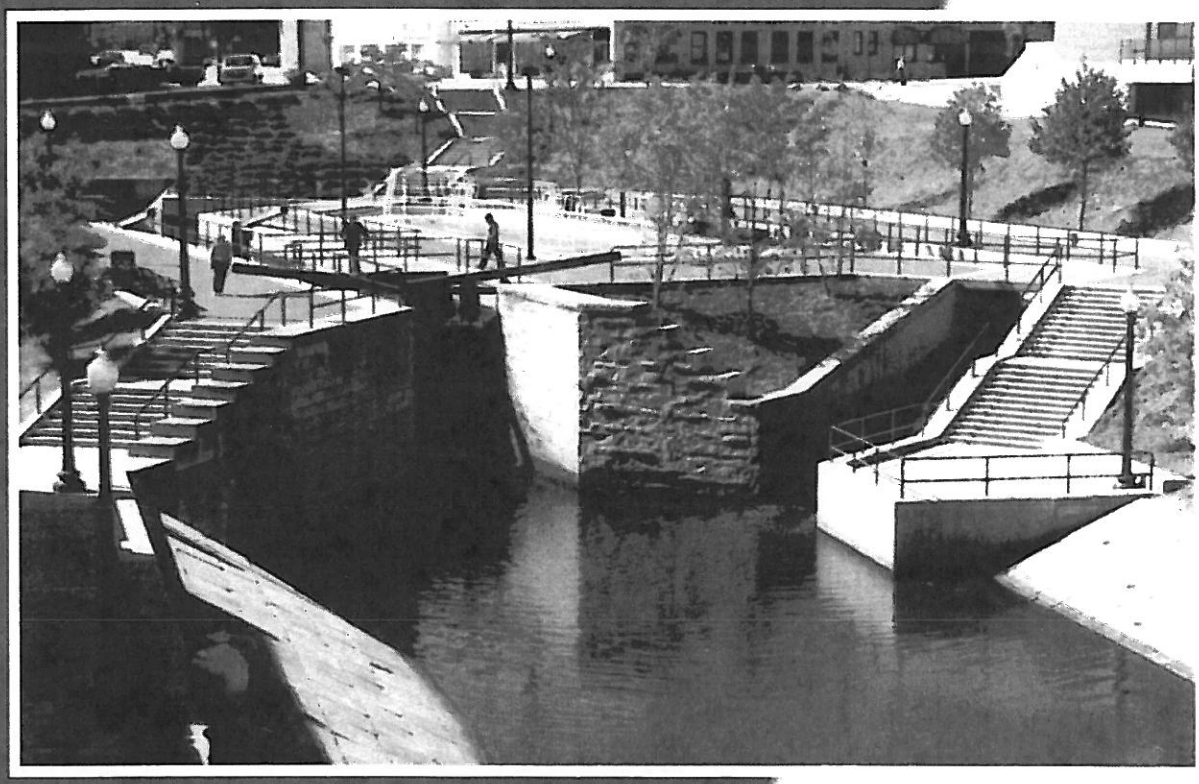

Post-Construction BMP Inspection Form and Guidance Manual for Post-Construction Maintenance

Stormwater Pond Operation, Maintenance, And Management Inspection Checklist

Project: _____
Location: _____
Site Status: _____

Date: _____
Time: _____

Inspector: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Embarkment and emergency spillway (Annual, After Major Storms)		
1. Vegetation and ground cover adequate		
2. Embarkment erosion		
3. Animal burrows		
4. Unauthorized planting		
5. Cracking, bulging, or sliding of dam		
a. Upstream face		
b. Downstream face		
c. At or beyond toe		
Downstream		
Upstream		
d. Emergency spillway		
6. Emergency spillway		
7. Seeps/leaks on downstream face		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
8. Slope protection or riprap failure		
9. Vertical/horizontal alignment of top of dam "As-Built"		
10. Emergency spillway clear of obstruction and debris		
11. Other (specify)		
2. Riser and principal spillway (Annual)		
Type: Reinforced concrete _____ Corrugated pipe _____ Masonry _____ 1. Low flow orifice obstructed		
2. Low flow track rack a. Debris removal necessary		
b. Corrosion control		
3. Weir trash rack maintenance a. Debris removal necessary		
b. Corrosion control		
4. Excessive sediment accumulation inside riser		
5. Concrete/masonry condition riser and Barrels a. Cracks or displacement		
b. Minor spalling (<1")		
c. Major spalling (rebars exposed)		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
d. Joint failures		
e. Water tightness		
6. Metal pipe condition		
7. Control valve a. Operational/exercised		
b. Chained and locked		
8. Pond drain valve a. Operational/exercised		
b. Chained and locked		
9. Outfall channels functioning		
10. Other (specify)		
3. Permanent Pool (Wet Ponds) (monthly)		
1. Undesirable vegetative growth		
2. Floating or floatable debris removal required		
3. Visible pollution		
4. Shoreline problem		
5. Other (specify)		
4. Sediment Forebays		
1. Sedimentation noted		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
2. Sediment cleanout when depth < 50% design depth		
5. Dry Pond Areas		
1. Vegetation adequate		
2. Undesirable vegetative growth		
3. Undesirable woody vegetation		
4. Low flow channels clear of obstructions		
5. Standing water or wet spots		
6. Sediment and/or trash accumulation		
7. Other (specify)		
6. Condition of Outfall into Ponds (Annual, After Major Storms)		
1. Reprap failures		
2. Slope erosion		
3. Storm drain pipes		
4. Endwalls/Headwalls		
5. Other (specify)		
7. Other (Monthly)		
1. Encroachment on pond or easement area		
2. Complaints from residents		

