# STORMWATER BEST MANAGEMENT PRACTICES

# INSPECTION & MAINTENANCE PLAN (IM PLAN)

## for:

## Rolling Hills 2MG Potable Water Tank

## Located at:

***TBD***
***Colorado Springs, CO 80929***

## Prepared for and Party Responsible for Maintenance and Inspection:

***Widefield Water and Sanitation District***
***8495 Fontaine Blvd.***
***Colorado Springs, CO 80925***

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# STORMWATER BEST MANAGEMENT PRACTICES
# INSPECTION & MAINTENANCE PLAN (IM PLAN)
# Widefield Water and Sanitation District
# Rolling Hills 2MG Potable Water Tank

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**Reference: This plan is adapted from various maintenance manuals developed in the Colorado Front Range**

## I. Compliance with Stormwater Best Management Practices Maintenance Requirements

All property owners are responsible for ensuring that stormwater best management practices (BMP's) or facilities installed on their property are properly maintained and that they function as designed. In some cases, this maintenance responsibility may be assigned to others through special agreements. The maintenance responsibility for a stormwater facility may be designated on the subdivision plat, the site development plan, and/or within a maintenance agreement for the property. Property owners should be aware of their responsibilities regarding stormwater facility maintenance and need to be familiar with the contents of this Inspection and Maintenance Plan (IM Plan). Maintenance agreement(s) associated with this property are provided.

## II. Inspection & Maintenance – Annual Reporting

Requirements for the inspection and maintenance of stormwater facilities, as well as reporting requirements are included in this Stormwater BMP IM Plan.

**Verification that the stormwater BMP's have been properly inspected and maintained: submittal of the required Inspection and Maintenance Forms shall be provided to El Paso County on an annual basis. The annual reporting form shall be provided to the County prior to May 31st of each year.**

Copies of the Inspection and Maintenance forms are located in ***Appendixes C & D***. Each form shall be reviewed and submitted by the property owner or property manager to the County.

## III. Preventative Measures to Reduce Maintenance Costs

The most effective way to maintain your water quality facility is to prevent the pollutants from entering the facility. Common pollutants include sediment, trash & debris, chemicals, pet wastes, runoff from stored materials, illicit discharges into the storm drainage system and many others. A thoughtful maintenance program will include measures to address these potential contaminants and will save money and time in the long run. Key points to consider in your maintenance program include:

- Educate property owners/residents to be aware of how their actions affect water quality and how they can help reduce maintenance costs.
- Keep properties, streets and gutters, and parking lots free of trash, debris, and lawn clippings.
- Ensure the proper use, storage, and disposal of hazardous wastes and chemicals. Promptly clean up and spilled materials and dispose of properly.
- Plan lawn care to minimize and properly use chemicals and pesticides.
- Sweep paved surfaces and put the sweepings back on the lawn.
- Be aware of automobiles leaking fluids. Use absorbents such as cat litter to soak up drippings – dispose of properly.
- Encourage pet owners to clean up pet wastes.
- Re-vegetate disturbed and bare areas to maintain vegetative stabilization.
- Clean any private storm drainage system components, including inlets, storm sewers, and outfalls.
- Do not store materials outdoors (including landscaping materials) unless properly protected from runoff.

## IV. Access and Right to Enter

All stormwater management facilities located on the site should have both a designated access location and the County has the right to enter for the purpose of inspecting and for maintaining BMP's where the owner has failed to do so.

## V. Safety

Keep safety considerations at the forefront of inspection procedures at all times. Likely hazards should be anticipated and avoided. Never enter a confined space (outlet structure, manhole, etc.) without proper training, number of personnel, and equipment.

Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas must be referred emergency services at 911 (non-emergency number is 444-7000). If a toxic or flammable substance is discovered, leave the immediate area and contact the local emergency services at 911.

Vertical drops may be encountered in areas located within and around the facility. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. If a vertical drop is greater than 48" in height, make the appropriate note/comment on the maintenance inspection form.

If any hazard is found within the facility area that poses an immediate threat to public safety, contact emergency services at 911 immediately.

## VI. Field Inspection Equipment

It is imperative that the appropriate equipment is taken to the field with the inspector(s). This is to ensure the safety of the inspector and allow the inspections to be performed as efficiently as possible. Below is a list of the equipment that may be necessary to perform the inspections of all stormwater BMP's:

- Protective clothing and boots
- Safety equipment (vest, hard hat, confined space entry equipment [if certified to perform confined space entry])
- Communication equipment
- IM Plan for the site
- Clipboard
- Stormwater BMP Inspection Form (See ***Appendix C***)
- Manhole Lid Remover
- Shovel

Some of the items identified above need not be carried by the inspector (manhole lid remover, shovel, and confined space entry equipment), but should be available in the vehicle driven to the site. Specialized equipment may require specific training related to that equipment and should only be used by trained individuals.

## VII. Inspecting Stormwater BMP's

The quality of stormwater entering the waters of the state relies heavily on the proper operation and maintenance of permanent BMP's. Stormwater BMP's must be periodically inspected to ensure that they function as designed. The inspection will determine the appropriate maintenance that is required for the facility.

A. Inspection Procedures

All Stormwater BMP's are required to be inspected a minimum of once per year. Inspections should follow the inspection guidance found in the SOP for the specific type of facility. (***Appendix B*** of this manual).

B. Inspection Report

The person(s) conducting the inspection activities shall complete the appropriate inspection report for the specific facility. An Inspection Reports is located in ***Appendix C***. A copy of each inspection form shall be kept by the owner a minimum of 5 years.

*The following information explains how to fill out the Inspection Forms:*

*General Information*

This section identifies the facility location, person conducting the inspection, the date and time the facility was inspected, and approximate days since the last rainfall. Property classification is identified as single-family residential, multi-family residential, commercial, or other.

The reason for the inspection is also identified on the form depending on the nature of the inspection. All facilities must be inspected on an annual basis at a minimum. In addition, all facilities should be inspected after a significant precipitation event to ensure the facility is draining appropriately and to identify any damage that occurred as a result of the increased runoff.

