

STORMWATER COLLECTION AND CONVEYANCE SYSTEM

OPERATION & MAINTENANCE PLAN

YAKIMA COUNTY

**UNINCORPORATED URBAN AREAS &
YAKIMA COUNTY OWNED FACILITIES
WITHIN OTHER MUNICIPAL NPDES PERMIT AREAS**

IN COMPLIANCE WITH THE EASTERN WASHINGTON PHASE II
MUNICIPAL STORMWATER PERMIT

PERMIT NUMBER: WAR04-6014



Regional Stormwater Management Program

November 6, 2009

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Stormwater facility descriptions and drawings were adapted from the Clark County Stormwater Facility Maintenance Manual (2009) and the Pierce County Stormwater Maintenance Manual for Private Facilities. Facility specific thresholds to initiate cleaning, repair, and corrective actions were either taken directly or adapted from the Ecology Eastern Washington Stormwater Manual (2004).

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1. Introduction

The following Stormwater Collection and Conveyance System Operation & Maintenance (O&M) Plan provides guidance to Yakima County for stormwater system maintenance including cleaning, repairs, and upgrading.

This plan is one segment of a set of O&M plans required by the Pollution Prevention and Good Housekeeping for Municipal Operations portion (S5.B.6) of the Eastern Washington Phase II National Pollutant Discharge Elimination System (NPDES) Stormwater permit. Yakima County obtained coverage under this permit from the Washington Department of Ecology (Ecology) for discharging stormwater to waters of the state.

This plan applies to unincorporated urban areas of Yakima County covered by the NPDES Permit. Some practices contained in this plan may already be implemented in other unincorporated areas of Yakima County.

Why Maintain Stormwater Conveyance Facilities?

A variety of urban pollutants can flow to and accumulate in the stormwater conveyance system. Trash, litter, organic matter, and sediment can all impede proper system functions or create the need for costly repairs. Regular inspection, cleaning, and maintenance are best management practices (BMPs) which increase public safety by mitigating street flooding in addition to lowering pollutant loads that stormwater carries into receiving waters.

Required Components for All O&M Plans

- BMPs that will protect water quality, reduce the discharge of pollutants to the maximum extent possible, and satisfy all known, available, and reasonable methods of prevention, control, and treatment.
- O&M standards within this plan must be at least as protective as those included in Chapters 5, 6, and 8 of the Ecology Eastern Washington Stormwater Manual (2004) or another technical stormwater manual approved by Ecology.
- Low impact development (LID) techniques should be considered for all new and redeveloped municipal facilities.
- Water conservation measures should be considered for all landscaped area, parks, and open spaces.
- Record keeping shall be done pursuant to the requirements in NPDES permit Section S9 *Reporting and Record Keeping*

1.1 Stormwater Facility Types

Table 1. Stormwater facilities listed by type (Collection and Conveyance, Runoff Treatment, and Flow Control). Some overlap.

Collection and Conveyance	Runoff Treatment	Flow Control
Currently Operated and Maintained		
Curb & Gutter	Drywells	Drywells
Catch Basins, Manholes, and Inlets	Infiltration Trenches	Infiltration Trenches
Storm Sewer Pipes	Infiltration Ponds	Infiltration Ponds
Open Channels & Ditches	Infiltration Swales	Energy Dissipaters
Culverts (stormwater conveying)	Bio-infiltration Swales	Outfalls
		Other Outlets (natural dispersion, irrigation canals, etc.)
May Install, Operate, and Maintain In Future		
	Wetpools/ponds	Detention Ponds
	Stormwater Treatment Wetlands	Evaporation Ponds
	Evaporation Ponds	Detention Tanks/Vaults
	Closed Treatment Systems (Tanks/Vaults)	Control Structures
	Biofiltration Swales	
	Wet Biofiltration Swales	
	Vegetated Filter Strips	
	Sand Filter (above or below ground)	
	Media Filter	
	Oil and Water Separators (Baffle or Coalescing Plate)	
	Debris Barrier (Trash Rack)	
	Catch Basin Insert	
	Stormfilter®	
	Vortech® System	
	Bio-infiltration Trenches	
	Bio-infiltration Swales	
	Infiltration Swales	
	Sediment Trap	

2. Stormwater Facility Inspection

Each facility type may have different inspection, cleaning, and repair needs.

All activities should be logged either as a hardcopy and/or electronically. Example forms for catch basins and runoff treatment/ flow control facilities are available in Appendix A. Inspection reports should document if cleaning, repairs, or illicit discharge (minor spills, sanitary sewer connections, etc.) investigation is needed.

Any suspected illicit discharges should be reported to the Illicit Discharge Hotline (574-2300) immediately for investigation.

An inspection schedule by general facility type is provided in Table 2. Appendix B contains facility descriptions and detailed thresholds to determine if and what cleaning and repair actions are necessary.

The Yakima County Public Services Department Road Maintenance Division is responsible for inspection of all stormwater facilities owned and operated by Yakima County.

Table 2. Stormwater Facility O&M Schedule including regular inspection and cleaning/repair. See Table 1 for a list of runoff treatment and flow control facilities.

Stormwater Facility O&M Schedule		
Facility	Inspection	Cleaning & Repair
Curb and Gutter	Two times per year (same time as Catch Basins & Inlets inspections, Street Sweeping)	Annual (during street sweeping)
Catch Basins, Manholes, and Inlets	Annual (either Fall or Spring)	As Identified by Inspection. -Clean with vacuum truck if >60% full below lowest pipe invert for catch basin sump or blocking >10% of inlet.
Stormwater Pipes	As Needed -Initial identification during Catch Basin and Manhole inspections	As Needed
Open Channels & Ditches	Annual (during road maint.)	As Identified by Inspection
Culverts (convey stormwater)	Annual (during road maint.)	As Identified by Inspection
Runoff Treatment BMP Facilities	Annual	As Identified by Inspection
Flow Control BMP and Other Facilities	Annual	As Identified by Inspection
Drainage Improvement District (DID) facilities (inlets, manholes, pipes, outfalls)	Annual	As Identified by Inspection

2.1 Additional Inspections

Runoff Treatment and Flow Control Facilities

In addition to regularly scheduled inspections for all stormwater facilities, runoff treatment and flow control facilities have additional inspection requirements as outlined in the NPDES permit.

See Table 1 for a list of which facilities fall under the runoff treatment and flow control categories. See Appendix A for a form that may be used for both regular and 10-year storm event inspections of these specific facilities.

- Minimum 95% of all known stormwater treatment and flow control facilities owned, operated, or maintained by Yakima County shall be inspected **at least once** during the permit cycle:
 - Problem facilities identified during inspections may need to be inspected more frequently.
 - Regularly scheduled annual inspections would meet this requirement
- Spot Checks after Major Storm Events
 - Event greater than 10-year recurrence interval rainfall or snowmelt
 - 10-year 24-hour Storm Event Information:
 - Yakima area: >1.4"
 - Sunnyside area: >1.2"

3. Stormwater Facility Cleaning & Repair

Cleaning

Cleaning techniques and frequency vary by each facility type. Detailed runoff treatment and flow control facility condition thresholds to determine frequency and techniques are provided in Appendix B. Cleaning is usually initiated after an inspection of the facility determines it is necessary (Table 2). Therefore, if a facility is identified for cleaning during each annual inspection, the cleaning frequency would be on an annual basis. Catch basin inspection and cleaning logs for Fall 2006 and Spring 2007 showed approximately 60% of catch basins inspected were cleaned.

Repair

Repair and upgrades vary by each facility type, but are usually completed on an as needed basis as identified by inspections (Table 2). Detailed facility condition thresholds to determine if and what repairs may be needed are provided in Appendix B.

The Yakima County Public Service Department Road Maintenance Division is responsible for cleaning and repair of all county owned and operated stormwater facilities.

4. Proper Waste Disposal

Proper disposal of cleaning wastes from stormwater facilities is important to prevent pollutants from reentering the stormwater conveyance system and to keep solid wastes from impeding flow or causing damage to the system.

4.1 Dangerous Cleaning Waste

Determination needs to be made as to whether the cleaning wastes are considered dangerous waste. Studies have shown this is usually **not** the case, but it is possible spills or high average daily traffic counts could lead to waste being considered dangerous.

Cleaning wastes suspected to be dangerous **should not** be collected with other wastes. These wastes should only be collected by an employee experienced in handling dangerous waste and the Dangerous Waste Regulations (Chapter 173-303 WAC) should be followed. Testing should be based on probable contaminants.

4.2 Normal Cleaning Waste

Stormwater facility cleaning wastes collected by vacuum are brought to the Summitview Pit, Yakima and Sunnyside Road Maintenance Shops, Terrace Heights Landfill, or Cheyne Landfill for dewatering.

Solid wastes are then disposed at the Terrace Heights or Cheyne Landfills.

The following disposal options are recommended by Ecology for liquid wastes (in order of preference):

- Municipal sanitary sewer (with approval)
- Basic Stormwater Treatment BMP Facility
- Back into storm sewer under the following conditions:
 - Other practical means not available
 - Pretreatment provided by discharging to a modified Type 2 Catch Basin (with a flow restrictor or oil/water separator) or water quality vault
 - The storm sewer owner/operator has granted approval.

Detailed guidance for disposal of both dangerous and normal cleaning waste is available in Appendix 8B of the Ecology Eastern Washington Stormwater Manual. This guidance is the same as for street wastes.

The Yakima County Public Service Department Road Maintenance Division is responsible for dewatering and disposal of wastes collected from the stormwater system.

5. Record Keeping

The catch basin inspection/cleaning log and runoff treatment/ flow control facility inspection form are located in Appendix A. These sample forms can be used for record keeping of facility inspection, cleaning, and repair activities.

All records are required to be kept for at least five years in accordance with the Reporting and Record Keeping portion of the NPDES permit.

The Yakima County Public Service Department Road Maintenance Division is responsible for all record keeping of stormwater facility inspection, cleaning, and repair activities. Records may need to be provided to the Surface Water Management Division's Stormwater Program for inclusion in the annual Stormwater Program Plan report.

Appendix A. Stormwater Facility Inspection Forms

Regional Stormwater Management Stormwater Facility Inspection Form

(required by section S5.B.5.c.ii & S5.B.6.a.ii of Washington Department of Ecology Eastern Washington Phase II Municipal Stormwater Permit effective Feb. 16, 2007)

Investigator: _____

Inspection Date: _____

Event Inspection? ☐ Event Date: _____

Inspection Time: _____

10-year 24-hour Storm Event Information:

Site ID: _____

10-yr. event: Yakima area: >1.4"; Sunnyside area: >1.2"

Site Name: _____

Size of event requiring inspection: _____ in.

Photo ID: _____

Assessment: Needs immediate attention ☐ Okay, maintenance indicated ☐ No damage ☐

Facility Components

Y	N	NC	N/A	All
				Sediment forebay (if present) no more than ½ full
				Emergency or overflow spillway clear of debris and obstructions
Y	N	NC	N/A	Dry Ponds, Wet Ponds or Wetlands
				Sediment interferes with volume capacity
				Trees or other shrub vegetation growing on the dam embankment
				The dam embankment denuded or otherwise presents an erosion problem
				Visible damage to any of the mechanical equipment, inlet, pipes or outlets
				The low flow orifice, forebay or concrete trickle ditch is blocked by trash, debris or sediment
				Animal burrows are present on the dam embankment
				Standing water remaining longer than 72 hours after a rain event (dry ponds)
				Emergency spillways should be clear of debris and obstructions
Y	N	NC	N/A	Sand Filters, Underground Detention, Manufactured Facilities
				Too much sediment to properly treat and drain stormwater runoff
				Excessive oil and debris has accumulated in the system; standing water is present
				There is visible damage present to any of the inlets, pipes or outlets
				Excessive sediment and/or debris has accumulated in the inlet/surface, pipes or outlets
				The accumulation of sediment is greater than the manufacturer's recommendation, or too much oil is present for proper water filtration (Manufactured Facilities)
Y	N	NC	N/A	Infiltration Trenches, Swales
				Trash, vegetation or other debris is present on the surface
				Woody vegetation begins to grow in the trench
				Visible damage to any of the mechanical equipment, inlets, pipes or outlets
				Standing water is present 48 hours after a rain event
				Runoff no longer infiltrates into but flows across the trench
Y	N	NC	N/A	Outfalls; Channels
				Clear of debris and obstructions
				Headwalls stable (not eroding)
				Visible damage to any of the mechanical equipment, inlet, pipes or outlets
				Open channels stable (not eroding) and free of sediment deposits

Y = Checked and condition present; N = Checked and condition absent; NC = Not checked, N/A = Not applicable

Appendix B. Facility Descriptions and Ecology O&M Recommendations

Stormwater facilities are broken down into three categories:

- Collection and Conveyance
- Runoff Treatment
- Flow Control

Some overlap exists between facilities in all three categories. The Ecology Eastern Washington Stormwater Manual was used to determine which category each facility is placed in.

Stormwater facility descriptions and drawings were adapted from the Clark County Stormwater Facility Maintenance Manual (2009) and the Pierce County Stormwater Maintenance Manual for Private Facilities.

Facility specific thresholds to initiate cleaning/ repair, corrective actions were either taken directly or adapted from the Ecology Eastern Washington Stormwater Manual (2004). Facilities numbers are listed in the title of each facility table as assigned by Ecology. Please disregard these numbers because they will not be in order within this document, as each facility type is organized into the three categories.

