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1.0 Introduction: Maintaining Your Stormwater Facilities in Pierce County

The intent of this stormwater maintenance manual is to assist private stormwater facility owners in performing proper maintenance of the facilities and the required reporting of maintenance procedures to Pierce County.

Pierce County Code Section 17A.40.020 states that private property owners are responsible for maintaining their own stormwater management structures. Owners should have a maintenance program that addresses every component of the stormwater system, to ensure the system does not lose its intended capability to manage stormwater. Pierce County’s "Stormwater Management and Site Development Manual", 1997 (Stormwater Manual) requires that owners of private stormwater management facilities applying for development after the effective date of the Stormwater Manual conduct routine and non-routine inspection and maintenance of their stormwater system and prepare an annual inspection report to be submitted to Pierce County on or before May 15.

Property owners with private systems constructed prior to the effective date of the Stormwater Manual are also required to maintain their stormwater facilities, but are not required to submit the annual inspection and maintenance report to Pierce County.

Stormwater management facilities consist of a series of collection and conveyance systems, detention systems, and treatment facilities. They are typically a combination of landscape and structural components that slow, filter, detain, or infiltrate stormwater runoff on-site after a rainfall event.

1.1 How to Apply this Manual

Private owners should review this manual for understanding of the general function of their stormwater management facilities. After determining the type of facilities associated with the owner’s site, the owner should download or copy the checklists for each facility and utilize them in facility inspection and maintenance.

It is important to note that there may be more than one facility associated with an individual site. For example, your site may include catch basins, a detention pond, and a control structure/flow restrictor. In this case, all three checklists should be utilized for inspection and maintenance.
1.2 Why Manage Stormwater Runoff?

When it rains or snows in urban areas, the stormwater runs off impervious surfaces (such as roofs and paved areas) instead of soaking into the ground. Stormwater runoff has traditionally been directed into drains and pipes that carry it off-site for eventual discharge into a river or stream.

The traditional approach to stormwater management has a number of harmful effects:

- Impervious areas and residential lawns generate large volumes of runoff relatively quickly. The increased volume and rate of runoff can cause flooding and erosion of natural waterways, damage to roads and other manmade structures, and destroy natural wildlife habitat.

- The stormwater runoff picks up oil, pesticides, metals, chemicals, sediment, and other pollutants that harm water quality and fish habitat.

- During warm weather, the runoff absorbs heat from the impervious surfaces. This increases the temperature of the receiving waters, with negative impacts on fish and other aquatic life.

- Less water is able to infiltrate into the ground. This reduces groundwater recharge which reduces summer base flow in streams.

Stormwater management facilities are designed to help mitigate for the negative effects of stormwater runoff from developed urban areas.
1.3 Frequently Asked Questions

Q. How do I improve the aesthetics of a privately owned stormwater facility?

A. *The Integrated Pond*, published by King County provides information for integrating stormwater facilities into attractive community spaces. This document can be downloaded from King County’s website at (http://dnr.metrokc.gov/wlr/dss/pond.htm).

Q. There is a ditch in front of my home. Who is responsible for maintaining it?

A. If you are in a private development: you and your neighbors will have to maintain the drainage. If you are within a city’s limits: contact your city’s public works department. If you are not within a city’s limits: storm drainage systems in public roads are maintained by the Transportation Division of Public Works and Utilities. Contact the Road Maintenance Shop for your area, contact numbers are listed below.

Q. There is tall grass and debris in the pond/creek near my house. Who takes care of this?

A. Publicly owned storm drainage ponds and some creeks are maintained by Water Programs. Call the Flood Line at 253-798-4274 to report your concern. Your call will be routed to a member of our maintenance team for inspection and the scheduling of a work crew if needed. Privately owned storm drain systems must be maintained by the property owner or homeowner's association.

Q. Can you make the flooding go away?

A. Not once the flooding has started, but we might be able to help keep it from flooding again. We use input from residents to figure out the best solution to flood problems and to prioritize which projects get constructed first. During a flood, sand bags can be picked up at your local Fire District Headquarters. If a blocked pipe or ditch is the cause of your flooding, the Road Maintenance Shops can also help with cleaning them out. If you’re unsure which Shop area you live in, you can call:

- Maintenance Administration Office at 253-798-7702
- Puyallup Road Shop #1: 253-798-3842
- Elk Plain Road Shop #2: 253-798-4980
- Lakewood Road Shop #3: 253-798-4972
- Purdy Road Shop #4: 253-798-4949.

Proper maintenance of private and public stormwater facilities is the best approach to preventing flooding.
Q. What are Best Management Practices (BMPs)?

A. BMPs are a series of actions that are designed to reduce stormwater pollution, prevent discharging contaminants to natural water bodies and reduce stormwater facility maintenance costs. These actions can take several different forms. Examples of these are:

Behavioral--For example, sweeping a driveway instead of hosing it into the storm drain.

Procedural--Such as implementing an inventory control program for hydraulic oil or other lubricants to identify changes in consumption. This type of program can be used to identify maintenance problems, and save the business owner money on equipment down-time and lubricant costs.

Structural--Such as building a roof over a production area, or installing an oil/water separator.

In general, behavioral and procedural type BMPs will cost the least to implement initially and may save money over time. Structural BMPs typically cost more to construct, operate, and maintain.

BMPs are separated into two broad categories, namely source control and treatment BMPs. As the name implies, source control BMPs prevent contaminants from entering stormwater runoff by controlling them at the source. Treatment BMPs are utilized to treat stormwater that is already contaminated. Most treatment BMPs require planning, designing, permitting, and construction, and none can remove 100% of the contaminants in stormwater. These factors, added to the typical expense of treatment BMPs, makes source control BMPs the preferred choice.

Q. Where do I find information on the West Nile virus?

A. West Nile virus is a mosquito-borne virus that can cause encephalitis (an inflammation of the brain) or meningitis (an inflammation of the lining of the brain and spinal cord) in humans and animals.

The risk of contracting the virus from a single mosquito bite is extremely low. In areas where mosquitoes may carry the virus, less than 1% of them actually do. Only certain species of mosquitoes carry the virus and very few mosquitoes are actually infected. Less than 1% of people bitten by infected mosquitoes become severely ill.

The Tacoma-Pierce County Health Department and the Washington State Department of Health are coordinating surveillance activities designed to provide early detection of West Nile virus.
Preventing mosquito bites and reducing mosquito-breeding habitat around your home are the best ways to protect your family. You should empty containers that hold standing water, such as old tires, buckets, and planters. Also, change the water in your birdbaths, fountains, wading pools and animal troughs weekly, and clean out your rain gutters so that they drain properly.

Do not fill or alter bodies of water that might be regulated by local, state, or federal governments before checking with them. Pierce County environmental biologists can answer your questions about wetlands. Please call (253) 798-7037 to speak with one of the biologists. For questions related to West Nile Virus, contact the Tacoma-Pierce County Health Department at (253) 798-6578.

The County program emphasizes mosquito habitat reduction through proper maintenance of the stormwater drainage facilities we manage. Elements of the strategy include doing an inventory of County facilities that hold water during mosquito season, maintaining facilities to reduce breeding habitat where possible, preparing a monitoring and sampling strategy in compliance with permit conditions, sharing information with Tacoma-Pierce County Health Department and the Washington State Department of Health, and applying larvicides as needed to control mosquito populations. A natural bacterial larvicide, *Bacillus thurengiensis israelensis* (known as Bti), will mainly be utilized in areas tributary to natural waters to prevent harm to aquatic insects which may serve as salmon food. Other larvicides may be used in closed depressions. Pierce County will not be treating wetlands or other natural waters, as these can contain predator species of insects and fish that can feed on mosquito larvae and adult mosquitoes.

Poorly maintained private stormwater drainage facilities can increase breeding sites for mosquitoes in your community or property. Owners of private stormwater drainage facilities can request a courtesy inspection of their system to insure proper operation by contacting Pierce County Water Programs at (253) 798-2725.

Please visit any of the following web sites for additional information:

- **Tacoma Pierce County Health Department**
- **Washington State Department of Health**
- **Centers for Disease Control and Prevention**
- **United States Environmental Protection Agency**
- **American Mosquito Control Association**
- **MosquitoBuzz.com**
Q. Where do I find more information on the cost of stormwater maintenance?

A. Unit costs for common maintenance procedures can be found on the Stormwater Managers Resource Center (SMRC) website at:

   Stormwater Managers Resource Center (SMRC)

Q. Where do I find information on pest control?

A. Integrated Pest Management (IPM) is a preventive measure aimed at knowing the exact pests being targeted for control, the locations and times when pests will pose problems, the level of pest-induced damage that can be tolerated without taking action, the most vulnerable life stage, and control actions that are least damaging to the environment. The major components of IPM are as follows:

   Monitoring and inventory of pest populations
   Determination of pest-induced injury and action levels
   Identification of priority pest problems
   Selection and timing of least toxic management tools
   Site-specific treatment with minimized chemical use
   Evaluation and adjustment of pesticide applications

   Monitoring of pest populations is a key to successful IPM implementation. Pest problems are easier to control if the problem can be discovered early. With IPM, pesticides are used only as a last resort. Maximization of natural controls, including biological controls and removal of pests by hand, is always the first choice.


Q. Why can’t I dump used motor oil and other wastes into the stormwater inlet on my street?

A. Stormwater inlets lead to stormwater management systems that discharge to natural water bodies (e.g. lakes or stream) or to the groundwater. Excessive contaminants, such as motor oils dumped into the storm system, will create the need for more frequent maintenance and higher maintenance costs.
Q. I wash my own car, how can I be environmentally responsible?

A. The best option is to use a commercial car wash where the wash water is recycled and does not drain to the storm system. Improper disposal of wash water will increase the required maintenance frequency resulting in higher maintenance costs. The Pierce County Stormwater Pollution Prevention Manual provides Best Management Practices (BMPs) for washing vehicles on private property; see additional resources section in Chapter 5.

Q. Can I get credit for maintaining my stormwater facility?

A. A properly maintained storm drainage system can reduce your Stormwater Service Charge by as much as 85 percent.

Credits to the Stormwater Service Charge can be received by meeting the requirements of Pierce County Code Section 11.02.050B.

For more information on receiving stormwater credits call (253) 798-4020.
2.0 **Stormwater Management Facilities**

To help understand stormwater facility maintenance requirements, it is useful to have a general knowledge of how they function. Some maintenance needs are common to all types of facilities, while others depend on the specific facility.

The three major components of stormwater management include stormwater collection/conveyance, stormwater quantity control (detention/retention) and stormwater quality control (treatment). This section describes general stormwater management theories and goals. Specific stormwater facility descriptions and maintenance requirements are provided in Section 3.0.

2.1 **Collection and Conveyance Systems**

Collection and conveyance systems intercept and transport stormwater and typically consist of inlets that collect water and pipes and/or open channels (ditches). Stormwater conveyance systems are designed to provide capacity for a specific maximum flow rate. Typical failures include reduced capacity due to clogged surface grates and pipes. Plugging commonly occurs due to sediment and large debris washed from adjacent surfaces. Reduced conveyance system capacity results in localized flooding and possible property damage.

2.2 **Stormwater Quantity Control (Detention/Retention)**

The intent of stormwater quantity control facilities is to slow down stormwater flow discharged to the environment from developed sites. Impervious surfaces, such as roads, roofs, and lawns, quicken the rate of stormwater runoff into natural streams which can create flooding. Stormwater quantity control facilities mitigate the increased runoff by providing temporary storage and controlling the release rate from the site to prevent flooding and erosion. Detention and retention facilities may be designed as ponds or underground facilities.

Detention facilities function by providing temporary storage of stormwater runoff to be released at a controlled rate. The intent of the detention facility is to match the pre-developed runoff rates for several specific storm events in the developed condition.

Retention facilities are typically located in areas where water soaks easily into the ground. Retention facilities provided temporary storage while allowing the water to soak into the ground, mimicking natural conditions. There is typically no release of stormwater to other pipes or water bodies.
2.3 **Stormwater Quality Control (Treatment)**

There are several Best Management Practices (BMPs) utilized for stormwater quality control. These systems provide stormwater treatment through a combination of filtration, sediment settling, plant nutrient uptake, and physical separation. The most common treatment systems include biofiltration swales, filter strips, wetponds, and sandfilters. There are also some proprietary structural treatment systems including Stormfilters®, oil/water separators, and Vortech® treatment units. The intent of all stormwater treatment facilities is to remove oils, chemicals, metals, and sediment from stormwater runoff prior to being discharged from the property.

