

The Vermont Rain Garden Manual

“Gardening to Absorb the Storm”

Helping to protect and restore Vermont’s rivers and lakes.





The Purpose of this Manual

This manual is a Vermont specific resource developed for homeowners, landscape architects, city planners, or anyone else interested in protecting local rivers and lakes through gardening. It's contents are designed to clarify the installation process, demonstrate how rain gardens are cost-effective stormwater management tools, and illustrate how they can be incorporated into a variety of landscapes.

Contents

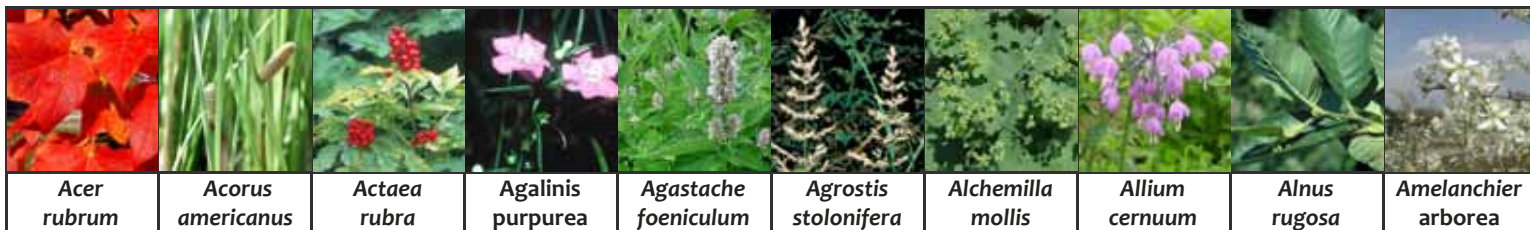
This manual is broken into sections to illustrate the step by step process in building a rain garden. The sections include:

Choosing a Location.....	p. 3
Sizing a Rain Garden.....	4
Designing a Rain Garden.....	6
Installing a Rain Garden.....	7
Care & Maintenance.....	9

This manual also includes:

An introduction to Curb-Cut Rain Gardens.....	10
The Vermont Rain Garden Plant List.....	11
Sample Rain Garden Planting Plans.....	15
An explanation of how rain gardens relate to the Vermont Stormwater Management Manual	18
Vermont Hardiness Zone Map.....	20

Photographs of each rain garden plant are arranged alphabetically throughout the manual



What is a rain garden?

A rain garden is a bowl-shaped garden designed to capture and absorb rainfall and snowmelt (collectively referred to as “stormwater”). When stormwater runs off impervious surfaces such as parking lots, roofs, compacted soils, and roads, it accumulates pollutants and delivers them to a nearby lake or river either directly or via a storm drain. Stormwater pollutants typically include sediment; nutrients (nitrogen and phosphorus); bacteria from animal waste; and oil, grease, and heavy metals from cars. Stormwater also causes increased flooding, which erodes stream banks resulting in additional problems. However, if captured by a rain garden, stormwater soaks into the ground recharges the groundwater at a rate 30% greater than that of a typical lawn. Ultimately, if we all work together to create landscape features that absorb the stormwater, we can restore and help preserve the waterways that make Vermont so beautiful.

Choosing a Location

- ✓ If capturing roof runoff, place the garden about 10 feet away from the building to prevent potential water seepage into the basement.
- ✓ Do not place a rain garden over a septic tank or leach field.
- ✓ Do not place a rain garden near a drinking water well.
- ✓ Call Dig Safe® at 1-888-DIG-SAFE at least three days before digging to avoid underground pipes and utilities.
- ✓ Check for any private wiring or underground utilities such as driveway lights and sheds with electricity.
- ✓ Select a flat area if possible to make installation easier.
- ✓ Do not place the rain garden in a naturally wet area.
- ✓ Avoid disturbing tree roots. Trees may be injured by digging and may not tolerate the additional soil moisture.