Post-Construction BMP Inspection Form
Stormwater Pond

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
3. Aesthetics a. Grass growing required		
b. Graffiti removal needed		
c. Other (specify)		
4. Any public hazards (specify)		
8. Constructed Wetland Area (Annual)		
1. Vegetation healthy and growing		
2. Evidence of invasive species		
3. Excessive sedimentation in Wetland area		

Additional Comments:

Actions to be Taken:

Infiltration Trench Operation, Maintenance, and Management Inspection Checklist

Project: _____
Location: _____
Site Status: _____

Date: _____
Time: _____

Inspector: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Debris Cleanout (Monthly)		
Trench surface clear of debris		
Inflow pipes clear of debris		
Overflow spillway clear of debris		
Inlet area clear of debris		
2. Sediment Traps or Forebays (Annual)		
Obviously trapping sediment		
Greater than 50% of storage volume remaining		
3. Dewatering (Monthly)		
Trench dewaters between storms		
4. Sediment Cleanout of Trench (Annual)		
No evidence of sedimentation in trench		
Sediment accumulation doesn't yet require cleanout		

Post-Construction BMP Inspection Form
Infiltration Trench

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
5. Inlets (Annual)		
Good condition		
No evidence of erosion		
6. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repair		
No evidence of erosion		
7. Aggregate Repairs (Annual)		
Surface of aggregate clean		
Top layer of stone does not need replacement		
Trench does not need rehabilitation		

Additional Comments:

Actions to be Taken:

Infiltration Basin Operation, Maintenance, Management and Inspection Checklist

Project: _____
Location: _____
Site Status: _____

Date: _____
Time: _____

Inspector: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Debris Cleanout (Monthly)		
Basin Bottom Clear of Debris		
Inlet Clear of Debris		
Outlet Clear of Debris		
Emergency Spillway Clear of Debris		
2. Sediment Traps or Forebays (Annual)		
Obviously trapping sediment		
Greater than 50% of storage volume Remaining		
3. Vegetation (Monthly)		
Mowing done when needed		
No evidence of erosion		
Fertilized per specifications		
4. Dewatering (Monthly)		
Basin dewaters between storms		

Post-Construction BMP Inspection Form
Infiltration Basin

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
5. Sediment Cleanout of Basin (Annual)		
No evidence of sedimentation		
Sediment accumulation does not yet require cleanout		
6. Inlets (Annual)		
Good condition, no need for repair		
No evidence of erosion		
7. Outlet/Overflow Spillway (Annual, After Major Storms)		
Good condition, no need for repair		
No evidence of erosion		
8. Structural Repairs (Annual, After Major Storms)		
Embankment in good repair		
Side slopes are stable		
No evidence of erosion		
9. Fences/Access Repairs (Annual)		
Fences in good condition		
No damage which would allow undesirable entry		
Lock and gate function adequate		
Access point in good condition		

Additional Comments:

Actions to be Taken:

Sand/Bio/Organic Filter Operation, Maintenance, and Management Inspection Checklist

Project: _____
Location: _____
Site Status: _____

Date: _____
Time: _____

Inspector: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Debris Cleanout (Monthly)		
Contributing areas clean of debris		
Filtration facility clean of debris		
Inlet and outlets clear of debris		
2. Oil and Grease (Monthly)		
No evidence of filter surface clogging		
Activities in drainage area minimize oil and grease entry		
3. Vegetation (Monthly)		
Contributing drainage area stabilized		
No evidence of erosion		
Area mowed and clippings removed		
4. Water Retention Where Required (Monthly)		
Water holding chambers at normal pool		

Post-Construction BMP Inspection Form
Sand/Bio/Organic Filter

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
No evidence of leakage		
5. Sediment Deposition (Annual)		
Filter chamber free of sediments		
Sedimentation chamber not more than half full of sediments		
6. Structural Components (Annual)		
No evidence of structural deterioration		
Any grates are in good condition		
No evidence of spalling or cracking of structural parts		
7. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repairs		
No evidence of erosion (if draining into a natural channel)		
8. Overall Function of Facility (Annual)		
Evidence of flow bypassing facility		
No noticeable odors outside of facility		

Additional Comments:

Actions to be Taken:

Maintaining Urban Ponds and Other Storm Water Facilities

Introduction

Urban Storm Water Facilities or Best Management Practices (BMPs), structures for managing storm water, have become common during the past twenty years. These facilities will cease to function as designed if not properly maintained. The purpose of this guidance manual is to describe four primary types of BMPs and to outline some basic maintenance tasks that will keep them functioning properly. This manual has been assembled primarily for homeowners associations and residential or commercial property managers.

