

**Stormwater Best Management Practices
Operations and Maintenance Manual (O&M Manual)**

for:

Ellicott School Addition - 2 Buildings

Located at:

399 S Ellicott Highway, Calhan, CO 80808

Date:

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Prepared for:

***Ellicott School District No 22
322 S Ellicott Hwy
Calhan, CO 80808
719.683.2700***

Prepared by:

***M.V.E., Inc.
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
(719) 635-5736***

Reference:

**This plan is adapted from various maintenance manuals developed in the
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Operations and Maintenance Manual (O&M Manual)**

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Stormwater Best Management Practices Operations and Maintenance Manual (O&M Manual)

I. Compliance with Stormwater Best Management Practices Maintenance Requirements

All property owners are responsible for ensuring that stormwater best management practices (BMPs) or facilities installed on their property are properly maintained and that they function as designed. The property owner at the time of subdivision platting or development plan approval has executed a legally binding "Private Detention Basin/ Stormwater Quality Best Management Practice Maintenance Agreement and Easement" document which runs with the land/ BMP Maintenance Agreement. Property owners should be aware of their responsibilities regarding stormwater facility maintenance and need to be familiar with the contents of this Operations and Maintenance Manual (O&M Manual).

II. Inspection & Maintenance

The aforementioned BMP Maintenance Agreement requires the landowner or other responsible parties to conduct regular and routine inspections, cleanings, and maintenance.

Requirements for the inspection and maintenance of stormwater facilities are included in this Stormwater Best Management Practices O&M Manual.

Copies of the Inspection and Maintenance forms for each of the stormwater BMPs are located in Appendix C and D. These are provided for the convenience of the property owner or property manager and may be useful in demonstrating regular inspection and maintenance of the facility.

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 El Paso County has the right to enter for the purpose of inspecting and for maintaining BMPs where the owner has failed to do so, in accordance with the BMP Maintenance Agreement.

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 personal, and equipment.

Potentially dangerous (e.g., fuel, chemicals, hazardous materials) substances found in the areas must be referred to 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 BMPs:

- Protective clothing and boots.
- Safety equipment (vest, hard hat, confined space entry equipment [if certified to perform confined space entry]).
- Communication equipment.
- O&M Manual for the site.
- Clipboard.
- Stormwater BMP Inspection Forms (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 BMPs

The quality of stormwater entering the waters of the state relies heavily on the proper operation and maintenance of permanent BMPs. Stormwater BMPs 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

It is recommended that all Stormwater BMPs be inspected a minimum of once per year. Inspections should follow the inspection guidance found in the Standard Operation Procedures (SOP) for the specific type of facility. (Appendix B of this manual).

B. Inspection Report

It is recommended that the person(s) conducting the inspection activities complete the appropriate inspection report for the specific facility. Inspection reports are located in Appendix C. It is recommended that a copy of each inspection form 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. It is recommended that 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.

VIII. Maintaining Stormwater BMPs

Stormwater BMPs 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 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 El Paso County; however, it is recommended that inspection and maintenance forms be completed with the information.

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 El Paso County. However, it is recommended that maintenance forms be completed and entered into the owner's maintenance records.

Rehabilitation Work

This work consists of large-scale maintenance and major improvements needed to address failures within the stormwater BMP. Consultation with El Paso County is recommended, which may result in a need for 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.

B. Maintenance Personnel

Maintenance personnel should be qualified to properly maintain stormwater BMPs, 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. Maintenance Forms for each facility type are provided in Appendix D. It is recommended that maintenance Forms shall be completed by the property owner, management company, or contractor completing the required maintenance items.

Appendix A

General Location and Description of Stormwater Best Management Practices

A. General Site Description

The proposed Ellicott School Addition - 2 Buildings site is located within the southwest quarter of Section 18, Township 14 South, Range 62 West of the 6th Principal Meridian, El Paso County, Colorado. The 28.51± acre site is situated north of Handle Road and east of South Ellicott Highway in El Paso County. The site contains an elementary school building that uses the address of 399 S Ellicott Highway, Calhan, CO 80808 and El Paso County Assessor's Schedule Number 2418000019.

