***Stormwater Control Measure***

***Maintenance Schedules and Descriptions***

Inspection and Maintenance Guide

Attachment A

Maintenance schedules and descriptions are provided for the following SCMs:

1. Bioretention (Rain Garden)
2. Constructed Wetland/Retention Pond
3. Extended Detention Basin (EDB)
4. Grass Buffer/Grass Swale
5. Permeable Pavement
6. Sand Filter
7. Underground/Proprietary SCM

Recommended maintenance schedules and descriptions adopted from Urban Storm Drainage Criteria Manual, Volume 3, Water Quality, Chapter 6, BMP Maintenance (<https://udfcd.org/volume-three>; UDFCD, 2010).

The maintenance schedules and descriptions provided in this document are meant to serve as examples only based on regional guidance. It is recommended that the provided maintenance schedule and description be modified as needed to ensure proper operation for the specific facility.

**Bioretention (Rain Garden)**

Recommended Maintenance Schedule and Description

## Maintenance Schedule

|  |  |  |
| --- | --- | --- |
| **Category** | **Element**  | **Recommended Frequency** |
| Routine | Visual Inspection | Twice annually following precipitation |
| Debris and Litter Removal | As needed, checked monthly |
| Mowing and Plant Care | Every two weeks, seasonally dependent |
| Irrigation Scheduling and Maintenance | As needed, checked monthly |
| Replacement of Wood Mulch | As needed, checked annually |
| Rehabilitative | Sediment Removal and Growing Media Replacement | As needed |
| Erosion and Structural Repairs | As needed |

## Visual Inspection

Inspect the infiltrating surface at least twice annually following precipitation events to determine if the bioretention area is providing acceptable infiltration. Bioretention facilities are designed with a maximum depth for the WQCV of one foot and soils that will typically drain the WQCV over approximately 12 hours. If standing water persists for more than 24 hours after runoff has ceased, clogging should be further investigated and remedied. Additionally, check for erosion and repair as necessary.

## Debris and Litter Removal

Remove debris and litter from the infiltrating surface to minimize clogging of the media. Remove debris and litter from the overflow structure.

## Mowing and Plant Care

* All vegetation: Maintain healthy, weed-free vegetation. Weeds should be removed before they flower. The frequency of weeding will depend on the planting scheme and cover. When the growing media is covered with mulch or densely vegetated, less frequent weeding will be required.
* Grasses: When started from seed, allow time for germination and establishment of grass prior to mowing. If mowing is required during this period for weed control, it should be accomplished with hand-held string trimmers to minimize disturbance to the seedbed. After established, mow as desired or as needed for weed control. Following this period, mowing of native/drought tolerant grasses may stop or be reduced to maintain a length of no less than 6 inches. Mowing of manicured grasses may vary from as frequently as weekly during the summer, to no mowing during the winter.

## Irrigation Scheduling and Maintenance

Adjust irrigation throughout the growing season to provide the proper irrigation application rate to maintain healthy vegetation. Less irrigation is typically needed in early summer and fall, while more irrigation is needed during the peak summer months. Native grasses and other drought tolerant plantings should not typically require routine irrigation after establishment, except during prolonged dry periods.

Check for broken sprinkler heads and repair them, as needed. Completely drain the irrigation system before the first winter freeze each year. Upon reactivation of the irrigation system in the spring, inspect all components and replace damaged parts, as needed.

## Replacement of Wood Mulch

Replace wood mulch only when needed to maintain a mulch depth of up to approximately 3 inches. Excess mulch will reduce the volume available for storage.

