise specified, or affects inletting or outletting condition of the facility.	Sediment is cleaned out to designed pond shape and depth. Pond is reseeded if necessary to control erosion.
	Liner (if applicable)	Liner is visible and has more than three ¼-inch holes in it.	Liner is repaired or replaced. Liner is fully covered.
Pond berms (dikes)	Settlements	Any part of berm has settled 4 inches lower than the design elevation. (If settlement is apparent, measure berm to determine amount of settlement.)  Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Water flow is discernible through pond berm. Ongoing erosion is observed, with potential for erosion to continue.  (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)	Piping is eliminated. Erosion potential is resolved.
Emergency overflow/spillway and berms over 4 feet high	Tree growth	Tree growth on emergency spillways reduces spillway conveyance capacity and may cause erosion elsewhere on the pond perimeter due to uncontrolled overtopping.  Tree growth on berms over 4 feet high may lead to piping through the berm, which could lead to failure of the berm and related erosion or flood damage.	Trees should be removed. If root system is small (base less than 4 inches), the root system may be left in place; otherwise, the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Piping	Water flow is discernible through pond berm. Ongoing erosion is observed, with potential for erosion to continue.  (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)	Piping is eliminated. Erosion potential is resolved.
Emergency overflow/spillway	Spillway lining insufficient	Only one layer of rock exists above native soil in area 5 square feet or larger, or native soil is exposed at the top of outflow path of spillway.  (Riprap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.

Table 5-11 Maintenance standards for bioinfiltration ponds/infiltration trenches/basins.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
<b>General</b>	Trash and debris	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
	Poisonous/noxious vegetation	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
	Contaminants and pollution	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
	Rodent holes	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
<b>Storage area</b>	Sediment	Water ponds in infiltration pond after rainfall ceases and appropriate time has been allowed for infiltration.  (A percolation test pit or test of facility indicates facility is working at only 90% of its designed capabilities. If 2 inches or more of sediment present, remove sediment).	Sediment is removed or facility is cleaned so that infiltration system works according to design.
<b>Rock filters</b>	Sediment and debris	By visual inspection, little or no water flows through filter during heavy rainstorms.	Gravel in rock filter is replaced.
<b>Side slopes of pond</b>	Erosion	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
<b>Emergency overflow/spillway and berms over 4 feet high</b>	Tree growth	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
	Piping	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
<b>Emergency overflow/spillway</b>	Rock missing	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
	Erosion	See <a href="#">Table 5-23</a> (wet ponds).	See <a href="#">Table 5-23</a> (wet ponds).
<b>Presettling ponds and vaults</b>	Facility or sump filled with sediment or debris	Sediment/debris exceeds 6 inches or designed sediment trap depth.	Sediment is removed.

Table 5-12 Maintenance standards for closed treatment systems (tanks/vaults).

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage area	Plugged air vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents are open and functioning.
	Debris and sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter.  (Example: 72-inch storage tank requires cleaning when sediment reaches depth of 7 inches for more than ½ the length of the tank.)	All sediment and debris are removed from storage area.
	Joints between tank/pipe section	Openings or voids allow material to be transported into facility.  (Will require engineering analysis to determine structural stability.)	All joints between tank/pipe sections are sealed.
	Tank/pipe bent out of shape	Any part of tank/pipe is bent out of shape for more than 10% of its design shape.  (Review required by engineer to determine structural stability.)	Tank/pipe is repaired or replaced to design specifications.
	Vault structure: includes cracks in walls or bottom, damage to frame or top slab	Cracks are wider than ½ inch and there is evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault is replaced or repaired to design specifications and is structurally sound.
Cracks are wider than ½ inch at the joint of any inlet/outlet pipe, or there is evidence of soil particles entering the vault through the walls.		No cracks are more than ¼-inch wide at the joint of the inlet/outlet pipe.	
Manhole	Cover not in place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than ½ inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover difficult to remove	One maintenance person cannot remove lid after applying normal lifting pressure.  <i>Intent: To prevent cover from sealing off access to maintenance.</i>	Cover can be removed and reinstalled by one maintenance person.
	Ladder unsafe	Ladder is unsafe due to missing rungs, misalignment, unsecure attachment to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch basins	See <a href="#">Table 5-15</a> (catch basins).	See <a href="#">Table 5-15</a> (catch basins).	See <a href="#">Table 5-15</a> (catch basins).