Build next to a house



Build next to a road



Build next to a parking lot

Photo courtesy Connecticut NEMO





Sizing the Rain Garden (4 Steps)

Step 1: Drainage Area

To calculate the drainage area (the area that will drain to the rain garden) from a roof, parking lot, sidewalk, or other impervious surface, multiply the length by the width.

$$(\text{Length}) \times (\text{Width}) = \text{_____ ft}^2 (\text{drainage area})$$



Add together the drainage area of multiple roofs.



Combine your roof runoff with a neighbors'.



Rain gardens can capture stormwater from a drip-line just as well as from a gutter system.



Estimating the stormwater that runs off streets, sidewalks, and parking lots can be tricky. It is best to visit the impervious area during a rain event to clearly see the extent of the drainage area.

Step 2: Soil

To determine if the soil type is suitable for a rain garden, first perform a simple pit test:

1. Dig a 6" deep hole and fill with water.
2. Choose a new location if the water is still standing after 24 hours.

After conducting the pit test, identify the soil type as sand, silt, or clay. Sandy soils have the fastest infiltration; clay soils have the slowest. Since clay soils take longer to drain water, they require a larger rain garden area. You can determine your soil type by performing the ribbon test:

1. Grab a handful of moist soil and roll it into a ball in your hand.
2. Place the ball of soil between your thumb and the side of your forefinger and gently push the soil forward with your thumb, squeezing it upwards to form a ribbon about ¼" thick.
3. Try to keep the ribbon uniform thickness and width. Repeat the motion to lengthen the ribbon until it breaks under its own weight. Measure the ribbon and evaluate below:

Courtesy of North Dakota State University



The ribbon formed here depicts a clay soil because it is greater than 1.5" in length.

- SAND:** Soil does not form a ribbon at all.
- SILT:** A weak ribbon < 1.5" is formed before breaking.
- CLAY:** A ribbon > 1.5" is formed.





Step 3: Slope

Calculate the slope to determine the rain garden's depth:

1. Place one stake at the uphill end of the rain garden and another at the downhill end as illustrated in Figure 1.
2. Level the string between the two stakes.
3. Measure the total length of the string and the height of the string at the downhill stake in inches.
4. Divide the height by the length and multiply the result by 100. This is the slope.
5. Use Table 1 to determine the recommended rain garden depth.

Slope	Depth
< 4%	3-5 in
5-7%	6-7 in
8-12%	8 in+

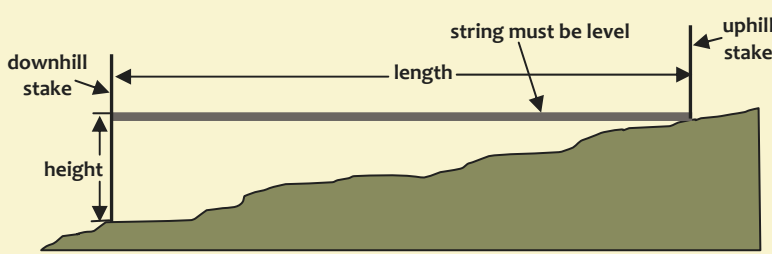


Figure 1: Determine the slope of the landscape.

Adapted from Rain Gardens: A How-to Manual for Homeowners, UWEX

Benefits of a Rain Garden

- Are easy and inexpensive to install and maintain
- Reduce stormwater runoff
- Recharge groundwater
- Help control flash flooding
- Provide wildlife habitat
- Improve water quality
- Help to sustain stream base flows
- Are an attractive alternative to detention ponds
- Remove Pollutants
- Can be retrofit into existing urban landscapes



Step 4: Size

Finally, determine the rain garden's size:

