

BIOINFILTRATION/BIORETENTION MAINTENANCE GUIDANCE

Bioinfiltration/bioretention maintenance activities focus largely on maintaining infiltration capacity and the health of vegetation. During periods of extended drought, bioinfiltration/bioretention SMPs may require watering approximately every ten days.

General recommended maintenance activities for bioinfiltration/bioretention SMPs are summarized in Table 4.1-5.

The designer is referred to Section 4.10, Pretreatment, Section 4.11, Inlet Controls, and Section 4.12, Outlet Controls, for information on maintenance guidance for pretreatment, inlet controls, and outlet controls.

**TABLE 4.1-5:
Bioinfiltration/Bioretention Maintenance Guidelines**

	ACTIVITY	FREQUENCY
EARLY	Water vegetation at the end of each day for two weeks after planting is completed.	<i>Daily for two weeks after installation</i>
	Water vegetation regularly to ensure successful establishment.	<i>Every four days during periods of four or more days without rain, June through August for the first year after installation</i>
	Inspect vegetation for signs of disease or distress.	<i>Biweekly for the first year after installation</i>
	Inspect inlet controls, outlet structures, and storage areas for trash and sediment accumulation.	<i>Monthly for the first year after installation to determine ongoing maintenance frequency</i>
ONGOING	Remulch void areas.	<i>As Needed</i>
	Treat diseased trees and shrubs.	
	Keep overflow free and clear of leaves.	
	Inspect soil and repair eroded areas.	<i>Monthly</i>
	Remove litter and debris.	
	Clear leaves and debris from overflow.	
	Inspect trees and shrubs to evaluate health, replacing if necessary.	
	Inspect underdrain cleanouts.	<i>Quarterly</i>
	Add additional mulch.	
	Inspect for sediment build-up, erosion, and vegetative conditions	<i>Ongoing</i>
Evaluate the drain down time of the SMP after a storm of at least one inch in no more than 24-hours to ensure an SMP drain down time of less than 72 hours.		
Maintain records of all inspections and maintenance activity.		

BLUE ROOF MAINTENANCE GUIDANCE

Maintenance of blue roof systems focuses on the periodic removal of sediment and debris from outlet and storage areas in order to prevent clogging and limit deterioration of the roof membrane. Maintenance activities can generally be performed by individual building owners or site maintenance staff as needed. The contractor responsible for the installation of the rooftop system should be contacted immediately if it is not performing as designed.

Maintenance of roof assembly and waterproofing membrane will be dependent on the assembly type, age, and quality of roof components. As with any roof system, periodic inspections should be performed to assure that repair or replacement is not necessary.

Blue roof components are relatively easy to maintain due to their simplicity and ease of access. In the both roof check dam and roof drain restrictor systems, maintenance activities are readily conducted at the roof surface. All restrictors and ponded areas must be accessible for periodic inspection and cleaning.

Problems with a blue roof system generally fall into two categories: (1) the system drains too slowly, resulting in buildup of excess water on the roof for extended periods of time, bypasses of the controlled flow roof drains, or bypasses/ overflows during small rainfall events; or (2) the system drains too quickly, due to leaking or other

issues, exceeding the design drain down rate. If problems persist, a licensed professional should be consulted.

General recommended maintenance activities for blue roof systems are summarized in Table 4.6-1.

**TABLE 4.6-1:
Blue Roof Maintenance Guidelines**

	ACTIVITY	FREQUENCY
EARLY	Inspect outlet structures, and storage areas for trash and sediment accumulation.	<i>Monthly for the first year after installation to determine ongoing maintenance frequency</i>
	Remove debris from drainage outlets and outlet screens to prevent clogging.	<i>During inspections or as needed to ensure performance</i>
Remove debris from secondary drainage/ overflows.		
Remove excessive buildup of sediment around the outlet controls or within the storage cells.		
ONGOING	Inspect for leaks.	<i>As needed during winter months</i>
	Break up ice formation around outlets and overflows.	
	Maintain records of all inspections and maintenance activity.	<i>Ongoing</i>

The designer is referred to Section 4.12, Outlet Controls, for information on maintenance guidance for outlet controls.