Table 5-13 Maintenance standards for control structure/flow restrictor.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and debris (includes sediment)	Accumulation exceeds 25% of sump depth or is within 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris are removed.
	Structural damage	Structure is not securely attached to manhole wall.	Structure is securely attached to wall and outlet pipe.
		Structure is not in upright position; allow up to 10% from plumb.	Structure is in correct position.
		Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are watertight; structure is repaired or replaced and works as designed.
		Holes other than designed holes are observed in the structure.	Structure has no holes other than designed holes.
Cleanout gate	Damaged or missing	Cleanout gate is not watertight or is missing.	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.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
Orifice plate	Damaged or missing	Control device is not working properly due to missing, out-of-place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Trash, debris, sediment, or vegetation blocks the plate.	Plate is free of all obstructions and works as designed.
Overflow pipe	Obstructions	Trash or debris blocks (or has the potential to block) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See <a href="#">Table 5-13</a> (closed treatment systems).	See <a href="#">Table 5-13</a> (closed treatment systems).	See <a href="#">Table 5-13</a> (closed treatment systems).
Catch basin	See <a href="#">Table 5-15</a> (catch basins).	See <a href="#">Table 5-15</a> (catch basins).	See <a href="#">Table 5-15</a> (catch basins).



Table 5-14 Maintenance standards for catch basins.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and debris	Trash or debris is immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris is immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) exceeds 60% 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 is clearance less than 6 inches from the debris surface to the invert of the lowest pipe.	No trash or debris is in the catch basin.
		Trash or debris in any inlet or outlet pipe blocks more than ¼ of its height.	Inlet and outlet pipes are free of trash or debris.
		Dead animals or vegetation could generate odors that might cause complaints or dangerous gases (such as methane).	No vegetation or dead animals are present within the catch basin.
	Sediment	Sediment (in the basin) exceeds 60% of the sump depth as measured from the bottom of the basin to invert of the lowest pipe into or out of the basin, but in no case is clearance less than 6 inches from the sediment surface to the invert of the lowest pipe.	No sediment is 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 ¼ inch. <i>Intent: To make sure no material is running into basin.</i>	Top slab is free of holes and cracks.
		Frame is not sitting flush on top slab (separation of more than ¼ inch of the frame from the top slab). Frame is not securely attached.	Frame is sitting flush on the riser rings or top slab and is firmly attached.
	Fractures or cracks in basin walls/bottom	Maintenance person judges that structure is unsound.	Basin is replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe, or there is evidence that soil particles have entered catch basin through cracks.	Pipe is regouted and secure at the basin wall.
	Settlement/misalignment	Failure of basin has created a safety, function, or design problem.	Basin is replaced or repaired to design standards.
	Vegetation	Vegetation is growing across and blocking more than 10% of the basin opening.	No vegetation blocks the opening to the basin.
		Vegetation growing in inlet/outlet pipe joints is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth is present.
	Contamination and pollution	Oil, gasoline, contaminants, or other pollutants are evident. <i>(Coordinate removal/cleanup with local water quality response agency.)</i>	No pollution is 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 ½ inch of thread.	Mechanism opens with proper tools.
Catch basin cover (continued)	Cover difficult to remove	One maintenance person cannot remove lid after applying normal lifting pressure. <i>Intent: To prevent cover from sealing off access to maintenance.</i>	Cover can be removed by one maintenance person.

Table 5-14 Maintenance standards for catch basins (continued).

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Ladder	Ladder unsafe	Ladder is unsafe due to missing rungs, insecure attachment to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance staff safe access.
Metal grates (if applicable)	Grate opening unsafe	Grate opening is wider than 7/8 inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris block more than 20% of grate surface inletting capacity.	Grate is free of trash and debris.
	Damaged or missing	Grate is missing or components of the grate are broken.	Grate is in place and meets design standards.

Table 5-15 Maintenance standards for debris barriers (such as trash racks).

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

Table 5-16 Maintenance standards for energy dissipaters.

