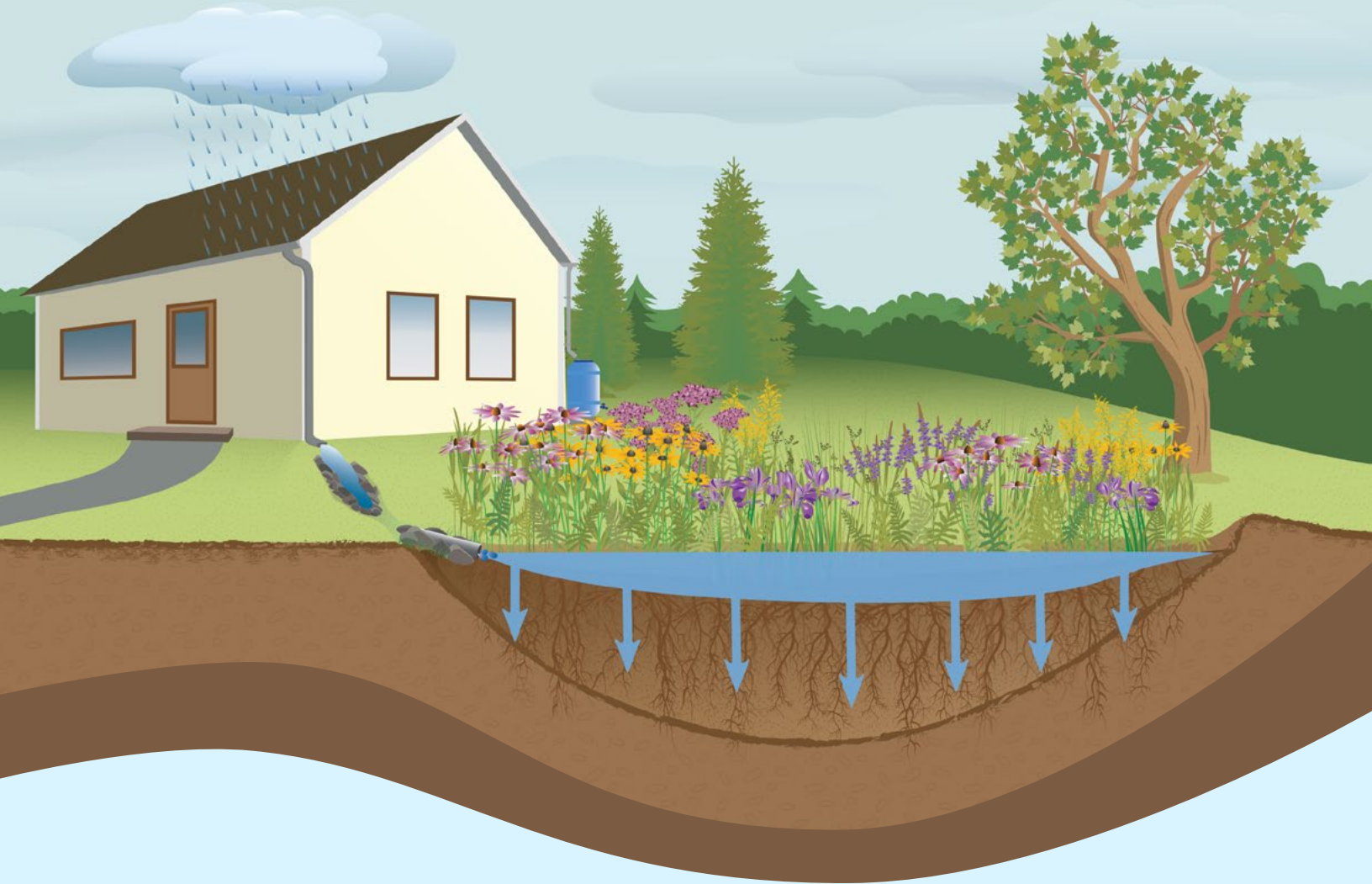


RAIN GARDENS

Design and Construction Guide for Homeowners



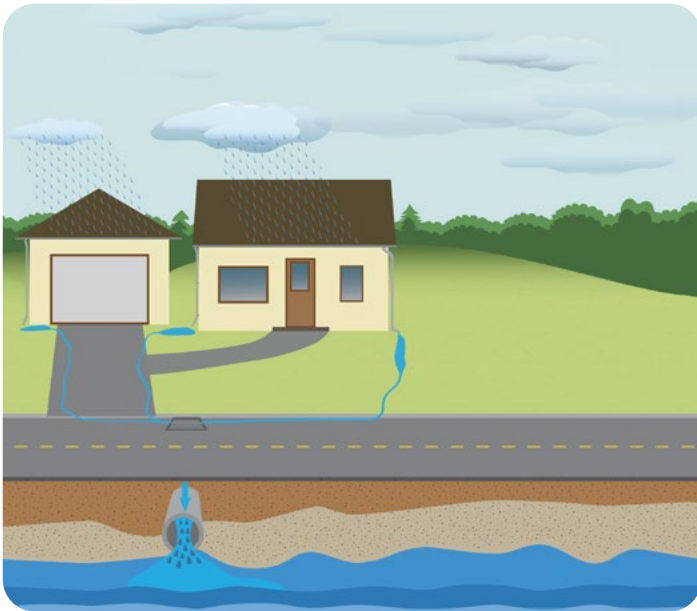
Manage stormwater on your property to help improve water quality in your community.