Over the past twenty years, the impacts of watershed urbanization have become apparent in our streams and rivers. Watershed drainage patterns altered by development that had no control for storm water runoff often resulted in downstream flooding on residential and commercial properties or at road crossings. Uncontrolled storm water volume increases stream bank erosion and produces major detrimental changes in the physical characteristics of receiving streams. Residential, commercial, and industrial land uses result in polluted storm water runoff, known as non-point source pollution, which can reach streams and rivers unless control mechanisms are in place. Pollutants include sediment, nutrients such as phosphorus and nitrogen, oil and grease, lawn and garden chemicals, heavy metals, and anything else that may wash off from streets and developed properties.

For many years, storm water management focused on reducing the risks of downstream flooding. During this time, detention basins were frequently used to control quantity impacts by temporarily storing runoff from large storms and then releasing it slowly so that peak flows were reduced. During the mid 1980's, the commonly-used facility designs were modified to reduce pollutants in basin discharges to help protect downstream aquatic life and drinking water quality. These dual purpose (quantity and quality) basins are generally referred to as urban Best Management Practices or BMPs. Federal, state, and local laws and regulations require storm water management and the control of non-point source pollution.

Home Owner Associations and facility managers can perform simple maintenance and contract with knowledgeable consultants for detailed, complex maintenance and repair. The goals of an effective maintenance program would be to prolong the life of storm water facilities, avert expensive repair costs and prevent adverse downstream impacts. Under City Ordinance No. 50.80, business and homeowners are responsible for routine maintenance and repair of on-site storm water management facilities. It is the goal of this manual to assist responsible parties in complying with the regulations, to help make storm water facilities an asset to the community and to protect local receiving streams and water bodies.

This manual is designed to help responsible parties understand basic maintenance needs and associated costs for the facilities being managed. Just as no two natural ponds or

lakes are the same, no two urban ponds are the same and therefore maintenance needs will differ from BMP to BMP.

Types of BMPs

The following information describes four common types of BMPs and includes Ponds, Infiltration Trenches, Underground Storage Structures, and Oil Grit Separators. In general, infiltration trenches and oil grit separators manage runoff quality while underground storage structures manage runoff quantity. Storm water management ponds may be designed to control runoff quantity only or to control both quantity and quality. Quantity management attempts to prevent downstream flooding and erosion while quality management attempts to control "first flush" effects in which the highest concentration of pollutants are carried during the first stages of runoff from developed sites.

It is not unusual, however, for multiple types of BMPs to be used at one site. For example, a site may include several oil grit separators at the edge of paved areas to treat the quality of runoff from that area prior to its entering a large detention basin which controls quantity impacts due to runoff from the rest of the site. Owners and operators must therefore conduct a holistic maintenance program which addresses every component in the entire system or the facility will lose its intended capability for quality and/or quantity management.

Storm Water Management Ponds

Dry Ponds

Most dry ponds provide quantity control through man-made basins which temporarily hold storm water after a storm. Prior to the mid-1980's, dry ponds represented the most common type of storm water management facility. To meet more recent quality control requirements, dry ponds are built in conjunction with quality control structures such as infiltration trenches. See ***Figure 1***.

Wet Ponds

Wet ponds are man-made retention basins which contain permanent pools of water that function much like natural ponds. The wet pond is designed to hold a certain amount of water permanently. Runoff from storm events is stored above the permanent pool with excess water being discharged at a controlled rate via outlet devices similar to those used in dry ponds. Over time, this permanent pool develops into an aquatic ecosystem. See ***Figure 2***.

