

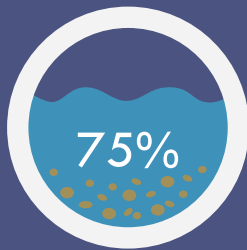
OUTFALL PROTECTION

fact sheet

WHAT IS OUTFALL PROTECTION?

A storm drain outfall is where a storm drain pipe or channel discharges stormwater runoff to a natural waterbody. There are thousands of these throughout the Prince George's County. Increased urbanization and stormwater runoff can damage an outfall.

Damaged outfalls can be stabilized or improved through the use of rip-rap, bioengineering techniques and/or vegetation. This also helps reduce the amount of sediment and erosion in the downstream channels and wetlands.



Approximately 75% of all sediment pollution in the Anacostia Watershed is caused by in-stream movement in the Northwest and Northeast branches. Restoring outfalls can help solve this problem.

COMMON METHODS INCLUDE:



TRANSFORMING STORMWATER MANAGEMENT

Much of Prince George's County's development occurred between the 1940s and 1980s before stormwater regulations were put in place.

In 2014, Prince George's County and Corvias Solutions implemented the Clean Water Partnership as the solution to its stormwater regulatory challenges.

New regulations state that impervious areas should be treated with Best Management Practices (BMPs) such as outfall protection.

The Clean Water Partnership is committed to retrofitting 2,000 acres of impervious area with green stormwater infrastructure by 2017.





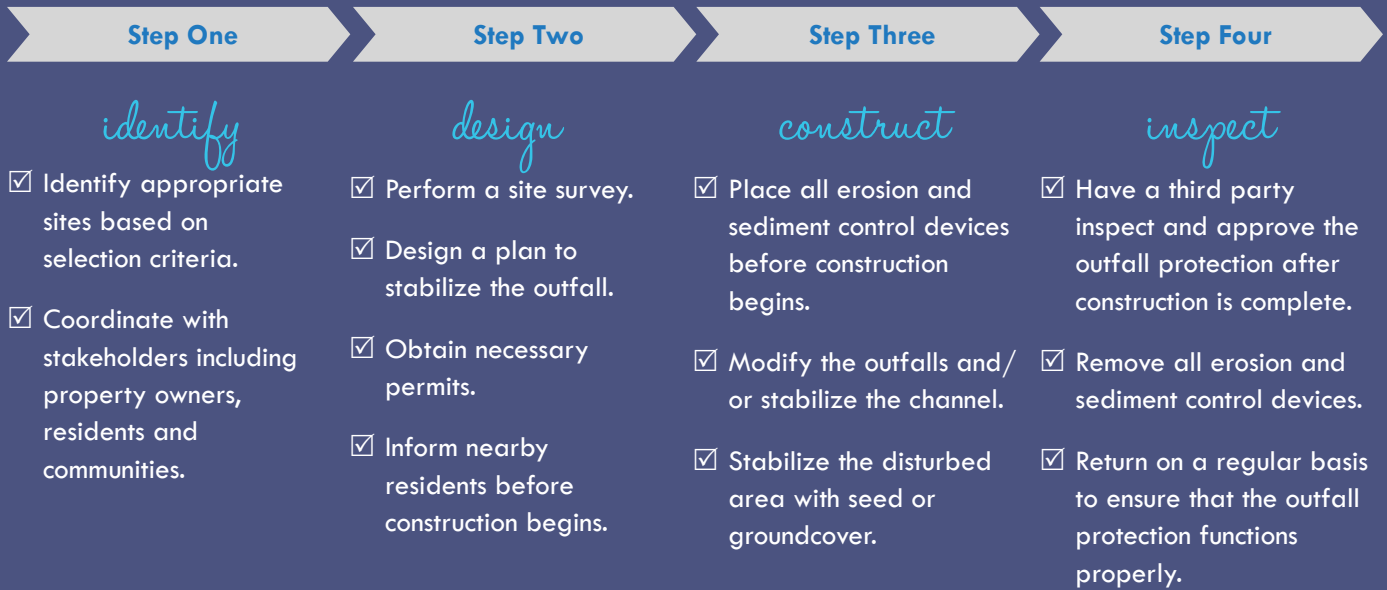
An existing unstable storm drain outfall



An outfall with properly sized rip-rap

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS



CONSTRUCTION AND MAINTENANCE

Corvias Solutions is managing the design, construction and long-term maintenance of stormwater BMPs installed by the program. It is committed to utilizing the County's small, minority and women-owned businesses for 30 – 40 percent of the total project scope.

Visit www.thecleanwaterpartnership.com/procurement to learn more about procurement opportunities.

HOW CAN I HELP?