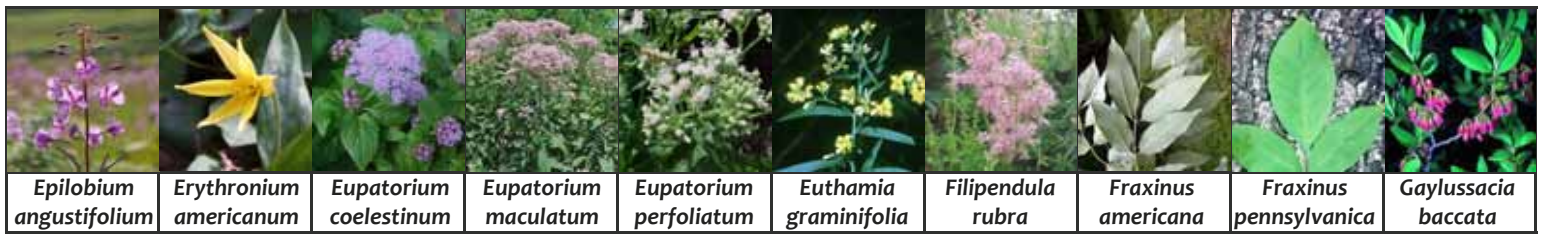
1. Use Table 2 to determine the size factor.
2. Multiply the size factor by the drainage area. This is the recommended rain garden size.

Soil Type	Depth		
	3-5 in	6-7 in	8 in +
Sand	0.19	0.15	0.08
Silt	0.34	0.25	0.16
Clay	0.43	0.32	0.20

$$\frac{\text{Size Factor}}{\text{Drainage Area}} \times \text{Drainage Area} = \text{Rain Garden Area}$$

Note: If the rain garden is > 30 ft away from the drainage area then the area of the rain garden can be a half size smaller than calculated above. This is because a large amount of stormwater will be absorbed along the pathway that leads to the rain garden.





Designing the Rain Garden (4 Steps)

Step 1: Determine the Shape

Your rain garden can be any shape but it **MUST** have a level bed.

Step 2: Design the Entrance



Stabilize the area where the water enters your rain garden with stone or gravel to slow stormwater flow and prevent erosion within the garden. Place hardy plants that thrive in moist conditions where the stormwater enters the garden.

Some common methods for directing water from the drainage area to the rain garden include:



Gutter Extensions: Specifically shaped to attach to the end of your downspout.



PVC & Plastic Corrugated Piping: Can be attached to gutter extensions and buried to carry stormwater underground.



Grass-lined & Rock-lined Swales: Can be used to direct water to the rain garden. Swales should be sloped at a 2:1 ratio (1 ft rise for every 2 ft across). Ideal for heavy flows from roads or parking lots.

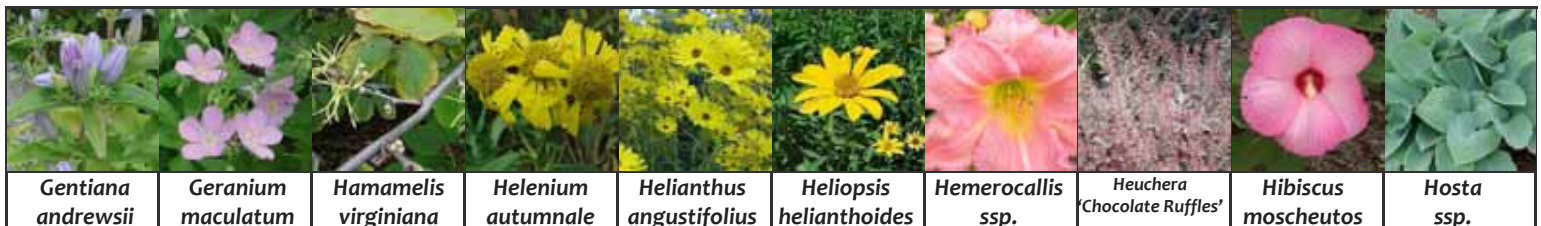
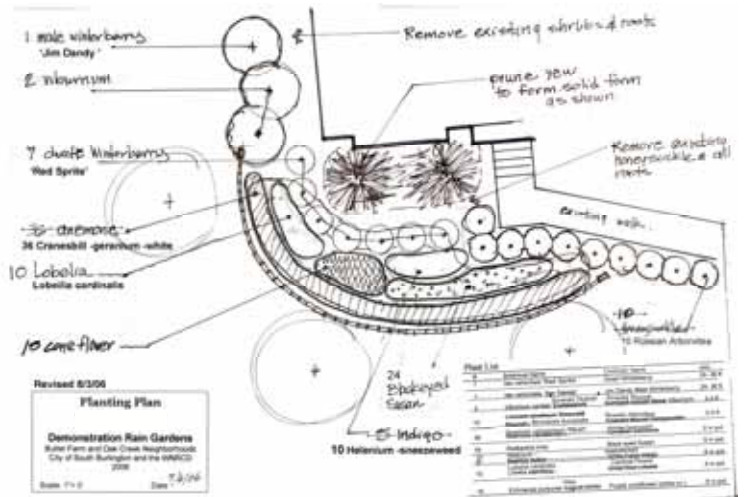
Step 3: Select Plants

