



Stormwater Permanent Control Measure Standard Inspection and Maintenance Plan Procedures/Forms

for:

Bioretention Basin

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Appendix A: Compliance with Permanent Control Measure (PCM) Requirements

All property owners are responsible for ensuring that stormwater PCMs installed on their property or as part of the development are properly maintained, function as designed, and are not modified from original design, to include ensuring proper drainage to the PCM from the development is maintained. Private property owners that own and maintain PCMs are required to enter a maintenance agreement contract with the City of Colorado Springs (the City). Property owners shall be aware of the responsibilities regarding PCM inspection and maintenance (IM) and shall be familiar with the contents of this IM Plan.

Annual Reporting

Verification that PCMs have been properly inspected and maintained by submittal of the IM forms shall be provided to the City on an annual basis. The reporting forms shall be provided to the City no later than (NLT) May 31st of each calendar year. IM forms are located in Appendix C, D and E of this plan.

Inspecting

PCMs must be inspected to ensure that they function as designed. The inspection shall determine any appropriate maintenance required for the facility. All PCMs are required to be inspected a minimum of once per year unless otherwise specified in Appendix F, if provided. Inspections shall follow the inspection guidance found in Appendix B.

Inspection Report

The annual inspection reporting form is located in Appendix C. The reporting form shall be submitted in conjunction with the IM forms no later than May 31st of each calendar year. A copy of all forms shall be retained by the owner for a minimum of 5 years.

Maintaining

PCMs must be properly maintained to ensure that they operate as designed. Routine maintenance can help avoid more costly rehabilitative maintenance.

Maintenance Categories

PCM maintenance programs are separated into three broad categories of work. The categories are separated based upon the magnitude and type of maintenance activities performed. A description of each category follows:

Routine Maintenance

This work consists of scheduled mowing, trash and debris removal, weed control, mosquito treatment, and algae treatment. This includes items such as the removal of debris/material that may be clogging any part of the outlet structure. These activities are normally performed numerous times during the year. This work can be completed without correspondence with the City; however, all work shall be documented on the maintenance form.

Restoration Work

This work consists of small-scale maintenance needed to address operational problems to include but not limited to; concrete repair and riprap repair/replacement. This work does not require prior correspondence with the City; however, all work shall be documented on the maintenance form.

Rehabilitation Work

This work consists of major maintenance needed to address failures within the PCM. This work requires consultation with an engineer and may require construction plans to be submitted for review and approval by the City. These items require prior correspondence with the City in addition to work being documented on the maintenance form.

Verification of Inspection and Maintenance Form Submittal

The PCM Inspection Form provides a record of inspection of the facility. Inspection Forms for each facility type are provided in Appendix D. The PCM Maintenance Form provides a record of maintenance activities and includes general cost information to assist property owners in budgeting for future maintenance. Maintenance Forms for each facility type are provided in Appendix E. Verification of inspections and maintenance of the stormwater facilities shall be provided to the City of Colorado Springs/Stormwater Enterprise on an annual basis NLT May 31st. The property owner and/or property manager shall verify the inspection and maintenance forms by signing the Annual Inspection and Maintenance Submittal Form provided in Appendix C.

Appendix B: Standard Operation Procedure For Inspection and Maintenance of Bioretention Basins

1. INSPECTING BIORETENTION BASINS

1.1. Bioretention Basin Components

1.1.1. Bioretention Basins have components that are designed to serve a particular function. It is critical that each feature is properly inspected to ensure that the overall facility functions as designed. Below is a list and description of the most common features within a Bioretention Basin and the corresponding inspection items that shall be anticipated:

1.1.2. Inspection Requirement Matrix

| Inspection Item Bioretention Basin Components | Erosion | Illicit Discharge | Overgrown Vegetation | Sediment Accumulation | Standing Water | Structural Condition | Trash & Debris Accumulation |
|---|---------|----------------------|-------------------------|--------------------------|-------------------|-------------------------|--------------------------------|
| Inflow Point | X | | X | X | | X | X |
| Filter Media | X | X | X | X | X | | X |
| Underdrain System | | | | X | X | X | |
| Outlet/Overflow Structure | X | X | X | X | X | X | X |
| Landscaping | X | | X | X | | | X |
| Embankments | X | | X | | | X | X |

1.2. Inflow Points

1.2.1. Inflow points are the point source of stormwater entrance into the facility. An inflow point for a Bioretention Basin is commonly a rock-lined or rip-rap run down or curb cut.