Build a Rain Garden to Help Manage Stormwater Runoff on Your Property

As the development of urbanized areas grew, human infrastructure has replaced forests and wetlands with impervious surfaces such as asphalt and buildings. Such surfaces prevent water from being absorbed naturally into the ground and are the main contributor to excess stormwater runoff.

Examples of impervious surfaces include streets, parking lots, paved driveways, rooftops, compacted lawns, or any other surface that prevents water from infiltrating the ground.



What is Stormwater Runoff?

Stormwater runoff is rainfall that flows over the ground surface. It is created when rain falls on impervious surfaces that prevent water from seeping into the ground.

As the water flows over such surfaces, it washes away various pollutants and carries them towards storm drains, local streams and waterbodies. Common pollutants found in stormwater runoff include bacteria, fertilizers, pesticides, oil products, road salt, pet waste, trash and sediments.

These pollutants are also known as nonpoint source pollution in a watershed. They can have a significant impact on water quality. And, in turn, degraded water quality can have harmful effects on wildlife, fisheries, drinking water supplies and recreation.

What is Stormwater Management?

Stormwater management is an effort to reduce the volume and improve the quality of runoff that reaches a natural environment. Every homeowner can take steps to help manage stormwater and help protect water quality. For example:

- Install a rain barrel on your downspout (this also helps to conserve water).
- Wash your car on the lawn (using eco-friendly soaps).
- Sweep your driveway instead of using a water hose.
- Plant more trees.
- Add more flower beds and shrubs.
- Build a rain garden.
- Pick up pet waste.
- Limit chemical fertilizers and pesticides.



What is a Rain Garden?

A rain garden is a functional piece of landscaping that benefits pollinators, the environment and your property. It is typically a shallow bowl-shaped depression that is planted with native, hardy and low maintenance plants.

A rain garden is designed to catch rainwater runoff in your yard. The best species of plants to place in rain gardens are perennials that are native to your region. They are adapted to wet and dry conditions and have deep roots that will help soak up rain water. Such long roots also create pores in the soil that helps rainwater filter into the ground.

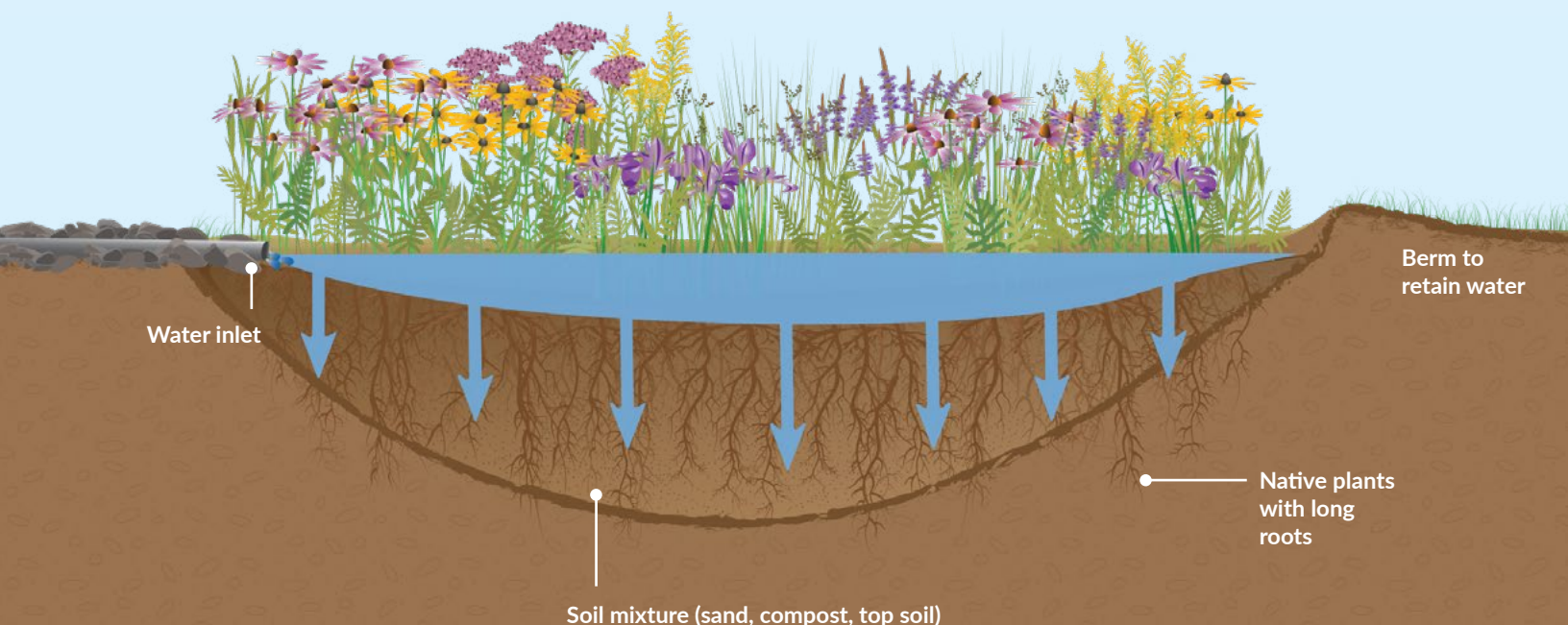
These gardens are created in lower-lying areas or within the flow paths where water drains away from your property. Unlike wetlands, rain gardens are dry most of the time; they hold water for a brief period of time during and after a rain event.