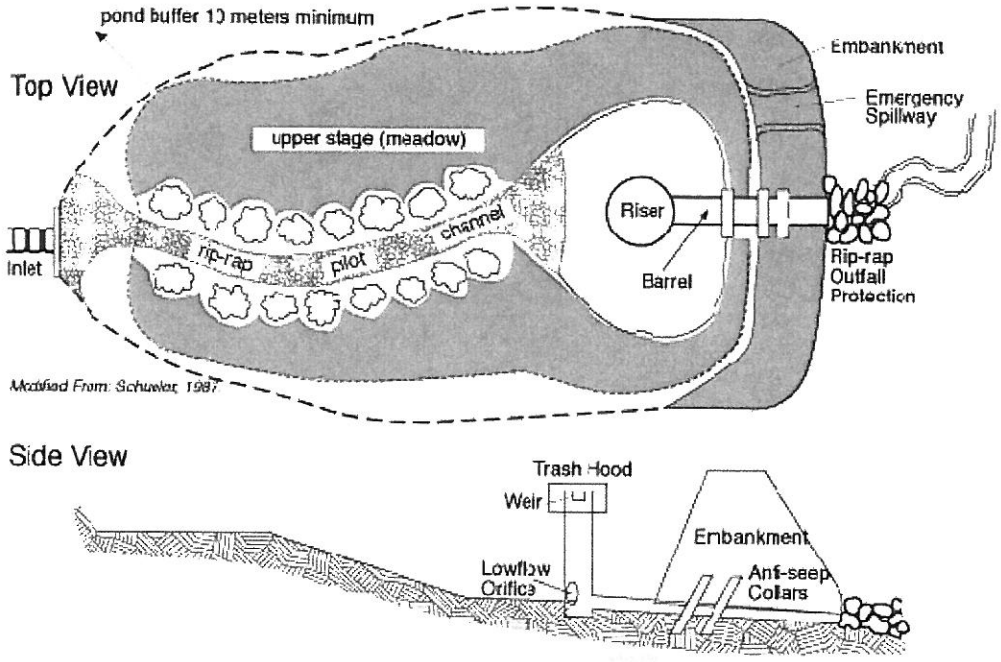

Figure 1. Typical Dry Pond

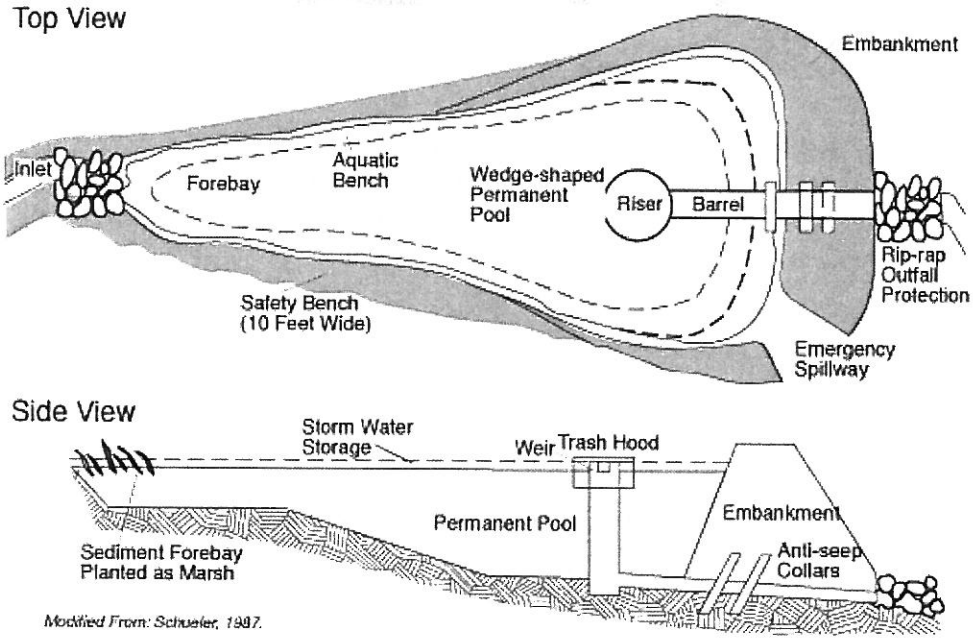

Figure 2. Typical Wet Pond

Infiltration Trenches

Infiltration trenches are gravel-filled excavations that temporarily store storm water and allow it to soak into the soil beneath the trench, filtering out pollutants as the water moves through the soil. Infiltration trenches are generally used for water quality control only. An example is shown in Figure 3.

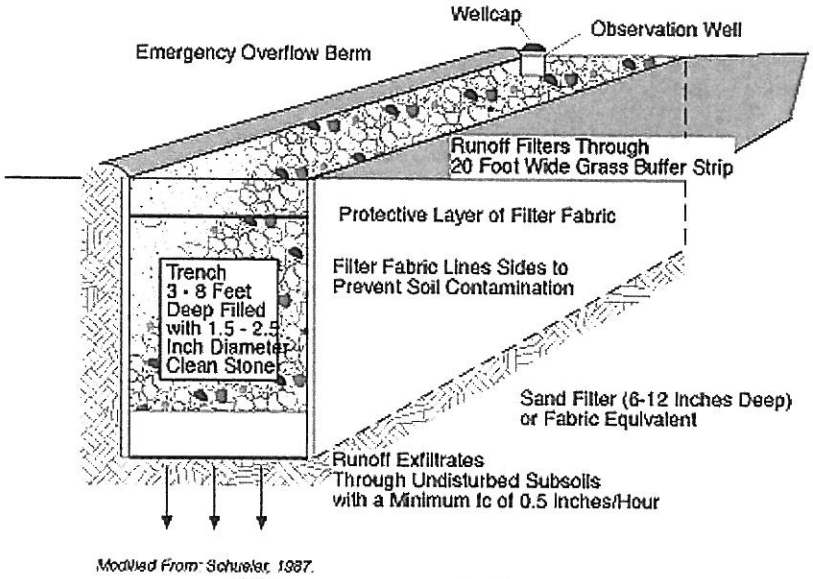

Figure 3. Typical Infiltration Trench.

The two basic types of infiltration trenches are distinguished by how storm water enters the facility. Dispersed input facilities allow storm water to enter the top of the trench as overland runoff. Concentrated input facilities receive storm water from curb inlets, gutters, and pipes. All underground BMPs are complex in structure and function, and a professional should be consulted to determine a particular facility's maintenance needs.