1.2.2. Typical inspection items noted for inflow points are:

1.2.2.1. Erosion – Erosion will require maintenance to prevent damage to the structure(s) and sediment transport within the facility.

1.2.2.2. Mowing, Weed Control and Overgrown Vegetation – Undesirable vegetation can significantly affect the performance of the facility. This type of vegetation includes trees, dense areas of shrubs, and vegetation not specified on the plan that could negatively impact the performance of the facility. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, and/or roots can cause damage to the structural components of the facility. In addition, noxious weeds growing in the facility can result in the loss of desirable native vegetation and impact adjacent open spaces/land.

1.2.2.3. Sediment Accumulation – To prevent a loss in hydraulic performance, sediment accumulation must

be removed in a timely manner.

1.2.2.4. Structural Damage – Structural damage can lead to operational problems with the facility, including loss of hydraulic performance.

1.2.2.5. Trash and Debris Accumulation – To prevent a loss in hydraulic performance, trash and debris accumulation must be removed in a timely manner.

1.3. Filter Media

1.3.1. The filter media is the main pollutant removal component of a Bioretention Basin. The filter media removes pollutants through several different processes, including sedimentation, filtration, infiltration and microbial uptake. Sedimentation is accomplished by the slow release of stormwater runoff through the filter media.

1.3.2. Typical inspection items noted for the Filter Media are:

1.3.2.1. Erosion - Erosion will require maintenance to prevent damage to the structure(s) and sediment transport within the facility.

1.3.2.2. Illicit Discharge – Indicators of illicit discharges include sheens, odors, discolored soil, and dead vegetation.

1.3.2.3. Mowing, Weed Control and Overgrown Vegetation – Undesirable vegetation can significantly affect the performance of the facility. This type of vegetation includes trees, dense areas of shrubs, and vegetation not specified on the plan that could negatively impact the performance of the facility. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, and/or roots can cause damage to the structural components of the facility. In addition, noxious weeds growing in the facility can result in the loss of desirable native vegetation and impact adjacent open spaces/land.

1.3.2.4. Sediment Accumulation – To prevent a loss in hydraulic performance and the need of replacing filter media, sediment accumulation must be removed in a timely manner. If Filter Media becomes clogged due to sediment permeation, full media replacement will be required.

1.3.2.5. Standing Water – Improperly draining structures can lead to mosquito and/or algae growth. Routine maintenance is required to prevent standing water.

1.3.2.6. Trash and Debris Accumulation - To prevent a loss in hydraulic performance, trash and debris accumulation must be removed in a timely manner.

1.4. Underdrain System

1.4.1. The underdrain system consists of a gravel storage area, slotted PVC pipes, and PVC clean out pipes. The gravel storage area allows for storage of stormwater runoff prior to the discharge of the runoff through the slotted PVC pipe.

1.4.2. Typical inspection items noted for the Underdrain System are:

1.4.2.1. Sediment Accumulation – To prevent a loss in hydraulic performance, sediment accumulation must be removed in a timely manner.

1.4.2.2. Standing Water – Improperly draining structures can lead to mosquito and/or algae growth. Routine maintenance is required to prevent standing water.

1.4.2.3. Structural Damage – Structural damage can lead to operational problems with the facility, including loss of hydraulic performance.

1.5. Outlet/Overflow Structure

1.5.1. The Outlet Structure drains the Bioretention Basin as engineered in specified quantities over limited time. This is accomplished by the installation of steel orifice plates anchored and sealed within the component to control the stormwater release rates. Trash racks are installed in front of the aboveground orifice plates to prevent clogging.