And since the water seeps into the ground within a 24- to 48-hour period, rain gardens are not a hotbed for mosquitoes.

The Benefits of a Rain Garden

Rain gardens are a sustainable way for homeowners to help manage surface water runoff to improve their communities' water quality. In a process known as bioretention, pollutants found in stormwater runoff can be filtered through the actions of plants, micro-organisms and soil.

Rain gardens absorb about 30% more water than a typical lawn. This contributes to groundwater recharge and reduces the risk of flooding. By choosing native species, a rain garden provides habitat and food for wildlife and benefits pollinators. Rain gardens can beautify your yard with colourful flowers and artistic creative designs.



Rain Garden Plants for New Brunswick

 Full Sun
  Partial Shade
  Full Shade
  Drought tolerant
  Flood resistant
  Pollinators

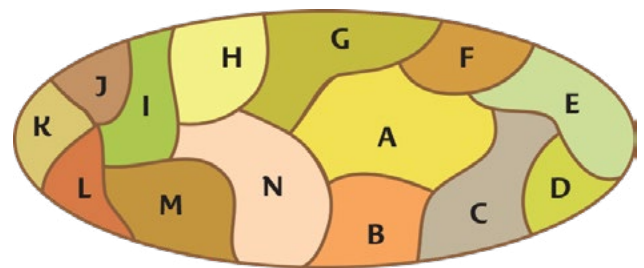
Autumn Joy Sedum (<i>Hylotelephium telephium</i>)*		Native Rush (<i>Juncus effusus</i>)	
Black-eyed Susan (<i>Rudbeckia hirta</i>)		Native Sedge (<i>Carex rostrata</i>)	
Bloodroot (<i>Sanguinaria canadensis</i>)		Ostrich Fern (<i>Matteuccia struthiopteris</i>)	
Blue Flag Iris (<i>Iris versicolor</i>)		Pearly Everlasting (<i>Anaphalis margaritacea</i>)	
Blue Vervain (<i>Verbena hastata</i>)		Purple Aster (<i>Aster sp.</i>)	
Boneset (<i>Eupatorium perfoliatum</i>)		Purple Coneflower (<i>Echinacea purpurea</i>)*	
Butterfly Milkweed (<i>Asclepias tuberosa</i>)*		Purple Milkweed (<i>Asclepias purpurascens</i>)*	
Christmas Fern (<i>Polystichum acrostichoides</i>)		Sensitive Fern (<i>Onoclea sensibilis</i>)	
Flame Grass (<i>Miscanthus purpurascens</i>)*		Solomon's Seal (<i>Polygonatum pubescens</i>)	
Goldenrod (<i>Solidago sp.</i>)		Swamp Milkweed (<i>Asclepias incarnata</i>)	
Joe Pye Weed (<i>Eupatorium maculatum</i>)		Sweet Grass (<i>Hierochloa odorata</i>)	
Karl Foerster Grass (<i>Calamagrostis acutiflora</i>)*		Turtlehead, Pink (<i>Chelone obliqua</i>)*	
Lake Sedge (<i>Carex lacustris</i>)		Turtlehead, White (<i>Chelone glabra</i>)	
Marsh Blue Violet (<i>Viola cucullata</i>)		White Aster, Upland (<i>Solidago ptarmicoides</i>)*	
Marsh Marigold (<i>Caltha palustris</i>)		Wild Rose (<i>Rosa virginiana</i>)	

* Non-native to New Brunswick

Rain Garden Layout Example

When designing a layout of plants for your rain garden, place flood-tolerant plants in the deepest part of the garden. These plants will be submerged for the longest period of time. Plants not marked as flood tolerant should be planted along the sides and front of the bowl-shaped bed.