*Inspection Scoring*

For each inspection item, a score must be given to identify the urgency of required maintenance. The scoring is as follows:

0 = No deficiencies identified

1 = Monitor – Although maintenance may not be required at this time, a potential problem exists that will most likely need to be addressed in the future. This can include items like minor erosion, concrete cracks/spalling, or minor sediment accumulation. This item should be revisited at the next inspection

2 = Routine Maintenance Required – Some inspection items can be addressed through the routine maintenance program. This can include items like vegetation management or debris/trash removal

3 = Immediate Repair Necessary – This item needs immediate attention because failure is imminent or has already occurred. This could include items such as structural failure of a feature (outlet works, forebay, etc), significant erosion, or significant sediment accumulation. This score should be given to an item that can significantly affect the function of the facility.

N/A = This is checked by an item that may not exist in a facility. Not all facilities have all of the features identified on the form (forebay, micro-pool, etc.).

*Inspection Summary/Additional Comments*

Additional explanations to inspection items, and observations about the facility not covered by the form, are recorded in this section.

*Overall Facility Rating*

An overall rating must be given for each facility inspected. The overall facility rating should correspond with the highest score (0, 1, 2, 3) given to any feature on the inspection form.

C. Verification of Inspection and Form Submittal

The Stormwater BMP Inspection Form provides a record of inspection of the facility. An Inspection Form is provided in ***Appendix C***. Verification of the inspection of the stormwater facilities and the facility inspection form(s) shall be provided to the County on an annual basis. The verification and the inspection form(s) shall be reviewed and submitted by the property owner or property manager on behalf of the property owner.

Refer to Section II of this Manual regarding the annual reporting of inspections.

## VIII. Maintaining Stormwater BMP's

Stormwater BMP's must be properly maintained to ensure that they operate correctly and provide the water quality treatment for which they were designed. Routine maintenance performed on a frequently scheduled basis, can help avoid more costly rehabilitative maintenance that results when facilities are not adequately maintained.

A. Maintenance Categories

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

*Routine Work*

The majority of this work consists of scheduled mowing and trash and debris pickups for stormwater management facilities during the growing season. This includes items such as the removal of debris/material that may be clogging the outlet structure well screens and trash racks. It also includes activities such as weed control, mosquito treatment, and algae treatment. These activities normally will be performed numerous times during the year. These items can be completed without any prior correspondence with the County; however, inspection and maintenance forms shall be completed with the information also being reported on the annual report forms that are submitted to the County.

*Restoration Work*

This work consists of a variety of isolated or small-scale maintenance and work needed to address operational problems. Most of this work can be completed by a small crew, with minor tools, and small equipment. These items do not require prior correspondence with the County, but do require that completed maintenance forms be submitted to the County with the annual report forms.

*Rehabilitation Work*

This work consists of large-scale maintenance and major improvements needed to address failures within the stormwater BMP. This work requires consultation with the County and may require an engineering design with construction plans to be prepared for review and approval by the County. This work may also require more specialized maintenance equipment, surveying, construction permits or assistance through private contractors and consultants. These items require prior correspondence with the County and require that completed maintenance forms be submitted to the County with the annual report forms.

B. Maintenance Personnel

Maintenance personnel should be qualified to properly maintain stormwater BMP's, especially for restoration or rehabilitation work. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

C. Maintenance Forms

The Stormwater BMP Maintenance Form provides a record of maintenance activities and includes general cost information to assist property owners in budgeting for future maintenance. A Maintenance Form is provided in ***Appendix D***. Maintenance Form shall be completed by the property owner, management company, or contractor completing the required maintenance items. The form shall then be reviewed by the property owner or an authorized agent of the property owner and submitted on an annual basis by May 31st to the following address:

El Paso County – Development Services
2880 International Circle
Colorado Springs, CO 80910

Refer to Section II of this Manual regarding the annual reporting of inspections and maintenance activities performed.

# Appendix A
# General Location and Description of Stormwater Best Management Practices

A. General Site Description

The subject facility is a proposed water storage tank site to serve development in the Widefield Water and Sanitation District. The Rolling Hills Tank site is located south of Drennan Road and occupies part of the Northwest ¼ of Section 2, Township 15 South, Range 65 West of the 6th P.M within El Paso County, Colorado. The site in located within a grazing field bound by Drennan Road to the north, S. Meridian Road to the east, Bradley Road to the south, and a 415 foot utility easement to the west. The proposed site will consist of a 2MG concrete water storage tank, buried pipelines, above-grade electrical/control equipment, and a future 2-5MG water storage tank, 0.75-1.5MG elevated tank, and booster pump station when/if needed by the District. Additionally, an onsite access road will be constructed from aggregate base course material.

The total acreage of disturbed land for the construction of the facilities is approximately 2.18 acres. Soils for this project are delineated as Tassel fine sandy loam and are characterized as Hydrologic Soil Group D (high runoff potential when thoroughly wet).

B. General Stormwater Management Description

All stormwater is conveyed via drainage swale to a sand filter basin (SFB) located adjacent to the access road that provides 10/100 -yr detention and water quality treatment. The outfall for the detention basin discharges to the east of the detention basin into the East Fork Tributary drainage basin. The site is not impacted from off-site flows due to the site location being on top of a hill.

C. Stormwater Facilities Site Plan

Inspection or maintenance personnel may utilize the documents in Appendix E for locating the stormwater facilities within this development.

D. On-Site / Off-Site Stormwater Management Facilities

Rolling Hills Tank Site contains both temporary and permanent BMP's, with some temporary BMP's capable of becoming permanent if necessary. Permanent BMP's consist of a Sand Filter Basin (SFB) w/ outlet structure. The temporary BMP's incorporated in the design include silt fencing. Each facility is described in detail below:

**Permanent BMP's**

*Sand Filter Basin w/ Outlet Structure*

The SFB providing 10-/100-yr detention was designed to collect and detain stormwater, allowing only historic runoff flows to proceed downstream. Water Quality Control Volume (WQCV) was also designed into the SFB to improve water quality by providing adequate time for sediment to be filtered out in the basin before being released downstream. The

SFB provides an 18-inch layer of filter material with an underdrain system that discharges into the outlet structure with a 0.35-inch orifice plate on the 4-inch underdrain pipe. The SFB will allow for partial infiltration and the stormwater that does not infiltrate is collected and removed by the underdrain system.