CISTERN MAINTENANCE GUIDANCE

Maintenance of cisterns focuses on the periodic removal of sediment and debris from pretreatment and storage areas. Sediment removal from tanks and pipes is typically conducted using vacuum or flushing systems. Guidance on the use and operation of vacuum or flushing sediment removal equipment is beyond the scope of this Manual; a maintenance professional should be contacted for additional details. As applicable, cistern maintenance procedures must meet Occupational Safety and Health Administration confined space entry requirements.

General recommended maintenance activities for cisterns are summarized in Table 4.5-2.

Periodic inspections and maintenance of cisterns must be conducted by a qualified professional. Maintenance requirements for cisterns that are part of rainwater harvesting systems vary according to reuse. Detailed maintenance guidance for rainwater harvesting systems is beyond the scope of this Manual.

The designer is referred to Section 4.10, Pretreatment, Section 4.11, Inlet Controls, and Section 4.12, Outlet Controls, for information on maintenance guidance for pretreatment, inlet controls, and outlet controls.

**TABLE 4.5-2:
Cistern Maintenance Guidelines**

	ACTIVITY	FREQUENCY
EARLY	Inspect inlet structures, outlet structures, and storage areas for trash and sediment accumulation.	<i>Monthly for the first year after installation to determine ongoing maintenance frequency</i>
	Regularly clean out gutters, gutter screening, first-flush chamber, and catch basins to reduce sediment load to the cistern. Clean intermediate sump boxes, replace filters, and otherwise clean pretreatment areas in directly connected systems. Remove sediment and debris from cisterns according to the manufacturer's recommendations or the site-specific maintenance plan. Test sediment for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if indications of pollution are present.	<i>As needed</i>
ONGOING	Brush the inside surfaces and thoroughly disinfect. Prior to freezing weather, to avoid structural damage perform winterization of cisterns as per manufacturer's requirements or design professional's specifications.	<i>Annually</i>
	Inspect cistern and control structures. Remove floating debris and accumulated petroleum products.	<i>Quarterly</i>
	Maintain records of inspections and maintenance activity.	<i>Ongoing</i>

GREEN ROOF MAINTENANCE GUIDANCE

Green roof maintenance activities largely focus on maintaining drainage capacity and the health of vegetation. All facility components, including plant material, growing medium, filter fabric, drainage layer, and waterproof membrane must be inspected regularly for proper operations, integrity of the waterproofing, and structural stability throughout the life of the green roof. General recommended maintenance activities for green roofs are summarized in Table 4.3-1.

During the plant establishment period, maintenance staff must conduct three to four visits per year to conduct basic weeding, fertilization, and in-fill planting. Thereafter, only two annual visits for inspection and light weeding is required (irrigated assemblies will require more intensive maintenance).

Use of herbicides must be avoided to prevent root penetration of waterproofing.

Fertilization must be applied according to soil test to maintain soluble nitrogen (nitrate and ammonium ion) levels between one and four ppm. The best source of nutrients for fertilization is mature compost.

Spill prevention measures from mechanical systems located on roofs must be exercised when handling substances that can contaminate stormwater.

The designer is referred to Section 4.12, Outlet Controls, for information on maintenance guidance for outlet controls.