Oil/Grit Separators

Oil/grit separators (also known as water quality inlets) are multiple stage, underground concrete storage structures that are designed to remove hydrocarbons (oil) and particulates (grit) from storm water. Typically associated with parking lots and other paved areas, these structures are common on commercial sites. These structures require routine removal of the materials accumulated in the storage chambers or their pollutant removal ability will be severely compromised.

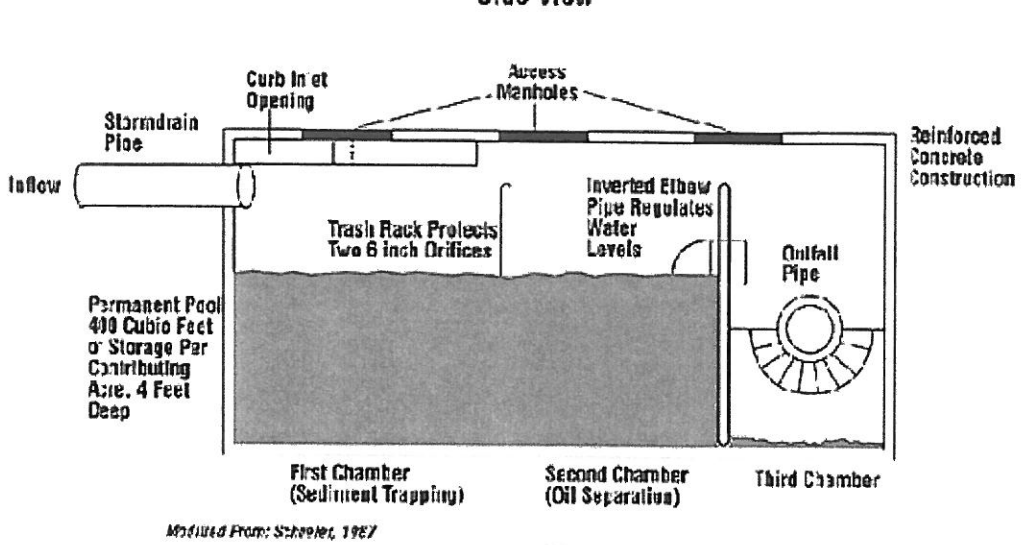

Figure 4. Typical Oil/Grit Separator at a Commercial Site

Underground Storage Structures

Underground storage structures manage runoff quality similar to ponds. Their advantage is that they do not take up valuable property and are located below parking garages in large buildings. Specialized certification and training are required for inspecting and maintaining these structures. An example is shown in ***Figure 5***.

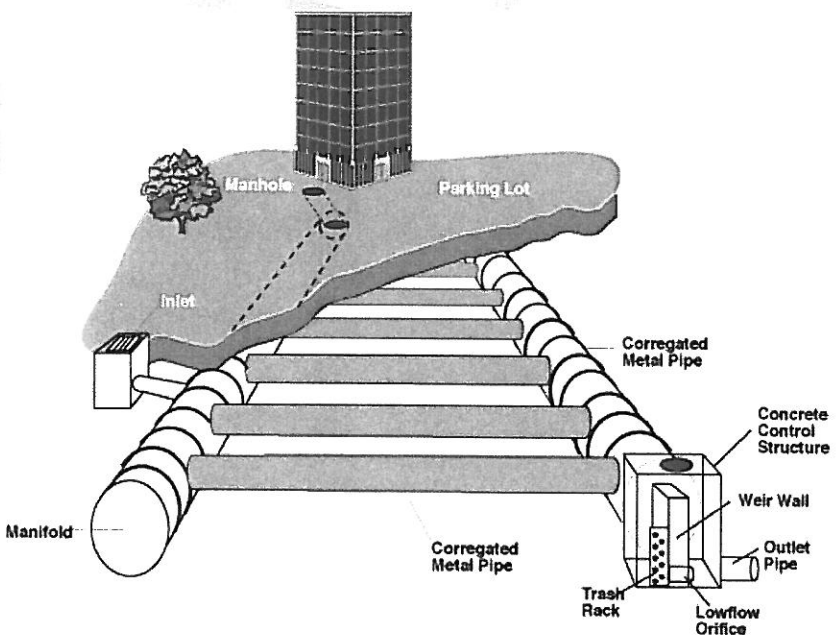

Figure 5. Typical Underground Storage Structure

Elements of a Maintenance Program

Overview

BMPs cannot perform their two functions, storm water storage and storm water quality improvement, unless they are maintained over time. If a facility loses its storage capacity, downstream flooding may occur. There may be no visible indicator, however, if a facility is not removing pollutants like nutrients and heavy metals as originally designed. A consistent maintenance program is the best way to ensure that a BMP will continue to perform its water quality improvement functions.

This section outlines the maintenance needs for the most common BMPs. It is important to note that while general maintenance tasks can be outlined, actual maintenance needs will vary according to specific site conditions.

