

Slow it. Spread it. Sink it!

A Homeowner's Guide to Sustainable Home Drainage

Practical and Eco-Friendly Ways to Protect
Your Property and the Environment from
the Effects of Stormwater Runoff





Get Into It

Slow it. Spread it. Sink it!

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Practical and Eco-Friendly Ways to Protect Your Property and the
Environment from the Effects of Stormwater Runoff

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STATEMENT OF PURPOSE

This manual has been developed for educational purposes by the City of Rockville. It was adapted with permission from the Resource Conservation District of Santa Cruz County (RCD). The stormwater runoff improvement practices included in this guide are to be used as general guidelines and are not to be used as professional engineered specifications. Prior to implementation of ANY practices, seek technical assistance from a licensed professional engineer or landscape architect, and/or certified professionals in erosion and sediment control for specifications for these practices. Site-specific designs that address each individual site's needs and constraints are essential.

ACKNOWLEDGEMENTS

Many individuals contributed to the development of this guide.

Additional information was compiled from the Low Impact Development Center, the Lake Tahoe Resource Conservation District, the San Francisco PUC, and the County of Santa Cruz. The Resource Conservation District of Santa Cruz County (RCD) has produced this guide with Clean Water Act 319(h) funds administered by the California State Water Resources Control Board.

Note: Federal, state, and local regulations in Maryland pertain to many of the subjects presented in this guide. Regulations change quickly, as do the technical methods and standards for environmental protection. Be sure to follow applicable regulations covering private land maintenance and related activities for your area. Permits or permission are required for some techniques found in this guide and when working in the right-of-way or on a City easement. Always check with the City to determine if a permit is necessary for your project.

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DID YOU KNOW?

Something as simple as water from a downspout contributes to a number of unwanted consequences.

Roofs and other impervious surfaces alter natural hydrology increasing the volume of stormwater runoff. This has a variety of impacts including streambank erosion and degraded wildlife habitat.

Other unintended outcomes associated with accelerated stormwater runoff are pot-holes, damage to structures, beach closures, and in severe cases, land and mud slides. Fortunately there are simple low-cost things that we all can do to help decrease the volume of, and minimize the pollutants in, the runoff leaving our properties.

And many have the added benefit of beautifying our landscapes! Read on.

DID YOU KNOW THAT THIS:

CAN CONTRIBUTE TO THIS:



SO WHY NOT TRY ONE OF THESE?

Here are just a few of the ideas you'll find in this guide to address stormwater runoff around your home.

Collect your roof water in a **RAIN BARREL**.



Cost: LOW
Installation difficulty: EASY
See page 22

Plant a **RAIN GARDEN** or **CONSERVATION LANDSCAPE**.



Cost: LOW to MODERATE
Installation difficulty: EASY to INTERMEDIATE
See page 25

Install a **WATERBAR** on your driveway.



Cost: MODERATE
Installation difficulty: INTERMEDIATE
See page 32

Use **PERVIOUS PAVERS** when renovating your patio.



Cost: MODERATE - HIGH
Installation difficulty: INTERMEDIATE
See page 28

Introduction

Before the City of Rockville became the developed, unique community it is today, the diverse collection of habitats including deciduous and evergreen forests, oak woodlands, riparian areas, and wetlands were virtually undisturbed. Rivers and streams, capturing and conveying rainwater, flowed to the Chesapeake along sinuous unchanneled corridors. Intact wetlands functioned as natural filters and buffers from major storms. Under these pre-development conditions as much as 50% of rainwater **infiltrated** (soaked into) the soil replenishing groundwater supplies, contributing to year-round stream flows, and sustaining plants. Another 40% was released into the atmosphere through **evapotranspiration** (evaporation of surface and ground water plus water loss from plants). Only about 10% contributed to **stormwater runoff** (rainwater that flows over the land surface).

Our modern day urban centers and suburbs are made up of **impervious surfaces** (hardened surfaces that do not allow water to pass through) such as roofs, streets, and parking areas. When rain falls on these surfaces, it flows faster and in greater amounts than it would have under pre-development

conditions significantly increasing runoff and decreasing infiltration and evapotranspiration. Runoff is typically conveyed by pipes, driveways, streets, and storm drains to creeks and rivers, where it can cause flooding, road damage, stream erosion, and landslides. Runoff also carries sediments and other pollutants to streams and rivers making them unsafe for recreation and wildlife. Though it starts as relatively clean rainwater, runoff collects pollutants as it flows over the landscape. For example excess lawn fertilizers, pet waste, soap from car washing, oil and grease from leaking engines, zinc from tires, and copper from brakes are just some contaminants that have been found in runoff in the City. The best way to protect local streams is to reduce stormwater pollution and runoff.

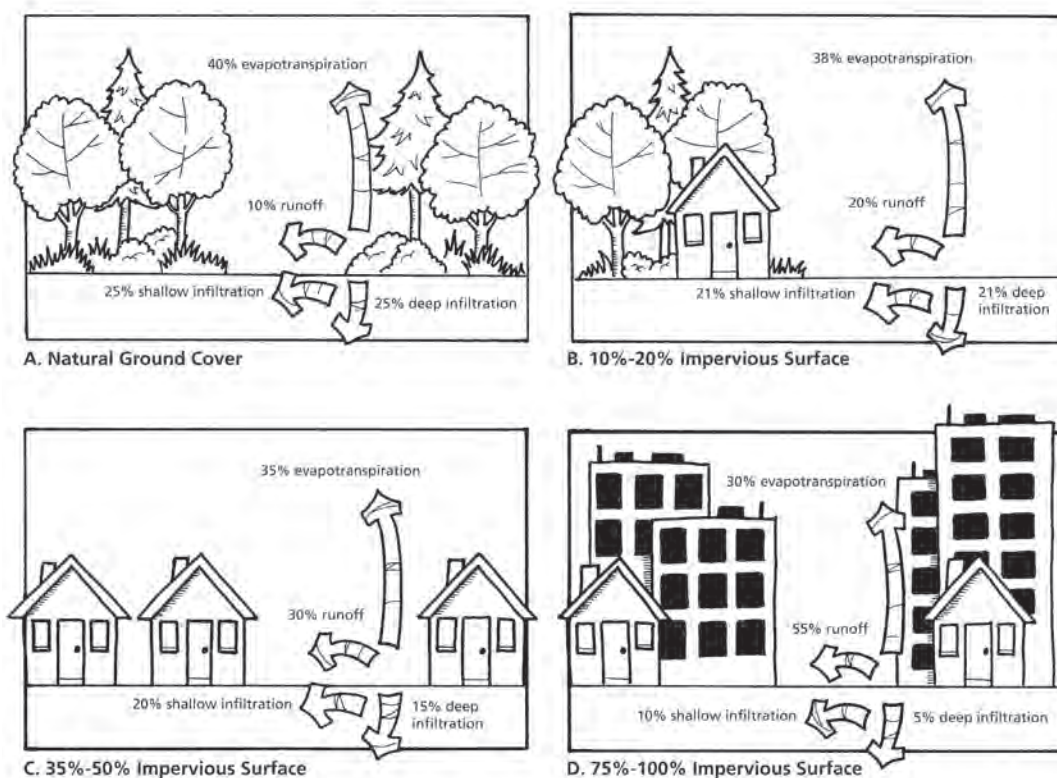


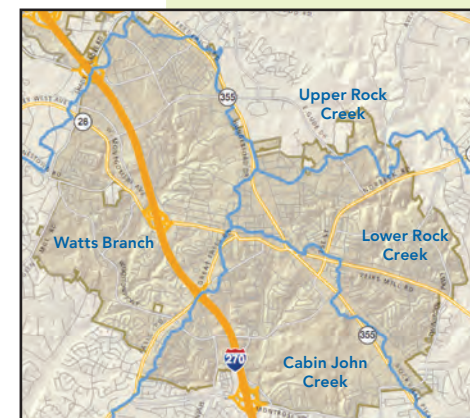
FIGURE 1: PERCENTAGE RUNOFF GENERATED FROM IMPERVIOUS SURFACES, ADAPTED FROM FISRWG 1998



RUNOFF FROM THE SURROUNDING HOMES AND STREETS FLOWS THROUGH THIS STORM DRAIN...



...AND CONTINUES DIRECTLY TO LOCAL STREAMS.



DID YOU KNOW?

Just as a city, county, state, or even our personal property has boundaries, so does a watershed. We define a watershed as the land that contributes water to a given area. Watersheds are normally named after the river, creek, or stream that they drain to. For instance, residents of Twinbrook are primarily in the Rock Creek Watershed. If you live in King Farm or West End, you are in the Watts Branch Watershed. All of the rainfall and runoff from a home drains into the watershed where it is located, eventually replenishing critical groundwater resources or flowing to the Chesapeake Bay.

One way to help reduce the negative impacts of runoff is by changing the way we approach new construction. However, since much of our City is already developed, a great benefit can be derived by addressing runoff from our existing homes. Just as with new construction, through good planning and designing we can accomplish the following:

- Conserve our natural resources
- Create healthier homes
- Clean up our creeks, streams, and the bay
- Protect infrastructure and reduce flooding

In addition to the information provided in this guide, the City of Rockville offers free educational workshops, on-site stormwater runoff evaluations, and cost-share assistance for implementing stormwater Best Management Practices (BMPs). For more information visit the City of Rockville web site at www.rockvillemd.gov/rainscapes.