1.5.2. Typical inspection items noted for the Outlet Structure are:

- 1.5.2.1. Erosion – Erosion will require maintenance to prevent damage to the structure(s) and sediment transport within the facility.
- 1.5.2.2. Illicit Discharge – Indicators of illicit discharges include sheens, odors, discolored soil, and dead vegetation.
- 1.5.2.3. Mowing, Weed Control and Overgrown Vegetation – Undesirable vegetation can significantly affect the performance of the facility. This type of vegetation includes trees, dense areas of shrubs, and vegetation not specified on the plan that could negatively impact the performance of the facility. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, and/or roots can cause damage to the structural components of the facility. In addition, noxious weeds growing in the facility can result in the loss of desirable native vegetation and impact adjacent open spaces/land.
- 1.5.2.4. Sediment Accumulation – To prevent a loss in hydraulic performance, sediment accumulation must be removed in a timely manner.
- 1.5.2.5. Standing Water – Improperly draining structures can lead to mosquito and/or algae growth. Routine maintenance is required to prevent standing water.
- 1.5.2.6. Structural Damage – Structural damage can lead to operational problems with the facility, including loss of hydraulic performance.
- 1.5.2.7. Trash and Debris Accumulation - To prevent a loss in hydraulic performance, trash and debris accumulation must be removed in a timely manner.

1.6. Landscaping

1.6.1. The landscaped component consists of soils with specific pH requirements and plants that provide biological uptake or removal of pollutants. These requirements are normally found within the permanent control measure plan.

1.6.2. Typical inspection items noted for Landscaping are:

- 1.6.2.1. Erosion – Erosion will require maintenance to prevent damage to the structure(s) and sediment transport within the facility.
- 1.6.2.2. Mowing, Weed Control and Overgrown and/or Adequate Vegetation – Undesirable vegetation can significantly affect the performance of the facility. This type of vegetation includes trees, dense areas of shrubs, and vegetation not specified on the plan that could negatively impact the performance of the facility. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, and/or roots can cause damage to the structural components of the facility. In addition, noxious weeds growing in the facility can result in the loss of desirable native vegetation and impact adjacent open spaces/land. Ensure required bioretention landscaping is adequate.
- 1.6.2.3. Sediment Accumulation – To prevent a loss in hydraulic performance, sediment accumulation must be removed in a timely manner.

1.6.2.4. Trash and Debris Accumulation - To prevent a loss in hydraulic performance, trash and debris accumulation must be removed in a timely manner.

1.7. Embankments

1.7.1. Typical inspection items noted for the Embankment are:

- 1.7.1.1. Erosion – Erosion will require maintenance to prevent damage to the structure(s) and sediment transport within the facility.
- 1.7.1.2. Mowing, Weed Control and Overgrown Vegetation – Undesirable vegetation can significantly affect the performance of the facility. This type of vegetation includes trees, dense areas of shrubs, and vegetation not specified on the plan that could negatively impact the performance of the facility. If woody vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, and/or roots can cause damage to the structural components of the facility. In addition, noxious weeds growing in the facility can result in the loss of desirable native vegetation and impact adjacent open spaces/land.
- 1.7.1.3. Structural Damage – Structural damage can lead to operational problems with the facility, including loss of hydraulic performance.
- 1.7.1.4. Trash and Debris Accumulation - To prevent a loss in hydraulic performance, trash and debris accumulation must be removed in a timely manner.

1.8. Inspection Forms

- 1.8.1. The Standard Bioretention Basin Inspection form is located in Appendix D. Inspection forms shall be completed by the person(s) conducting the inspection activities. Each form shall be verified and submitted by the property owner or representative to the City NLT May 31st each year to stormwater.PCMs@coloradosprings.gov or the address located on the submittal form in Appendix B. These inspection forms shall be retained for a minimum of 5 years and made available to the City upon request.

2. MAINTAINING BIORETENTION BASINS

2.1. Maintenance Categories and Activities

- 2.1.1. A standard Bioretention Basin Maintenance Program consists of three broad categories of work: Routine, Restoration, and Rehabilitation. Within each category of work, a variety of maintenance activities can be performed. A maintenance activity can be specific to a Bioretention Basin component or general to the overall facility. This section of the SOP explains each of the categories and briefly describes the standard maintenance activities.