**TABLE 4.3-1:
Green Roof Maintenance Schedule**

	ACTIVITY	FREQUENCY
EARLY	Water vegetation at the end of each day for two weeks after planting is completed.	<i>Daily for two weeks after installation</i>
	Water vegetation regularly to ensure successful establishment.	<i>Every four days during periods of four or more days without rain, June through August for the first year after installation</i>
	Hand-weed non-target/invasive plants.	<i>Four times per year for the first 24 months after planting</i>
	Inspect vegetation for signs of disease or distress.	<i>Biweekly for the first year after installation</i>
ONGOING	Roof drains must be cleared when soil substrate, vegetation, debris or other materials clog the drain inlet. Under normal operating conditions, all roof discharge must be filtered and medium must not be vulnerable to migration toward the drains. Sources of sediment and debris must be identified and corrected.	<i>As needed</i>
	Plant material must be maintained to provide a minimum of 90% foliage cover during warm months. If coverage rate is declining, determine the reason (e.g., soil nutrition or soil moisture conditions) and implement remedial measures.	
	Preferentially, weeding must be done manually, with herbicide use limited to extreme instances of weed infestations that compromise the plant cover integrity. Weeds must be removed entirely.	
	Inspect root development. If root zone is not well developed, determine the reason (e.g., soil nutrition or soil moisture conditions) and implement remedial measures.	
	Projects with permanent irrigation must be inspected and irrigation dosing rates adjusted to optimize plant performance and water use efficiency.	<i>Quarterly</i>
	Growing medium must be inspected for evidence of erosion from wind or water. If erosion channels are evident, a problem with the drainage system or with the green roof medium is indicated. Surface ponding or runoff must not occur except during very large rainfall events. After correcting the problem, refresh the affected areas with additional growth medium and provide temporary soil stabilization.	
	Manually cut detrital herbaceous vegetation from the previous growing season to four to six inches above the ground.	
	Inspect drain inlet pipe and containment system.	
	Test growing medium for soluble nitrogen content. Fertilize as needed.	<i>Annually</i>

This is an excerpt from SMGM v 3.2.

More information on green roofs can be found in Section 4.3.

MEDIA FILTER MAINTENANCE GUIDANCE

All areas of the filter should be inspected regularly and after significant storm events for ponding, sediment and/or debris accumulation, and damage. Corrective measures should be taken when ponding, sediment and/or debris accumulation, and/or damage occurs.

In areas where the potential exists for the discharge and accumulation of toxic pollutants (such as metals), filter media removed from filters must be handled and disposed of in accordance with all City, State, and Federal regulations.

General recommended maintenance activities and frequencies for media filters are summarized in Table 4.9-1.

If the SMP design proposes modifications to the approved saturated hydraulic conductivity of media filters, appropriate modifications should be made to the maintenance schedule (Table 4.9-1) for the proposed management practice. For example, utilizing an increased filtration rate for sand is appropriate if the maintenance schedule includes increased frequency of sediment removal and replacement of filter media.

The designer is referred to Section 4.10, Pretreatment, Section 4.11, Inlet Controls, and Section 4.12, Outlet Controls, for information on maintenance guidance for pretreatment, inlet controls, and outlet controls.

**TABLE 4.9-1:
Media Filter Maintenance Guidelines**

ACTIVITY	FREQUENCY
Rake filter media surface for the removal of trash and debris from control openings.	<i>As needed</i>
Repair leaks from the sedimentation chamber or deterioration of structural components.	
Inspect filter for standing water (filter drainage is not optimal) and discoloration (organics or debris have clogged filter surface).	<i>Quarterly</i>
Remove the top few inches of filter media and cultivate the surface when filter bed is clogged.	<i>Annually</i>
Clean out accumulated sediment from filter bed chamber.	
Clean out accumulated sediment from sedimentation chamber.	
Maintain records of all inspections and maintenance activity.	<i>Ongoing</i>

POND AND WET BASIN MAINTENANCE GUIDANCE

Maintenance of ponds and wet basins focuses on the periodic removal of sediment and debris from pretreatment and storage areas and prevention of outlet control clogging.

General recommended maintenance activities for ponds and wet basins are summarized in Table 4.7-1.

The designer is referred to Section 4.10, Pretreatment, Section 4.11, Inlet Controls, and Section 4.12, Outlet Controls, for information on maintenance guidance for pretreatment, inlet control, and outlet control systems.

