

STORMWATER SOLUTIONS

A HOMEOWNER'S GUIDE

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Contents



A Homeowners' Guide to Stormwater

01.

What is Stormwater?

02.

Purpose of this Toolkit

03.

What is the problem with Stormwater?

04.

Assessing the Landscape

05.

Homeowner's Checklist

06.

Slow it down, Soak it in, Spread it out!

07.

Best practices for home landscapes

08.

Homeowner's decision guide

09.

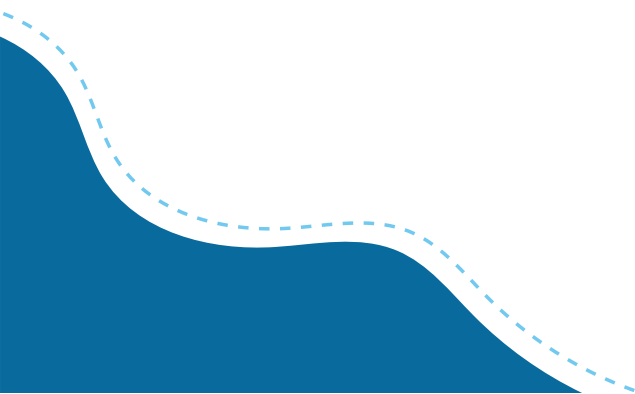
Resources



Disclaimer

The publication was funded by a grant from Fairfax Water to Virginia Cooperative Extension Prince William.

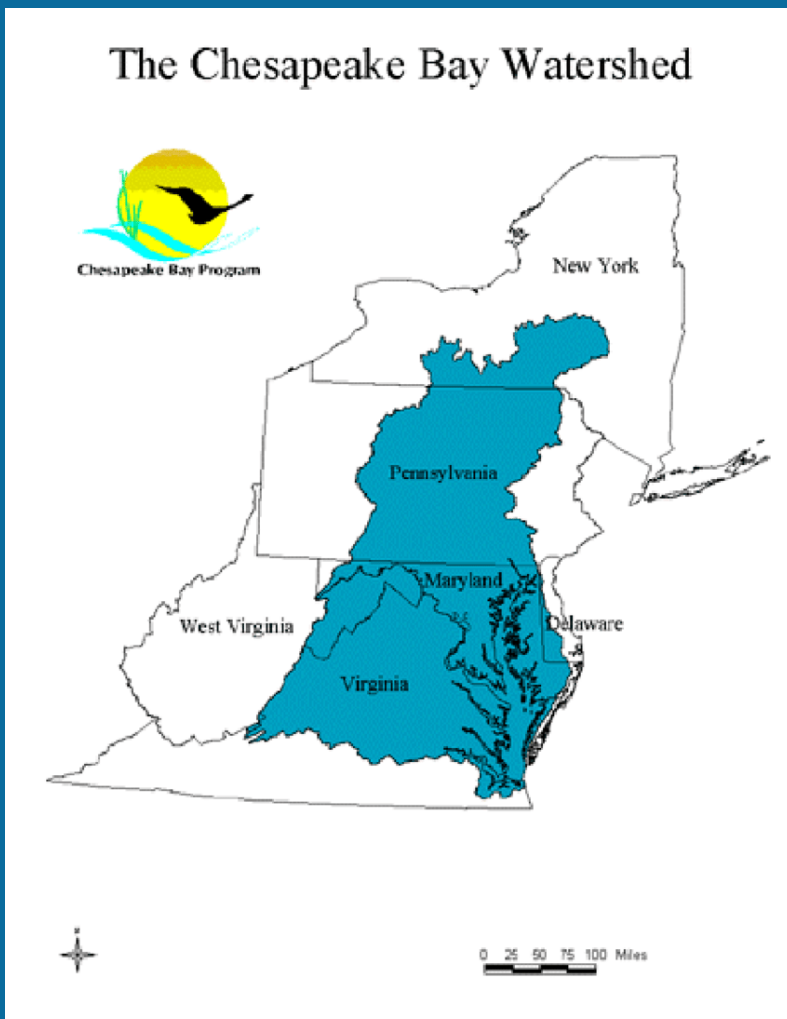
Stormwater practices in the toolkit are provided for general education to assist homeowners in assessing their own property. This guide does not supersede any local or federal regulations, nor is it a substitute for professional design and installation. Stormwater is a complex problem and each site is unique.



01.

What is Stormwater?

Precipitation that does not evaporate or soak into the ground, but collects and flows into storm drains and streams is called runoff. Increased development across the Chesapeake Bay Watershed has made stormwater the fastest growing source of pollution in our waterways and the Chesapeake Bay



02.

Purpose of this Toolkit



Photo: Rawpixel.com

As a homeowner, are you experiencing increased run off on your property? Do you live on a waterfront where the shoreline is eroding? Are you planning to make improvements to your landscape, but are not sure how that will affect the stormwater on your property?

This guide will assist you in developing a plan to keep stormwater on your property by allowing it to soak in, spread out and slow down to provide useful irrigation to native plants. These techniques will also protect local waterways.

Awareness of local and regional regulations is important. These local jurisdictions have resources and professional advice for homeowners

[Prince William County](#)
[Environmental Management](#)
[Manassas City Stormwater](#)
[Manassas Park Stormwater](#)

03.

What's the problem?

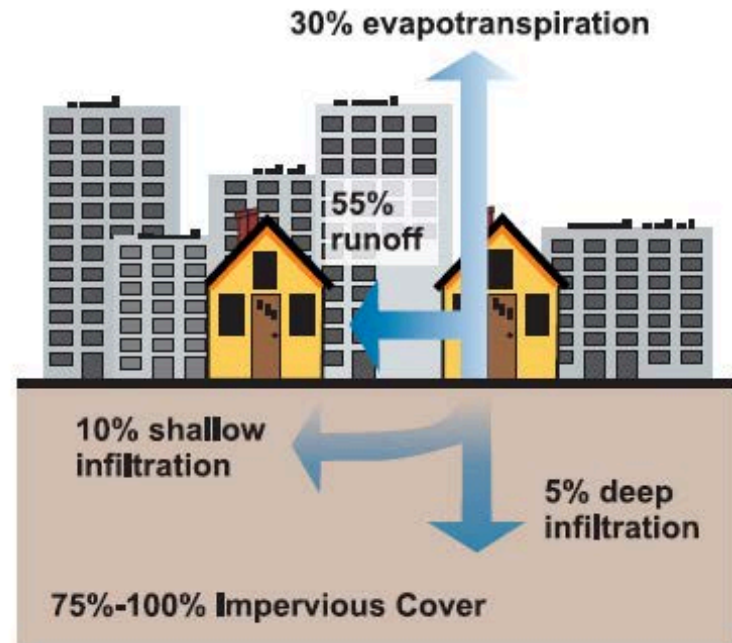
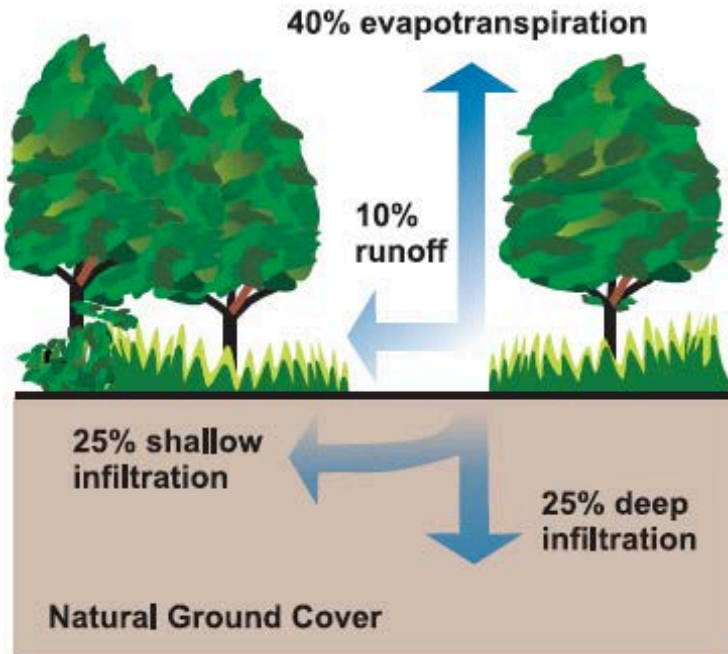