B. General Stormwater Management Description

All stormwater drains in a combination of sheet flow and concentrated flow across the site and exit the site at the southeastern corner going offsite into the north ditch of Handle Road and continuing east. The north ditch of Handle Road is a well vegetated, grassed ditch in good condition with existing CMP culverts underneath all driveways accessing the site that allow the flows in the north roadside ditch of Handle Road to remain uninterrupted. Flows continue east in the roadside ditch until reaching Black Squirrel Creek approximately 6,000 feet east of the east property line of the site. Water quality treatment for the high school Voc-Tech and the elementary school 3-5 buildings will be provided by two (2) rain gardens, each one located downstream of the high school Voc-Tech and the elementary school 3-5 buildings.

C. Stormwater Facilities Map

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

D. On-Site Stormwater Management Facilities

Volume Reduction Facilities

The school site utilizes Minimized Directly Connected Impervious Areas (MDCIA). Runoff from roofs and paved areas flows over native grassed areas prior to draining to the water quality facilities.

Storage Facilities (Detention)

No detention is provided for the water quality facilities on site.

Water Quality Facilities

The school site utilizes two (2) rain gardens for water quality treatment: Phase-I rain garden is located downstream of the high school Voc-Tech building. Phase-II rain garden is located downstream of the elementary school 3-5 buildings.

Source Control Best Management Practices

The school site does not include any nonstructural BMPs.

Appendix B

Standard Operation Procedures for Inspection and Maintenance

Porous Landscape Detention
(PLDs)
Also Known as Rain Gardens
or Bioretention Ponds

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PLD-1 BACKGROUND

Porous Landscape Detention (PLDs) are a common type of Stormwater Best Management Practice (BMP) utilized within the Front Range of Colorado. PLDs consist of a low-lying vegetated area underlain by a sand and peat 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 and peat bed, filling the void spaces of the sand. The underdrain gradually dewateres the sand and peat 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 stormwater¹. 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 SAND FILTER BASINS (PLDs)

PLD-2.1 Access and Easements

Inspection and maintenance personnel may utilize the figures located in Appendix E containing the location(s) of the access points and potential maintenance easements of the PLD(s) within this development.

PLD-2.2 Stormwater Best Management Practice (BMP) Locations

Inspection or maintenance personnel may utilize the figures located in Appendix E containing the location(s) of the PLD(s) within this development.

PLD-2.3 Extended Detention Basin (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:

Remove any references to EDB to avoid confusion. I think this is just a typo in this location.

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

Remove. Or notate as N/A for this site.

Table PLD-1
Typical Inspection & Maintenance Requirements Matrix

PLD Features	Sediment Removal	Mowing/ Weed control	Trash & Debris Removal	Erosion	Overgrown Vegetation Removal	Removal/ Replacement	Structure Repair
Inflow Points	X		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 the 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 structures and sediment transport within the facility. It is imperative that material utilized to correct erosion problems within the filter media meets

the requirement for filter media as shown on the approved construction drawings.

c. 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 infrastructure, sediment that accumulates in this area must be removed on a timely basis.

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

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

Remove. Or notate as N/A for this site.

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 items that are required for the underdrain system are as follows:

With proper maintenance of the filter media 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 (or WQCV) during the storm event contains the majority of 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 stormwater system. The outlet works is typically constructed of a reinforced concrete box in the embankment of the PLD. The concrete structure typically has 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 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.

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 embankments to store the WQCV.

The typical maintenance activities that are required for the embankment 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. Access – Access needs to be maintained.

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 enforcement agency.

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**

Remove any references to EDB to avoid confusion. I think this is just a typo in this location. EDB does not equal PLD.

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.

PLD-2.4 Inspection Forms

PLD 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 El Paso County per the requirements of the Inspection and Maintenance Plan. It is recommended that these inspection forms be kept a minimum of 5 years. A continuing record of inspection and maintenance forms will demonstrate proper maintenance over time in compliance with the BMP Maintenance Agreement.

PLD-3 MAINTAINING EXTENDED DETENTION BASINS (PLDS)

PLD-3.1 Maintenance Personnel

Maintenance personnel should 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 Inspection and Maintenance Plan
- 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 Safety

The PLD Maintenance Form provides a record of each maintenance operation performed by maintenance contractors. It is recommended that the PLD Maintenance Form be filled out in the field after the completion of the maintenance operation. It is recommended that each form be retained by the property owner or property manager for a minimum of five years. The PLD Maintenance form is located in Appendix D.