CHAPTER 1

UNDERSTANDING AND EVALUATING STORMWATER RUNOFF AROUND YOUR HOME

This guide will focus on BMPs that you can do at home. The BMPs are not complicated. They are geared toward residential homes or small developments and the underlying concepts behind them follow a simple mantra: Slow it. Spread it. Sink it!

- **Slow the runoff down**
- **Spread it out in planters, gardens, or over other pervious surfaces - do not confine runoff to pipes**
- **Sink it back into the ground!**

This chapter divides your property into five major areas or “zones” that can contribute to runoff: 1) roofs, 2) elevated structure, 3) walkways and patios, 4) driveways and parking areas, and 5) bare soils and landscapes. It examines each zone for common problems related to runoff and suggests potential solutions. The end of the chapter provides instructions for a simple do-it-yourself evaluation of your property to assist you in choosing BMPs that suit your specific needs. It is important to note that multiple BMPs may be needed. Consult a professional for assistance in choosing which technique are right for your property or if you have severe runoff issues that may not be solved by techniques in this guide.

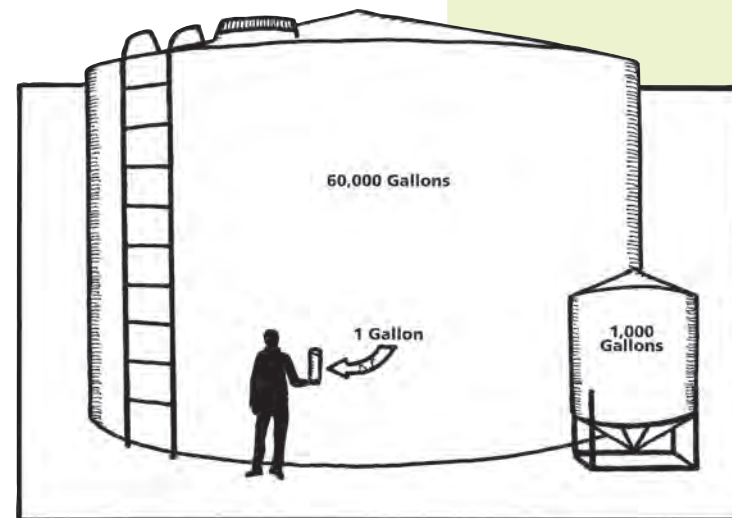


ROOFS

Your roof likely generates the most runoff from your home. While the majority of roofs are outfitted with gutters and downspouts, some are not, so protection measures for either possibility are discussed. Regardless of which system you use, all eaves and downspouts should be routed away from sensitive areas such as hillside building foundations and neighboring properties.

NON-GUTTERED ROOFS

It is highly recommended that gutters be installed on all roofs. If it is not possible to install gutters because of cost or other issues, you will need to protect the ground below the eaves which is referred to as the drip-line. Runoff from eaves can cause significant erosion and the resulting moisture can damage foundations and cause unhealthy mold to develop.



DID YOU KNOW?

It takes only one inch of rain falling on a typical 1500-square-foot roof to generate approximately 1,000 gallons of runoff. Annual rainfall in Rockville is about 43 inches. This means that in one year, your roof alone could shed between 45,000 gallons of water as runoff!

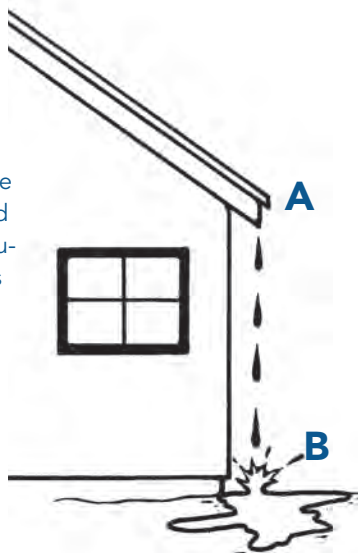
POTENTIAL PROBLEMS

A Non-guttered roofs can cause problems along the drip-line of your home

B Water from a non-guttered roof can cause erosion, damage structures and foundations, and contribute to downstream pollution. Ponding near foundations can also cause unhealthy mold to develop.



Repairing mold and water damage



SOLUTIONS



A Adding gutters and downspouts works to direct water to a safe location away from bare soil and buildings (see page 20).

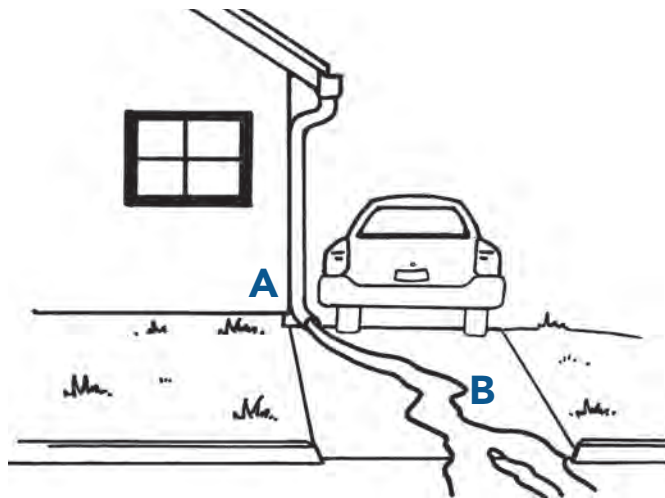


B Vegetated or rock drip-line protection SLOWS runoff thus reducing erosion and promoting infiltration. It is also designed so that the ground slopes away from the home's foundation.

GUTTERED ROOFS

Gutters and downspouts are an excellent choice for handling roof runoff; however, they must be properly sized, managed, and maintained to prevent damage to property and the environment. Undersized gutters clog and overflow more frequently, which can damage foundations. Directing downspout runoff toward impervious surfaces like driveways is common but can contribute to downstream flooding, surface water pollution, potholes and other issues. ALWAYS avoid sending runoff towards hillsides and buildings where they could cause significant damage to yours or others property.

POTENTIAL PROBLEMS



A The downspout is directed toward an impervious (concrete) driveway that drains to the street. The resultant runoff may damage roads, exacerbate downstream flooding, or carry pollutants to nearby waterways.

B This driveway is constructed of impervious materials (concrete), and all of the runoff is directed toward the street. The resultant runoff may damage roads, exacerbate downstream flooding, or carry pollutants to nearby waterways.



Runoff from residential homes can carry pollutants to local streams that can be harmful to wildlife.

SOLUTIONS

A Rain barrels, downspout diverters, and rain gardens are all potential solutions for treating downspout runoff by SLOWING water down and SPREADING it out (pages 22, 24 and 25).

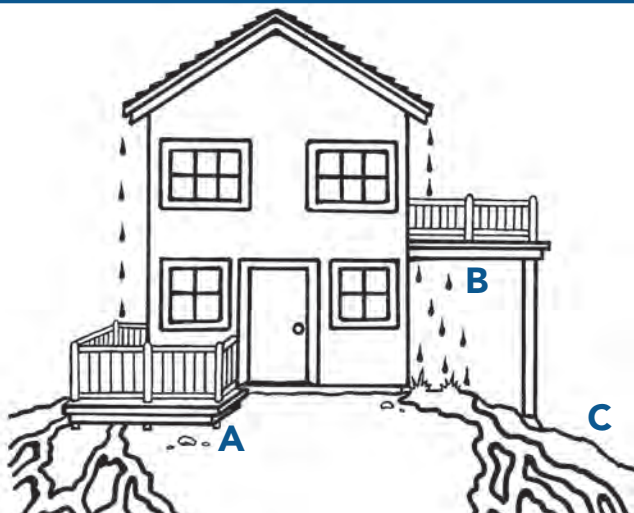


B See Driveways and Parking Areas (page 15).

ELEVATED STRUCTURES

The area underneath decks, outdoor stairs, and other elevated structures where water impacts the ground is called the drip-line. Significant soil loss, damage to supporting structures, or worse can occur if this area is not adequately protected. Where signs of erosion are present such as soil loss or uneven ground from water flow, it is important to take protection measures. Locations with over a 50% slope are particularly vulnerable and may require treatments designed and installed by a qualified licensed professional.

POTENTIAL PROBLEMS



A Low decks may prohibit the addition of protective ground cover, leaving bare soil to erode.

B The runoff from high decks impacts the soil with greater force than low decks. It can cause structural damage to supports and contribute to sediment and other pollutants entering nearby storm drains and streams.



Visible erosion under a deck is common.

C Runoff on steep slopes with bare soils can cause significant erosion. Ground covers such as rock and mulch are hard to keep in place and can easily wash away.

SOLUTIONS



A Adding drain rock or vegetation to the perimeter SLOWS and SPREADS water limiting the transport of sediment.



B Adding drain rock SLOWS runoff and safeguards the drip-line area under elevated surfaces. Mulch around the perimeter adds extra protection to the surrounding bare soil.



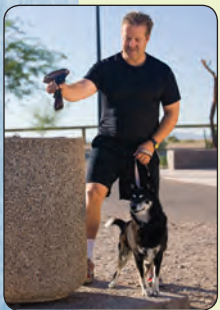
C Terracing or retaining walls may be added to sloped areas to keep rock or other mulch in place and protect hillsides (page 33)

DID YOU KNOW?

