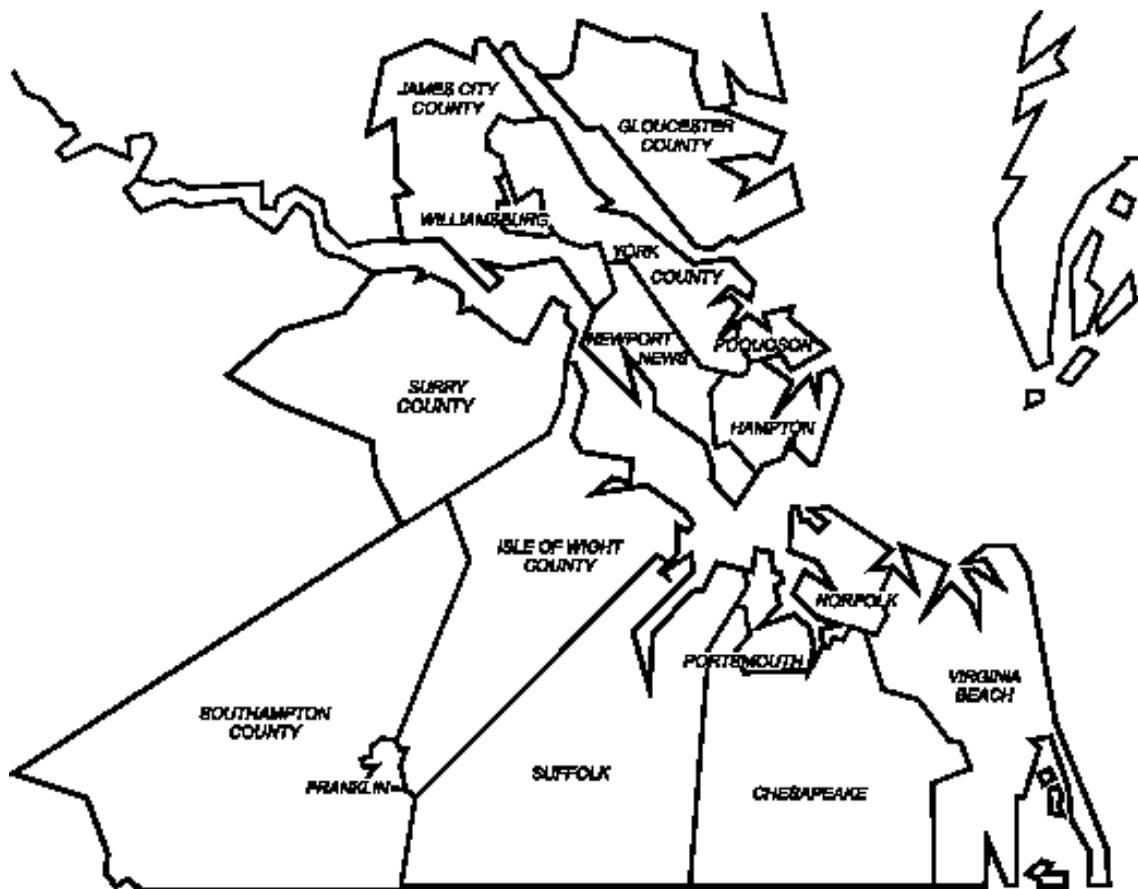




A GUIDE FOR MAINTAINING AND OPERATING BMPs

H R S T O R M



A regional effort to help establish and maintain BMPs throughout Hampton Roads

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Talk the Talk

Here is a glossary to help guide you through the maze of acronyms and technical jargon.

Access Systems:

Measures and devices that provide access to facility components by maintenance personnel and equipment.

Aeration:

The process to increase oxygen levels in the water by circulating the water in a lake or pond.

Algae:

A small plant that grows naturally in most rivers, lakes, and bays. Nutrients like phosphorus and nitrogen can make algae grow faster.

Anti-vortex Device:

A device that promotes the settling of pollutants by preventing a whirlpool from occurring at the outlet device.

A Guide to Maintaining BMPs

Best Management Practices (BMPs), are devices used to reduce pollution in stormwater runoff, thereby protecting area waterways. These practices are often permanent facilities designed to handle stormwater runoff for a specific area. As a property owner or Homeowners Association, you may be responsible for maintenance of a BMP.

Why BMPs?