PLD-3.4 Maintenance Categories and Activities

A typical PLD Maintenance Program will consist of three broad categories of work: Routine, Restoration (minor), and Rehabilitation (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 are 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 mowing, 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 can be completed without any prior correspondence with El Paso County; however, it is recommended that completed inspection and maintenance forms shall be retained by the owner for a minimum of five years.

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

Discuss spillway maintenance here too and under Restoration Maintenance section.

**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 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.

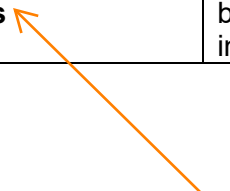
Frequency – Routine – As needed based on inspections.

PLD- 3.6 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 correspondence with El Paso County. However, it is recommended that completed inspection and maintenance forms be retained for each inspection and maintenance activity for a minimum of five years by the owner.

**Table – PLD-3
Summary of Restoration 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 Underdrains	As needed, based upon inspection	Sediment build-up /non draining system	Clean drains; Jet Vac if needed



Remove. Or notate as N/A for this site.

How will this be done since this is a vegetated rain garden and not a sand filter basin? Discuss having to re-vegetate area after sediment removal.

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 Material (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 (%)
9.5mm (3/8 inch)	100
4.75mm (No. 4)	95-100
2.36mm (no. 8)	80-100
1.18mm (No. 16)	50-85
600nm (no. 30)	25-60
300nm (no. 50)	10-30
150nm (no. 100)	2-10

In addition, only Peat Moss that meets current County Specifications (Drainage Criteria Manual, V.2) and percentages shall be utilized with the filter media.

Other types of sand and 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 the County's 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 – Nonroutine – As necessary based upon inspections and infiltration tests. Sediment removal in the sedimentation chamber 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 function 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 repairs to the pond embankments, spillways, and adjacent to structures involve consultation with the County's Engineering staff.

Frequency – Nonroutine – As necessary based upon inspections.

PLD-3.6.3 Jet-Vac/Clearing Drains

Remove. Or notate as N/A for this site.

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 – Nonroutine – As necessary based upon inspections.

PLD-3.7 Rehabilitation Maintenance Activities

This work consists of larger maintenance/operational problems and failures within the stormwater management facilities. All of this work requires consultation with the County's Engineering staff is recommended 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 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; 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 City Engineering

PLD-3.7.1 Major Sediment/Pollutant Removal

Major sediment/pollutant 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 damaged 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 – Nonroutine – Repair as needed based upon inspections.

No underdrain.

Discuss having to re-vegetate area after sediment removal.

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 – Nonroutine – 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 the County's Engineering staff shall take place prior to all structural repairs.

Frequency – Nonroutine – 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 the County's Engineering staff shall take place prior to any rebuild project.

Frequency – Nonroutine – As needed, based upon inspections.

Reference:

This Manual is adapted from City of Colorado Springs Best Management Practices IM Plan, SEMSWA (2007) and from the Town of Parker, Colorado (2004), STORMWATER PERMANENT BEST MANAGEMENT PRACTICES (PBMP) LONG-TERM OPERATION AND MAINTENANCE MANUAL

APPENDIX C

INSPECTION FORM

Many of the components of an EDB do not apply to a rain garden. Create a rain garden specific form or find one from another municipality (so you don't have to make your own). I unfortunately don't have a good go-by to send you.

EXTENDED DETENTION BASIN (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 2 = Routine maintenance required
1 = Monitor (potential for future problem) 3 = Immediate repair necessary
N/A = Not applicable

FEATURES

1.) Inflow Points

- ___ Riprap Displaced
- ___ Erosion Present/Outfall Undercut
- ___ Sediment Accumulation
- ___ Structural Damage (pipe, end-section, etc.)