## Sediment Removal and Growing Media Replacement

If ponded water is observed in a bioretention cell more than 24 hours after the end of a runoff event, check underdrain outfall locations and clean-outs for blockages. Maintenance activities to restore infiltration capacity of bioretention facilities will vary with the degree and nature of the clogging. If clogging is primarily related to sediment accumulation on the filter surface, infiltration may be improved by removing excess accumulated sediment and scarifying the surface of the filter with a rake. If the clogging is due to migration of sediments deeper into the pore spaces of the media, removal and replacement of all or a portion of the media may be required. The frequency of media replacement will depend on site-specific pollutant loading characteristics. Based on experience to date in the metro Denver area, the required frequency of media replacement is not known. To date UDFCD is not aware of any rain gardens constructed to the recommendations of these criteria that have required full replacement of the growing media. Although surface clogging of the media is expected over time, established root systems promote infiltration. This means that mature vegetation that covers the filter surface should increase the life span of the growing media, serving to promote infiltration even as the media surface clogs.

## Erosion and Structural Repairs

Repair basin inlets, outlets, and all other structural components required for the basin to operate as intended. Repair and vegetate eroded areas as needed following inspection.

**Constructed Wetland/Retention Pond**

Recommended Maintenance Schedule and Description

## Maintenance Schedule

|  |  |  |
| --- | --- | --- |
| **Category** | **Element**  | **Recommended Frequency** |
| Routine | Visual Inspection | Annually |
| Debris and Litter Removal | As needed, checked monthly |
| Plant Care/Removal | As needed, checked annually |
| Mosquito Control | As needed, checked weekly |
| Rehabilitative | Sediment Removal from Forebay | As needed, checked annually |
| Sediment Removal from Pond Bottom | As needed, checked annually |
| Erosion and Structural Repairs | As needed |

## Visual Inspection

Inspect the pond at least annually. Note the amount of sediment in the forebay and look for debris at the outlet structure.

## Debris and Litter Removal

Remove debris and litter from the pond as needed. This includes floating debris that could clog the outlet or overflow structure.

## Aquatic Plant Harvesting

Harvesting plants will permanently remove nutrients from the system, although removal of vegetation can also resuspend sediment and leave areas susceptible to erosion. Additionally, the plants growing on the safety wetland bench of a retention pond help prevent drowning accidents by demarking the pond boundary and creating a visual barrier. For this reason, UDFCD does not recommend harvesting vegetation completely as routine maintenance. However, aquatic plant harvesting can be performed if desired to maintain volume or eliminate nuisances related to overgrowth of vegetation. When this is the case, perform this activity during the dry season (November to February). This can be performed manually or with specialized machinery.

If a reduction in cattails is desired, harvest them annually, especially in areas of new growth. Cut them at the base of the plant just below the waterline, or slowly pull the shoot out from the base. Cattail removal should be done during late summer to deprive the roots of food and reduce their ability to survive winter.

## Mosquito Control

Mosquito control may be necessary if the constructed wetland/retention pond is located in proximity to outdoor amenities. The most effective mosquito control programs include weekly inspection for signs of mosquito breeding followed by larval treatment provided when breeding is found. Larval control is preferred because pesticides can be applied to known habitats rather than broadcast. The city recommends the use of *Bacillus thuringiensis israeliensus* (Bti) for use a larvicide, a naturally occurring soil bacteria that is toxic to mosquito pupae in the feeding stage. These inspections and treatment can be performed by a mosquito control service and typically start in mid-May and extend to mid-September. The use of larvicidal briquettes or "dunks" is not recommended for ponds due to their size and configuration.

Weekly mosquito inspections with targeted treatments are frequently less costly and more effective than regular widespread application of insecticide.

## Sediment Removal from the Forebay

Remove sediment from the forebay before it becomes a significant source of pollutants for the remainder of the pond. More frequent removal will benefit long-term maintenance practices. For dry forebays, sediment removal should occur once a year. Sediment removal in wet forebays should occur approximately once every four years or when buildup of sediment results in excessive algae growth or mosquito production. Ensure that the sediment is disposed of properly and not placed elsewhere in the pond.

## Sediment Removal from the Pond Bottom

Removal of sediment from the bottom of the pond may be required every 10 to 20 years to maintain volume and deter algae growth. This typically requires heavy equipment, designated corridors, and considerable expense. Harvesting of vegetation may also be desirable for nutrient removal. When removing vegetation from the pond, take care not to create or leave areas of disturbed soil susceptible to erosion. If removal of vegetation results in disturbed soils, implement proper erosion and sediment control measures until vegetative cover is reestablished.