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Stormwater Collection and Conveyance Facilities

Catch Basins

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

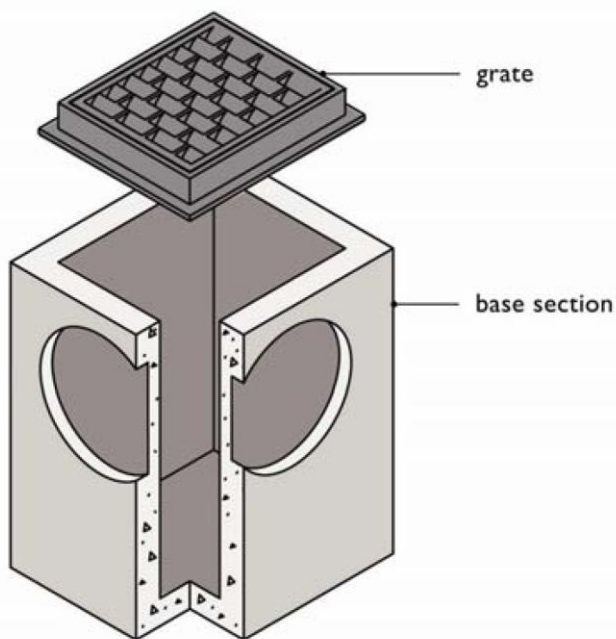
Type 1 Catch Basin:

- Rectangular box (approx. 3'x2'x5').
- Used when connected to conveyance pipes less than 18 inches in diameter and depth from grate to the bottom of pipe is than 5 feet.

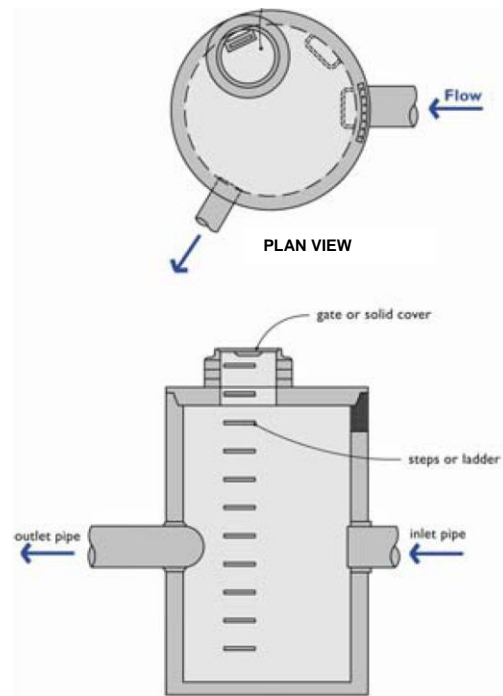
Type 2 Catch Basin:

- Commonly referred to as a stormwater manhole.
- Round concrete structures ranging in diameter from 4 feet to 8 feet.
- Used when connecting conveyance is 18 inches or greater and grate to pipe depth exceeds 5 feet. Manhole steps mounted for access.

Both types typically have a sump below the outlet pipe to allow sediment and debris settle out of the stormwater runoff. May be associated with other stormwater facilities and/or fitted with a spill control device to contain large quantities of grease or oils.



Type 1



Side Profile

Type 2

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60% of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Contamination and Pollution	See "Wetponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Stormwater Conveyance Pipe

Stormwater pipes convey stormwater in, through, and out of stormwater facilities. Pipes are built from many materials. Stormwater pipes are cleaned to remove sediment or blockages when problems are identified.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Obstructions, Including Roots	Root enters or deforms pipe, reducing flow.	Use mechanical methods to remove root. Do not put root-dissolving chemicals in storm sewer pipes. If necessary, remove the vegetation over the line.
	Pipe Dented or Broken	Inlet/outlet piping damaged or broken and in need of repair	Pipe repaired and/or replaced.
	Pipe Rusted or Deteriorated	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired and/or replaced.
	Sediment & Debris	Sediment depth is greater than 20% of pipe diameter.	Install upstream debris traps (where applicable) then clean pipe and remove material.
	Debris barriers or Trash Rack Missing	Stormwater pipes ≥ 18 in. need debris barrier	Debris barrier present on all stormwater pipes 18 in. and greater.



(Center for Watershed Protection Illicit Discharge Detection and Elimination Manual, 2004).

Open Channels and Ditches

Open channels and ditches typically convey stormwater along roadsides or between other stormwater facilities. Sediment accumulation, trash, overgrown vegetation, and erosion are typical issues which may occur with open channels and ditches.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Sediment Accumulation	Excessive sediment accumulation impedes water flow.	Use mechanical methods to remove excess sediment.
	Rubbish and debris	Trash and other rubbish impedes water flow and raises pollutants loads.	Free of rubbish and debris
	Overgrown Vegetation	Remove vegetation only when flow is blocked or excess sediments have accumulated.	Vegetation such as grass which does not impede flow and cause sediments to accumulate.
	Erosion	Excessive localized erosion of ditch or channel.	Install erosion control BMPs, focus on vegetation.



Culverts (stormwater conveying)

Culverts that only convey stormwater have similar maintenance needs to those that convey stream flow. Many stormwater culverts will be placed in conjunction with roadside ditches.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Sediment Accumulation	Excessive sediment accumulation impedes water flow.	Use mechanical methods to remove excess sediment.
	Rubbish and debris	Trash and other rubbish impedes water flow and raises pollutants loads.	Free of rubbish and debris
	Inlet and Outlet Overgrown Vegetation	Remove vegetation only when flow is blocked or excess sediments have accumulated.	Vegetation such as grass which does not impede flow and cause sediments to accumulate.
	Inlet and Outlet Erosion	Inlet and Outlet scour.	Install erosion control BMPs such as energy dissipaters.
	Energy Dissipater	If applicable, see Energy Dissipater	If applicable, see Energy Dissipater



Stormwater Runoff Treatment Facilities

Drywell

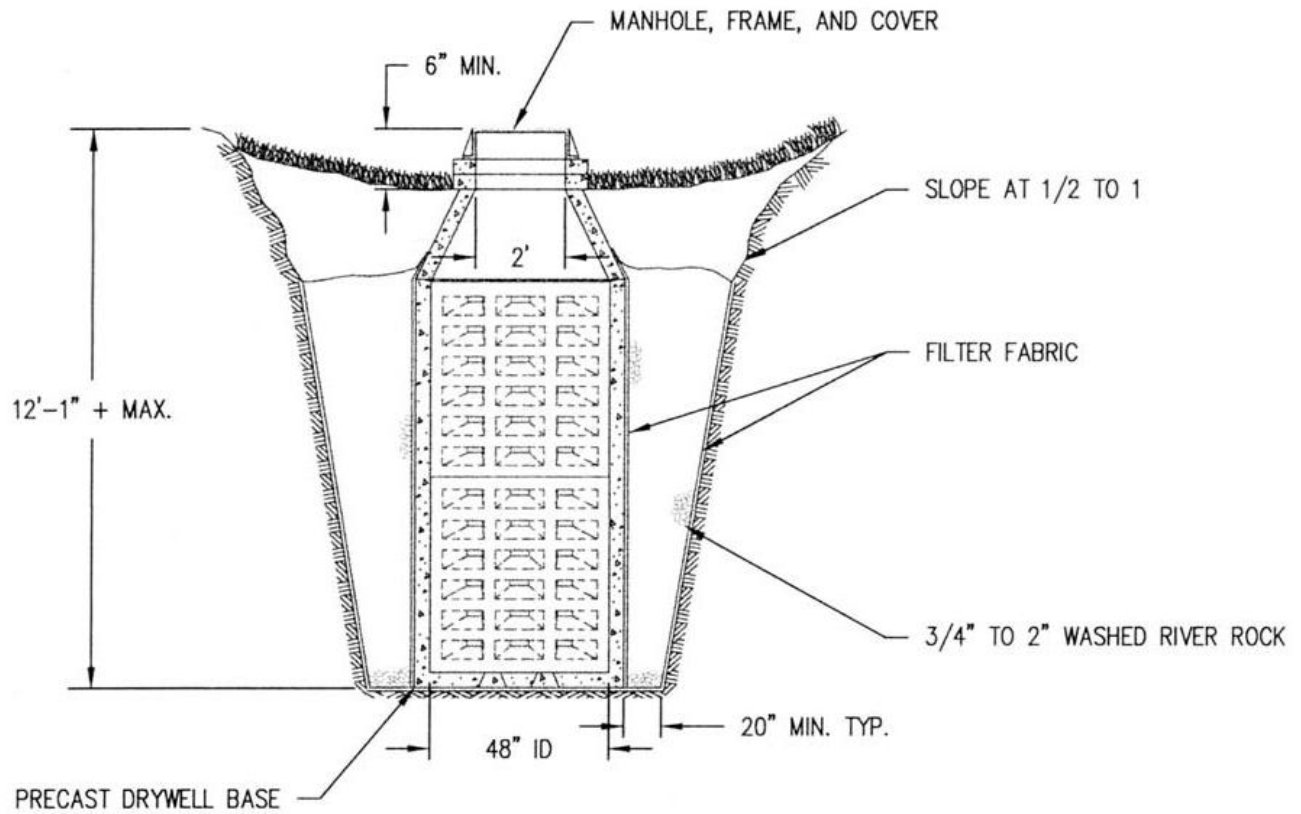
A drywell is a perforated, open-bottomed manhole used to infiltrate stormwater into the ground. Drywells temporarily store stormwater runoff during rain events. Drywells may require additional pollution and sediment control BMPs because they are easily clogged and tend to concentrate pollutants in one place.

The unsaturated geologic material between the bottom of the infiltration facility and the top of an unconfined aquifer, called the vadose zone, usually provides some level of treatment by removing contaminants by filtration, adsorption, and/or degradation. In some cases, the treatment provided by the vadose zone is suitable for protecting groundwater quality. In other cases, additional pre-treatment may be required to protect groundwater quality. See the Ecology Eastern Washington Stormwater Manual for additional information.

Drywell performance is dependent upon proper installation, regularly scheduled maintenance, and contaminants reaching swale and drywell facility.

Facilities typically associated with a drywell:

- Access road and easement
- Fence, gate, and water quality sign
- Field inlet
- Bioswale
- StormFilter



TYPICAL INFILTRATION SYSTEM

NOT TO SCALE

Drywells

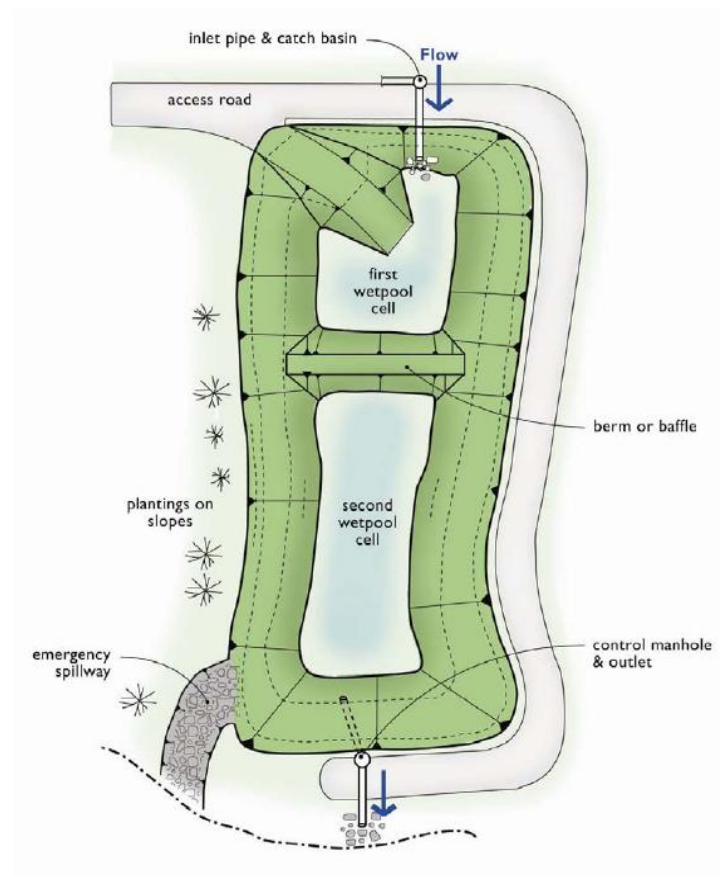
Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Does Not Dissipate Stormwater	Does not dissipate stormwater.	Replace or repair
	Opening Clogged	Openings are clogged, reducing capacity	Water-jet clogged openings or Convert existing clogged drywell to sediment trap and install new drywell or infiltration trench.
	Standing Water	Standing water indicates the drywell is in the water table	Rebuild drywell to prevent stormwater infiltrating directly into groundwater
	Trash and Debris	Trash, debris, or floatables present	No trash or debris in drywell
	Sediment	Sediment in drywell reaches the lowest row of slots providing outflow.	No sediment in drywell
	Structure Damage	Structure unsound including cracks.	Replacement or repair
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants (report to Stormwater Illicit Discharge staff)	No contaminants or pollutants present
Drywell Manhole	Cover Not In Place	Cover is missing or only partially in place	Cover is closed
	Cover Difficult to Remove	One maintenance person cannot remove after applying normal lifting pressure	Cover can be removed by one maintenance person
Metal Grates (if applicable)	Grate opening unsafe	Grate with opening wider than 3/4 inch	Grate opening meets design standards
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity	Grate free of trash and debris
	Damaged or Missing	Grate missing or broken	Grate is in place and meets design standards

Wetponds

A wetpond is an open basin that retains a permanent pool of water year round or only during the wet season. Sediment and pollutants settle out of the runoff and any wetland vegetation provides additional treatment through nutrient removal. Additional temporary storage volume may be available above the permanent pool elevation.

Facilities typically associated with a wetpond:

- Access road or easement
- Fence, gate, and water quality sign
- Control Structure/flow restrictor
- Energy dissipaters
- Debris Barrier
- Conveyance stormwater pipe



No. 1 – Wetponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	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.	Trash and debris cleared from site.
	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by state or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with state or local eradication policies required.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)

No. 1 – Wetponds

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

No. 1 – Wetponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height.	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Goethechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)	Piping eliminated. Erosion potential resolved.