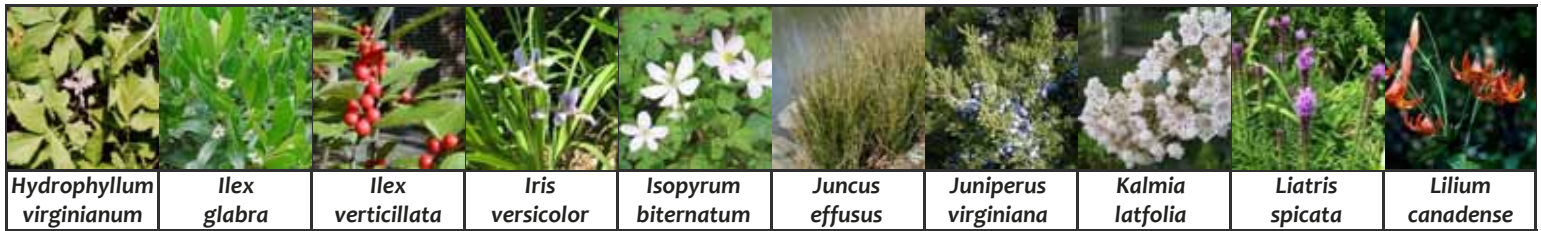
Plants must be able to tolerate the extreme moisture conditions typical of a rain garden. When choosing plants it is important to remember that rain gardens are not wetlands. Rain gardens mimic upland forest systems. Plants that consistently require wet soils or standing water are not appropriate. Refer to The Vermont Rain Garden Plant List beginning on page 11 of this manual.

There are likely many more plants suitable for Vermont rain gardens than what is included in the plant list. To evaluate the suitability of each additional plant, use the following criteria: A suitable rain garden plant 1) is greater than 6" in height when mature and does not have low basal leaves—these plants may struggle when overcome by heavy flows; 2) can tolerate both wet and dry conditions; and 3) can survive in the local hardiness zone. Refer to the **Plant Hardiness Zones in Vermont** map included on the back cover.

Step 4: Final Rain Garden Design Sketch

Complete a to-scale drawing of the rain garden before breaking ground:





Hydrophyllum virginianum	Ilex glabra	Ilex verticillata	Iris versicolor	Isopyrum biternatum	Juncus effusus	Juniperus virginiana	Kalmia latifolia	Liatris spicata	Lilium canadense
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Installing the Rain Garden



Build the berm with sod



Borders defined by an earthen berm



Create a berm with landscaping stone



Borders defined by edging

Step 1: Define the Borders

Delineate the outline of the rain garden on the ground using string or spray paint. The berm or edging will go outside the string.