Stormwater treatment facilities have a limited pollutant removal capability and are not intended to replace proper site management. The most effective technique for reducing pollutant discharge from the site is to provide good housekeeping through source control Best Management Practices (BMPs) as provided in the Stormwater Pollution Prevention Manual located at [http://www.co.pierce.wa.us/PC/services/home/environ/water/swm/sppman/](http://www.co.pierce.wa.us/PC/services/home/environ/water/swm/sppman/).
### 3.0 Facility Descriptions and Maintenance Checklists

Each of the following subsections includes a facility description, illustrated exhibit, and maintenance checklist for 23 common stormwater facilities/components utilized in Pierce County. These include:

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Detention Ponds</td>
</tr>
<tr>
<td>2.</td>
<td>Infiltration Facilities</td>
</tr>
<tr>
<td>3.</td>
<td>Closed Detention Systems (Tanks/Vaults)</td>
</tr>
<tr>
<td>4.</td>
<td>Control Structure/Flow Restrictor</td>
</tr>
<tr>
<td>5.</td>
<td>Catch Basins</td>
</tr>
<tr>
<td>6.</td>
<td>Debris Barriers (e.g. Trash Racks)</td>
</tr>
<tr>
<td>7.</td>
<td>Energy Dissipaters</td>
</tr>
<tr>
<td>8.</td>
<td>Typical Biofiltration Swale</td>
</tr>
<tr>
<td>9.</td>
<td>Wet Biofiltration Swale</td>
</tr>
<tr>
<td>10.</td>
<td>Filter Strips</td>
</tr>
<tr>
<td>11.</td>
<td>Wetponds</td>
</tr>
<tr>
<td>12.</td>
<td>Wet Vaults</td>
</tr>
<tr>
<td>13.</td>
<td>Sand Filters (Above Ground/Open)</td>
</tr>
<tr>
<td>14.</td>
<td>Sand Filters (Below Ground/Enclosed)</td>
</tr>
<tr>
<td>15.</td>
<td>Stormfilter® Cast-In-Place, Precast, Linear Stormfilter and Catch Basin Units</td>
</tr>
<tr>
<td>16.</td>
<td>Oil/Water Separator (API Type)</td>
</tr>
<tr>
<td>17.</td>
<td>Coalescing Plate Oil/Water Separator</td>
</tr>
<tr>
<td>18.</td>
<td>Catch Basin Insert</td>
</tr>
<tr>
<td>19.</td>
<td>Fencing/Shrubbery Screen/Other Landscaping</td>
</tr>
<tr>
<td>20.</td>
<td>Gates</td>
</tr>
<tr>
<td>21.</td>
<td>Grounds (Landscaping)</td>
</tr>
<tr>
<td>22.</td>
<td>Ecology Embankment</td>
</tr>
<tr>
<td>23.</td>
<td>Vortech® Stormwater Treatment System</td>
</tr>
</tbody>
</table>

Private stormwater facility owners should print the checklists that apply to their facilities and follow the inspection recommendations and frequencies. The checklists should be used for the maintenance report submitted to the County as required by maintenance agreement or for storm utility credit.
3.1 Detention Ponds

Stormwater detention ponds are open basins built by excavating below existing ground or by constructing above-ground berms (embankments). The detention pond temporarily stores stormwater runoff during rain events and slowly releases it through an outlet (control structure). Detention ponds are typically designed to completely drain within 24 hours after the completion of a storm event. Components that are typically associated with a detention pond include the following: control structure/flow restrictor, debris barrier (e.g. trash rack), energy dissipaters, access road, and fence.
### Detention Ponds Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M,S</td>
<td>General</td>
<td>Trash &amp; Debris</td>
<td>Any trash and debris which exceed 5 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size garbage can). 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.</td>
<td>Trash and debris cleared from site.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>Poisonous Vegetation and noxious weeds</td>
<td>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).</td>
<td>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.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td>Contaminants and Pollution</td>
<td>Any evidence of oil, gasoline, contaminants or other pollutants</td>
<td>No contaminants or pollutants present. (Coordinate removal/cleanup with local water quality response agency).</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>Rodent Holes</td>
<td>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.</td>
<td>Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>Beaver Dams</td>
<td>Dam results in change or function of the facility.</td>
<td>Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>Insects</td>
<td>When insects such as wasps and hornets interfere with maintenance activities.</td>
<td>Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>Tree Growth and Hazard Trees</td>
<td>Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If</td>
<td>Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).</td>
</tr>
<tr>
<td>Frequency</td>
<td>Drainage System Feature</td>
<td>Date</td>
<td>Problem</td>
<td>Conditions to Check For</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------</td>
<td>------</td>
<td>---------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td></td>
<td>trees are not interfering with access or maintenance, do not remove</td>
</tr>
<tr>
<td>M</td>
<td>Side Slopes of Pond</td>
<td></td>
<td>Erosion</td>
<td>If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements)</td>
</tr>
<tr>
<td>M</td>
<td>Side Slopes of Pond</td>
<td></td>
<td>Erosion</td>
<td>Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.</td>
</tr>
<tr>
<td>M,S</td>
<td>Side Slopes of Pond</td>
<td></td>
<td></td>
<td>Any erosion observed on a compacted berm embankment.</td>
</tr>
<tr>
<td>M</td>
<td>Storage Area</td>
<td></td>
<td>Sediment</td>
<td>Accumulated sediment that exceeds 10% (typically 6” to 12”) of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.</td>
</tr>
<tr>
<td>M</td>
<td>Storage Area</td>
<td></td>
<td>Liner (If Applicable)</td>
<td>Liner is visible and has more than three 1/4-inch holes in it.</td>
</tr>
<tr>
<td>A</td>
<td>Pond Berms (Dikes)</td>
<td></td>
<td>Settlements</td>
<td>Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.</td>
</tr>
<tr>
<td>A</td>
<td>Pond Berms (Dikes)</td>
<td></td>
<td>Piping</td>
<td>Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.</td>
</tr>
</tbody>
</table>
### Detention Ponds Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Emergency Overflow/Spillway</td>
<td></td>
<td>Tree Growth</td>
<td>Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.</td>
<td>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.</td>
</tr>
<tr>
<td>A</td>
<td>Emergency Overflow/Spillway</td>
<td></td>
<td>Emergency Overflow/Spillway</td>
<td>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 outflow path of spillway. (Rip-rap on inside slopes need not be replaced.)</td>
<td>Rocks and pad depth are restored to design standards.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.

(A) Once in late summer (preferable September)

(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.2 Infiltration Facilities

Stormwater infiltration facilities are open basins built by excavating below existing ground or by constructing above-ground berms (embankments). Like the detention pond, the infiltration pond temporarily stores stormwater runoff during rain events, but unlike the detention pond, the infiltration pond does not discharge to a downstream conveyance system or nearby surface water. Instead, the infiltration facility relies on the ability of the site’s soils to absorb the stormwater into the ground. Components that are typically associated with a retention pond include the following: energy dissipaters, access road, and fence.
## Infiltration Facilities Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
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<td>General</td>
<td></td>
<td>Trash &amp; Debris</td>
<td>Any trash and debris which exceed 5 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size garbage can). 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.</td>
<td>Trash and debris cleared from site.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td>Poisonous Vegetation and noxious weeds</td>
<td>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).</td>
<td>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</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Contaminants and Pollution</td>
<td>Any evidence of oil, gasoline, contaminants or other pollutants</td>
<td>No contaminants or pollutants present. (Coordinate removal/cleanup with local water quality response agency).</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Rodent Holes</td>
<td>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.</td>
<td>Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Beaver Dams</td>
<td>Dam results in change or function of the facility.</td>
<td>Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td>Insects</td>
<td>When insects such as wasps and hornets interfere with maintenance activities.</td>
<td>Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies.</td>
</tr>
<tr>
<td>M</td>
<td>Storage Area</td>
<td></td>
<td>Sediment</td>
<td>Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. If two inches or more sediment is present, remove).</td>
<td>Sediment is removed and/or facility is cleaned so that infiltration system works according to design.</td>
</tr>
<tr>
<td>M</td>
<td>Filter Bags (if applicable)</td>
<td></td>
<td>Filled with Sediment and Debris</td>
<td>Sediment and debris fill bag more than ½ full.</td>
<td>Filter bag is replaced or system is redesigned.</td>
</tr>
<tr>
<td>M,S</td>
<td>Rock Filters</td>
<td></td>
<td>Sediment and Debris</td>
<td>By visual inspection, little or no water flows through filter during heavy rain storms.</td>
<td>Gravel in rock filter is replaced.</td>
</tr>
<tr>
<td>M</td>
<td>Side Slopes of Pond</td>
<td></td>
<td>Erosion</td>
<td>Eroded damage over 2 inches deep where cause of damage</td>
<td>Slopes should be stabilized using</td>
</tr>
<tr>
<td>Frequency</td>
<td>Drainage System Feature</td>
<td>Date</td>
<td>Problem</td>
<td>Conditions to Check For</td>
<td>Conditions That Should Exist</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------</td>
<td>------</td>
<td>---------</td>
<td>-------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✓ ✓ ✓ ✓</td>
<td>is still present or where there is potential for continued erosion.</td>
<td>appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Pond Berms (Dikes)</td>
<td></td>
<td>Settlements</td>
<td>Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.</td>
<td>Dike is built back to the design elevation.</td>
</tr>
<tr>
<td>A</td>
<td>Pond Berms (Dikes)</td>
<td></td>
<td>Piping</td>
<td>Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.</td>
<td>Piping eliminated. Erosion potential resolved.</td>
</tr>
<tr>
<td>A</td>
<td>Emergency Overflow/Spillway</td>
<td></td>
<td>Tree Growth</td>
<td>Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.</td>
<td>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.</td>
</tr>
<tr>
<td>A</td>
<td>Emergency Overflow/Spillway</td>
<td></td>
<td>Emergency Overflow/Spillway</td>
<td>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.)</td>
<td>Rocks and pad depth are restored to design standards.</td>
</tr>
<tr>
<td>M</td>
<td>Pre-settling Ponds and Vaults</td>
<td></td>
<td>Facility or sump filled with Sediment and/or debris</td>
<td>6&quot; or designed sediment trap depth of sediment.</td>
<td>Sediment is removed.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:
Infiltration Facilities Checklist (Continued)

Key:
(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.3 Closed Detention Systems (Tanks/Vaults)

Closed detention systems function similar to detention ponds with the temporary storage volume provided by an underground structure to regulate the storm discharge rate from the site. The structure is typically constructed of large diameter pipe (48” diameter or greater) or a concrete box (Vault). These systems are typically utilized for sites that do not have space available for an above-ground system and are more commonly associated with commercial sites.

Underground detention systems are an enclosed space where harmful chemicals and vapors can accumulate. Therefore, the inspection and maintenance of these facilities should be conducted by an individual with training and certification in working in hazardous confined spaces.
## Closed Detention Systems (Tanks/Vaults) Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Storage Area</td>
<td></td>
<td>Plugged Air Vents</td>
<td>One-half of the cross section of a vent is blocked at any point or the vent is damaged.</td>
<td>Vents open and functioning.</td>
</tr>
<tr>
<td>M</td>
<td>Storage Area</td>
<td></td>
<td>Debris and Sediment</td>
<td>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 1/2 length of tank.)</td>
<td>All sediment and debris removed from storage area.</td>
</tr>
<tr>
<td>A</td>
<td>Storage Area</td>
<td></td>
<td>Joints Between Tank/Pipe Section</td>
<td>Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).</td>
<td>All joint between tank/pipe sections are sealed.</td>
</tr>
<tr>
<td>A</td>
<td>Storage Area</td>
<td></td>
<td>Tank Pipe Bent Out of Shape</td>
<td>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).</td>
<td>Tank/pipe repaired or replaced to design.</td>
</tr>
<tr>
<td>A</td>
<td>Storage Area</td>
<td></td>
<td>Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab</td>
<td>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.</td>
<td>Vault replaced or repaired to design specifications and is structurally sound.</td>
</tr>
<tr>
<td>A</td>
<td>Storage Area</td>
<td></td>
<td>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</td>
<td>No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Manhole</td>
<td></td>
<td>Cover Not in Place</td>
<td>Cover is missing or only partially in place. Any open manhole requires maintenance.</td>
<td>Manhole is closed.</td>
</tr>
<tr>
<td>A</td>
<td>Manhole</td>
<td></td>
<td>Locking Mechanism Not Working</td>
<td>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).</td>
<td>Mechanism opens with proper tools.</td>
</tr>
</tbody>
</table>
**Closed Detention Systems (Tanks/Vaults) Checklist (Continued)**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Manhole</td>
<td></td>
<td>Cover Difficult to Remove</td>
<td>One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.</td>
<td>Cover can be removed and reinstalled by one maintenance person.</td>
</tr>
<tr>
<td>A</td>
<td>Manhole</td>
<td></td>
<td>Ladder Rungs Unsafe</td>
<td>Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.</td>
<td>Ladder meets design standards. Allows maintenance person safe access.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