TABLE 4.7-1:
Pond and Wet Basin Maintenance Guidelines

	ACTIVITY	FREQUENCY
EARLY	Water vegetation at the beginning of each day for eight weeks after planting is completed.	<i>Daily for eight weeks after installation</i>
	Water vegetation regularly to ensure successful establishment.	<i>Every four days during periods of four or more days without rain, June through August for the 24 months after installation</i>
	Inspect vegetation for signs of disease or distress.	<i>Biweekly for the first year after installation</i>
	Inspect inlet controls, outlet structures, and storage areas for trash and sediment accumulation.	<i>Monthly for the first year after installation to determine ongoing maintenance frequency</i>
ONGOING	Remove trash and debris from forebay, pond, and outlet structure. Remove non-target/invasive vegetation. Grassed areas require periodic prudent fertilizing, dethatching and soil conditioning. Trees, shrubs, and other vegetative cover will require periodic maintenance such as fertilizing, pruning and pest control.	<i>As needed</i>
	Mow/trim detention basin vegetation, excluding aquatic bench and buffer.	
	Treat basin for mosquito larvae if stagnant water remains for longer than 72 hours.	
	Dredge large volumes of sediment and organic debris from basin and forebay areas. Accumulated sediment must never occupy greater than 50% of the forebay volume.	<i>As Needed At least once every five to ten years*</i>
	Inspect outlet control structure for clogging.	<i>Quarterly and after every storm greater than one inch</i>
	Inspect SMP for potential problems, including: subsidence, erosion, cracking, or tree growth on the embankment; damage to the emergency spillway; sediment accumulation around the outlet; inadequacy of the inlet/outlet channel erosion control measures; changes in the condition of the pilot channel; and erosion within the SMP and its banks.	<i>Annually</i>
	Maintain records of all inspections and maintenance activity.	<i>Ongoing</i>

**The frequency of sediment removal depends on site conditions such as soil type and maintenance of site stabilization which influence the sediment load on the SMP.*

POROUS PAVEMENT MAINTENANCE GUIDANCE

Maintenance of porous pavement systems focuses on the periodic removal of sediment and debris from the porous surfaces. General recommended maintenance activities for porous pavement are summarized in Table 4.2-4.

Sediment Control

Superficial soil does not necessarily clog the voids in porous surfaces. However, soil that is ground in repeatedly by tires can lead to clogging. Therefore, trucks or other heavy vehicles should be prevented from tracking or spilling soil onto the pavement. Furthermore, all construction or hazardous materials carriers should be prohibited from entering a porous pavement lot. Areas with heavy vehicular traffic will require more frequent vacuuming.

Winter Maintenance

Winter maintenance for a porous pavement may be necessary, but is usually less intensive than that required for a standard asphalt lot. By its very nature, a porous pavement system with subsurface aggregate bed may have better snow and ice melting characteristics than standard pavement. Once snow and ice melt, they flow through the porous pavement rather than refreezing. Therefore, ice and light snow accumulation are generally not as problematic. However, snow will accumulate during heavier storms. Abrasives such as sand or cinders must not be applied on or adjacent to the porous pavement. Snow plowing is acceptable, provided it is done carefully (i.e., by setting the blade about 0.5 inches higher than usual and using a rubberized blade or blade tip). Salt is acceptable for use as a deicer on the porous pavement, though non-toxic, organic deicers, applied either as blended, magnesium chloride-based liquid products or as pretreated salt, are preferable. Any deicing materials should be used in moderation.

Repairs

Potholes are not common; though settling might occur if a soft spot in the subgrade is not removed during construction. Damaged areas that are smaller than 50 square feet and comprising less than 10% of the total porous area can be patched with a porous or standard

**TABLE 4.2-4:
Porous Pavement Maintenance Guidelines**

	ACTIVITY	FREQUENCY
EARLY	Inspect erosion control and flow spreading devices until soil settlement and vegetative establishment of contributing areas has occurred.	<i>Biweekly</i>
	Mow grass in permeable paver or grid systems that have been planted with grass.	<i>As Needed</i>
	Vacuum porous asphalt or concrete surfaces with regenerative air sweeper or commercial vacuum sweeper (traditional street sweepers are not appropriate). Clean out inlet structures within or draining to the structural SMP beneath the porous pavement surface. Inspect underdrain cleanouts, if any.	<i>Semiannually</i>
	Maintain records of all inspections and maintenance activity.	<i>Ongoing</i>

asphalt mix, depending on the location within the porous area. In many cases the loss of porous surface will be insignificant. If an area greater than 50 square feet or 10% of the total is in need of repair, approval of patch type must be sought from either the engineer or owner. Porous pavement must never be seal coated under any circumstances. Any required repair of drainage structures should be done promptly to ensure continued proper functioning of the system.

Outlet Controls

The designer is referred to Section 4.12, Outlet Controls, for information on maintenance guidance for outlet controls.