Step 2: Remove the Grass

To avoid digging through sod, kill the grass first by laying black plastic or a tarp on the lawn for several weeks. Using a herbicide is not recommended—It could harm the newly installed plants.

Step 3: Start Digging

Building on a slope: If the rain garden is built on a slope, a berm or low wall on the downhill side is required to increase the water holding capacity of the garden. Create the berm while digging the rain garden by heaping the soil around the edges where the berm will be (see figure 2). The berm height should be level with the uphill side of the garden, therefore making the entire perimeter of the garden the same height. After shaping the berm, compact the soil and cover with sod, mulch, or a groundcover. Use straw or other matting to protect the berm from erosion while the grass or groundcover takes root.

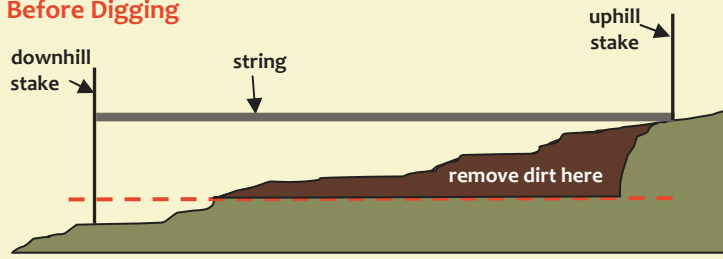
Building on level ground: If the rain garden is built on level ground, the profile of the garden can vary depending on available space and aesthetic preference. If space permits, the rain garden can have gently sloping sides (Figure 3). Note that soil conditions in the upper slope of this type of rain garden may be too dry for a true rain garden plant to survive, therefore a variety of upland plants might be appropriate here. If there is not a lot of space, then the profile in figure 4 might be appropriate. Only plants that can tolerate very moist soil conditions should be planted in this type of rain garden. This design is common in urban settings where a curb-cut is used to direct stormwater into the garden. A berm does not need to be constructed in a rain garden that is built on level ground because the stormwater is held in by the depression that is dug. Excavated soil therefore should be removed from the site. Landscaping stone, or other edging can be used to help hold water in the garden as well as to prevent grass from growing into the bed. *Tip:* Think about where stormwater will go when the rain garden overflows during a very large storm. Design a slight dip in the berm/perimeter to direct potential overflow away from the neighbors' yard or other priority area.



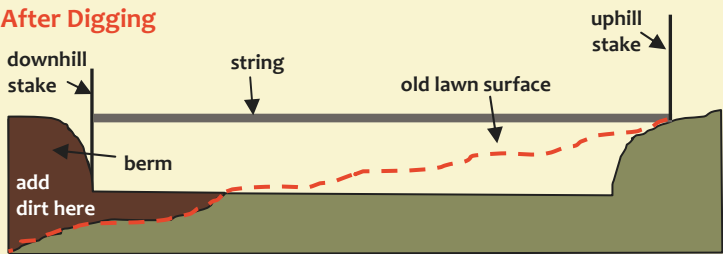
Lindera benzoin	Lobelia cardinalis	Lobelia spicata	Lysimachia ciliate ssp.	Matteuccia struthiopteris	Mentha arvensis	Mertensia virginica	Mimulus ringens	Mitella diphylla	Mondarda didyma
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Before Digging



After Digging



Adapted from Rain Gardens: A How-to Manual for Homeowners, UWEX

Figure 2: When building a rain garden on a slope, a berm must be created to hold the water in the garden. When leveling the bed, use the dirt that you remove to build the berm.

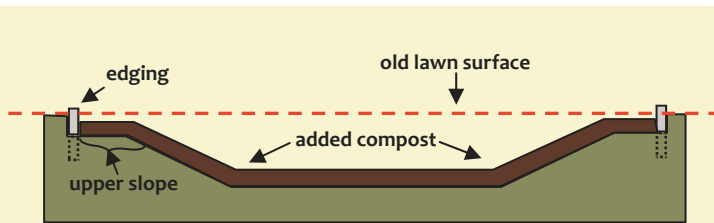


Figure 3: Level bed with sloping edges. This design requires more space. Only plants that can thrive in drier soil conditions can be planted on the upper slope of this type of raingarden; true rain garden plants will not thrive here.

