Stormwater Management Facility
Operation and Maintenance (O&M) Manual

for:

Villas at Aspen Trails

Located at:
SE Corner of Bradley Rd and Legacy Hill Dr
El Paso County, Colorado

Prepared for:

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I. Compliance with Stormwater Facility Maintenance Requirements

All property owners are responsible for ensuring that stormwater 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. Maintenance agreement(s) associated with this property are provided in Appendix A.

II. Inspection & Maintenance- Annual Reporting

Requirements for the inspection and maintenance of stormwater facilities, as well as reporting requirements are included in this Stormwater Management Facility Operation and Maintenance (O&M) Manual.

Verification that the Stormwater facilities have been properly inspected and maintained; submittal of the required Inspection and Maintenance Forms and Inspector qualifications shall be provided to Waterview III Metro District on an annual basis. The annual reporting form shall be provided to Waterview III Metro District prior to May 31st of each year.

Copies of the Inspection and Maintenance forms for each of the stormwater facilities are located in Appendix D and E. A standard annual reporting form is provided in Appendix F. Each form shall be reviewed and submitted by the property owner or property manager to Waterview III Metro District.

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 in the first place. Common pollutants include sediment, trash & debris, chemicals, dog 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 disposal of hazardous wastes and chemicals.
- Plan lawn care to minimize the use of 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.
- Re-vegetate disturbed and bare areas to maintain vegetative stabilization.

- Clean out the upstream components of the storm drainage system, including inlets, storm sewers and outfalls.
- Do not store materials outdoors (including landscaping materials) unless properly protected from runoff.

IV. Access and Easements

All stormwater management facilities located on the site have both a designated access location as well as a maintenance easement. Refer to the Stormwater Facilities Map located in Appendix G for access and easement locations.

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 or equipment. A confined space should never be entered without at least one additional person present.

If a toxic or flammable substance is discovered, leave the immediate area and contact the local Sheriff at 911.

Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas must be referred to the local Sheriff's Office immediately for response by the Hazardous Materials Unit. The emergency contact number is 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 identified within the pond that 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 the local Sheriff's Office 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 Management Facilities:

- Protective clothing and boots.
- Safety equipment (vest, hard hat, confined space entry equipment).
- Communication equipment.
- Operation and Maintenance Manual for the site including stormwater management facility location maps.
- Clipboard.
- Stormwater Facility Maintenance Inspection Forms (See Appendix D).

- 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). However, this equipment should be available in the vehicle driven to the site.

VII. Inspecting Stormwater Management Facilities

The quality of stormwater entering the waters of the state relies heavily on the proper operation and maintenance of permanent best management practices. Stormwater management facilities 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 management facilities are required to be inspected by a qualified individual at a minimum of once per year. Inspections should follow the inspection guidance found in the SOP for the specific type of facility. (Appendix C of this manual).

B. Inspection Report

The person(s) conducting the inspection activities shall complete the appropriate inspection report for the specific facility. Inspection reports are located in Appendix D.

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 should 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 (See SOP in appendix A). 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 Management Facility Inspection Form provides a record of inspection of the facility. Inspection Forms for each facility type are provided in Appendix D. Verification of the inspection of the stormwater facilities, the facility inspection form(s), and Inspector Qualifications shall be provided to Waterview III Metro District on an annual basis. The verification and the inspection form(s) shall be reviewed and submitted by the property owner or property manager.

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

VIII. Maintaining Stormwater Management Facilities

Stormwater management facilities 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 management facility maintenance programs are separated into three broad categories of work. These categories are based largely on the Urban Drainage and Flood Control District's Maintenance Program for regional drainage facilities. 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 mowings 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 Waterview III Metro District; however, completed inspection and maintenance forms shall be submitted Waterview III Metro District for each inspection and maintenance activity.

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 require prior correspondence with Waterview III Metro District and require that completed maintenance forms be submitted to Waterview III Metro District for each maintenance activity.

Rehabilitation Work

This work consists of large-scale maintenance and major improvements needed to address failures within the stormwater management facilities. This work requires consultation with Waterview III Metro District and may require an engineering design with construction plans to be prepared for review and approval. 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 Waterview III Metro District and require that completed maintenance forms be submitted to Waterview III Metro District for each maintenance activity.