No. 1 – Wetponds

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

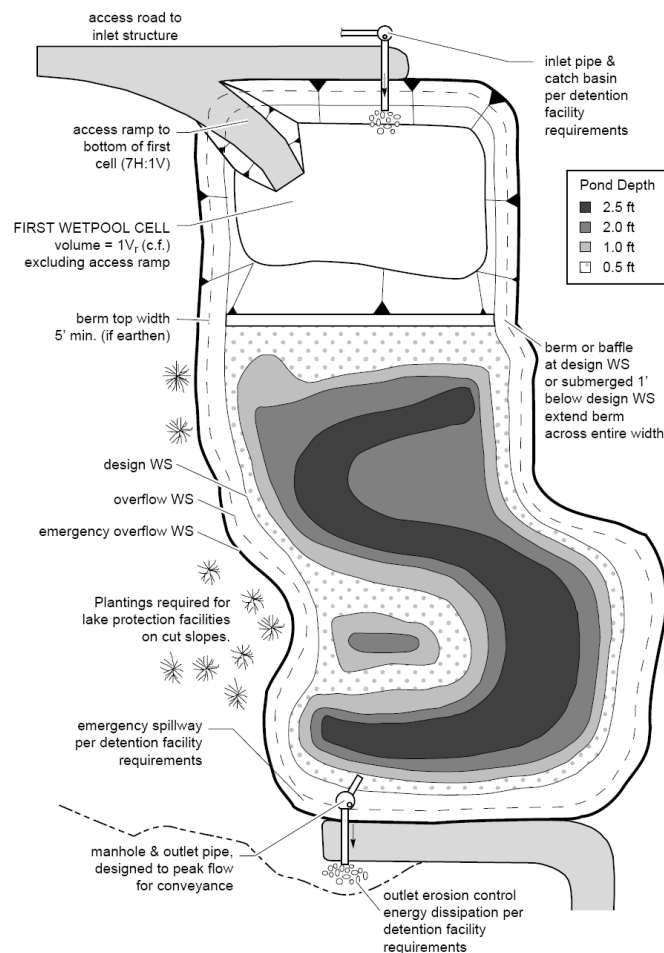
Stormwater Treatment Wetland

A stormwater treatment wetland is a shallow man-made pond that is designed to treat stormwater through the biological processes associated with emergent aquatic plants. These facilities use dense wetland vegetation and settling to filter sediment and oily materials out of stormwater.

Stormwater treatment wetlands are used to capture pollutants in a managed environment so that they will not reach natural wetlands and other ecologically important habitats. Vegetation must occasionally be harvested and sediment dredged in stormwater treatment wetlands. Stormwater wetlands perform well to remove sediment, metals, and pollutants that bind to humic or organic acids.

Facilities typically associated with a wetpond:

- Access road or easement
- Fence, gate, and water quality sign
- Control Structure/flow restrictor
- Energy dissipaters
- Conveyance stormwater pipe



Stormwater Treatment Wetlands

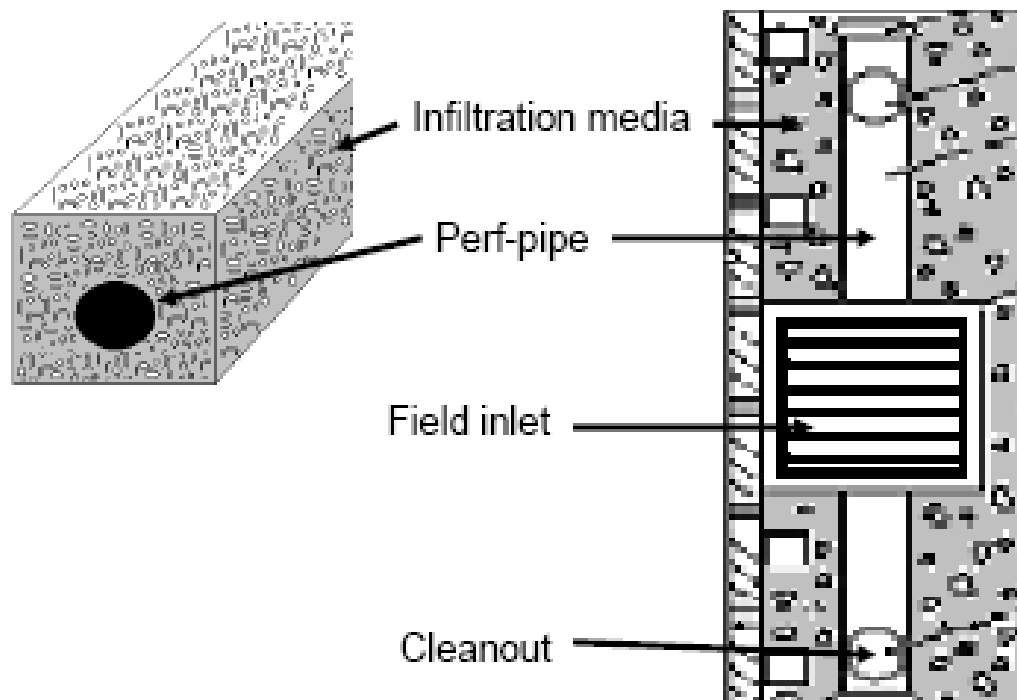
Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Sediment Accumulation	Sediment accumulation exceeds design standards in presettling cell.	Remove sediment deposits in presettling cell.
	Water Depth	Water not retained to a depth of about 18 inches during the wet season.	Repair outlet so that water is retained in the wet swale.
	Rubbish and debris	Trash and other rubbish impedes water flow and raises pollutants loads.	Free or rubbish and debris.
	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration.	Determine cause of lack of vigor of vegetation and correct. Replant as needed.
		Nuisance plant species become abundant.	Nuisance plant species should be removed and desirable species should be planted.
	Erosion	Excessive localized erosion of ditch or channel.	Install erosion control BMPs, focus on vegetation.

Infiltration Trench

An infiltration trench is a closed basin excavated below ground which temporarily stores stormwater runoff and does not discharge to a downstream conveyance system or nearby surface water. Instead, they rely on the ability of the site's soils to infiltrate the stormwater into the ground.

Facilities typically associated with an infiltration trench:

- Access road or easement
- Fence, gate, and water quality sign
- Bioswale
- Sediment trap
- Field inlet



No. 2 – Bio-infiltration/Infiltration Trenches/Basins

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
	Poisonous/Noxious Vegetation	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
	Contaminants and Pollution	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
	Rodent Holes	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
Storage Area	Sediment	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).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
	Piping	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
Emergency Overflow Spillway	Rock Missing	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
	Erosion	See "Wetponds" (No. 1).	See "Wetponds" (No. 1).
Pre-Settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Bio-infiltration Trench

- See Infiltration Trenches and Biofiltration Swales.

Bio-infiltration Swale (Grass Percolation Area)

- See Infiltration Trenches, Biofiltration Swales, and Vegetated Filter Strips.

Infiltration Swale

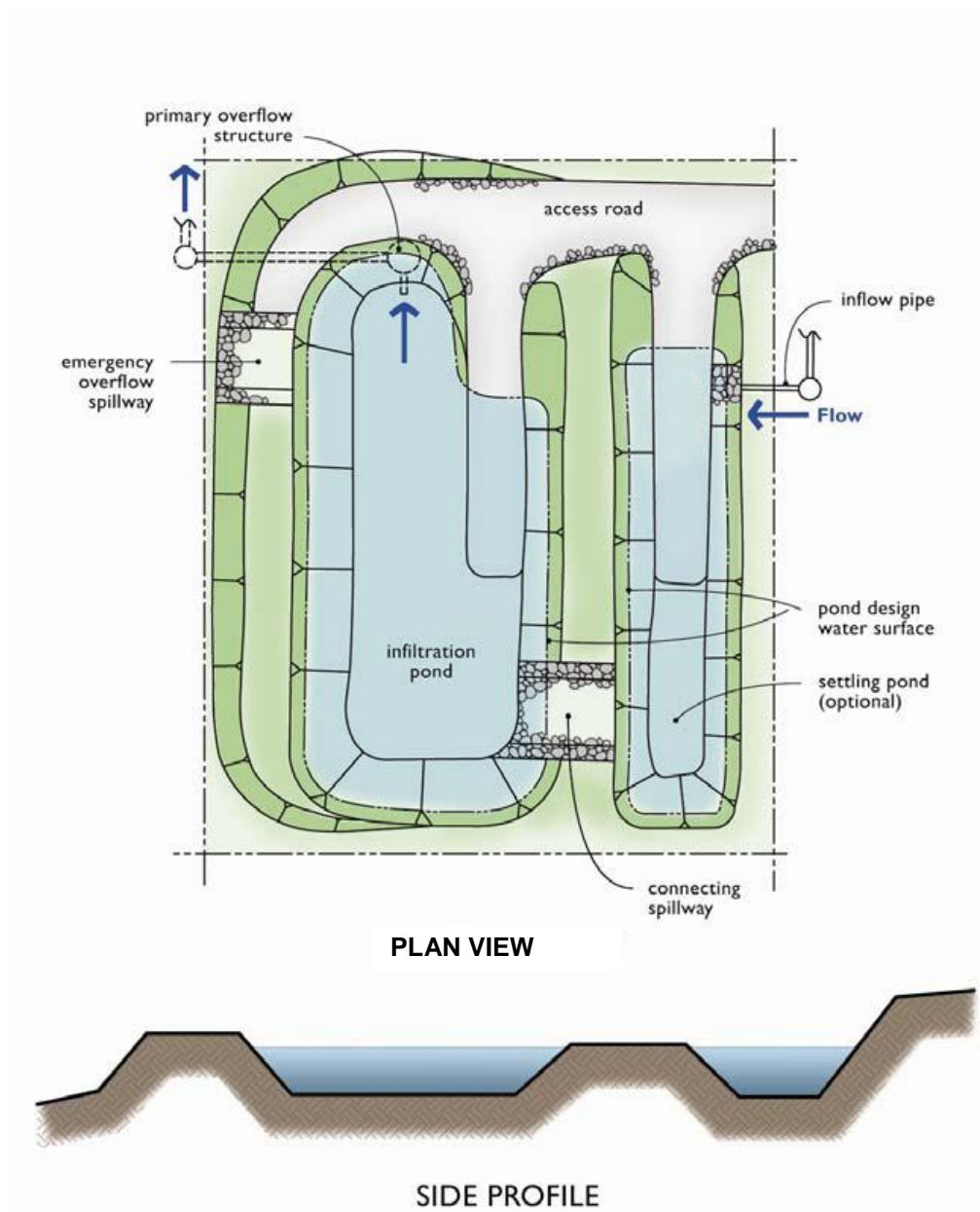
- See Infiltration Trenches and Biofiltration Swales.

Infiltration Pond

An infiltration pond/basin disposes of water by holding it in an area where it can soak into the ground. Infiltration ponds are managed similar to detention ponds, but with greater emphasis on maintaining the capacity to infiltrate stormwater.

Facilities typically associated with an infiltration basin:

- Access road or easement
- Fence, gate, and water quality sign
- Energy dissipaters
- Conveyance stormwater pipe



Maintenance Requirements for Infiltration Ponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash & Debris	See "Detention Ponds".	See "Detention Ponds".
	Poisonous/Noxious Vegetation	See "Detention Ponds".	See "Detention Ponds".
	Contaminants and Pollution	See "Detention Ponds".	See "Detention Ponds".
	Rodent Holes	See "Detention Ponds".	See "Detention Ponds".
Storage Area	Sediment	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).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Detention Ponds".	See "Detention Ponds".
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Detention Ponds".	See "Detention Ponds".
	Piping	See "Detention Ponds".	See "Detention Ponds".
Emergency Overflow Spillway	Rock Missing	See "Detention Ponds".	See "Detention Ponds".
	Erosion	See "Detention Ponds".	See "Detention Ponds".
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Evaporation Ponds

An evaporation pond settles out the suspended solids, heavy metals, and hydrocarbons. Evaporation ponds without an outlet may be used for water quality treatment.

See Detention Pond or Infiltration Pond for drawing. Structure would be very similar.

Maintenance Requirements for Evaporation Ponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash & Debris	See "Detention Ponds".	See "Detention Ponds".
	Poisonous/Noxious Vegetation	See "Detention Ponds".	See "Detention Ponds".
	Contaminants and Pollution	See "Detention Ponds".	See "Detention Ponds".
	Rodent Holes	See "Detention Ponds".	See "Detention Ponds".
Side Slopes of Pond	Erosion	See "Detention Ponds".	See "Detention Ponds".
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
General	Inlet Pipe	Inlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil-absorbent pads or vacuor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as <i>Juncus effusus</i> (soft rush) which can uptake small concentrations of oil.
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom, that exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Maintenance Requirements for Evaporation Ponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General (cont'd)	Snow	Snow removal operations deposit snow into evaporative system	This added factor must be considered in the water budget, especially if snow from another basin is put into the system. Temporary sediment ponds should be included in the design, to prevent sediment-laden runoff from entering the pond and storm disposal system during construction.