Photo: U.S. Environmental Protection Agency

Asphalt, compacted soil, concrete, brick and stone are impenetrable, or impervious surfaces. These surfaces prevent precipitation from soaking into the soil and groundwater. Fertilizers, pet waste, road salt, herbicides and soil are carried over impervious areas into storm drains and directly into our waterways

Sheet Flow Across Impervious Surfaces



PHOTOS: VIRGINIA SOIL AND WATER CONSERVATION DISTRICT



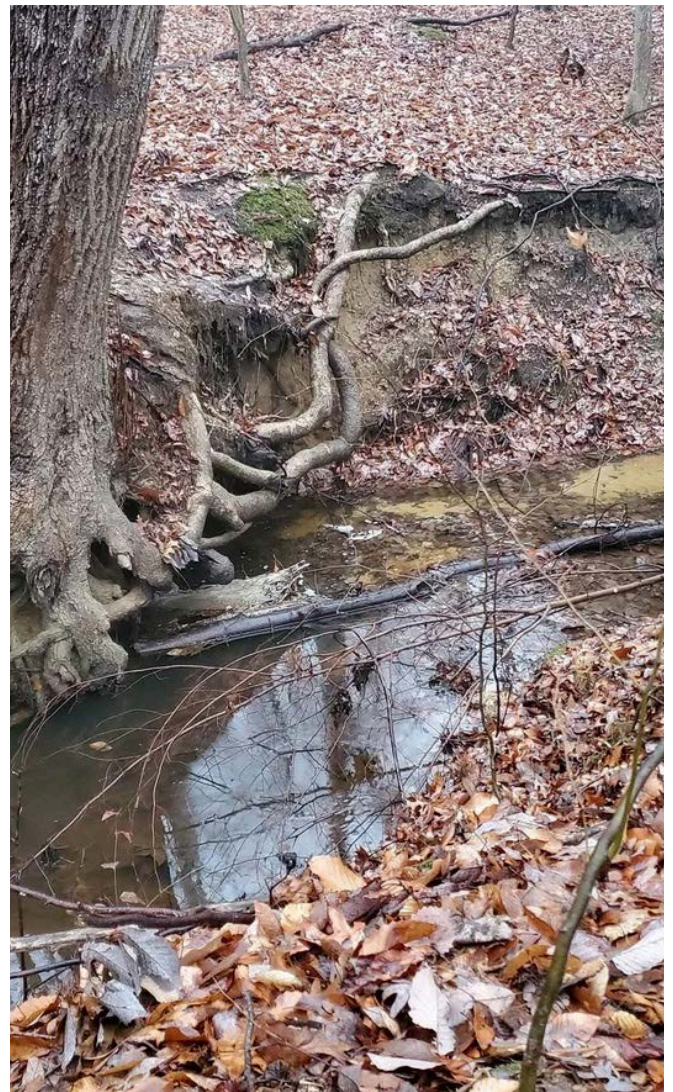
Debris, nitrogen and phosphorus from fertilizers and pet waste washes directly into storm drains from surrounding land into streams and ultimately the Chesapeake Bay

Photo: Dan Keck openverse



Herbicides and fertilizers attach to sediment.

Photo NRCS Montana openverse



Fast moving runoff undercuts stream banks putting vegetation at risk.

Photo: Keith Hansen

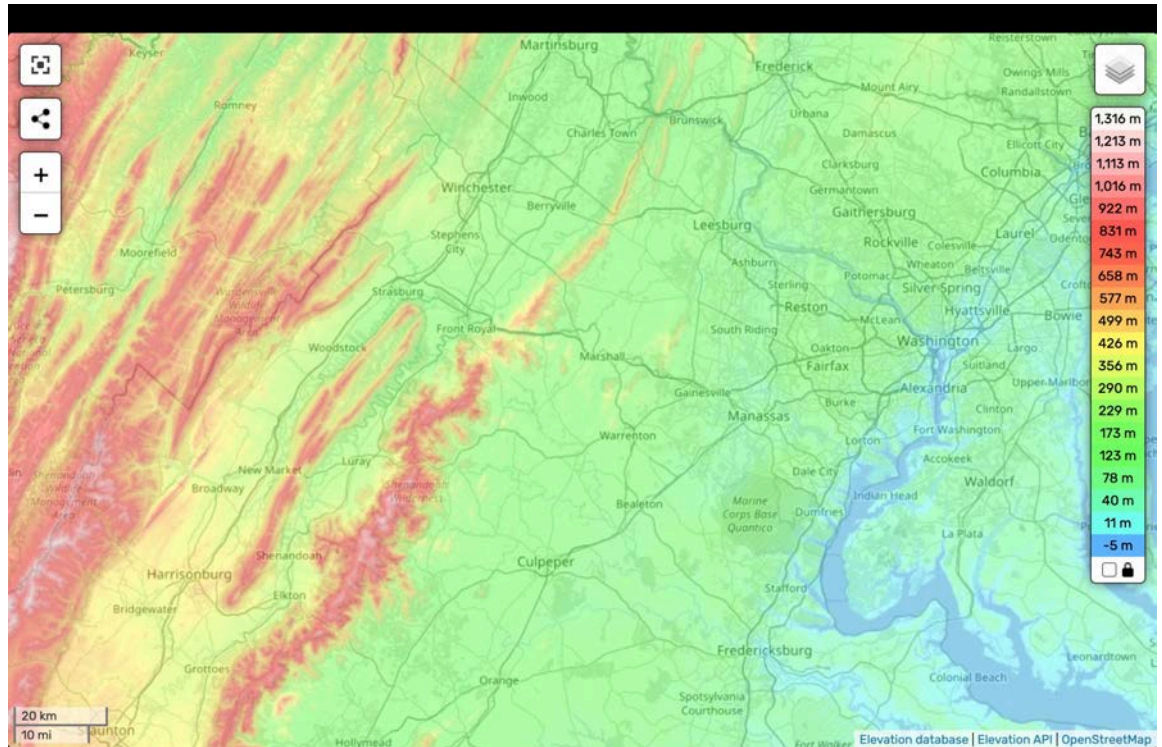
While precipitation is critically important to gardeners, farmers, wildlife and for drinking water, recent precipitation has tended to be sporadic or intense.