The Clean Water Partnership is working with community members to learn about local challenges and the best locations to install BMPs. In many cases, the Clean Water Partnership will need to coordinate construction with an individual property owner or a homeowners association. Installed practices will be mapped on the Clean Water Partnership's website. Please contact us if you notice excessive trash, plant die-off or erosion or any other issues where outfall protection has been constructed.

WHERE CAN I GET MORE INFORMATION?

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MICRO-BIORETENTION

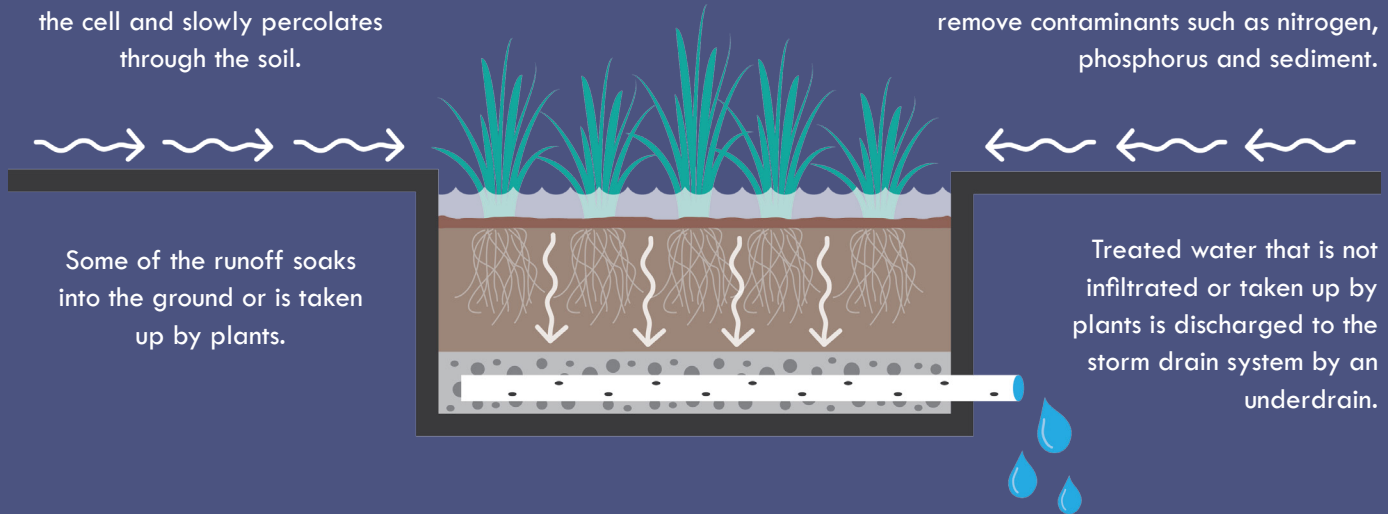
fact sheet

WHAT IS MICRO-BIORETENTION?

A micro-bioretenion cell is a small-scale Best Management Practice (BMP) that captures and treats stormwater runoff from buildings, roads or parking lots. It works by collecting stormwater from impervious surfaces and allowing it to pond temporarily. Plants in micro-bioretenion include native species that are adaptable to wet and dry soil conditions.

Stormwater runoff flows into the cell and slowly percolates through the soil.

Engineered soil and native plants remove contaminants such as nitrogen, phosphorus and sediment.



Some of the runoff soaks into the ground or is taken up by plants.

Treated water that is not infiltrated or taken up by plants is discharged to the storm drain system by an underdrain.

TRANSFORMING STORMWATER MANAGEMENT

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Micro-bioretenion adjacent to a building 3/2011 10/02



Micro-bioretenion in a parking lot

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS

Step One

identify

- ☑ Identify appropriate sites based on selection criteria.
- ☑ Coordinate with stakeholders including property owners, residents and communities.

Step Two

design

- ☑ Perform a site survey.
- ☑ Design the micro-bioretenion facility.
- ☑ Obtain necessary permits.
- ☑ Inform nearby residents before construction begins.

Step Three

construct

- ☑ Install all erosion and sediment control devices before construction begins.
- ☑ Excavate and construct the facility.
- ☑ Stabilize the disturbed area with seed or groundcover.

Step Four

inspect

- ☑ Have a third party inspect and approve the micro-bioretenion after construction is complete.
- ☑ Remove all erosion and sediment control devices.
- ☑ Return on a regular basis to ensure that the micro-bioretenion functions properly.

CONSTRUCTION AND MAINTENANCE

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WHERE CAN I GET MORE INFORMATION?