It's important to scoop your poop! Roundworms, *E. coli*, and *Giardia* are just a few of the many harmful microorganisms that can be transmitted from pet waste to humans. Some can last in your yard for as long as four years if not cleaned up. Children who play outside and adults who garden are at greatest risk of infection. Pet waste is also one of the causes of bacterial contamination of creeks in Maryland. The American Pet Products Manufacturers Association claims four in 10 U.S. households have at least one dog. That equates to over 140,000 dogs within the county and incorporated cities! Holy pooch! That's a lot of poop. Let's work to keep our families healthy and waterways clean.

The solution is safe and easy:

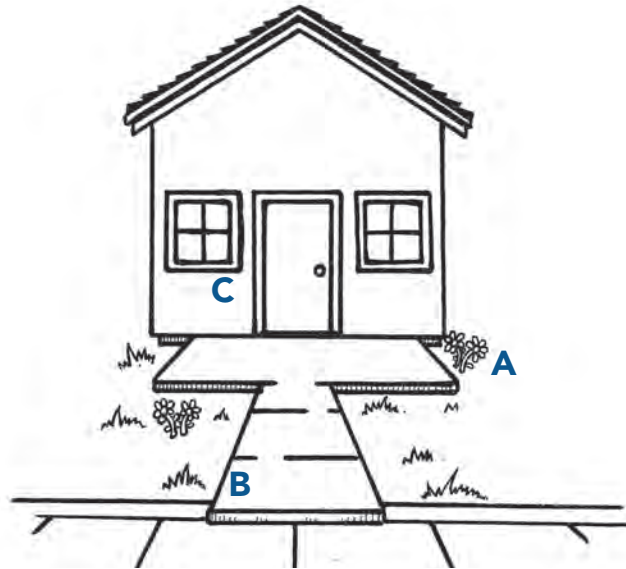
1. Scoop the poop;
2. Put it in a bag (recycled or biodegradable bags are the best option);
3. Place it in the trash; and
4. Wash your hands.



WALKWAYS AND PATIOS

Walkways and patio areas often become conduits for runoff. For existing paved paths or patios look for areas of standing water or visible signs of erosion where the path or patio surface meets the soil. Does your walkway drain to the street or toward your house? When constructing a new walkway or patio always consider where it will drain. Angle it toward a vegetated area or try one of the new porous materials that will reduce runoff and promote infiltration.

POTENTIAL PROBLEMS



A Foot traffic, even in low use areas, can inhibit plant growth and leave bare soil to erode.

B Walkways or other hard surfaces that drain to the street increase runoff causing problems downstream.

C Hard durable surfaces such as patios are often constructed of concrete or other impervious materials that don't allow runoff to infiltrate.



Residential runoff that drains to the street contributes to localized flooding.

SOLUTIONS



A Mulch, gravel, or wood chips work well in low-traffic areas and allow for more runoff to SINK into the ground (page 30).



B Turf block works well for allowing water to SINK into the soil in walkways or other medium traffic areas. (page 29).



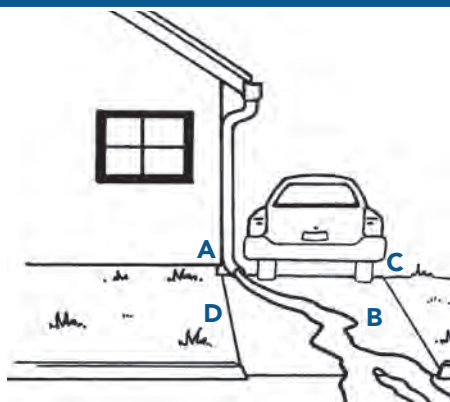
C Use paver stones for high-traffic areas and patios. For areas with excess runoff, use plant borders to allow more water to SINK into the ground (pages 28.)

DRIVEWAYS AND PARKING AREAS

Traditionally driveways have been constructed to divert runoff directly to the street. That runoff can carry with it a variety of pollutants, such as oil and grease, soaps from car washing, leaked antifreeze and more. Your driveway also acts as a conduit for large volumes of roof runoff. Concentrating large volumes of water that outlet to the street increases the chances of potholes, flooding, and erosion. Check to see where your driveway water goes and locate the nearest storm drain. There are now many alternatives available to replace impervious concrete and a variety of solutions for addressing runoff on your driveway or parking areas.

POTENTIAL PROBLEMS

A The downspout is directed toward an impervious (concrete) driveway that drains to the street. The resultant runoff may damage roads, exacerbate downstream flooding, or carry pollutants to nearby waterways.



B This driveway slopes toward the street and creates runoff potentially contributing to flooding, erosion, and pollutants in nearby storm drains and streams.

C This driveway is constructed of impervious materials (concrete), and all of the runoff is directed toward the street. The resultant runoff may damage roads, exacerbate downstream flooding, or carry pollutants to nearby waterways.



D Driveways that do direct water runoff away from the street can still contribute to erosion if the area collecting the runoff is not properly protected or maintained.

Driveways can act as conduits for excess amounts of runoff that can damage roads.

SOLUTIONS

A See Guttered Roofs on page 12.



B An asphalt berm (like a small speed bump) known as a waterbar can be added to existing driveways to SLOW and SPREAD runoff to vegetated or rocked infiltration areas (page 32).



C Pervious pavers or other materials such as paver stones, allow water to SINK into the soil decreasing runoff (page 28).



D A rocked or vegetated swale lining the edge of a road or driveway reduces erosion potential by SLOWING runoff and then SINKING it back into the soil or directing it to a safer outlet (page 27).

DID YOU KNOW?

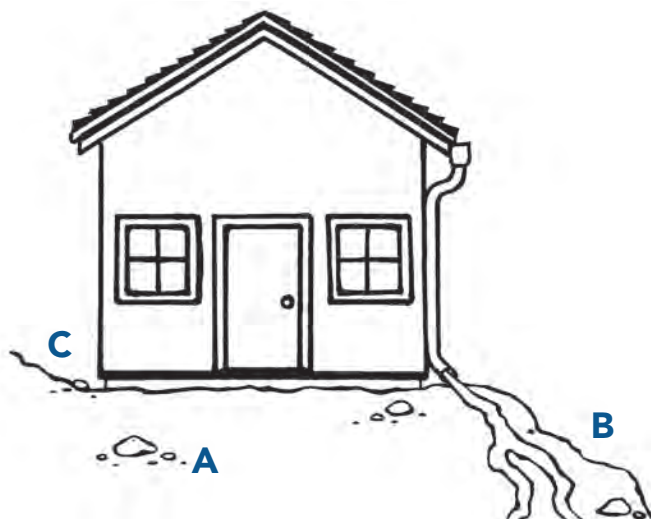
We have all heard that cars contribute to air pollution. But, did you know they can also play a part in water contamination? Soap from car washing, oil and grease from leaking engines, zinc from tires, and copper from brakes can all end up in the water where we play, fish, live, and even drink! Keeping cars properly maintained, using commercial car washes, washing vehicles on lawns or gravel parking areas, recycling oil and antifreeze, recycling used batteries, keeping tires properly inflated, and simply driving less will all contribute to cleaner water for everyone!



BARE SOILS AND LANDSCAPES

In any landscape, bare soils and sloped areas are the most vulnerable to the impacts of runoff. Without a protective cover of vegetation, duff (decaying leaves and needles), or mulch (wood chips, etc.), these areas erode and increase runoff. Erosion reduces soil fertility, can compromise support structures for decks and buildings. Erosion on bare soils can be identified by uneven soil surfaces, depressions in the soils that create small gullies, and any sign that indicates soil loss. If water is flowing across bare soil anywhere on your property, at least some soil is being carried away (eroding). Since vegetation plays an important role in preventing soil loss, it is important to use plants adapted to your site. Some plants such as certain kinds of ivy or ice plant can actually hinder the stability of sloped areas due to poor root structure or added weight.

POTENTIAL PROBLEMS



A Bare soils are highly susceptible to erosion.

B In steeply sloped or hilly areas soil erosion is not only harmful to the environment, but can pose a serious threat to life and limb when land movement occurs.

C Moderately sloped areas are also prone to erosion and can cause damage to surrounding structures if they become unstable.



Bare soils are susceptible to erosion and increase runoff that delivers sediments and other pollutants to streets and storm drains and eventually to local waterways.

SOLUTIONS



A Mulch protects soil from direct rain impact and **SLOWS** runoff across bare soils (page 30).



B Retaining walls help hold sloped areas in place and **SLOW** runoff. They also add beauty to a landscape and can double as benches and planter boxes (page 33).



C Using carefully chosen vegetation can help **SLOW** and **SPREAD** runoff in order to prevent soil erosion on slopes.

DO-IT-YOURSELF RUNOFF EVALUATION

To discover where you can implement techniques that draw on the fundamentals of “slow it, spread it, sink it,” we recommend that you conduct a simple do-it-yourself evaluation of your property. The evaluation consists of a walk around your property on a rainy day to record observations of the 5 zones and how runoff is currently handled, where runoff is going, and where there might be potential for installing BMPs. The kids can even don their rubber boots and join you!