2.2. Routine Maintenance

- 2.2.1. This work consists of scheduled mowing, trash and debris removal, weed control, mosquito treatment, and algae treatment. This includes items such as the removal of debris/material that may be clogging any part of the outlet structure. These activities are normally performed numerous times during the year. This work can be completed without correspondence with the City; however, all work shall be documented on the inspection and maintenance forms.

2.3. Restoration Work

- 2.3.1. This work consists of small-scale maintenance needed to address operational problems to include but not limited to; concrete repair and riprap repair/replacement. This work does not require prior correspondence with City; however, all work shall be documented on the inspection and maintenance forms.

2.4. Rehabilitation Work

2.4.1. This work consists of major repairs needed to address failures within the PCM. This work requires consultation with an engineer and may require design plans be submitted for review and approval by the City. These items require prior correspondence with the City in addition to work being documented on the inspection and maintenance forms.

2.5. Maintenance Activities are summarized in the table below, and further described in the following sections.

2.6. Maintenance Activity Matrix

| Maintenance Activity | Erosion Repair | Mowing/ Weed control | Sediment Accumulation Removal | Mosquito and Algae Treatment | Structural Damage Repairs | Trash & Debris Removal |
|--------------------------------------|-----------------------|-----------------------------|--------------------------------------|-------------------------------------|----------------------------------|-----------------------------------|
| Bioretention Basin Components | | | | | | |
| Inflow Point | X | X | X | | X | X |
| Filter Media | X | X | X | X | | X |
| Underdrain System | | | X | X | X | |
| Outlet/Overflow Structure | X | X | X | X | X | X |
| Landscaping | X | X | X | | | X |
| Embankment | X | X | | | X | X |

2.7. Erosion Repair

2.7.1. The repair of eroded areas is necessary to ensure the proper function of the Bioretention Basin, minimize sediment transport, and to reduce potential impacts to other features. Erosion can vary in magnitude from minor rills to major gullies. Major erosion repairs may require consultation with an engineer. Erosion repairs can be routine maintenance, restoration and/or rehabilitation.

2.7.2. Recommended frequency – As needed, based on inspections.

2.8. Mowing

2.8.1. Mowing, tree thinning and dense vegetation removal is necessary to limit vegetation overgrowth, ensure functionality and to improve the overall appearance. Native vegetation should be mowed to a height of 4”- 6”. Mowing, tree thinning and dense vegetation removal is routine maintenance.

2.8.2. Recommended frequency – Twice annually or as needed.

2.9. Weed Control

2.9.1. Noxious weeds and other unwanted vegetation must be treated as needed throughout the PCM. This activity can be performed through mechanical means (mowing/pulling) or with herbicide. Consultation with a weed inspector is highly recommended prior to the use of herbicide. Weed control is routine maintenance.

2.9.2. Recommended frequency – As needed, based on inspections.

2.10. Sediment Removal

2.10.1. Sediment removal is necessary to maintain the original design volume of the PCM and to ensure proper functionality of the infrastructure. Routine sediment removal from the filter media and underdrain can significantly reduce the frequency of major sediment removal activities. Jet-Vac cleaning is normally the best way to remove sediment from the underdrain. If Filter Media becomes clogged due to sediment permeation, full media replacement will be required. Major (restoration/rehabilitation) sediment removal activities may require surveying and consultation with an engineer to ensure design volumes/grades are achieved.

Stormwater sediment removed from PCMs do not meet the State's definition of hazardous waste; however, sediment may be contaminated with a wide array of organic and inorganic pollutants. All removed sediment must be disposed of in accordance with State laws concerning regulated wastes. Sediment removal can be routine maintenance, restoration and/or rehabilitation.

2.10.2. Recommended frequency – Once annually or as needed, based upon inspections.

2.11. Mosquito/Algae Treatment

2.11.1. Improperly draining structures can lead to mosquito and/or algae growth. Treatment of standing water may be necessary to control mosquitoes and undesirable aquatic vegetation that can create nuisances. Only EPA approved chemicals/materials can be used in areas that are warranted. Mosquito and algae treatment is routine maintenance.