An outlet structure was integrated in the SFB to release the WQCV, 10-yr, and 100-yr storm event. The outlet structure design was based on a drain time of 12 hours for the WQCV. The 100-yr release rate is based on a drain time of 90% of the historic flow. This structure is comprised of a sloped inlet concrete box with 1.5-inch circular orifice and overflow weir including an outlet pipe with 3.75-inch circular orifice plate. A 15-inch RCP outlet pipe discharges flows off-site and into the East Fork Tributary.

When storm events greater than the 10-year event occurs (or when an event occurs, and the orifice is plugged) water will enter the outlet structure via an inlet grate at the top. An orifice plate located on the outlet pipe from the structure will not allow greater than 90% of the 100-year historic flows to exit.

An emergency spillway conveys storm events greater than 100-yr over the embankment of the sand filter basin and released into the East Fork Tributary.

The SFB will be constructed at the start of construction to be used during construction activities to control stormwater leaving the Site. Silt fencing, erosion control sock, and erosion control blankets, discussed further below, will be used to reduce sediment loadings to the SFB during construction and before permanent vegetation is established.

**Temporary BMP's**

*Silt Fencing*

Silt fencing is a temporary sediment barrier constructed of filter fabric stretched across supporting posts. The bottom edge of the fabric is entrenched and covered with backfill. Sediment must be periodically removed from behind the silt fence when it accumulates to half the fence height. Silt fencing shall be removed when adequate vegetative cover has been attained.

*Erosion Control Sock*

Erosion control sock are linear rolls made of natural materials such as straw, coconut fiber, or compost that are used as a sediment barrier to intercept sheet flow runoff from disturbed areas. In the case of the Rolling Hills Tank Site, erosion control socks will be used as check dams in the small drainage swales on-site to reduce sediment loading to the SFB during construction.

*Erosion Control Blanket*

Erosion control blankets are geotextiles or filter fabrics that are used to stabilize soils, steep slopes, and drainage channels. In the case of the Rolling Hills Tank Site, erosion control blankets will be used on all slopes with a 3:1 slope or greater, in drainage channels, and on SFB slopes. Blankets will require regular inspections to determine if fabric is damaged or has come loose, and appropriate repairs or replacement of damaged materials.

*Vehicle Tracking Control Pad*

Vehicle tracking refers to the stabilization of construction entrances, roads, parking areas, and staging areas to prevent the tracking of sediment from the construction site to improved areas. A vehicle tracking control pad is designed for this project at the entrance to the Site, and can remain in place after construction is completed, becoming a permanent BMP, if desired. The vehicle tracking control pad is comprised of coarse aggregate (stones or riprap), approximately 12 inches deep. Stones/riprap must be replaced as necessary to maintain its integrity.

Appendix B

# Standard Operating Procedures

for

# Inspection and Maintenance

# Sand Filter Basins (SFBs)

February 2021

Appendix B

# Standard Operation Procedures
for
# Inspection and Maintenance

# Sand Filter Basins (SFBs)

May 2008

CITY OF COLORADO SPRINGS

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## SFB-1 BACKGROUND

Sand Filter Basins (SFBs) are a common type of stormwater best management practice (BMP) utilized within the Front Range of Colorado. A SFB consists of a sedimentation chamber, a flat surfaced area of sand (sometimes covered with grass or sod), a filtration chamber, and a flat sand filter bed with an underdrain system. A surcharge zone exists within the sedimentation and filtration chambers for temporary storage of the Water Quality Capture Volume (WQCV). During a storm, runoff enters the sedimentation chamber, where the majority of sediments are deposited. The runoff then enters the filtration chamber where it ponds above the sand bed and gradually infiltrates into the underlying sand filter, filling the void spaces of the sand. The underdrain gradually dewaters the sand bed and discharges the runoff to a nearby channel, swale, or storm sewer. SFBs provide for filtering and absorption of pollutants in the stormwater[1]. The popularity of SFBs has grown because they allow the WQCV to be provided on a site that has little open area available for stormwater management. However, there are limitations on their use due to potential clogging from large amounts of sediment.

## SFB-2 INSPECTING SAND FILTER BASINS (SFBs)

### SFB-2.1 Access and Easements

Inspection and maintenance personnel may utilize the figures located in Appendix F containing the locations of the access points and potential maintenance easements of the SFBs within this development.

### SFB-2.2 Stormwater Best Management Practice (BMP) Locations

Inspection and maintenance personnel may utilize the figures located in Appendix F containing the locations of the SFBs within this development.

### SFB-2.3 Sand Filter Extended Detention Basin (SFB) Features

SFBs have a number of features that are designed to serve a particular function. Many times the proper function of one feature depends on another. It is important for maintenance personnel to understand the function of each of these features to prevent damage to any feature during maintenance operations. Below is a list and description of the most common features within a SFB and the corresponding maintenance inspection items that can be anticipated:

**TABLE SFB-1**
**Typical Inspection & Maintenance Requirements Matrix**

| | Sediment Removal | Mowing Weed control | Trash/ Debris Removal | Erosion | Overgrown Vegetation Removal | Removal/ Replacement | Structure Repair |
|---|---|---|---|---|---|---|---|
| **Inflow Points/Splitter Box** | X | | X | | | | X |
| **Sedimentation Chamber** | X | X | X | X | X | | |
| **Filter Media** | X | X | X | X | X | X | |
| **Underdrain System** | X | | | | | X | |
| **Overflow Outlet Works** | X | | X | | | | X |
| **Embankment** | | X | X | X | X | | |

[1] Design of Stormwater Filtering Systems, Centers for Watershed Protection, December 1996

SFB-2.3.1 Inflow Points/Splitter Box

Inflow points or outfalls into SFBs are the point of stormwater discharge into the facility. An inflow point is commonly a curb cut with a concrete or riprap rundown or a storm sewer pipe outfall with a flared end section.