In recent years, the impacts on area waterways, due to the urbanization of watersheds, have become evident. With continued construction of paved surfaces and development projects, the drainage patterns become altered, which often results in flooding. Normal day-to-day activities such as washing the car and fertilizing the lawn, have also contributed to water pollution. Excess fertilizer, lawn chemicals, automotive products, pet waste, leaves, debris, litter and anything else that washes from the landscape are carried with each rain storm into drainage systems, some of which flow directly into area waterways. BMPs reduce the flow which allows for filtration of pollutants before the stormwater enters our streams, rivers, lakes and bays. To ensure that BMPs perform as expected, they must be maintained properly. No two BMPs are alike, and their maintenance needs may differ.

Types of BMPs In Hampton Roads

Infiltration Trenches/Basins are stone-filled excavations that temporarily store stormwater runoff and allow it to soak into the soil beneath it. There are two basic types of infiltration facilities, distinguished by how stormwater enters the facility.

Dispersed input facilities allow stormwater to enter the top of the trench or basin as overland runoff.

Concentrated input facilities receive stormwater from curb inlets, gutters and pipes.



A well-maintained detention or dry pond.

Detention Basins/Ponds (also known as dry ponds) are man-made basins, which detain water for specified periods of time after a storm. Dry ponds do not contain a permanent pool of water and are normally dry during non-rainfall periods. Water is impounded temporarily to allow much of the sediment carried by the runoff to settle to the bottom. Many of the pollutants, such as nutrients, are attached to sediment particles and are also removed. The impounded water is discharged via an outlet. No standing water should remain if the facility is functioning properly.



A well-kept retention pond with rip rap.

allow more time for pollutant settling and removal. Since there are only two natural lakes in Virginia, it is likely the lake in your neighborhood is actually a stormwater retention pond.



If you have a grassed swale like this in your yard, you have a BMP.

Retention Basins/Ponds (also known as wet ponds or stormwater ponds) have a permanent pool of water. Retention ponds are more effective at improving water quality than dry ponds because they

Grassed Swales are gently sloped areas of vegetation that slow the flow of runoff, channeling it to other BMPs. Grassed swales are typically found in residential developments as an alternative to curb and gutter. Swale maintenance is typically the responsibility of the homeowner and includes mowing and periodic reseeding. Mowing the grass too short or improperly applying lawn chemicals can negatively impact the performance of the BMP.

Aquascaping:

Landscaping the shoreline of ponds and lakes with aquatic and wetland vegetation.

Berm:

A ridge of material, typically soil, which is used to retain or redirect stormwater flow.

Bioaugmentation:

Adding naturally occurring bacteria to a pond or lake to reduce nutrient levels, typically used to reduce algae blooms.

BMP:

Best Management Practice; devices used to reduce pollution in stormwater runoff.

Bypass System:

A system which allows maintenance by temporarily diverting stormwater.

Dam/Embankment:

The structure that impounds runoff into a stormwater facility.

Detention

Basin/Pond:

A BMP which provides temporary storage of stormwater runoff. Also known as a dry pond.

Emergency

Outlet/Spillway:

A structure that safely conveys stormwater overflow from a BMP pond.

Emergent Plants:

An aquatic plant that is rooted in sediment but has leaves at or above the water.

Environmentally Friendly

Landscaping:

Landscaping that requires minimal chemicals and improves water absorption.

Filter Fabric/

Geomembrane:

A webbed fabric which serves to filter pollutants or to hold a filter medium, such as sand or gravel, in place.

Filter Strips and Buffers are areas of vegetation that remove pollutants in runoff as the water flows through it. Filter strips are similar to grass swales, only wider. Buffer areas can contain a variety of vegetation, including trees and shrubs.

Elements of a Maintenance Program

Overview of BMP Maintenance

BMPs will not perform as designed if they are not regularly maintained. If a facility's storage capacity is reduced, some downstream flooding will indicate the problem; however, if a facility is not removing sediment and nutrients as originally designed, there may not be any obvious indicators of the problem. A regular maintenance program is the best way to ensure that a BMP will consistently perform its water quality improvement functions.

It is important to note that while general maintenance tasks can be outlined, actual maintenance needs will vary according to specific site conditions, particularly the following elements:

Landscaping: Certain vegetation may require more attention. Consider using native plants to reduce maintenance needs.

Upstream Conditions: Watershed conditions upstream of the facility will affect the amount of sediment and pollutants that must be managed.

Safety: Some tasks can be effectively handled by residents; however, a maintenance program should ensure the safety of anyone carrying out tasks, and often a professional should be hired to do the work.