1) TOOLS. Below is a list of items you will need:

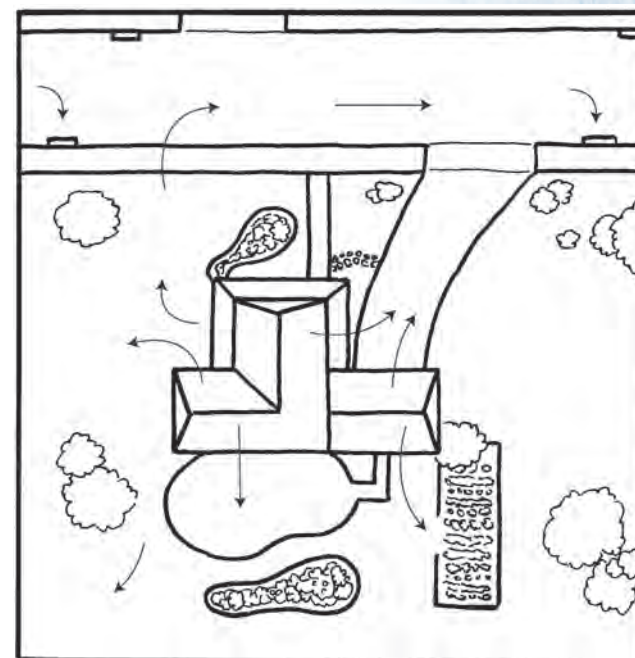
- rain gear
- a clipboard with scratch paper
- a simple sketch of your property
- a pencil (ink may run if it gets wet)
- an umbrella (to keep the paper dry)
- camera

2) SKETCH YOUR PROPERTY. Your sketch will be used to record observations about where the runoff comes from and flows to. The sketch can be very simple. It should include property boundaries, an outline of your house and foundation, outbuildings, driveways, areas of bare soil and any major vegetation (trees, lawns, etc.). Also note how close you are to the nearest stream, storm drain, or ditch that carries water away from your property. If you aren’t sure, see if you can find it on your walk! If you need assistance, it is always good to take photographs when water is flowing! You can then contact Rockville Staff with questions, go to www.rockvillemd.gov/environment for contact information.

3) WALK YOUR PROPERTY. Once you’ve gathered all of the tools and completed an initial property sketch, head outside on a rainy day for the stormwater evaluation walk. For the most accurate results, do not choose the first storm of the season or go out during the first few minutes of rain. Wait until there have been at least one or two good rain events (more than a ½ inch). Go out during a subsequent storm once you see water flowing on your property. During the walk, you can record stormwater runoff observations by drawing arrows that follow the direction of water movement on your property (see sample drawing). You can also record potential locations where you might apply the Best Management Practices (BMPs) listed in chapter 2. For example, if you have a downspout that currently drains to a driveway, look around and note locations where you might direct the runoff to a rain garden or hook up a rain barrel. During your walk, also take note of potential pollution sources such as automobile leaks on your driveway.

4) KNOW YOUR SOILS AND RAINFALL RATES! This is one of the most critical pieces of information you need. Soil maps are available through Natural Resource Conservation Service (NRCS) offices. However, it is highly recommended that you consult a professional for an evaluation of the soils at your location. Soils with poor infiltration rates are NOT RECOMMENDED for many of the techniques described in this guide unless the soil is modified.

5) EVALUATE YOUR RESULTS. Using your results and the solution descriptions in chapter 2, you can determine what practices you might want to employ to beautify your landscape, protect your property, reduce flooding, and help improve local water quality. Contact a landscape professional for additional assistance with choosing the right techniques.



CALL BEFORE YOU DIG!

Miss Utility is a FREE service available to anyone planning a project that entails digging. It is simple and easy to use. Before calling Miss

Utility, outline your digging location with white chalk paint or another medium clear enough to enable underground facility members to determine the area of digging. At least, two working days BEFORE you start your project, call 811 or 1-800-257-7777. Miss Utility will contact the appropriate agencies to come and mark any publicly maintained utilities that interfere with your project location. For more detailed information, visit Miss Utility at www.missutility.net.

Note: Privately maintained lines will not be marked by MISS UTILITY.

CHAPTER 2

TECHNIQUES FOR STORMWATER RUNOFF AROUND YOUR HOME

Disclaimer: The Best Management Practices (BMPs) described in this guide are provided exclusively for general educational and information purposes. The guide is intended to help landowners consider their current runoff practices and to identify concerns and potential solutions. Any BMP should be installed with the consultation of an experienced professional who can address specific site conditions. This chapter outlines a number of well-established practices along with recently introduced options for managing stormwater runoff.

Managing stormwater on your property is not a new idea. Most residential homes were constructed using the runoff methods of the era in which they were built. For the past 50 years, that approach has been to direct runoff away from the property as quickly as possible using pipes and pavement. While largely effective, we now recognize that this approach only shifted problems downstream. We are now experiencing the consequences of those methods in a variety of ways including increased potential for flooding, damage to public and private property, stress on our water supplies, and degradation of our local waterways and habitats. The **Best Management Practices or BMPs** (practices thought to be the most practical and cost-effective) recommended in this guide move away from the old “pipe it and pave it” model and toward the slow it, spread it, sink it approach: Slow the water down, spread the water out, and sink the water into the land. That notion is at the heart of these practices and is a simple mantra you can use to address the runoff on your own property. The following chapter includes information on a variety of BMPs. Find the one that best fits your needs, your pocketbook, and your unique site conditions. Following this chapter is a must-read section on difficult locations and site constraints. While this guide presents great ideas, it is critical to recognize when and where they are NOT appropriate.

Before embarking on any new project please remember:

1. In many cases a simple **change in management** of your current system may be all that is needed to minimize negative impacts of stormwater runoff. Each BMP includes details on maintenance. It is important to recognize that each BMP requires ongoing maintenance to remain effective, and to factor this maintenance into your plans. If you already use one of the listed BMPs, please review the maintenance section for tips on getting the most out of your existing features.
2. **Vegetation** plays several important roles in the function of BMPs, which may include:
 - Slowing down water and physically removing sediments
 - Helping to stabilize slopes through their root structure and reduction of rain impact on the soil
 - Biological removal of nutrients and other pollutants (bioremediation)
 - Improving soil infiltration
3. **Structural practices** are usually more expensive to install and maintain and place a greater strain on resources and the environment. Structural practices should only be used when management changes or vegetation is not an option.
4. **ALWAYS check with applicable regulatory agencies to determine if a permit is necessary for any project.** Examples of projects for which a permit may be required include building a retaining wall, installing a large cistern, sending runoff to a creek or stream, and pervious paver driveways.
5. **CALL BEFORE YOU DIG!** Call 811 or 1-800-257-7777. See expanded information to the left.



Gutters should be cleared out regularly to ensure proper conveyance of water.

BENEFITS	
	Conserves water
	Creates wildlife habitat
	Improves landscape aesthetics
	Reduces peak flows or runoff timing
	Reduces erosion
	Protects infrastructure
COST	
	Low cost
	Medium cost
	High cost
INSTALLATION DIFFICULTY	
	Easy
	Moderate
	Complex
REBATES	
	RainScapes rebate available

The **Best Management Practices (BMPs)** described in this chapter include general information on the benefits of each practice, an estimated cost range of low to high, and a level of difficulty for installation by the homeowner. It is additionally noted where using a qualified licensed professional is highly recommended.

Potential benefits include the following:

Conserves water: Water can be conserved through capturing rainwater, using plants with low water needs OR directing runoff water to areas where it can be stored in the soil for later use by plants

Creates wildlife habitat: When installing BMPs that use vegetation, choosing appropriate plants can create habitat for local wildlife and act as natural pest control.

Improves landscape aesthetics: Many of the BMPs in this guide can actually beautify your landscape

Reduces peak flows or facilitates runoff timing: Peak flows occur when runoff reaches its highest point. By changing the timing of our residential runoff, we can reduce peak flows and mitigate flooding potential.

Reduces Erosion: Practices that reduce erosion limit the loss of top soil and reduce the volume sediments entering local streams.

Protects infrastructure: These practices help reduce runoff that could damage structures, foundations, or public infrastructure such as roads.



Gutters and Downspouts

\$-\$\$\$

E-M



USES: ROOF RUNOFF

NEW INSTALLATIONS OR RETROFITS

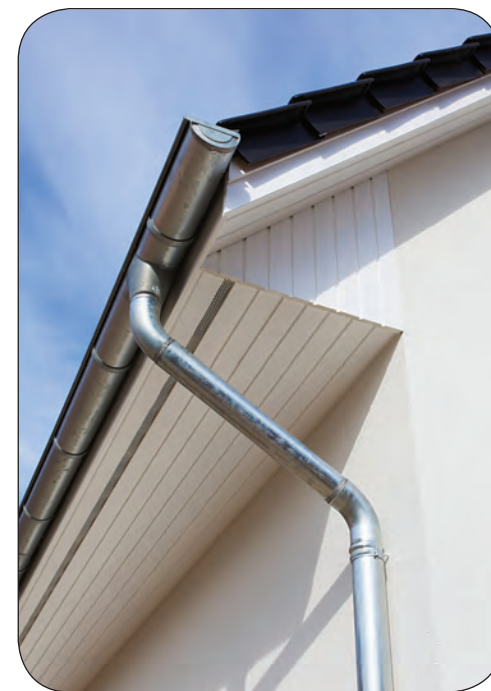
Properly sized gutters and downspouts are crucial for proper performance. While installation is fairly simple, calculating the correct size system for your roof can prove more difficult. You will need to know your roof area and pitch or slope and your location's annual rainfall. We recommend contacting a local qualified professional to assist with calculating correct gutter and downspout sizes.