SFBs are designed to treat only the WQCV. The WQCV is a volume of water that runs off a site during an 80$^{th}$ percentile event. Any amount over the WQCV is allowed to go to the storm sewer system without water quality treatment. The splitter box is generally constructed of reinforced concrete. The splitter box typically has a lower wall that has a height that will trap the required WQCV. Volumes over the WQCV are allowed to spill over the wall and enter a storm sewer system that often conveys the runoff to a regional detention facility. Proper inspection and maintenance of the splitter box is essential in ensuring the long-term operation of the SFB.

An energy dissipater is typically immediately downstream of the splitter box, at the discharge point into the SFB, to protect the sedimentation and filtration chambers from erosion. In some cases, the splitter box outfall can have a toe-wall or cut-off wall immediately below the structure to prevent undercutting of the outfall from erosion.

*The typical maintenance activities that are required at inflow points are as follows:*

*a. Riprap Displaced* – Many times, because of the repeated impact/force of water, the riprap can shift and settle. If any portion of the riprap apron appears to have settled, soil is present between the riprap, or the riprap has shifted, maintenance may be required to ensure future erosion is prevented.

*b. Sediment Accumulation* – Because of the turbulence in the water created by the energy dissipater, sediment often deposits immediately downstream of the inflow point. To prevent a loss in performance of the upstream infrastructure, sediment that accumulates in this area must be removed on a timely basis.

*c. Structural Damage* – Structural damage can occur at anytime during the life of the facility. Typically for an inflow, the structural damage occurs to the pipe flared end section (concrete or steel). Structural damage can lead to additional operating problems with the facility, including loss of hydraulic performance.

SFB-2.3.2 Sedimentation Chamber

The sedimentation chamber is located adjacent to the splitter box and generally consists of a flat irrigated turf grass area followed by a water trapping device that allows water to be briefly held in the sedimentation chamber before being released into the filtration chamber. This slowing of the runoff allows sediments to be deposited in the sedimentation chamber and not the filtration chamber where they can cause clogging of the filter media.

*The typical maintenance activities that are required within the sedimentation chamber are as follows:*

*a. Mowing/woody growth control/weeds present* - Routine mowing of the turf grass within the sediment chamber is necessary to improve the overall appearance and to ensure proper function of the SFB. Turf grass should be mowed to a height of 2 to 4-inches and shall be bagged to prevent potential contamination of the filter media. If undesirable vegetation is not routinely mowed/removed, the growth can cause debris/sediment to accumulate, resulting in blockage of the filter media. Also, shrub,

grass and weed roots can cause damage to the filter media and underdrain system. Routine management is essential to prevent more extensive and costly future maintenance.

SBF-2.3.3 Filter Media

The filter media is the main pollutant removal component of the SFB. The filter media consists of 18-inches of washed sand. 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. This slow release allows for sediment particles that were not deposited in the sedimentation chamber to be deposited on the top layer of the filter media where they are easily removed through routine maintenance. Other pollutants are also removed through this process because they are attached to sediment.

Filtration is the main pollutant removal mechanism of SFBs. When the stormwater runoff migrates down through the filter media, many of the particulate pollutants are physically strained out as they pass through the filter bed of sand and are trapped on the surface or among the pores of the filter media.

SFBs that are not lined with an impervious liner allow for infiltration into the native soils. This process also allows for additional pollutant removal.

Microbes that naturally occur in the filter media can assist with pollutant removal by breaking down organic pollutants.

*The typical maintenance activities that are required within the filter media areas are as follows:*

*a. Mowing/woody growth control/weeds present* - Noxious weeds and other unwanted vegetation must be treated as needed throughout the SFB. This activity can be performed either through mechanical means (mowing/pulling) or with herbicide. Consultation with a local Weed Inspector is highly recommended prior to the use of herbicide. Herbicides should be utilized sparingly and as a last resort. All herbicide applications should be in accordance with the manufacturer's recommendations.

*b. Sediment/Pollutant Removal* – Although SFBs should not be utilized in areas where large concentrations of sediment and other pollutants will enter the SFB, it is inevitable that some sediment and other pollutants will enter the SFB. Most sediment will be deposited in the sedimentation chamber, however finer suspended particles will migrate to the filter media. These sediments need to be removed to ensure proper infiltration rates of the stormwater runoff.

*c. Filter Replacement* - The top layers of the filter media are the most susceptible to pollutant loading and therefore may need to be removed and disposed of properly on a semi-regular basis when infiltration rates slow.

*d. Infiltration Rate Test* - An infiltration test may be necessary to ensure proper functioning of the filter media. The infiltration test can be conducted by filling the sand filter with water to the elevation of the overflow wall in the splitter box. The sand filter needs to drain completely within 40-hours of the filling. If the drain time for the basin is longer than 40-hours, the filter is in need of maintenance.

SFB-2.3.4 Underdrain System

The underdrain system consists of a layer of geotextile fabric, gravel storage area and perforated PVC pipes. The geotextile fabric is utilized to prevent the filter media from entering the underdrain system. The gravel storage area allows for storage of treated stormwater runoff prior to the discharge of the runoff through the perforated PVC pipe.

*The typical maintenance activities that are required for the underdrain system are as follows:*

With proper maintenance of the filter media and sediment chamber, there should be a minimum amount of maintenance required on the underdrain system. Generally, the only maintenance performed on the underdrain system is jet-vac cleaning.

SFB-2.3.5 Overflow Outlet Works

Some SFBs include an overflow outlet works in place of the splitter box. The overflow outlet works allows runoff amounts that exceed the WQCV to exit the SFB to the detention facility. The outlet works is typically constructed of reinforced concrete into the embankment of the SFB. The concrete structure typically has steel orifice plates anchored/embedded into it to control stormwater release rates. The larger openings (flood control) on the outlet structure typically have trash racks over them to prevent clogging. Proper inspection and maintenance of the outlet works is essential in ensuring the long-term operation of the SFB.

*The typical maintenance activities that are required for the overflow outlet works are as follows:*

*a. Structural Damage* - The overflow outlet structure is primarily constructed of concrete, which can crack, spall, and settle. The steel grate on the overflow outlet structure is also susceptible to damage.