Technical Expertise: BMPs are stormwater treatment facilities. While many maintenance needs like litter and debris removal are obvious, some problems may not be detectable to the untrained eye.

Financing: A fund should be established to provide for the costs of long-term maintenance needs.

Routine Maintenance Needs

Inspections

Local regulations do not require a particular schedule of inspections. Annual inspection by a qualified professional is recommended to ensure that the facility is functioning properly.

Your local Department of Public Works or Department of Engineering (see Resources on pg. 13) can answer questions about what to check for. At a minimum, an inspector should check for the following.

Vegetation Management

Vegetative cover serves several purposes in BMPs: slows the velocity of the runoff; filters sediment from runoff as it is collected in the BMP; and prevents erosion of the banks and bottom of the facility.

Grass is generally used around retention basins, infiltration trenches and in and around dry detention basins. It must be mowed and maintained. Mowing requirements can be tailored to the specific needs of a site and the neighboring

properties. The grass in a BMP may be hardiest if maintained as an upland meadow, cutting no shorter than 6-8 inches.

Maintaining a more manicured expanse of grass decreases the effectiveness of the BMP, as well as increasing its maintenance costs.

Wetland plants may also be used along the fringe of the BMP in areas where conditions are favorable. Some of these types of plants may inhabit the area naturally.

The vegetation surrounding infiltration trenches or buffer strips also removes some



Plants along the edges of BMPs filter pollutants.

Fountain:

A decorative water feature that does not improve water quality because it uses a low volume of water at high pressure (not an aerator).

Impervious Cover:

Any hard surface that prevents water from soaking into the soil.

Infiltration Trench:

Stone filled excavations that temporarily store stormwater runoff and allow it to soak into the soil.

Inlet:

The pipe that carries stormwater into the BMP.

Nonpoint Source

Pollution:

A type of pollution that doesn't come from a single identifiable source, or point, such as a sewage treatment plant or an industrial discharge pipe. It is generated in day-to-day activities.

Nutrients:

Substances which help plants and animals live and grow. Excess amounts of two nutrients, nitrogen and phosphorus, can cause algae blooms and fish kills.

Outfall:

A pipe that discharges stormwater directly into a stream, river, or waterway.

Principle Outlet:

The main structure that controls and conveys a facility's flow of water.

Pump System:

Electrical and mechanical components including pipework used to convey BMP discharge.

Retention**Basin/Pond:**

A BMP which provides permanent storage of stormwater runoff. Also known as a wet pond.

sediment before the stormwater enters the BMP. If plants are damaged or become laden with sediment, they can no longer perform beneficially. Therefore, the condition of these areas should be closely monitored, and vegetation replaced if necessary.

Debris and Litter Removal

Regular removal of debris and litter is efficient and effective, having several benefits:

- Reduces the chance of clogging in outlet structures, trash racks and other components.
- Prevents possible damage to vegetated areas.
- Reduces potential mosquito breeding habitats.
- Maintains facility appearance.
- Reduces conditions for excessive surface algae.



Remove debris to improve BMP function and aesthetics.

Mechanical Component Maintenance

Each type of BMP may have mechanical components that need periodic attention to ensure their continued performance. Valves, gates, pumps, fences, locks and access hatches should be maintained at all times. Design and site factors will determine the amount of maintenance that is necessary.

Pest Control

Mosquito and other insect breeding grounds can be created by standing water. The most effective control technique in retention basins is to prevent stagnant areas. Prompt removal

of floating debris helps. In larger basins, it may also be possible to maintain stocks of fish that feed upon mosquito larvae. The wave action created by surface aerators increases oxygen levels and also discourages mosquito breeding.

Animal burrows will also deteriorate the structural integrity of an embankment. Muskrats and nutria, in particular, will burrow tunnels up to six inches in diameter. Existing burrows should be filled as soon as possible.

Non-Routine Maintenance Needs

Pond Maintenance

To ensure peak performance of retention basins, a healthy aquatic environment should exist. A healthy aquatic ecosystem typically requires little maintenance. Excess



nutrients are a common problem with retention ponds. An indicator of excess nutrients is excessive algae growth in the permanent pool of a retention basin. In most cases, growth of more desirable aquatic and semi-aquatic vegetation in and around the permanent pool will help to utilize nutrients in the pond, thus deterring the growth of algae and other nuisance vegetation.

An algae bloom is an indicator of excessive nutrients.

Bank Stabilization

It is very important to prevent erosion of the banks and bottom of detention basins (dry ponds) and the visible banks of retention ponds. The easiest way to do this is to keep groundcover healthy. Areas of bare soil will erode quickly, clogging the basin with soil and threatening its integrity. Any bare areas should be re-seeded and stabilized as quickly as possible.