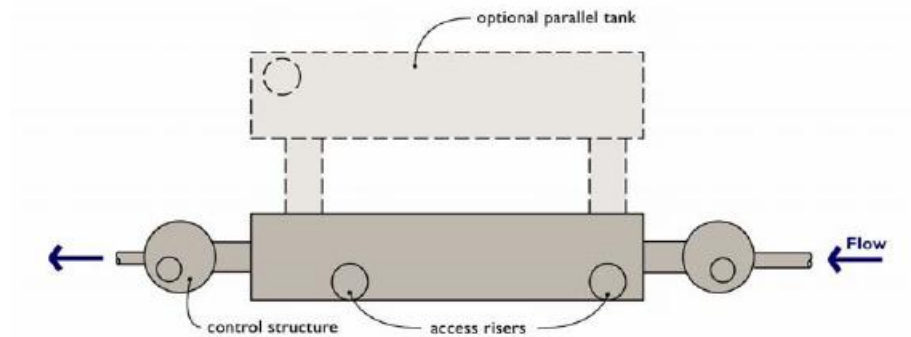
Closed Treatment Systems (Tanks/Vaults)

A closed treatment/detention system functions similarly to a detention pond with temporary storage volume provided by an underground structure to regulate the storm discharge rate from the site. These systems are often utilized for sites that do not have space available for an above-ground system and more commonly associated with commercial sites.

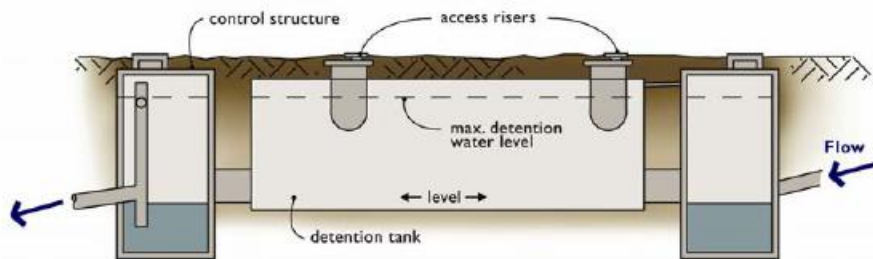
Only personnel trained to work in hazardous confined spaces should conduct maintenance on these facilities as harmful chemicals and vapors can accumulate.

Facilities typically associated with a closed treatment/detention system:

- Access road or easement
- Fence, gate, and water quality sign
- Control structure/flow restrictor
- Conveyance stormwater pipe



PLAN VIEW



Note:
Closed detention systems will contain water during rainfall events, but should be empty during dry periods.

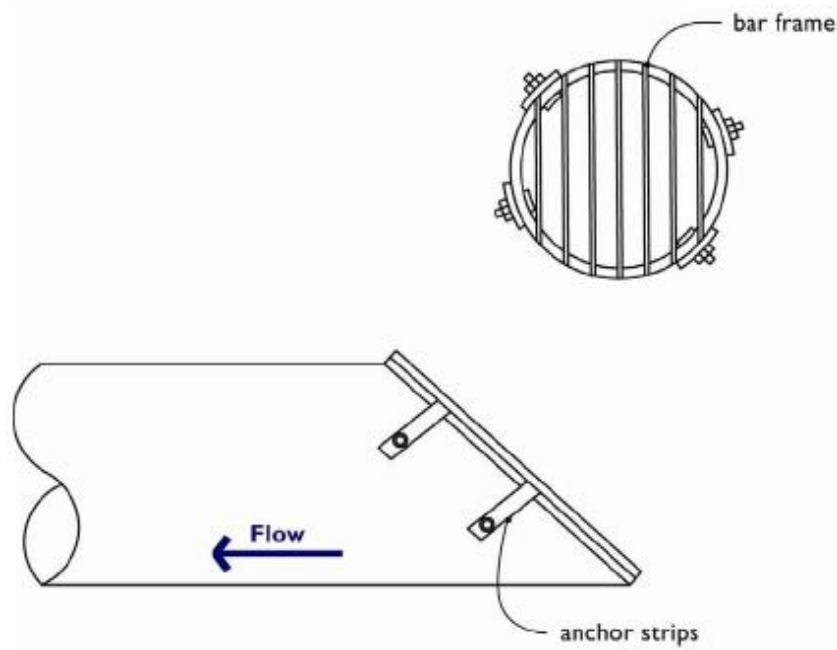
SIDE PROFILE

No. 3 – Closed Treatment Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See "Catch Basins" (No. 5)	See "Catch Basins" (No. 5).	See "Catch Basins" (No. 5).

Debris Barrier (Trash Rack)

A debris barrier is a bar grate over the open end of a culvert or stormwater conveyance pipe with the intent of preventing large materials from entering a closed pipe system. Should be place on both outlets and inlets.



No. 6 – Debris Barriers (e.g., Trash Racks)

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

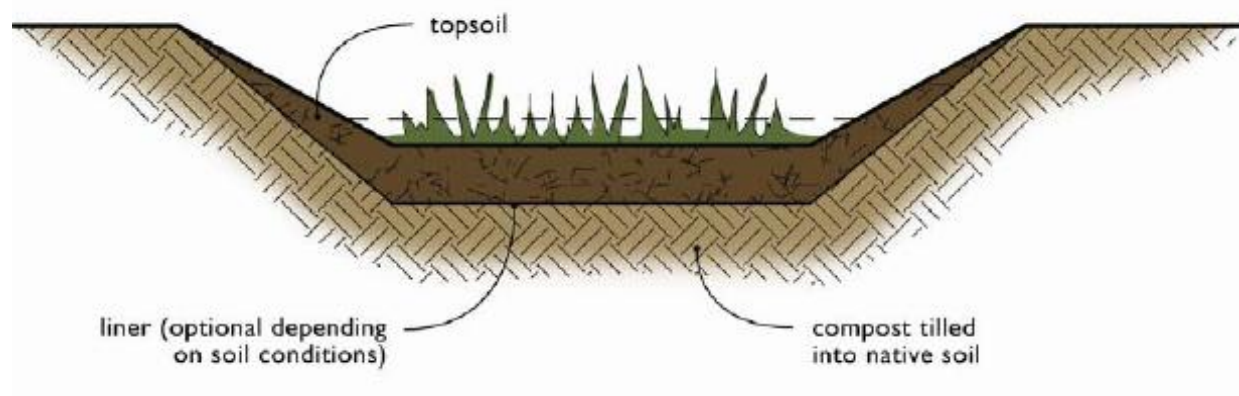
Biofiltration Swale

A biofiltration swale uses grass or other dense vegetation to filter sediment and oily materials out of stormwater. Usually look like flat-bottomed channels with grass growing in them. Pollutants are removed as the runoff passes through the vegetation which also slows the velocity.

Biofiltration Swales provide stormwater treatment, but may not provide detention/retention.

Facilities associated with a typical biofiltration swale:

- Access road or easement
- Fence, gate, and water quality sign
- Energy dissipaters
- Debris barrier
- Catch Basins/ Field Inlets
- Drywell
- Infiltration trench



No. 8 – Biofiltration Swale

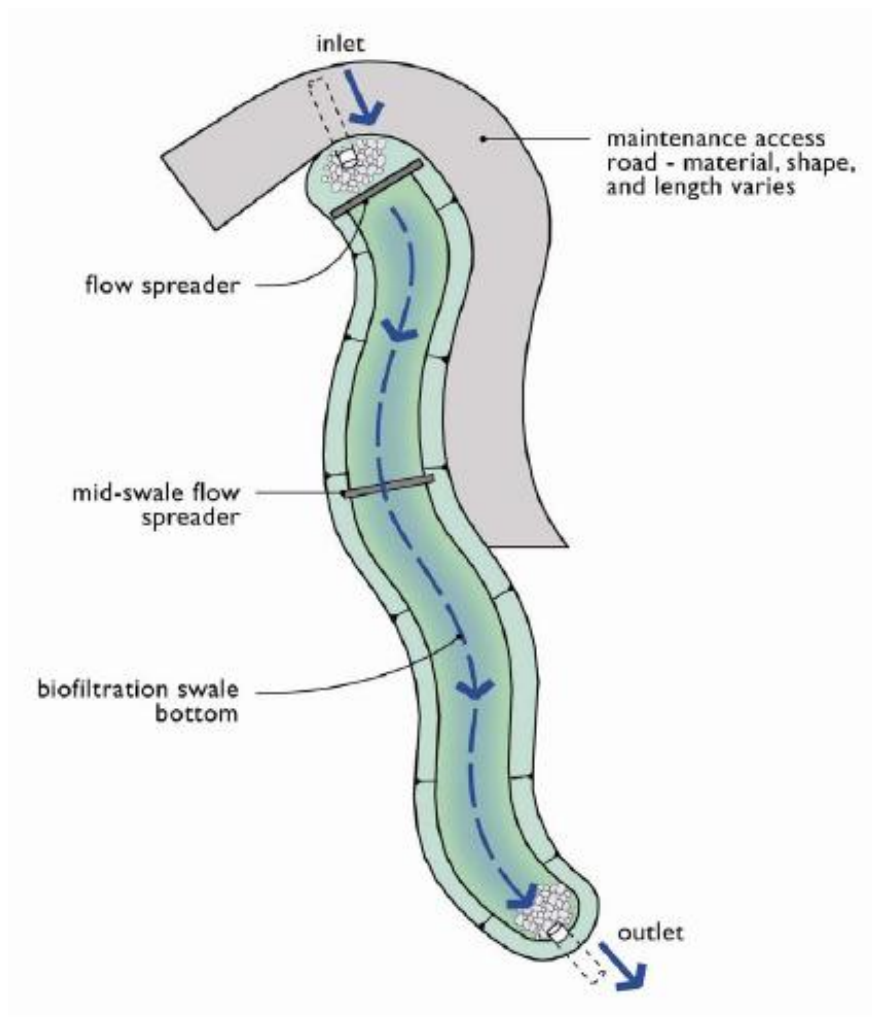
Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.
	Standing Water	When water stands in the swale between storms and does not drain freely.	Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.
	Flow spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.	Level the spreader and clean so that flows are spread evenly over entire swale width.
	Constant Baseflow	When small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.	Add a low-flow pea-gravel drain the length of the swale or by-pass the baseflow around the swale.
	Poor Vegetation Coverage	When grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.	Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.
	Vegetation	When the grass becomes excessively tall (greater than 10 inches); when nuisance weeds and other vegetation start to take over.	Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.
	Excessive Shading	Grass growth is poor because sunlight does not reach swale.	If possible, trim back over-hanging limbs and remove brushy vegetation on adjacent slopes.
	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.	Remove material so that there is no clogging or blockage in the inlet and outlet area.
	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale.
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

Wet Biofiltration Swale

A wet biofiltration swale is a variation of a basic biofiltration swale for use where the centerline slope is slight, the groundwater table is 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 exceed about two weeks, typically 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.

Facilities associated with a typical biofiltration swale:

- Access road or easement
- Fence, gate, and water quality sign
- Energy dissipaters
- Debris barrier
- Catch Basins/ Field Inlets



Wet Biofiltration Swale

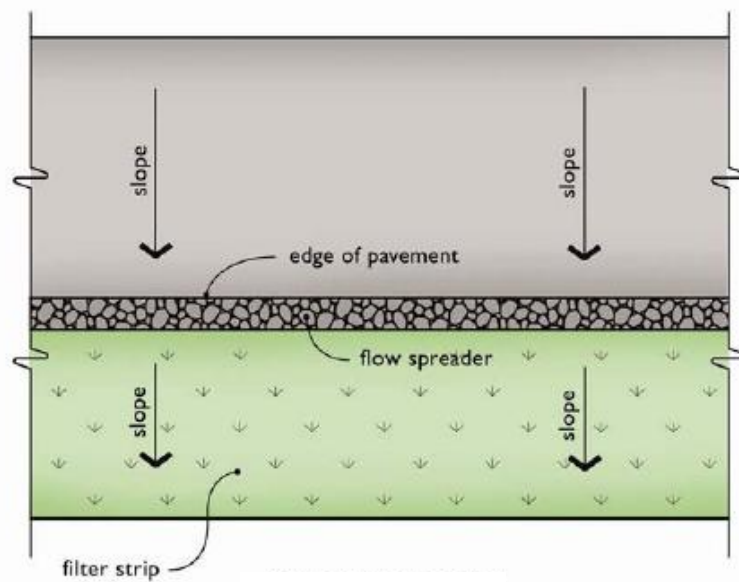
Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Sediment Accumulation	Sediment depth exceeds 2 inches in 10% of the swale area.	Remove sediment deposits in area.
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that water is retained in the wet swale.
	Rubbish and debris	Trash and other rubbish impedes water flow and raises pollutants loads.	Free or rubbish and debris.
	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration.	Determine cause of lack of vigor of vegetation and correct. Replant as needed.
		Nuisance plant species become abundant.	Nuisance plant species should be removed and desirable species should be planted.
	Erosion	Excessive localized erosion of ditch or channel.	Install erosion control BMPs, focus on vegetation. Evaluate swale size.

Vegetated Filter Strip

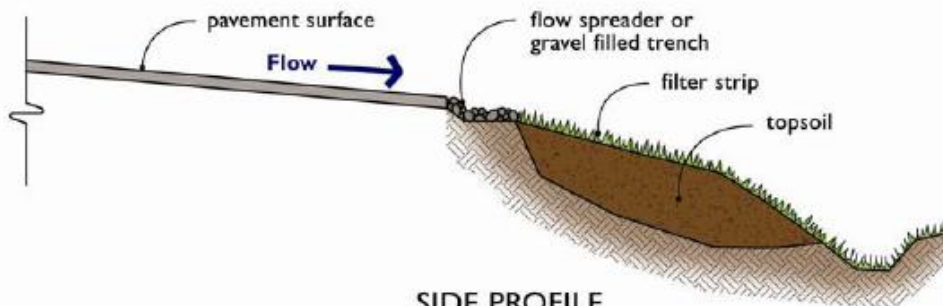
A vegetated filter strip is a linear strip of grass that removes sediment and oils from stormwater by filtering it. Vegetated filter strips are usually placed along edges of linear pavement including roads and parking areas.

