STORMWATER MANAGEMENT TECHNIQUES

Site Assessments for Rain Gardens and other stormwater tips

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Introduction

Managing stormwater provide some interesting opportunities to conserve water and to better protect your property from damage over time. Simple steps can be used to help keep water away from you foundation or direct it towards a space that is designed to receive large quantities of water. Low-impact development or green infrastructure means creating green, vegetated spaces within an urban environment to help water from storms sink into the ground as close to where it fell as possible. When green, vegetated areas are replaced by hard surfaces such as roofs, parking lots and roads, water travels over these surfaces and can pick up speed, debris and pollutants and can result in flash flooding. Contaminated storm-water is one of the most significant causes of poor water quality in our streams, rivers, lakes and oceans.

This guide is an introduction to some simple and affordable techniques that can be used to manage stormwater on your property and can be effective for many sce-narios. Further research may be required for some projects or, depending on what is happening on your property, more extensive techniques may be required. Please use this guide as an introduction to what can be done and – depending on your interest, skills and, creativity – to provide some wonderful additions to your property.

Photos from the Seven Lakes rain garden project in Porters Lake, Nova Scotia.

Rain Gardens

Rain gardens are perhaps the most versatile, fun and beautiful of the "low-impact development" or "green infrastructure" stormwater management tools. A rain garden is just like a normal garden, with a few key differences:

It is dug down, with a concave, bowl shape, instead of a convex, mound shape, designed to create a pocket for water to collect and soak into the ground over the period of a day or less.

It works best with perennial native plants that do well both with lots of water and with dry periods.

Once established, requires little maintenance.

It is not a pond, but rather an extra absorbent, spongy area.

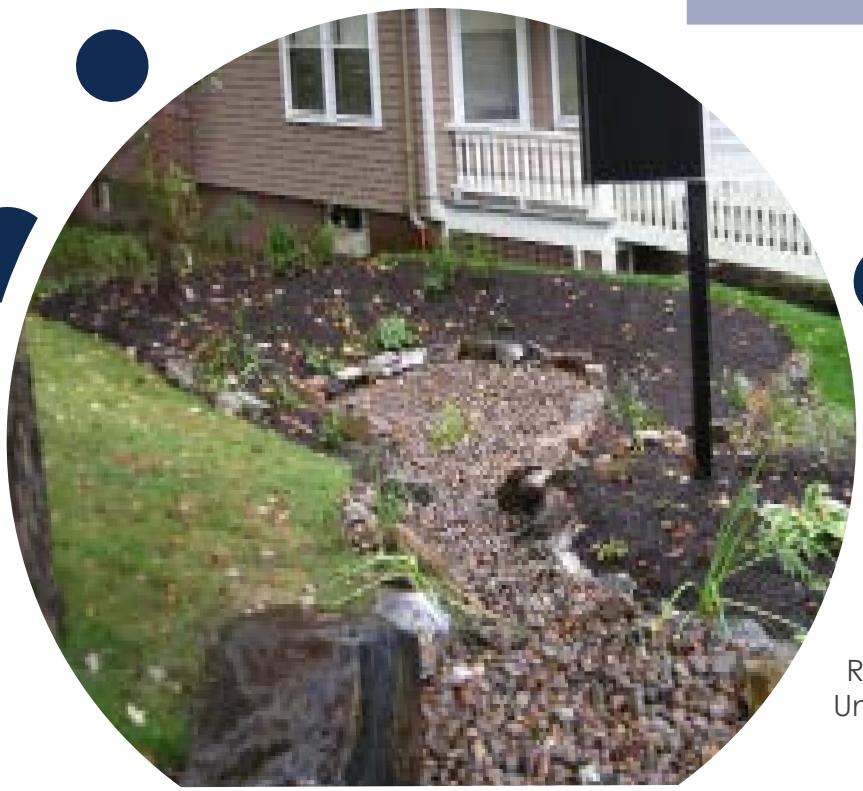
What About Insurance?