Consider the height and exposure requirements of each plant. Plants requiring full sun should be placed at the front or in a location that provides the most exposure to sunlight. Choosing plants that are drought tolerant will require less watering during long dry periods. The following illustration is an example of a rain garden layout.



A - Flame Grass **B** - Native Rush **C** - Swamp Milkweed
D - Ostrich Fern **E** - Pearly Everlasting **F** - Purple Aster
G - Purple Coneflower **H** - Black-eyed Susan **I** - Sensitive Fern
J - Marsh Blue Violet **K** - Autumn Joy Sedum **L** - White Turtlehead
M - Blue Vervain **N** - Native Sedge

Step-by-Step Rain Garden Construction

The following is a step-by-step illustrated guide that covers the basics to planting a functional rain garden. Rain gardens can range from small and simple to larger pieces of landscape that can be designed to match your personal preferences.

EQUIPMENT & MATERIALS

Calculator
Measuring tape
Metre stick
Two Long stakes (2-4 ft)
String

Eco-friendly marking
Shovel(s)
Spade (Optional)
Trowel(s)
Rake(s)

Wheelbarrow(s)
Carpenter's level
Tarp(s)
Plants
Compost

Mulch
Flat stones (Optional)
River stones (Optional)
Inlet/outlet piping, if needed

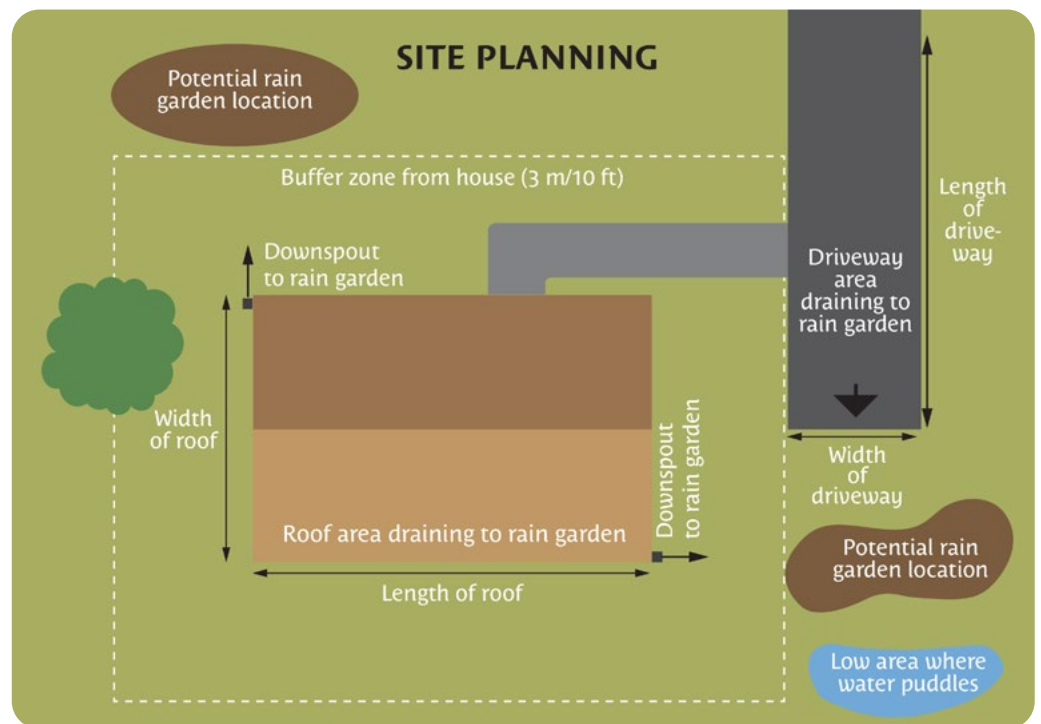
1 - Location - Where to Build Your Rain Garden?

Before you get started, take some time to observe where and how rainwater flows over your property. Remember that the largest sources of runoff originate from the rooftop and driveway.

Determine where most of the water ends up by following the drainage paths towards the low spots in your yard.

Consider planting a rain garden along a drainage path to intercept water before it pools in these lowest spots.

When choosing your location, you may also consider that water can be redirected towards your garden through an extension of your downspout, through a swale lined with decorative rocks, or from an underground pipe such as a French drain.