Facilities often associated with a vegetated filter strip:

- Access road or easement
- Fence, gate, and water quality sign
- Energy dissipaters



PLAN VIEW



SIDE PROFILE

No. 9 – Vegetated Filter Strip

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

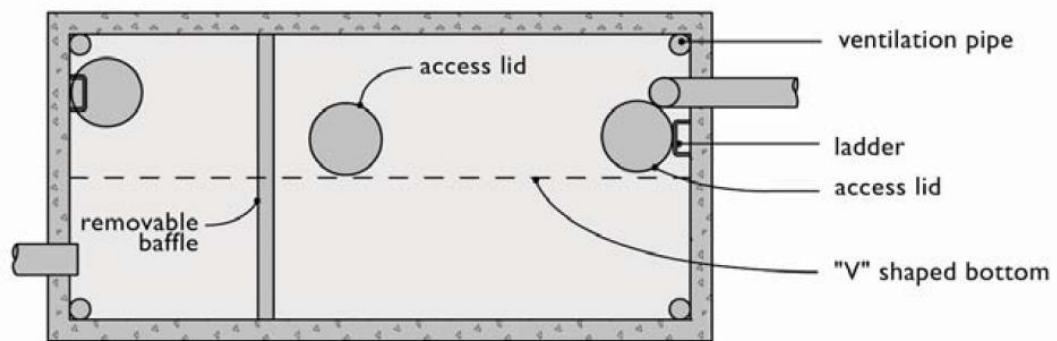
Wetvaults

A wetvault 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.

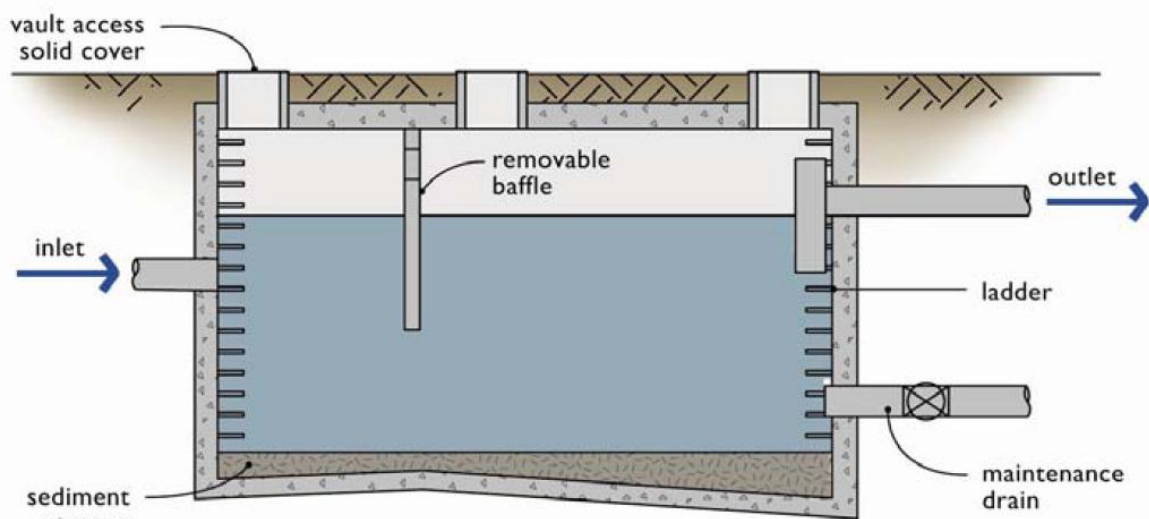
Wet vaults are closed space where harmful chemicals and gasses can accumulate. Therefore, the inspection and maintenance of these facilities should be conducted by a trained individual that is certified to work in hazardous confined spaces.

Facilities often associated with a wetvault:

- Access road or easement
- Fence, gate, and water quality sign
- Conveyance stormwater pipe



PLAN VIEW



SECTION PROFILE

No. 10 – Wetvaults

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Remove trash and debris from vault.
	Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.	Remove sediment from vault.
	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.	Pipe repaired or replaced to proper working specifications.
	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	Maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Baffles repaired or replaced to specifications.
	Access Ladder Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements. Ladder and entry notification complies with OSHA standards.

Sand Filter (Above Ground/Open)

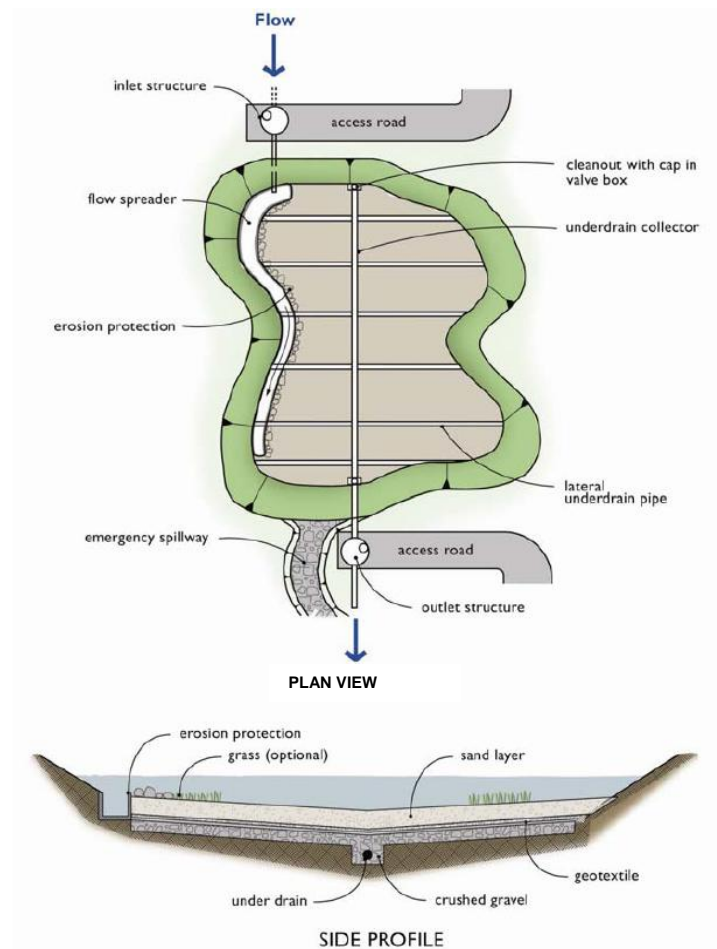
A sand filter strains stormwater runoff through a sand bed approximately 18 inches in depth. The treated runoff is collected in the underdrain system and routed to a detention/ retention facility or a downstream conveyance system.

Sand filtration system may consist of:

- Pretreatment system for large debris
- Flow spreader
- Sand bed
- Underdrain piping

Facilities typically associated with an open sand filter:

- Access road or easement
- Fence, gate, and water quality sign
- Control structure/ flow restrictor
- Energy dissipater
- Conveyance stormwater pipe



No. 11 – Sand Filters (above-ground/open)

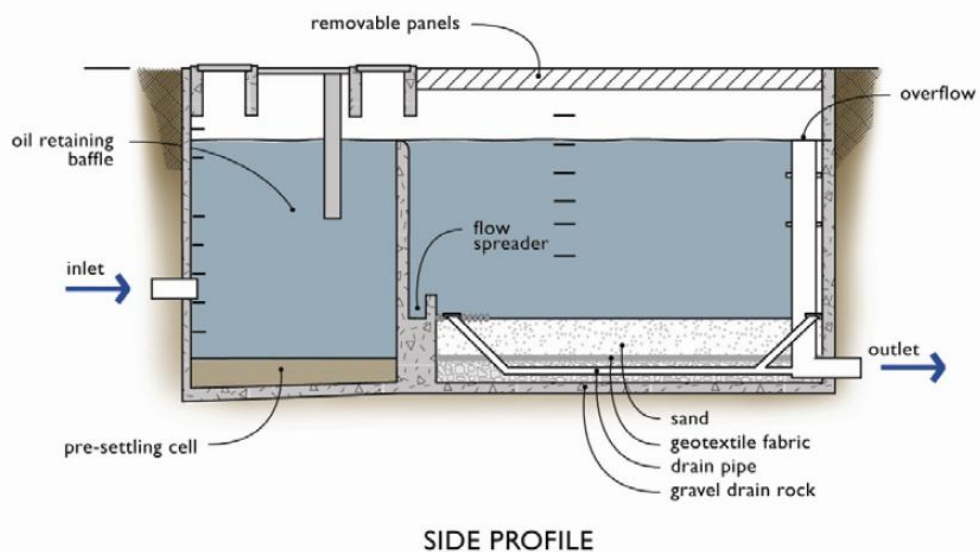
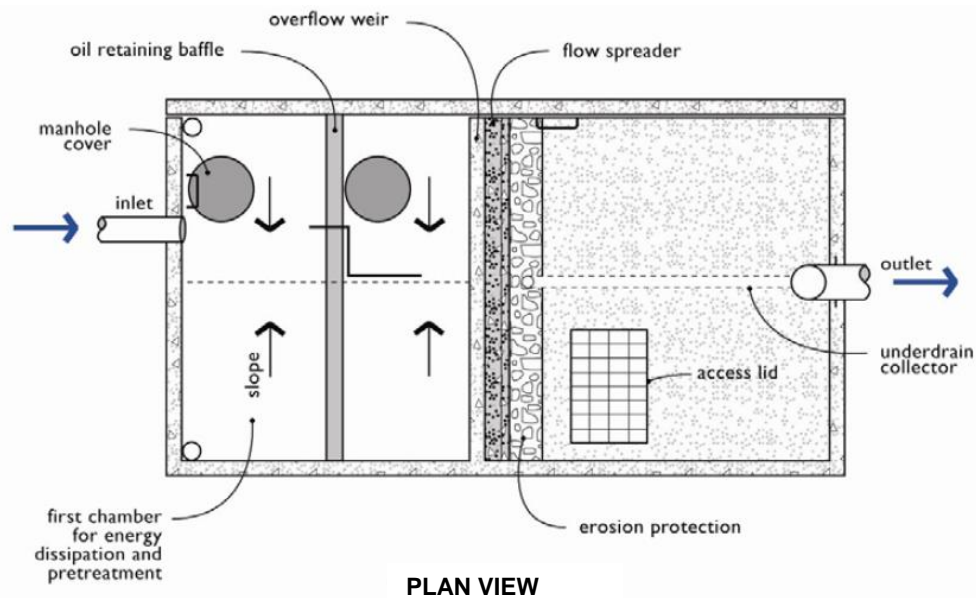
Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Above-Ground (open sand filter)	Sediment Accumulation on top layer	Sediment depth exceeds 1/2-inch.	No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.
	Trash and Debris Accumulations	Trash and debris accumulated on sand filter bed.	Trash and debris removed from sand filter bed.
	Sediment/ Debris in Clean-Outs	When the clean-outs become full or partially plugged with sediment and/or debris.	Sediment removed from clean-outs.
	Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24-hours, and/or flow through the overflow pipes occurs frequently.	Top several inches of sand are scraped. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).
	Prolonged Flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities.	Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.
	Short Circuiting	When flows become concentrated over one section of the sand filter rather than dispersed.	Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area.
	Erosion Damage to Slopes	Erosion over 2-inches deep where cause of damage is prevalent or potential for continued erosion is evident.	Slopes stabilized using proper erosion control measures.
	Rock Pad Missing or Out of Place	Soil beneath the rock is visible.	Rock pad replaced or rebuilt to design specifications.
	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter.	Spreader leveled and cleaned so that flows are spread evenly over sand filter.
	Damaged Pipes	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.	Pipe repaired or replaced.

Sand Filter (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.

Facilities typically associated with an enclosed sand filter:

- Access road or easement
- Fence, gate, and water quality sign
- Conveyance stormwater pipe



No. 12 –Sand Filters (below-ground/enclosed)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below -Ground Vault.	Sediment Accumulation on Sand Media Section	Sediment depth exceeds 1/2-inch.	No sediment deposits on sand filter section that which would impede permeability of the filter section.
	Sediment Accumulation in Pre-Settling Portion of Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.	No sediment deposits in first chamber of vault.
	Trash/Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault and inlet/outlet piping.
	Sediment in Drain Pipes/Cleanouts	When drain pipes, cleanouts become full with sediment and/or debris.	Sediment and debris removed.
	Short Circuiting	When seepage/flow occurs along the vault walls and corners. Sand eroding near inflow area.	Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover. Maintenance person cannot remove cover using normal lifting pressure.	Cover repaired to proper working specifications or replaced.
	Ventilation	Ventilation area blocked or plugged	Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles/Internal walls	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.