Also consider where your downspouts drain. Wherever possible and safe, divert downspouts AWAY from impervious surfaces such as concrete driveways, walkways, or compacted soils and instead direct them to well vegetated areas of your property to allow runoff to SINK into the soil. This decreases water volume on streets and in storm drains and reduces the potential for downstream flooding.

General guidelines for selecting and installing gutters and downspouts or improving capacity:

GUTTERS

Select gutters at least 5 inches wide. Use materials made from galvanized steel (29 gauge minimum) or aluminum (.025 inch minimum). To enhance flow, slope gutters according to the manufacturer's recommendations (commonly 1/16 inch to 1/8 inch per 1 foot of sectional gutter; or 1/16 to 1/8 inch per 10 feet of seamless gutters). Tilt the gutter forward keeping the front 1/2 inch lower than the back. For straight runs exceeding 40 feet, use expansion joints at connections. Select elbows with 45, 60, 75 or 90 degree angles, as needed.



GUTTER PROFILES



Half Round



Ogee

Gutters not only come in different sizes, they come in different shapes too. It's important to understand that the shape of your gutter determines the amount of water it can handle from your roof during a storm. Ogee shaped gutters, for example, can handle more water than rounded gutters. However the ogee gutter's sharp edges and corners can collect sediment and debris.

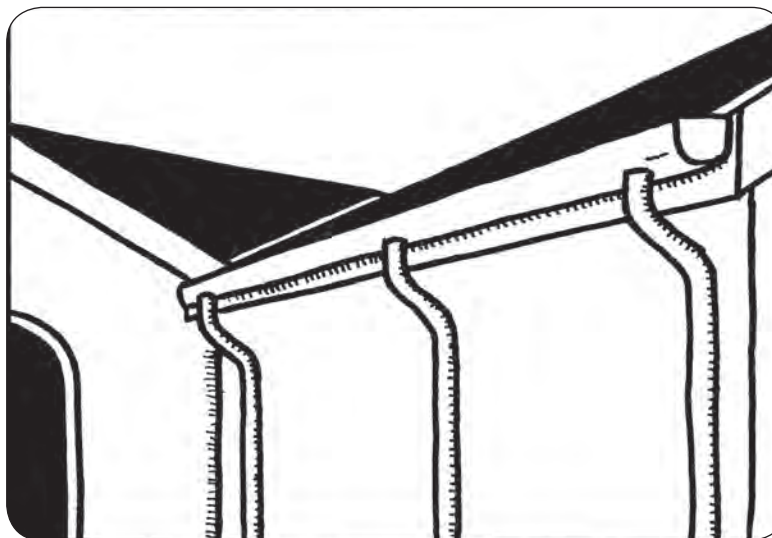
DOWNSPOUTS

Space downspouts from 20 to 50 feet apart. Adding additional downspouts can increase capacity where necessary and help SLOW water down and SPREAD it out. Do not exceed 45-degree angle bends. Where needed use 4-inch-diameter extensions (flexible or rigid) to convey water to infiltration areas such as rain gardens and swales or to other safe outlets away from structures and steep slopes. All downspouts and pipes that outlet onto surfaces without substantial vegetation cover should use one of the outlet protection BMPs described on page 26. Do not direct downspout outlets to driveways or other impervious surfaces unless there are no safe alternatives. Instead, route them to vegetated areas.

MAINTENANCE: Setting up a maintenance schedule is one of the easiest and most cost-effective solutions to many roof runoff issues. Clean your gutters at the beginning of each rainy season and as needed throughout the winter.

In areas with dense trees or vegetation, trim trees and vines away from gutters to maintain a minimum 24-inch clearance zone. Add gutter guards to reduce debris buildup. You can also add a drip-line treatment below gutters that clog often. Check your system for leaks, damaged parts, rust, and evidence of past erosion. Make sure to check hidden outlets under decks or staircases that might be forgotten.

Always check and clean gutters after severe storms.



Adding an additional downspout helps reduce the volume and velocity of runoff at any given point reducing the potential for erosion.

DID YOU KNOW?

A RAIN CHAIN can be used instead of a downspout. Rain chains ('kusari dio' in Japanese) have been used for hundreds of years in Japan. Not only are they visually appealing, they also provide some runoff reduction through evaporation and spillage. When installing rain chains, make sure to take the same precautions for outlet protections as you would with standard downspouts.



DO

- Direct runoff to a rain garden or swale.
- Collect runoff in a rain barrel or cistern.
- Check and clean gutters after severe storms.

DON'T

- Release water onto bare soil.
- Direct runoff to steep slopes or foundations.
- Send runoff onto a neighbor's property.

DID YOU KNOW?

Sediment and debris that collect in the corners and edges of gutters support the growth of bacteria and other organisms that could contaminate rainwater. Because rounded gutter systems have fewer edges than their square-cornered counterparts, they provide cleaner water for rainwater catchment systems.

DO

- Use water regularly (e.g., water indoor plants).
- Use gravity to your advantage.
- Use multiple barrels where possible.
- Keep covered to eliminate debris and mosquito breeding.

DON'T

- Allow access for mosquitos, rodents, children, pets, or debris.
- Use for drinking.
- Capture water from roofs with excessive debris (e.g., leaves, pine needles, or bird droppings.)

Rainwater Collection Systems

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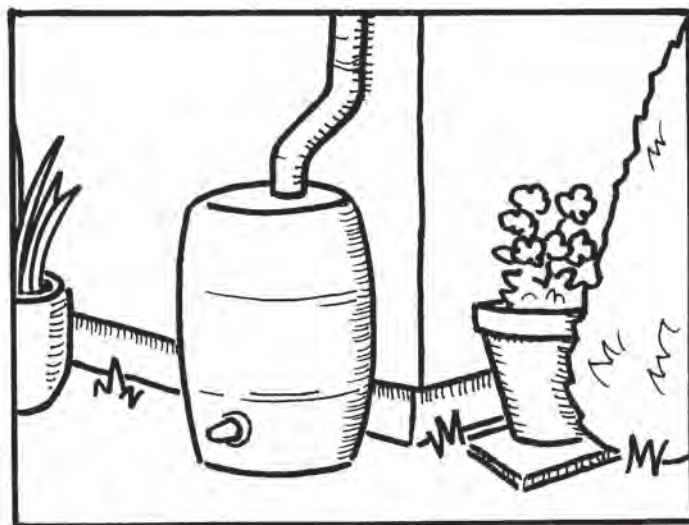
E-M

**USES: COLLECT AND STORE WATER FROM ROOFS**

Rainwater collection is an excellent opportunity to SLOW water down by temporarily storing it. Captured water can be reused for irrigation or other non-potable options or metered off slowly after storm events to allow for infiltration and reduced flooding.

RAIN BARRELS are small- to medium-sized containers placed outside buildings and connected to roof downspouts to collect runoff for later use in non-potable applications. Rain barrels have many advantages in urban settings. They take up very little space, are inexpensive, and easy to install. Rain barrels conserve water and reduce the volume of runoff moving off-site.

MAINTENANCE: Rain barrels require regular draining after rainstorms and removal of leaves and debris collected on screens. Always check that the overflow is clear and directed to an appropriate location.



WATER TANKS (CISTERNS) are manufactured water storage containers for non-potable use in residential, commercial, or industrial applications. Water tanks can be installed both above and below ground. Some tanks come as sectional pieces that can be put together to fit different space constraints. Tanks can be used with most guttered roofs to collect runoff and reduce runoff volume. Both water tanks and rain barrels can be used without pumping devices, instead relying on gravity flow. However, depending on the desired use for the water, a pump may be necessary for best performance.

Larger tanks can be designed to also function as privacy screens, fences, or small retaining walls. Tanks can also be hidden under decks or serve as the foundation for play structures or other landscape features. Get creative!

Underground tanks are excellent options for areas with limited space. However, do not install underground systems beneath the path of vehicles or heavy machinery traffic unless they have been engineered for that purpose. Extra precautions may be needed when placing tanks in locations with high water tables or saturated clay soils. Contact an experienced licensed professional for tank installations under these conditions.

Basic components of a rainwater collection system:

- | | |
|---|--|
| <ul style="list-style-type: none"> ■ Catchment surface
<i>This is normally a roof, but there are other options.</i> ■ Gutters and downspouts
<i>Round gutters are recommended because they are less likely to collect sediment in corners and edges. This sediment can then support bacteria growth.</i> ■ Screening of tanks or barrels and downspout openings ■ First-flush device
<i>Although recommended, this is optional.</i> | <ul style="list-style-type: none"> ■ Water tanks
<i>There are various options including manufacturing on-site.</i> ■ Water tank vent ■ Overflow device
<i>This should be equal to or larger in diameter than the inflow pipe to avoid backup.</i> ■ Faucet and valve ■ Filters and pumps (optional) |
|---|--|

MAINTENANCE: Remove accumulated sediment and debris annually and inspect all components such as gutters and downspouts regularly. The inside the tank must also be inspected. Look for system leaks and cracks. Check all connections and hoses for wear and all screens or mesh for debris accumulation and holes. Make sure overflow is clear and directed to an appropriate location. Inspect all seams for leaks. Follow all manufacturers' recommended maintenance for any storage device.