---

**Key:**
(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.4 Control Structure/Flow Restrictor

Control structures/flow restrictors are located on the outlet pipe of a detention system. The control structure is typically a Type 2 concrete catch basin (see Section 3.5 for catch basin description) with a riser (vertical pipe). The control structure reduces the discharge rate of stormwater from a detention facility. The flow is regulated by a combination of orifices (holes with specifically sized diameters) and weirs (plates with rectangular or vee shaped notch). Lack of maintenance of the control structure can result in the plugging of an orifice. This can result in flooding of the stormwater system and/or an increase in the rate of discharge from the site potentially damaging downstream property.
<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Trash and Debris (Includes Sediment)</td>
<td>Material exceeds 25% of sump depth or 1 foot below orifice plate.</td>
<td>Control structure orifice is not blocked. All trash and debris removed.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td>Structural Damage</td>
<td>Structure is not securely attached to manhole wall.</td>
<td>Structure securely attached to wall and outlet pipe.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td>Structural Damage</td>
<td>Structure is not in upright position (allow up to 10% from plumb).</td>
<td>Structure in correct position.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td>Structural Damage</td>
<td>Connections to outlet pipe are not watertight and show signs of rust.</td>
<td>Connections to outlet pipe are watertight; structure repaired or replaced and works as designed.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td>Structural Damage</td>
<td>Any holes--other than designed holes--in the structure.</td>
<td>Structure has no holes other than designed holes.</td>
</tr>
<tr>
<td>A</td>
<td>Cleanout Gate</td>
<td></td>
<td>Damaged or Missing</td>
<td>Cleanout gate is not watertight or is missing.</td>
<td>Gate is watertight and works as designed.</td>
</tr>
<tr>
<td>A</td>
<td>Cleanout Gate</td>
<td></td>
<td>Damaged or Missing</td>
<td>Gate cannot be moved up and down by one maintenance person.</td>
<td>Gate moves up and down easily and is watertight.</td>
</tr>
<tr>
<td>A</td>
<td>Cleanout Gate</td>
<td></td>
<td>Damaged or Missing</td>
<td>Chain/rod leading to gate is missing or damaged.</td>
<td>Chain is in place and works as designed.</td>
</tr>
<tr>
<td>A</td>
<td>Cleanout Gate</td>
<td></td>
<td>Damaged or Missing</td>
<td>Gate is rusted over 50% of its surface area.</td>
<td>Gate is repaired or replaced to meet design standards.</td>
</tr>
<tr>
<td>A</td>
<td>Orifice Plate</td>
<td></td>
<td>Damaged or Missing</td>
<td>Control device is not working properly due to missing, out of place, or bent orifice plate.</td>
<td>Plate is in place and works as designed.</td>
</tr>
<tr>
<td>M,S</td>
<td>Orifice Plate</td>
<td></td>
<td>Obstructions</td>
<td>Any trash, debris, sediment, or vegetation blocking the plate.</td>
<td>Plate is free of all obstructions and works as designed.</td>
</tr>
<tr>
<td></td>
<td>Overflow Pipe</td>
<td></td>
<td>Obstructions</td>
<td>Any trash or debris blocking (or having the potential of blocking) the overflow pipe.</td>
<td>Pipe is free of all obstructions and works as designed.</td>
</tr>
<tr>
<td>A</td>
<td>Manhole</td>
<td></td>
<td>Cover Not in Place</td>
<td>Cover is missing or only partially in place. Any open manhole requires maintenance.</td>
<td>Manhole is closed.</td>
</tr>
</tbody>
</table>
### Control Structure/Flow Restrictor Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Manhole</td>
<td></td>
<td>Locking Mechanism Not Working</td>
<td>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).</td>
<td>Mechanism opens with proper tools.</td>
</tr>
<tr>
<td>A</td>
<td>Manhole</td>
<td></td>
<td>Cover Difficult to Remove</td>
<td>One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.</td>
<td>Cover can be removed and reinstalled by one maintenance person.</td>
</tr>
<tr>
<td>A</td>
<td>Manhole</td>
<td></td>
<td>Ladder Rungs Unsafe</td>
<td>Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.</td>
<td>Ladder meets design standards. Allows maintenance person safe access.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.5 Catch Basins

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

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

Type 2 catch basins, also commonly referred to as storm manholes, are round concrete structures ranging in diameter of 4 feet to 8 feet. Type 2 catch basins are used when the connecting conveyance pipe is 18 inches or greater or the depth from grate to pipe bottom exceeds 5 feet. Type 2 catch basins typically have manhole steps mounted on the side of the structure to allow for access.

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

The most common cleaning method for catch basins is to utilize a truck with a tank and vacuum hose (vactor truck) to remove sediment and debris from the sump. Catch basins may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a catch basin, it should be conducted by an individual with training and certification in working in hazardous confined spaces.
**Catch Basins Checklist**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td>“Dump no pollutants” Stencil or stamp not visible</td>
<td>Stencil or stamp should be visible and easily read</td>
<td>Warning signs (e.g., &quot;Dump No Waste Drains to Stream&quot;) shall be painted or embossed on or adjacent to all storm drain inlets.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Trash &amp; Debris</td>
<td>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%</td>
<td>No trash or debris located immediately in front of catch basin or on grate opening.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Trash &amp; Debris</td>
<td>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.</td>
<td>No trash or debris in the catch basin.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Trash &amp; Debris</td>
<td>Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.</td>
<td>Inlet and outlet pipes free of trash or debris.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Trash &amp; Debris</td>
<td>Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).</td>
<td>No dead animals or vegetation present within the catch basin.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Sediment</td>
<td>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.</td>
<td>No sediment in the catch basin</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td></td>
<td>Structure Damage to Frame and/or Top Slab</td>
<td>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).</td>
<td>Top slab is free of holes and cracks.</td>
</tr>
<tr>
<td>Frequency</td>
<td>Drainage System Feature</td>
<td>Date</td>
<td>Problem</td>
<td>Conditions to Check For</td>
<td>Conditions That Should Exist</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
<td>------</td>
<td>---------</td>
<td>-------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>✓</td>
<td>Structure Damage to Frame and/or Top Slab</td>
<td>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.</td>
<td>Frame is sitting flush on the riser rings or top slab and firmly attached.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>✓</td>
<td>Fractures or Cracks in Basin Walls/ Bottom</td>
<td>Maintenance person judges that structure is unsound.</td>
<td>Basin replaced or repaired to design standards.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>✓</td>
<td>Fractures or Cracks in Basin Walls/ Bottom</td>
<td>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.</td>
<td>Pipe is re-grouted and secure at basin wall.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>✓</td>
<td>Settlement / Misalignment</td>
<td>If failure of basin has created a safety, function, or design problem.</td>
<td>Basin replaced or repaired to design standards.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>✓</td>
<td>Vegetation</td>
<td>Vegetation growing across and blocking more than 10% of the basin opening.</td>
<td>No vegetation blocking opening to basin.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>✓</td>
<td>Vegetation</td>
<td>Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.</td>
<td>No vegetation or root growth present.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>✓</td>
<td>Contamination and Pollution</td>
<td>Any evidence of oil, gasoline, contaminants, or other pollutants (Coordinate removal/cleanup with local water quality response agency).</td>
<td>No contaminants or pollutants present.</td>
</tr>
<tr>
<td>A</td>
<td>Catch Basin Cover</td>
<td>✓</td>
<td>Cover Not in Place</td>
<td>Cover is missing or only partially in place.</td>
<td>Any open catch basin requires maintenance. Catch basin cover is closed</td>
</tr>
<tr>
<td>A</td>
<td>Catch Basin Cover</td>
<td>✓</td>
<td>Locking Mechanism Not Working</td>
<td>Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.</td>
<td>Mechanism opens with proper tools.</td>
</tr>
<tr>
<td>A</td>
<td>Catch Basin Cover</td>
<td>✓</td>
<td>Cover Difficult to Remove</td>
<td>One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep cover from sealing off access to maintenance.)</td>
<td>Cover can be removed by one maintenance person.</td>
</tr>
</tbody>
</table>
### Catch Basins Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ladder</td>
<td></td>
<td>Ladder Rungs Unsafe</td>
<td>Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.</td>
<td>Ladder meets design standards and allows maintenance person safe access.</td>
</tr>
<tr>
<td></td>
<td>Grates</td>
<td></td>
<td>Grate opening Unsafe</td>
<td>Grate with opening wider than 7/8 inch.</td>
<td>Grate opening meets design standards.</td>
</tr>
<tr>
<td>M,S</td>
<td>Grates</td>
<td></td>
<td>Trash and Debris</td>
<td>Trash and debris that is blocking more than 20% of grate surface inletting capacity.</td>
<td>Grate free of trash and debris.</td>
</tr>
<tr>
<td>A</td>
<td>Grates</td>
<td></td>
<td>Damaged or Missing.</td>
<td>Grate missing or broken member(s) of the grate.</td>
<td>Grate is in place and meets design standards.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.6 Debris Barriers (e.g. Trash Racks)

Debris barriers consist of bar grates over the open end of a culvert or conveyance pipe. The intent of a debris barrier is to prevent large materials from entering a closed pipe system. Debris barriers are typically located on the outlet pipe from a detention pond to the control structure. If a debris barrier is not located on the outlet pipe, one should be provided to prevent plugging of the control structure and possible flooding.

Access barriers are similar to debris barriers but are included on all pipe ends that exceed 18 inches in diameter. Their function is to prevent debris and unauthorized access into the storm conveyance pipe. Removing debris and maintenance to the debris barrier when there is flow through the conveyance pipe should be performed by qualified personnel only.
# Debris Barriers (e.g. Trash Racks) Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M,S</td>
<td>General</td>
<td>✓ ✓ ✓ ✓</td>
<td>Trash and Debris</td>
<td>Trash or debris that is plugging more than 20% of the openings in the barrier.</td>
<td>Barrier cleared to design flow capacity.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>✓ ✓ ✓ ✓</td>
<td>Damaged/ Missing Bars.</td>
<td>Bars are bent out of shape more than 3 inches.</td>
<td>Bars in place with no bends more than 3/4 inch.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>✓ ✓ ✓ ✓</td>
<td>Damaged/ Missing Bars.</td>
<td>Bars are missing or entire barrier missing.</td>
<td>Bars in place according to design.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>✓ ✓ ✓ ✓</td>
<td>Damaged/ Missing Bars.</td>
<td>Bars are loose and rust is causing 50% deterioration to any part of barrier.</td>
<td>Barrier replaced or repaired to design standards.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>✓ ✓ ✓ ✓</td>
<td>Inlet/Outlet Pipe</td>
<td>Debris barrier missing or not attached to pipe.</td>
<td>Barrier firmly attached to pipe.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

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(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
### 3.7 Energy Dissipaters

Energy dissipaters are provided on the inlet and outlet to a closed pipe system to prevent erosion at these locations. Design of an energy dissipater can vary significantly from highly engineered systems (concrete or rock gabion structures) to the more commonly used rock pad. The rock pad is typically constructed of 4- to 12-inch diameter rocks a minimum of 12 inches thick and is often lined with filter fabric. The rock pad should extend above the top of the pipe a minimum of 1 foot.
# Energy Dissipaters Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Rock Pad</td>
<td>Missing or Moved Rock</td>
<td>Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.</td>
<td>Rock pad replaced to design standards.</td>
</tr>
<tr>
<td>M</td>
<td>Rock Pad</td>
<td>Erosion</td>
<td>Soil erosion in or adjacent to rock pad.</td>
<td>Rock pad replaced to design standards.</td>
</tr>
<tr>
<td>M</td>
<td>Dispersion Trench</td>
<td>Pipe Plugged with Sediment</td>
<td>Accumulated sediment that exceeds 20% of the design depth.</td>
<td>Pipe cleaned.flushed so that it matches design.</td>
</tr>
<tr>
<td>M</td>
<td>Dispersion Trench</td>
<td>Not Discharging Water Properly</td>
<td>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.</td>
<td>Trench redesigned or rebuilt to standards.</td>
</tr>
<tr>
<td>M</td>
<td>Dispersion Trench</td>
<td>Perforations Plugged</td>
<td>Over 1/2 of perforations in pipe are plugged with debris and sediment.</td>
<td>Perforated pipe cleaned or replaced.</td>
</tr>
<tr>
<td>M</td>
<td>Dispersion Trench</td>
<td>Water Flows Out Top of “Distributor” Catch Basin.</td>
<td>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.</td>
<td>Facility rebuilt or redesigned to standards.</td>
</tr>
<tr>
<td>M</td>
<td>Dispersion Trench</td>
<td>Receiving Area Over-Saturated</td>
<td>Water in receiving area is causing or has potential of causing landslide problems.</td>
<td>No danger of landslides.</td>
</tr>
<tr>
<td><strong>Internal:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Manhole/Chamber</td>
<td>Worn or Damaged Post, Baffles, Side of Chamber</td>
<td>Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound.</td>
<td>Structure replaced to design standards.</td>
</tr>
<tr>
<td>M</td>
<td>Manhole/Chamber</td>
<td>Trash&amp; Debris</td>
<td>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.</td>
<td>No trash or debris in the catch basin.</td>
</tr>
<tr>
<td>M</td>
<td>Manhole/Chamber</td>
<td>Trash&amp; Debris</td>
<td>Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.</td>
<td>Inlet and outlet pipes free of trash or debris.</td>
</tr>
<tr>
<td>M</td>
<td>Manhole/Chamber</td>
<td>Trash&amp; Debris</td>
<td>Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).</td>
<td>No dead animals or vegetation present within the catch basin.</td>
</tr>
<tr>
<td>Frequency</td>
<td>Drainage System Feature</td>
<td>Date</td>
<td>Problem</td>
<td>Conditions to Check For</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
<td>------</td>
<td>---------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Internal (Continued):</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Manhole/Chamber</td>
<td></td>
<td>Sediment</td>
<td>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. There shall be a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.</td>
</tr>
<tr>
<td>A</td>
<td>Manhole/Chamber</td>
<td></td>
<td>Structure Damage to Frame and/or Top Slab</td>
<td>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)</td>
</tr>
<tr>
<td>A</td>
<td>Manhole/Chamber</td>
<td></td>
<td>Structure Damage to Frame and/or Top Slab</td>
<td>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</td>
</tr>
<tr>
<td>A</td>
<td>Manhole/Chamber</td>
<td></td>
<td>Fractures or Cracks in Basin Walls/Bottom</td>
<td>Maintenance person judges that structure is unsound.</td>
</tr>
<tr>
<td>A</td>
<td>Manhole/Chamber</td>
<td></td>
<td>Fractures or Cracks in Basin Walls/Bottom</td>
<td>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.</td>
</tr>
<tr>
<td>A</td>
<td>Manhole/Chamber</td>
<td></td>
<td>Settlement / Misalignment</td>
<td>If failure of basin has created a safety, function, or design problem.</td>
</tr>
<tr>
<td>M</td>
<td>Manhole/Chamber</td>
<td></td>
<td>Contamination and Pollution</td>
<td>Any evidence of oil, gasoline, contaminants, or other pollutants (Coordinate removal/cleanup with local water quality response agency).</td>
</tr>
<tr>
<td>A</td>
<td>Catch Basin Cover</td>
<td></td>
<td>Cover Not in Place</td>
<td>Cover is missing or only partially in place.</td>
</tr>
</tbody>
</table>
## Energy Dissipaters Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Catch Basin Cover</td>
<td>✓</td>
<td>Locking Mechanism Not Working</td>
<td>Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.</td>
<td>Mechanism opens with proper tools.</td>
</tr>
<tr>
<td>A</td>
<td>Catch Basin Cover</td>
<td>✓</td>
<td>Cover Difficult to Remove</td>
<td>One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep cover from sealing off access to maintenance.)</td>
<td>Cover can be removed by one maintenance person.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

