

Porous Paving

Porous pavement is a hard paved surface that resembles asphalt roads, driveways, etc. It is generally found in parking lots or driveways—generally areas with light vehicular traffic. Porous paving allows significant amounts of stormwater to infiltrate through the paving and into the ground.



Standard Asphalt

Porous Paving

You can generally tell the difference between porous paving and standard asphalt paving when the two types of pavement are immediately next to each other.



Asphalt-based porous paving is the most common type of porous paving. However, other types of aggregates from concrete to stone can be used for porous paving. No matter the aggregate type, all porous paving is designed to allow stormwater to infiltrate in lieu of running off into the storm sewer.

Porous Paving Maintenance and Common Issues

Typical Maintenance Indicators	Typical Maintenance Actions
Accumulation of sediment, litter, or debris on surface of porous pavement, as applicable	Remove and properly dispose of accumulated materials. Surface vacuuming should be conducted at least twice a year to allow the BMP to function as intended.
Standing water in permeable paving area	Flush fine sediment from paving and subsurface gravel. Ensure that sediment is not washed off-site. Surface vacuuming would be more ideal as power washing could clog the surface.
Damage to permeable paving surface resulting in reduced storm water intake capacity	Repair or replace damaged surface as appropriate.

What to Look For

Accumulation of Sediment, Litter, Grease, etc.

Standing Water

Structural Damage



Photo: pavementinteractive.org



Photo: lidaengineering.com



Built-up sediment, debris, etc. is a common problem with porous paving. Sediment tends to fill in and clog the pavement thus taking away the ability for the paving to allow stormwater to infiltrate. Dumpsters and landscaping materials (sand, mulch, dirt, etc.) should never be stored or located on porous pavement. Stored landscaping materials easily clog porous paving, and dumpsters can leak hazardous materials that infiltrate into the ground and affect the drinking water supply.

Rain Garden (bio-retention)

Rain gardens are bio-retention facilities very similar to infiltration basins, but generally on a smaller scale. They can be found from the back yards of homes to along the side of a street. A rain garden collects immediate stormwater runoff and infiltrates in a ponding zone in the middle of the BMP.