DO

- Obtain necessary permits.
- Secure tanks with straps for protection from earth movement.
- Use gravity to your advantage wherever possible.
- Keep underground tanks a minimum of $\frac{1}{4}$ full at all times to prevent collapsing of certain tank types.

DON'T

- Place tanks on steep hillsides.
- Place water tanks below ground unless they are approved for this use.
- Collect water from cedar or highly degraded roofs.
- Collect roof water from areas prone to large amounts of debris (leaf litter, etc.)



Underground systems can be customized to fit various shapes and sizes using these modular RainBoxes.

Outlet Protection

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USES: DOWNSPOUT, PIPE, OR CULVERT OUTLETS

One of the most overlooked parts of a drainage system is the outlet of downspouts and pipes. Outlets should not release water onto bare soil or to an area prone to erosion. On the other hand, discharging water onto hardened impervious surface eliminates infiltration and increases the velocity of water that is directed to streets and streams creating a new set of challenges. All outlets that drain onto soils or other erodible surfaces should have some type of outlet protection. The BMPs below work to SLOW water down and/or SPREAD it out so it can SINK back into the soil.

SPLASH GUARDS are simple devices that reduce the initial force of the water at the outlets and allow it to SPREAD out into an area of vegetation or an appropriate infiltration area and SINK back in to the soil.

A HOSE ADAPTER is a neat option (Drought Buster East Connect is pictured) that allows a standard garden hose to connect directly to a downspout. The hose can then be moved to different locations of your yard when it rains. It is perfect for watering trees or keeping any one area from becoming too saturated by allowing the water to SPREAD out through the landscape.

ROCK DISSIPATORS are placed at outlets to SLOW runoff by reducing the initial impact of concentrated, high velocity runoff. For downspout outlets there are several easy creative options like filling a large plant container (it must have drain holes) with pebbles or placing rock on the ground surrounded by a wood border (similar to a rock drip-line). Large containers (1/2 wine barrels are an inexpensive option) with established plants and a thick layer of mulch (wood chips or gravel) also work well. Make sure that the drainage from under the pots flows away from your foundation.

For culverts or outlets with drain pipes over 8" in diameter, rock must be properly sized to prevent movement and placed with filter fabric underneath. Angular rock is typically recommended for high velocity flows because it locks in place and has a greater capacity to slow the water than rounded rock or broken concrete which tends to have some smooth edges. Rock should be carefully laid by hand forming an evenly lined depression or basin with no spaces between the rocks. It is highly advisable to contact a licensed qualified professional for design assistance.

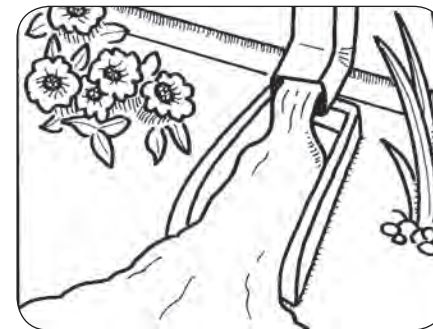
Generally speaking, work done at any outlets that drain directly into a waterway will need a permit. Contact the City for permitting assistance.

DO

- Direct downspouts to vegetated areas or rock dissipators.
- Protect ALL outlets on your property.

DON'T

- Allow water to pond near foundations.
- Direct water to driveways or other impervious surface that drain directly to the street.



Rain Gardens

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USES: ROOF, WALKWAY, DRIVEWAY, OR PARKING AREA RUNOFF

A **rain garden** is a specialized landscape design that captures stormwater runoff from roofs, driveways, or other impervious surfaces and allows water to SINK back into the ground. It uses plants to remove pollutants and improve infiltration allowing water to soak back into the ground. In soils with low permeability this system may be used to temporarily store water (not completely infiltrate) and remove pollutants before they enter a waterway.

A rain garden design can be as simple as a shallow depression filled with plants that can flourish in both moist and dry conditions. The required size, shape, and depth of the garden depend on how much water you are trying to capture. For large amounts of runoff or areas with insufficient infiltration, there are a full spectrum of engineered features, such as specialized soil mixtures, an aggregate base, and subsurface drains that can be added. These more complex designs are often referred to as bioretention cells. Before constructing a rain garden on your property, an infiltration test should be done to ensure that the water will drain within 48 hours. It is recommended that a professional landscaping contractor be consulted for sizing, siting and infiltration testing.

Plant the center of the garden with species that tolerate wet conditions, such as native sedges and rushes. Around these, put plants suited to occasional standing water, like Swamp Milkweed (*Asclepias Incarnata*) or Blazing Star (*Liatriis Spicata*). At the furthest edges there are a variety of native evergreen and deciduous shrubs that prefer drier soil. Contact the City or a local plant nursery knowledgeable in native and drought tolerant species for more suggestions. Rain gardens should be located at least 10 feet from your house and at least 40 feet from a septic system or steep slope. They should also be designed to drain within 48 hours to reduce the risk of standing water and mosquito breeding. Rain gardens are a beautiful way to protect your property from erosion and protect the water quality of local creeks. They can enhance the aesthetic value of a site; be used on small parcels of land, easements, and right-of-ways; and are easily incorporated into existing landscapes or open space.

MAINTENANCE: Routine maintenance is required and can be performed as part of the regular site landscaping program. Weeding and irrigation are essential in the first couple of months while plants become established. Annual pruning and mulching are recommended. Additional irrigation may be necessary during drought years. The use of native, site-appropriate vegetation reduces the need for fertilizers, pesticides, excessive water, and overall maintenance.

DO

- Use Maryland native or drought tolerant plants as appropriate.
- Minimize fertilization to prevent water contamination and try organic options.

DON'T

- Site in soils with high water tables or clay soils without an overflow device.
- Place too close to your home's foundation.





Swales

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USES: ROOF, WALKWAY, DRIVEWAY, OR PARKING AREA RUNOFF; LOW TO MODERATELY SLOPED HILLSIDES

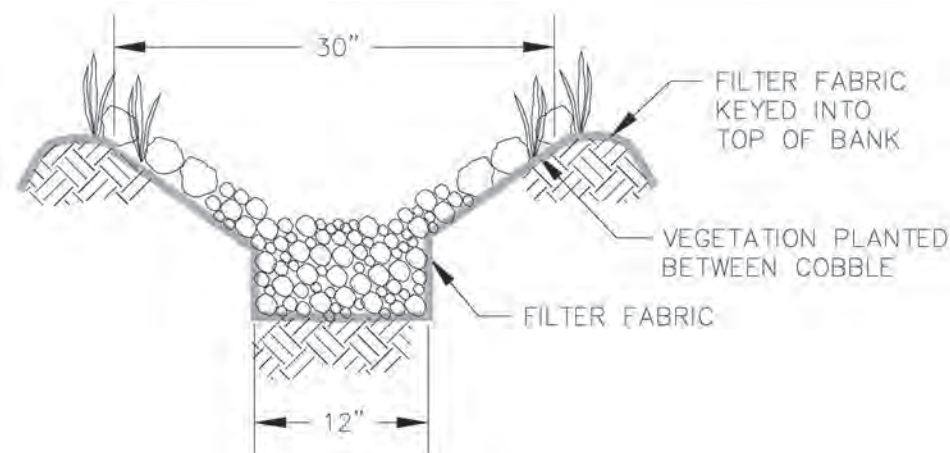
Swales are shallow channels designed to SLOW water down, SPREAD it out and allow it to SINK into the soil during low flows. Once saturated, they convey water to a safe outlet such as a rain garden (page 25) or other infiltration areas. They can be formed to fit almost all site conditions and landowner objectives. Depending on the existing landscape and available space, swales can have a meandering or nearly straight alignment. An advantage to a meandering swale is that its geometry maximizes the time water spends in the swale thus aiding the trapping of pollutants and sediments and infiltration. There are two types of swale systems: vegetated or rock-lined (sometimes called dry creek beds).

VEGETATED SWALES

Grassed swales are vegetated with native perennial grass species along the bottom and sides of the channel. The vegetation in the channel slows runoff, allows sediments to filter out, and can help remove nutrients. Bioswales are vegetated swales that use engineered media (usually a designed soil mix consisting of sand, loam soil and hardwood mulch) beneath the swale to improve water quality, reduce runoff volume, and control peak runoff rates. Although their functions are similar to grassed swales, bioswales have a greater capacity for water retention, nutrient removal, and pollutant removal. Adding gravel or other permeable material below the soil mixture further enhances infiltration.

When installing a swale, use a minimum 2% slope from beginning to end (longitudinal slope) to ensure that water is conveyed away from any structures and to a desired destination. Vegetation in the swale should be established before the first winter storms, so plant accordingly. Once saturated, swales function as conveyance structures carrying runoff to a rain garden, wetland, infiltration area, or other safe location. Swales are not recommended for areas that receive large amounts of sediment that can prematurely fill the swale and impede its functionality.