The increase in development and intensive landscape practices often leads to more impervious surfaces . The precipitation falling on these non-absorbent surfaces builds up speed and increases the quantity of runoff causing property damage and water quality concerns.

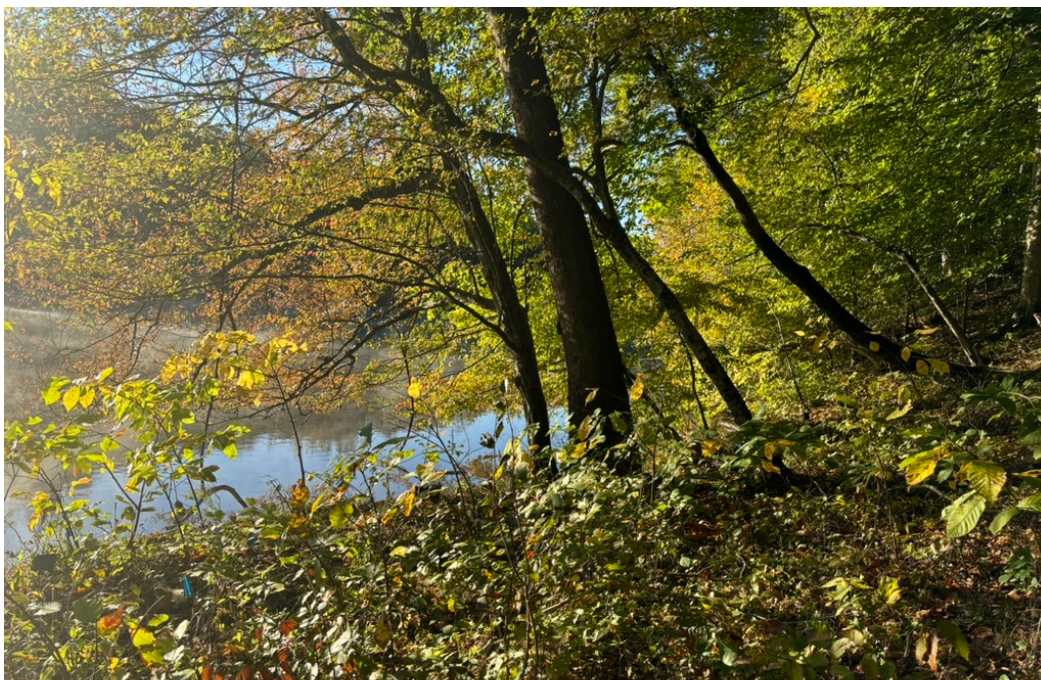
Rapidly flowing stormwater destroys the banks of streams and disrupts aquatic life by washing sediment and pollutants into waterways.

Topography of Prince William County

The topography of our community is varied. Some areas of Prince William County have steep slopes and erodible soils.

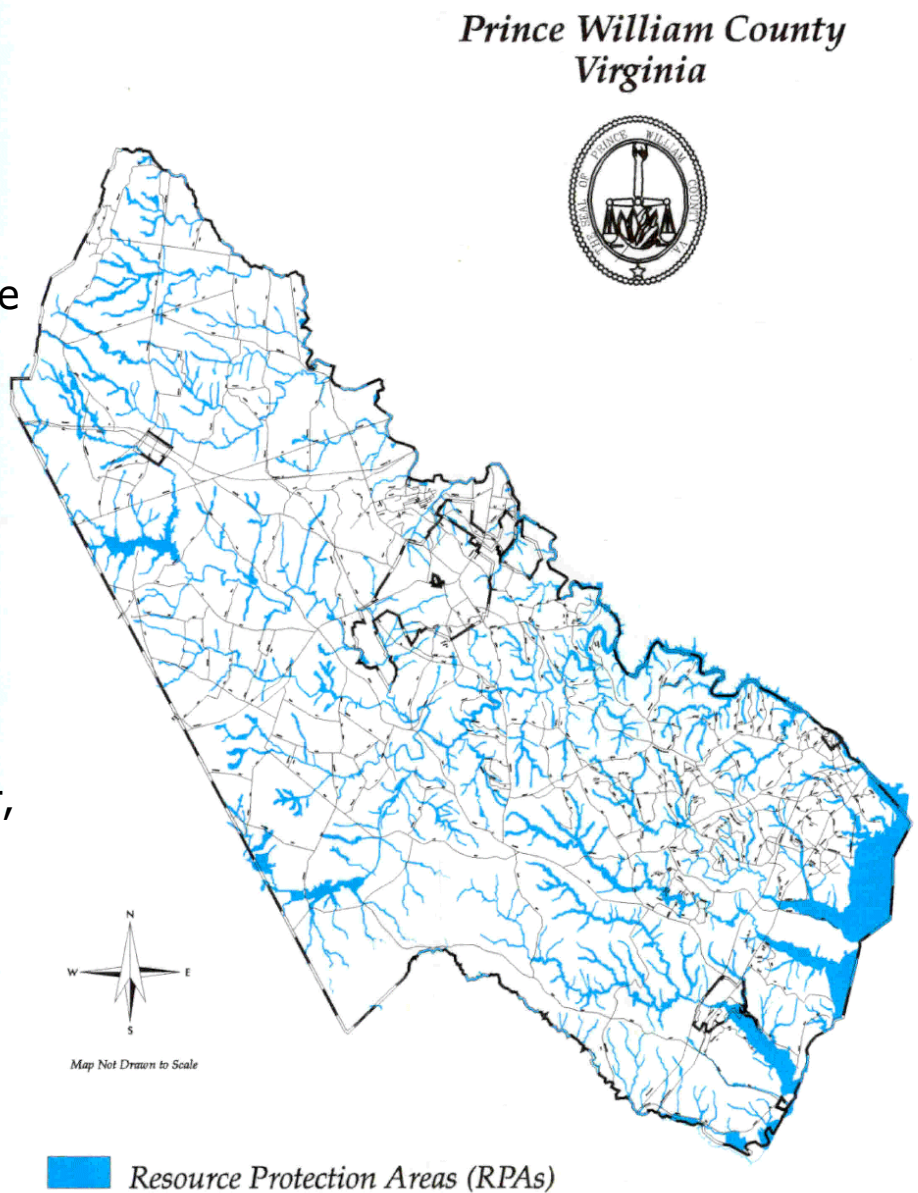


Other portions are flood plain or rocky outcrops. Construction, slopes with thin vegetation, and soil disturbance cause erosion, in turn affecting water quality. The topography of the Occoquan Basin is characterized by hills and steep gorges.