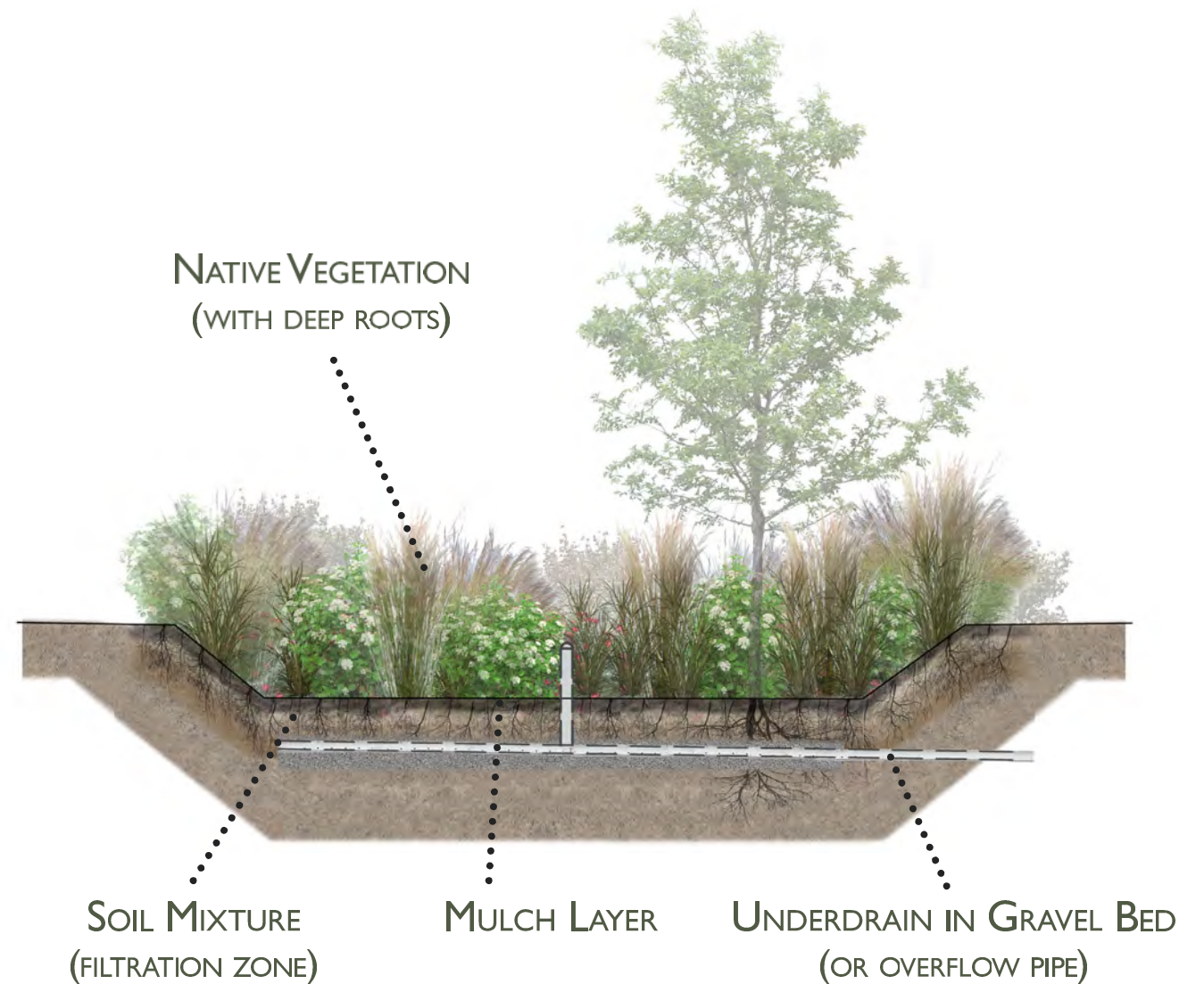
Photo: DIYNetwork.com

OVERFLOW STRUCTURE

STONE DISSIPATOR

SOIL MIXTURE

NATIVE PLANT



Rain Garden Maintenance

Typical Maintenance Indicators	Typical Maintenance Actions
Accumulation of sediment (over 2 inches deep or covers vegetation), litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation. Confirm that soil is not clogging and that the area drains after a storm event. Till or replace soil as necessary.
Poor vegetation establishment	Ensure vegetation is healthy and dense enough to provide filtering and to protect soils from erosion. Replenish mulch as necessary (if less than 3 inches deep), remove fallen leaves and debris, prune large shrubs or trees, and mow turf areas.
Overgrown vegetation—woody vegetation not part of design is present	Mow or trim as appropriate but not less than the design height of the vegetation. Replace dead plants and remove noxious and invasive weeds.
Erosion due to concentrated stormwater runoff flow	Repair/re-seed eroded areas and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or re-grading where necessary. Remove obstructions and sediment accumulations so water disperses.
Standing water (BMP not draining) <i>If mosquito larvae are present and persistent, contact PADEP. Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor.</i>	Where there is an underdrain, check the underdrain piping to make sure it is intact and unobstructed.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet, or outlet structures	Repair or replace as applicable.

The original design for your rain garden most likely outlined an amended soil mixture. The soil mixture is an important component for both the vegetation and to allow stormwater to infiltrate. It is important to maintain good draining soils for the health of your rain garden.



What to Look For

Accumulation of Sediment,
Litter, Debris, Dumping, Grease

Standing Water

Erosion

Poor Vegetation/Invasive Weeds

Overgrown Vegetation/Invasive Weeds

Clogged Inlet/Outlet Structures

Structural Damage

Common Rain Garden Issues

Poor Vegetation/Invasive Weeds

- The designed vegetation for a rain garden is critical for the BMP's function and performance. With poor vegetation cover, the rain garden does not perform as intended.
- New rain gardens that are poorly maintained will result in invasive weeds quickly taking over (or, as in the case with example pictures, crabgrass or other similar weeds will take over and inhibit the BMP's function).
- Invasive weeds and dead vegetation should be removed and replaced with the original designed vegetation. A rain garden should be monitored at least monthly during the growing season to ensure invasive weeds are not taking over.
- Refer to the invasive weed section of this guide for pictures of common weeds. If these weeds are encountered, they should be removed.



Standing Water/Poor Drainage

- Standing water in a rain garden is generally a sign of poor soil mixture (filter media). A number of factors could have caused such an issue, but this indicator generally means that the soil mixture needs to be replaced.
- Standing water can create a mosquito breeding ground, so rain gardens should be checked after rain events to ensure it is draining properly.
- Standing water may kill vegetation and thus leading to more problems with clogged overflow structures, erosion, and sediment accumulation that will need to be dealt with in addition to the poor soil mixture.



Rain Garden Considerations



Overflow Structures

Most rain gardens are intended to infiltrate a portion of the stormwater runoff. However, and for larger storm events, rain gardens will have an overflow structure for the runoff to go somewhere instead of flooding the immediate area.