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(M) Monthly from November through April.
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(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.8 Typical Biofiltration Swale

Biofiltration swales are engineered grass-lined open channels with moderate centerline slope similar in appearance to typical ditches. Biofiltration uses vegetation in conjunction with slow and shallow-depth flow for runoff treatment. As runoff passes through the vegetation, pollutants are removed through the combined effects of filtration, infiltration, and settling. These effects are aided by the reduction of the velocity of stormwater as it passes through the biofilter.

Biofiltration swales provide stormwater quality control (treatment), but do not provide stormwater quantity control (detention/retention).
## Typical Biofiltration Swale Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Sediment Accumulation on Grass</td>
<td>Sediment depth exceeds 2 inches.</td>
<td>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.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Standing Water</td>
<td>When water stands in the swale between storms and does not drain freely.</td>
<td>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.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Flow spreader</td>
<td>Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.</td>
<td>Level the spreader and clean so that flows are spread evenly over entire swale width.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Constant Baseflow</td>
<td>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.</td>
<td>Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Poor Vegetation Coverage</td>
<td>When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.</td>
<td>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.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Vegetation</td>
<td>When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.</td>
<td>Mow vegetation or remove nuisance vegetation so that flow is not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.</td>
</tr>
<tr>
<td>Frequency</td>
<td>Drainage System Feature</td>
<td>Date</td>
<td>Problem</td>
<td>Conditions to Check For</td>
<td>Conditions That Should Exist</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
<td>------</td>
<td>---------</td>
<td>-------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Excessive Shading</td>
<td>Grass growth is poor because sunlight does not reach swale.</td>
<td>If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Inlet/Outlet</td>
<td>Inlet/outlet areas clogged with sediment and/or debris.</td>
<td>Remove material so that there is no clogging or blockage in the inlet and outlet area.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Trash and Debris Accumulation</td>
<td>Trash and debris accumulated in the bioswale.</td>
<td>Remove trash and debris from bioswale.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Erosion/Scouring</td>
<td>Eroded or scoured swale bottom due to flow channelization, or higher flows.</td>
<td>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 regraded 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.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

**Key:**

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.9 Wet Biofiltration Swale

A wet biofiltration swale is a variation of a basic biofiltration swale for use where the centerline slope is slight, groundwater tables are high, or a continuous low base flow is likely to result in wet soil conditions for long periods of time. Where continuously wet soil conditions exceeds about 2 weeks, typical grasses will die. Thus, vegetation specifically adapted to wet soil conditions is needed. Different vegetation in turn requires modification of several of the design and maintenance requirements from the basic biofiltration swale.
<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td>Sediment Accumulation</td>
<td>Sediment depth exceeds 2-inches in 10% of the swale treatment area.</td>
<td>Remove sediment deposits in treatment area.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>Water Depth</td>
<td>Water not retained to a depth of about 4 inches during the wet season.</td>
<td>Build up or repair outlet berm so that water is retained in the wet swale.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>Wetland Vegetation</td>
<td>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.</td>
<td>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.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>Inlet/Outlet</td>
<td>Inlet/outlet area clogged with sediment and/or debris.</td>
<td>Remove clogging or blockage in the inlet and outlet areas.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>Trash and Debris Accumulation</td>
<td>Any trash and debris which exceed 5 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size garbage can). 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.</td>
<td>Remove trash and debris from wet swale.</td>
</tr>
</tbody>
</table>
If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

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(S) After any major storm (use 1-inch in 24 hours as a guideline).
### 3.10 Filter Strips

A basic filter strip consists of a vegetated slope area that provides the same treatment functions as a biofiltration swale. Contaminated stormwater runoff is distributed as shallow flow across the top width of a biofilter strip through a level-spreader device or curb cuts at the edge of a paved area. The level-spreader device typically consists of a gravel trench with a board or concrete curb with a level top to evenly distribute the stormwater runoff across the entire length of the filter strip. Most filter strips have a collection ditch at its base to collect and route the treated runoff to a detention/retention facility or downstream conveyance system.
## Filter Strips Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Sediment Accumulation on Grass</td>
<td>Sediment depth exceeds 2 inches.</td>
<td>Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Vegetation</td>
<td>When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts to take over.</td>
<td>Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Trash and Debris Accumulation</td>
<td>Trash and debris accumulated on the filter strip.</td>
<td>Remove trash and Debris from filter.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Erosion/Scouring</td>
<td>Eroded or scoured areas due to flow channelization, or higher flows.</td>
<td>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.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Flow spreader</td>
<td>Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.</td>
<td>Level the spreader and clean so that flows are spread evenly over entire filter width.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

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(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.11 Wetponds

A wetpond is an open basin that retains a permanent pool of water (wetpool) year round or only during the wet season. The volume of the wetpool allows sediment and other pollutants to settle out of the runoff. Wetland vegetation is typically planted within the wetpond to provide additional treatment through nutrient (i.e. nitrogen) removal. Detention quantity control can be provided with additional temporary storage volume above the permanent pool elevation.
## Wetponds Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Water level</td>
<td>First cell is empty, doesn’t hold water.</td>
<td>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 re-suspension.</td>
</tr>
<tr>
<td>M</td>
<td>Trash and Debris</td>
<td></td>
<td>Accumulation that exceeds 1 CF per 1000-SF of pond area.</td>
<td>Trash and debris removed from pond</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Inlet/Outlet Pipe</td>
<td></td>
<td>Inlet/Outlet pipe clogged with sediment and/or debris material</td>
<td>No clogging or blockage in the inlet and outlet piping.</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Sediment Accumulation in Pond Bottom</td>
<td></td>
<td>Sediment accumulations in pond bottom that exceeds the depth of sediment zone plus 6-inches, usually in the first cell.</td>
<td>Sediment removed from pond bottom.</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Oil Sheen on Water</td>
<td></td>
<td>Prevalent and visible oil sheen.</td>
<td>Oil removed from water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Erosion</td>
<td></td>
<td>Erosion of the pond’s side slopes and/or scouring of the pond bottom, which exceeds 6-inches, or where continued erosion is prevalent.</td>
<td>Slopes stabilized using proper erosion control measures and repair methods.</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Settlement of Pond Dike/Berm</td>
<td></td>
<td>Any part of these components which has settled 4-inches or lower than the design elevation, or inspector determines dike/berm is unsound.</td>
<td>Dike/berm is repaired to specifications</td>
<td></td>
</tr>
</tbody>
</table>
Wetponds Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Internal Berm</td>
<td></td>
<td></td>
<td>Berm dividing cells should be level.</td>
<td>Berm surface is leveled so that water flows evenly over entire length of berm.</td>
</tr>
<tr>
<td>A</td>
<td>Overflow Spillway</td>
<td></td>
<td></td>
<td>Rock is missing and soil is exposed at top of spillway or outside slope.</td>
<td>Rocks replaced to specifications.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.12 Wet Vaults

A wet vault is an underground structure similar in appearance to a detention vault, except that a wet vault has a permanent pool of water (wetpool) which dissipates energy and improves the settling of sediment and other pollutants. Being underground, the wet vault lacks the nutrient removal ability of vegetation.

As discussed in the underground detention systems, wet vaults are a closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities should be conducted by an individual with training and certification in working in hazardous confined spaces.
## Wet Vaults Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Trash/Debris Accumulation</td>
<td></td>
<td>Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).</td>
<td>Remove trash and debris from vault.</td>
<td></td>
</tr>
<tr>
<td>Genera</td>
<td>Sediment Accumulation in Vault</td>
<td></td>
<td>Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.</td>
<td>Remove sediment from vault.</td>
<td></td>
</tr>
<tr>
<td>Genera</td>
<td>Damaged Pipes</td>
<td>Inlet/outlet piping damaged or broken and in need of repair.</td>
<td>Pipe repaired and/or replaced.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genera</td>
<td>Access Cover Damaged/Not Working</td>
<td>Cover cannot be opened or removed, especially by one person.</td>
<td>Pipe repaired or replaced to proper working specifications.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genera</td>
<td>Ventilation</td>
<td>Ventilation area blocked or plugged.</td>
<td>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).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vault Structure</td>
<td>Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab</td>
<td>Maintenance/inspection personnel determine that the vault is not structurally sound.</td>
<td>Vault replaced or repairs made so that vault meets design specifications and is structurally sound.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vault Structure</td>
<td>Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab</td>
<td>Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.</td>
<td>Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vault Structure</td>
<td>Baffles</td>
<td>Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.</td>
<td>Baffles repaired or replaced to specifications.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Wet Vaults Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Ladder</td>
<td>✓ ✓ ✓ ✓</td>
<td>Damage</td>
<td>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.</td>
<td>Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements.</td>
<td></td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**
(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.13 Sand Filters (Above Ground/Open)

Sand filters function by filtering stormwater runoff through a sand bed typically 18 inches in depth. The treated runoff is collected in the underdrain system and routed to a detention/retention facility or a downstream conveyance system. A typical sand filtration system consists of, a pretreatment system for removing larger sediment and debris from the runoff, a flow spreader, a sand bed, and an underdrain piping. The sand filter bed typically includes a woven (geotextile) fabric between the sand bed and the underdrain system.

Open, above-ground sand filters have a physical appearance similar to a detention pond with the main difference being the sand lined bottom.
# Sand Filters (above ground/open) Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td></td>
<td>Sediment Accumulation on top layer</td>
<td>Sediment depth exceeds 1/2-inch.</td>
<td>No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.</td>
</tr>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td></td>
<td>Trash and Debris Accumulations</td>
<td>Trash and debris accumulated on sand filter bed.</td>
<td>Trash and debris removed from sand filter bed.</td>
</tr>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td></td>
<td>Sediment/ Debris in Clean-Outs</td>
<td>When the clean-outs become full or partially plugged with sediment and/or debris.</td>
<td>Sediment removed from clean-outs.</td>
</tr>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td></td>
<td>Sand Filter Media</td>
<td>Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently.</td>
<td>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).</td>
</tr>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td></td>
<td>Prolonged Flows</td>
<td>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.</td>
<td>Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.</td>
</tr>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td></td>
<td>Short Circuiting</td>
<td>When flows become concentrated over one section of the sand filter rather than dispersed.</td>
<td>Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area.</td>
</tr>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td></td>
<td>Erosion Damage to Slopes</td>
<td>Erosion over 2-inches deep where cause of damage is prevalent or potential for continued erosion is evident.</td>
<td>Slopes stabilized using proper erosion control measures.</td>
</tr>
<tr>
<td>A</td>
<td>Above Ground (open sand filter)</td>
<td></td>
<td>Rock Pad Missing or Out of Place</td>
<td>Soil beneath the rock is visible.</td>
<td>Rock pad replaced or rebuilt to design specifications.</td>
</tr>
</tbody>
</table>
### Sand Filters (above ground/open) Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td>☑️ ☑️ ☑️ 🆘</td>
<td>Flow Spreader</td>
<td>Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter.</td>
<td>Spreader leveled and cleaned so that flows are spread evenly over sand filter.</td>
</tr>
<tr>
<td>M</td>
<td>Above Ground (open sand filter)</td>
<td>☑️ ☑️ ☑️ 🆘</td>
<td>Damaged Pipes</td>
<td>Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.</td>
<td>Pipe repaired or replaced.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.