It is important to understand that many insurance policies do not cover flooding in the home caused by overland flooding. However, sewer back up insurance can often be purchased and would help in cases when sewers become overwhelmed. One way to determine if your home is at risk for sewers backing up is to evaluate the elevation, neighbourhood density and the frequency of severe weather events in your area. Installing a backflow preventative valve can also reduce the risk of a sewer back up causing damage to your home.

In most cases, it is best to take steps to protect your home from water damage before flooding occurs. This could include rethinking what you keep in your basement, from moving valuable items or important documents to higher levels of your home to securely anchoring fuel tanks to the floor. If flooding were to occur, the materials in your basement could contaminate the water causing additional damage.

Managing the stormwater on your property can be an effective way to protect your home from flooding or water damage.

For more information visit:
http://www.ibc.ca/on/disaster/water

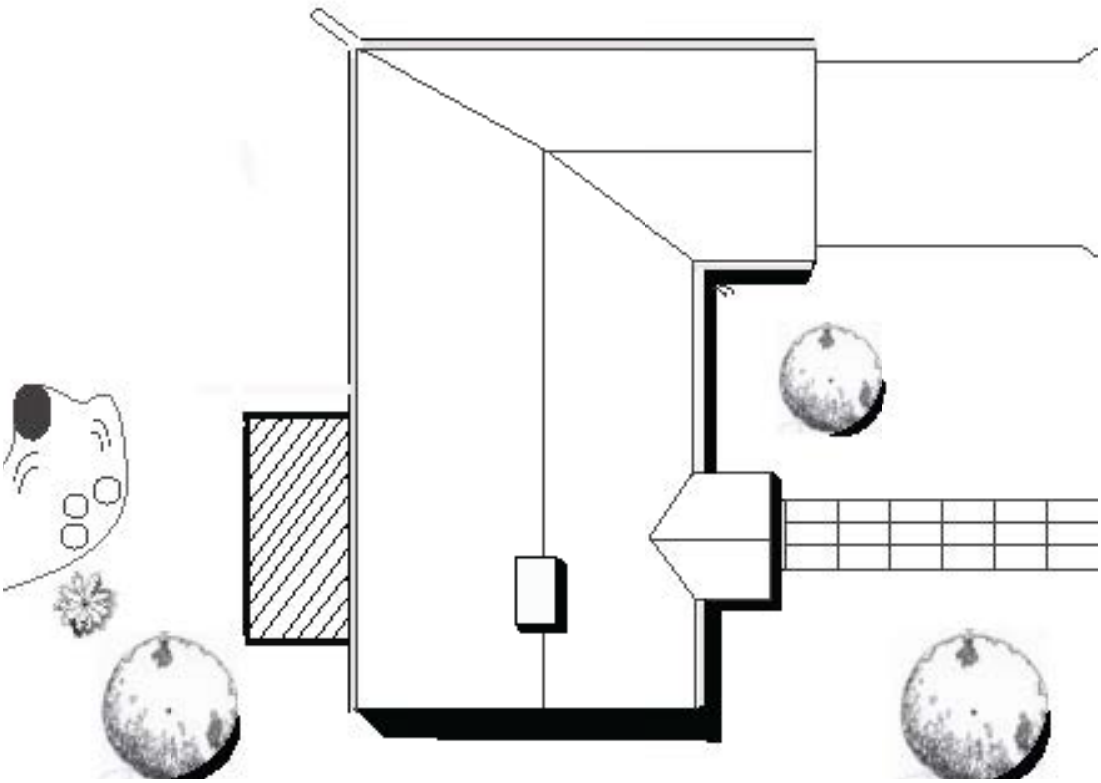


Rain Garden Project at Dalhousie University in Haliafx. Nova Scotia.