B. Maintenance Personnel

Maintenance personnel must be qualified to properly maintain stormwater management facilities. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

C. Maintenance Forms

The Stormwater Management Facility Maintenance Form provides a record of maintenance activities. Maintenance Forms for each facility type are provided in Appendix E. Maintenance Forms shall be completed by the 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 to the Southeast Metro Stormwater Authority.

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

Confirm that this agreement is for this site.
This isn't the detention maintenance agreement that we need between a site rep and EPC.

W3MD Case No. _____
City/County Case No. _____

STORMWATER FACILITY MAINTENANCE AGREEMENT

This Stormwater Maintenance Agreement is entered into by and between the WATERVIEW III METRO DISTRICT ("W3MD") and ROS Equity Holdings-Independence, LLC (the "Owner").

RECITALS

WHERAS, ROS Equity Holdings-Independence, LLC is the Owner of that certain parcel of land known as:

A TRACT OF LAND LOCATED IN A PORTION OF SECTION 9, IN TOWNSHIP 15 SOUTH, RANGE 65 WEST OF THE 6TH P.M., EL PASO COUNTY, COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTH 1/4 CORNER OF SAID SECTION 9;

THENCE S00°19'32"E, ALONG THE NORTH-SOUTH CENTERLINE OF SAID SECTION 9, A DISTANCE OF 1612.07 FEET TO A POINT ON THE SOUTHERLY R.O.W. LINE OF BRADLEY ROAD AS RECORDED IN BOOK 5307 AT PAGE 1472 OF THE RECORDS OF SAID EL PASO COUNTY:
THE FOLLOWING 3 COURSES ARE ALONG THE SAID SOUTHERLY R.O.W. LINE OF BRADLEY ROAD.

1) THENCE S89°30'29"W A DISTANCE OF 3.78 FEET TO A POINT OF CURVE TO THE LEFT;

2) THENCE ON SAID CURVE, HAVING A RADIUS OF 2759.79 FEET, AN ARC LENGTH OF 730.29 FEET, A DELTA ANGLE OF 15°09'41", WHOSE LONG CHORD BEARS S81°55'38"W A DISTANCE OF 728.16 FEET;

3) THENCE S74°20'48"W A DISTSNCE OF 385.14 FEET TO THE POINT OF BEGINNING;

THENCE S15°39'12"E DEPARTING SAID RIGHT-OF-WAY LINE, A DISTANCE OF 449.99 FEET;

THENCE S74°20'48"W A DISTANCE OF 160.21 FEET;

THENCE N15°39'12"W A DISTANCE OF 20.00 FEET;

THENCE S74°20'48"W A DISTANCE OF 199.80 FEET TO A POINT OF CURVE TO THE RIGHT;

THENCE ON SAID CURVE, HAVING A RADIUS OF 75.00 FEET, AN ARC LENGTH OF 78.64 FEET, A DELTA ANGLE OF 60°04'25", WHOSE LONG CHORD BEARS N75°37'00"W A DISTANCE OF 75.08 FEET;

THENCE N15°39'12"W A DISTANCE OF 392.40 FEET, RETURNING TO SAID SOUTHERLY R.O.W. LINE OF BRADLEY ROAD;

THENCE S74°20'48"W, ALONG SAID SOUTHERLY R.O.W. LINE OF BRADLEY ROAD, A DISTANCE OF 425.01 FEET TO THE POINT OF BEGINNING.

referred to as the “Property”; and

WHEREAS, W3MD requires that the Facilities shown on the Development Plan be constructed and adequately maintained by the Owner; and

WHEREAS, W3MD has required that the Owner submit an Operation and Maintenance Manual as specified in the El Paso County Stormwater Management Manual, hereinafter referred to as the “O&M Manual,”

NOW THEREFORE, in consideration of mutual benefits and other good and valuable consideration, the receipt and sufficiency or which are hereby acknowledged, the parties agree as follows:

AGREEMENT

1. The Owner shall provide maintenance for all the facilities as described on the Plan to ensure that the Facilities are and remain in proper working condition in accordance with the El Paso County Stormwater Management Manual, and other applicable W3MD approved standards, and applicable legal requirements. Maintenance shall include routine landscaping, sediment removal, repair, reconstruction, or replacement of the Facilities as necessary to meet the requirements of this Agreement.