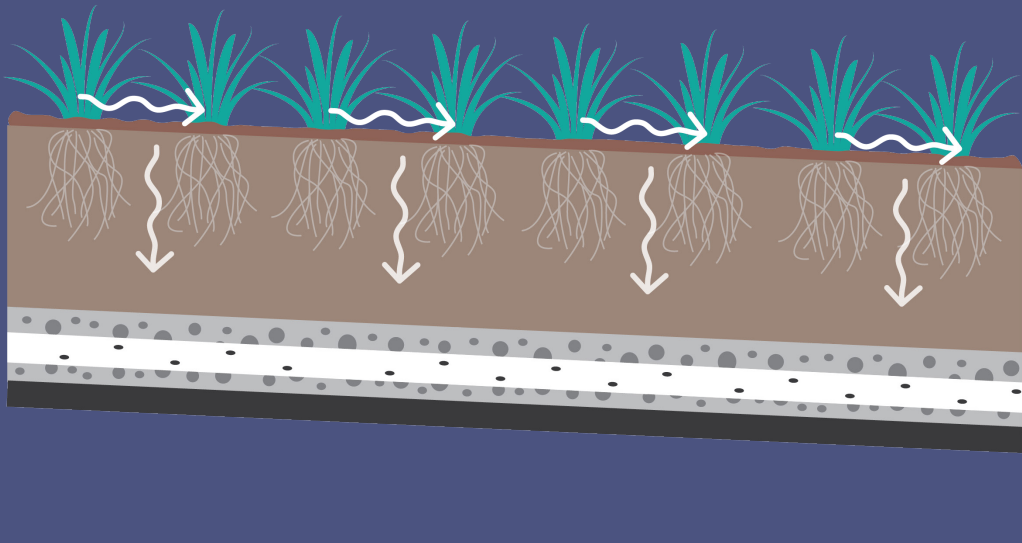
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BIOSWALE

fact sheet

WHAT IS A BIOSWALE?

A bioswale is a Best Management Practice (BMP) that uses plants and an engineered soil mix to treat stormwater runoff. Water is not ponded in a bioswale. It flows across the plants and engineered soil in the swale where runoff is infiltrated or filtered out. The shape of a bioswale can be linear or it can meander along roads or parking lots.



Stormwater flows through the bioswale and is filtered by the soil and plants.

The bioswale is planted with water-loving plants.

The treated water is carried by an underdrain and discharged into the storm drain system.

TRANSFORMING STORMWATER MANAGEMENT

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New regulations state that impervious areas should be treated with best management practices such as bioswales.

The Clean Water Partnership is committed to retrofitting 2,000 acres of impervious area with green stormwater infrastructure by 2017.





Bioswale in an open space



Bioswale adjacent to a parking lot

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS



CONSTRUCTION AND MAINTENANCE

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HOW CAN I HELP?

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WHERE CAN I GET MORE INFORMATION?

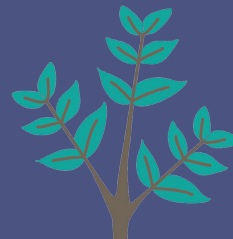
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TREE BOX FILTER

fact sheet

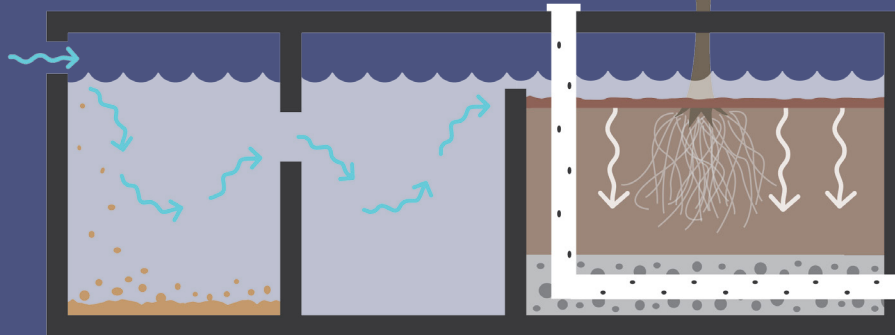
WHAT IS A TREE BOX FILTER?

A tree box filter is a concrete box filled with engineered soil that can filter out pollutants from stormwater. The soil mix is designed to handle a large flow of water; this allows the device to treat a large impervious area with only a small footprint. This Best Management Practice (BMP) is often used in areas where there is limited space.



The tree helps to take up nutrients such as nitrogen and phosphorus that would otherwise pollute streams and ponds.

The box has an empty chamber that allows sediments to settle out, and a second chamber that holds the soil.



The treated water is carried by an underdrain and discharged into the storm drain system.

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Tree box filter in a parking lot



Tree box filter that compliments the existing landscape

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS



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WHERE CAN I GET MORE INFORMATION?