SUBSURFACE DETENTION MAINTENANCE GUIDANCE

Maintenance of subsurface detention SMPs requires the periodic removal of sediment and debris from pretreatment and storage areas and the prevention of outlet control clogging. Sediment removal from vaults, chambers, and pipes is typically conducted using vacuum or flushing systems. Guidance on the use and operation of vacuum or flushing sediment removal equipment is beyond the scope of this Manual; a maintenance professional should be contacted for additional details. As applicable, subsurface detention SMP maintenance procedures must meet OSHA confined space entry requirements.

General recommended maintenance activities for subsurface detention systems are summarized in Table 4.8-1.

The designer is referred to Section 4.10, Pretreatment, Section 4.11, Inlet Controls, and Section 4.12, Outlet Controls, for information on maintenance guidance for pretreatment, inlet controls, and outlet controls.

**TABLE 4.8-1:
Subsurface Detention Maintenance Guidelines**

	ACTIVITY	FREQUENCY
EARLY	Inspect erosion control and flow spreading devices until soil settlement and vegetative establishment of contributing areas has occurred.	Biweekly
	Inspect inlet controls, outlet structures, and storage areas for trash and sediment accumulation.	Monthly for the first year after installation to determine ongoing maintenance frequency
ONGOING	Regularly clean out gutters and catch basins to reduce sediment load to detention system. Clean intermediate sump boxes, replace filters, and otherwise clean pretreatment areas in directly connected systems. Remove sediment and debris from subsurface detention SMP sedimentation chamber, as applicable, when the sediment zone is 3/4 full.	As Needed
	Remove sediment and debris from pipe/vault systems. Sediment depth is not to reach a maximum depth of four inches below the SMP's outlet invert elevation. Removal of sediment from grid systems must be per manufacturer's recommendations or as per the site-specific maintenance schedule.	
	Inspect subsurface detention facility and control structures. Remove floating debris and accumulated petroleum products.	Quarterly
	Maintain records of all inspections and maintenance activity.	Ongoing

SUBSURFACE INFILTRATION MAINTENANCE GUIDANCE

Maintenance of subsurface infiltration SMPs focuses on the periodic removal of sediment and debris from pretreatment and storage areas. Sediment removal from vaults, chambers, and pipes is typically conducted using vacuum or flushing systems. Guidance on the use and operation of vacuum or flushing sediment removal equipment is beyond the scope of this Manual; a maintenance professional should be contacted for additional details. As applicable, subsurface SMP maintenance procedures must meet OSHA confined space entry requirements. General recommended maintenance activities for subsurface infiltration SMPs are summarized in Table 4.4-1.

The designer is referred to Section 4.10, Pretreatment, Section 4.11, Inlet Controls, and Section 4.12, Outlet Controls, for information on maintenance guidance for pretreatment, inlet controls, and outlet controls

**TABLE 4.4-1:
Subsurface Infiltration Maintenance Guidelines**

	ACTIVITY	FREQUENCY
EARLY	Inspect erosion control and flow spreading devices until soil settlement and vegetative establishment of contributing areas has occurred.	<i>Biweekly</i>
	Inspect inlet controls, outlet structures, and storage areas for trash and sediment accumulation.	<i>Monthly for the first year after installation to determine ongoing maintenance frequency</i>
ONGOING	Regularly clean out gutters and catch basins to reduce sediment load to infiltration SMP. Clean intermediate sump boxes, replace filters, and otherwise clean pretreatment areas in directly connected systems.	<i>As Needed</i>
	Remove of sediment and debris from subsurface infiltration SMP sedimentation chamber, as applicable, when the sediment zone is 3/4 full.	
	Remove sediment and debris from pipe/vault systems. Sediment depth is not to reach a maximum depth of four inches below the SMP's outlet invert elevation. Removal of sediment from grid systems must be per manufacturer's recommendations or as per the site-specific maintenance plan.	
	Inspect subsurface infiltration facility and control structures.	
	Remove floating debris and accumulated petroleum products.	<i>Quarterly</i>
	Evaluate the drain down time of the SMP after a storm of at least one inch to ensure a SMP drain down time of less than 72 hours.	<i>Ongoing</i>
	Maintain records of all inspections and maintenance activity.	