Overflow structures come in all shapes and sizes. Most overflow structures are set just a few inches higher than the bottom of the rain garden to allow the runoff to be captured and treated.

Overflow structures should be free of debris, clogs, and defects. These structures perform an important role when considering flooding and the overall health of the rain garden and should be checked at least twice a year.

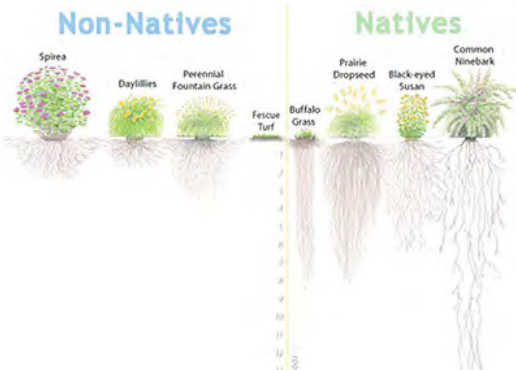


Inlet Points

Stormwater runoff can enter rain gardens either through a very defined point or over a broad area (for “sheet flows”).

Defined entry points or broad entry areas are generally identifiable by stone in the area. The stone serves the purpose of a “dissipator” that is intended to capture larger debris and sediment before entering the treatment area of the BMP.

Stone areas of a rain garden should be checked periodically for trash, sediment, and other large debris; and such debris should be removed.



Vegetation

The vegetation for a rain garden is critical for the performance and function of the BMP. It is important to maintain deep-rooted native vegetation (with proper soils) that was most likely in the original design for the rain garden. Mulch coverage should always be present to protect the root systems. Invasive weeds and non-native plants can push out the deep-rooted native vegetation—so keep them out with consistent weeding!

Riparian Buffer - Land Next to the Stream

A riparian buffer is simply vegetation along streams and waterbodies. While many riparian buffers exist naturally, the planting of riparian buffer vegetation along waterways is a commonly used stormwater BMP to help stabilize streambanks and minimize streambank erosion. The riparian buffer vegetation also filters out pollutants in the stormwater runoff.

Riparian buffer plantings can include trees, shrubs, grasses, wildflowers and other vegetation that are suited for riparian habitats. When riparian buffers are installed as stormwater BMPs, native plants are often used since the native vegetation is accustomed to the local conditions. Another advantage of using native vegetation is that it provides habitat for native wildlife.

Operations and Maintenance Plans for a riparian buffer installed for stormwater management purposes should show the boundary of the riparian buffer area. Riparian buffers are typically at least 35 feet wide on both sides of the stream to maximize the streambank stabilization. If unsure about the area of your riparian buffer, contact your local municipality or professional consultant for assistance.



Riparian Buffer Maintenance

What to Look For

Invasive plants

Erosion

Survival rate of planted vegetation

If plants are dying, try to determine why:

- Invasive plants out-competing planted vegetation?
- Deer eating the leaves and / or are rodents feeding on the roots?
- Tree shelters and stakes not properly maintained in an upright position; etc?

Typical Maintenance Indicators	Typical Maintenance Actions
Invasive weeds / plants	Mow or trim as appropriate and remove invasive plants. Selective herbicides can be used if in accordance with local, state, and federal laws. Refer to invasive weeds/plants section of the guide for pictures.
Erosion, poor vegetation establishment	Re-seed, re-establish vegetation.
Planted trees and shrubs are not upright	Stabilize trees and shrubs with stakes and shelters (if applicable); Ensure that tree shelters are properly secured to the tree stake and in the ground.
Dead or dying vegetation	Replant vegetation as needed.
Accumulation of litter or debris	Remove and properly dispose of accumulated trash or debris as these materials can damage the planted vegetation.

Common Riparian Buffer Issues That Should Be Addressed:

Invasive Weeds / Plants

- Many invasive plant species are transported by water and are therefore, quickly able to establish along streambanks. Invasive plant species are aggressive and can outcompete and grow over riparian buffer plantings. Many invasive plant species can kill-off other vegetation and completely overtake streambanks. Invasive species are often less effective at streambank stabilization and erosion control than the variety of native vegetation planted for a riparian buffer stormwater BMP.
- The preferred invasive plant removal technique is mechanical (i.e. remove by hand). Selective herbicides can also be effective but should be implemented only by a professional consultant specializing in invasive plant control in aquatic areas.
- Refer to the invasive weed section of this guide for pictures of common weeds. If these weeds are encountered, they should be removed.