2. The maintenance of the Facilities shall be performed in accordance with the O&M Manual for the specified facility. In the event that an O&M does not exist, the Owner will be required to prepare one in accordance with the specifications set forth in the El Paso County Stormwater Management Manual, and submit to W3MD for recommendation of approval by the County/City.

3. The Owner shall cause inspections on the facilities to be conducted as follows:

    A. The Owner agrees to cause inspection of the facilities, at the Owner’s expense, by a person experienced in the inspection of stormwater facilities. Inspections shall occur at least once every calendar year.

    B. An inspection report shall be submitted in writing to W3MD prior to January15th of each year for the Facilities. The inspection report shall be in accordance with the requirements set forth in the O&M Manual.

C. The Owner agrees to perform promptly all needed maintenance and report maintenance activities in accordance with the requirements set forth in the O&M Manual.

4. The Owner, hereby, grants, bargains and conveys to W3MD and its agents easements over the property for access from public rights-of-way, abutting private roadway, and/or private driveway, to the facilities for the purpose of inspecting, operating, installing, constructing, reconstructing, maintaining, repairing or replacing Facilities to the extent that Owner fails to do so and as necessary to ensure their proper working condition as provided in paragraphs one and two above.

5. In the event the Owner fails to inspect, report, or properly maintain the Facilities within fourteen (14) days after written notice by W3MD of such deficiencies to the owner, W3MD may enter upon the property and take whatever steps it deems necessary to maintain the Facilities. However, if the Owner's failures could cause damage to property, loss of life or a violation of a NPDES MS4 Permit, W3MD may take immediate action, without notice to the Owner, to alleviate that failure. It is expressly understood and agreed that W3MD is under no obligation to maintain or repair the Facilities and in no event shall this Agreement be considered to impose any such obligation on W3MD.

6. The Owner agrees that it will not at any time dedicate the Facilities to the public, to public use or to W3MD without W3MD's written consent, nor will it subdivide or convey the property without covenant providing that a proportionate share of the cost of maintenance and other costs associated with other of the obligations and duties contained herein runs with each subdivided part of the original tract or parcel of land.

7. In an event of emergency involving Facilities, W3MD or its agents may enter immediately upon the Property and take whatever reasonable steps it deems necessary to meet the emergency. W3MD shall notify the Owner of such emergency and entry as soon as possible but in no event later than twenty-four (24) hours after such entry. Alternatively, W3MD may notify the Owner by phone to take whatever reasonable action is necessary within a specified period of time. Should the Owner fail to respond, orshould the Owner inform W3MD that it intends to not respond within the specified period of time, W3MD or its agents may enter immediately upon emergency.

8. W3MD shall not pay any compensation at any time for its use of the Property in any way necessary for the inspections and maintenance of the Facilities, including access to the Facilities.

9. In the event W3MD, pursuant to this Agreement, performs work or expends any funds reasonably necessary for the maintenance or construction of the Facilities, including labor, equipment, supplies and materials, the Owner shall reimburse W3MD within ten (10) days after W3MD gives the Owner written notice of such expenditures. If the Owner or its successor or assigns fail to make timely payment as required herein, Owner hereby authorizes W3MD to file a mechanic's lien on the Property in the amount of unpaid work, foreclose on that lien and request and be awarded its costs and attorney fees.

10. Any amounts owed to W3MD and not paid within ten (10) days of the date of notification shall be the joint and several obligations of any owner of record of the Property or any portion thereof served by the Facilities, on the date the liability arose and all of the successors of interest of such Owner.

11. The Owner, its successors and assigns shall indemnify and hold harmless W3MD, its agents and employees for any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against W3MD arising out of or resulting from the construction, presence, existence maintenance or use of the Facility.