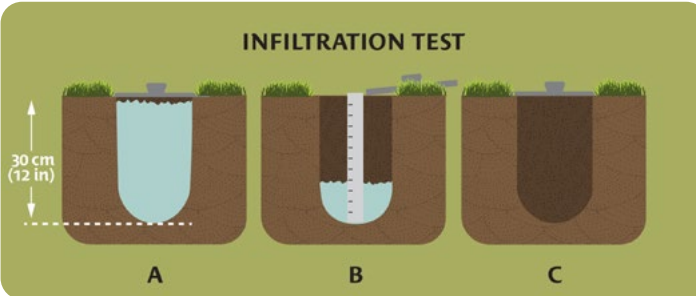
When choosing the location for your rain garden, there are several factors to consider:

- Rain gardens should be located at least 3 metres (10 ft) away from the house, to avoid seepage of water along the foundation.
- Do not install within at least 4.5 metres (15 ft) from a septic tank, leach field or drinking water well.
- Call before you dig! Make sure there are no underground utilities before disturbing the soil.
- Your garden should be in a lower-lying area or within a drainage area, capturing water flowing from the downspout, lawn, driveway or even a walkway.
- Do not choose an area where water already pools, this is an indication of poor infiltration or a high water table.
- Choose an area that is exposed to full or partial sunlight.
- Avoid locations too close to trees; roots may become damaged and the tree might not tolerate the added soil moisture.
- A rain garden can be planted on a slope, but it should not be steeper than 12%.
- Performing an infiltration test will help detect areas with poor drainage that are not great options for rain gardens. However, a rain garden can be adapted by amending the soil and adjusting the size and depth in the design.

2 - Test Your Soil

The type of soil will influence the rate at which the water will infiltrate the ground. Water drains faster in sandy soil than in soil containing clay.

To determine the type of soil in any potential location for your rain garden, you can perform an infiltration test to assess the ability of the soil to absorb water.



- Using a shovel or posthole digger, dig a 30-cm-deep hole (12 inches).
- If water fills the hole on its own, choose another location. If it remains dry, move to the next step.
- Fill the hole with water and let it drain completely. If the water remains after 24 hours, choose another location.
- Refill the hole with water a second time, cover the hole for safety and check back 24 hours later.
- If the water has drained away after 24 hours, the soil type is sandy (well draining).
- If the water has not drained after 24 hours, the soil type is clay (poor draining). If options for a location are limited, use the appropriate multiplier in sizing (Step 3).

Optional: clay soil can be amended by mixing in sand. The amount of sand needed will differ from site to site; once you mix in some sand, perform additional infiltration tests until a 24-hour infiltration rate is achieved.

3 - Sizing & Design

Sizing your rain garden does not have to be scary; you can size your rain garden based on the drainage area and the type of soil, or you can use the space that is available to you. Consider how much runoff you would like your rain garden to hold, while remaining within your budget. Even an undersized rain garden is better than no rain garden at all.

A residential rain garden is typically between 10 and 30 square metres (100 to 300 square feet) and approximately 10 to 20 centimetres (4 to 8 inches) in depth. As a frame of reference, a standard vehicle parking space is 16.7 square metres (180 square feet).

The size of your rain garden is entirely up to you. However, if you wish to maximize the capacity of your garden to handle larger volumes of water, you can calculate your garden size and depth using the following steps.

A - Calculate the Drainage Area

To determine the size of your rain garden, you will need to measure the approximate drainage area that will feed into the garden. Identify the surfaces that will drain into the garden, such as rooftops, driveways, walkways, etc.

Measure the length and the width of each impervious surface feeding your rain garden. Consider what portion of your rooftop will flow towards each downspout. Multiply the length by the width to get the drainage area for each surface, then add them together.

The following step is to use a multiplier based on the soil type (calculated in Step 2). If your soil type is sandy (infiltration test less than 24 hours), multiply your drainage area by 20%. If the soil type is clay (infiltration test more than 24 hours), multiply your drainage area by 30%.

If the resulting size is greater than the available space, it is suggested that a rain garden should be at least 5% of the drainage area.

$$\text{Length (m) X Width (m) = Drainage Area (m}^2\text{)}$$

Soil Type: Sand

$$\text{Drainage Area (m}^2\text{) X 0.20 = Rain Garden Size (m}^2\text{)}$$

Soil Type: Clay

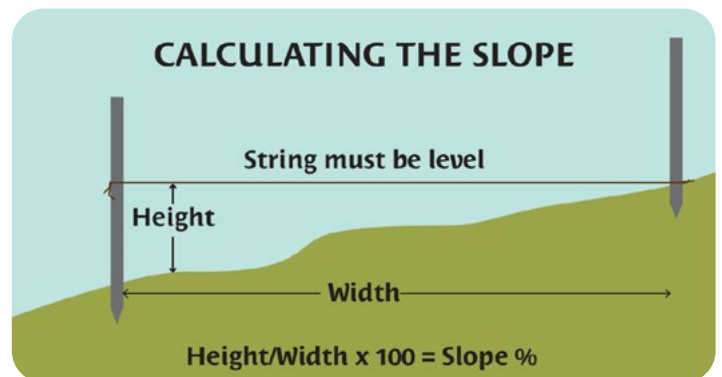
$$\text{Drainage Area (m}^2\text{) X 0.30 = Rain Garden Size (m}^2\text{)}$$

Minimum Rain Garden Size

$$\text{Drainage Area (m}^2\text{) X 0.05 = Rain Garden Size (m}^2\text{)}$$

B - Slope

The slope of your lawn will determine the depth of the rain garden and the height of the berm. The berm will help catch and retain the runoff to allow the time for the water to be absorbed into the ground.