The roots of woody growth, such as young trees and shrubs, can also destabilize embankments. Consistent maintenance can control any stray seedlings that take root in an embankment. Woody growth away from the embankment does not generally pose a threat to the stability of the

Rip Rap:

Large stones engineered and placed to prevent erosion.

Riser: A vertical pipe extending from the bottom of a BMP that is used to control the rate of stormwater discharge.

Runoff Pollution:

The pollution caused when water washes chemicals and other pollutants off of farm fields, yards, and roads and carries them to streams and waterways.

Sediments: Soil particles carried by rainwater into streams, lakes, rivers and bays.

Stormwater:

Rainwater that runs off over land.

Swale: gently sloped area of vegetation used to slow the flow of runoff, channeling it to other BMPs.

Vegetative Buffer:

Areas of vegetation that remove pollutants in runoff as the water flows through it (also known as filter strips and buffers).

Watershed: An area of land that slopes or drains toward or into a lake, river, stream, or wetland. This is also known as a drainage basin.

embankment and can play an important role in the health of the vegetative environment. For ease of maintenance, trees and shrubs should be planted outside maintenance and access areas.



Healthy ground cover prevents erosion.

Sediment Removal

Sediment removal, or dredging, may be a maintenance option for you to consider. Dredging removes the layer of highly enriched materials from the lake's bottom. Removing this nutrient "bank" prevents phosphorus from releasing back into the water column and consequently being discharged into receiving waters during the next storm. This also helps lower nutrient concentrations in the lake, thus decreasing nuisance algae blooms. Dredging can help to improve water quality by deepening the BMP, providing additional storage capacity. But, deeper is not always better! Consult a professional for optimum BMP depth.

Sediment Removal in Retention and Detention Basins

Sediment will accumulate in a BMP and will eventually need to be removed, but facilities vary so much that there are no hard and fast rules about when and how. For



Dredging helps lower nutrient concentrations in water.

planning purposes, sediment removal should be considered on the following intervals:

- Extended detention basins (dry ponds): every 2-10 years
- Retention basins (wet ponds): every 5 –15 years

Sediment removal is usually the largest single cost of BMP maintenance; therefore, it is best to plan ahead to allow for contractual negotiations, as well as adequate funding.



BMPs reduce pollution and flooding by containing stormwater.

The sediment removed from your basin will require proper disposal.

Typically, an onsite area or a site adjacent to the facility (but outside the floodplain) is set aside for the spoil. If such a disposal area is not set aside,

transportation and landfill tipping fees can greatly increase the cost of sediment removal. Once the sediment is removed, the bottom of the basin and any disturbed areas need to be stabilized and revegetated or the facility will quickly clog and require sediment removal again.

Wet sediment is more difficult and expensive to remove than dry sediment. In some cases the entire basin can be drained and allowed to dry so that equipment can remove sediment from the bottom. In other cases, where this is not practical, it may be necessary to remove sediment from a vantagepoint on the shoreline or by hydraulic dredging from the surface. This additional cost of sediment removal for a retention facility is partially offset by the longer interval between dredging cycles. Disposal of wet sediment is not allowed in many landfills, so the material often must be dried (dewatered) prior to disposal. This extra step adds to the cost and requires a place where wet material can be temporarily placed to dry.

In general, maintenance programs will contain the following components:

Routine:

- Regular inspections
- Vegetation management
- Debris and litter control
- Mechanical components maintenance

Non-Routine:

- Bank stabilization
- Sediment removal
- Outlet structure maintenance and replacement



A properly functioning retention pond.

Sediment Removal in Infiltration Trenches

Infiltration facilities tend to clog more frequently than either detention or retention basins. Therefore, it is recommended that these facilities be inspected at least two to four times a year. Most infiltration trenches have a sediment trap or filter to remove some sediment before the stormwater enters the trench. Keeping this sediment filter clean is vital to ensuring the long-term performance of the infiltration trench.

This is especially critical for concentrated input facilities that use sediment traps. If the sediment trap is full, sediment-laden water will be conveyed into the trench. With dispersed input facilities, a clogged sediment barrier is indicated when water cannot flow into the trench and goes through the overflow channel. For any overflow condition, the observation well should be checked to determine the cause. If the trench remains filled with water after a rain event and causes regular overflow, then the aggregate stone should be excavated and the facility rebuilt.