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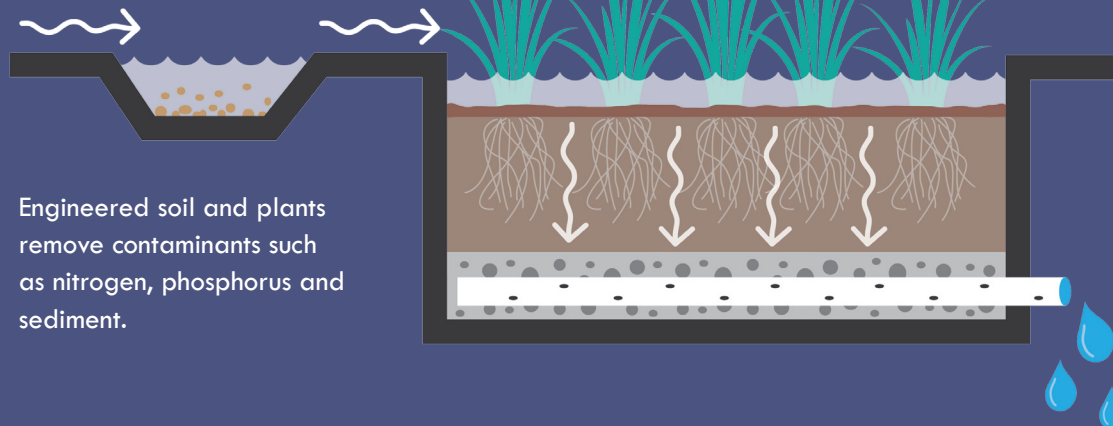
BIORETENTION

fact sheet

WHAT IS A BIORETENTION?

A bioretention cell is a medium to large scale Best Management Practice (BMP) that captures and treats stormwater runoff from buildings, roads or parking lots. A bioretention cell reduces stormwater runoff volume and can treat up to 5 acres of impervious area.

Stormwater runoff first enters a pre-treatment area where leaves, coarse sediments and other floating materials are captured.



Plants in bioretention cells include native species that are adaptable to both wet and dry soil conditions.

Runoff is filtered through plants and an engineered soil where the water infiltrates into the ground or discharges to the storm drain system.

Engineered soil and plants remove contaminants such as nitrogen, phosphorus and sediment.

TRANSFORMING STORMWATER MANAGEMENT

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Bioretention with fore-bay



Bioretention planting with seasonal interest

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS



CONSTRUCTION AND MAINTENANCE

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WHERE CAN I GET MORE INFORMATION?

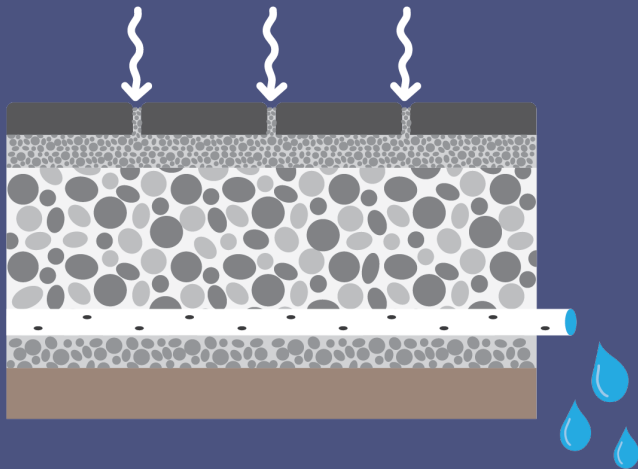
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PERMEABLE PAVEMENT

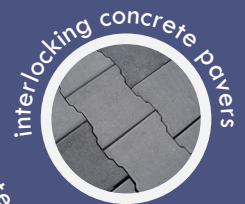
fact sheet

WHAT IS PERMEABLE PAVEMENT?

Permeable pavement is an alternative to conventional pavement systems that treats stormwater runoff. The pavement surface allows stormwater to flow through to a gravel storage area underneath. The stormwater infiltrates into the ground or discharges to the storm drain system by an underdrain. Permeable pavement can be found in different applications such as parking spaces, alleys, sidewalks or pedestrian plaza areas.



TYPES OF PERMEABLE PAVEMENT



TRANSFORMING STORMWATER MANAGEMENT

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New regulations state that impervious areas should be treated with Best Management Practices (BMPs) such as permeable pavement.

The Clean Water Partnership is committed to retrofitting 2,000 acres of impervious area with green stormwater infrastructure by 2017.





Permeable pavement for on-street parking



Permeable pavement in a parking lot

Photos courtesy of Stormwater Maintenance, LLC. (left) and Low Impact Development Center (right)

THE CONSTRUCTION PROCESS



CONSTRUCTION AND MAINTENANCE

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HOW CAN I HELP?

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WHERE CAN I GET MORE INFORMATION?