2.11.2. Recommended frequency – As needed, based on inspections.

2.12. Structural Repair

2.12.1. Structural repairs to Bioretention Basin components may require input from an engineer. Minor displacement of rip-rap and minor concrete repairs can be performed routinely. Major structural damage could impact the functionality of the infrastructure. Structural repairs can be routine maintenance, rehabilitation or restoration.

2.12.2. Recommended frequency – As needed, based on inspections.

2.13. Trash/Debris Removal

2.13.1. Trash and debris must be removed to minimize outlet clogging and to improve aesthetics. Debris can clog the outlet/overflow structure and the orifice plate. This activity should be performed prior to mowing operations.

2.13.2. Recommended frequency – Twice annually or as needed.

2.14. Maintenance Forms

2.14.1. The Standard Bioretention Basin Maintenance Form is located in Appendix D. Each form shall be verified and submitted by the property owner or representative to the City NLT May 31st each year to stormwater.PCMs@coloradosprings.gov or the address located on the submittal form in Appendix C. Inspection forms and maintenance forms shall be retained by the property owner for a minimum of 5 years and made available to the City upon request.



Appendix C: Annual PCM Inspection and Maintenance Submittal Form

(This form to be submitted to City of Colorado Springs prior to May 31 of each year)

Date: _____

**To: City of Colorado Springs/Stormwater Enterprise
Attn: PCM Program
30 S Nevada Suite 410
Colorado Springs, CO 80903**

OR

stormwater.PCMs@coloradosprings.gov

Re: Verification of Inspection and Maintenance; Submittal of forms

Property/Subdivision Name: _____

Property Maintenance Agreement Reference No.: _____

Property Address: _____

Contact Name: _____

Contact Email Address: _____

I verify that the required inspections and maintenance have been completed in accordance with the Stormwater PCM Maintenance Agreement and the Inspection and Maintenance Plan associated with the above referenced property.

The required PCM Inspection and Maintenance forms are attached.

Property Owner or Representative

Signature



Appendix D: Bioretention Basin Inspection Form

Property/Subdivision Name: _____ Date: _____

For each Bioretention Basin component, please indicate if inspection items are acceptable (A), deficient (D), or not applicable (N/A).

Inflow Points

- Erosion
- Overgrown Vegetation
- Sediment Accumulation
- Structural Conditions
- Trash and Debris

Landscaping

- Erosion
- Overgrown Vegetation
- Sediment Accumulation
- Trash and Debris
- Adequate Bioretention Vegetation

Embankments

- Erosion
- Overgrown Vegetation
- Structural Conditions
- Trash and Debris

Filter Media

- Erosion
- Illicit Discharge
- Overgrown Vegetation
- Sediment Accumulation
- Standing Water
- Trash and Debris

Underdrain System

- Sediment Accumulation
- Standing Water
- Structural Conditions
- Orifice Clogged
- Trash Rack Clogged

Outlet/Overflow Structure

- Erosion
- Illicit Discharge
- Overgrown Vegetation
- Sediment Accumulation
- Standing Water
- Structural Condition
- Trash and Debris

Miscellaneous

- Graffiti/Vandalism
- Structure Modification
- Other – Explain Below

Inspection notes/additional comments: _____



Appendix E: Bioretention Basin Maintenance Form

Property/Subdivision Name: _____ Date: _____

Please indicate all maintenance activities performed in the last 12 months.

- ___ **Mowing** Date(s) Performed: _____
- ___ **Weed/Tree Removal/Treatment** Date(s) Performed: _____
- ___ **Trash and Debris Removal** Date(s) Performed: _____
- ___ **Underdrain/Outlet Structure Cleaning** Date(s) Performed: _____
- ___ **Mosquito/Algae Treatment** Date(s) Performed: _____
- ___ **Sediment Removal** Date(s) Performed: _____

___ **Erosion Repairs**
 Location and description of repair(s): _____

 Date Performed: _____

 Location and description of repair(s): _____

 Date Performed: _____

___ **Structural Repairs**
 Location and description of repair(s): _____

 Date Performed: _____

 Location and description of repair(s): _____

 Date Performed: _____

Maintenance notes/additional comments: _____