The specific sediment removal procedure will depend on the manner in which the stormwater enters the facility. Concentrated input facilities will have some kind of in-line filter system or sediment trap. Clean-out procedures should be described in approved facility plans, as well as in any maintenance agreement. If there is any question on how routine sediment removal is to be performed for a

given facility, the designing engineer or your local Public Works or Engineering Departments can make recommendations.

For typical trenches using dispersed input, routine sediment removal usually means removing the top 6 to 12 inches of filter gravel and replacing the filter cloth sediment barrier that covers the aggregate reservoir. A layer of clean filter gravel replaces the gravel removed. Any bare spots or damaged areas in the grass filter strip should be replaced with sod upon completion of the sediment removal procedure.

Who Should Carry Out the Maintenance?

Before tackling any maintenance project, the first step is to contact your local Department of Public Works or Department of Engineering. When designing a maintenance program, safety, cost and effectiveness of the maintenance activities need to be balanced. Some activities, like mowing and litter removal, can be less expensive if done in-house.

It is usually worthwhile to hire professionals to detect problems early, when they are most cost effective to fix. This might include filling eroded areas, soil disturbing activities, grading, and sediment removal. If not performed properly, efforts may be wasted, and cause damage to the facility by excessive erosion. Be sure to contract with a reputable firm and ask for references and sites that you can check.

Other Things You Can Do

Aquascaping

Aquascaping is simply landscaping the shoreline of ponds and lakes with aquatic and wetland plants. Ponds and lakes with a landscape design have fewer problems than those without. Vegetation filters polluted runoff and traps sediments. Aquatic plants pump oxygen into the water and create habitats by providing cover and nurseries for fish and other organisms. More importantly, vegetated shorelines help improve water quality. Vegetated stormwater



Plants absorb runoff water.

Minimum Inspection Checklist

- Excessive erosion or sedimentation
- Obstruction of the inlet or outlet devices by trash or debris
- Cracking or settling of the dam
- Low spots in the bottom of an extended detention facility
- Deterioration of pipes
- Condition of the emergency spillway
- Stability of the side-slopes, up and downstream channel conditions
- Signs of vandalism

lakes have a pollutant removal capacity that can be up to five times higher than unvegetated lakes. With proper planning and planting, stormwater BMPs can thrive like natural lakes, prolonging their lifespan and enhancing their ability to improve water quality.

Aeration

Aeration is a cost-effective method of enhancing water quality and provides an environmentally friendly alternative to chemical use.



Aerators can be functional and decorative, unlike fountains which are only decorative.

Aeration stimulates natural processes that improve water quality. Aeration also keeps dissolved oxygen levels high, which can help prevent fish kills in the summer. By raising oxygen levels, aeration also stimulates aerobic bacteria, which are important for stormwater BMPs, as they digest excess nutrients.

Aeration is a science, so when considering an aeration system for your pond or lake, consult an expert. Look for companies that specialize in lake management and aeration.

Remember that fountains are NOT aerators. A fountain is a decorative water feature that does not improve water quality. Fountains have no impact on water quality because they use a low volume of water at high pressure. Aerators use a high volume of water at low pressure to circulate water throughout the lake, rather than simply spraying the water into the air.

Chemicals

Chemical treatments require a professional with the appropriate licensing. A mistake in dosage can be toxic to fish and can have serious impacts downstream. Oxygen depletion and fish kills are distinct hazards when treating large infestations of nuisance vegetation. Furthermore, chemical control is usually temporary and, at best, merely treats the symptoms.

Maintenance efforts that emphasize chemical treatments year after year are expensive and can perpetuate nuisance algae and vegetation problems.

Bioaugmentation

Bioaugmentation involves the addition of a special blend of naturally occurring bacteria to the pond or lake. These bacteria compete with algae for nutrients, digest dead organic matter throughout the water column and sludge layer, and eliminate pond odor caused by ammonia and hydrogen sulfide. Bioaugmentation products are sold under brand names such as LakePak and OtterClear. If considering bioaugmentation, consult a professional. The effectiveness of any bioaugmentation product is greatly enhanced with the use of an aeration system.