*b. Mowing/woody growth control/weeds present* – The presence of plant material not part of the original landscaping, such as wetland plants or other woody growth, can clog the overflow outlet works during a larger storm event, causing flooding damage to adjacent areas. This plant material may indicate a clogging of the filter media and may require additional investigation.

SFB-2.3.6 Embankments

Some SFBs utilize irrigated turf grass embankments to store the WQCV.

*The typical maintenance activities that are required for the embankments areas are as follows:*

*a. Vegetation Sparse* – The embankments are one of the most visible parts of the SFB and, therefore, aesthetics is important. Adequate and properly maintained vegetation can greatly increase the overall appearance of the SFB. Also, vegetation can reduce the potential for erosion and subsequent sediment transport to the filter media, thereby reducing the need for more costly maintenance.

*b. Erosion* – Inadequate vegetative cover may result in erosion of the embankments. Erosion that occurs on the embankments can cause clogging of the filter media.

*c. Trash/Debris* – Trash and debris can accumulate in the upper area after large events, or from illegal dumping. Over time, this material can clog the SFB filter media and outlet works.

*d. Mowing/woody growth control/weeds present* – The presence of plant material not part of the original landscaping, such as wetland plants or other woody growth, can result in difficulty in performing maintenance activities. These trees and shrubs may also damage the underdrain system of the SFB. This plant material may indicate a clogging of the filter media and may require additional investigation.

SFB-2.3.7 Emergency Overflow

An emergency spillway is typical of all SFBs and designed to serve as the overflow in the event the volume of the pond is exceeded. The emergency spillway is typically armored with riprap (or other hard armor), and is sometimes buried with soil or may be a concrete wall or other structure. The emergency spillway is typically a weir (notch) in the basin embankment. Proper function of the emergency spillway is essential to ensure flooding does not affect adjacent properties.

*The typical maintenance activities that are required for the emergency overflow areas are as follows:*

*a. Riprap Displaced* – As mentioned before, the emergency spillway is typically armored with riprap to provide erosion protection. Over the life of an SFB, the riprap may shift or become dislodged due to flow.

*b. Erosion Present* – Although the spillway is typically armored, stormwater flowing through the spillway can cause erosion damage. Erosion must be repaired to ensure the integrity of the basin embankment, and proper function of the spillway.

*c. Mowing/weed/woody growth control* – Management of woody vegetation is essential in the proper long-term function of the spillway. Larger trees or dense shrubs can capture larger debris entering the SFB and reduce the capacity of the spillway. These trees and shrubs may also damage the underdrain system of the SFB.

*d. Obstruction/Debris* – The spillway must be cleared of any obstruction (man made or natural) to ensure the proper design capacity.

SFB-2.3.8 Miscellaneous

There are a variety of inspection/maintenance issues that may not be attributed to a single feature within the SFB. This category on the inspection form is for maintenance items that are commonly found in the SFB, but may not be attributed to an individual feature.

*a. Access* – Access needs to be maintained.

*b. Graffiti/Vandalism* – Vandals can cause damage to the SFB infrastructure. If criminal mischief is evident, the inspector should forward this information to the local emergency agency.

*c. Public Hazards* – Public hazards include items such as vertical drops of greater than 4-feet, containers of unknown/suspicious substances, and exposed metal/jagged concrete on structures. **If any hazard is found within the facility**

**area that poses an immediate threat to public safety, contact the local emergency services at 911 immediately.**

*d. Other* – Any miscellaneous inspection/maintenance items not contained on the form should be entered here.

### SFB-2.4 Inspection Forms

SFB Inspection forms are located in Appendix C. Inspection forms shall be completed by the person(s) conducting the inspection activities. Each form shall be reviewed and submitted by the property owner or property manager to the City of Colorado Springs/Stormwater Team per the requirements of the Inspection and Maintenance Plan. These inspection forms shall be kept a minimum of 5 years and made available to the City of Colorado Springs upon request.

## SFB-3 MAINTAINING SAND FILTER BASINS (SFBs)

### SFB-3.1 Maintenance Personnel

Maintenance personnel should be qualified to properly maintain SFBs. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

### SFB-3.2 Equipment

It is imperative that the appropriate equipment and tools are taken to the field with the operations crew. The types of equipment/tools will vary depending on the task at hand. Below is a list of tools, equipment, and material(s) that may be necessary to perform maintenance on a SFB:

1.) Mowing Tractors
2.) Trimmers (extra string)
3.) Shovels
4.) Rakes
5.) All Surface Vehicle (ASVs)
6.) Skid Steer
7.) Back Hoe
8.) Track Hoe/Long Reach Excavator
9.) Dump Truck
10.) Jet-Vac Machine
11.) Engineers Level (laser)
12.) Riprap (Minimum - Type M)
13.) Geotextile Fabric
14.) Erosion Control Blanket(s)
15.) Sod
16.) Illicit Discharge Cleanup Kits
17.) Trash Bags
18.) Tools (wrenches, screw drivers, hammers, etc)
19.) Confined Space Entry Equipment
20.) Approved Inspection and Maintenance Plan

21.) ASTM C-33 Sand

Some of the items identified above may not be needed for every maintenance operation. However, this equipment should be available to the maintenance operations crews should the need arise.

### SFB-3.3 Safety

Vertical drops may be encountered in areas located within and around the SFB. Avoid walking on top of retaining walls or other structures that have a significant vertical drop. If a vertical drop is identified that is greater than 48-inches in height, make the appropriate note/comment on the maintenance inspection form.

### SFB-3.4 SFB Maintenance Forms

The SFB Maintenance Form provides a record of each maintenance operation performed by maintenance contractors. The SFB Maintenance Form shall be filled out in the field after the completion of the maintenance operation. Each form shall be reviewed and submitted by the property owner or property manager to the City of Colorado Springs/Stormwater Team per the requirements of the Inspection and Maintenance Plan. The SFB Maintenance form is located in Appendix D.

### SFB-3.5 SFB Maintenance Categories and Activities

A typical SFB Maintenance Program will consist of three broad categories of work: Routine, Minor and Major. Within each category of work, a variety of maintenance activities can be performed on a SFB. A maintenance activity can be specific to each feature within the SFB, or general to the overall facility. This section of the SOP explains each of the categories and briefly describes the typical maintenance activities for a SFB.