2.) Forebay

- ___ Sediment/Debris Accumulation
- ___ Concrete Cracking/Failing
- ___ Drain Pipe/Wier Clogged (not draining)
- ___ Wier/Drain Pipe Damage ___ Woody Growth/Weeds Present

3.) Trickle Channel (Low-flow)

- ___ Sediment/Debris Accumulation
- ___ Concrete/Riprap Damage
- ___ Woody Growth/Weeds Present
- ___ Erosion Outside Channel

4.) Bottom Stage (Micro-Pool)

- ___ Sediment/Debris Accumulation
- ___ Woody Growth/Weeds Present
- ___ Bank Erosion
- ___ Mosquitoes/Algae Treatment
- ___ Petroleum/Chemical Sheen

5.) Outlet Works

- ___ Trash Rack/Well Screen Clogged
- ___ Structural Damage (concrete, steel, subgrade)
- ___ Orifice Plate(s) Missing/Not Secure
- ___ Manhole Access (cover, steps, etc.)
- ___ Woody Growth/Weeds Present

6.) Emergency Spillway

- ___ Riprap Displaced
- ___ Erosion Present
- ___ Woody Growth/Weeds Present
- ___ Obstruction/Debris

7.) Upper Stage (Dry Storage)

- ___ Vegetation Sparse
- ___ Woody Growth/Undesirable Vegetation
- ___ Standing Water/Boggy Areas
- ___ Sediment Accumulation
- ___ Erosion (banks and bottom)
- ___ Trash/Debris
- ___ Maintenance Access

8.) Miscellaneous

- ___ Encroachment in Easement Area
- ___ Graffiti/Vandalism
- ___ Public Hazards
- ___ Burrowing Animals/Pests
- ___ Other

Inspection Summary / Additional Comments: _____

OVERALL FACILITY RATING (Circle One)

0 = No Deficiencies Identified 2 = Routine Maintenance Required

1 = Monitor (potential for future problem exists) 3 = Immediate Repair Necessary

It is recommended that this inspection form be retained for a minimum of 5 years by owner.

APPENDIX D

MAINTENANCE FORM

Revise form per my comments above.

Revise to "Porous Landscape Detention" to match acronym in parenthesis.

EXTENDED DETENTION BASIN (PLD) MAINTENANCE FORM

Subdivision/Business Name: _____ Completion Date: _____

Subdivision/Business Address: _____ Contact Name: _____

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

MAINTENANCE ACTIVITIES PERFORMED

ROUTINE WORK

- ___ MOWING
- ___ TRASH/DEBRIS REMOVAL
- ___ OUTLET WORKS CLEANING (TRASH RACK/WELL SCREEN)
- ___ WEED CONTROL (HERBICIDE APPLICATION)
- ___ MOSQUITO TREATMENT
- ___ ALGAE TREATMENT

RESTORATION WORK

REHABILITATION WORK

- | | |
|--------------------------------------|---------------------------------|
| ___ SEDIMENT REMOVAL | ___ SEDIMENT REMOVAL (DREDGING) |
| ___ FOREBAY | ___ BOTTOM STAGE |
| ___ TRICKLE CHANNEL | ___ UPPER STAGE |
| ___ INFLOW | |
| ___ EROSION REPAIR | ___ EROSION REPAIR |
| ___ INFLOW POINT | ___ OUTLET WORKS |
| ___ TRICKLE CHANNEL | ___ UPPER STAGE |
| ___ VEGETATION REMOVAL/TREE THINNING | ___ BOTTOM STAGE |
| ___ INFLOW(S) | ___ SPILLWAY |
| ___ TRICKLE CHANNEL | ___ STRUCTURAL REPAIR |
| ___ UPPER STAGE | ___ INFLOW |
| ___ BOTTOM STAGE | ___ OUTLET WORKS |
| ___ REVEGETATION | ___ FOREBAY |
| ___ JET-VAC/CLEARING DRAINS | ___ TRICKLE CHANNEL |
| ___ FOREBAY | |
| ___ OUTLET WORKS | OTHER _____ |
| ___ INFLOWS | _____ |
| | _____ |

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:

It is recommended that this Maintenance Activity Form be retained for a minimum of 5 years by owner.