Waterways in Prince William County

This map shows protected areas surrounding streams, ponds, reservoirs called Resource Protection Areas (RPAs). Careful management of these sensitive areas whether on public or private property is critical for healthy water for drinking, irrigation and recreation. County regulations about what activities are permissible in these areas can be found at the link below. Many streams in Prince William County are on the impaired waters list, including the Occoquan Reservoir, the drinking water supply for Fairfax and Prince William Counties. Concerns include high levels of phosphorus, cloudiness, low dissolved oxygen and the presence of metals and pharmaceuticals.



Water quality is directly tied to landscape practices. Low dissolved oxygen and turbidity (cloudiness) reduce the oxygen and sunlight aquatic life and plants need for survival. Overuse of fertilizers, and wrong timing of application to turf grass is a common source of nitrogen and phosphorus pollution.



Matters

Healthy waterways are needed for recreation, fishing, and our drinking water. If you live on a waterfront property, your property value is affected by whether the water is healthy or impaired.

Check out your local waterway's health at the Department of Environmental Quality's
"How's My Waterway?"

<https://mywaterway.epa.gov/>

04.

Assessing the Landscape

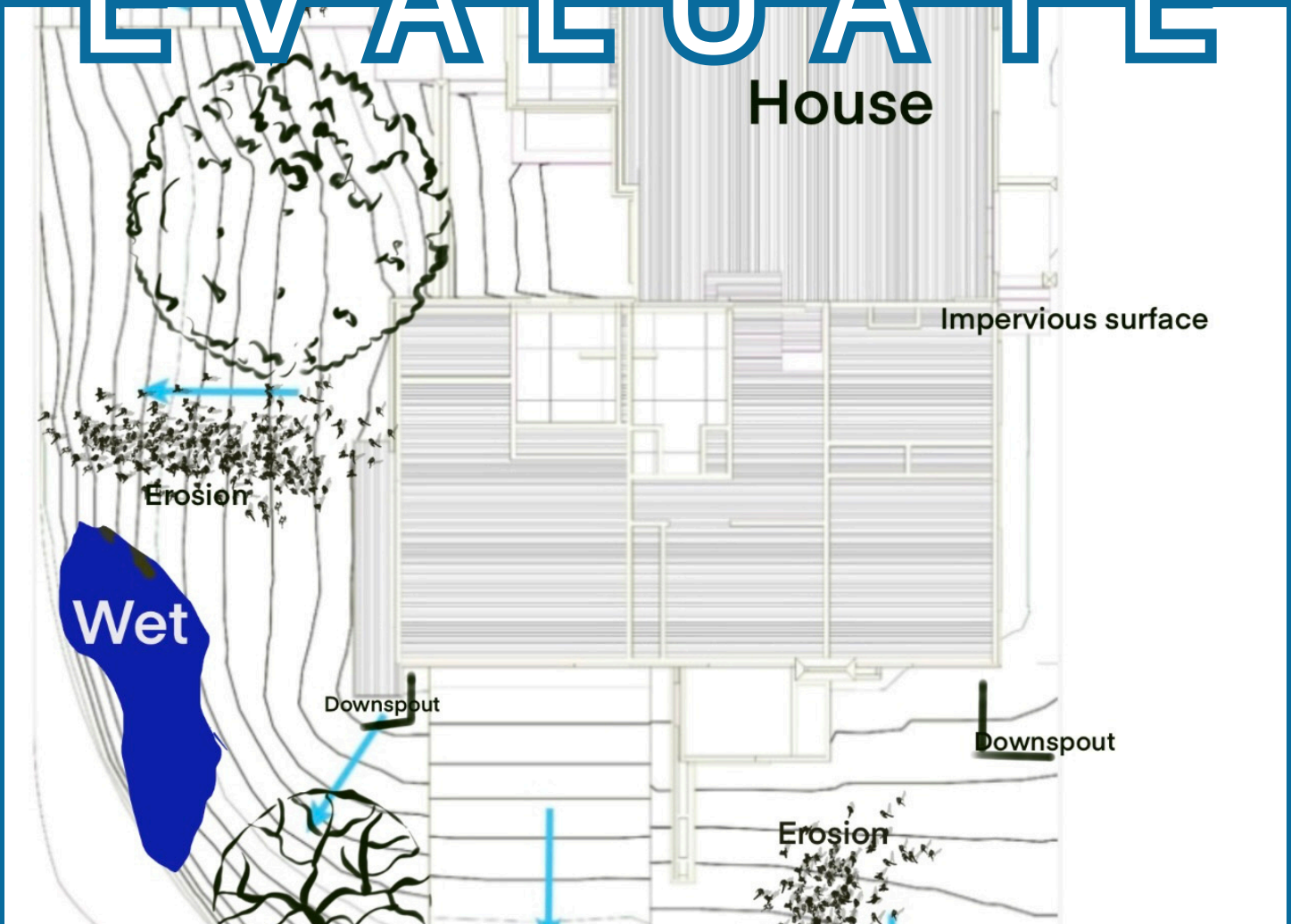


Before addressing any problem, it is vital to define the issues and the possible causes. With stormwater runoff, knowing how precipitation behaves on your property is a good first step. Putting on your boots and rain gear when there is a downpour and observing the soil, vegetation and water patterns during and after the event can help to assess the problems.

Make sure property boundaries are confirmed with [The Prince William County Mapper](#). On the mapper, an online GIS tool, there are options for viewing the topography (hills and valleys) and this can provide insight into how water flows or collects. Print a copy of the plat or aerial photo from mapper or Google Earth and take a walk looking carefully at areas where erosion is occurring.

EVALUATE

House



- Mark areas of erosion on a simple diagram of the landscape.
- Identify the source of the stormwater and add arrows to indicate the direction of water flow.
- Does the water flow across impervious (non-absorbent, hard surfaces) areas like decks, patios, parking areas, walkways with compacted soil?
- Compacted soils are virtually impervious due to foot or vehicle traffic or soil composition.
- Mark areas with vegetation, including trees, shrubs, groundcover.
- Note any areas that are wooded
- If there is a septic system, evaluate the quality of the groundcover vegetation in that area.
- Indicate any water on the property (wetlands, ponds, pools, streams). Note any areas where water puddles.
- Mark roof downspouts and the direction of water flow from the downspouts with arrows.
- Mark any areas where there is ponding on the property or depressions where snow melts last or stays moist.

How much stormwater runoff is on my property?