Follow these steps to measure the slope:

- At the site of the rain garden, place a stake at the uphill end and another at the downhill end.
- The stakes should be at least 4.5 metres (15 ft) apart.
- Tie a string to the bottom of the uphill stake, so that the string touches the ground.

- d) Bring the other end of the string to the downhill stake.
- e) Level the string between the two stakes (using a carpenter's level) and tie it to the stake at that height.
- f) Measure the height from the ground to the string on the downhill stake.
- g) Measure the length of the string (width).
- h) Find the slope percentage by dividing the height with the width, and multiply by 100.
- i) If the slope is greater than 12%, it is advised to choose a different location for your rain garden.

Calculate the slope:

$$\text{Height} \div \text{Width} \times 100 = \text{Slope \%}$$

C - Depth

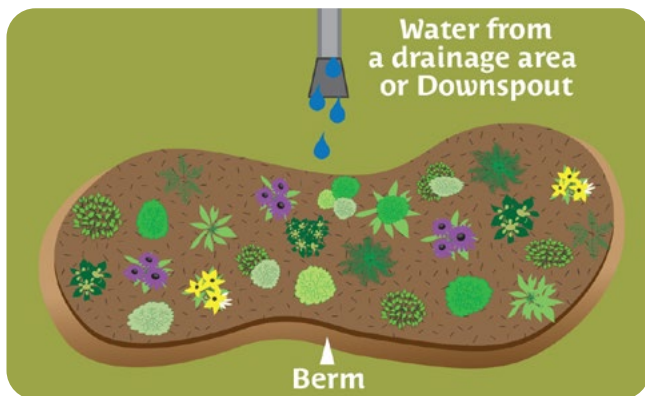
A residential rain garden is typically between 10 to 20 centimetres (4 to 8 inches) in depth. The slope affects the recommended depth.

Using the slope percentage, use the following guidelines:

- The slope is 4% or less: 10–13 cm (4–5 inches)
- The slope is between 5 and 7%: 15–18 cm (6–7 inches)
- The slope is between 8 and 12%: 20 cm (8 inches)

D - Berm

A berm is an “earth wall” that captures and retains the water flowing into the rain garden. The berm will be at its highest along the back of the garden (the downhill side) and run along the sides gradually tapering off as it reaches the front. Shape the berm into a smooth ridge about 30 centimetres (1 ft). To prevent erosion, the berm will need to be compacted and covered with either mulch or grass seed.



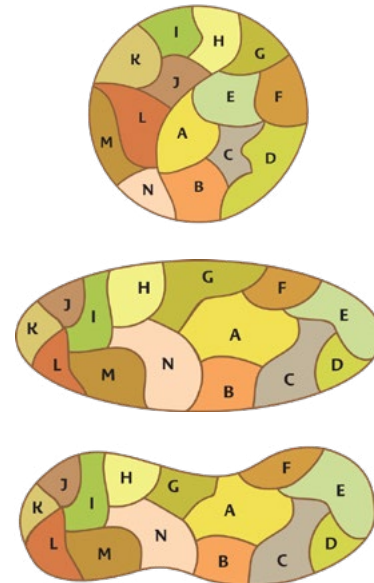
The slope will help determine the height of the berm. On level ground, a berm is optional because stormwater is held by the depression of the rain garden. On a slope, the height of the berm will be the same as the height of the string used to measure the slope. Build the berm so that the entire perimeter of the garden is at the same height and is level.

Consider the berm as an extension of the garden's “bowl shape” because it will affect the total depth. The distance from the top of the berm is equal to the ponding area depth of the garden.

E - Shape

When designing your rain garden, there are several shapes that you can choose from. A typical rain garden is twice as long as it is wide. Rain gardens can be oval, kidney-shaped, teardrop shaped, odd shaped or form-fitting around infrastructure such as walkways.

The flow pattern of water entering the garden can influence the shape. The most effective design is a garden that is placed perpendicular to the flow of the runoff, so that runoff flows into a wider area.



F - Design the Inlet and Outlet

The location where the water enters the rain garden (inlet) should be stabilized with gravel or decorative rocks to slow down the flow and prevent erosion. If needed, water can be redirected towards your rain garden. Methods include a downspout extension, a PVC or corrugated pipe (above or below ground), and a rock-lined swale. When installing a pipe, it should be installed at a 2% slope for an optimum flow velocity.

An overflow channel (outlet) can be designed to control excess water during a heavy rain storm. Design an outlet where water can be directed to a desired location. An outlet can be an overflow pipe or a simple dip in the berm or in the perimeter. Like the inlet, the outlet should be lined with rocks to prevent erosion.