Table 1
Components of a Maintenance Program

Routine Visual	Non-Routine	
Visual Inspection	Bank Stabilization	This table shows the tasks that need to be considered as part of a general maintenance program. Other factors which need to be considered include: *Visibility of the Facility.* Community needs and preferences determine to a large extent the type and amount of necessary maintenance for aesthetic purposes. *Landscaping.* Maintenance needs vary greatly depending upon the type of vegetation.
Vegetation Management	Sediment Removal	
Debris/Litter Control	Outlet Structure Maintenance/ Replacement	
Cleaning of Oil/Grit Separators	-	

Watershed conditions above the facility will largely determine type and amount of sediment and other pollutants that are entering that facility. For example, erosion problems upstream can dramatically increase the amount of sediment entering a basin. A BMP maintenance program should also consider the following:

Safety. Some tasks can be carried out by non-technical staff or residents quite effectively; however, all programs should carefully ensure the safety of anyone carrying out maintenance tasks, and often a professional should be hired to conduct the work.

Confined spaces should never be entered without proper training and permits from occupational and safety regulatory agencies.

Need for professional judgement. Professional judgement should be solicited regularly to ensure that all needs of the facility are met. Even though some maintenance tasks can be routinely performed by non-professionals, there are many problems that are not obvious to the untrained eye.

Financing. A fund should be established to provide for the costs of long-term maintenance needs, such as sediment removal, which can be considerable.

Routine Maintenance Needs

Inspections

The City's new storm water management policy requires that routine maintenance inspections occur at all privately-owned storm water management facilities. The City has developed "checklists" for use during routine inspections at facilities. A minimum checklist for ponds is provided below.

- Obstructions of the inlet or outlet devices by trash and debris
- Excessive erosion or sedimentation in the basin
- Cracking or settling of the dam
- Low spots in the bottom of a dry pond
- Deterioration of pipes
- Condition of the emergency spillway
- Stability of the side-slopes
- Upstream and downstream channel conditions
- Signs of vandalism

Infiltration Trenches

Infiltration facilities have been shown to become dysfunctional due to clogging by sediments more frequently than either detention or retention basins. Therefore, it is recommended to inspect these facilities two times a year. The purpose of regular inspection is to determine if the sediment removal structures require routine maintenance. Most infiltration trenches have a grassed and/or gravel filter to remove some sediment before the storm water enters the trench. Keeping this sediment filter clean is vital to ensuring the long-term performance of the infiltration trench. Although these operations must be undertaken more often than with surface facilities, the costs are significantly less.

The performance of an infiltration trench should be monitored as part of the routine inspection. The observation well installed in most trenches can be used to determine how long it takes the water to infiltrate into the soil after a storm event. This determination can be made in two ways. Several water level readings can be made over a period of days after a large storm. The rate the water level falls can be directly determined by two or more readings. The alternative method is a "one stop" method where a single water level reading is taken and compared to the local rainfall record. Although less accurate than the multiple reading method, the "one stop" method does provide enough information to approximate the emptying time and will identify trenches which are severely clogged.

Debris and Litter Removal

The regular removal of debris and litter provides a variety of benefits as listed below. Special attention should be given to the removal of floating debris which can clog the outlet device or riser.

- Reduce the chance of clogging in outlet structures, trash rocks, and other facility components
- Prevent possible damage to vegetated areas
- Reduce potential mosquito breeding habitats
- Maintain facility appearance
- Reduce conditions for excessive surface algae

Mechanical Components

Each type of BMP may have mechanical components that need periodic attention to ensure their continued performance. Valves, sluice gates, fence gates, locks and access hatches should be functional at all times. The specific BMP design used will determine how maintenance intensive the facility will be.

Vegetation Management

Vegetative cover filters sediment from runoff as it flows into the BMP and prevents erosion of the banks and in the bottom of the facility. Grass is generally used in and around detention basins and around retention basins and infiltration trenches. There should be at least a 10 foot buffer strip around ponds and streams which is mowed no more than four times a year.

Mowing requirements can be tailored to the specific needs of a site and the neighboring residents or office building tenants. The grass in a BMP may be hardiest if maintained as an upland meadow, cutting no shorter than 6 to 8 inches. If a more manicured lawn setting is desired, more mowing and special attention to turf health will be needed. Some communities consider the tall wetlands-type vegetation (typically, cattails or rushes) that

may spring up in dry ponds as unaesthetic. Some of this vegetation is actually beneficial as it provides water quality benefits and wildlife habitat.

Surrounding vegetation should not be overfertilized or excess nutrients will be washed off into the storm water management facility and contribute to algae growth problems. Nutrient needs of surrounding vegetation should be evaluated by testing the pH and nutrient content of the soil prior to fertilization. Fertilization of all turf areas should be done in the fall of the year. Local soil conservation service or extension service offices can provide testing as well as interpretation of the results.

Vegetation planted around infiltration trenches, known as a buffer strip, often serves the specific purpose of removing some sediment before the storm water enters the facility. The health of buffer strips should be closely monitored and the turf replaced if necessary. If the buffer strip becomes laden with sediment and is damaged, bare spots will emerge and contribute excessive sediment loads into the trench.