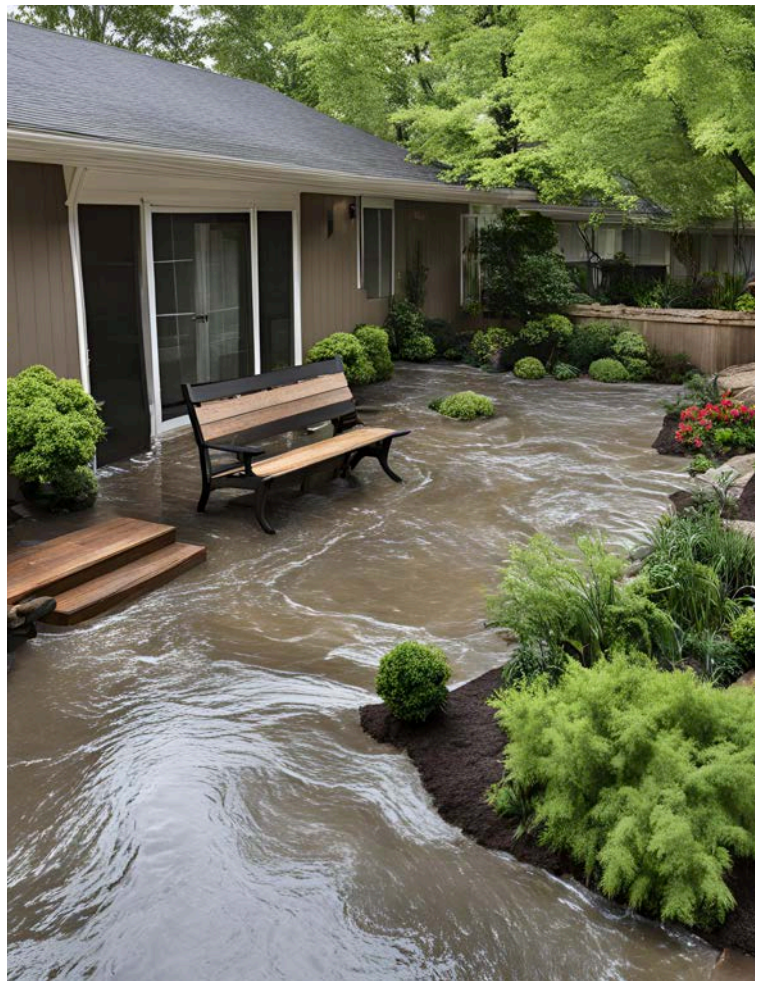


A typical impervious surface, like concrete or asphalt can generate a significant amount of stormwater runoff, with around 90% of rainfall running off due to its inability to absorb water. For every inch of rain, almost an inch of water would run off directly into storm drains; this is often represented by a runoff coefficient of 0.833 for impervious surfaces.

To compute how much stormwater runoff there is on the property, add the approximate area of roof and other impervious surfaces. This formula will calculate how much runoff occurs with a 1" storm (average storm volume). Use a tape measure, laser measuring device or measuring wheel. The amount is dependent on how long the rainstorm lasts, the slope of the property and the type of soil.

Total square feet of impervious area
 $\times 0.0833 \times 7.48 =$ _____ gallons of runoff

This information will provide data that will determine what type and how large an installation could handle stormwater on your property. This can also help to decide whether a do-it-yourself project or professional contractor is more feasible.



Are these present in your landscape?

- ☐ Exposed roots
- ☐ Channels or gullies
- ☐ Piles of small rocks
- ☐ Collapsed stream bank
- ☐ Undercutting of tree roots
- ☐ Soil accumulation
- ☐ Exposed rocks
- ☐ Cloudy water
- ☐ Clogged or covered drainage pipes
- ☐ Excess runoff from downspouts
- ☐ Slopes with poor vegetative cover
- ☐ Shoreline erosion
- ☐ Bare spots in lawn
- ☐ Leaking or failing gutters

One or more of these factors suggest there may be a water quality concern.

Selection of best practices in this toolkit or a consultation with a stormwater professional is advisable.

Slow it down, Soak it in, Spread it out!

The following best practices are accessible as do-it-yourself projects to homeowners to mitigate stormwater runoff and protect property from erosion and damage. These techniques will be described in this toolkit along with local resources to assist citizens in the community.

- **Filter strip**
- **No mow zone**
- **Smart management of turf areas**
- **Streamside/Pond/Lake/Reservoir buffers**
- **Conversion of turf grass areas to native plants (also called conservation landscaping)**
- **Removal of invasive plants and replacement with native flowers, shrubs and trees**
- **Stop dams (with native vegetation)**
- **Vegetated dry swale**
- **Disconnecting a downspout/adding rain barrel(s), also call rainwater harvesting**
- **Rain garden**



Photo: Openverse Alabama Extension

More Complex Practices

These engineered practices require a professional plan and sometimes an engineer's seal and liability documentation.

1 Green Roofs



Constructed Wetlands



2

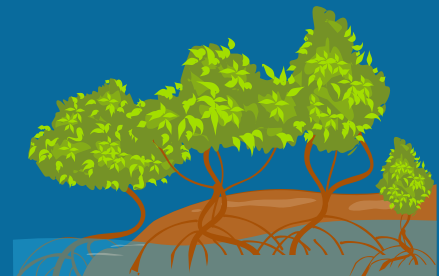
3 Permeable Pavers



4 Cistern



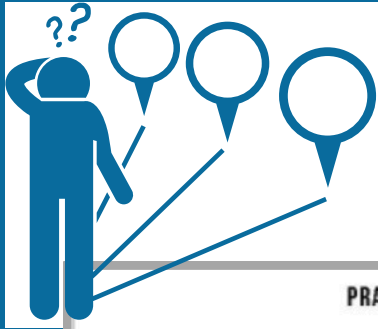
5 Living Shoreline



6 Engineered raingardens and wet swales with underdrains



How to Choose



The following chart* displays the effectiveness of each practice for erosion, vegetation coverage and excess runoff.

PRACTICE	EROSION	POOR COVER	EXCESS RUNOFF
IMPERMEABLE SURFACE REMOVAL	Yellow	Red	Green
CONSERVATION LANDSCAPING 1: MEADOW	Red	Green	Red
CONSERVATION LANDSCAPING 2: TREE PLANTING	Green	Green	Red
CONSERVATION LANDSCAPING 3: MULCHED BED	Red	Green	Red
CONSERVATION LANDSCAPING 4: FILTER STRIP	Green	Yellow	Green
CONSERVATION LANDSCAPING 5: RIPARIAN BUFFER	Green	Green	Red
RAIN GARDEN	Green	Yellow	Green
DRY WELL	Green	Red	Green
CONSTRUCTED WETLANDS	Green	Yellow	Green
RAINWATER HARVESTING	Yellow	Red	Green
VEGETATED STORMWATER CONVEYANCE: WET SWALE	Green	Yellow	Green
VEGETATED STORMWATER CONVEYANCE: DRY SWALE	Green	Yellow	Green
VEGETATED STORMWATER CONVEYANCE: STEP POOL	Green	Red	Yellow
BIORETENTION	Green	Red	Green
INFILTRATION	Green	Red	Green
PERMEABLE PAVERS	Yellow	Red	Green
GREEN ROOF	Red	Red	Green
LIVING SHORELINE	Green	Red	Red

Not an appropriate practice for this resource concern

Can be used to address the resource concern, but may not be ideal

Ideal to treat the resource concern

Sometimes, a combination of practices is the best choice. This is called a "treatment train" and combines at least two practices and is designed maximize control of pollutants in runoff.

*Chart courtesy of Virginia Soil and Water Conservation Districts.