For constructed wetland ponds, reestablish growth zone depths and replant if necessary.

**Extended Detention Basin (EDB)**

Recommended Maintenance Schedule and Description

## Maintenance Schedule

|  |  |  |
| --- | --- | --- |
| **Category** | **Element**  | **Recommended Frequency** |
| Routine | Visual Inspection | Twice annually following precipitation |
| Debris and Litter Removal | As needed, checked monthly |
| Aeration | Annually |
| Mowing and Plant Care | Every two weeks, seasonally dependent |
| Mosquito Control | As needed, checked weekly |
| Irrigation Scheduling and Maintenance | As needed, checked monthly |
| Sediment Removal from the Forebay, Trickle Channel, and Micropool | Annually |
| Rehabilitative | Sediment Removal from the Basin Bottom | As needed |
| Erosion and Structural Repairs | As needed |

## Visual Inspection

Visually inspect the EDB at least twice annually following precipitation events, observing the amount of sediment in the forebay and checking for debris at the outlet structure. EDB facilities are designed to drain the WQCV over approximately 48 hours. If standing water persists for more than 3 days after runoff has ceased, clogging should be further investigated and remedied.

## Debris and Litter Removal

Remove debris and litter from the detention area as required to minimize clogging of the outlet.

## Mowing and Plant Care

When starting from seed, mow native/drought tolerant grasses only when required to deter weeds during the first three years. Following this period, mowing of native/drought tolerant grass may stop or be reduced to maintain a height of no less than 6 inches (higher mowing heights are associated with deeper roots and greater drought tolerance). In general, mowing should be done as needed to maintain appropriate height and control weeds. Mowing of manicured grasses may vary from as frequently as weekly during the summer, to no mowing during the winter.

## Aeration

For EDBs with manicured grass, aeration will supply the soil and roots with air and increase infiltration. It reduces soil compaction and helps control thatch while helping water move into the root zone. Aeration is done by punching holes in the ground using an aerator with hollow punches that pull the soil cores or "plugs" from the ground. Holes should be at least 2 inches deep and no more than 4 inches apart.

Aeration should be performed at least once per year when the ground is not frozen. Water the turf thoroughly prior to aeration. Mark sprinkler heads and shallow utilities such as irrigation lines and cable TV lines to ensure those lines will not be damaged. Avoid aerating in extremely hot and dry conditions. Heavy traffic areas may require aeration more frequently.

## Mosquito Control

The Urban Drainage and Flood Control District recommended EDB design implements practices specifically developed to deter mosquito breeding, however, some level of mosquito control may be necessary if the facility is located in close proximity to outdoor amenities. The most effective mosquito control programs include weekly inspection for signs of mosquito breeding followed by larval treatment provided when breeding is found. Larval control is preferred because pesticides can be applied to known habitats rather than broadcast. The city recommends the use of *Bacillus thuringiensis israeliensus* (Bti) for use a larvicide, a naturally occurring soil bacteria that is toxic to mosquito pupae in the feeding stage. These inspections and treatment can be performed by a mosquito control service and typically start in mid-May and extend to mid-September. The use of larvicidal briquettes or "dunks" is not recommended for ponds due to their size and configuration.

Weekly mosquito inspections with targeted treatments are frequently less costly and more effective than regular widespread application of insecticide..

The use of larvicidal briquettes or "dunks" may be appropriate. These are typically effective for about one month and perform best when the basin has a hard bottom (e.g., concrete lined micropool).

## Irrigation Scheduling and Maintenance

Adjust irrigation throughout the growing season to provide the proper irrigation application rate to maintain healthy vegetation. Less irrigation is typically needed in early summer and fall, with more irrigation needed during July and August. Native grass and other drought tolerant plantings should not require irrigation after establishment.