Site Consideration

Before you can start building your rain garden, it is important to consider where to put it. The two main considerations are that a rain garden is an area for water to be pulled deep into the ground and will requiring digging. Rain gardens should not be placed in areas which should not have water near them, do not drain well or where you should not dig. Avoid placing rain gardens next to:

- House foundations (at least 3m/10 ft away from the building)
- Septic systems (7.6m/25ft away)
- Tree roots (look up, where there are branches, there are roots)
- Where water naturally ponds (this area is not well-drained)
- Where the water table is nearly at the surface
- Where there is bedrock within a foot or two below the surface



On this property the sides of the house are limited by the foundation. In the front and back trees may limit the ability to dig. Finally, the small pond should be avoided.

However there are still multiple potential locations for a rain gardens.

Once you've identified which location is suitable from your site option list, your next step is to go outside on your property during a rain storm and observe where water comes from and flows. You'll want to place your rain garden somewhere along the water's path to intercept it and slow its flow.

Site Consideration

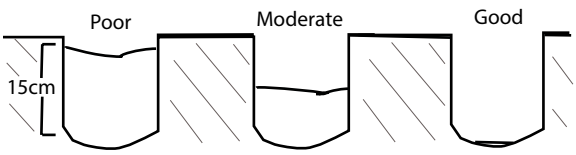
Soil Type

The soil type at your rain garden site will determine how quickly water can infiltrate, and thus the size of the garden. If a site is too rocky or has very thick clay, the site is not suitable for a rain garden. Sandy soils have the fastest infiltration; clay the slowest. Sandy soils are described as gritty and coarse, silty as smooth but not sticky, and clay as sticky and clumpy. Soil is often a combination of different soil types so they can be hard to classify. However, an area with predominantly clay soil should either be avoided or would require that the garden be larger to handle infiltration and should have sandy pits installed in them to help infiltration.

Testing Your Soil

Ribbon test to determine soil type: Work a handful of moist soil into a small ball in your hand. Squish the soil ball between your thumb and the side of your forefinger and try to make the longest ribbon you can using consistent pressure on the soil before it breaks. Measure the length of the ribbon. If the soil does not form a ribbon at all, you have SANDY soil. If you have a ribbon of 3 cm or less, you have SILTY soil. If you have a ribbon longer than 3 cm, you have CLAY soil.

One simple test to test if the potential location has enough infiltration is to dig a hole 15 cm (6 inches) deep and fill with water and allow it to filter away. If it takes more than 24 hours to drain, the soil is more clay-based and is not suitable for a rain garden.



Sandy soil will have good drainage, whereas clay soil will drain poorly.

Slope

The slope of the site of your rain garden is important to take into consideration because it determines how quickly water flows into your site, and therefore how quickly your garden will fill. This will impact both the structure and size of your garden. For example, two garden sites equal in all ways except for slope will require a larger berm and either a larger area or deeper dug garden for the site with the steeper slope.

To calculate the slope of the intended rain garden site, pound one stake uphill of the site and the other at the downhill end approximately 5 m (15 feet) apart. Tie the string to the uphill stake and pull the string to the downhill stake. Hold the string level and measure the length of the string. Measure the height from the level string to the ground at the downhill stake. The percent slope will be equal to: Percent Slope = Height/ Length x 100.

Slope	<4%	5-7%	8-12%	12-20%
Depth of the concave	8-13 cm	15-18 cm	20 cm	Easier to install else-where