Filter Strips/No Mow Zone

Homeowners living on waterfront property are the last defense for stormwater flowing into a waterway. Management of these landscapes requires careful selection of techniques to filter, slow down and absorb stormwater. One of the simplest solutions is to allow vegetation to cover or directly plant native grasses on the banks of the waterway. Lawn grass does a poor job of filtering pollutants and preventing erosion of banks because of shallow roots. When lawns are mowed up to the edge of the bank, sediment, pollutants and any material uphill are washed into the waterway and the bank is subject to erosion and undercutting of the root systems of existing plants. Native grasses have deep roots, beautiful form and color and are available in various heights.



Ai image

Letting grasses grow at the edge of a stream rather than mowing or string trimming is a good first step in protecting water quality, a strip of 50-100' to allow vegetation to slow, soak in and filter water. Even more effective is to plant a buffer of native plants alongside a stream, lake, pond or reservoir. This buffer provides the following benefits:

- Stabilizes the shoreline
- Provides habitat for food for wildlife
- Add visual beauty to the landscape
- Reduces flooding
- Provides shade, lowering the water temperature.
- Reduces algal blooms
- Reduces runoff that causes harmful algal blooms by filtering runoff of nitrogen and phosphorus.
- Deters waterfowl from nesting on shoreline



Photo: Keith Hansen

Undercutting of tree roots and streambank erosion due to lack of streamside vegetation buffer, putting the bank at risk.

Riparian buffer

(Resource Protection Area RPA)

A riparian buffer is an area around a body of water or wetland planted with native trees, shrubs and flowering plants that slow, soaks in and utilizes stormwater, protecting the waterway from harmful nutrients, pollutants and erosion.

This practice:

- filters,
- stabilizes banks, and
- reduces flooding,
- as well as providing habitat and food for wildlife
- is relatively low maintenance once the plants are established.

Maintenance includes:

- removal of invasive plants and weeds,
- some watering until plants are established, and
- removal of debris.

The fall months are the best time to install a buffer, but spring is possible also. The more complex the buffer, the greater the wildlife value and filtering advantages. The width of a buffer can vary from 50- 300', but 50-100' is common. The width of the vegetated buffer will vary with the homeowner's needs, the soils, slope, and current vegetation. Installation can be done by the homeowner making this technique more affordable. Vegetation need not obstruct the view of the water and can be carefully chosen to meet the homeowners' needs.

Some cost share programs are available. See resources at the end of this publication.



Photos: Green Book for the Buffer



Photo: Nancy Berlin, Gentle Landscaping LLC

Coconut fiber logs impregnated with landscape plugs or seeds for native grasses and sedges hold back erosion until plants get established.

Stop dams (check dams, or water breaks) with native vegetation



The protection of uphill slopes as well as the bank of the waterway is important to intercept and slow the flow of stormwater. This can be accomplished with biodegradable coconut fiber ledges that disrupt the grade and provides a planting area for native vegetation to be established. The water is forced to slow down, soak in and spread out, irrigating the plants on the ledge. Coconut fiber logs are filled with soil and anchored in place with stakes. Downed trees/logs can also be used but must be secured to be useful.

This image shows coconut fiber logs impregnated with landscape plugs or seeds for native grasses and sedges hold back erosion until plants are established. Native groundcovers and shrubs suited to neighboring plant community are chosen for planting on these ledges. Root systems of these plants hold the soil and slow runoff on slopes.

Smart management of lawn areas

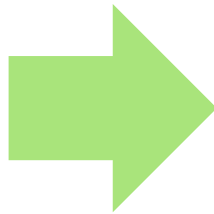
Thin, poorly managed and compacted soils allow increased pollutants to enter waterways.

Fertilization is effective only when the roots of the grass can use the additional nutrients, which is in the fall months for cool season grasses, such as fescues, and in spring for warm season grasses like zoysia. Turf grass does a poor job of slowing storm water and filtering pollutants but is slightly better than bare soil. Homeowners often prefer a turf area on their property for recreation and aesthetics. Consider reducing the size and converting turf to native plants, trees and shrubs for better stormwater control.

For areas where there is turfgrass, keep it thick and healthy by using research-based procedures and contacting the Virginia Cooperative Extension Prince William BEST Landscapes program at BestLawnsAudubon@pwcgov.org

Other tips:

- Fertilize based on a soil test
- Mow high (3" or higher) and avoid mowing within 50' of a waterway
- Sweep up excess fertilizer spills
- Grow alternate groundcovers in shady areas or under trees instead of turf



Conservation Landscaping

Beautiful native shrubs and plants with root systems that grip and protect the soil provide attractive and valuable water quality protection and habitat. Selection of appropriate plants should be based on soil conditions and type, sun exposure, soil moisture levels, and existing vegetation. Native plants are well suited to local soils therefore soil amendments like compost and fertilizers are unnecessary. These local plants support beneficial insects, like butterflies, predators of garden pests and other pollinators. Native vegetation is critically important to our backyard birds and other native wildlife and are drought tolerant, once established.



Native asters, Ironweed, and Sneezeweed provide beauty, erosion control and seeds for backyard birds.



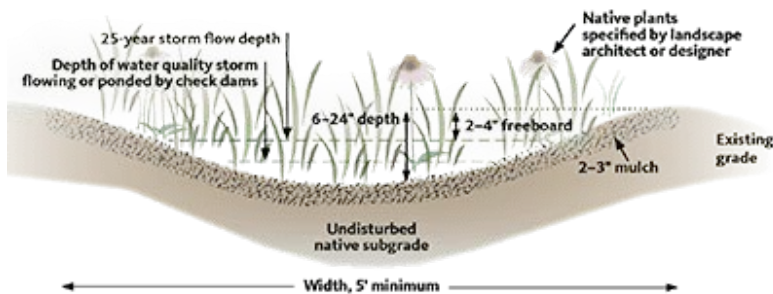
Vegetated Swale

(dry swale, no underdrain)



A vegetated swale is a gently sloping conveyance channel that can be an attractive, relatively low cost and low maintenance solution.

This practice can slow down and settle runoff and provide absorption with native plantings. Adequate porosity of the soils is needed. The native plants chosen should be consistent with neighboring ecology and soils.



If the soil does not infiltrate adequately, a different location or a more engineered solution with an under drain may be necessary. A swale may also funnel runoff into a rain garden. Check dams with coir logs or rocks can also be used depending on the slope grade and amount of runoff expected. Choose native plants, including grasses, sedges and perennials with deep roots that can survive wet periods and drought and hold the soil to prevent scouring