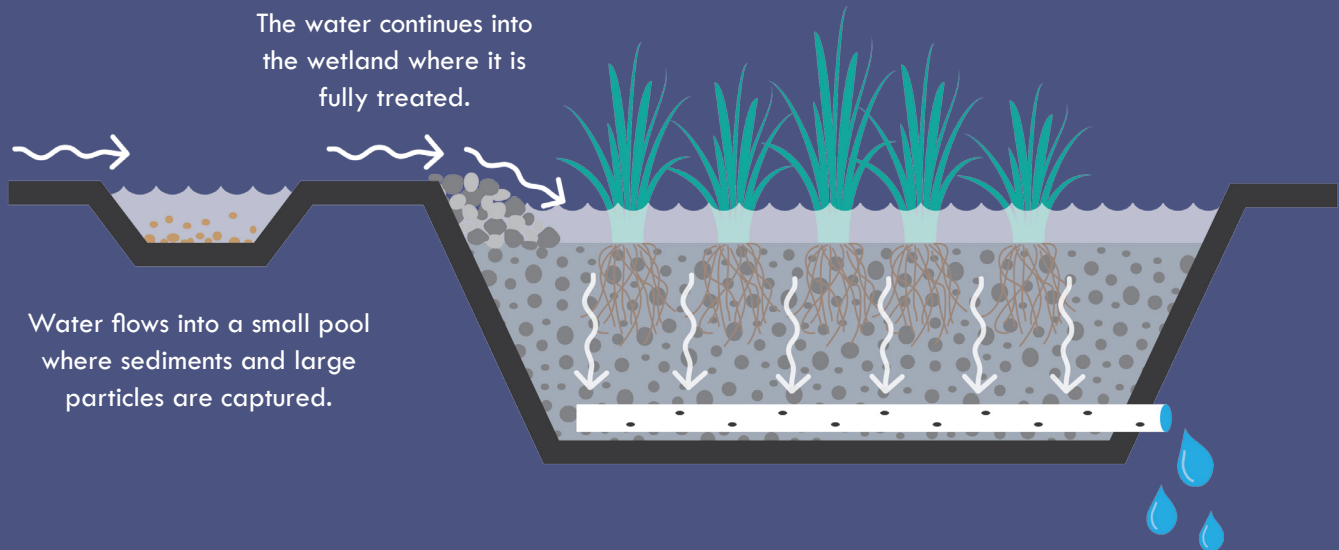
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SUBMERGED GRAVEL WETLAND

fact sheet

WHAT IS A SUBMERGED GRAVEL WETLAND?

A submerged gravel wetland is a Best Management Practice (BMP) that can be placed in wet or poor-draining soil areas. The wetland is filled with gravel and covered with a layer of soil. Native emergent plants are then planted in the wetland. They remove nutrients such as nitrogen, phosphorus and sediment. A submerged gravel wetland will stay wet at all times so it must be located in larger drainage areas to sustain the plants and ecosystem.



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Emergent plants in the wetland



native grasses and shrubs on the wetland edge

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS



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WHERE CAN I GET MORE INFORMATION?

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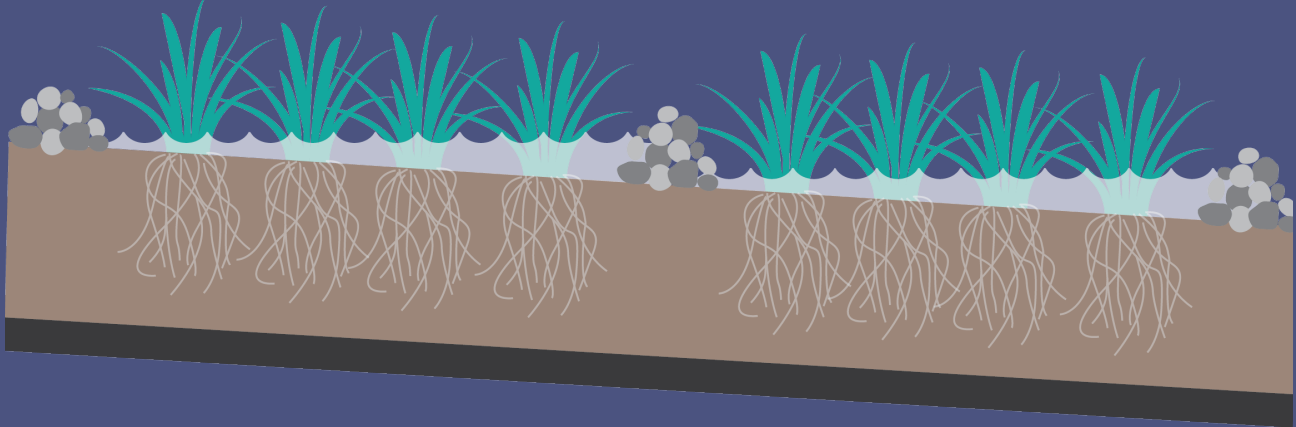
WET SWALE

fact sheet

WHAT IS A WET SWALE?