A variety of maintenance activities are typical of SFBs. The maintenance activities range in magnitude from routine trash pickup to the reconstruction of the SFB filter media or underdrain system. Below is a description of each maintenance activity, the objectives, and frequency of actions:

### SFB-3.6 Routine Maintenance Activities

The majority of this work consists of scheduled mowings, trash and debris pickups for the SFB during the growing season. It also includes activities such as weed control. These activities normally will be performed numerous times during the year. These items typically do not require any prior correspondence with the City, however, completed inspection and maintenance forms shall be submitted to the City of Colorado Springs/Stormwater Team for each inspection and maintenance.

The Routine Maintenance Activities are summarized below, and further described in the following sections.

**TABLE SFB-2**
**Summary of Routine Maintenance Activities**

| Maintenance Activity | Minimum Frequency | Look for: | Maintenance Action |
|---|---|---|---|
| | | | |
| **Mowing** | Twice annually | Excessive grass height/aesthetics | 2”-4” grass height |
| **Trash/Debris Removal** | Twice annually | Trash/debris in SFB | Remove and dispose of trash and debris |

| | | | |
|---|---|---|---|
| **Splitter Box/Overflow Outlet Works Cleaning** | As needed - after significant rain events – twice annually minimum | Clogged outlet structure; ponding water | Remove and dispose of debris/trash/sediment to allow outlet to function properly |
| **Woody growth control /Weed removal** | Minimum twice annually | Noxious weeds; Unwanted vegetation | Treat w/herbicide or hand pull; consult a local Weed Inspector |

SFB-3.6.1 Mowing

Routine mowing of the turf grass embankments and turf grass located in the sedimentation chamber is necessary to improve the overall appearance of the SFB and ensure proper performance of the sediment chamber. Turf grass should be mowed to a height of 2 to 4-inches and shall be bagged to prevent potential contamination of the filter media.

*Frequency* – Routine - Minimum of twice annually or depending on aesthetics.

SFB-3.6.2 Trash/Debris Removal

Trash and debris must be removed from the entire SFB area to minimize outlet clogging and to improve aesthetics. This activity must be performed prior to mowing operations.

*Frequency* – Routine – Prior to mowing operations and minimum of twice annually.

SFB-3.6.3 Splitter Box/Overflow Outlet Works Cleaning

Debris and other materials can clog the splitter box/overflow outlet work's grate. This activity must be performed anytime other maintenance activities are conducted to ensure proper operation.

*Frequency* - Routine – After significant rainfall event or concurrently with other maintenance activities.

SFB- 3.6.4 Woody Growth Control/Weed Removal

Noxious weeds and other unwanted vegetation must be treated as needed throughout the SFB. This activity can be performed either through mechanical means (mowing/pulling) or with herbicide. Consultation with a local County Weed Inspector is highly recommended prior to the use of herbicide. Herbicides should be utilized sparingly and as a last resort. All herbicide applications should be in accordance with the manufacturer's recommendations.

*Frequency* – Routine – As needed based on inspections.

**SFB-3.7 Restoration Maintenance Activities**

This work consists of a variety of isolated or small-scale maintenance/operational problems. Most of this work can be completed by a small crew, hand tools, and small equipment. These items do not require prior approval from the City.

Completed inspection and maintenance forms shall be submitted to City of Colorado Springs/Stormwater Team for each inspection and maintenance period. In the event that the SFB needs to be dewatered, care should be given to ensure sediment, filter material and other pollutants are not discharged. All dewatering activities shall be appropriately permitted.

**TABLE SFB-3**
**Summary of Restoration Maintenance Activities**

| Maintenance Activity | Minimum Frequency | Look for: | Maintenance Action |
|---|---|---|---|
| | | | |
| **Sediment/Pollutant Removal** | As needed; typically every 1 –2 years | Sediment build-up in sedimentation chamber and filter media; decrease in infiltration rate | Remove and dispose of sediment |
| **Erosion Repair** | As needed, based upon inspection | Rills/gullies on embankments or sedimentation in the forebay | Repair eroded areas & revegetate; address cause |
| **Jet-Vac/Cleaning Underdrains** | As needed, based upon inspection | Sediment build-up /non-draining system | Clean drains; Jet-Vac if needed |

SFB-3.7.1 Sediment Removal/Pollutant Removal

Sediment removal is necessary to ensure proper function of the filter media. The infiltration rate of the SFB needs to be checked in order to ensure proper functioning of the SFB. A SFB should drain completely within 12-hours of a storm event. If drain times exceed the 12-hour drain time than maintenance of the filter media shall be required.

At a minimum, the top 3-inches of filter media should be removed at each removal period. Additional amounts of filter media may need to be removed if deeper sections of the filter media are contaminated. New filter media will need to be placed back into the SFB when the total amount of sand removed reaches 9-inches. This may take multiple maintenance events to accomplish. It is critical that only sand that meets the American Society for Testing and Materials (ASTM) C-33 standard be utilized in the replacement of the filter media.

ASTM C-33 Sand Standard

| **US Standard Sieve Size (Number)** | **Total Percent Passing (%)** |
|---|---|
| 9.5 mm (3/8 inch) | 100 |
| 4.75 mm (No. 4) | 95-100 |
| 2.36 mm (No. 8) | 80-100 |
| 1.18 mm (No. 16) | 50-85 |
| 600□m (No. 30) | 25-60 |
| 300□m (No. 50) | 10-30 |
| 150□m (No. 100) | 2-10 |

Other types of sand and soil material may lead to clogging of the SFB. The minor sediment removal activities can typically be addressed with shovels, rakes and smaller equipment. Major sediment removal activities will require larger and more specialized equipment. Extreme care should be taken when utilizing motorized or heavy equipment to ensure damage to the underdrain system does not occur. The major sediment removal activities will also require surveying with an engineer's level, and consultation with the City's Engineering staff to ensure design volumes/grades are achieved.