Rain Barrel

Downspout disconnection, rainwater harvesting



Photo: openverse

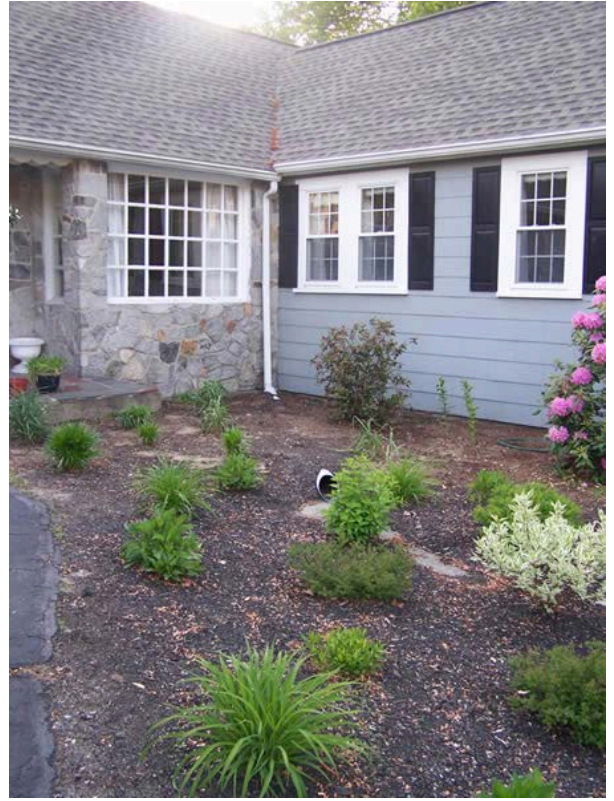


Photo: U.S., Environmental Protection Agency

Collection of rainfall from the roof of a house or other building and saving or redirecting can be an effective way to reduce the flow of stormwater. It is important that the amount of rainfall is estimated so that the correct size(s) of rain barrels are used. An alternative to a barrel is a disconnection of a downspout and redirection into a garden bed or rain garden and away from a house foundation.



Rain Garden

Bioretention

How does a rain garden work?

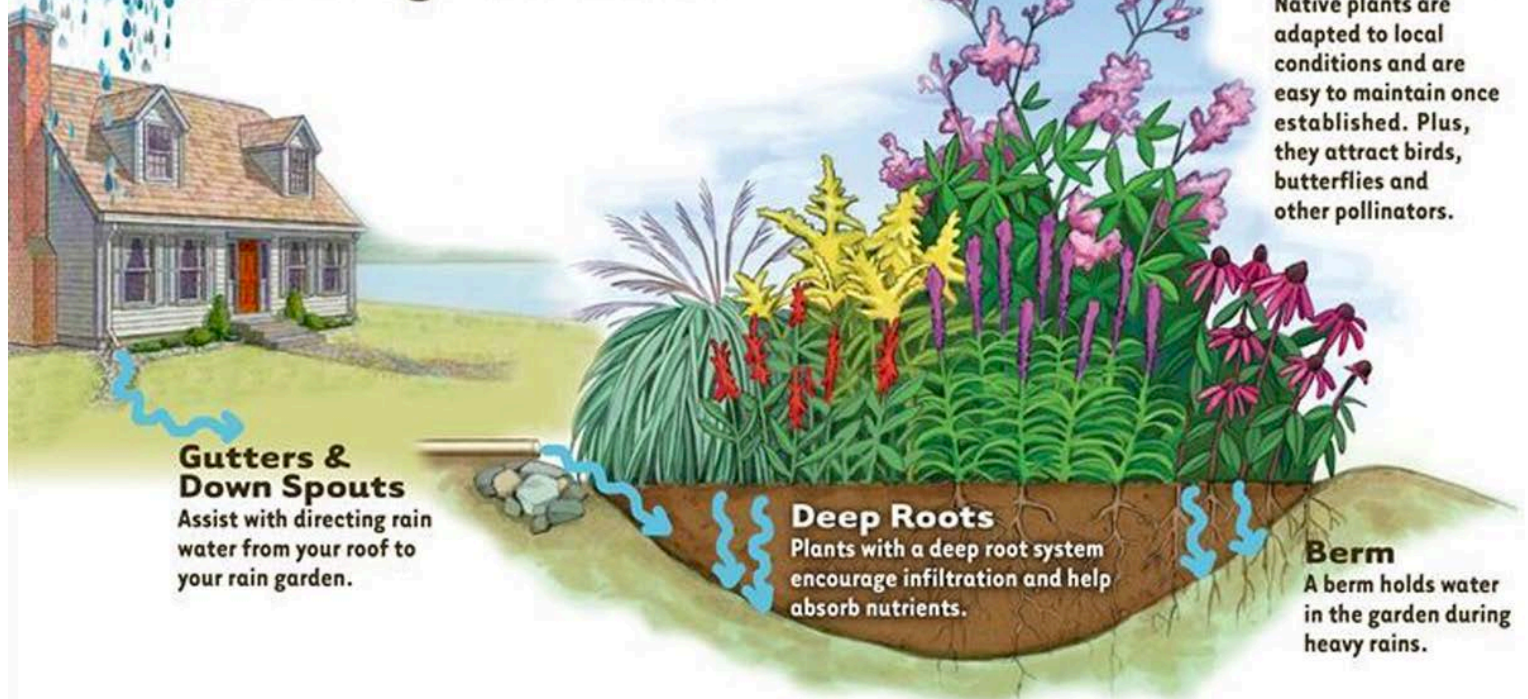


Photo: Department of Wildlife Resources

A rain garden is a bowl-shaped garden with an inlet and outlet that uses soil, mulch, and deep-rooted plants to capture, infiltrate and filter stormwater. A special soil blend is needed to maximize infiltration. Careful calculations are made for the inlet, outflow and size based on topography and amount of impervious collection area. Soil permeability should be investigated with an infiltration test to determine if the site is appropriate, the soil mixture required, and if an underdrain is necessary. Rain gardens should be 10 feet or more away from a house foundation and should not be located in wet areas. A rain garden should drain within 48 hours.

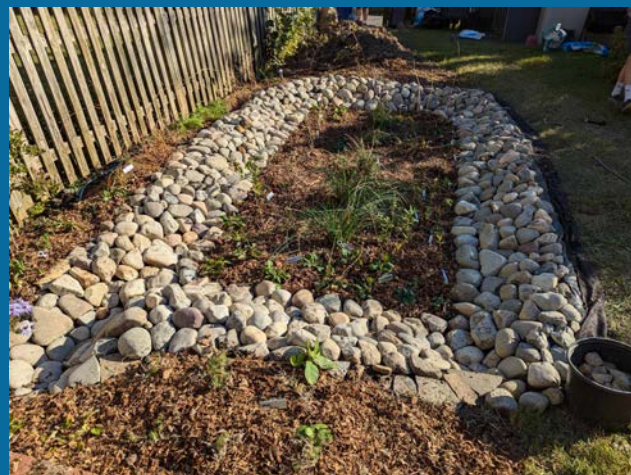


Photo: Adrian Willing Bee America LLC



Photo: Chesapeake Conservation Landscaping Council



08. Homeowners' Decision Guide

Assess Property

Is the stormwater a problem on **your property**? If so, go on to step two. If not (i.e. HOA Common area, County/VDOT property, Conservation Easements) contact authorities for next steps*.

1

Identify Problems

- Pooling water in yard
- Poor vegetation cover
- Waterfront/stream bank erosion
- Fast flow erosion from sloped area
- Pooling near downspout
- Difficulty getting groundcover to grow (i.e. grass)

2

Map Your Property

Draw a simple diagram of your property marking the problem areas.

Label the issues in each area.