APPENDIX E

STORMWATER FACILITIES MAP

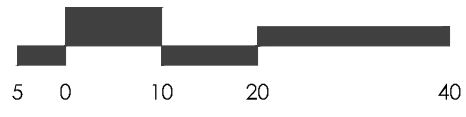
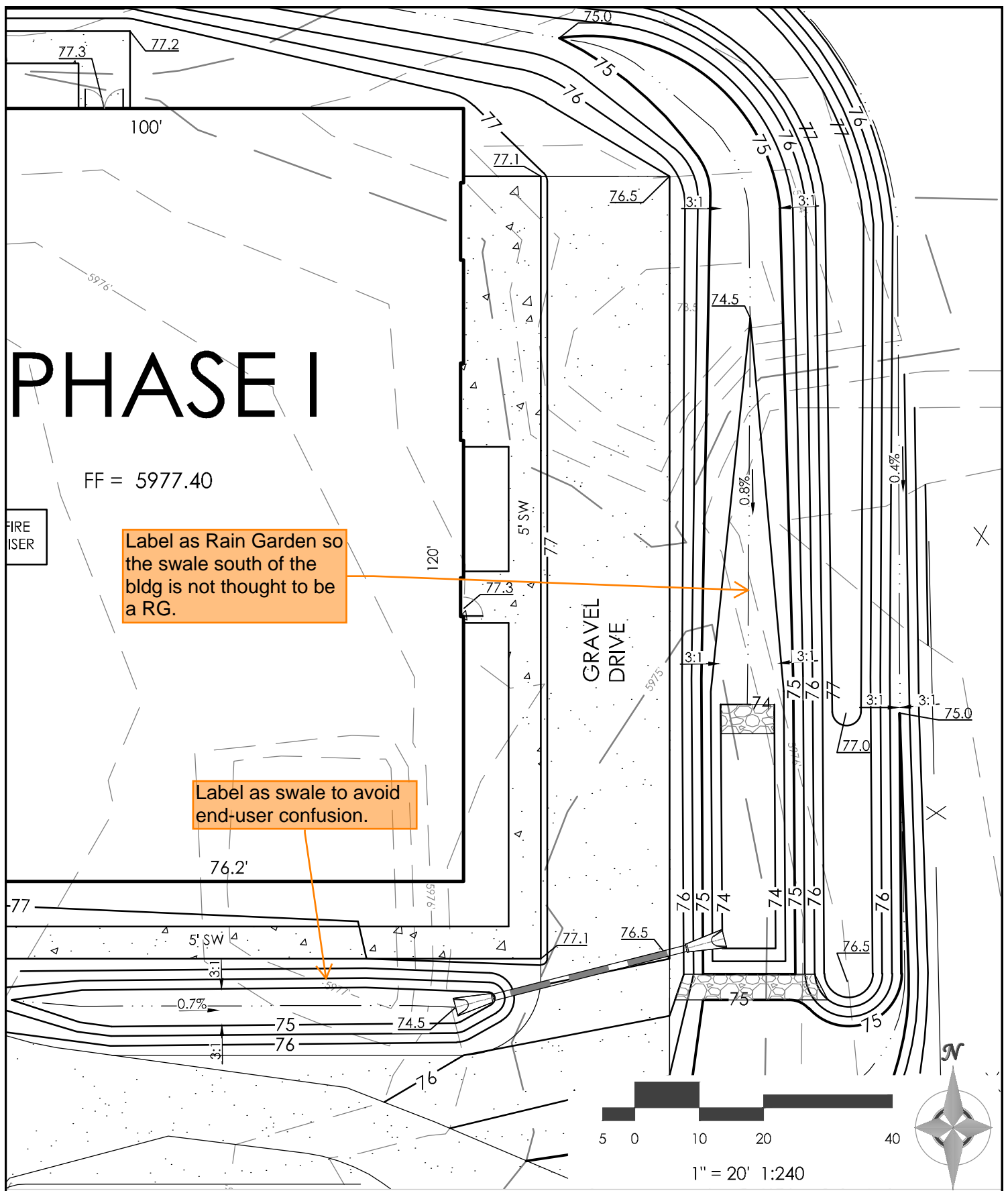
PHASE I

FF = 5977.40

FIRE
ISER

Label as Rain Garden so
the swale south of the
bldg is not thought to be
a RG.