12. The Owner shall notify W3MD when the Owner transfers its interest in Property or any portion thereof. The Owner shall supply W3MD with a duly executed copy of any document of transfer. The Owner agrees to notify W3MD upon any change of legal address.

13. The responsibilities and obligations of the Owner shall constitute a covenant running with the land, and shall be binding upon all present and subsequent owners, their administrators, executors, assigns, heirs, and any other successors in interest so long as they own an interest in the Property of any portion thereof served by the Facilities.

14. The Owner recognizes that the executed Final Development Plan, Administrative Site Plan, Location and Extent, Use by Special Review, Engineering Case, or other case process determined by El Paso County to be a final plan, includes the following language: "The property owner shall be responsible for maintenance of all permanent Best Management Practices (BMP's) and Stormwater Facilities installed pursuant to the Subdivision Improvement Agreements and the Operations and Maintenance (O&M) Manual. Requirements include, but are not limited to, maintaining the specified BMP's contained in the O& M Manual recorded at reception number , and the Stormwater Facilities shown in the approved Phase III Drainage Report and shown on the approved Construction Drawings. The Owners of this Subdivision, their successors and/or assigns in interest, or some entity other than W3MD, agree to the responsibility of maintaining all permanent BMP's and/or Stormwater Facilities associated with this

development. If the permanent BMP's and Stormwater Facilities are not properly maintained, W3MD may provide necessary maintenance and assess the maintenance cost to the owner of the property." Failure to abide by the note shall constitute a Zoning Violation, as defined in the El Paso County Land Development Code.

If the Owner or its successors or assigns fail to make timely payment as required herein, f unpaid work, foreclose on that lien and request and be awarded its costs and attorney fees.

In addition, any fines or assessments levied against W3MD as a result of the Owner's or its successor's or assign's failure to comply with the terms of this Paragraph shall be the sole and absolute responsibility of the Owner or its successors or assigns.

15. This Agreement shall be recorded in the El Paso County Clerk and Recorder's Office.

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W3MD Case No. _____
City/County Case No. _____

For the Board of Waterview III Metro District

_____
Executive Director

Owner: _____

By: _____

Name: _____

STATE OF COLORADO)
)SS.
COUNTY OF)

The foregoing instrument was acknowledged before me this _____ day of _____, 20___, by _____, as _____ of _____.

My commission expires _____. Witness my hand and official seal.

_____
Signature

_____
Name of Notary

_____
Address of Notary

Appendix B

General Location and Description of Stormwater Management Facilities

A. General Site Description

Villas at Aspen Trails is located in El Paso County on the southeast corner of Bradley Road and Legacy Hill Drive. The 4.32-acre site will consist of 12 townhouse buildings with a total of 41 residential units.

B. General Stormwater Management Description

All stormwater is conveyed via a combination of grass swales or curb and gutter with both a storm inlet/pipe network and a conventional reinforced concrete rundown to a single porous landscape detention/water quality pond. Flows from the porous landscape detention/water quality pond are conveyed in a major drainageway eventually out falling into the Jimmy Camp Creek Basin.

C. Stormwater Facilities Site Plan

Inspection or maintenance personnel may utilize the Stormwater Facilities Map located in Appendix G for locating the stormwater facilities within this development.

D. On-Site Stormwater Management Facilities

Storage Facilities (Detention)

Detention for Villas at Aspen Trails site is provided in a single porous landscape detention/water quality pond as described in the FDR submitted for this site.

Water Quality Facilities

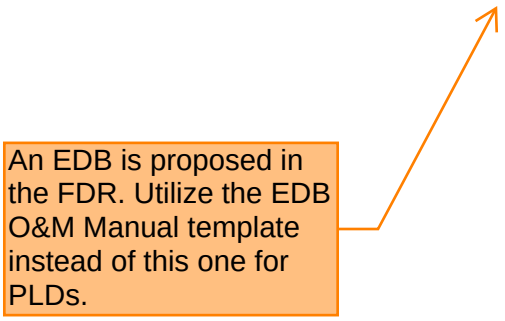
Villas at Aspen Trails site utilizes 1 porous landscape detention/water quality pond for providing water quality capture volume for the site.

Source Control Best Management Practices

Villas at Aspen Trails site does not include any nonstructural BMPs.