No. 12 –Sand Filters (below-ground/enclosed)

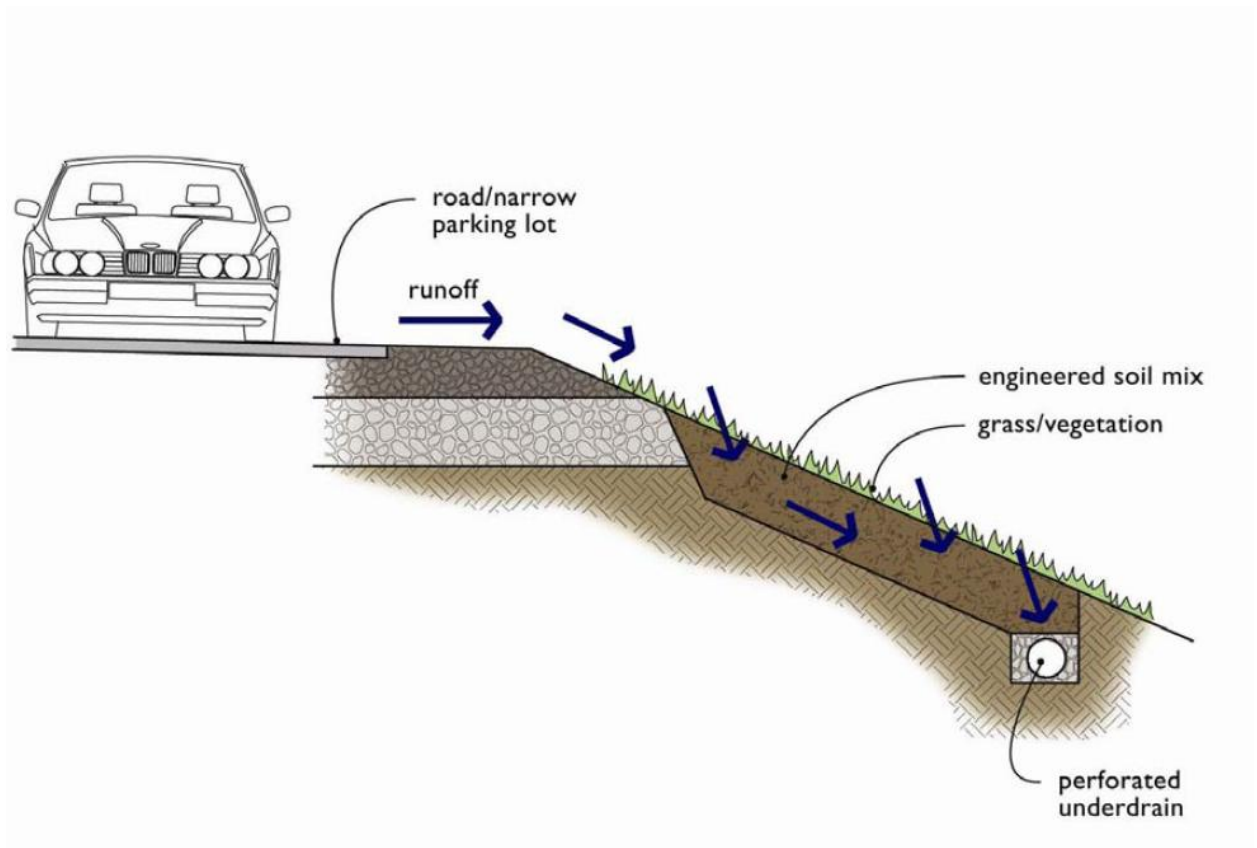
Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired to specifications, and is safe to use as determined by inspection personnel.

Media Filter

The media filter, previously referred to as the ecology embankment, is a linear flow-through stormwater runoff treatment device that can be sited along highway side slopes and medians, borrow ditches, and other linear depressions. The media filter can be used where available right of way is limited, sheet flow from the highway surface is feasible, and lateral gradients are generally less than 25% (4H:1V).

Facilities often associated with media filters:

- Easement



No. 13 – Media Filter

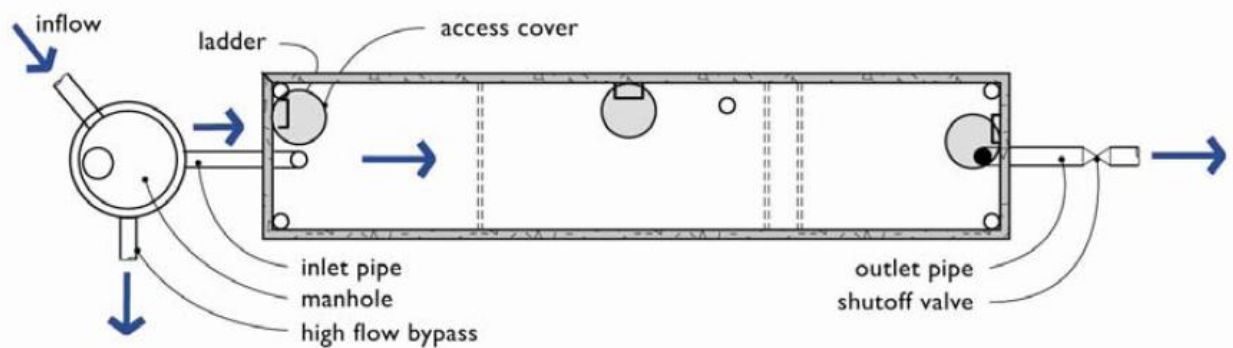
Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below-Ground Vault	Sediment Accumulation on Media.	Sediment depth exceeds 0.25-inches.	No sediment deposits which would impede permeability of the media.
	Sediment Accumulation in Vault	Sediment depth exceeds 6 inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on filter bed.	Trash and debris removed from the filter bed.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Below-Ground Cartridge Type	Filter Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.

Baffle Oil/ Water Separators (American Petroleum Institute type)

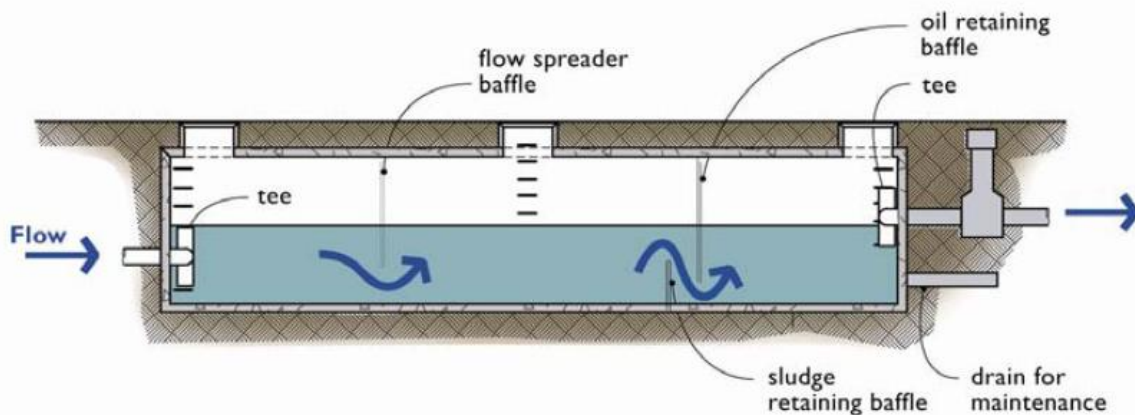
A baffle oil/water separator is an underground vault that treats stormwater by mechanically separating oil from water. The oil rises to the surface and floats on the water and sediment settles to the bottom. These are typically utilized in locations where high oil concentrations in the stormwater runoff are anticipated.

Facilities typically associated with a baffle oil/water separator:

- Access road and easement
- Control structure/ flow restrictor



PLAN VIEW



SIDE PROFILE

No. 14 – Baffle Oil/Water Separators (API Type)

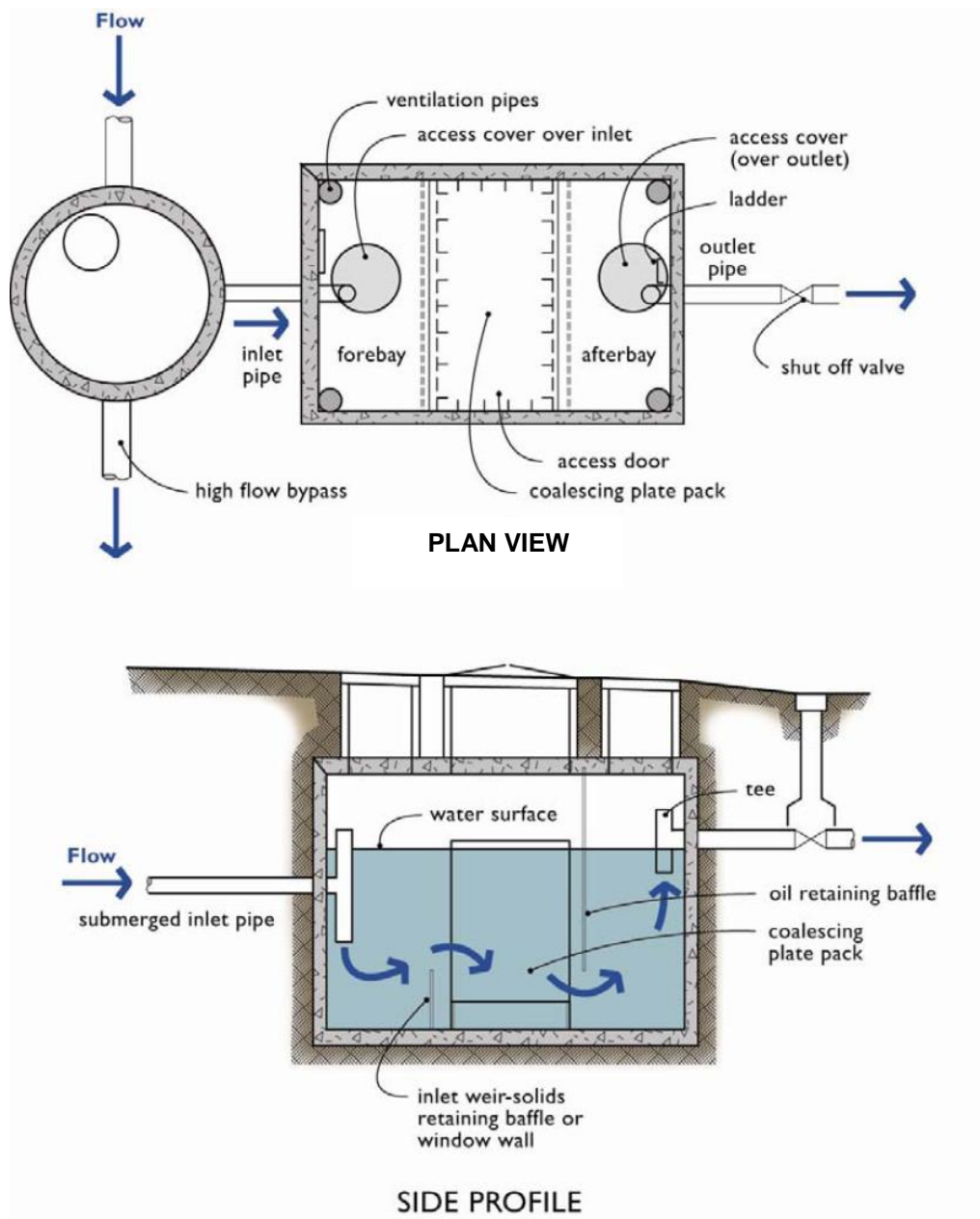
Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with out thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6 inches in depth.	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Oil accumulations that exceed 1 inch, at the surface of the water.	Extract oil from vault by vactoring. Disposal in accordance with state and local rules and regulations.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	See "Catch Basins" (No. 5)	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

Coalescing Plate Oil/Water Separator

A coalescing plate oil/water separator is 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.

Facilities typically associated with a coalescing plate oil/water separator:

- Access road or easement
- Control structure/ flow restrictor
- Conveyance stormwater pipe



No. 15 – Coalescing Plate Oil/Water Separators

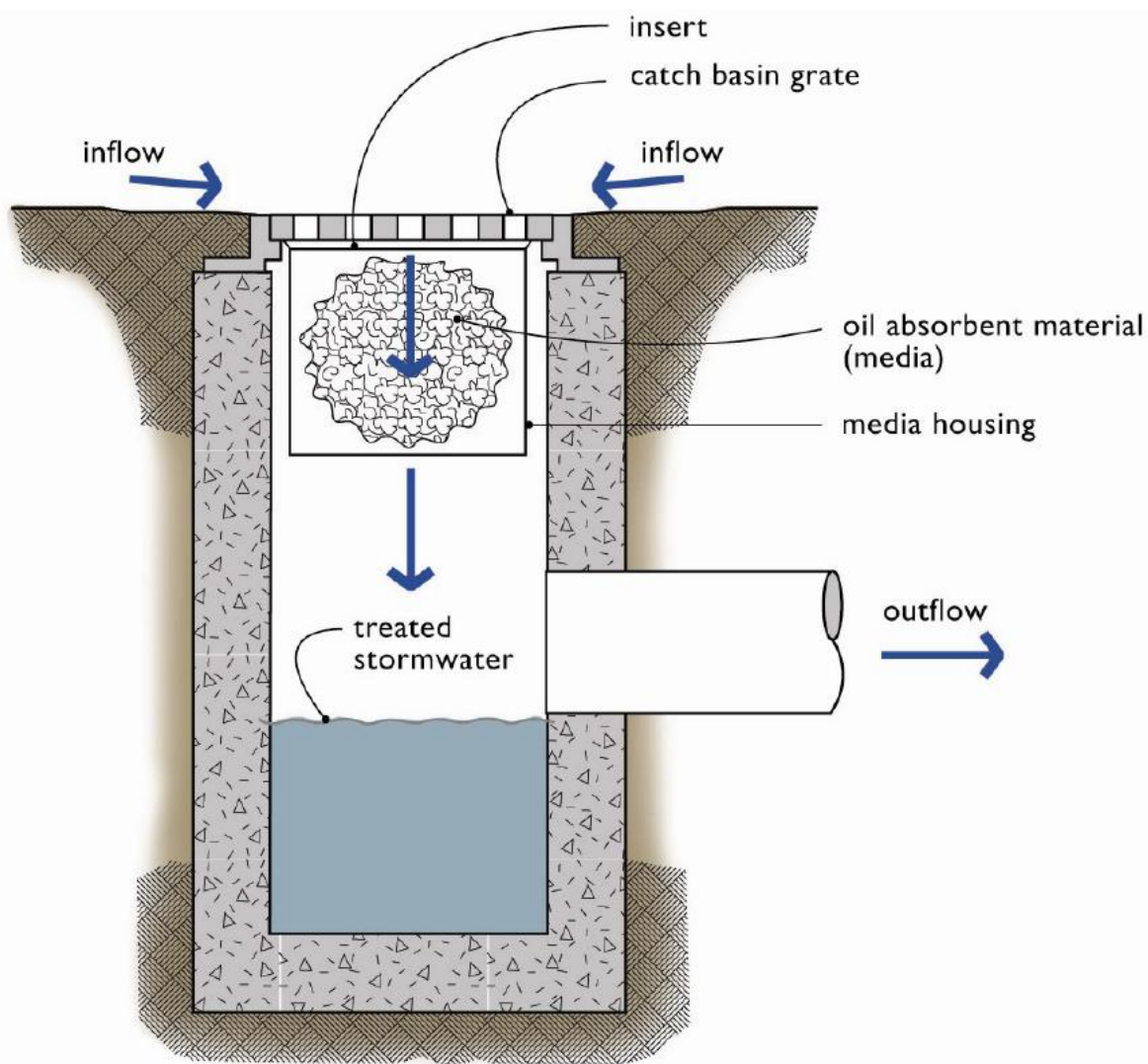
Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with no thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6 inches in depth and/or visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault and inlet/outlet piping.
	Oil Accumulation	Oil accumulation that exceeds 1 inch at the water surface.	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water.
	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/or showing signs of failure.	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

Catch Basin Insert

Catch basin inserts trap sediment and oil entering catch basins. Filter media and oil-absorbent pads are placed in a screened box or brackets within the catch basin. Filters avoid flooding by overflowing when clogged or there are high storm flows.