(A) Once in late summer (preferable September)

(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.14 Sand Filters (Below Ground/Enclosed)

A sand filter vault is similar to an open sand filter except that the sand layer and underdrains are installed below ground in a vault. It consists of presettling and sand filtration cells and functions by filtering stormwater runoff through a sand bed. Treated runoff is collected in the underdrain system and routed to a detention/retention facility or a downstream conveyance system.
# Sand Filters (below ground/enclosed) Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Sediment Accumulation on Sand Media Section</td>
<td>Sediment depth exceeds 1/2-inch.</td>
<td>No sediment deposits on sand filter section that which would impede permeability of the filter section.</td>
</tr>
<tr>
<td>M</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Sediment Accumulation in Pre-Settling Portion of Vault</td>
<td>Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.</td>
<td>No sediment deposits in first chamber of vault.</td>
</tr>
<tr>
<td>M</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Trash/Debris Accumulation</td>
<td>Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.</td>
<td>Trash and debris removed from vault and inlet/outlet piping.</td>
</tr>
<tr>
<td>M</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Sediment in Drain Pipes/Cleanouts</td>
<td>When drain pipes, cleanouts become full with sediment and/or debris.</td>
<td>Sediment and debris removed.</td>
</tr>
<tr>
<td>M</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Short Circuiting</td>
<td>When seepage/flow occurs along the vault walls and corners. Sand eroding near inflow area.</td>
<td>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.</td>
</tr>
<tr>
<td>A</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Damaged Pipes</td>
<td>Inlet or outlet piping damaged or broken and in need of repair.</td>
<td>Pipe repaired and/or replaced.</td>
</tr>
<tr>
<td>A</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Access Cover Damaged/Not Working</td>
<td>Cover cannot be opened, corrosion/deformation of cover. Maintenance person cannot remove cover using normal lifting pressure.</td>
<td>Cover repaired to proper working specifications or replaced.</td>
</tr>
<tr>
<td>M</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Ventilation</td>
<td>Ventilation area blocked or plugged.</td>
<td>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).</td>
</tr>
<tr>
<td>A</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.</td>
<td>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.</td>
<td>Vault replaced or repairs made so that vault meets design specifications and is structurally sound.</td>
</tr>
</tbody>
</table>
Sand Filters (above ground/open) Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Below Ground Vault.</td>
<td></td>
<td>Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.</td>
<td>Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.</td>
</tr>
<tr>
<td>A</td>
<td>Below Ground Vault.</td>
<td>Baffles/Internal walls</td>
<td>Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.</td>
<td>Baffles repaired or replaced to specifications.</td>
</tr>
<tr>
<td>A</td>
<td>Below Ground Vault.</td>
<td>Access Ladder</td>
<td>Damaged Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.</td>
<td>Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.15 Stormfilter® Cast-In-Place, Precast, Linear Stormfilter and Catch Basin Units

This media filter technology has been under development in the Pacific Northwest since the early 1990s. During the early stages of development, leaf compost was used in fixed beds, replacing sand. Continued development of this technology is based on placing the media in filter cartridges (vertical media filters) instead of fixed beds.

The filter media can be housed in cartridge filters enclosed in concrete vaults or catch basin like structures. Assortments of filter media types are available from the manufacturer. The system functions by routing the stormwater through the filtering medium, which traps particulates and/or soluble pollutants.

Stormfilter® units are a proprietary manufactured system. See manufacturer's publications for additional maintenance information.
### Stormfilter® Cast-In-Place, Precast, Linear Stormfilter Units and Catch Basin Units Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td>Sediment accumulation on top of filter cartridges</td>
<td>Sediment accumulation exceeds 0.25 inches on top of cartridges.</td>
<td>No sediment deposits on top of cartridges. Sediment on cartridges likely indicates that cartridges are plugged and require maintenance.</td>
</tr>
<tr>
<td></td>
<td>Media filter vault</td>
<td>✓</td>
<td>Sediment accumulation in vault</td>
<td>Sediment accumulation in vault exceeds 2 inches. Look for other indicators of clogged cartridges or overflow.</td>
<td>Sediment in vault should be removed. Cartridges should be checked and replaced or serviced as needed.</td>
</tr>
<tr>
<td></td>
<td>Media filter vault</td>
<td>✓</td>
<td>Trash and floatable debris accumulation</td>
<td>Trash and floatable debris accumulation in vault.</td>
<td>No trash or other floatable debris in filter vault.</td>
</tr>
<tr>
<td>S</td>
<td>Media filter vault</td>
<td>✓</td>
<td>Filter cartridges submerged</td>
<td>Filter vault does not drain within 24 hours following storm. Look for evidence of submergence due to backwater or excessive hydrocarbon loading.</td>
<td>Filter media checked and replaced if needed. If cartridges are plugged with oil additional treatment or source control BMP may be needed.</td>
</tr>
<tr>
<td></td>
<td>Forebay</td>
<td>✓</td>
<td>Sediment accumulation</td>
<td>Sediment accumulation exceeds 6 inches or 1/3 of available sump.</td>
<td>Sediment accumulation less than 6 inches.</td>
</tr>
<tr>
<td></td>
<td>Forebay</td>
<td>✓</td>
<td>Trash and floatable debris accumulation</td>
<td>Trash and/or floatable debris accumulation.</td>
<td>Trash and/or floatable debris should be removed during monthly inspections. Significant oil accumulation may indicate the need for additional treatment or source control.</td>
</tr>
<tr>
<td></td>
<td>Below ground vault</td>
<td>✓</td>
<td>Access cover Damaged/ Not working</td>
<td>One maintenance person cannot remove lid after applying 80 pounds of lift, corrosion of deformation of cover.</td>
<td>Cover repaired to proper working specifications or replaced.</td>
</tr>
<tr>
<td></td>
<td>Below ground vault</td>
<td>✓</td>
<td>Damaged Pipes</td>
<td>Any part of the pipes are crushed or damaged due to corrosion and/or settlement.</td>
<td>Pipe repaired or replaced.</td>
</tr>
<tr>
<td></td>
<td>Below ground vault</td>
<td>✓</td>
<td>Vault structure has cracks in wall, bottom, and damage to frame and/or top slab.</td>
<td>Cracks wider than ½ inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.</td>
<td>Vault repaired or replaced so that vaults meet design specifications and is structurally sound.</td>
</tr>
<tr>
<td></td>
<td>Below ground vault</td>
<td>✓</td>
<td>Vault structure has cracks in wall, bottom, and damage to frame and/or top slab.</td>
<td>Cracks wider than 0.5 inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks</td>
<td>Vault repaired so that no cracks exist wider than 0.25 inch at the joint of inlet/outlet pipe.</td>
</tr>
</tbody>
</table>
### Stormfilter® Cast-In-Place, Precast, Linear Stormfilter Units and Catch Basin Units Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Below ground vault</td>
<td></td>
<td>Baffles</td>
<td>Baffles corroding, cracking, warping, and/or showing signs of failure as determined by maintenance/inspection person.</td>
<td>Baffles repaired or replaced to design specifications.</td>
</tr>
<tr>
<td>A</td>
<td>Below ground vault</td>
<td></td>
<td>Ladder rungs unsafe</td>
<td>Maintenance person judges that ladder is unsafe due to missing rungs, misalignment, rust, or cracks. Ladder must be fixed or secured immediately.</td>
<td>Ladder meets design standards and allows maintenance persons safe access.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.

(A) Once in late summer (preferable September)

(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.16 Oil/Water Separator (API Type)

American Petroleum Institute (API) oil water separators consist of an underground vault separated into three bays by a series of partial divider walls (baffles). The three bays consist of a forebay, separator section, and the afterbay. Oil/water separators are typically utilized in locations where high oil concentrations in the stormwater runoff are anticipated (i.e. service and fuel stations). Oil/water separators are most commonly used as the first pre-treatment facility in a series of stormwater management facilities ('treatment train').
## Baffle Oil/Water Separators (API Type) Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M,S</td>
<td>Monitoring</td>
<td></td>
<td>Inspection of discharge water for obvious signs of poor water quality.</td>
<td>Sheen, obvious oil present.</td>
<td>Effluent discharge from vault should be clear with out thick visible sheen.</td>
</tr>
<tr>
<td>M,S</td>
<td>Monitoring</td>
<td></td>
<td>Sediment Accumulation</td>
<td>Sediment depth in bottom of vault exceeds 6-inches in depth.</td>
<td>No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.</td>
</tr>
<tr>
<td>M,S</td>
<td>Monitoring</td>
<td></td>
<td>Trash and Debris Accumulation</td>
<td>Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.</td>
<td>Trash and debris removed from vault, and inlet/outlet piping.</td>
</tr>
<tr>
<td>M,S</td>
<td>Monitoring</td>
<td></td>
<td>Oil Accumulation</td>
<td>Oil accumulations that exceed 1-inch, at the surface of the water.</td>
<td>Extract oil from vault by vactoring. Disposal in accordance with state and local rules and regulations.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Damaged Pipes</td>
<td>Inlet or outlet piping damaged or broken and in need of repair.</td>
<td>Pipe repaired or replaced.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Access Cover Damaged/Not Working</td>
<td>Cover cannot be opened, corrosion/deformation of cover.</td>
<td>Cover repaired to proper working specifications or replaced.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Vault Structure Damage Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab</td>
<td>Maintenance person judges that structure is unsound.</td>
<td>Vault replaced or repairs made so that vault meets design specifications and is structurally sound.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Vault Structure Damage Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab</td>
<td>Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.</td>
<td>Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.</td>
</tr>
</tbody>
</table>
# Baffle Oil/Water Separators (API Type) Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Baffles</td>
<td>Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.</td>
<td>Baffles repaired or replaced to specifications.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Access Ladder Damaged</td>
<td>Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.</td>
<td>Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.17 Coalescing Plate Oil/Water Separator

Coalescing plate oil water separators are generally the same as the API type. The main difference is that coalescing plate separators include a series of parallel plates in the separation bay (2nd bay) that increase the oil removal efficiency of the separator.
## Coalescing Plate Oil/Water Separators Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Monitoring</td>
<td>Inspection of discharge water for obvious signs of poor water quality.</td>
<td>Effluent discharge from vault should be clear with no thick visible sheen.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Sediment Accumulation</td>
<td>Sediment depth in bottom of vault exceeds 6-inches in depth and/or visible signs of sediment on plates.</td>
<td>No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Trash and Debris Accumulation</td>
<td>Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.</td>
<td>Trash and debris removed from vault, and inlet/outlet piping.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Oil Accumulation</td>
<td>Oil accumulation that exceeds 1-inch at the water surface.</td>
<td>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.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Damaged Coalescing Plates</td>
<td>Plate media broken, deformed, cracked, and/or showing signs of failure.</td>
<td>A portion of the media pack or the entire plate pack is replaced depending on severity of failure.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Damaged Pipes</td>
<td>Inlet or outlet piping damaged or broken and in need of repair.</td>
<td>Pipe repaired and or replaced.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Baffles</td>
<td>Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.</td>
<td>Baffles repaired or replaced to specifications.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Vault Structure Damage</td>
<td>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.</td>
<td>Vault replaced or repairs made so that vault meets design specifications and is structurally sound.</td>
</tr>
</tbody>
</table>
## Coalescing Plate Oil/Water Separators Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td></td>
<td>Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.</td>
<td>Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Access Ladder Damaged</td>
<td>Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.</td>
<td>Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
Catch basin inserts have been under development for many years in the Puget Sound Basin. They function similarly to media filtration except that they are typically limited by the size of the catch basin. They also are likely to be maintenance intensive.

Catch basin inserts typically consist of the following components:

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

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td>☑</td>
<td>Sediment Accumulation</td>
<td>When sediment forms a cap over the insert media of the insert and/or unit.</td>
<td>No sediment cap on the insert media and its unit.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>☑</td>
<td>Trash and Debris Accumulation</td>
<td>Trash and debris accumulates on insert unit creating a blockage/restriction.</td>
<td>Trash and debris removed from insert unit. Runoff freely flows into catch basin.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>☑</td>
<td>Media Insert Not Removing Oil</td>
<td>Effluent water from media insert has a visible sheen.</td>
<td>Effluent water from media insert is free of oils and has no visible sheen.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>☑</td>
<td>Media Insert Water Saturated</td>
<td>Catch basin insert is saturated with water and no longer has the capacity to absorb.</td>
<td>Remove and replace media insert</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>☑</td>
<td>Media Insert-Oil Saturated</td>
<td>Media oil saturated due to petroleum spill that drains into catch basin.</td>
<td>Remove and replace media insert.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>☑</td>
<td>Media Insert Use Beyond Normal Product Life</td>
<td>Media has been used beyond the typical average life of media insert product.</td>
<td>Remove and replace media at regular intervals, depending on insert product.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
### 3.19 Fencing/Shrubbery Screen/Other Landscaping

Fencing and shrubbery screen are provided around open stormwater management facilities to limit unauthorized access for safety purposes and to minimize the visual impact of the facility.