A wet swale combines the functions of a wetland and a swale. The wet swale safely conveys stormwater to a natural outfall such as a wetland or stream. The wetland in the bottom of the swale slows down the flow of stormwater and filters out pollutants. A wet swale can be used along roadways or parking lots where the groundwater table

is high and the soil is damp. Native plantings or turf are both appropriate for different areas. A wet swale will often have large piles of stone or check dams where water will pond to help slow and maintain the water flow. This allows the device to filter pollutants such as nitrogen, phosphorus and sediments.



TRANSFORMING STORMWATER MANAGEMENT

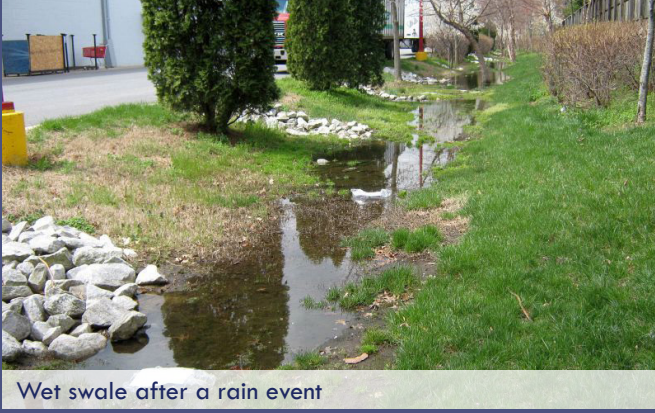
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Wet swale after a rain event



Wet swale with check dams

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS



CONSTRUCTION AND MAINTENANCE

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WHERE CAN I GET MORE INFORMATION?

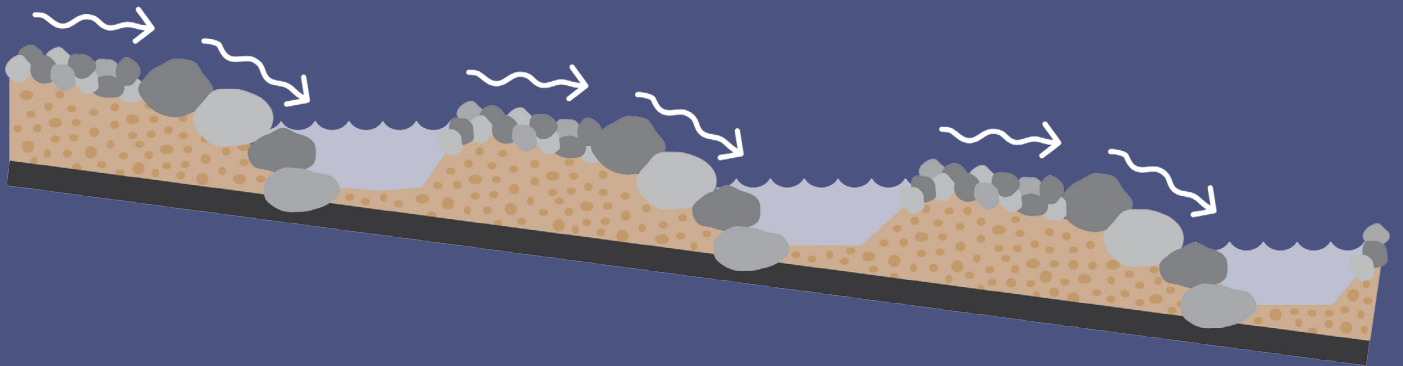
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REGENERATIVE STEP POOL STORM CONVEYANCE

fact sheet

WHAT IS A REGENERATIVE STEP POOL STORM CONVEYANCE?

Regenerative Step Pool Storm Conveyance (SPSC) is a best management practice that is located at the ends of storm drain pipes or man-made channels. SPSC is designed to stabilize and restore eroded outfalls. A series of small pools and riffles help to remove sediment and control downstream erosion. A sand and woodchip stream bed filters pollutants and promotes infiltration into the natural ground water system.



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SPSC during construction



SPSC with planting

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS



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STREAM RESTORATION

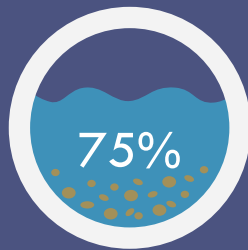
fact sheet

WHAT IS STREAM RESTORATION?

Stream restoration is a major construction project that stabilizes eroded streams. Stabilization of stream banks can help to reduce erosion and down cutting of channels. This is done by installing grade controls such as adding rocks at the bottom of the streambed, re-grading the side slopes and stabilizing the banks with rocks and vegetation. The projects may also reconnect the

stream with the natural floodplain to reduce downstream flooding and help re-establish natural habitat areas in and along the stream. The overall condition of the stream can be improved through the proper management of a healthy riparian buffer. Even small riparian zones have been shown to bring great benefits to stream health and wildlife habitat.