Check for broken sprinkler heads and repair them, as needed. Completely drain the irrigation system before the first winter freeze each year. Upon reactivation of the irrigation system in the spring, inspect all components and replace damaged parts, as needed.

## Sediment Removal from the Forebay, Trickle Channel, and Micropool

Remove sediment from the forebay and trickle channel annually. If portions of the watershed are not developed or if roadway or landscaping projects are taking place in the watershed, the required frequency of sediment removal in the forebay may be as often as after each storm event. The forebay should be maintained in such a way that it does not provide a significant source of resuspended sediment in the stormwater runoff. Sediment removal from the micropool is required about once every one to four years, and should occur when the depth of the pool has been reduced to approximately 18 inches. Small micropools may be vacuumed and larger pools may need to be pumped in order to remove all sediment from the micropool bottom. Removing sediment from the micropool will benefit mosquito control. Ensure that the sediment is disposed of properly and not placed elsewhere in the basin.

## Sediment Removal from the Basin Bottom

Remove sediment from the bottom of the basin when accumulated sediment occupies about 20% of the water quality design volume or when sediment accumulation results in poor drainage within the basin. The required frequency may be every 15 to 25 years or more frequently in basins where construction activities are occurring.

## Erosion and Structural Repairs

Repair basin inlets, outlets, trickle channels, and all other structural components required for the basin to operate as intended. Repair and vegetate eroded areas as needed following inspection.

**Grass Buffer/Grass Swale**

Recommended Maintenance Schedule and Description

## Maintenance Schedule

|  |  |  |
| --- | --- | --- |
| **Category** | **Element**  | **Recommended Frequency** |
| Routine | Visual Inspection | Twice annually |
| Debris and Litter Removal | Twice annually and as needed |
| Aeration | Annually |
| Mowing | Every two weeks, seasonally dependent |
| Irrigation Scheduling and Maintenance | As needed, checked monthly |
| Fertilizer, Herbicide, and Pesticide Application | Only as needed |
| Rehabilitative | Sediment Removal | As needed |
| Erosion and Structural Repairs | As needed |

## Visual Inspection

Inspect vegetation at least twice annually for uniform cover and traffic impacts. Check for sediment accumulation and rill and gully development.

## Debris and Litter Removal

Remove litter and debris to prevent rill and gully development from preferential flow paths around accumulated debris, enhance aesthetics, and prevent floatables from being washed offsite. This should be done as needed based on inspection, but no less than two times per year.

## Aeration

Aerating manicured grass will supply the soil and roots with air. It reduces soil compaction and helps control thatch while helping water move into the root zone. Aeration is done by punching holes in the ground using an aerator with hollow punches that pull the soil cores or "plugs" from the ground. Holes should be at least 2 inches deep and no more than 4 inches apart.

Aeration should be performed at least once per year when the ground is not frozen. Water the turf thoroughly prior to aeration. Mark sprinkler heads and shallow utilities such as irrigation lines and cable TV lines to ensure those lines will not be damaged. Avoid aerating in extremely hot and dry conditions. Heavy traffic areas may require aeration more frequently.

## Mowing

When starting from seed, mow native/drought-tolerant grasses only when required to deter weeds during the first three years. Following this period, mowing of native/drought tolerant grass may stop or be reduced to maintain a length of no less than six inches. Mowing of manicured grasses may vary from as frequently as weekly during the summer, to no mowing during the winter.

**CSU Extension Recommendations for Mowing Manicured Turf (Source: T. Koski and V. Skinner, 2003)**

The two most important facets of mowing are mowing height and frequency. The minimum height for any lawn is 2 inches. The preferred mowing height for all Colorado species is 2.5 to 3 inches. Mowing to less than 2 inches can result in decreased drought and heat tolerance and higher incidence of insects, diseases and weeds. Mow the lawn at the same height all year. There is no reason to mow the turf shorter in late fall.