#### Fencing/Shrubbery Screen/Other Landscaping Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Missing or broken parts/dead shrubbery</td>
<td>Any defect in the fence or screen that permits easy entry to a facility.</td>
<td>Fence is mended or shrubs replaced to form a solid barrier to entry.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Erosion</td>
<td>Erosion has resulted in an opening under a fence that allows entry by people or pets.</td>
<td>Replace soil under fence so that no opening exceeds 4 inches in height.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Unruly vegetation</td>
<td>Shrubbery is growing out of control or is infested with weeds.</td>
<td>Shrubbery is trimmed and weeded to provide appealing aesthetics. Do not use chemicals to control weeds.</td>
</tr>
<tr>
<td>A</td>
<td>Fences</td>
<td></td>
<td>Damaged parts</td>
<td>Posts out of plumb more than 6 inches.</td>
<td>Posts plumb to within 1-1/2 inches of plumb.</td>
</tr>
<tr>
<td>A</td>
<td>Fences</td>
<td></td>
<td>Damaged parts</td>
<td>Top rails bent more than 6 inches.</td>
<td>Top rail free of bends greater than 1 inch.</td>
</tr>
<tr>
<td>A</td>
<td>Fences</td>
<td></td>
<td>Damaged parts</td>
<td>Any part of fence (including posts, top rails, and fabric) more than 1 foot out of design alignment.</td>
<td>Fence is aligned and meets design standards.</td>
</tr>
<tr>
<td>A</td>
<td>Fences</td>
<td></td>
<td>Damaged parts</td>
<td>Missing or loose tension wire.</td>
<td>Tension wire in place and holding fabric.</td>
</tr>
<tr>
<td>A</td>
<td>Fences</td>
<td></td>
<td>Damaged parts</td>
<td>Missing or loose barbed wire that is sagging more than 2-1/2 inches between posts.</td>
<td>Barbed wire in place with less than 3/4-inch sag between posts.</td>
</tr>
<tr>
<td>A</td>
<td>Fences</td>
<td></td>
<td>Damaged parts</td>
<td>Extension arm missing, broken, or bent out of shape more than 1-1/2 inches.</td>
<td>Extension arm in place with no bends larger than 3/4 inch.</td>
</tr>
<tr>
<td>A</td>
<td>Fences</td>
<td></td>
<td>Deteriorated paint or protective coating</td>
<td>Part or parts that have a rusting or scaling condition that has affected structural adequacy.</td>
<td>Structurally adequate posts or parts with a uniform protective coating.</td>
</tr>
<tr>
<td>M</td>
<td>Fences</td>
<td></td>
<td>Openings in fabric</td>
<td>Openings in fabric are such that an 8-inch diameter ball could fit through.</td>
<td>No openings in fabric.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

**Key:**
- (M) Monthly from November through April.
- (A) Once in late summer (preferable September)
- (S) After any major storm (use 1-inch in 24 hours as a guideline).
### Gates

Gates typically consist of a chain link gate for fenced stormwater facilities to provide safety and allow vehicle and/or personnel access to the facility.

#### Gates Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td>Damaged or missing components</td>
<td>Gate is broken, jammed, or missing.</td>
<td>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 County field staff has a key.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td>Damaged or missing components</td>
<td>Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person.</td>
<td>Hinges intact and lubed. Gate is working freely.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>Damaged or missing components</td>
<td>Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment.</td>
<td>Gate is aligned and vertical.</td>
</tr>
<tr>
<td>A</td>
<td>General</td>
<td>Damaged or missing components</td>
<td>Missing stretcher bands, and ties.</td>
<td>Stretcher bar, bands, and ties in place.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

**Comments:**

**Key:**

(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.21 Grounds (Landscaping)

Landscaping is an essential component of stormwater management. Bare soil areas generate higher levels of stormwater runoff and sedimentation in stormwater facilities. The following check list gives some general guidance for landscape management.

Grounds (Landscaping) Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Weeds (nonpoisonous)</td>
<td>Weeds growing in more than 20% of the landscaped area (trees and shrubs only).</td>
<td>Weeds present in less than 5% of the landscaped area.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Insect hazard</td>
<td>Any presence of poison ivy or other poisonous vegetation or insect nests.</td>
<td>No poisonous vegetation or insect nests present in landscaped area.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Trash or litter</td>
<td>See Ponds Checklist.</td>
<td>See Ponds Checklist.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Erosion of Ground Surface</td>
<td>Noticeable rills are seen in landscaped areas.</td>
<td>Causes of erosion are identified and steps taken to slow down/spread out the water. Eroded areas are filled, contoured, and seeded.</td>
</tr>
<tr>
<td>A</td>
<td>Trees and shrubs</td>
<td></td>
<td>Damage</td>
<td>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.</td>
<td>Trim trees/shrubs to restore shape. Replace trees/shrubs with severe damage.</td>
</tr>
<tr>
<td>M</td>
<td>Trees and shrubs</td>
<td></td>
<td>Damage</td>
<td>Trees or shrubs that have been blown down or knocked over.</td>
<td>Replant tree, inspecting for injury to stem or roots. Replace if severely damaged.</td>
</tr>
<tr>
<td>A</td>
<td>Trees and shrubs</td>
<td></td>
<td>Damage</td>
<td>Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.</td>
<td>Place stakes and rubber-coated ties around young trees/shrubs for support.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

Key:
(M) Monthly from November through April.
(A) Once in late summer (preferable September)
(S) After any major storm (use 1-inch in 24 hours as a guideline).
3.22 Ecology Embankment

An ecology embankment is a filter strip designed for impervious areas with flow paths of 30 feet or less that can drain along their widest dimension to grassy areas. Typical applications of ecology embankments are for roads with limited right-of-way widths or for narrow parking strips.
<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>No Vegetation Zone adjacent to pavement</td>
<td>✓ ✓ ✓ ✓</td>
<td>Erosion, scour, or vehicular damage</td>
<td>No vegetation zone is uneven or clogged so that flows are not uniformly distributed.</td>
<td>Level the area and clean so that flows are spread evenly.</td>
</tr>
<tr>
<td>M</td>
<td>No Vegetation Zone adjacent to pavement</td>
<td>✓ ✓ ✓ ✓</td>
<td>Sediment accumulation on edge of pavement</td>
<td>Flows no longer sheeting off of roadway. Sediment accumulation on pavement edge exceeds top of pavement elevation.</td>
<td>Remove sediment deposits such that flows can sheet off of roadway.</td>
</tr>
<tr>
<td>M</td>
<td>Vegetated Filter</td>
<td>✓ ✓ ✓ ✓</td>
<td>Sediment Accumulation on Grass</td>
<td>Sediment depth exceeds 2 inches.</td>
<td>Remove sediment deposits, re-level so slope is even and flows pass evenly through Ecology Embankment.</td>
</tr>
<tr>
<td>M</td>
<td>Vegetated Filter</td>
<td>✓ ✓ ✓ ✓</td>
<td>Excessive vegetation or undesirable species.</td>
<td>When the grass becomes excessively tall; when nuisance weeds and other vegetation starts to take over or shades out desirable vegetation growth characteristics.</td>
<td>Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height that encourages dense even herbaceous growth.</td>
</tr>
<tr>
<td>M</td>
<td>Vegetated Filter</td>
<td>✓ ✓ ✓ ✓</td>
<td>Erosion, scour, or vehicular damage.</td>
<td>Eroded or scoured areas due to flow channelization, high flows, or vehicular damage.</td>
<td>For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with suitable topsoil. (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.</td>
</tr>
<tr>
<td>M</td>
<td>Media Bed</td>
<td>✓ ✓ ✓ ✓</td>
<td>Erosion, scour, or vehicular damage.</td>
<td>Eroded or scoured areas due to flow channelization, high flows, or vehicular damage.</td>
<td>For ruts or areas less than 12 inches wide, repair the damaged area by filling with suitable media. If bare areas are large, generally greater than 12 inches wide, the media bed should be re-graded.</td>
</tr>
<tr>
<td>M</td>
<td>Media Bed</td>
<td>✓ ✓ ✓ ✓</td>
<td>Sediment Accumulation on Media Bed.</td>
<td>Sediment depth inhibits free infiltration of water.</td>
<td>Remove sediment deposits, re-level so slope is even and flows pass freely through Media Bed.</td>
</tr>
<tr>
<td>M</td>
<td>Underdrains</td>
<td>✓ ✓ ✓ ✓</td>
<td>Sediment</td>
<td>Depth of sediment within perforated pipe exceeds 0.5&quot;.</td>
<td>Flush underdrains through access ports and collect flushed sediment.</td>
</tr>
</tbody>
</table>
### Ecology Embankment Checklist (Continued)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Trash and Debris Accumulation</td>
<td>Trash and debris which exceed 5 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size garbage can). 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.</td>
<td>Remove trash and debris.</td>
</tr>
<tr>
<td>M</td>
<td>General</td>
<td></td>
<td>Flows are bypassing Ecology Embankment</td>
<td>Evidence of significant flows down-slope (rills, sediment, vegetation damage, etc.) of Ecology Embankment.</td>
<td>Remove sediment deposits, re-level so slope is even and flows pass evenly through Ecology Embankment. If Ecology Embankment is completely clogged it may require more extensive repair or replacement.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**

(M) Monthly from November through April.

(A) Once in late summer (preferable September)

(S) After any major storm (use 1-inch in 24 hours as a guideline).
### 3.23 Vortechs® Stormwater Treatment System

Vortechs® Stormwater Treatment System consists of a cylindrical vessel where the inlet flow spirals around the perimeter in a vortex-type action causing the heavier particles to settle out of the stormwater. It uses a vortex-enhanced settling mechanism (swirl-concentration) to capture settleable solids, floatables, and oil and grease.

Vortechs® treatment units are a proprietary manufactured system. See manufacturer's publications for additional maintenance information.
## Vortechs Stormwater Treatment System Checklist

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Drainage System Feature</th>
<th>Date</th>
<th>Problem</th>
<th>Conditions to Check For</th>
<th>Conditions That Should Exist</th>
</tr>
</thead>
<tbody>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Sediment accumulation</td>
<td>Sediment depth is within 6&quot; of dry weather water surface elevation.</td>
<td>Accumulated sediment should be removed.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Trash and Debris Accumulation</td>
<td>Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.</td>
<td>Trash and debris removed from vault, and inlet/outlet piping.</td>
</tr>
<tr>
<td>M,S</td>
<td>General</td>
<td></td>
<td>Oil Accumulation</td>
<td>Oil accumulation that exceeds 1-inch at the water surface.</td>
<td>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.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Damaged Pipes</td>
<td>Inlet or outlet piping damaged or broken and in need of repair.</td>
<td>Pipe repaired and or replaced.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Baffles</td>
<td>Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.</td>
<td>Baffles repaired or replaced to specifications.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab</td>
<td>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.</td>
<td>Vault replaced or repairs made so that vault meets design specifications and is structurally sound.</td>
</tr>
<tr>
<td>A</td>
<td>Structure</td>
<td></td>
<td>Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab</td>
<td>Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.</td>
<td>Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.</td>
</tr>
</tbody>
</table>

If you are unsure whether a problem exists, please contact a Professional Engineer.

Comments:

**Key:**
- **A**=Annual (March or April preferred)
- **M**=Monthly (see schedule)
- **S**=After major storms (use 1-inch in 24 hours as a guideline)
4.0 Developing a Maintenance Program

A stormwater maintenance program is essential to ensure that the facilities continue to function as designed to prevent possible flooding and property damage. The maintenance program consists of inspections and repairs as detailed in the maintenance checklists provided in Section 3.0.

Stormwater management facilities are not intended to replace good housekeeping procedures. Good housekeeping includes educating facility users of proper storage and disposal of chemicals and potential pollutants, procedures for spill cleanup, proper use of fertilizers and other lawn care products, and maintenance of equipment to prevent release of pollutants to the stormwater system. Guidelines for establishing good housekeeping procedures (Source Control BMPs) and developing a training program to educate facility users can be found in the Pierce County Stormwater Pollution Prevention Manual located at:

http://www.co.pierce.wa.us/PC/services/home/environ/water/swm/sppman/.

4.1 Who Should Perform Maintenance Duties?

Private stormwater facility owners are responsible for ensuring that the facilities are maintained and continue to function as designed. Some activities such as litter removal and mowing can be effectively undertaken by facility owners, however, it is usually worth the cost to have a professional do the more difficult tasks. Filling eroded areas and soil disturbing activities, such as reseeding or re-planting vegetation are tasks that a professional landscaping firm should manage. If these tasks are not performed properly, erosion may occur resulting in accelerated sedimentation of stormwater facilities. Grading and sediment removal are tasks that are best left to professional contractors with the equipment and experience to safely perform the task and who are also able to identify potential problems early when it is most cost effective to make repairs or alterations.
4.2 Working with Maintenance Contractors

Selecting and working with a maintenance contractor can be an intimidating process for many private facility owners. The following is a guideline for researching and choosing a qualified contractor to meet your maintenance needs.