Approximately 75% of all sediment pollution in the Anacostia Watershed is caused by in-stream movement in the Northwest and Northeast branches. Stream restoration can help solve this problem.



RESTORATION TECHNIQUES



TRANSFORMING STORMWATER MANAGEMENT

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Stream restoration during construction



Stream restoration post construction

Photos courtesy of Stormwater Maintenance, LLC.

THE RESTORATION PROCESS

Step One

identify

- ✓ Identify appropriate sites based on selection criteria.
- ✓ Coordinate with stakeholders including property owners, residents, and communities.

Step Two

design

- ✓ Perform a site survey and select stream restoration practices.
- ✓ Design the stream restoration plan.
- ✓ Obtain necessary permits.
- ✓ Inform nearby residents before construction begins.

Step Three

construct

- ✓ Place all erosion and sediment control devices before construction begins.
- ✓ Implement and construct stream restoration practices.
- ✓ Stabilize the disturbed area with seed or groundcover.

Step Four

inspect

- ✓ Have a third party inspect and approve the stream restoration after construction is complete.
- ✓ Remove all erosion and sediment control devices.
- ✓ Return on a regular basis to ensure that the stream restoration functions properly.

CONSTRUCTION AND MAINTENANCE

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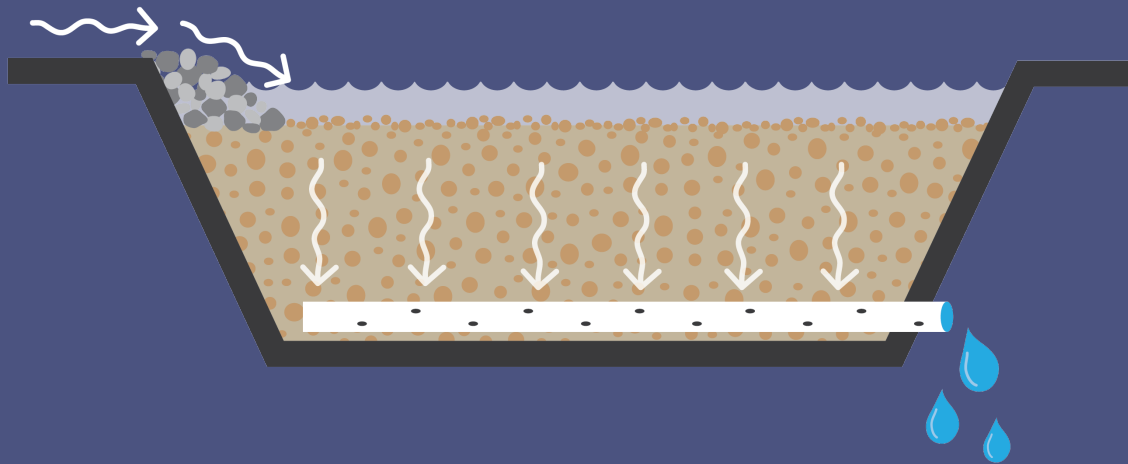
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POCKET SAND FILTER

fact sheet

WHAT IS POCKET SAND FILTER?

A pocket sand filter is a Best Management Practice (BMP) designed to remove pollutants by filtering water through a bed of sand. Pocket sand filters are a small depression in the ground filled with sand. These often look like a small volleyball court or sandbox. After flowing through the BMP, the treated water is either absorbed by the soil under the sand filter or is conveyed into the storm drain system by an underdrain. Pocket sand filters can be found in open spaces near buildings or parking areas.



TRANSFORMING STORMWATER MANAGEMENT

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New regulations state that impervious areas should be treated with best management practices such as pocket sand filters.

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Pocket sand filter during construction



Pocket sand filter in a community

Photos courtesy of Stormwater Maintenance, LLC.

THE CONSTRUCTION PROCESS



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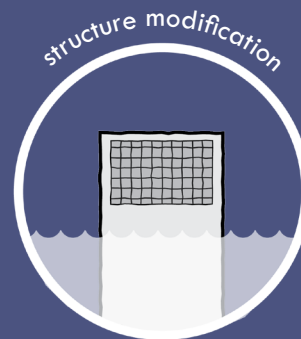
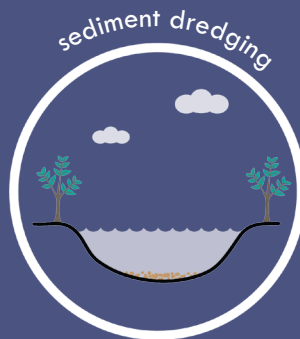
POND RETROFIT

fact sheet

WHAT IS POND RETROFIT?

The County has a large number of existing stormwater management ponds on public and private properties that do not meet the current water quality standards for stormwater Best Management Practices (BMPs). Retrofits include reconfiguring and re-grading the pond so that they provide a permanent pool of water. Water flows into a fore-bay that captures and settles out pollutants such as sediment and nutrients.