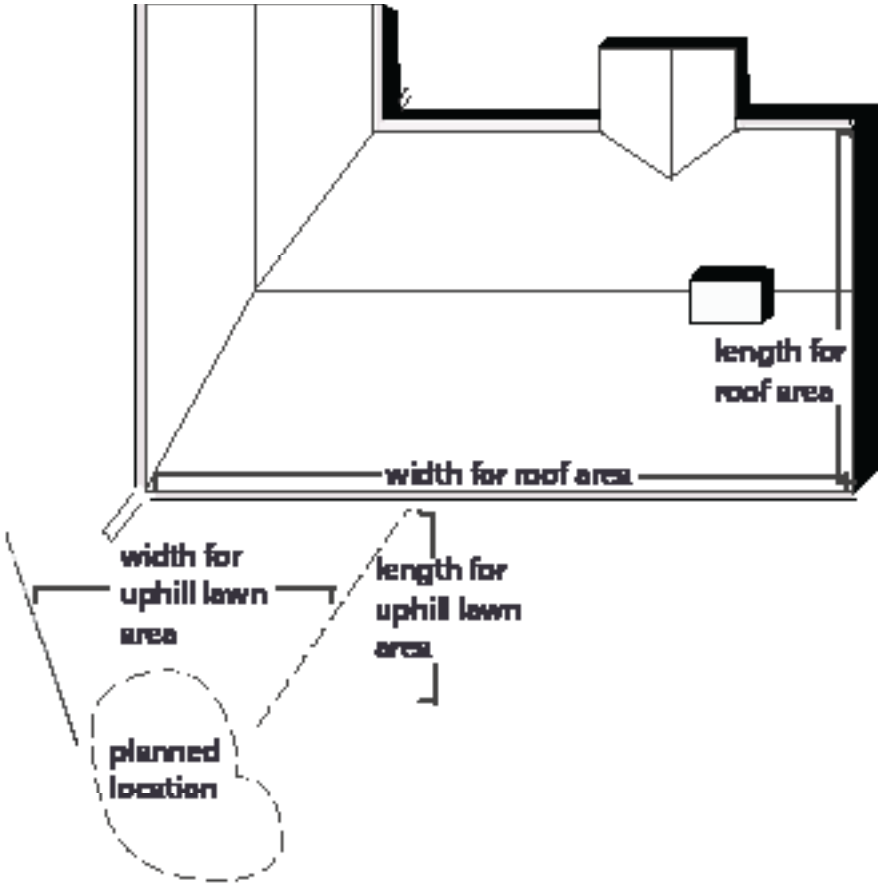
Sizing Your Rain Garden

The steps and table outlined in this section will help you design a rain garden intended to catch 100% of rain flows. While the below information contains a lot of technical details, stormwater experts agree that digging a depression of any size and planting a few hardy plants will help ease the stormwater volume and help keep surface water cleaner.

Estimating how much water will reach your rain garden or your water catchment area, can be very helpful. The chart on the following page refers to rain garden located within 9 meters of a downspout, and those beyond 9 meters. It is assumed that if the garden is within 9 meters, then you need only calculate the stormwater coming off of your house via the downspout. To do this, you'll need to measure the length and width of the building and multiple them together to determine the area of the roof, and then divide the area by the number of downspouts on the building.

Example

You have a building that is 5 m long and 5 m wide and has 2 downspouts that share the load equally. The ground floor area is: 5 m x 5 m = 25 m^2. If your 2 downspouts are equal, one will take care of 50% of the water. Your drainage area will then be: 25 m^2 x 0.5 =12.5 m^2.



For this site both the roof area and the lawn area were calculated to deterine total drainage area.

If the site is over 9 meters away from a downspout you will need to consider drainage from the lawn. From your rain garden site, you will need to include the parts of the lawn that slope towards your garden. Similar to how you calculated the catchment area of your roof, you will need to measure the length and width of the uphill lawn to determine the lawn area. To calculate the total drainage area, add the lawn area to the roof drainage area calculated in the previous step.

Sizing Your Rain Garden

Combining all this information together will help to determine the final area and depth of your rain garden. The table below provides a size factor which, based on the depth of your rain garden and the soil present, is multiplied by your calculated drainage area to determine the final area of your rain garden.

Location	Depth	Sandy	Silty	Clay
Within 9m				
	8-13 cm	0.19	0.34	0.43
	15-18 cm	0.15	0.25	0.32
	20 cm	0.08	0.16	0.20
Beyond 9m	All Depths	0.03	0.06	0.10

Once you calculate the size of your rain garden, it is time to design the shape of the garden. Popular choices are kidney bean or oval shaped gardens though many different configurations can work. It is best to have a garden whose length is 1.5 times the width – for reference the length is the dimension that is perpendicular to the slope.