Insect Control

Mosquitoes are not as big a problem as is often perceived and there are proven control strategies that can be used. While ponded water can create mosquito and other insect breeding habitat, it also provides habitat for insect predators to keep the nuisance populations in check.

The best mosquito control technique in retention basins is to prevent stagnant areas from forming in the permanent pool. Prompt removal of floating debris helps to eliminate still or standing surface waters that provide breeding habitat. In larger basins, it may also be possible to maintain stocks of fish which feed on mosquito larvae.

Pond Habitat Maintenance

An important, yet often overlooked aspect of non-routine retention basin maintenance is the need to ensure a healthy aquatic environment. Suitable habitat and a healthy aquatic ecosystem can be ensured with a regular monitoring program and should require little maintenance. For example, a common problem in wet ponds is excessive algae growth (blooms) resulting from excess nutrients in storm water runoff entering the facility. In many cases, excess nutrients will be taken up by more desirable aquatic and semi-aquatic vegetation encouraged to grow in and around the permanent pool of a retention facility. The presence of submerged and emergent plants will help reduce the amount of algal growth and will provide desirable pond habitat for aquatic and terrestrial creatures. Pond management experts can provide algae management plans that might include aeration fountains, and, in extreme cases, herbicides.

Bank Stabilization

It is very important to ensure the integrity of the banks, slopes, and bottom of a dry pond and the visible banks of a wet pond. A healthy ground cover must be routinely maintained on the embankments and bottoms of basins. Bare areas should be re-seeded and stabilized as quickly as possible to avoid soil erosion and clogging of the facility. The roots of woody growth, such as young trees and bushes, tend to be destabilizing on embankments. Impoundments over a certain size must comply with state and local dam safety standards. Consistent mowing will control any stray seedlings that take root on an embankment. Woody growth away from the embankment does not generally pose a threat to the stability of the embankment and can play an important role in maintaining a healthy pond ecosystem. Trees and bushes should, however, be planted outside maintenance and access areas.

Beavers have been known to take up residence in facilities with ponded water. These animals can cut down small trees in the BMP area and may cause an increase in the amount of ponding. Should excessive tree damage or ponding be observed, it is suggested that the Ohio Department of Natural Resources be contacted.

Other animals, such as muskrats and groundhogs, may dig out burrows that could deteriorate the structural integrity of an embankment. Muskrats in particular will burrow tunnels up to 6 inches in diameter. Existing burrows should be filled as soon as possible to minimize animal burrowing.

Sediment Removal

Dry and Wet Ponds. Since one of the purposes of BMPs is to remove sediment from stormwater, sediment will accumulate in a BMP and eventually need to be removed. Facilities vary so dramatically that there are no "rules of thumb" to guide responsible parties on the frequency for sediment removal from a surface basin. Upstream conditions, including land use, type of land cover (vegetated vs. paved), and soil types are important factors in determining how rapidly sediment accumulates in a basin. For planning purposes, sediment removal should be considered on the intervals shown below.

POND TYPE	INTERVAL
Dry	2 to 10 years
Wet	5 to 20 years

Sediment removal is usually the largest single cost of maintaining a BMP facility. Responsible parties should therefore plan ahead and set aside the necessary funds in advance. The sediment removed from a basin will need to be disposed. The best solution is to have an on-site area or a site adjacent to the facility, but outside of the floodplain, set

aside for the sediment. If such a disposal area is not set aside, transportation and landfill tipping fees can greatly increase the cost. Once the sediment is removed, the bottom of the basin and any disturbed areas need to be immediately stabilized and re-vegetated 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 facility can be drained and allowed to dry so that heavy equipment can remove sediment from the bottom. In other cases, where this is not practical, it may be necessary to remove sediment from 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.

Infiltration Trenches. If an overflow condition is observed at an infiltration trench, its observation well should be checked to determine the cause. This is especially critical for concentrated input facilities which use sediment traps, because if the sediment trap is full, sediment laden water will be conveyed into the trench. With dispersed input (surface-fed) facilities, a clogged sediment barrier is indicated when water cannot flow into the trench and goes through the overflow channel prematurely. If an infiltration trench is found to stay filled with water after a rain and cause regular overflow, the aggregate stone must be excavated and the facility rebuilt.

The specific sediment removal procedure will depend on the manner in which storm water enters the facility. Concentrated input facilities will have an in-line filter system or sediment trap. Clean-out procedures are described in the maintenance checklists for those specific facilities. If there is any question on how routine sediment removal is to be performed for a given facility, contact the County for instructions.

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 covering the aggregate reservoir beneath. A layer of clean filter gravel replaces the gravel removed. Any bare spots or damaged areas in the grass filter strip should be sodded upon completion of the sediment removal procedure.

Who Should Carry Out the Maintenance

In designing a maintenance program, safety, cost and effectiveness of the maintenance activities need to be balanced. Some activities can be cost effectively undertaken by facility owners, if desired. Manageable landscaping tasks, litter removal, and even some mowing, are tasks appropriate for owners to handle themselves.