Erosion



Invasive Mile-A-Minute taking over native vegetation



Photo: Go Native Long Island

Tree may die if not upright



Photo:Whitescarver Natural Management, LLC

Stone Filter Trench

A stone filter trench is similar to an infiltration trench, but the underground perforated pipe in the trench is connected to storm sewer pipes instead of allowing stormwater runoff to purely infiltrate into the ground. As the name implies, the purpose of a filter trench is to collect stormwater runoff and filter out pollutants prior to discharge into the storm sewer system.



DECO STONE

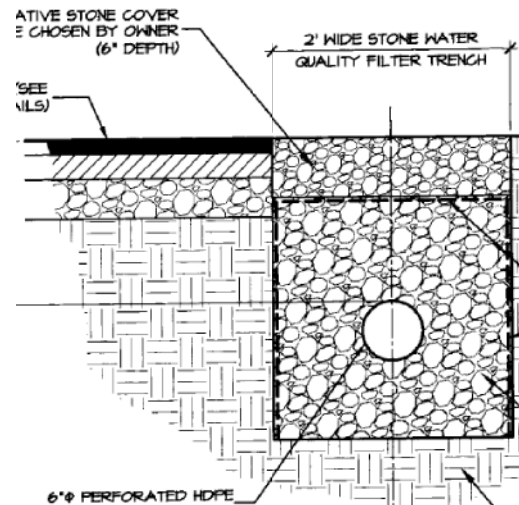
UNDERGROUND
PIPING

CLEANOUT



Deco Stone

- Stone bed on top of trench helps filter large particles and debris, while providing an aesthetically-pleasing landscape
- There is no absolute one type of rock that needs to be used for the stone bed. In turn, your filter trench can have a different type of rock, stone, or similar material.



Detail courtesy of ELA Group

Underground Piping

- Stormwater is filtered through the stone layers and collected by the underground perforated pipe connected to the storm sewer system.
- The underground pipe can be checked/inspected via the cleanout access points.



Cleanout

- Connection and access point to the underground piping in the trench.
- Point at which debris can be cleaned from underground piping and/or observe that water is draining from the trench area to the storm sewer piping.

Stone Filter Trench Maintenance

What to Look For

Invasive plants/weeds

Clogged piping

Debris
(leaves, trash, etc.)

Standing water

Important Fact Regarding Filter Trenches

With proper maintenance, the life span of a filter trench should be around 30-35 years. Based on influences from the surrounding area, the life span could be shorter or longer than the average. At the end of the life cycle, you may need to consider re-building the trench or installing a different BMP.

Signs of invasive weeds, accumulation of debris, and standing water should be checked at least monthly. Inspecting underground piping via the cleanouts can be performed annually.

Review your O&M Plan for alternate frequencies that may have been approved in the Site Stormwater Management Plan.

Typical Maintenance Indicators	Typical Maintenance Actions
Overgrown vegetation and invasive weeds/plants	Remove invasive plants and/or vegetation. Selective herbicides can be used if in accordance with local, state, and federal laws. Stone filter trenches should not have any vegetation growing in the stone areas. Presence of vegetation is also a sign that a significant amount of sediment has most likely accumulated in the deco stone and may be clogging the facility.
Signs of dumping (grease, piles of grass clippings, discolored grass, etc.)	Contact your local municipality to report a potential illicit discharge/illegal dumping.
Clogged piping	Pull debris from pipe via the cleanouts. If standing water is encountered in the pipes, there may be a clog at the connection from the perforated piping to the storm sewer system. Contact your local municipality regarding next steps to unclog a connection, which may entail a forced flushing if approved.
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials such as trash, dirt, and landscape debris (leaves, etc.). Frequent accumulation and/or infrequent maintenance will require periodic replacement of the decorative stone and top of filter fabric (every 3-4 years).
Standing water (BMP not draining or runoff flows over the BMP and does not infiltrate) <i>If mosquito larvae are present and persistent, contact the PADEP. Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor.</i>	Underground piping or stone is most likely clogged with debris, sediment, or other materials, or the rock under the deco stone has been compacted. Check and clean clogged piping or deco stone areas. If the rock has been compacted, the trench will need to be re-built.



Common Stone Filter Trench Issue That Should Be Addressed:

Accumulation of Debris and Sediment

- The deco stone in a filter trench is intended to capture debris, sediment/dirt, and other landscape waste to filter out the stormwater runoff. This built-up debris and waste (leaves, sediment, etc.) should be cleaned out periodically (annually at a minimum).
- Clogging of the voids/open spaces between the stones may result in stormwater ponding or flowing over the trench and causing flooding problems.
- Excessive debris may require removing the stones, cleaning out the debris and sediment, and re-setting the stones. If this is needed, the top layer of filter fabric should also be replaced (be careful not to compact the layer of rock under the filter fabric).