Facilities typically associated with catch basin inserts:

- Structure (screened box, brackets, etc.) which contains the filter media
- Means of suspending the structure in a catch basin
- Filter media such as sand, carbon, fabric, etc.
- Primary inlet and outlet for the stormwater
- Secondary outlet by bypassing flows that exceed design flow



No. 16 – Catch Basin Inserts

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

Stormwater Management StormFilter[®]

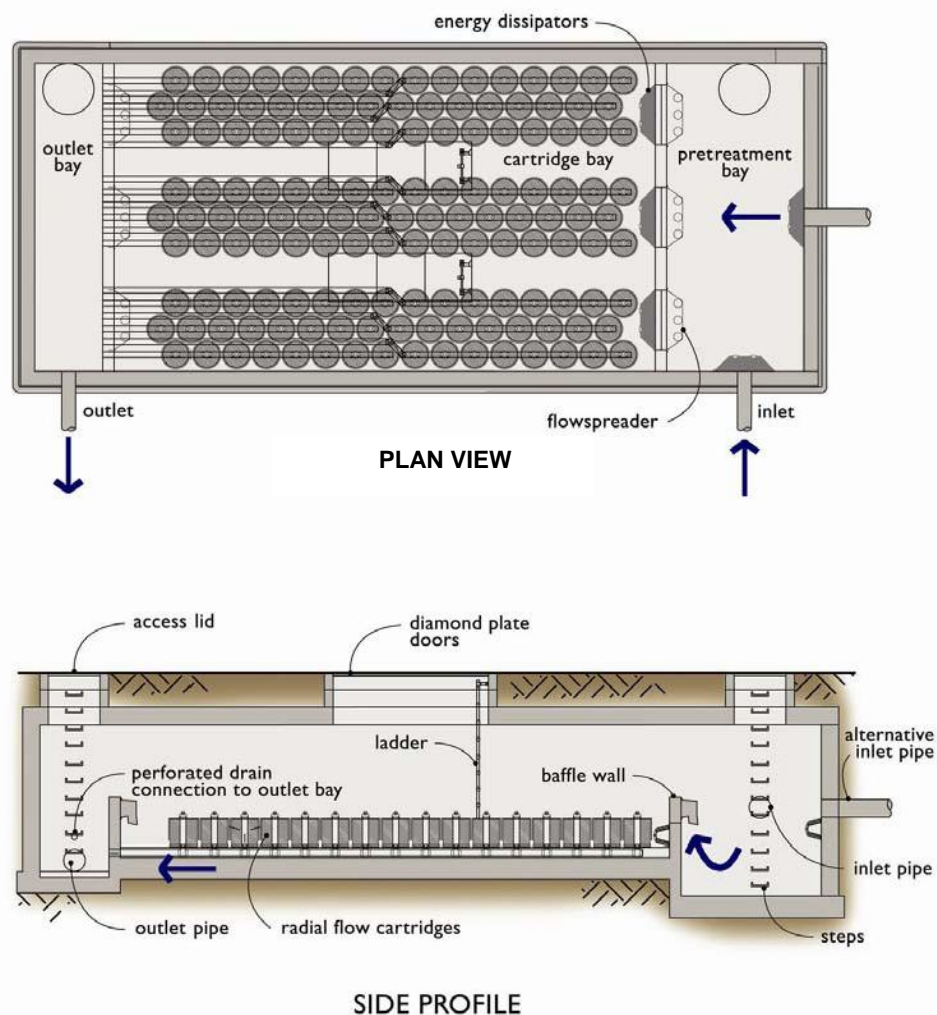
The Stormwater Management StormFilter[®] is a passive, flow-through, stormwater filtration system. The system is comprised of one or more vaults that house rechargeable, media-filled filter cartridges. Stormwater passes through the filtering medium, which traps particulates and/or adsorb pollutants such as dissolved metals and hydrocarbons. The treated stormwater is then discharged to a flow control structure.

The filter media can be housed in cartridge filters enclosed in concrete vaults or catch basin-like structures.

See the manufacturer's publications for additional maintenance information.

Facilities typically associated with a Stormwater Management StormFilter[®]:

- Access road or easement
- Control structure/ flow restrictor
- Conveyance stormwater pipe



Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
Fore bay	Sediment Accumulation	Sediment accumulation exceeds 6 inches or 1/3 of available sump.	Sediment accumulation less than 6 inches.
Media Filter Vault	Sediment Accumulation on Top of Filter Cartridges	Sediment depth exceeds 0.25-inches on top of filter cartridges.	No sediment deposits on top of cartridges. Sediment on cartridges likely indicates that cartridges are plugged and require maintenance. No sediment deposits which would impede permeability of the compost media.
	Sediment Accumulation in Vault	Sediment depth exceeds 4 inches in first chamber. Look for other indicators of clogged cartridges or overflow.	Sediment in vault should be removed. Cartridges should be checked and replaced or serviced as needed. No sediment deposits in vault bottom of first chamber.
	Rubbish and debris	Trash and other rubbish impedes water flow and raises pollutants loads.	Free of rubbish and debris.
	Sediment in Drain Pipes/Clean outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
	Vault Structure includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	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.	Vault replaced or repairs made so that the vault meets design specifications and is structurally sound.
		Cracks wider than ½-inch at any joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than ¼-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking, warping, and/or showing signs of failure as determined by inspection.	Baffles repaired so that no cracks exist wider than ¼-inch at the joint of the inlet/outlet pipe.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications and is structurally sound.
Below Ground Cartridge Type	Compost Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.
	Filter cartridges submerged	Filter vault does not drain within 24 hours following storm. Look for evidence of submergence due to backwater or excessive hydrocarbon loading.	Filter media inspected and replaced if needed. If cartridges are plugged with oil. Additional treatment or source control BMP may be needed.

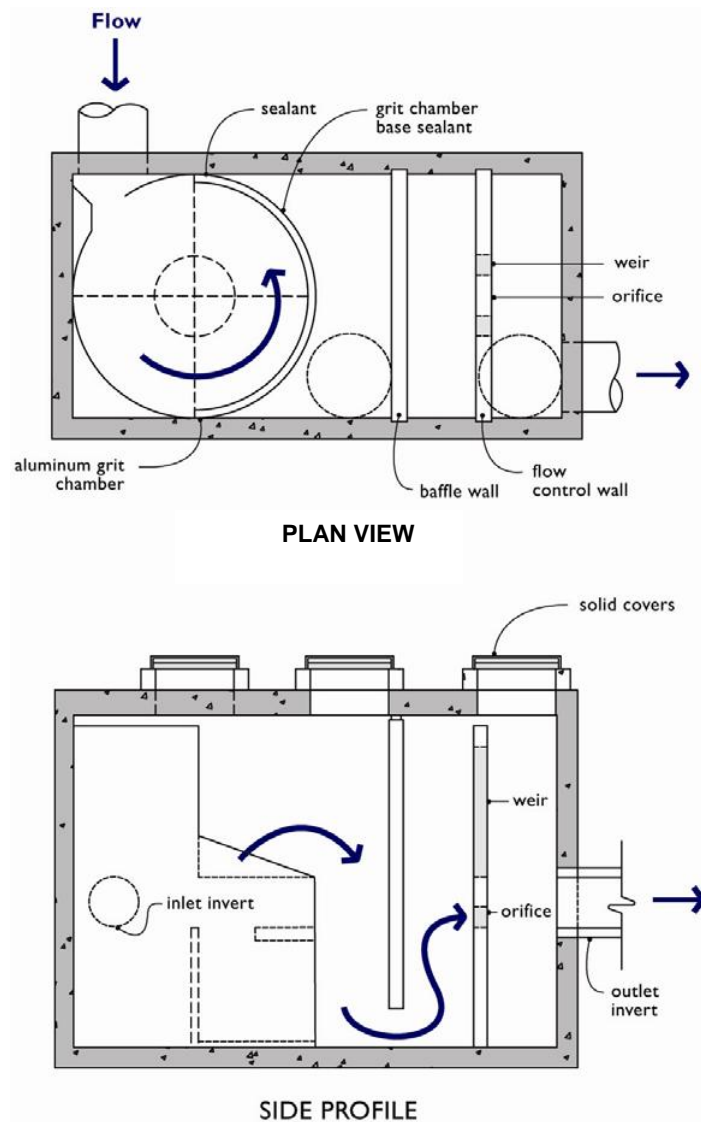
Vortechs® Stormwater Treatment System

A vortex-enhanced sedimentation vault consists of a cylindrical vessel where 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/grease.

Vortechs® treatment units are a proprietary manufactured system. See manufacturer's publications for additional maintenance information.

Facilities typically associated with a Vortechs® Stormwater Treatment System:

- Access road or easement
- Control structure/ flow restrictor
- StormFilter
- Conveyance stormwater pipe



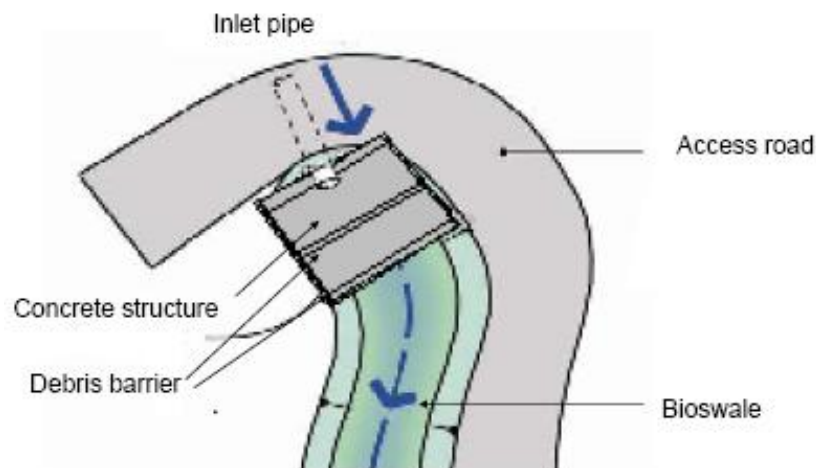
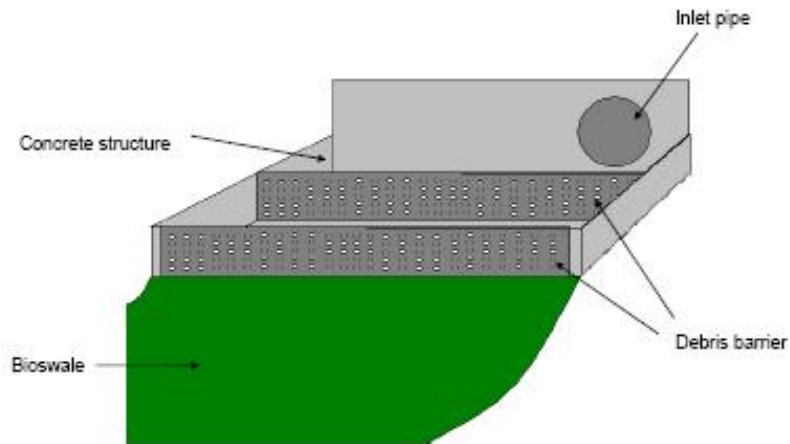
Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Sediment Accumulation	Sediment depth is within 12"-18" of dry weather water surface elevation.	Accumulated sediment should be removed.
	Rubbish and debris	Trash and other rubbish impedes water flow and raises pollutants loads.	Free of rubbish and debris.
	Oil Accumulation	Oil accumulation that exceeds 1-inch at the water surface.	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
	Baffles	Baffles corroding, cracking, warping, and/or showing signs of failure as determined by inspection.	Baffles repaired or repairs made so that vault meets design specifications and is structurally sound.
	Vault Structure includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	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.	Vault replaced or repairs made so that the vault meets design specifications and is structurally sound.
		Cracks wider than ½-inch at any joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than ¼-inch at the joint of the inlet/outlet pipe.
	Sediment in Drain Pipes/Clean outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Access ladder damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

Sediment Trap

A sediment trap is a concrete structure typically fitted with a slotted grate or multiple slotted grates (debris barriers). The concrete structure provides a storage volume (sump) with a spill control device (elbow on outlet pipe) intended to help direct and dissipate flow. The slotted grate (debris barrier) prevents larger debris from exiting the weir.