MAINTENANCE: Routine maintenance is required. Before a planted swale is densely vegetated, it is extremely vulnerable to erosion and must be protected with straw matting and other erosion control materials. Maintenance of a dense, healthy vegetated cover consists of periodic mowing (keep grass 2-4 inches high), weed control, reseeding of bare areas, and clearing of debris and accumulated sediment. The swales should be regularly inspected for pools of water, formation of gullies, and for uniformity in cross section width and longitudinal slope. When the uniformity is compromised it should be corrected quickly.



DO

- Use Maryland native plants or drought tolerant plants.
- Use fertilizer and pesticides only when necessary.

DON'T

- Walk or drive machinery directly in the swale as this will cause soil compaction.
- Place too close to your home's foundation.

ROCK-LINED SWALES (DRY CREEK BEDS)

A rock-lined swale (or dry creek bed) uses rock instead of grass or other vegetation to safely infiltrate and convey runoff. Most are designed with rounded rock for an aesthetically pleasing landscape feature that mimics a creek bed.

When installing a swale use a minimum 2% slope from beginning to end (longitudinal slope) to ensure that water is conveyed away from any structures and to a desired destination. Non-woven geotextile fabric can be used underneath the rock.

MAINTENANCE: Periodically remove leaves and replace rocks moved by surface flow.

DO

- Use existing rock from your property if available.
- Use washed rock from a local quarry.
- Make sure the outlet does not cause erosion or clog
- Use non-woven geotextile fabric beneath the rock.

DON'T

- Install in soils with high water tables or saturated clay soils without an overflow device.
- Place too close to your home's foundation.
- Allow leaf litter to accumulate.



Pervious Hardscapes

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USES: WALKWAYS, PATIOS, PARKING AREAS AND DRIVEWAYS

There are many new types of pervious materials that allow runoff to pass through and SINK back into the soil. Some popular choices are paver stones, turf block and permeable asphalts and pavements. There are now pervious options for almost any application. Since the variety of options is growing rapidly, we will only discuss them generally. For specifics on installation and use, contact your local retailer or product manufacturer.



PAVER STONES/FLAG STONES

Paver stones are normally made of pre-cast brick, concrete, stone or other material and installed over a sand base. They come in various shapes and normally interlock and can form different shapes and patterns. Pervious pavers are designed to allow more runoff to SINK into the ground than traditional pavers. Each paver has a spacer that ensure the ideal distance between placed stones for maximum infiltration. Each piece is placed with gaps between to allow the infiltration of water. Flag stones are larger and may be placed directly on the soil. A low-growing ground cover may be planted between flag stones to allow for greater infiltration. Pavers can be used in high use area such as parking lots, patios and walkways. Contact the City for approved specifications for permeable paver driveways and details on the RainScapes Rebate.

MAINTENANCE: Keep the area clear of sediment to prevent clogging. Annual vacuum sweeping with a shop vac helps maintain permeability. The gaps between pavers may require occasional weeding or scorching and sand or gravel replenishment. Because pervious pavers are easily lifted and reset, they are easy to repair or replace.

DO

- Consult the City when replacing impermeable surfaces with permeable pavers for proper specifications and rebate information.
- Plant vegetation in between or around pavers.

DON'T

- Use in areas with high sediment loads that can clog porous areas.

TURF BLOCK

Turf block (concrete blocks with holes) and similar products can be filled with sand or planted. They provide soil stability for walkways and other moderate traffic areas. Sometimes the pores are filled with gravel or cobble. They are not ideal for everyday parking, because of irrigation and maintenance demands, and if they are planted, long term parking inhibits sunlight required for plant growth.

MAINTENANCE: Planted turf block may require regular mowing (depending on plant choices) as well as irrigation, fertilization and weeding.

DO

- Choose low water grasses such as native fescues.

DON'T

- Use in high traffic areas or permanent parking areas.
- Aerate.



PERVIOUS PAVEMENT

Pervious pavements contain pore spaces that allow infiltration of runoff. The water seeps through the material to a rock base layer underneath and is naturally filtered through the underlying soil where pollutants are removed. There are different types of pervious (or porous) pavements including porous asphalt and pervious concrete. Soil must have permeability between 0.5 and 3.0 inches per hour to be considered for pervious concrete installations. The bottom of the rock base/reservoir should be completely flat so that runoff will be able to infiltrate through the entire surface. Pervious pavement should be located a minimum of 2 to 5 feet above the seasonally high groundwater table and at least 100 feet away from drinking water wells. Ideal uses include walkways, patios, and other moderate traffic areas that need extra stability.

Although installation is becoming easier and a more cost-effective alternative to traditional paving methods, appropriate construction techniques are necessary to ensure the effective performance of pervious pavements. Hiring a licensed contractor experienced in these materials is highly recommended and may even be required depending on the application.

MAINTENANCE: Keep clear of soil, rocks, leaves, and other debris. Vacuuming annually, using a shop vac or specialized vacuum for larger areas, may be necessary to remove debris from the surface of the pavements. Other cleaning options may include power blowing and pressure washing. Always follow the manufacturer's maintenance recommendations.

DO

- Consult a professional to recommend a design customized to your site.
- Treat surrounding bare soil areas by planting or mulching.

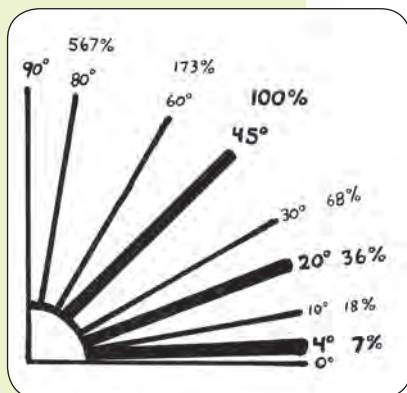
DON'T

- Use in areas where there is a possibility of sediment contamination.
- Seal or repave with non-porous materials.



DID YOU KNOW?

There is much confusion when referring to the “steepness” of slope. We sometimes find a slope measured in degrees and other times as a percentage such as a 20% slope. To figure out the percentage slope, you would use the rise over run formula. For instance a distance of one foot horizontally with a one foot rise over that distance would give you the formula $1/1$ or 100% slope. The equivalent angle or degree would be a 45° angle. The chart below is an easy conversion table to calculate the equivalent % grade to degree of slope.

**SLOPE GRADIENT CONVERSION TABLE****Ground Covers**

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**USES: TEMPORARY AND PERMANENT SOIL COVER, LOW USE WALKWAYS, AND SLOPE PROTECTION**

Using mulches or vegetation to cover bare soil is a key ingredient to **SLOWING** down and thus preserving valuable top soil, preventing sediment from being carried downstream, and reducing the potential for erosion. Ground cover varieties include vegetation, wood chip, gravel, or other mulches. Mulches are a good choice for areas with **LESS THAN** a 33% slope. Vegetation works well on areas with **LESS THAN** a 50% slope.

MULCH (ROCK, WOOD CHIPS, OR OTHER MATERIALS)

Mulching is a simple and beneficial conservation practice you can use in your yard. Mulch is simply a protective layer of material that is spread on top of the soil. Mulches can be organic -- such as grass clippings, straw, bark chips, and similar materials -- or inorganic -- such as stones, brick chips, and recycled glass. Mulching has many benefits such as protecting soil from erosion, reducing compaction from the impact of heavy rains, conserving soil moisture, maintaining an even soil temperature, and preventing weed growth. It is also useful as temporary ground cover until supplemental vegetation becomes established.

MAINTENANCE: Organic mulch may need to be replaced annually. Removal of old mulch and plant debris each fall prevents growth of fungus and other unwanted pests and diseases. Keep any organic materials at least 6 inches from building siding. Gravel or rock should be raked regularly to prevent the buildup of organic materials.

DO

- Use recycled material whenever possible.
- Keep rock free of organic materials.

DON'T

- Use wood chips from diseased trees.
- Use straw mulch near stream channels.

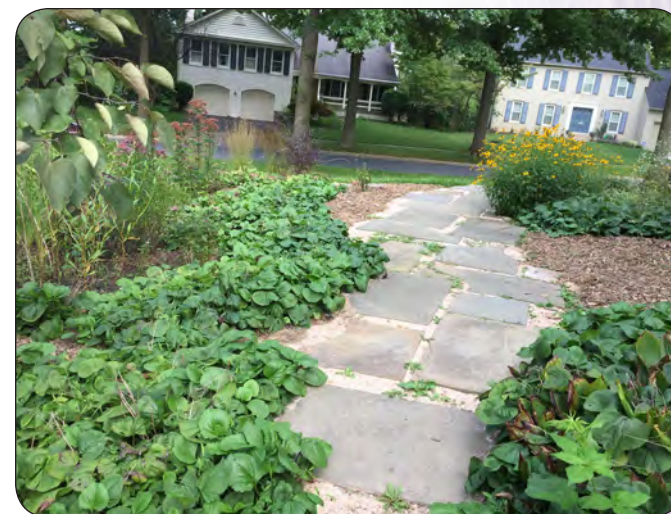
PLANTINGS/CONSERVATION LANDSCAPING

Plants cover and protect the soil. Once established, plants provide excellent long-term erosion control. Their roots knit together to hold the soil in place. Their leaves, needles and twigs reduce the impact of rain, and the organic matter they add to the soil improves water infiltration. A drip irrigation system provides slow delivery of water to plants, so water infiltrates with little or no runoff.