Resource Agencies

State

Department of Conservation and
Recreation
1548 Holland Road
Suffolk, VA 23434
757-925-2468
www.state.va.us/~dcr

Department of Environmental Quality
Tidewater Regional Office
5636 Southern Boulevard
Virginia Beach, VA 23462
757-518-2000
www.deq.state.va.us

Regional

Hampton Roads Planning
District Commission
723 Woodlake Drive
Chesapeake, VA 23320
757-420-8300
www.hrpd.org

Virginia Cooperative Extension
Diamond Springs Research Station
1444 Diamond Springs Road
Virginia Beach, VA 23455
757-363-3900
www.ext.vt.edu

Local

Chesapeake

Department of Public Works
Stormwater Management
757- 382-3333
www.chesapeake.va.us

James City County

Environmental Division
757-253-6670
www.james-city.va.us

Franklin

Department of Public Works and
Utilities
757-562-8565

Newport News

Department of Engineering
Stormwater Management
757-926-8611
www.newport-news.va.us

Gloucester County

Office of Community Development
Department of Public Works
804-693-4040
www.co.gloucester.va.us

Norfolk

Department of Public Works
Stormwater Management
757-441-2408
www.norfolk.va.us

Hampton

Department of Public Works
Engineering
757-727-6388
www.hampton.va.us

Poquoson

Department of Engineering and
Utilities
757-868-3025
www.ci.poquoson.va.us

Isle of Wight County

Department of Planning and Zoning
757-357-3191

Portsmouth

Department of Engineering &
Technical Services
757-393-8592
www.portsmouth.va.us

Southampton County

Department of Utilities
757-653-3015

Suffolk

Department of Public Works
Engineering
757-934-3111
www.suffolk.va.us

Surry County

Department of Planning
757-294-5210

Virginia Beach

Department of Public Works
Engineering Division
757-427-4131
www.virginia-beach.va.us

Williamsburg

Department of Public Works and
Utilities
757-220-6140
www.ci.williamsburg.va.us

York County

Department of Environmental &
Development Services
757-890-3752
www.co.york.va.us

**For further information, visit our website:
www.hrstorm.org**

Inspection Log

Date: _____ **Inspected by:** _____

Observations: _____

Date: _____ **Inspected by:** _____

Observations: _____

Date: _____ **Inspected by:** _____

Observations: _____

Date: _____ **Inspected by:** _____

Observations: _____

Date: _____ **Inspected by:** _____

Observations: _____

Date: _____ **Inspected by:** _____

Observations: _____

Date: _____ **Inspected by:** _____

Observations: _____



BMP Inspection Checklist

Routine self inspection of your BMP is the best way to catch potential problems before they become a liability. The following is a guide to get you started. Answering YES to any of these questions indicates a need for corrective action or consultation with a professional inspector. We encourage you to copy this checklist and maintain a record of your inspections.

	Yes	No
Does the facility show signs of settling, cracking, bulging, misalignment or other structural deterioration?	<input type="checkbox"/>	<input type="checkbox"/>
Do the embankments, emergency spillways, side slopes or inlet/outlet structures show signs of erosion?	<input type="checkbox"/>	<input type="checkbox"/>
Is the outlet pipe damaged or not functioning properly?	<input type="checkbox"/>	<input type="checkbox"/>
Do the impoundment and inlet areas show erosion, low spots or lack of stabilization?	<input type="checkbox"/>	<input type="checkbox"/>
Is woody vegetation that may interfere with the facility's performance present on the banks?	<input type="checkbox"/>	<input type="checkbox"/>
Is there evidence of animal burrows?	<input type="checkbox"/>	<input type="checkbox"/>
Are contributing areas unstabilized with evidence of erosion?	<input type="checkbox"/>	<input type="checkbox"/>
Do vegetated areas need mowing or is there a build up of clippings that could clog the facility?	<input type="checkbox"/>	<input type="checkbox"/>
Does the depth of sediment pose a threat to storage volume?	<input type="checkbox"/>	<input type="checkbox"/>
Is there standing water in appropriate areas? In inappropriate areas?	<input type="checkbox"/>	<input type="checkbox"/>
Is there accumulation of trash or debris?	<input type="checkbox"/>	<input type="checkbox"/>
Is there evidence of encroachment or improper use of the impounded areas?	<input type="checkbox"/>	<input type="checkbox"/>
Are there signs of vandalism?	<input type="checkbox"/>	<input type="checkbox"/>
Do any safety devices such as fences, gates or locks need repair?	<input type="checkbox"/>	<input type="checkbox"/>
Is there excessive algae or dominance of one type of vegetation?	<input type="checkbox"/>	<input type="checkbox"/>
Is there evidence of automotive fluids entering or clogging the facility?	<input type="checkbox"/>	<input type="checkbox"/>
Is there evidence of a fish kill?	<input type="checkbox"/>	<input type="checkbox"/>



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