Standard Operation Procedures
for
Inspection and Maintenance

Porous Landscape Detention (PLDs)



February 2023

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PLD-1 BACKGROUND

Porous Landscape Detention (PLD) is a common type of Stormwater Management Facility utilized within the Front Range of Colorado. PLDs consist of a low-lying vegetated area underlain by a sand bed with an underdrain pipe. A shallow surcharge zone exists above the PLD for temporary storage of the Water Quality Capture Volume (WQCV). During a storm, accumulated runoff ponds in the vegetated zone and gradually infiltrates into the underlying sand bed, 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. The PLD provides for filtering, adsorption, and biological uptake of constituents in stormwater[1]. The popularity of PLDs has increased because they allow the WQCV to be provided on a site that has little open area available for stormwater management.

PLD-2 INSPECTING POROUS LANDSCAPE DETENTION (PLD)

PLD-2.1 Access and Easements

Inspection or maintenance personnel may utilize the stormwater facility map located in Appendix G containing the locations of the access points and maintenance easements of the PLDs within this development.

PLD-2.2 Stormwater Management Facilities Locations

Inspection or maintenance personnel may utilize the stormwater facility map located in Appendix G containing the locations of the PLDs within this development.

PLD-2.3 Porous Landscape Detention (PLD) Features

PLDs 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 PLD and the corresponding maintenance inspection items that can be anticipated:

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

Table PLD-1
Typical Inspection & Maintenance Requirements Matrix

	Sediment Removal	Mowing Weed control	Trash/ Debris Removal	Erosion	Overgrown Vegetation Removal	Removal/ Replacement	Structure Repair
Inflow Points	X		X				X
Landscaping	X	X	X	X	X		
Filter Media	X	X	X	X	X	X	
Underdrain System						X	
Overflow Outlet Works	X		X				X
Embankment		X	X	X	X		

PLD-2.3.1 Inflow Points

Inflow points or outfalls into PLDs are the point of stormwater discharge into the facility. An inflow point is commonly a curb cut with a concrete or riprap rundown. In limited cases, a storm sewer pipe outfall with a flared end section may be the inflow point into the PLD.

An energy dissipater (riprap or concrete wall) is typically immediately downstream of the discharge point into the PLD to protect the PLD from erosion. In some cases, the storm sewer 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 items 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 rundown or 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. Erosion Present/Outfall Undercut – In some situations, the energy dissipater may not have been sized, constructed, or maintained appropriately and erosion has occurred. Any erosion within the vicinity of the inflow point will require maintenance to prevent damage to the structure(s) and sediment transport within the facility. It is imperative that material utilized to correct erosion

problems within the filter media meets the requirements for filter media as shown on the approved construction drawings.

d. 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.

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

PLD-2.3.2 Landscaping

The landscaped area consists of specific plant materials and associated landscaping mulch in the bottom of the PLD. These plantings provide several functions for the PLD. Planting not only provides an aesthetic value for the PLD, but in many cases assists with biological uptake or removal of pollutants.

The plants are carefully selected for use in the PLDs. Plants utilized in PLDs must be able to grow in dry sandy soils but also be able to withstand frequent inundation by stormwater runoff. These plants also must be able to withstand a variety of pollutants commonly found in stormwater runoff. In addition, plants utilized in PLDs cannot have a deep extensive root system that may cause maintenance difficulty or damage to the facility.

The typical maintenance activities that are required within the landscape areas are as follows:

a. Woody Growth/Weeds Present – Undesirable vegetation can grow in and around the landscaped area in the PLD that can significantly affect the performance of the facility. This type of vegetation includes dense areas of shrubs (willows), grasses and noxious weeds. If undesired 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.

b. General Landscape Care – The landscape elements of the PLD are the same as any other landscape area and need to be provided with regular care. Landscape mulch will need to be removed and replaced to ensure the aesthetics of the PLD.

PLD-2.3.3 Filter Media

The filter media is the main pollutant removal component of the PLD. The filter media consists of 18-inches of a mixture of washed sand and peat. The filter media removes pollutants through several different processes, including sedimentation, filtration, absorption, infiltration and microbial uptake.