Maintenance Components	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
<b>External:</b>			
<b>Rock pad</b>	Missing or moved rock	Only one layer of rock exists above native soil in area 5 square feet or larger, or native soil is exposed.	Rock pad is replaced to design standards.
	Erosion	Soil erosion is evident in or adjacent to rock pad.	Rock pad is replaced to design standards.
<b>Dispersion trench</b>	Pipe plugged with sediment	Accumulated sediment exceeds 20% of the design depth.	Pipe is cleaned/flushed so that it matches design.
	Not discharging water properly	There is visual evidence of water discharging at concentrated points along trench—normal condition is a “sheet flow” of water along trench. <i>Intent: To prevent erosion damage.</i>	Trench is redesigned or rebuilt to standards.
	Perforations plugged	Over ½ of perforations in pipe are plugged with debris and sediment.	Perforated pipe is cleaned or replaced.
	Water flows out top of “distributor” catch basin	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm, or water is causing (or appears likely to cause) damage.	Facility is rebuilt or redesigned to standards.
	Receiving area over-saturated	Water in receiving area is causing (or has potential of causing) landslide problems.	There is no danger of landslides.
<b>Internal:</b>			
<b>Manhole/chamber</b>	Worn or damaged post, baffles, side of chamber	Structure dissipating flow deteriorates to ½ of original size or any concentrated worn spot exceeds 1 square foot, which would make structure unsound.	Structure is replaced to design standards.
	Other defects	See entire contents of <a href="#">Table 5-15</a> (catch basins).	See entire contents of <a href="#">Table 5-15</a> (catch basins).

Table 5-17 Maintenance standards for biofiltration swale.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing water	Water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages; improve grade from head to foot of swale; remove clogged check dams; add underdrains; or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant base flow	Small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea gravel drain the length of the swale, or bypass the base flow around the swale.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches occur in more than 10% of the swale bottom.	Consult with roadside vegetation specialists to determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or replant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches. Mowing is not required for wet biofiltration swales. However, fall harvesting of very dense vegetation after plant die-back is recommended.
	Excessive shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/outlet	Inlet/outlet areas are clogged with sediment/debris.	Remove material so there is no clogging or blockage in the inlet and outlet area.
	Trash and debris	Trash and debris have accumulated in the swale.	Remove trash and debris from bioswale.
	Erosion/scouring	Swale bottom has eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with 50/50 mixture of crushed gravel and compost. If bare areas are large (generally greater than 12 inches wide), the swale should be regraded and reseeded.  For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

**Table 5-18 Maintenance standards for vegetated filter strip.**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on grass	Sediment depth exceeds 2 inches.	Remove sediment deposits. Relevel so slope is even and flows pass evenly through strip.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow grass and control nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Trash and debris	Trash and debris have accumulated on the vegetated filter strip.	Remove trash and debris from filter.
	Erosion/scouring	Areas have eroded or scoured due to flow channelization or high flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with a 50/50 mixture of crushed gravel and compost. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the vegetated filter strip should be regraded and reseeded. For smaller bare areas, overseed when bare spots are evident.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

**Table 5-19 Maintenance standards for media filter drain.**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation zone/flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean so that flows are spread evenly over entire embankment width.
	Poor vegetation coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Consult with roadside vegetation specialists to determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost or replant with plugs of grass from the upper slope.
	Vegetation	Grass becomes excessively tall (greater than 10 inches); nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 6 inches.
	Media filter drain mix replacement	Water is seen on the surface of the media filter drain mix from storms that are less than a 6-month, 24-hour precipitation event. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.
	Excessive shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.
	Trash and debris	Trash and debris have accumulated on embankment.	Remove trash and debris from embankment.
	Flooding of media filter drain	When media filter drain is inundated by flood water	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.

**Table 5-20 Maintenance standards for permeable pavement.**

The BMP maintenance table for permeable pavement has been moved to the HRM Category 1 BMPs document found here:

[www.wsdot.wa.gov/Design/Hydraulics/FAQ.htm](http://www.wsdot.wa.gov/Design/Hydraulics/FAQ.htm)