G - Decorative Stones and Edging

The use of decorative stones such as river rocks can elevate the beauty and stability of your rain garden. The option to add rocks will help prevent erosion, capture sediment and slow down the flow of water entering the garden.

However, decorative rocks can add significant cost to your landscaping project unless they can be sourced naturally. Edging a garden with rocks, bricks or other materials creates a physical and visual barrier that separates the garden from the surrounding lawn.



4 - Choose Your Plants

When you choose plants native to New Brunswick, you help support biodiversity by providing wildlife with food and habitat. Native plants are also adapted to our climate and growing conditions. You may find plants on your property or from the wild that can be transplanted into your rain garden.

This guide provides a list of perennial plant species that are both recommended for rain gardens and native to this region. These plants are adapted to wet and dry conditions, and can tolerate periodic inundation. Plants that are drought tolerant will require less maintenance in terms of watering. As our summers become hotter with longer periods without rain, regular watering will be required when choosing species that are not drought tolerant.

5 - Installing the Rain Garden

Now that your plan is complete, it's time to dig in!

A - Define the Borders

Using a string or chalk, delineate the borders of your rain garden according to the size and shape from your sketched design. Avoid using spray paint that can contain harmful chemicals.

B - Remove Surface Grass

Using a shovel or a spade, cut into the lawn along the delineated border of your rain garden. Maneuver your shovel to cut horizontally underneath the lawn, to slice through the grass roots. The pieces of sod can be flipped upside down and used to build the foundation for the berm.

C - Start Digging!

You will be shaping the soil bed into a bowl shape. Avoid digging when the soil is wet to avoid compaction in the garden.

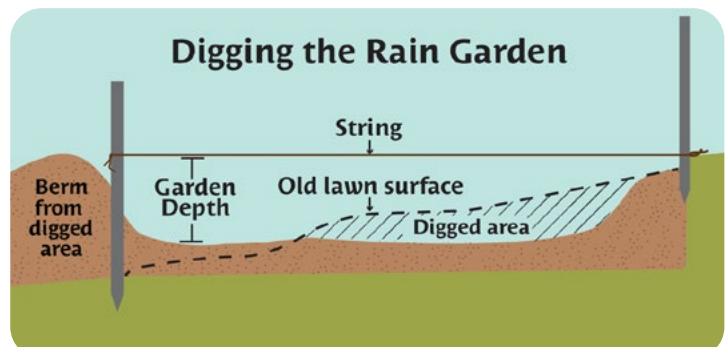
The first few centimetres of soil are normally rich in nutrients; you can preserve this layer of soil on a tarp for later use. Continue digging and create the berm with the shovelled soil. Use a wheelbarrow to remove excess soil. Use a rake to shape and smooth the berm, and compact the soil as much as possible.

Gently slope the sides of the bed and create a flat bottom. Dig the rain garden bed 10 to 15 centimetres (4–6 inches) deeper than your plan to allow for the addition of compost, preserved topsoil and mulch. When the digging is done, use

Consider the exposure to sunlight in the location of your rain garden when choosing your plants. The cost and availability of each plant at local nurseries will also be a factor when designing your rain garden.

Every rain garden should include a mixture of sedges, rushes and grasses. They provide a thick root system that keeps the entire garden in balance. They prevent other plants from outgrowing or outcompeting other species, while also controlling weeds. Sedges, rushes and grasses are flood-tolerant and will maintain the core functions of the rain garden. They also provide texture to the design.

Flowering plants will support pollinators and beautify your yard with a splash of colour. Consider the bloom periods of each plant to have flowers throughout the growing seasons. You can transform your rain garden into a butterfly garden by planting Butterfly Milkweed, Purple Milkweed and Swamp Milkweed. Milkweeds are the host plants that support the monarch butterfly.

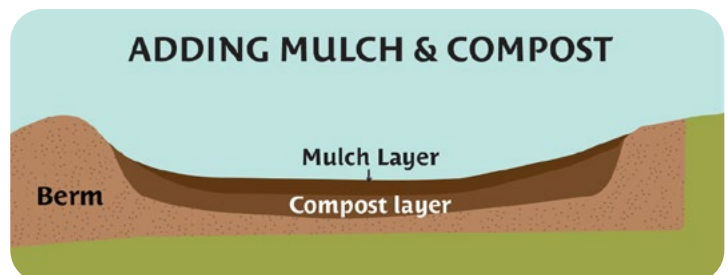


a rake to loosen the soil and smooth the bed's shape. It is important that the bottom of the bed is level.

Optional: Install a rock border or other edging material.

D - Compost

Adding nutrients to your garden can increase the survival rate of your plants. Add a layer of compost and mix it into the garden's soil using a rake. If you saved your top layer of soil on a tarp, you can mix compost to the dirt then return the content of the tarp to the garden.