Mow the turf often enough so no more than 1/3 of the grass height is removed at any single mowing. If your mowing height is 2 inches, mow the grass when it is 3 inches tall. You may have to mow a bluegrass or fescue lawn every three to four days during the spring when it is actively growing but only once every seven to 10 days when growth is slowed by heat, drought or cold. Buffalograss lawns may require mowing once every 10 to 20 days, depending on how much they are watered. If weather or another factor prevents mowing at the proper time, raise the height of the mower temporarily to avoid cutting too much at one time. Cut the grass again a few days later at the normal mowing height.

## Irrigation Scheduling and Maintenance

Irrigation Scheduling and Maintenance Adjust irrigation schedules throughout the growing season to provide the proper irrigation application rate to maintain healthy vegetation. Less irrigation is typically needed in early summer and fall, with more irrigation needed during July and August. Native grass should not require irrigation after establishment, except during prolonged dry periods when supplemental, temporary irrigation may aid in maintaining healthy vegetation cover. Check for broken sprinkler heads and repair them, as needed. Do not overwater. Signs of overwatering and/or broken sprinkler heads may include soggy areas and unevenly distributed areas of lush growth. Completely drain and blowout the irrigation system before the first winter freeze each year. Upon reactivation of the irrigation system in the spring, inspect all components and replace damaged parts, as needed.

## Fertilizer, Herbicide, and Pesticide Application

Use the minimum amount of biodegradable nontoxic fertilizers and herbicides needed to establish and maintain dense vegetation cover that is reasonably free of weeds. Fertilizer application may be significantly reduced or eliminated by the use of mulch-mowers, as opposed to bagging and removing clippings. To keep clippings out of receiving waters, maintain a 25-foot buffer adjacent to open water areas where clippings are bagged. Hand-pull the weeds in areas with limited weed problems.

Frequency of fertilizer, herbicide, and pesticide application should be on an as-needed basis only and should decrease following establishment of vegetation. For additional information on managing vegetation in a manner that conserves water and protects water quality, see the 2008 GreenCO Best Management Practices Manual ([www.greenco.org](http://www.greenco.org)) for a series of Colorado-based fact sheets on topics such as irrigation, plant care, and soil amendments.

## Sediment Removal

Remove sediment as needed based on inspection. Frequency depends on site-specific conditions. For planning purposes, it can be estimated that 3 to 10% of the swale length or buffer interface length will require sediment removal on an annual basis.

* For Grass Buffers: Using a shovel, remove sediment at the interface between the impervious area and buffer.
* For Grass Swales: Remove accumulated sediment near culverts and in channels to maintain flow capacity. Spot replace the grass areas as necessary.

Reseed and/or patch damaged areas in buffer, sideslopes, and/or channel to maintain healthy vegetative cover. This should be conducted as needed based on inspection. Over time, and depending on pollutant loads, a portion of the buffer or swale may need to be rehabilitated due to sediment deposition. Periodic sediment removal will reduce the frequency of revegetation required. Expect turf replacement for the buffer interface area every 10 to 20 years.

**Permeable Pavement**

Recommended Maintenance Schedule and Description

## Maintenance Schedule

|  |  |  |
| --- | --- | --- |
| **Category** | **Element**  | **Recommended Frequency** |
| Routine | Visual Inspection | Annually |
| Infiltration Test | Annually |
| Sweeping and Vacuuming | As needed, twice a year recommended |
| Rehabilitative | Aggregate Replacement | As needed |
| Pavement or Paver Replacement | As needed |

## Visual Inspection

Inspect pavement condition and observe infiltration at least annually, either during a rain event or with a garden hose to ensure that water infiltrates into the surface. Video, photographs, or notes can be helpful in measuring loss of infiltration over time. Systematic measurement of surface infiltration of pervious concrete, Permeable Interlocking Concrete Pavers (PICP), concrete grid pavement, and porous asphalt can be accomplished using the following method specified in the Colorado Stormwater Center, Inspection and Maintenance Field Guide:

Permeable Pavement Infiltration Test

* Pour 1 gallon of water onto the PP over approximately 30 seconds
* The water will infiltrate through the surface creating a “wetted area”
* Measure the diameter of the wetted area using a tape measure
* If wetted area is longer than 10 feet, then maintenance is necessary

## Debris Removal, Sweeping, and Vacuuming

* All Pavements: Debris should be removed, routinely, as a source control measure. Typically, sites that require frequent sweeping already plan for this activity as part of their ongoing maintenance program. For example, a grocery store may sweep weekly or monthly. Depending on the season, city streets also may have a monthly plan for sweeping. This is frequently performed with a broom sweeper such as the one shown in Photo 6-4. Although this type of sweeper can be effective at removing solids and debris from the surface, it will not remove solids from the void space of a permeable pavement. Use a vacuum or regenerative air sweeper to help maintain or restore infiltration. If the pavement has not been properly maintained, a vacuum sweeper will likely be needed.
* PICP, Concrete Grid Pavements (with aggregate infill), Pervious Concrete, and Porous Asphalt: Use a regenerative air or vacuum sweeper after any significant site work (e.g., landscaping) and approximately twice per year to maintain infiltration rates. This should be done on a warm dry day for best results. Do not use water with the sweeper. The frequency is site specific and inspections of the pavement may show that biannual vacuuming is more frequent than necessary. After vacuuming PICP and Concrete Grid Pavers, replace infill aggregate as needed.

## Snow Removal

In general, permeable pavements do not form ice to the same extent as conventional pavements. Additionally, conventional liquid treatments (deicers) will not stay at the surface of a permeable pavement as needed for the treatment to be effective. Sand should not be applied to a permeable pavement as it can reduce infiltration. Plowing is the recommended snow removal process. Conventional plowing operations should not cause damage to the pavements.

* PICP and Concrete Grid: Deicers may be used on PICP and grid pavers; however, it may not be effective for the reason stated above. Sand should not be used. If sand is accidently used, use a vacuum sweeper to remove the sand. Mechanical snow and ice removal should be used.
* Pervious Concrete: Do not use liquid or solid deicers or sand on pervious concrete. Deicers can damage the concrete and sand will reduce infiltration. Mechanical snow and ice removal should be used.
* Porous Asphalt: Use liquid or solid deicers sparingly; mechanical snow and ice removal is preferred. Do not apply sand to porous asphalt.

## Full and Partial Replacement of the Pavement or Infill Material

* PICP and Concrete Grid: Concrete pavers, when installed correctly, should have a long service life. If a repair is required, it is frequently due to poor placement of the paver blocks. Follow industry guidelines for installation and replacement after underground repairs.

If surface is completely clogged and rendering a minimal surface infiltration rate, restoration of surface infiltration can be achieved by removing the first ½ to 1 inch of soiled aggregate infill material with a vacuum sweeper. After cleaning, the openings in the PICP will need to be refilled with clean aggregate infill materials. Replacement of the infill is best accomplished with push brooms.

* Porous Gravel: Remove and replace areas of excessive wear or reduced infiltration as needed. The frequency is dependent on site characteristics including site uses, vegetation, and materials.
* Pervious Concrete: Partial replacement of pervious concrete should be avoided. If clogged, power washing or power blowing should be attempted prior to partial replacement because saw cutting will cause raveling of the concrete. Any patches should extend to existing isolated joints. Conventional concrete may be used in patches, provided that 90 percent of the original pervious surface is maintained.
* Reinforced Grass: Remove and replace the sod cover as needed to maintain a healthy vegetative cover or when the sod layer accumulates significant amount of sediment (i.e., >1.5 inches). Maintenance and routine repairs should be performed annually, with sod replacement approximately every 10 to 25 years. When replacing sod, use a high infiltration variety such as sod grown in sandy loam.
* Porous Asphalt: Conventional asphalt may be used in patches, provided that 90 percent of the original permeable surface is maintained.