Stormwater sediments removed from SFBs do not meet the regulatory definition of "hazardous waste". However, these sediments can be contaminated with a wide array of organic and inorganic pollutants and handling must be done with care to ensure proper removal and disposal. Sediments should be transported by motor vehicle only after they are dewatered. All sediments must be taken to a licensed landfill for proper disposal. Should a spill occur during transportation, prompt and thorough cleanup and disposal is imperative.

*Frequency* – Non-routine – As necessary, based upon inspections. Sediment removal in the sedimentation chamber may be necessary as frequently as every 1-2 years.

SFB-3.7.2 Erosion Repair

The repair of eroded areas is necessary to ensure the proper functioning of the SFB, to minimize sediment transport, and to reduce potential impacts to other features. Erosion can vary in magnitude from minor repairs to filter media and embankments, to rills, and gullies in the embankments and inflow points. The repair of eroded areas may require the use of excavators, earthmoving equipment, riprap, concrete, and sod. Extreme care should be taken when utilizing motorized or heavy equipment to ensure damage to the underdrain

system does not occur. Major erosion repair to the pond embankments, spillways, and adjacent to structures will require consultation with the City's Engineering staff.

*Frequency* – Non-routine – As necessary, based upon inspections.

SFB-3.7.3 Jet-Vac/Clearing Drains

A SFB contains an underdrain system that allows treated stormwater runoff to exit the facility. These underdrain systems can develop blockages that can result in a decrease of hydraulic capacity and also create standing water. Many times the blockage to this infrastructure can be difficult to access and/or clean. Specialized equipment (jet-vac machines) may be necessary to clear debris from these difficult areas.

*Frequency* – Non-routine – As necessary, based upon inspections.

**SFB-3.8 Rehabilitation Maintenance Activities**

This work consists of larger maintenance/operational problems and failures within the stormwater management facilities. All of this work requires approval from the City's Engineering staff to ensure the proper maintenance is performed. This work requires that Engineering staff review the original design and construction drawings to assess the situation and assign the necessary maintenance activities. This work may also require more specialized maintenance equipment, design/details, surveying, or assistance through private contractors and consultants. In the event that the basin needs to be dewatered, care should be given to ensure sediment, filter material and other pollutants are not discharged. Proper permitting is required prior to any dewatering activity.

**TABLE SFB-4**
**Summary of Rehabilitation Maintenance Activities**

| Maintenance Activity | Minimum Frequency | Look for: | Maintenance Action |
|---|---|---|---|
| | | | |
| **Major Sediment/Pollutant Removal** | As needed – based upon scheduled inspections | Large quantities of sediment in the sedimentation chamber and/or filter media; reduced infiltration rate /capacity | Remove and dispose of sediment. Repair vegetation as needed |
| **Major Erosion Repair** | As needed – based upon scheduled inspections | Severe erosion including gullies, excessive soil displacement, areas of settlement, holes | Repair erosion – find cause of problem and address to avoid future erosion |
| **Structural Repair** | As needed – based upon scheduled inspections | Deterioration and/or damage to structural components – broken concrete, damaged pipes & outlet works | Structural repair to restore the structure to its original design |
| **SFB Rebuild** | As needed – due to complete failure of SFB | Removal of filter media and underdrain system | Contact City Engineering |

SFB-3.8.1 Major Sediment/Pollutant Removal

In very rare cases the filter media of the SFB may be contaminated so badly that the entire 18-inches of the filter media may need to be removed.

Major sediment/pollutant removal consists of removal of large quantities of sediment/filter media. Extreme care should be taken when utilizing motorized or heavy equipment to ensure damage to the underdrain system does not occur. The sediment/filter media needs to be carefully removed, transported and properly disposed. Vegetated areas need special care to ensure design volumes and grades are preserved or may need to be replaced due to the removal activities. Stormwater sediments removed from SFBs do not meet the regulatory definition of "hazardous waste". However, these sediments can be contaminated with a wide array of organic and inorganic pollutants and handling must be done with care to insure proper removal and disposal. Sediments should be transported by motor vehicle only after they are dewatered. All sediments must be taken to a licensed landfill for proper disposal. Should a spill occur during transportation, prompt and thorough cleanup and disposal is imperative.

*Frequency* – Non-routine – Repair as needed, based upon inspections.

SFB-3.8.2 Major Erosion Repair

Major erosion repair consists of filling and revegetating areas of severe erosion. Determining the cause of the erosion as well as correcting the condition that caused the erosion should also be part of the erosion repair. Care should be given to ensure design grades and volumes are preserved. Extreme care should be taken when utilizing motorized or heavy equipment to ensure damage to the underdrain system does not occur.

*Frequency* – Non-routine – Repair as needed, based upon inspections.

SFB-3.8.3 Structural Repair

A SFB generally includes a splitter box or concrete overflow outlet structure that can deteriorate or be damaged during the service life of the facility. These structures are constructed of steel and concrete that can degrade or be damaged and may need to be repaired or re-constructed from time to time. Major repairs to structures may require input from a structural engineer and specialized contractors. Consultation with the City's Engineering staff shall take place prior to all structural repairs.

*Frequency* – Non-routine – Repair as needed, based upon inspections.

SFB-3.8.4 SFB Rebuild

In very rare cases a SFB may need to be rebuilt. Generally, the need for a complete rebuild is a result of improper construction, improper maintenance resulting in structural damage to the underdrain system, or extensive contamination of the SFB. Consultation with the City's Engineering staff shall take place prior to any rebuild project.

*Frequency* – Non-routine – As needed, based upon inspections.