3

Source Support

Community assistance:

- Virginia Cooperative Extension
- Prince William Soil & Water Conservation
- Price William County Environmental Management
- Chesapeake Bay Landscape Professionals

4

Get Started

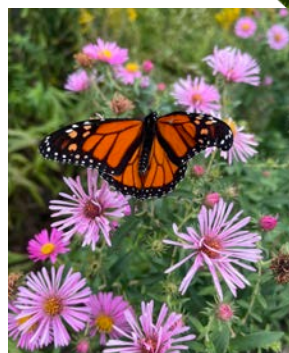
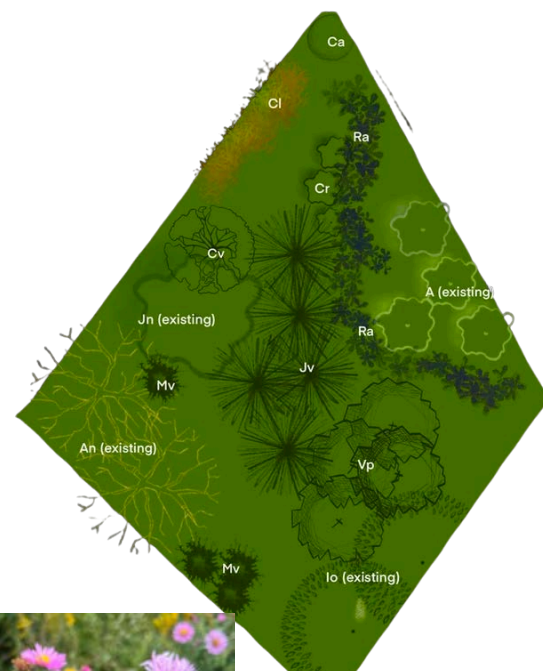
Ask for the assistance from a contractor familiar with best practices and native plants.

5

* If you live in a community with a homeowners' association (HOA), check any property improvement requirements (PIR) prior to planning your project

Which stormwater best practices fit your property goals?

- **Want more color?**
 - Consider conservation landscaping or a rain garden if conditions are appropriate.
- **Want to spend less time mowing?**
 - Consider conservation landscaping, or a tree or shrub bed.
- **Are you a bird or butterfly watcher?**
 - Select native plants that serve as nectar, pollen and host plants for butterflies. Choose host plants with fruit, or draw insects that birds need.
- **Have a small yard &/or a vegetable garden that needs irrigation?**
 - Consider a rain barrel
- **Have waterfront property?**
 - Establish a riparian or grassy buffer
- **Got erosion or slopes with thin vegetation?**
 - Consider a swale, rain garden, conservation



Photos: Gentle Landscaping, LLC.

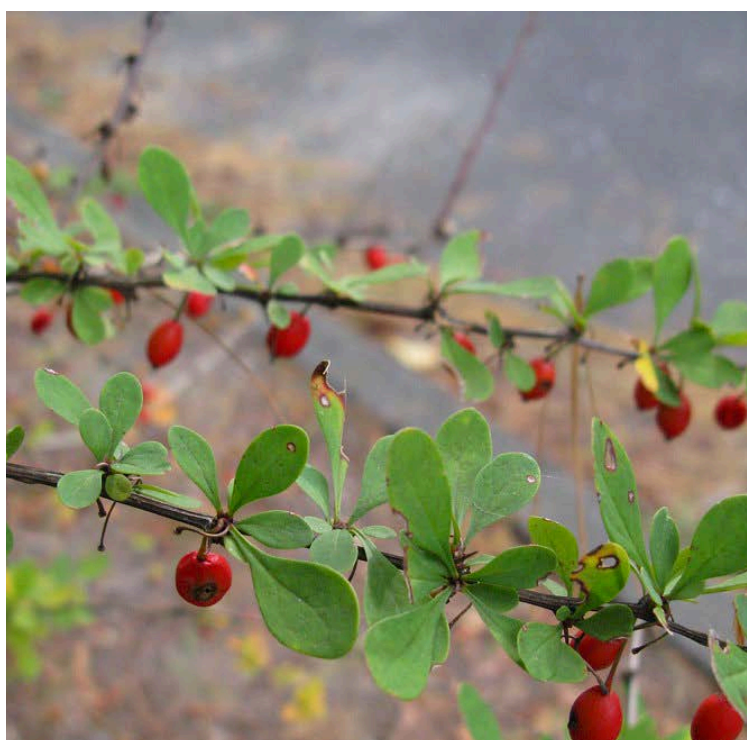
A Word About Invasives

Chances are you have invasive plants on your property. These should be removed before installation of a practice for stormwater. Invasive plants are more than just weeds.

These plants produce profuse numbers of seeds and often have aggressive root systems that make them difficult to eradicate.

For identification and management, please contact Virginia Cooperative Extension Horticulture Help Desk mastergardener@pwcva.gov

If you live on a waterfront property, special invasive plant removal techniques are required to protect water quality. Removal in stages is advised to prevent erosion.



Japanese barberry - invasive plant Creative Commons



Resources

Planning & installing a filter strip:

[Virginia Cooperative Extension Prince William](#)
[Prince William Soil and Water Conservation District](#)
[Plant NOVA Natives](#)
[Chesapeake Bay Landscape Professionals](#)
[Prince William Wildflower Society](#)

Resources to help with smart lawn care:

[Virginia Cooperative Extension – Prince William – BEST Landscapes Program](#)
[Virginia Tech resources for turf care](#)

Resources to assist with conservation landscaping

[Virginia Cooperative Extension Prince William](#)
[Plant NOVA Natives](#)
[Prince William Wildflower Society](#)
[Flora of Virginia Digital Atlas](#)
[Earth Sangha](#)
[Chesapeake Bay Landscape Professionals](#)
[Prince William Soil and Water Conservation District](#)
[Homegrown National Park](#)
[Xerxes Society](#)

Resources to assist homeowners with riparian buffers

[Prince William Soil and Water Conservation District \(VCAP cost share\)](#)
[Fairfax Water Homeowner Program \(cost share\)](#)
[Virginia Cooperative Extension Prince William \(technical assistance\)](#)
[Chesapeake Bay Landscape Professionals \(design & installation\)](#)
[Virginia Tech publication: Creating a Waterfront Buffer](#)
[Green book for the Buffer \(Maryland\)](#)

Resources for swales

[Virginia Tech - Dry Swales](#) <https://www.pubs.ext.vt.edu/426/426-129/426-129.html>
<https://www.epa.gov/system/files/documents/2021-11/bmp-grassed-swales.pdf>
<https://www.pubs.ext.vt.edu/426/426-129/426-129.html>
<https://extension.oregonstate.edu/catalog/pub/em-9209-water-quality-swales-low-impact-development-fact-sheet>

Engineered practices

[Chesapeake Bay Landscape Professional](#) <https://cblpro.org/>
[Virginia Association of Landscape Architects](#) <https://www.vaasla.org/>

Resources for planning and constructing a rain garden:

[Virginia Cooperative Extension Prince William](#)
[Virginia Cooperative Extension publications on rain gardens/bioretentation](#)
[Prince William Soil and Water Conservation District Virginia Conservation Assistance Program](#)
[Chesapeake Bay Landscape Professionals](#)

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Water

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Strickland



Fairfax Water

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