However, it is usually worth the cost to have a professional do the more difficult work. Mowing and handling a wheelbarrow can be dangerous on the sloping embankments of a detention basin. Filling eroded areas and soil disturbing activities, such as resodding or

replanting vegetation, are also items that a professional landscaping firm might best manage. If not performed properly the first time, not only will the effort have been wasted, but damage may be done to the facility by creating excessive erosion. Grading and sediment removal are best left to professional contractors.

In addition, trained personnel will be able to identify potential problems early on when it is most cost-effective to make repairs or alterations. The maintenance needs of BMPs are somewhat site specific and the total costs for conducting needed maintenance will vary greatly. However, it is possible to estimate cost for some general BMP maintenance tasks. The costs for routine and non-routine tasks should be evaluated separately since they vary dramatically.

Maintenance Costs (in 2005 dollars)

Routine costs for maintaining a BMP are highly site-specific and dependent on factors like type of development and landscaping on the site. Routine maintenance includes inspections, debris and litter control, mechanical components maintenance, vegetation management, and other routine tasks as determined for the specific facility.

Grounds keeping maintenance costs can range between $100 per acre per year for mowing and fertilizing only, to over $600 per acre per year for mowing, fertilizing, litter control, resodding and insect control.

Costs for dredging and sediment removal of BMPs are highly site specific and vary greatly depending upon the size and depth of the facility, the volume of sediment trapped in the BMP, ease of access to the BMP, and whether or not on-site disposal of the dredged sediments is possible. In general, both wet and dry pond maintenance costs are similar. Total non-routine costs can range from as little as $7,000 for a small pond of 0.25 acres to over $400,000 for a larger facility of 10 acres.

Planning Ahead

The costs of maintaining a BMP over the long run can therefore be considerable, particularly when dredging or other non-routine maintenance is needed. To lessen the immediate financial impact of non-routine costs, responsible parties should consider creating a fund for this eventuality. For dry ponds, which need to have sediment removed every 2 to 10 years, 10% to 50% of the anticipated dredging costs should be collected per year. For wet ponds, which need to be dredged every 5 to 20 years, approximately 5% to 20% of the anticipated costs should be accrued per year. The rate of assessment can include anticipated interest over the collection interval.

BMP	INTERVAL
Ponds	Annually
Oil/Grit Seperator	6 Months
Infiltration trenches	Annually
Underground Storage Structures	Annually

Community Involvement

Stormwater facilities, particularly pond BMPs, can provide unique opportunities for fostering stewardship and involvement in community based activities. There are many ongoing school and community-based outreach programs that homeowners' associations can take advantage of which will enhance the BMPs in their communities and make for cleaner local streams.

Residents can adversely affect the functioning of BMPs by:

- allowing trash to accumulate in and around BMPs
- dumping grass clippings or leaves on or into BMPs
- using excess or in appropriately applied fertilizers that can then run off into the BMP
- disturbing vegetated areas and leaving bare areas which produce sediment laden runoff to the BMP
- introducing swimming pool discharges or allowing toxic substances (oil or antifreeze, e.g.,) to run off into the BMPs or into storm drains that lead to BMPs

In most residential areas, the most common type of storm water control is some form of pond. ***Table 3*** includes activities that can be organized and performed by homeowners, schools or other volunteer groups to help maintain and improve the pond environment. Some of these activities may need to involve environmental or engineering professionals. Many private companies focus on proper plantings around ponds and can be found in the phone book under landscaping or gardening.

Table 3
Community Activities to Maintain and Improve BMPs

PROBLEM	EVIDENCE	SOLUTION
Trash accumulation in and around the BMP	Trash and debris settled in basin bottom or floating in wet pond or collected on trash rack	Organize neighborhood trash pickup; contact local school or scout troop and offer prizes for largest item found or most trash collected
Using excess or incorrectly applied fertilizers	Excessive algal growth and fish kills	Find or create a fact sheet on proper fertilizer use and distribute it in your neighborhood; encourage your neighbors to closely follow manufacturer's instructions on concentration and application rates for fertilizers and follow recommended application periods (contact the County Cooperative Extension Office)
Oil or other toxic substances	Oily sheen on basin bottom or on surface of pool area; presence of dead fish or other aquatic organisms	Find or create a fact sheet on proper disposal of hazardous household waste; encourage your neighbors to follow manufacturer's directions for concentrations and application of pesticides
Bare, exposed areas in or around pond or in areas draining to facility	Water in pond is cloudy	Spread hay on temporarily disturbed areas; reseed and stabilize disturbed areas as soon as possible; organize planting of grass or shrubs in disturbed areas; plant water loving shrubs if disturbed areas are adjacent to pond

Table 3
Community Activities to Maintain and Improve BMPs

PROBLEM	EVIDENCE	SOLUTION
Animal activity	Burrows (holes) in pond sides or embankment; small trees cut down around pond or in nearby yards; increase in wet pond area	Coordinate with the County's Cooperative Extension Office

References

Northern Virginia Planning District Commision. *Maintaining BMPs: A Guide Book for Private Owners and Operators in Northern Virginia*

Schueler, T. R. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*