# APPENDIX C

**SAND FILTER BASIN (SFB)**
**INSPECTION FORM**

Date:_____

Inspector: _____

Subdivision/Business Name:_____

Subdivision/Business Address:_____

Weather:_____

Date of Last Rainfall:_____ Amount:_____Inches

**Property Classification:** Residential Multi Family Commercial Other:_____
(Circle One)

**Reason for Inspection:** Routine Complaint After Significant Rainfall Event
(Circle One)

**INSPECTION SCORING** – For each facility inspection item, insert one of the following scores:
0 = No deficiencies identified
1 = Monitor (potential for future problem)
2 = Routine maintenance required
3 = Immediate repair necessary
N/A = Not applicable

**FEATURES**

**1.) Inflow Points/Splitter Box**
- ____Riprap Displaced
- ____Sediment Accumulation
- ____Structural Damage (pipe, end-section, etc.)
- ____Trash/Debris

**2.) Sedimentation Chamber**
- ____Mowing/weed/woody growth control
- ____Erosion Present
- ____Trash/Debris
- ____Sediment Accumulation

**3.) Filter Media**
- ____Mowing/weed/woody growth control
- ____Sediment/Pollutant Removal
- ____Filter Replacement
- ____Infiltration Rate Check

**4.) Underdrain System**
- ____Evidence of clogged system (jet-vac cleaning required)

**5.) Outlet Works**
- ____Structural Damage (concrete, steel, subgrade)
- ____Mowing/weed/woody growth control

**6.) Embankments**
- ____Vegetation Sparse
- ____Erosion Present
- ____Trash/Debris
- ____Mowing/weed/woody growth control

**7.) Emergency Overflow**
- ____Riprap Displaced
- ____Erosion Present
- ____Woody Growth/Weeds Present
- ____Obstruction/Debris

**8.) Miscellaneous**
- ____Encroachment in Easement Area
- ____Graffiti/Vandalism
- ____Public Hazards
- ____Other

Inspection Summary / Additional Comments:_____

**OVERALL FACILITY RATING (Circle One)**

0 = No Deficiencies Identified
1 = Monitor (potential for future problem exists)
2 = Routine Maintenance Required
3 = Immediate Repair Necessary

This inspection form shall be kept a minimum 5 years and made available to the County upon request.

# APPENDIX D

**SAND FILTER BASIN (SFB)**
**MAINTENANCE FORM**

Subdivision/Business Name:_____ Completion Date:_____
Subdivision/Business Address:_____ Contact Name:_____

**Maintenance Category:** Routine Restoration Rehabilitation
(Circle All That Apply)

**Reason for Inspection:** Routine Complaint After Significant Rainfall Event
(Circle One)

## MAINTENANCE ACTIVITIES PERFORMED

### ROUTINE WORK

____ MOWING
____ TRASH/DEBRIS REMOVAL
____ OUTLET WORKS CLEANING (TRASH RACK/WELL SCREEN)
____ WEED CONTROL (HERBICIDE APPLICATION)

### RESTORATION WORK

_____ SEDIMENT REMOVAL
- _____ INFLOW POINT/SPLITTER BOX
- _____ OUTLET WORKS
- _____ FILTER MEDIA
- _____ SEDIMENTATION CHAMBER
- _____ EMERGENCY OVERFLOW

_____ EROSION REPAIR
- _____ INFLOW POINTS/SPLITTER BOX
- _____ OUTLET WORKS
- _____ EMBANKMENTS
- _____ SEDIMENTATION CHAMBER
- _____ EMERGENCY OVERFLOW
- _____ FILTER MEDIA

_____ VEGETATION REMOVAL/TREE THINNING
- _____ INFLOW(S)
- _____ TRICKLE CHANNEL
- _____ UPPER STAGE
- _____ BOTTOM STAGE

_____ REVEGETATION
_____ JET-VAC/CLEARING DRAINS
- _____ INFLOWS
- _____ OUTLET WORKS
- _____ UNDERDRAIN

### REHABILITATION WORK

_____SEDIMENT REMOVAL (DREDGING)
- _____FILTER MEDIA
- _____SEDIMENTATION CHAMBER

_____EROSION REPAIR
- _____INFLOW POINT/SPILTTER BOX
- _____OUTLET WORKS
- _____EMBANKMENTS
- _____SEDIMENTATION CHAMBER
- _____EMERGENCY OVERFLOW
- _____FILTER MEDIA

_____STRUCTURAL REPAIR
- _____INFLOW POINT/SPLITTER BOX
- _____OUTLET WORKS
- _____FILTER MEDIA
- _____SEDIMENTATION CHAMBER
- _____EMERGENCY OVERFLOW

OTHER_____

_____

ESTIMATED TOTAL MANHOURS: _____

COSTS INCURRED (include description of costs):_____

EQUIPMENT/MATERIAL USED (include hours of equipment usage and quantity of material used):

_____

_____

COMMENTS/ADDITIONAL INFO:_____

_____

This Maintenance Activity Form shall be kept a minimum of 5 years and made available to the County upon request.

# Appendix E

## As-Built Plans

(When Complete)

# Appendix F

## Civil Engineer
## Stormwater Best Management Practice (permanent) Certification Letter

02/08/2021

Attn.: EPC Review Engineer

To Whom it May Concern:

The permanent stormwater Best Management Practices (BMPs) for *Widefield Water and Sanitation District – Rolling Hills 2MG Potable Water Storage Tank south of Drennan Road in Colorado Springs, CO* consist of *silt fencing, revegetation and mulching, and a sand filter basin.*

*JDS-Hydro Consultants, Inc.* has reviewed the site to ensure it is in compliance with the approved BMP's for this project. Based upon this information and information gathered during periodic site visits to the project during significant/key phases of the stormwater BMP installation, *JDS-Hydro* is of the opinion that the stormwater BMPs have been constructed in general compliance with the approved Erosion and Stormwater Quality Control Plan, Construction Plans, and Specifications as filed with the County.

**Statement Of Engineer In Responsible Charge:**

I, Gwen J. Dall, a registered Professional Engineer in the State of Colorado, in accordance with Sections 5.2 and 5.3 of the Bylaws and Rules of the State Board of Registration for Professional Engineers and Professional Land Surveyors, do hereby certify that I or a person under my responsible charge periodically observed the construction of the above mentioned project. Based on the on-site field observations and review of pertinent documentation, it is my professional opinion that the required permanent BMPs have been installed and are in general compliance with the approved Erosion and Stormwater Quality Control Plan, Construction Plans, and Specifications as filed with the of County. For BMPs with a Water Quality Capture Volume (WQCV), I have attached the post-construction As-Built drawings. The As-Built drawings accurately depict the final installation of the stormwater BMPs and verify the WQCV.

*Gwen J Dall, P.E.*
Colorado No. 51810 *Seal & Signature*