Start your search for a contractor the right way - be informed. The information provided below will help you in your search for the right contractor for your job.

- Landscape maintenance contractors are typically capable of providing most routine maintenance for stormwater facilities. Special, non-routine maintenance may require an earthwork contractor or vactor company. Recently, several contractors have started specializing in stormwater facility maintenance. Private owners can choose to hire contractors when individual maintenance needs arise or enter into annual maintenance agreements where the contractor monitors and provides routine maintenance throughout the year as needed.

- Develop a list of potential contractors. Look in the Yellow Pages and/or ask friends, neighbors, relatives, and coworkers who they have used. Find out if their experiences were good or bad and why. Ask if they would use the contractor again.

- Ask contractors for references. Call your potential contractors and ask for a list of their customers or locations of completed jobs. Call references and ask whether they were satisfied with the job done, if the contractor kept to the agreed upon schedule, and whether they would hire the same contractor again.

- Ask to which trade associations the contractor belongs. Membership in a professional association is one sign the contractor recognizes the responsibilities of being a professional.

- Make sure to obtain and evaluate bids. Ask for a free written estimate of the work you want done. Be sure everyone is bidding on the same exact scope of work and including the exact materials you want. Be sure all quotes include everything you want and that there is a clear understanding of work to be performed by owner and work to be performed by contractor.

- Remember "you get what you pay for." A higher bid may be worth the price for better workmanship and contractor reliability.

- Make sure you understand the different types of bids you may receive. Be careful about hiring a contractor on an hourly time-and-materials, or cost-plus basis. Although the price may seem high at first, a fixed-price bid may give you the best protection and price. Also beware of "special deals," "demonstration projects," or "a great deal from a friend of a friend." Completely review and understand the contract prior to authorizing work.
Questions to Ask Before Hiring a Contractor

- What experience, expertise and/or certification do you have? Do you specialize?

- Who will be doing the actual work: you personally, your employees, or subcontractors?

- Who will oversee the day-to-day job? (You may really like the contractor, but that person may not be the one performing or supervising the work.)

- How many other jobs will you be working on at the same time as mine? (If there are several, yours may not get the attention you want. On the other hand, the contractor's business may be large and he may be able to handle several jobs.)

- How long will the job take? What kind of mess, noise, and inconvenience should I expect? What problems may come up? (Asking questions before the job starts helps prevent surprises later.)

- Where will you dispose of material removed from storm drainage facilities? Is there an extra fee for contaminated materials?

- Does hiring this contractor feel right? (Use intuition - if you do not feel comfortable, find someone else.)

- Do I have rapport with this contractor? Am I confident in his expertise and ideas? Does he care about my concerns? Will he be reliable, keep his appointments, and return my telephone calls?

- Can I communicate with this person? Does he seem honest and forthright? (The contractor may be top-notch at the trade, but if the final product is not what you expected, you will not be happy.)

- Am I willing to be reasonable about unexpected costs that arise and to let my contractor make a profit?

- Am I ready for the unexpected, such as digging into solid rock, major replacement, etc.?

- Can I be flexible when the job takes longer than expected?

- Are my expectations so high that I will never be satisfied with my contractor?
4.3 How much will it Cost to Maintain a Stormwater Management System?

Specific maintenance costs depend on the characteristics of the facility, the site, and the area that contributes runoff to the facility. The general rule of thumb is that annual maintenance costs will be 5 to 10% of the facility’s total capital cost. Routine, scheduled maintenance can help keep overall costs down by addressing problems before they require major attention.

Most of the routine maintenance measures recommended in the checklists (excluding major repair and replacement) are estimated to have an annual cost of $200 to $600 per acre of facility, above current landscape maintenance costs. Costs can vary depending on the types and level of maintenance practices used.

The cost and intensity of maintenance activities are usually higher during the two-year plant establishment period than after the facility has “settled in” after those first two years.

You need to determine how you will finance your maintenance needs. A healthy reserve should be put into place for both capital maintenance procedures (e.g., facility replacement and non-routine maintenance such as sediment removal, facility component repair or replacement, major replanting, or safety structure construction) and operating maintenance procedures (routine activities such as facility inspection, debris removal, and vegetation management).

The best recommendation is to establish a facility maintenance fund. For homeowner associations, this could be a portion of homeowner fees or a specific assessment. The fund should include:

- Ten percent of the facility’s capital cost for annual routine maintenance per year.

- A percentage of the non-routine maintenance costs per year (i.e. for sediment removal, vegetation replacement) based on the frequency of removal. For example, if the facility needs mechanical sediment removal every 10 years, 10 percent of the total cost should be put aside each year.

- An additional 3 to 5% of the facility’s capital cost per year for eventual facility replacement, based on the facility’s life expectancy. Most of these facilities have a life expectancy of 25 to 50 years.
5.0 Additional Information/Resources

For more information on operation and maintenance of your stormwater management system contact:

Pierce County Department of Public Works, Environmental Services, Water Programs Division, (253) 798-2725

Or refer to information provided in the following resources:

Pierce County Stormwater Pollution Prevention Manual
http://www.co.pierce.wa.us/PC/services/home/environ/water/swm/sppman/

King County Drainage Maintenance Standards for Commercial and Multifamily Drainage Facilities, 1997.

Puget Sound Shoreline Stewardship Guide Book,
6.0 Glossary

Reference: (Pierce County Stormwater Management and Site Development Manual, 1997.)

Applicant - The person, party, firm, corporation, or other legal entity that proposes to develop property in unincorporated Pierce County by submitting an application.

Appurtenances - Machinery, appliances, or auxiliary structures attached to a main structure, (but not considered an integral part thereof), for the purpose of enabling it to function.

Aquifer - A geologic stratum containing groundwater that can be withdrawn and used for human purposes.

As-built Drawings - As-constructed engineering plans that include all changes made to a project during construction and submitted to the County. All drawing changes shall be made by a Professional Engineer or Land Surveyor.

Backwater - Water upstream from an obstruction which is deeper than it would normally be without the obstruction.

Base Flood - The flood having a one percent chance of being equaled or exceeded in any given year, also referred to as the "100-year flood". Designation on maps will always include the letter "A".

Base Flood Elevation - The water surface elevation, in feet, above mean sea level for the base flood. Referenced to the National Geodetic Vertical Datum of 1929 (or Pierce County Datum or United States Coast and Geodetic Survey 1929 Datum which are the same).

Basin - An area from which surface runoff is concentrated, usually to a single point such as the mouth of a stream.

Bench - A relatively level step excavated into natural earth or fill material.

Berm - A constructed barrier of compacted earth.

Best Management Practice (BMP) - Physical, structural, and/or managerial practices approved by the Department of Ecology (DOE) that, when used singly or in combination, prevent or reduce pollution of water.

Biofilter - A designed, vegetated treatment facility where the more or less simultaneous processes of filtration, infiltration, adsorption and biological uptake of pollutants in stormwater takes place during the conveyance of concentrated or sheet flowing stormwater.

Biofiltration - The process of reducing pollutant concentrations in water by filtering the polluted water through biological materials.
Glossary (Continued)

**BMP** - Best Management Practice.

**Bollard** - A post (may or may not be removable) used to prevent vehicular access.

**Buffer** - The zone contiguous with a sensitive area that is required for the continued maintenance, function, and structural stability of the sensitive area.

**Catchment** - Surface drainage area.

**Catch line** - The point where a severe slope intercepts a different, more gentle slope.

**Certification** - A written engineering opinion, stamped, signed, and dated by an engineer, concerning the progress or completion of work.

**Channel** - A surface feature that conveys surface water and is open to the air.

**Channel, constructed** - Channels or ditches constructed (or reconstructed natural channels) to convey surface water.

**Channel, natural** - Streams, creeks, or swales that convey surface/groundwater and have existed long enough to establish a stable route and/or biological community.

**Check Structure** - A dam (e.g. rock, earthen, log) used in channels to reduce water velocities, promote sediment deposition, and/or enhance infiltration.

**Clearing** - The removal of vegetative material such as timber (including stumps), brush, sod, etc., that does not require reforestation per an approved Forest Practices Application/notification issued by the Department of Natural Resources.

**Closed Basin** - A basin for which there is no surface water outlet.

**Closed Depression** - An area which is low lying and either has no, or such a limited, surface water outlet that during storm events the area acts as a retention basin.

**Compaction** - The condensing of fill by mechanical means.

**Constructed Wetland** - Those wetlands intentionally created on sites previously without wetlands for the primary purpose of stormwater treatment and managed as such. Constructed wetlands are normally considered as part of the stormwater collection and treatment system and are subject to maintenance requirements. (These wetlands are not the same as wetlands created for mitigation purposes, which are typically viewed in the same manner as natural, regulated wetlands).

**Conveyance** - A mechanism for transporting water from one point to another, including pipes, ditches, channels, culverts, gutters, manholes, weirs, man-made and natural channels, water quality filtration systems, dry wells, etc.

**Conveyance System** - The drainage facilities, both natural and man-made, which collect, contain, and provide for the flow of surface and stormwater from the highest points on the land down to a receiving water.
Glossary (Continued)

**County, The** - “County” means the Pierce County Executive or designee; also Pierce County, its duly authorized representatives, and the jurisdictional boundaries of Pierce County.

**Critical Areas** - As defined by P.C.C. Title 18E, Development Regulations - Critical Areas.

**Critical Habitat** - Habitat necessary for survival of endangered, threatened, rare, sensitive, or monitored species.

**Culvert** - Pipe or concrete box structure which drains open channels, swales, or ditches under a roadway or embankment. Typically with no catch basins or manholes along its length.

**Dead Storage** - The volume available in a depression in the ground below any conveyance system, or surface drainage pathway, or outlet invert elevation that could allow the discharge of surface and stormwater runoff.

**Dedication** - Is the deliberate appropriation of land by an owner for any general and public uses, reserving to himself no other rights than those compatible with the full exercise and enjoyment of the public uses to which the property has been devoted. To show the intent to dedicate, the owner shall file or final plat (or short plat) showing the land to be dedicated. Public acceptance shall be shown by the approval of the plat for filing by the appropriate governmental unit.

**Design Engineer (Project Engineer)** - The professional civil engineer licensed in the State of Washington who prepares the analysis, design, and engineering plans for an applicant's permit or approval submittal.

**Design Event** - A synthetic precipitation event (storm) represented by the jurisdiction's designated hyetograph for use in designing a drainage facility.

**Detention Facility** - A facility (e.g. pond, vault, pipe) in which surface and stormwater is temporarily stored and released at a controlled rate.

**Detention Time** - The theoretical time required to displace the contents of a stormwater treatment facility at a given rate of discharges (i.e. drawdown time).

**Detention Pond** - A detention facility in the form of an open pond.

**Developer** - The person or legal entity who holds title to the property or has a sufficient interest in the project to propose the project. The developer of the project.

**Development** - Any man-made change to improved or unimproved real estate including, but not limited to, buildings or other structures, placement of manufactured home/mobile home, mining, dredging, clearing, filling, grading, paving, excavation, drilling operations, or the subdivision of property. See also the definitions for new development, redevelopment and land disturbing activities.
Glossary (Continued)

**Dispersed discharge** - The release of surface and storm water runoff from a drainage facility system that allows the runoff to spread over a wide area. The area is located so the flow does not concentrate anywhere upstream of an erodible drainage channel.

**Disturbed Area** - An area inside project boundaries altered from its natural state.

**Ditch** - A long narrow excavation dug in the earth for drainage with its top width less than 10 feet at design flow.

**Drainage** - Refers to the collection, conveyance, containment, and/or discharge of surface and storm water runoff.

**Drainage Basin** - A geographic and hydrologic sub unit of a watershed.

**Drainage Channel** - A drainage pathway with well-defined bed and banks indicating frequent conveyance of surface and storm water runoff.

**Drainage Course** - A pathway for watershed drainage characterized by wet soil vegetation; often intermittent in flow.

**Drainage Easement** - A legal encumbrance that is placed against a property's title to reserve specified privileges for the users and beneficiaries of the drainage facilities contained within the boundaries of the easement.

**Drainage Pathway** - The route that surface and stormwater runoff follows down slope when leaving any part of the site.

**Drainage System** - Refers to the combination of Best Management Practices, collection, conveyance, retention, detention, treatment and outfall features or structures on a project.

**Drop Structure** - A structure for dropping water to a lower level and dissipating its surplus energy; a fall. A drop may be vertical or inclined.

**Dry Pond** - A detention facility which drains dry after a storm.

**Earth/Earth Material** - Means naturally occurring rock, soil, stone, dirt, or a combination thereof.

**Earthwork** - Any operation involving the excavation, grading, filling, or moving of earth materials.

**Easement** - The legal right to use a described piece of land for a particular purpose. It does not include fee ownership, but may restrict the owner's use of the land. All easements granted pursuant to the Manual shall be legally recorded with the County Auditor.