Example
You have a drainage area of 18.5 m^2 sandy soil, and a depth of 8-13 cm. The surface area of your rain garden should then be: 18.5 m^2 x 0.19 = 3.5 m^2.

Successful rain gardens have been built in many shapes and sizes.

Choosing Plants

One of the most exciting things about rain gardens is the opportunity they provide to plant native species in urban areas, thus helping to restore urban habitat for birds and pollinators like bumblebees and butterflies.

Ferns- A common water loving plant that prefers shaded areas. They can provide variety to a rain garden and are typically very hearty.
Local Examples – Ostrich Fern *(Matteuccia struthiopteris)*

Grasses or sledges- Often omitted in traditional gardens, sledges and grass are very common in Nova Scotia and often thrive in moist conditions. Furthermore they can add layers and contrast to a rain garden.
Local Examples – Fox Sedge *(Carex vulpinoidea)*

Ground Cover- This is excellent way to fill space in a rain garden and mitigate the development of weeds. Ground cover can be aesthetically appealing and are a common Native Species.
Local Examples – Naked Miterwort *(Mitella nuda)*

Trees – Although not all rain gardens will be so large a tree is appropriate, in some it can be a great fit. Make sure to select a species which can sustain damp conditions and that is planted in a safe place on your property.
Local Example– Red Maple *(Acer rubrum)*

Perennial – Another way to add variety to your rain garden is through flowering perennials. The roots survive the winter so every summer they can return and bring colour to the garden when they flower.
Local Examples – Firecracker *(Lysimachia ciliata)*

Shrubs- A gorgeous addition to any rain garden with many options for native species. They also can aid local ecology by as supporting butterfly or bee populations.
Local Examples – New England Aster *(Aster novae-angliae)*

Rain Barrels

Another way to take advantage of stormwater on your property is through adding a rain barrel. These can connect directly to downspouts and store rain water for non-potable use, such as watering plants or washing a car. Rain barrels can be purchased or made from a repurposed container. Many home improvement stores sell rain barrels which can be directly installed to a downspout or by attaching a downspout diverter. Proper installation is required to ensure that the rain barrel does not over flow. You can also find designs to build your own rain barrels: a large barrel or container along with a few tools and attachments is all you need if you want to make your own.

Rain barrel must be disconnected for the winter. Attach an extension to your downspout to insure stormwater is still diverted away from your foundation. Place the barrel upside-down to insure that water does not buildup and freeze inside.

Elevating a rain barrel that have spouts at the bottom can make using the water easier by increasing the water pressure.

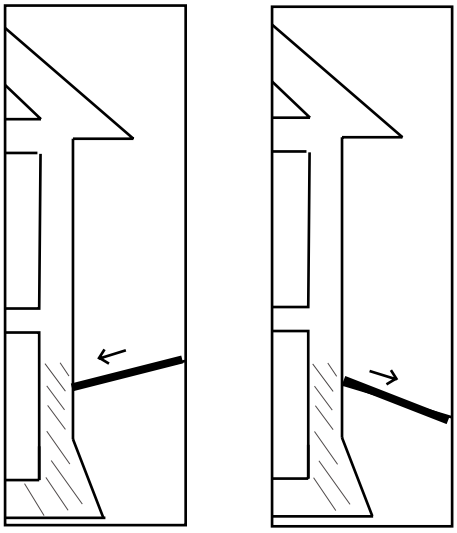
Downspout Diverter – A diverter can be installed onto a downspout and attached to a rain barrel. The diverter fills the rain barrel, while not causing it to overfill or backup. Proper installation of diverters requires that the outflow from the diverter is level to the inflow on the rain barrel. When the barrel is full the water pressure will stop water from entering into the rain barrel and it will flow down the downspout.