Facilities typically associated with a Sediment Trap:

- Access road or easement
- Control structure/ flow restrictor
- StormFilter
- Bioswale or another BMP



Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Sediment Accumulation	Sediment exceeds 60 percent of the sump depth.	Accumulated sediment should be removed.
	Rubbish and debris	Trash and other rubbish impedes water flow and raises pollutants loads.	Free of rubbish and debris.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants.	No contaminants or pollutants present.
	Structure damage includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Inspection finds that structure is unsound or is not functioning correctly.	Structure is free of holes, cracks, or other defects and meets design standards.
	Settlement/Misalignment	Cracks wider than 1/2-inch at any joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Vegetation	If failure of basin has created a safety, function, or design problem.	Sediment trap replaced or repaired to design standards.
		Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to sediment trap.
Debris Barrier	Trash and Debris	Trash and debris blocking more than 20% of the grate surface.	Grate free of trash and debris.
	Damaged or Missing	Grate missing or broken.	Grate is in place and meets design standards.

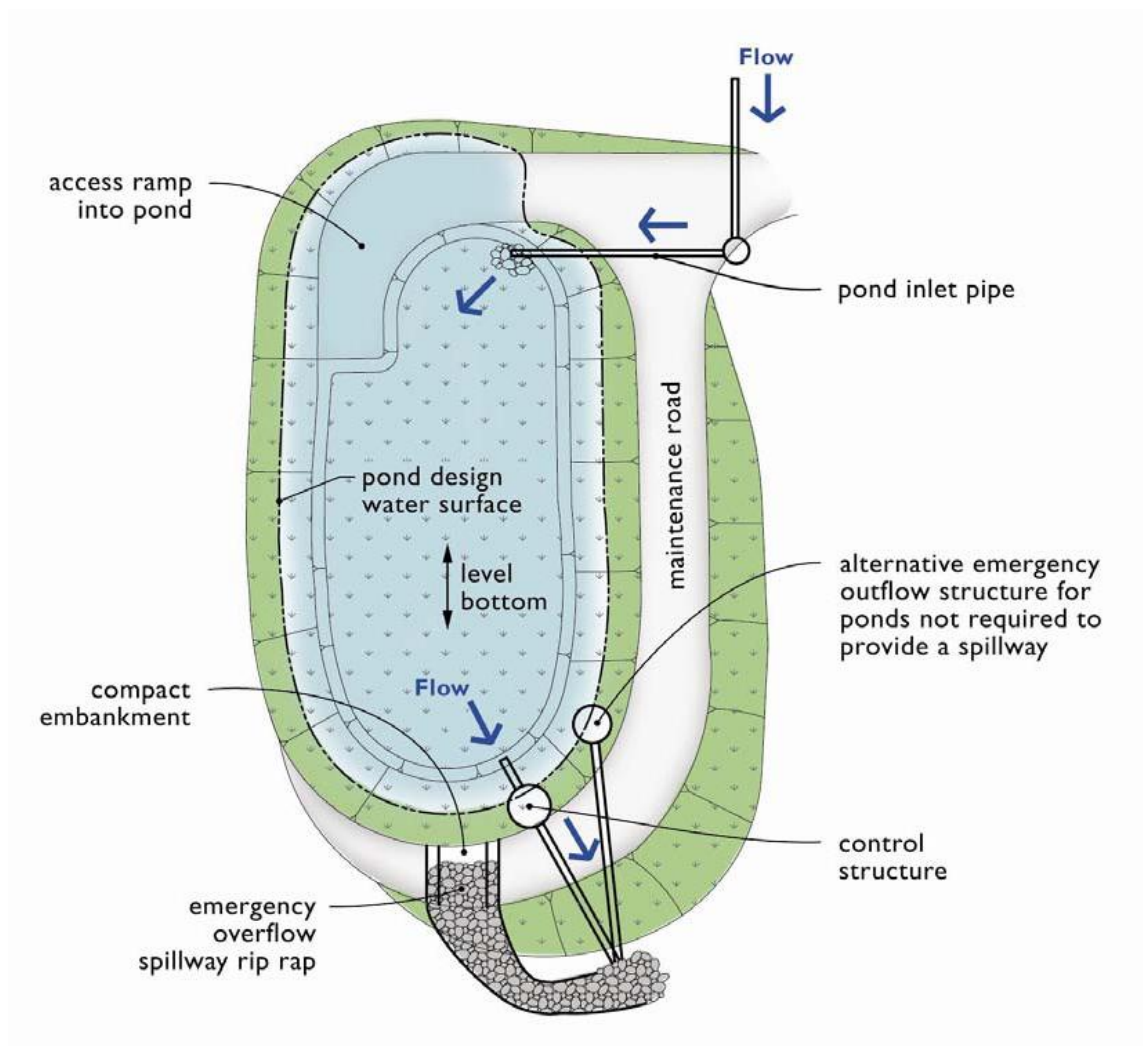
Flow Control Facilities

Detention Pond (Dry Pond)

A detention pond is an open basin that temporarily stores stormwater runoff during rain events and slowly releases it through an outlet. A detention pond typically is designed to completely drain within 25 hours after the end of a storm event. Detention ponds are built by excavating below ground or by constructing above ground berms. Styles vary from well manicured to natural appearing depending on the location.

Facilities typically associated with a Detention Pond:

- Access road or easement
- Fence, gate, and water quality sign
- Control structure/flow restrictor
- Energy dissipaters
- Conveyance stormwater pipe



Maintenance Requirements for Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	<p>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.</p> <p>If less than threshold all trash and debris will be removed as part of next scheduled maintenance.</p>	Trash and debris cleared from site.
	Poisonous Vegetation and noxious weeds	<p>Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public.</p> <p>Any evidence of noxious weeds as defined by State or local regulations.</p> <p>(Apply requirements of adopted Integrated Pest Management (IPM) policies for the use of herbicides).</p>	<p>No danger of poisonous vegetation where maintenance personnel or the public might normally be.</p> <p>(Coordinate with local health department)</p> <p>Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required</p>
	Contaminants and Pollution	<p>Any evidence of oil, gasoline, contaminants or other pollutants</p> <p>(Coordinate removal/cleanup with local water quality response agency).</p>	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department and Ecology Dam Safety Office if pone exceeds 10 acre feet)
	Beaver Dams	Dam results in change or function of the facility.	<p>Facility is returned to design function.</p> <p>(Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)</p>
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	<p>Insects destroyed or removed from site.</p> <p>Apply insecticides in compliance with adopted IPM policies.</p>

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
	Tree Growth and Hazard Trees	<p>Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove</p> <p>If dead, diseased, or dying trees are identified</p> <p>(Use a certified Arborist to determine health of tree or removal requirements)</p>	<p>Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).</p> <p>Remove hazard trees</p>
Side Slopes of Pond	Erosion	<p>Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.</p> <p>Any erosion observed on a compacted berm embankment.</p>	<p>Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.</p> <p>If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.</p>
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Pond Berms (Dikes)	Settlements	<p>Any part of berm which has settled 4 inches lower than the design elevation.</p> <p>If settlement is apparent measure berm to determine amount of settlement.</p> <p>Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.</p>	Dike is built back to the design elevation.
	Piping	<p>Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue.</p> <p>(Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.</p>	Piping eliminated. Erosion potential resolved.

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
	Basin Walls/ Bottom	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds"	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (if applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Drywells

- Cross-listed under Runoff Treatment Facilities

Infiltration Trenches

- Cross-listed under Runoff Treatment Facilities

Infiltration Ponds

- Cross-listed under Runoff Treatment Facilities

Evaporation Ponds

- Cross-listed under Runoff Treatment Facilities

Detention Tanks/Vaults

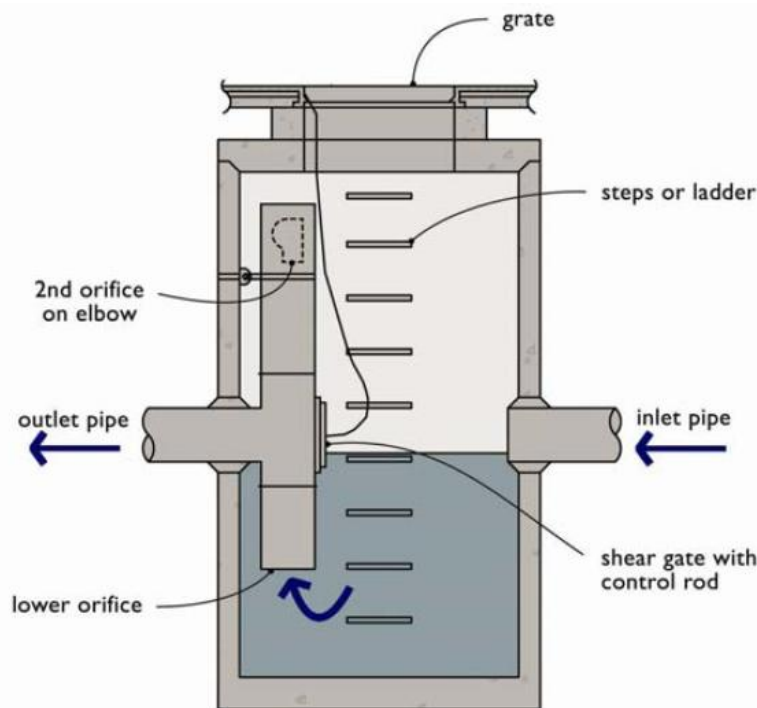
- Cross-listed under Runoff Treatment Facilities

Control Structure/ Flow Restrictor

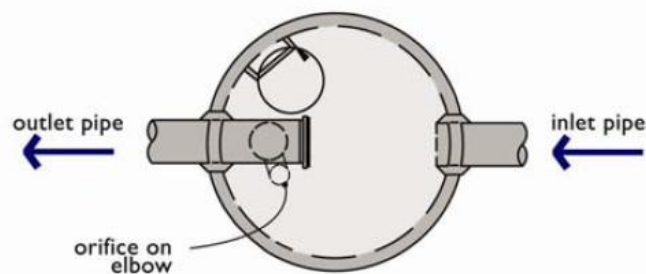
Flow control structures and restrictors direct or restrict flow in or out of facility components. Flow is regulated by a combination of orifices and weirs (plates with rectangular or “V” shaped notch). Lack of maintenance could result in plugging of an orifice. If this occurs, the facility could overtop or release water too quickly which could damage streams, habitat, and property.

Facilities typically associated with a control structure/flow restrictor:

- Detention ponds
- Closed detention facilities
- Conveyance stormwater pipes



SECTION VIEW



PLAN VIEW

No. 4 – Control Structure/Flow Restrictor for Wetponds

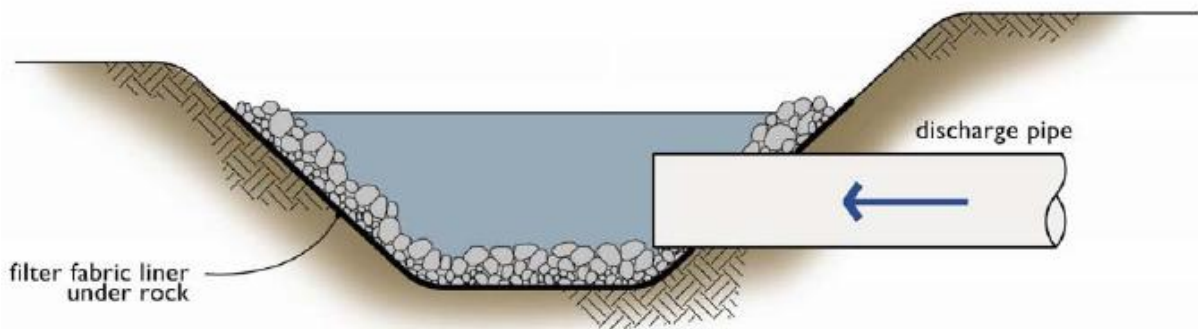
Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural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

Energy Dissipaters

An energy dissipater is installed on or near the inlet or outlet to a closed pipe system to prevent erosion at these locations. A variety of designs including wire gabion baskets, rock splash pads, trenches, and specially designed pools or manholes. The rock pad should extend a minimum of one foot above the top of the pipe.

Facilities typically associated with energy dissipaters:

- Detention Ponds
- Infiltration Ponds
- Wetponds
- Treatment Wetlands
- Culverts
- Outfalls or Other Outlets



No. 7 – Energy Dissipators

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

Stormwater Surface Discharge Points (Outfalls, Other Outlets)

Stormwater surface discharge points include outfalls to receiving waters and any other outlets. Other outlets could include discharge points to natural dispersion, irrigation canals, ephemeral streams, or other dry drainage areas. These discharge points need to be assessed to make sure stormwater is not causing any negative impacts to the associated drainage area. The monitoring component may overlap with Illicit Discharge Detection and Elimination permit requirements.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed or Not Needed
General	Missing or Move Rock	Only one layer of rock exists above native soil in the area five square feet or larger, or any exposure of native soil.	Rock pad replaced to design standards.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
	Obstructions, Including Roots	Roots or debris enters pipe or deforms pipe, reducing flow.	Use mechanical methods to remove root. Do not put root-dissolving chemicals in storm sewer pipes. If necessary, remove the vegetation over the line.
	Pipe Rusted or Deteriorated	Any part of the pipe that is broken, crushed, or deformed more than 20% or any other failure to the piping.	Pipe repaired or replaced.
	Energy Dissipater	If applicable, see Energy Dissipater	If applicable, see Energy Dissipater
Monitoring	Inspection of Discharge Water for Obvious Sign of Poor Water Quality	Sheen, oil, or other contaminants present. Report to Stormwater Program staff.	Effluent discharge from facility should be clear.
	Receiving Area Saturated	Water in receiving area is causing substrate to become saturated and unstable. Report to Stormwater Program staff.	Receiving area stable.
	Off Site Assessment	Erosion, scouring, or headcuts in ditch or stream banks due to flow channelization, or higher flows.	Ditch or stream banks stable.