**Easement, Private** - An interest in the land of someone else, usually for the benefit of one or more individuals, and constitutes an encumbrance on another's land.
Glossary (Continued)

**Embankment** – A structure of earth, gravel, or similar material raised to form a pond bank or foundation for a road, building pad, or similar fill for a particular use.
Glossary (Continued)

**Energy Dissipater** - Any means by which the total energy of flowing water is reduced. In stormwater design, they are usually mechanisms that reduce velocity prior to, or at, discharge from an outfall in order to prevent erosion. They include rock splash pads, drop manholes, concrete stilling basins or baffles, and check dams.

**Engineer** - A professional civil engineer, currently licensed by the State of Washington, retained by and acting on behalf of the Applicant. The term “engineer” also means design engineer and project engineer.

**Environmentally Sensitive Area (sensitive area)** - As defined by ordinance or resolution by the County.

**Erosion** - Detachment of soil or rock fragments by water, wind, ice and gravity.

**Erosion/Sedimentation Control** - Any temporary or permanent measures taken to reduce erosion, control siltation and sedimentation, and ensure that sediment-laden water does not leave the site.

**Erosion/Sedimentation Control Facility** - A type of drainage facility designed to hold water for a period of time to allow sediment contained in the surface and storm water runoff directed to the facility to settle out so as to improve the quality of the runoff.

**ESC** - Erosion and Sediment Control (Plan) - See Drainage and Erosion/Sediment Control Plan.

**Eutrophication** - Refers to the process where nutrient over enrichment of water leads to excessive growth of aquatic plants.

**Experimental Best Management Practice (BMP)** - A BMP that has not been tested and evaluated by the Department of Ecology in union with local governments and technical experts.

**Filter Fabric** - A woven or non-woven, water-permeable material, generally made of synthetic products such as polypropylene and used in stormwater management and erosion and sediment control applications to trap sediment or prevent the clogging of aggregates by fine soil particles. See the WSDOT State Standard Specifications and Amendments, specifically, Section 9-33 Construction Geotextiles.

**Filter Fabric Fence** - A temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts and entrenched. The filter fence is constructed of stakes and synthetic filter fabric with a rigid wire fence backing where necessary for support.

**Flow Control Manhole** - A manhole with a flow regulating device or system such as weirs and orifice plates.

**Freeboard** - The vertical distance between the design water surface elevation and the elevation of the barrier which contains the water.
Glossary (Continued)

**Frequency of Storm (Design Storm Frequency)** - The anticipated period in years that will elapse, based on average probability of storms in the design region, before a storm of a given intensity and/or total volume will recur.

**Grading** - Any excavating, filling, clearing, or creating of impervious surfaces or combination thereof.

**Groundwater** - The underground water usually found in aquifers. Groundwater usually originates from infiltration. Wells tap the groundwater for water supply uses.

**Grubbing** - The removal and disposing of all unwanted vegetative matter from underground, such as sod, stumps, roots, buried logs, or other debris.

**Gully** - A channel caused by the concentrated flow of surface and stormwater runoff over unprotected erodible land.

**Habitat** - The specific area or environment in which a particular type of plant or animal lives. The sum total of all the environmental factors of a specific place that is occupied by an organism, a population or a community. An organism's habitat must provide all of the basic requirements for life.

**Hardpan** - A cemented or compacted and often clay-like layer of soil that is impenetrable by roots.

**Harmful Pollutant** - A substance that has adverse effects to an organism including immediate death, chronic poisoning, impaired reproduction, cancer or other effects.

**Hyetograph** - A graph of percentages of total precipitation for a series of time steps representing the total time in which precipitation occurs.

**Illicit Discharge** - All non-stormwater discharges to stormwater drainage systems that cause or contribute to a violation of state water quality, sediment quality or ground water quality standards.

**Impervious** - A surface which cannot be easily penetrated. For instance, rain does not readily penetrate paved surfaces.

**Impervious Surface** - A hard surface area which either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development. A hard surface area which causes water to run off the surface in greater quantities or at an increased rate of flow than the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, gravel parking lots, packed earthen materials, and oiled, macadam or other surfaces which similarly impede the natural infiltration of stormwater. Open, uncovered retention/detention facilities shall not be considered as impervious surfaces.

**Impoundment** - A natural or man-made containment for surface water.
**Glossary (Continued)**

**Improved Property** - Land from which runoff has been permanently increased through the actions of man.
Glossary (Continued)

**Improvement** - Any thing or structure constructed for the benefit of all or some residents of the subdivision or the general public such as but not limited to roads, alleys, storm drainage systems and ditches, sanitary sewer pipes or main lines, and storm drainage containment facilities.

**Infiltration** - The downward movement of water from the surface to the subsoil.

**Infiltration Facility (or System)** - A drainage facility designed to use the hydrologic process of surface and stormwater runoff soaking into the ground, commonly referred to as percolation, to dispose of surface and stormwater runoff.

**Ingress/egress** - The points of access to and from a property.

**Inlet** - A form of connection between the surface of the ground and a drain or sewer for the admission of surface and stormwater runoff.

**Junction** - Point where two or more drainage pipes or channels converge (e.g. manhole).

**Land Disturbing Activity** - Any activity that results in a change in the existing soil cover (both vegetative and non vegetative) and/or the existing soil topography. Land disturbing activities include, but are not limited to, demolition, construction, clearing, grading, filling and excavation.

**Landscaping** - The improvement or installation on a parcel or portion thereof of objects or vegetation for decorative or ornamental effect. Examples include: trees, bushes, shrubs, flowers, grass, weeds, ornamental rocks or figures, and low-lying ground cover, sprinkler systems, sidewalks, and lighting fixtures.

**Lined Pond, Conveyance** - A lined pond or conveyance system is one in which the bottom and sides of the facility have been made impervious to the transmission of liquids.

**Live Storage** - The amount of storage in a detention facility that is intended to completely drain after a storm event.

**Natural Buffer Area (NBA)** - A parcel or strip of land that is designated to permanently remain in an undisturbed and untouched condition. No building, clearing, filling, or grading is permitted within this area, except for minor firewood harvest and watercourse maintenance when applicable. Roads, septic tank drain field areas, and reserved drain field areas are not permitted in natural buffer areas.

**Natural Channel** - Stream, creek, river, lake, wetland, estuary, gully, swale, ravine, or any open conduit where water will concentrate and flow intermittently or continuously.

**Natural Location** - The location of those channels, swales, and other non-manmade conveyance systems as defined by the first documented topographic contours existing for the subject property, either from maps or photographs, or such other means as appropriate.

**Non-Stormwater Discharge** - Wash down water and other wastewater that enters the drainage system.
Glossary (Continued)

**Nutrients** - Essential chemicals needed by plants or animals for growth. Excessive amounts of nutrients can lead to degradation of water quality and the growth of excessive numbers of algae. Some nutrients can be toxic at high concentrations.

**Off-site** - Any area lying upstream of the site that drains onto the site and any area lying downstream of the site to which the site drains.

**Oil Water Separator** - A structure or device used to remove oil and greasy solids from water.

**On-site** - The entire property that includes the proposed development.

**Orifice** - An opening with closed perimeter, usually sharp-edged, and of regular form in a plate, wall, or partition through which water may flow, generally used for the purpose of measurement or control of such water.

**Outfall** - The point where water flows from a manmade conduit, channel, or drain into a water body or other natural drainage feature. (See Natural Channel)

**Overtopping** - To flow over the limits of a containment or conveyance element.

**Perviousness** - Related to the size and continuity of void spaces in soils; related to a soil's infiltration rate.

**Post-Development Conditions** - The condition of site after the project has been constructed.

**Pothole** - A closed basin. See also closed depression and/or basin.

**Professional Civil Engineer** - A person registered with the State of Washington as a Professional Engineer in Civil Engineering.

**Public Storm Drainage Facility** - A conveyance, system of conveyances, or stormwater control facility(ies) (including roads with drainage systems, catch basins, curbs, gutter, ditches, man-made channels, storm drains, retention/detention facilities and infiltration facilities) owned and operated by the County, which is (are) designed or used for collection, storage, conveyance and treatment of storm water.

**Recharge** - The flow to groundwater from the infiltration of surface and stormwater runoff.

**Regional Detention and/or Retention Facility** - Stormwater detention and/or retention or water quality control facility designed to manage runoff from large tracts of land.

**Retention** - The process of collecting and holding surface and stormwater runoff with no surface outflow.

**Retention/Detention Facility** - A facility with an outlet to surface water but which is intended to primarily discharge to groundwater and evaporation.
Retention Facility - A facility with no outlet to surface water and which is intended to discharge to groundwater and/or evaporation.

Retention Pond - A retention facility that is an open pond.

Retrofitting - The renovation of an existing structure or facility to meet changed conditions or to improve performance.

Riprap - A facing layer or protective mound of stones placed to prevent erosion or sloughing of a structure or embankment due to flow of surface and stormwater runoff.

Runoff - Water originating from rainfall and other precipitation that is found in drainage facilities, rivers, streams, springs, seeps, ponds, lakes and wetlands as well as shallow groundwater.

Scour - Erosion of channel banks due to excessive velocity of the flow of surface and stormwater runoff.

Sediment - Fragmented material that originated from weathering and erosion of rocks or unconsolidated deposits, and is transported by, suspended in, or deposited by water.

Sedimentation - The depositing or formation of sediment.

Sensitive Area - Those areas designated by resolution or ordinance of the Pierce County Council pursuant to Washington Administrative Code 197-11-908 and Pierce County Code, Chapter 18E24 or the most recent amendments thereto. See Environmentally Sensitive Area.

Sheet Erosion - The relatively uniform removal of soil from an area without the development of conspicuous water channels.

Site - Any parcel or combination of contiguous parcels where grading, filling, clearing, or creation of an impervious surface is proposed, and which may be controlled by more than one property owner.

Site Development Plan - Site development plans shall include the following, as specifically required by the County in each instance: Site plan, erosion and sedimentation control plan, grading plan, storm drainage plan, stormwater drainage control report, soils report, flood study, road construction plans, entering sight distance variances and verifications, and other documents required in the review of proposed development of the property.

Slope - An inclined earth surface, the inclination of which is expressed as the ratio of horizontal distance to vertical distance. The gradient in feet per feet or expressed as percent.

Sloughing - The sliding of overlying material. It is the same effect as caving, but it usually occurs when the bank or an underlying stratum is saturated or scoured.

Soil Permeability - The ease with which gases, liquids, or plant roots penetrate or pass through a layer of soil.
Glossary (Continued)

**Standard Plans and Standard Specifications** - The most recent edition of the *Standard Plans for Road, Bridge, and Municipal Construction* and the *Standard Specifications for Road, Bridge, and Municipal Construction* by Washington State Department of Transportation in cooperation with the American Public Works Association, and as amended by Pierce County.

**Steep Slope** - Slopes of 40% gradient or steeper.

**Storm Drain System** - The system of gutters, pipes, streams, or ditches used to carry surface and storm water from surrounding lands to streams, lakes, or Puget Sound.

**Storm Drains** - The enclosed conduits that transport surface and stormwater runoff toward points of discharge (sometimes called storm sewers).

**Stormwater** - That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels or pipes into a defined surface water channel, or a constructed infiltration facility.

**Stormwater Management Manual for the Puget Sound Basin** - The manual as prepared by the Department of Ecology (DOE) that contains BMPs to prevent, control or treat pollution in stormwater.

**Structure** - A catch basin or manhole in reference to a storm drainage system.

**Stub-out** - A short length of pipe provided for future connection to the storm drainage system.

**Sub-basin** - A drainage area which drains to a point contained within a larger basin.

**Suspended Solids** - Organic or inorganic particles that are suspended in and carried by the water. The term includes sand, mud, and clay particles (and associated pollutants) as well as solids in stormwater.

**Swale** - A shallow drainage conveyance with relatively gentle side slopes, generally with flow depths less than one foot.

**Toe of Slope** - A point or line of slope in an excavation or cut where the lower surface changes to horizontal or meets the existing ground slope.

**Top of Slope** - A point or line on the upper surface of a slope where it changes to horizontal or meets the original surface.

**Treatment BMP** - A BMP that is intended to remove pollutants from stormwater.

**Water Quality** - The chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

**Water Quality BMP** - A BMP specifically designed to control the quality of runoff.

**Water Quality Design Storm** - The 6-month, 24-hour design storm.
Glossary (Continued)

**Water Quantity BMP** - A BMP specifically designed to control the quantity of runoff.

**Watershed** - A geographic region within which water drains into a particular river, stream, or body of water as identified and numbered by the State of Washington Resource Inventory Areas (WRIA) as defined in Chapter 173-500 WAC.

**Wetlands** – An area inundated or saturated by ground or surface water at a frequency and duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

**Wet Pond** - A stormwater treatment pond designed to maintain a continuous or seasonal water level below the pond outlet elevation.