E - Planting

Set the plants down, still in their pots, according to your design plan and space them appropriately. Set perennial plants a minimum of one per square foot. Leave at least 1 metre (3 ft) of space between shrubs.



Use the pot of each plant to measure the size of the hole. It should be twice as wide and deep enough for the pot to fit inside. The soil inside the pot should be level with the ground.

Using a shovel or a trowel, outline the size of the hole then move the plant aside. Dig the hole and test the depth by placing the potted plant inside. Once you have the proper depth, loosen the soil in the bottom of the hole.



To remove the plant from its pot, press on all sides to compress the soil. Grip the base of the plant gently but firmly, and work the root ball out of the pot. Loosen the root ball gently with your fingertips and place into the ground. Fill the holes with dirt and press down firmly with your hands until the plants are stable. Water the plants immediately.

F - Mulching



Mulch helps to maintain moisture and soil temperature, control weeds, filter pollutants and protect your garden against erosion. The mulch also adds organic matter to the garden as it degrades.

Spread an even layer of mulch over the entire surface of the garden, carefully between your plants. The mulch should be no more than 5 to 7 centimetres (2 to 3 inches) thick.

6 - Maintenance

Rain gardens need relatively little attention and care. However, there is some maintenance required to ensure your plant's survival and the functionality of your rain garden.

Watering: Although the garden catches stormwater, new plants need to be watered regularly until their roots are established. Watering may also be required during long periods of heat and drought. Choosing drought-tolerant plants will help protect your investment.

Weeding: Weeding is necessary during the first few years to prevent weeds from competing with your plants.

Mulch: As mulch degrades, reapply mulch every few years to maintain the proper thickness - 5 to 7 centimetres (2-3 inches).

Final Thoughts

Creating a rain garden will help manage stormwater runoff originating from your property. A network of rain gardens in a community has a cumulative effect in protecting surface water quality in a watershed.

This guide is by no means an exhaustive list of rules for the creation of a rain garden. The goal is to provide the necessary tools for any homeowner to design and install a beautiful and functional rain garden. There is also a vast amount of information available online that can help inspire a creative rain garden project that is right for you.

Reference Documents

- The Vermont Rain Garden Manual: Gardening to Absorb the Storm. Winooski Natural Resources Conservation District
- How to Create a Rain Garden: A Guide for Homeowners! Essex Region Conservation Authority
- New Hampshire Homeowner's Guide to Stormwater Management; Do-It-Yourself Stormwater Solutions for your Home. New Hampshire Department of Environmental Services
- Rain Garden Design and Construction; A Northern Virginia Homeowner's Guide. Northern Virginia Soil and Water Conservation District
- Rain Gardens: A how-to manual for homeowners. Wisconsin Department of Natural Resources
- A Complete Guide to Building and Maintaining a Rain Garden. Toronto and Region Conservation Authority
- Rain Gardens: A How to Guide for a Healthy Yard. University of Saskatchewan



Watershed Management for Water Quality

The Shediac Bay Watershed Association (SBWA) has a mandate to protect and enhance water quality throughout the watershed. The water quality in the bay's saltwater ecosystems is influenced by the quality of the freshwater rivers and streams that flow into it. In order to ensure good water quality in the Shediac Bay, there must be proper management of surface water and land uses in the watershed as a whole.

Studies have provided data on the levels of bacteria and other pollutants contained in the stormwater runoff within the Shediac Bay watershed. Numerous recommendations for watershed management strategies include the use of bioretention systems such as rain gardens. By absorbing stormwater runoff, rain gardens help reduce the volume of stormwater entering our storm sewers and small streams, all of which drains into the Shediac Bay.

This project was undertaken with the financial support of:
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Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

Residential Rain Garden Program

The Shediac Bay Watershed Association (SBWA) began working on naturalized stormwater management in 2017. Partnerships with watershed residents are essential for on-the-ground projects such as rain gardens, bioswales and other bioretention systems.

The SBWA is looking to work with homeowners living within the Shediac Bay watershed to increase the network of residential rain gardens to manage stormwater. The Association can provide support for homeowners who wish to create their own rain garden project.

This step-by-step guide is designed to increase local capacity for residential rain gardens and encourage residents to manage stormwater runoff.

Watershed residents may also qualify to receive financial support for their rain garden when funding is available. As a non-profit organization, funding applications are submitted each year to help support our environmental initiatives. Funding criteria are also subject to change on a year to year basis.

To receive up-to-date information on the Residential Rain Garden Program, such as funding opportunities and public workshops, please:

- Visit our [website](#)
- Follow us on social media
- Subscribe to our newsletter
- Send us an email: sbwa@nbnet.nb.ca



www.shediacbayassociation.org

The Shediac Bay Watershed Association is a non-profit environmental organization that works to protect and enhance the Shediac Bay watershed. The organization envisions communities working together to foster healthy ecosystems that will sustain the quality of water for future generations.



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