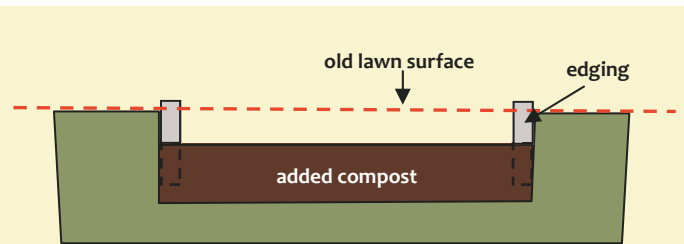
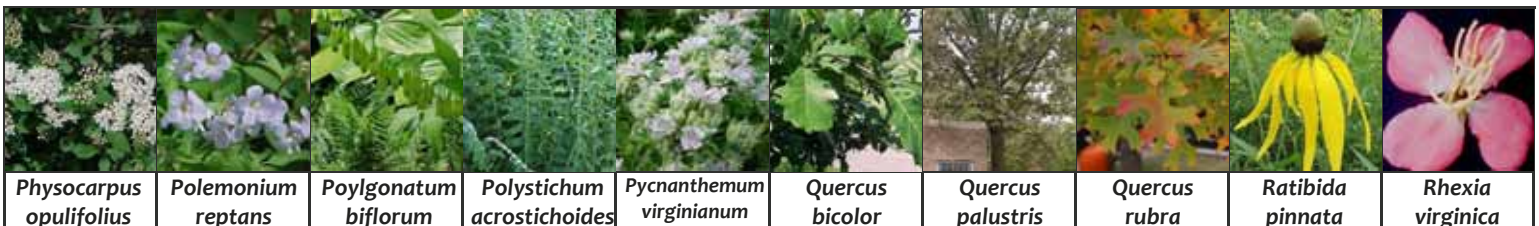


Figure 4: Level bed without sloping edges. Ideal design for tight spaces.





Level the bed



Improve the soil



Plant



Mulch



Water

Step 4: Level the Bed

Dig the rain garden bed 4-6” deeper than determined earlier to allow for the addition of compost and mulch. Maintain the rain garden’s ability to absorb water by avoiding soil compaction. Work from one side to the other, or from the center to the outside. Loosen soil with a shovel if it becomes compacted. When the whole area has been dug out to the approximate depth, lay a 2x4 board in the rain garden with the carpenter’s level sitting on it. Adjust to form a flat bottom. When the rain garden is completely level, rake the soil. *Tip:* Avoid digging and planting under wet conditions, especially when working in clay soils—Disturbing wet soils can result in compaction.

Step 5: Improve the Soil

At least two inches of compost should be added to the rain garden and mixed into the native soil. This helps the soil retain moisture and improve plant growth. Using a rototiller to mix in the compost will make the job much easier.

Step 6: Plant

Set the plants out in the garden to match the planting plan. When removing the plants from the pots, gently loosen the root ball with your fingers before placing them in the ground. Water immediately after planting.

Step 7: Mulch

Apply a 2-3” layer of mulch to help retain soil moisture and discourage weeds. A cubic yard of mulch will cover a 100 square foot area with about three inches of mulch.

Care & Maintenance

- Water:** New plants need to be watered regularly until their roots are established, even though the rain garden catches stormwater.
- Weed:** Frequent weeding will be necessary in the first few years before plants become established.
- Mulch:** To maintain the bowl-shaped profile and stormwater holding capacity of the rain garden, mulching is not suggested until a few years after the initial installation. Once the rain garden is established, mulch is not necessary, unless its more formal appearance is preferred. When applying mulch, maintain a 2-3” layer.