**Table 5-21 Maintenance standards for dispersion areas (natural and engineered).**

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment accumulation on dispersion area	Sediment depth exceeds 2 inches.	Remove sediment deposits while minimizing compaction of soils in dispersion area. Relevel so slope is even and flows pass evenly over/through dispersion area. Handwork is recommended rather than use of heavy machinery.
	Vegetation	Vegetation is sparse or dying; significant areas are without ground cover.	Control nuisance vegetation. Add vegetation, preferably native ground cover, bushes, and trees (where consistent with safety standards) to bare areas or areas where the initial plantings have died.
	Trash and debris	Trash and debris have accumulated on the dispersion area.	Remove trash and debris from filter. Handwork is recommended rather than use of heavy machinery.
	Erosion/scouring	Eroded or scoured areas due to flow channelization, or high flows are observed.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel/compost mix (see <a href="#">Section 5-4.3.2</a> for the compost specifications). The grass will creep in over the rock mix in time. If bare areas are large (generally greater than 12 inches wide), the dispersion area should be reseeded. For smaller bare areas, overseed when bare spots are evident. Look for opportunities to locate flow spreaders, such as dispersion trenches and rock pads.
	Flow spreader	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire filter width.	Level the spreader and clean so that flows are spread evenly over entire filter width.

Table 5-22 Maintenance standards for wet ponds.

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Water level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.
	Trash and debris	Accumulations exceed 1 cubic foot per 1,000 square feet of pond area.	Remove trash and debris from pond.
	Inlet/outlet pipe	Inlet/outlet pipe is clogged with sediment or debris material.	Unclog and unblock inlet and outlet piping.
	Sediment accumulation in pond bottom	Sediment accumulations in pond bottom exceed the depth of sediment zone plus 6 inches, usually in the first cell.	Remove sediment from pond bottom.
	Oil sheen on water	Oil sheen is prevalent and visible.	Remove oil from water using oil-absorbent pads or Vactor truck. Locate and correct source of oil. If chronic low levels of oil persist, plant wetland species such as <i>Juncus effusus</i> (soft rush), which can uptake small concentrations of oil.
	Erosion	Pond side slopes or bottom show evidence of erosion or scouring in excess of 6 inches and the potential for continued erosion is evident.	Stabilize slopes using proper erosion control measures and repair methods.
	Settlement of pond dike/berm	Any part of the pond dike/berm has settled 4 inches or lower than the design elevation, or the inspector determines dike/berm is unsound.	Repair dike/berm to specifications.
	Internal berm	Berm dividing cells are not level.	Level berm surface so that water flows evenly over entire length of berm.
Overflow/spillway	Rock is missing and soil exposed at top of spillway or outside slope.	Replace rocks to specifications.	

## **APPENDIX B**

# **Questions for Ecology about the SWMMWW BMP Maintenance Standards**



## Questions for Ecology Staff Interviews

SAM Study: Evaluation of Stormwater BMPs Maintenance Conditions  
City of Bellevue and Aspect Consulting  
12/1/22

### INTRODUCTION AND BACKGROUND

#### Task 4 of Study: *Interview Ecology Staff*

Ecology engineers and permit writers (up to four) will be interviewed to understand the background and basis for some of the maintenance conditions of selected BMPs in the BMP Maintenance Tables (SWMMWW Appendix V-A). [LINK](#)

This task is to better understand how certain maintenance conditions were identified, what publications or references were used, and what BMPs could use more input for maintenance conditions needs.

The interviews are intended to complement Task 2 (survey of municipal O&M programs) and Task 3 (BMP O&M literature review) regarding the evaluation of BMP maintenance criteria.

For this Study, we're focused on four BMP types: ponds, trenches, vaults, and tanks.

#### **BMP Maintenance Tables list. Grayed out BMPs are not included in this study.**

<b>Table No.</b>	<b>BMP</b>	<b>Pond, Trench, Vault, or Tank</b>
V-A.1	Detention Ponds	Pond
V-A.2	Infiltration	Pond
V-A.3	Closed Detention (Tanks/Vaults)	Tank and Vault
V-A.4	Control Structure/Flow Restrictor	other
V-A.5	Catch Basins	other
V-A.6	Debris Barriers (Trash Racks)	other
V-A.7	Energy Dissipators	other
V-A.8	Typical Biofiltration Swale	Trench
V-A.9	Wet Biofiltration Swale	Trench
V-A.10	Filter Strips	Trench
V-A.11	Wetponds	Pond
V-A.12	Wetvaults	Vault
V-A.13	Sand Filters (above ground/open)	Vault
V-A.14	Sand Filters (below ground/enclosed)	Vault
V-A.15	Manufactured Media Filters	Vault
V-A.16	Baffle Oil/Water Separator (API)	Vault
V-A.17	Coalescing Plate Oil/Water Separators	Vault
V-A.18	Catch Basin Inserts	other
V-A.19	Media Filter Drain	Trench
V-A.20	Compost Amended Vegetation Strips	Trench
V-A.21	Bioretention Facilities	Pond
V-A.22	Permeable Pavement	other
V-A.23	Vegetated Roofs	other