When selecting plants for a landscape, it is important to understand the site conditions. While most property owners select plant materials for their form and color, it is essential to know their solar, soil, and moisture requirements. Plants that do well in specific microclimates on a site are termed “site appropriate.” For the purpose of improving stormwater runoff choose plants that improve infiltration, decrease runoff, filter pollutants, and help stabilize slopes. If applying for a RainScapes Rebate, contact the City or a local plant nursery knowledgeable in native species best suited for these functions.

Native plants (vegetation that grows naturally in particular climates or regions) are a great choice because of their performance, site enhancement, and life cycle cost benefits. Native plants typically are more cost-effective in the long run because they require less water and fertilizer, and they are more resistant to local pests and diseases than nonnative ornamentals. Costs are also reduced due to lower maintenance and replanting requirements. Additionally, native plants provide habitat for local/regional wildlife. If you choose nonnative plants, care should be taken to not plant invasive species as they tend to crowd out the native species. Contact the City for a list of plants that should be avoided.

MAINTENANCE: Routine maintenance is required and can be performed as part of the regular site landscaping program. Weeding and irrigation are essential in the first couple of months while plants become established. Annual pruning and mulching are recommended. Additional irrigation may be necessary during drought years. The use of native, site-appropriate vegetation reduces the need for fertilizers, pesticides, excessive water, and overall maintenance requirements.



DO

- Use Maryland natives or drought tolerant plants that can endure periods of saturation.
- Keep plants well pruned near foundations and siding to allow adequate ventilation.
- Minimize fertilization or try organic options to prevent water contamination.

DON'T

- Plant invasive species such as periwinkle (Vinca) or certain ivys.
- Allow irrigation water to drain to your driveway, the street, or bare soils.

Cross Drains

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USES: DRIVEWAYS, PRIVATE ROADS

Cross drains are used to SLOW water down by breaking up the impervious surface area into smaller sections. Smaller sections help divert the water to a point where it can SINK in to help combat the ill effects of driveway and road runoff. The BMPs described here can be installed on existing driveways and roads, both paved and unpaved. If you are constructing or reconstructing a road, other techniques such as outsloping can be used but are beyond the scope of this guide. Contact the City to determine the proper permits.

WATERBARS

Waterbars are used to break up runoff into small units so that it does not have enough energy to erode soils. They also divert water away from streets and allow it to infiltrate. On unpaved roads, an earthen waterbar, also known as a water break, consists of a shallow trench with a parallel berm or ridge on the downslope side which is angled down across the road. On these surfaces they can be constructed by hand, with a backhoe, or with a blade-equipped tractor. Optimal size of an earthen waterbar is 12 inches above the road surface and 6 inches below the road surface. Asphalt or cement waterbars can be smaller in size (6 inches) and thereby provide greater ease of access. Water bars should be installed at a 30 to 45 degree angle and in most cases the outlet of waterbars should be protected with rock dissipaters.

MAINTENANCE: Keep the outlets clear of debris and sediment so water drains freely. Inspect annually and make necessary repairs to earthen berms that break down over time and ensure there is no erosion.

SLOTTED CHANNEL DRAIN

A slotted drain installed across the width of your driveway is another option to address surface runoff. It consists of a metal-grated conveyance structure that transports water to a safe location. Decorative varieties are also available. Slotted channel drains are installed flush with the driveway surface, a feature that makes these conveyance devices more appealing for aesthetic reasons. The drain should be sloped no less than a ½ inch per foot of length to prevent clogging from sediment and debris. It should also be angled at 30-45 degrees. Although slotted channel drains may be installed on any driveway, they are recommended for driveways with slopes greater than five percent.



MAINTENANCE: Ensure that the grate is open before and during storm events (not covered by leaf litter). Check that the outlet is protected, non-eroding, and clear of debris and sediment so water drains freely.



DO

- Install energy dissipaters at all outlets.
- Install at 30 to 45 degree angles.

DON'T

- Direct runoff to erodible surfaces.
- Outlet water onto steep slopes.
- Direct water to a neighbor's property.

DO

- Ensure the drain is large enough so that the majority of water enters the drain and doesn't flow over.
- Install energy dissipaters at all outlets.
- Install at 30 to 45 degree angles.

DON'T

- Install channel drains in areas with large amounts of leaf debris.
- Outlet water onto steep slopes.
- Direct water to a neighbor's property.

Retaining Walls and Terracing

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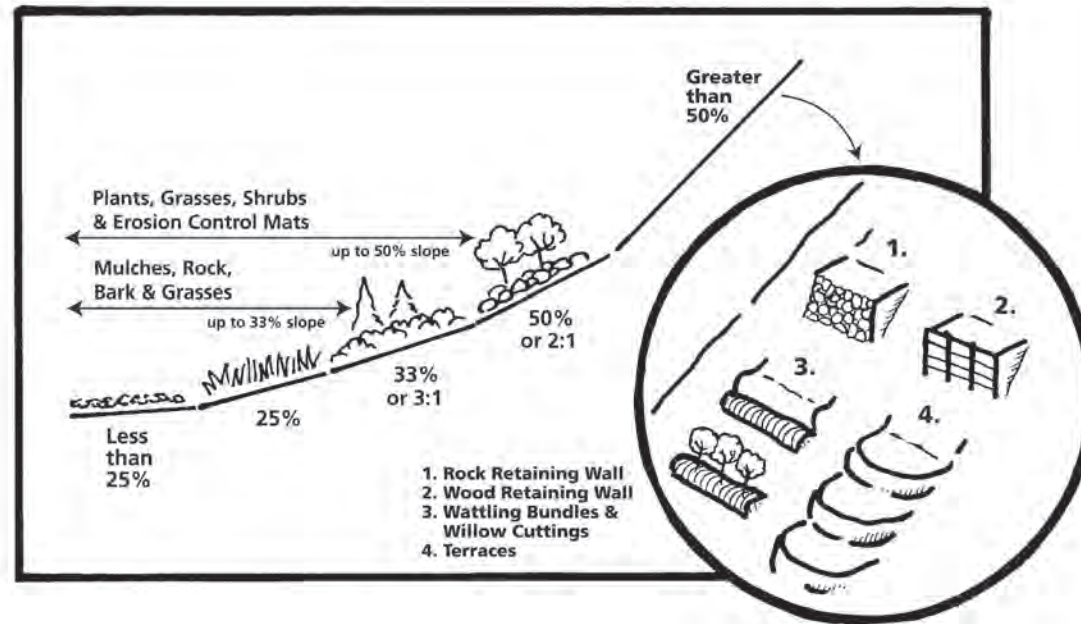
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USES: SLOPED AREAS

Protecting steep slopes is very serious! Improperly installed systems can pose a serious threat to life and property. We recommend that ALL retaining wall and terraced areas be designed and installed by a licensed qualified professional.

Retaining walls and terraces are used to reduce the gradient or slope and provide level or gently sloping areas for establishing vegetation. Retaining walls and terrace walls are constructed with boulders, treated timber, bricks and/or interlocking concrete blocks. (Walls over 3 feet high must be designed by an engineer). There are MANY different types of retaining walls, each with a different purpose, so always check with a qualified professional before embarking on any wall project for soil retention. A building permit and engineering expertise are required to build many retaining walls. Always check with the City to determine if a permit is necessary for your project.



RETAINING WALLS

Rock retaining walls are an alternative to wood retaining walls and are often used next to a roadway or drainage way. They are freestanding walls built from rock 10 inches to 2 feet in diameter. A footing trench is dug along the toe of the slope, and the largest boulders are placed in the trench. Subsequent rocks are laid with at least three bearing points on previously laid rocks. The external face of the wall should incline slightly uphill, though the wall itself is freestanding and does not lean. As the wall is built, fill material is placed around and behind the rocks and packed in. Since the finished slope behind the wall will be flatter than before treatment, possibly a level terrace, it should be easier to establish all-important perennial plants on and above the wall.



MAINTENANCE: Always check retaining walls to make sure they are not leaning or failing. Ensure there is adequate drainage behind walls and the drains remain functional.

Wood retaining walls can be used on slopes steeper than 50 percent and are often located between the base of a slope and an adjacent road, driveway or drainage way. Lumber and posts should be treated with an approved wood preservative (not creosote). Ensure proper drainage methods behind the wall are utilized. As always, vegetation should be established on the slope above the wall.

TERRACES

Many materials are available for building terraces. Treated wood is easy to work with, blends well with plants, and is often less expensive than other materials. Interlocking concrete blocks are made specifically for walls and terraces and are more easily installed by a homeowner than other materials, such as fieldstone and brick. The steepness of the slope dictates wall height. Make the terraces in your yard high enough so the land between them is close to level. This soil surface should be carefully revegetated. Be sure the terrace material is strong and anchored well to stay in place through cycles of freezing, thawing, and heavy rainstorms. Large terraces should be tied back into the slope and properly drained. This takes expertise and equipment, so you may want to restrict the terraces you build to a foot or two in height. Get help from a professional to make sure higher walls stand up to the forces of gravity and water pressure in the soil.

DO

- Provide adequate drainage behind retaining walls.
- Use a qualified professional to design your wall.

DON'T

- Install without checking on permit requirements.
- Use creosote-treated wood.



City of
Rockville
Get Into It

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