POND RETROFIT TOOLBOX



TRANSFORMING STORMWATER MANAGEMENT

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In 2014, Prince George's County and Corvias Solutions implemented the Clean Water Partnership as the solution to its stormwater regulatory challenges.

New regulations state that impervious areas should be treated with Best Management Practices (BMPs) such as pond retrofits.

The Clean Water Partnership is committed to retrofitting 2,000 acres of impervious area with green stormwater infrastructure by 2017.





A retrofit pond with wet storage



Pond retrofit with inflow protection

Photos courtesy of Stormwater Maintenance, LLC.

THE RETROFIT PROCESS



CONSTRUCTION AND MAINTENANCE

Corvias Solutions is managing the design, construction and long-term maintenance of stormwater BMPs installed by the program. It is committed to utilizing the County's small, minority and women-owned businesses for 30 – 40 percent of the total project scope.

Visit www.thecleanwaterpartnership.com/procurement to learn more about procurement opportunities.

HOW CAN I HELP?

The Clean Water Partnership is working with community members to learn about local challenges and the best locations to install BMPs. In many cases, the Clean Water Partnership will need to coordinate construction with an individual property owner or a homeowners association. Installed practices will be mapped on the Clean Water Partnership's website. Please contact us if you notice excessive trash, plant die-off or any other issues where pond retrofit practices have been constructed.

WHERE CAN I GET MORE INFORMATION?

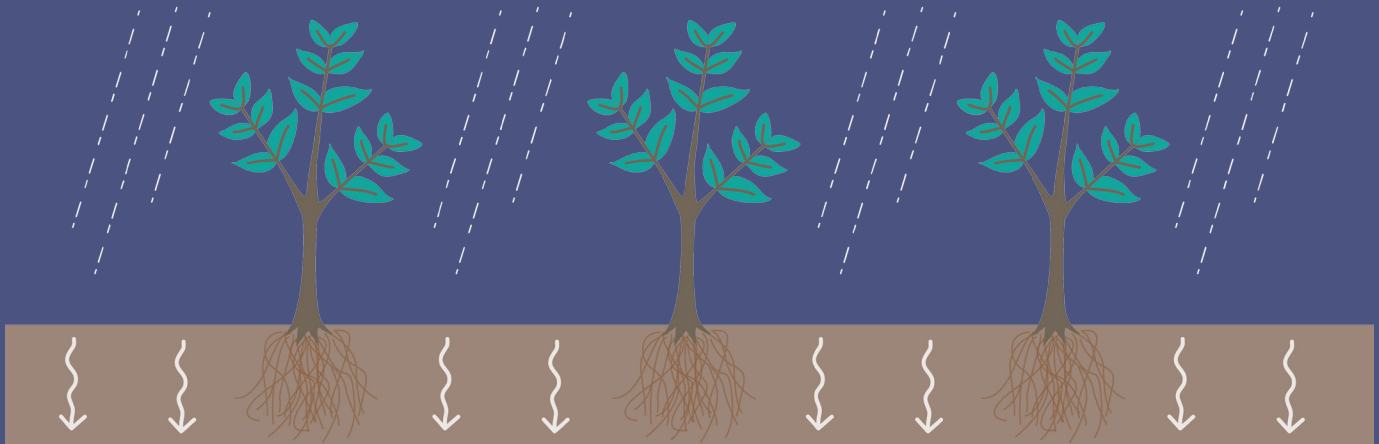
The Clean Water Partnership is committed to working with communities throughout the entirety of the construction process. Please contact info@thecleanwaterpartnership.com if you have any questions, comments or concerns.

TREE PLANTING

fact sheet

WHAT IS TREE PLANTING?

Trees are one of the greenest and most economical stormwater Best Management Practices (BMPs). When it rains, trees intercept rainwater and allow it to evaporate or slowly soak into the ground. As water moves through the soil, the roots help to remove pollutants by absorbing nutrients. Trees provide soil stabilization, improve air quality and help keep communities within a healthy temperature range in the summer.



TRANSFORMING STORMWATER MANAGEMENT

Much of Prince George's County's development occurred between the 1940s and 1980s before stormwater regulations were put in place.

In 2014, Prince George's County and Corvias Solutions implemented the Clean Water Partnership as the solution to its stormwater regulatory challenges.

New regulations state that impervious areas should be treated with Best Management Practices (BMPs) such as tree planting.

The Clean Water Partnership is committed to retrofitting 2,000 acres of impervious area with green stormwater infrastructure by 2017.





Tree planting in a city park



Community organized volunteer tree planting event

Photos courtesy of Casey Trees

THE PLANTING PROCESS



CONSTRUCTION AND MAINTENANCE

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WHERE CAN I GET MORE INFORMATION?

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