**ECOLOGY INTERVIEW QUESTIONS**  
**Regarding SWMMWW Appendix V-A BMP Maintenance Tables**  
**for ponds, trenches, vaults, and tanks**

**General questions for all four BMP types:**

1. Is there a bibliography for Appendix V-A? Some references are made in the Notes of the Tables, including the SWMMWW design standards and the LID Manual. But for some maintenance criteria, there are no references cited.
2. For references used to develop quantitative maintenance criteria, how were ranges of values or conflicting numbers handled for a given maintenance type? Are some criteria considered critical items that must be maintained per the Tables (needed vs. required)?
3. For the relatively newer BMP types of Bioretention Facilities, Permeable Pavement, and Vegetated Roofs, the Tables include a recommended frequency. Has Ecology considered adding recommended frequencies to other BMP types? If so, which ones?
4. What other regulations were considered or incorporated besides stormwater NPDES regulations when determining maintenance criteria? Such as OSHA for federal safety regulations, or local regulations for critical areas or shoreline management.

**Questions about Pond BMPs:**

1. How were specific maintenance criteria determined?

**For Pond, Wetpond, Infiltration Pond, Bioretention Facilities**

- a. Trash of 1 cf/1,000 sq ft or more
  - b. Erosion on side slopes and spillways: 2 inches or more (ponds) or 6 inches or more (wetponds)
  - c. Sediment in pond 10% of pond depth or more
  - d. Berm settlement of 4 in or more (3 inches for bioretention)
  - e. Sump depth in pre-settling vault of 6 inches or more
  - a. Infiltration rate of 90% or more
  - b. Vegetation survival rate of 75% or less (reference given in table)
  - c. Watering rates:
    - i. For new vegetation years 3-5?
    - ii. During drought conditions?
2. What is the source for some of the best practices recommendations?
    - a. Animal removal vs habitat benefits (e.g., for rodents, the Tables recommended only “eradicate” or “destroy”)
    - b. Dead tree: removal per Tables vs habitat benefits
    - c. Maintenance frequencies:
      - i. Assessing drawdown (Sand Filter, Media Filter)
      - ii. Erosion inspection

**Questions about Trench BMPs:**

1. How were specific maintenance criteria determined?

**For Biofiltration Swale, Media Filter Drain, and Composted Amended Veg Strips**

- a. Sediment depth of 2 inches or more
  - b. Vegetation coverage exceeds 10% of swale bottom
  - c. Erosion areas less than 12 inches wide
  - d. Water Depth of 4 or more inches (wet swale)
  - e. Sparse vegetation (bare areas) coverage of 10% or more
2. Source for some of the best practices recommendations?
    - a. Remove grass clippings (rather than mulch in)
    - b. Maintenance frequencies?

**Questions about Vault BMPs:**

1. How were specific maintenance criteria determined?

**For Wetvaults, Sand Filters, and Oil-Water Separators**

- a. Sediment depth:
    - i. 6 inches or more Wetvaults
    - ii. ½ inch or more Sand Filters
    - iii. ¼ inch or more Media Filters
  - b. Structural: 10% or more “bent out of shape”
  - c. Vault structure: crack size ½-inch or more, or ¼-in at pipe joints
  - d. Media drawdown: more than 1 hour
  - e. Sand filter drawdown: more than 24 hours
  - f. Oil accumulation: 1 inch at water surface
2. Source for some of the best practices recommendations?
    - a. Guidance to identify “obvious poor water quality” (in OWS)?
    - b. Maintenance frequencies:
      - i. Assessing drawdown (Sand Filter, Media Filter)
      - ii. Erosion inspection

**Questions about Tank BMPs:**

1. How were specific maintenance criteria determined?

**For Closed Detention Systems**

- a. Sediment depth of tanks: 10% of diameter for half of length of tank
  - b. Structural: 10% or more “bent out of shape”
  - c. Vault structure: crack size ½-inch or more, or ¼-in at pipe joints
2. Source for some of the best practices recommendations?
    - a. Safety considerations for ladder, cover status and removal, plugged air vents
    - b. Maintenance frequencies?