Sedimentation is accomplished by the slow release of stormwater runoff through the filter media. This slow release allows sediment particles 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 many pollutants utilize sediment as a transport mechanism.

Filtration is the main pollutant removal mechanism of PLDs. 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.[2]

Absorption results from the peat utilized in the filter media. Organic materials have a natural ability to attach to soluble nutrients, metals and organic pollutants. This attachment then prevents these pollutants from leaving the PLD.

PLDs 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. Infiltration Rate Check – The infiltration rate of the PLD needs to be checked in order to ensure proper functioning of the PLD. Generally, a PLD should drain completely within 12-hours of a

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

storm event. If drain times exceed the 12-hour drain time then maintenance of the filter media shall be required.

b. Sediment Removal – Although PLDs should not be utilized in areas where large concentrations of sediment may enter the PLD, it is inevitable that some sediment will enter the PLD.

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.

PLD-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 for the underdrain system are as follows:

With proper maintenance of the landscape areas and filter media, 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.

PLD-2.3.5 Overflow Outlet Works

Generally, the initial runoff ("first flush") or WQCV during the storm event contains the majority of the pollutants. PLDs are designed to treat only the WQCV and any amount over the WQCV is allowed to go to a detention facility without water quality treatment. The overflow outlet works allows runoff amounts over the WQCV to exit the PLD to the detention facility. The outlet works is typically constructed of a reinforced concrete box in the embankment of the PLD. The concrete structure typically has a steel grate to trap litter and other debris from entering the storm sewer system. Proper inspection and maintenance of the outlet works is essential in ensuring the long-term operation of the PLD.

The most typical maintenance items that are found with 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. Woody Growth/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.

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 PLD outlet works.

PLD-2.3.6 Embankments

Some PLDs utilize irrigated turf grass embankment to store the WQCV.

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

a. Vegetation Sparse – The embankments are one of the most visible parts of the PLD, and therefore aesthetics is important. Adequate and properly maintained vegetation can greatly increase the overall appearance of the PLD. 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.

PLD-2.3.7 Miscellaneous

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

a. Encroachment in Easement Area – Private lots/property can sometimes be located very close to the PLDs, even though FLD requires that PLDs be located in tracts with drainage easements. Property owners may place landscaping, trash, fencing, or other

items within the easement area that may affect maintenance or the operation of the facility.

b. Graffiti/Vandalism – Vandals can cause damage to the PLD infrastructure. If criminal mischief is evident, the inspector should forward this information to the local Sheriff's Office.

c. Public Hazards – Public hazards include items such as 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 Sheriff's Office at 911 immediately.**

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

PLD-2.4 Inspection Forms

PLD Inspection forms are located in Appendix D. 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 Waterview III Metro District per the requirements of the Operations and Maintenance Manual. These inspection forms shall be kept indefinitely and made available to the Waterview III Metro District upon request.

PLD-3 MAINTAINING POROUS LANDSCAPE DETENTIONS (PLD)

PLD-3.1 Maintenance Personnel

Maintenance personnel must be experienced to properly maintain PLDs. Inadequately trained personnel can cause additional problems resulting in additional maintenance costs.

PLD-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 PLD:

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 Stormwater Facility Operation and Maintenance Manual
21.) ASTM C-33 Sand
22.) Peat
23.) Wood Landscaping Mulch

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.

PLD-3.3 PLD Maintenance Forms

The PLD Maintenance Form provides a record of each maintenance operation performed by maintenance contractors. The PLD 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 Waterview III Metro District per the requirements of the Operations and Maintenance Manual. The PLD Maintenance form is located in Appendix E.

PLD-3.4 PLD Maintenance Categories and Activities

A typical PLD 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 PLD. A maintenance activity can be specific to each feature within the PLD, 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 PLD.

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

PLD-3.5 ROUTINE MAINTENANCE ACTIVITIES

The majority of this work consists of scheduled mowings, trash and debris pickups and landscape care for the PLD 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 do not require any prior approval by W3MD , however, completed inspection and maintenance forms shall be submitted to W3MD for each inspection and maintenance activity.