Barrel with overflow – A rain barrel can be attached directly to the bottom of a downspout. Make sure that the rain barrel has an out flow, such as a length of hose installed to direct water away from the foundation. This will help prevent the rain barrels from overflowing

Maintain Permeable Surfaces
Where ever possible around your property it is best to maintain a permeable surface. On grasses avoid heavy maintenance which can lead to soil compaction and reduced infiltration. In areas which you pave use permeable paving stones to mitigate the impact.

Grading and Re-directing Downspouts

Preventing water from pooling against the foundation of buildings is an effective way to minimise damage to a building over time. The simplest and most effective way to do this is to regrade areas which slope toward your house. This can be done by adding soil to areas with depressions to elevate the height of the soil against the foundation and allow the water to pool away from the foundation, rather than up against it. Be cautious that window ledges or vents do not become covered when adding soil. A low slope is all that is required and once the ground is regraded it can be seeded with grass or planted with shrubs or flowers to help absorb some of the water that does infiltrate in the area.



On the left the water will pool against the foundation. On the right water flows away.

Depressions in the soil can happen over time as soil compacts or settles so areas around the foundation should be checked from time to time. Another cause can be if downspouts drain straight onto the soil below and compact the soil over time. Adding an extension to the downspout so the stormwater is redirected away from the building's foundation can not only prevent the soil from compacting but also keep the stormwater away from the foundation. Attach a short section of downspout or flexible tubing to the downspout with a downspout elbow and position to point away from the building so that the stormwater exits the downspout at least 6 feet from the foundation. An effective way to manage stormwater on your property can be to redirect a downspout so that stormwater heads toward a vegetated area or away from areas that traditionally stay damp.

Successful downspout redirecting from accross the HRM.

Resources

It can be a challenge to find sources of native plants, many nurseries have only a very small selection of native plants. Here's a list of nurseries in Nova Scotia that supply native plants suitable for rain gardens.

Baldwin Nurseries Falmouth, NS 798-9468 www.baldwinnurseries.com
Blomidon Nurseries Wolfville, NS 542-2295 www.blomidonnurseries.com
Bunchberry Nurseries Upper Clements, NS 532- 7777 www.bunchberrynurseries.ca
Oceanview Garden and Landscaping Chester, NS 275-2505 www.plantcrazy.ca
Ouestville Perennials West Pubnico, NS 762-3198 www.ouestvilleperennials.com

The Evergreen Native Plant Database (http://nativeplants.evergreen.ca/) is a great tool for learning about and choosing native plants.

Here is a list to get you started.

Plant Common Name	**Plant Latin Name**
Dwarf Goat's Beard	*Aruncus aethusifolius*
Woods Purple New York Aster	*Aster novi-belgii*
Blue Flag Iris	*Iris veriscolor*
Switch Grass	*Panicum Virgatum*
Hard Shield Fern	*Polystichum aculeatum*
Goldsturm Black-Eyed Susan	*Rudbeckia fulgida "Goldsturm"*
Red twig Dogwood	*Cornus sericea*
Sweet Flag	*Acorus americanus*
Swamp Milkweed	*Asclepius incarnata*
Marsh Marigold	*Caltha palustris*
White Turtle Head	*Chelone glabra*
Christmas Fern	*Polystichum acrostichoides*
New England Aster	*Symphyotrichum novae-angliae*
Vernal Witch Hazel	*Hamamelis vernalis*
Native Rhododendron	*Rhododendron canadense*
Labrador tea	*Ledum groenlandicum*
Winterberry	*Ilex verticillata*
Royal fern	*Osmunda regalis spectabilis*
Native Columbine	*Aquilegia canadensis*
Sensitive Fern	*Onoclea sensibilis*
Cardinal Flower	*Lobelia cardinalis*
Sweet Fern	*Comptonia peregrina*
Bearberry	*Arctostaplylos uva-ursi*
Wild geranium	*Geranium maculatum*
Northern Maidenhair Fern	*Adiantum pedatum*
Joe Pye Weed	*Eupatorium maculatum*
Serviceberry	*Amelanchier canadensis*