**Sand Filter**

Recommended Maintenance Schedule and Description

## Maintenance Schedule

|  |  |  |
| --- | --- | --- |
| **Category** | **Element**  | **Recommended Frequency** |
| Routine | Visual Inspection | Twice annually following precipitation |
| Debris and Litter Removal | As needed, checked monthly |
| Filter Surface Maintenance | As needed, checked annually |
| Rehabilitative | Filter Media Replacement | As needed |
| Erosion and Structural Repairs | As needed |

## Visual Inspection

Inspect the facility area twice annually following precipitation events to determine if the sand filter is providing acceptable infiltration. Also check for erosion and repair as necessary.

## Debris and Litter Removal

Remove debris and litter from detention area to minimize clogging of the media. Remove debris and litter from the overflow structure.

## Filter Surface Maintenance

Scarify the top 2 inches of sand on the surface of the filter. This may be required once every two to five years depending on observed drain times. After this has been done two or three times, replenish the top few inches of the filter with clean coarse sand (AASHTO C-33 or CDOT Class C filter material) to the original elevation. Maintain a minimum sand depth of 12 inches. Eventually, the entire sand layer may require replacement.

The functionality of the sand filter is dependent on having a level filter surface. An uneven surface may result in short circuiting and erosion of the filter media. The filter media should be leveled to the elevation specified in the construction drawings when rill erosion is observed during an inspection or when filter surface maintenance is performed.

## Erosion and Structural Repairs

Repair basin inlets, outlets, and all other structural components required for the SCM to operate as intended. Repair and vegetate any eroded side slopes as needed following inspection.

**Underground/Proprietary SCM**

Recommended Maintenance Schedule and Description

## Maintenance Schedule

|  |  |  |
| --- | --- | --- |
| **Category** | **Element**  | **Recommended Frequency** |
| Routine | Visual Inspection | Every 3 months, or following storm event |
| Debris Removal/Vacuuming | As needed, see manufacturer specifications |
| Filter Cartridge Replacement | As needed, see manufacturer specifications |
| Rehabilitative | Structural Repair/Replacement | As needed |

Maintenance requirements of underground SCMs can vary greatly depending on the type of SCM. For proprietary devices, detailed maintenance requirements from the manufacturer should be incorporated into this recommended maintenance schedule and description.

## Visual Inspection

* All Underground SCMs: Inspect underground SCMs at least quarterly for the first two years of operation and then twice a year for the life of the SCM, if a reduced inspection schedule is warranted based on the initial two years. Specifically look for debris that could cause the structure to bypass water quality flows. Strong odors may also indicate that the facility is not draining properly. Inspection should be performed by a person who is familiar with the operation and configuration of the SCM.
* Inlet Inserts: Inspect inlet inserts frequently; at a minimum, inspect after every storm event exceeding 0.6 inches. Removal of flow blocking debris is critical for flood control.

## Debris Removal, Cartridge Replacement, and Vacuuming

* All Underground SCMs: Follow the manufacturer's recommended maintenance requirements and remove any flow blocking debris as soon as possible following inspection.
* Filter Cartridges: Inspection of filter cartridges is recommended twice yearly. Replacement of filter cartridges is anticipated on an annual basis. Depending on site characteristics, the replacement frequency may be extended to no less than once every three years. However, semi-annual inspection should continue to ensure that proper function of the system is maintained. Maintenance is required when any of the following conditions exist:
	+ If there is more than 4 inches of accumulated sediment on the vault floor.
	+ If there is more than ¼ inch of accumulation on the top of the cartridge.
	+ If there is more than 4 inches of standing water in the cartridge bay for more than 24 hours after the end of a rain event.
	+ If the pore space between media granules is full.
	+ If inspection is conducted during an average rainfall event and the system remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges).
	+ If hazardous material release (automotive fluids or other) is reported. If pronounced scum line (≥ 1/4" thick) is present above top cap.
	+ If system has not been maintained for three years.
* Hydrodynamic Separators: Vacuum units at least once annually and more frequently as needed, based on inspections or manufacturer recommendations.