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

Table PLD-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 PLD	Remove and dispose of trash/debris
Overflow Outlet Works Cleaning	As needed - after significant rain events – twice annually minimum	Clogged outlet structure; ponding water above outlet elevation	Remove and dispose of debris/trash/sediment to allow outlet to function properly
Weed Control	As needed, based upon inspection	Noxious weeds; Unwanted vegetation	Treat w/herbicide or hand pull; consult a local Weed Inspector

PLD-3.5.1 Mowing

Routine mowing of the turf grass embankments is necessary to improve the overall appearance of the PLD. 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.

PLD-3.5.2 Trash/Debris Removal

Trash and debris must be removed from the entire PLD 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.

PLD-3.5.3 Overflow Outlet Works Cleaning

Debris and other materials can clog the 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.

PLD-3.5.4 Weed Control

Noxious weeds and other unwanted vegetation must be treated as needed throughout the PLD. 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.

Frequency – Routine – As needed based on inspections.

PLD-3.6 MINOR MAINTENACE 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 require approval by W3MD. Completed inspection and maintenance forms shall be submitted to W3MD for each inspection and maintenance period. In the event that the PLD needs to be dewatered, care should be given to ensure sediment, filter material and other pollutants are not discharged. All dewatering activities shall be coordinated with W3MD.

Table PLD-3
Summary of Minor Maintenance Activities

Maintenance Activity	Minimum Frequency	Look for:	Maintenance Action
Sediment/Pollutant Removal	As needed; Based on infiltration test	Sediment build-up; decrease in infiltration rate	Remove and dispose of sediment
Erosion Repair	As needed, based upon inspection	Rills/gullies forming on embankments	Repair eroded areas & revegetate; address cause
Jet Vac/Cleaning underdrain system	As needed, based upon inspection	Sediment build-up /non draining system	Clean drains; Jet-Vac if needed

PLD-3.6.1 Sediment/Pollutant Removal

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

Generally, 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 replace the removed filter media. 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
600μm (No. 30)	25-60
300μm (No. 50)	10-30
150μm (No. 100)	2-10

In addition, only Peat Moss that meets the following specifications shall be utilized with the filter media.

pH (Units)	**7.6**
Total Salts (MMHOS/CM, 1:5)	**2.28**
Organic Matter (%)	**20.22**
Moisture (%)	**21.43**
Dry Matter Basis:	
Nitrogen - Total (%)	**0.780**
Nitrogen - Organic (%)	**0.773**
Nitrogen - Ammonia (PPM)	**46.8**
Nitrogen - Nitrate (PPM)	**31.3**
Total Phosphorus **(%) as P** **(%) as P_2O_5**	 **0.103** **0.237**
Total Potassium **(%) as K** **(%) as K_2O**	 **0.138** **0.166**
Carbon / Nitrogen Ratio	**13.6**

Other types of sand or soil material may lead to clogging of the PLD. 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 W3MD Engineering Staff to ensure design volumes/grades are achieved.

Stormwater sediments removed from PLDs 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. 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 and infiltration tests. Sediment removal in the forebay and trickle channel may be necessary as frequently as every 1-2 years.

PLD-3.6.2 Erosion Repair

The repair of eroded areas is necessary to ensure the proper functioning of the PLD, 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 W3MD Engineering Staff.

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

PLD-3.6.3 Jet-Vac/Clearing Drains

A PLD 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 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.

PLD-3.7 MAJOR MAINTENANCE ACTIVITIES

This work consists of larger maintenance/operational problems and failures within the stormwater management facilities. All of this work requires consultation with W3MD Engineering 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. This work may also require more specialized maintenance equipment, design/details, surveying, or assistance through private contractors and consultants.