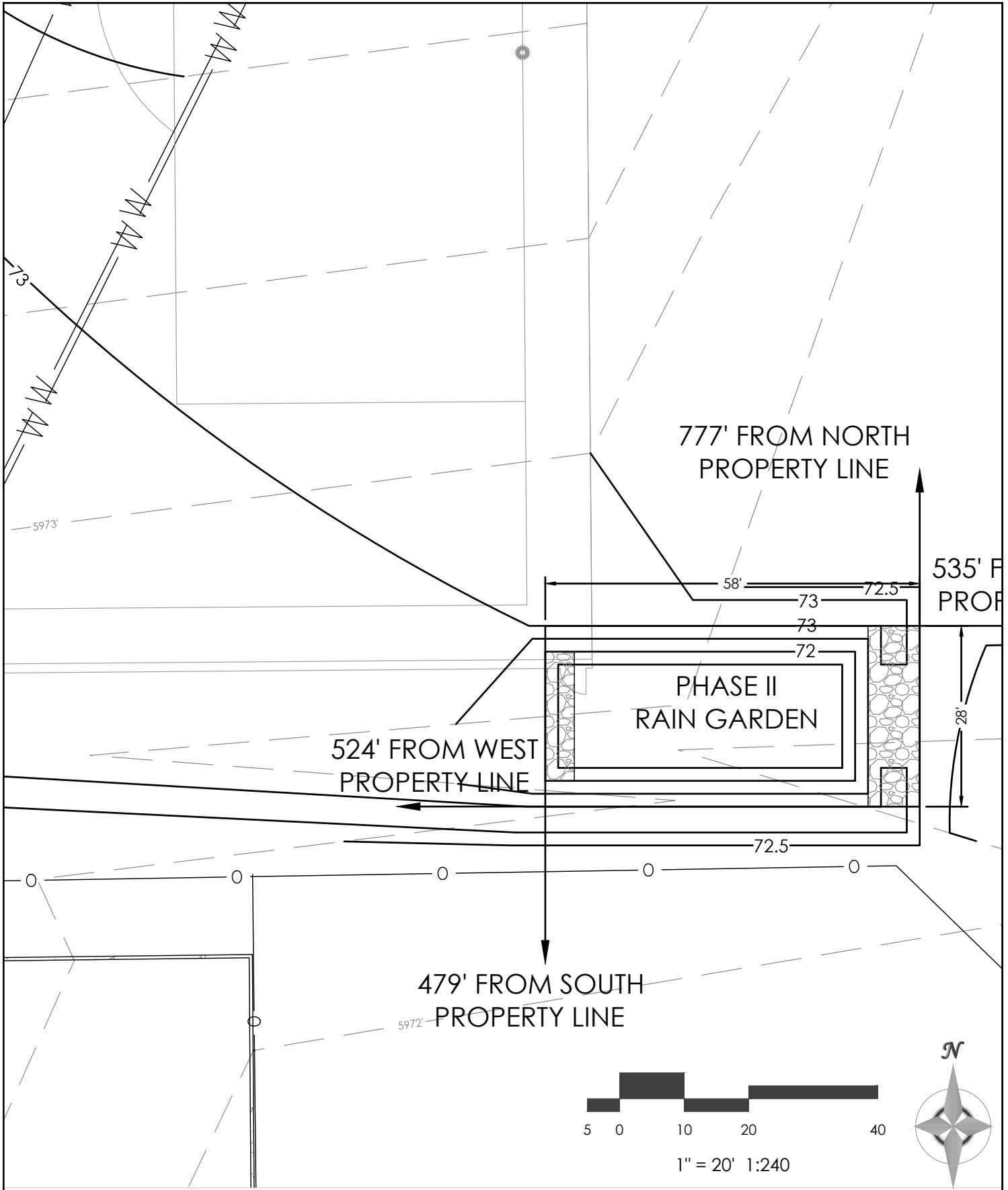
Label as swale to avoid
end-user confusion.



1" = 20' 1:240



MONUMENT VALLEY ENGINEERS INC. ENGINEERS * SURVEYORS 1133 PARASIT COLORADO SPRINGS, COLORADO 80909 (719) 597-5753	DATE	NO. OF SHEETS	ELLICOTT SCHOOL - ADDITION 2 BLDGS	
	PROJECT NO.	TITLE	DRAWING NO.	SHEET NO.
61183	PHASE 1 RAIN GARDEN	OM-RG1	1 OF 2	
	DATE			
	12/20/2022			



MONUMENT VALLEY ENGINEERS INC. ENGINEERS * SURVEYORS 1903 LELARAY STREET COLORADO SPRINGS, COLORADO 80909 PHONE (719) 635-5736	XREFS	PROJECT:	ELLICOTT SCHOOL - ADDITION 2 BLDGS	
		TITLE:	PHASE 2 RAIN GARDEN	
	PROJ. NO.	DATE:	DRAWING NO.	SHEET
	61183	12/20/2022	OM-RG2	2 OF 2