Table PLD-4
Summary of Major Maintenance Activities

Maintenance Activity	Minimum Frequency	Look for:	Maintenance Action
Major Sediment/Pollutant Removal	As needed – based upon scheduled inspections	Large quantities of sediment; reduced pond capacity	Remove and dispose of sediment. Repair vegetation as needed
Major Erosion Repair	As needed – based upon scheduled inspections	Severe erosion including gullies forming, 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
PLD Rebuild	As needed – due to complete failure of PLD	Removal of filter media and underdrain system	Contact WHMD Engineering

PLD-3.7.1 Major Sediment/Pollutant Removal

Major sediment removal consists of removal of large quantities of pollutants/sediment/filter media/landscaping material. Extreme care should be taken when utilizing motorized or heavy equipment to ensure damage to the underdrain system does not occur. Some PLDs also contain an impermeable liner that can be easily damage if care is not taken when removing the filter media. Stormwater sediments removed from PLDs 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. Vegetated areas need special care to ensure design

volumes and grades are preserved or may need to be replaced due to the removal activities.
Frequency – Non-routine – Repair as needed, based upon inspections.

PLD-3.7.2 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.

PLD-3.7.3 Structural Repair

A PLD generally includes a 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 W3MD Engineering Staff shall take place prior to all structural repairs.

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

PLD-3.7.4 PLD Rebuild

In very rare cases, a PLD 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 PLD. Consultation with W3MD Engineering Staff shall take place prior to any rebuild project.

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

POROUS LANDSCAPE DETENTION (PLD)
INSPECTION FORM

Date:_____

Subdivision/Business Name:_____ Inspector:_____

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
- ____Rip Rap Displaced/Rundown or Pipe Damage
- ____Erosion Present/Outfall Undercut
- ____Sediment Accumulation
- ____Structural Damage

2.) Filter Media
- ____Infiltration Rate Check
- ____Sediment Removal
- ____Filter Replacement

3.) Landscaping
- ____Woody Growth/Weeds Present
- ____General Landscape Care

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

6.) Embankments
- ____Vegetation Sparse
- ____Erosion Present

5.) Overflow Outlet Works
- ____Structural Damage
- ____Woody Growth/Weeds Present
- ____Trash/Debris

7.) 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 indefinitely and made available to the Waterview III Metro District upon request.

POROUS LANDSCAPE DETENTION (PLD)
MAINTENANCE FORM

Subdivision/Business Name:_____ Completion Date:_____

Subdivision/Business Address:_____ Contact Name:_____

Maintenance Category: Routine Restoration Rehabilitation
(Circle all that apply)

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
- ____ OUTLET WORKS
- ____ FILTER MEDIA

____ EROSION REPAIR
- ____ INFLOW POINT
- ____ EMBANKMENTS
- ____ OUTLET WORKS

____ REVEGETATION
- ____ EMBANKMENTS

____ JET-VAC/CLEARING DRAINS
- ____ OUTLET WORKS
- ____ INFLOWS
- ____ UNDERDRAIN SYSTEM

REHABILITATION WORK

____ SEDIMENT REMOVAL (DREDGING)
- ____ FILTER MEDIA
- ____ INFLOW POINT

____ EROSION REPAIR
- ____ OUTLET WORKS
- ____ EMBANKMENTS
- ____ BOTTOM STAGE

____ STRUCTURAL REPAIR
- ____ INFLOW
- ____ OUTLET WORKS
- ____ FILTER MEDIA

OTHER_____ _____
_____ _____
_____ _____
_____ _____
_____

ESTIMATED TOTAL MANHOURS: _____

EQUIPMENT/MATERIAL USED: _____

_____

_____

COMMENTS/ADDITIONAL INFO: _____

_____

This Maintenance Activity Form shall be kept indefinitely and made available to the Waterview III Metro District upon request.

Annual Inspection and Maintenance Reporting Form
for
Stormwater Facilities

(This form to be submitted to W3MD prior to May 31 of each year)

Date: _____

To: Waterview III Metro District
(address to be determined)

Re: Certification of Inspection and Maintenance; Submittal of forms

Property/Subdivision Name: _____

Property Address: _____

Contact Name: _____

I verify that the required stormwater facility inspections and required maintenance have been completed in accordance with the Stormwater Facilities Maintenance Agreement and the Operations and Maintenance Manual associated with the above referenced property.

The required Stormwater Facility Inspection and Maintenance forms are hereby provided.

_____	_____
Name of Party Responsible for Inspection & Maintenance	Property Owner
_____	_____
Authorized Signature	Signature