Curb-Cut Rain Gardens

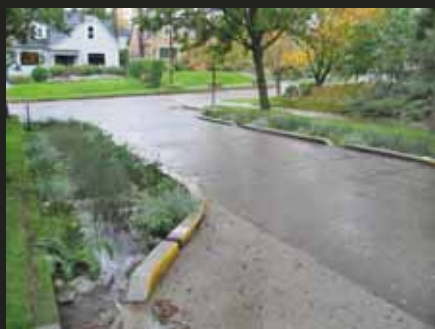
Rain gardens designed with a curb-cut can be effective in capturing stormwater from streets, parking lots, and other paved areas. In addition to reducing stormwater volume, curb-cut rain gardens increase urban aesthetics, reduce pollutant concentrations, and help counteract urban heat. A sample curb-cut rain garden planting plan is included on page 17 of this manual. Below are some things to consider when designing a curb-cut rain garden:

Plant Height: When planting in a streetscape, be sure to consider overhead conflicts (utility lines) and visibility issues, especially when planting in a median.

Salt Tolerance: Plants in a curb-cut rain garden must be able to tolerate road salt that accumulates in the soil and on exposed trunks and branches in the winter months. See the enclosed plant list for salt tolerant plants.

Right-of-Way: Anyone wishing to work within the right-of-way must obtain permission from the state or local municipality. A permit may be required.

Pretreatment: To prevent clogging due to excess sediment it is best to pre-treat the stormwater before it enters the curb-cut rain garden if stormwater runoff is collected from a road or parking lot. Three recommended options for pretreatment are give on page 18 of this manual.



Photos courtesy of © Bureau of Environmental Services, Portland Oregon

“With green infrastructure, stormwater management is accomplished by letting the environment manage water naturally; capturing and retaining rainfall, infiltrating runoff, and trapping and absorbing pollutants.” Natural Resources Defense Council

Common Questions

Does a rain garden form a pond?

No. After most storms a properly constructed rain garden will absorb water within a period of 24 hours and not more than 48 hours for larger storms depending on the soil type.

Do mosquitoes breed in rain gardens?

No. Mosquitoes require 7 to 12 days of standing water to lay and hatch eggs. Standing water will only last a few hours after most storms.

Do they require maintenance?

Like any garden, diligent weeding and watering will be needed in the first two years. As the garden matures, maintenance requirements will lessen. Plants may need to be thinned after a few years.

How much does a rain garden cost?

The cost varies depending on who does the work, the size of the garden, where the plants come from, and the planting density. If you purchase the plants and materials but you do all the labor, the cost will be roughly \$4-\$6 per sq ft. If you hire a professional to design and install the garden, it will cost roughly \$10-\$14 per sq ft.

Should a rain garden be placed where there is typically standing water?

Rain gardens are designed to infiltrate water. Standing water indicates poor infiltration, and we do not recommend directing additional water to these naturally wet areas.

What if there is a dry spell?

Plants suitable for a rain garden can handle both wet and dry conditions. However, during a dry spell, it is best to water the rain garden.

The Vermont Rain Garden Plant List

This plant list contains 150 plants that are suitable for Vermont rain gardens. These plants can be placed in any part of your rain garden with success. However, some plants will be more successful in the wetter or drier sections of your garden. Therefore, when designing the garden, be aware of each plant's ideal soil conditions and place in the garden accordingly. This plant list includes three separate tables: 1) Ferns, Grasses, and Perennials, 2) Shrubs, and 3) Trees. Each table provides categories specific to the needs of each type of plant. An explanation of the plant list categories are provided below.

Plant List Categories

VT Native: X = Yes

Using plants native to Vermont is recommended when planting a rain garden (or any garden). Native plants require less watering, fertilizing, and overall maintenance and care as they have adapted to and thrive in Vermont's climate.

Tolerant to Salt: X = Yes

Salt can injure plants by scorching leaf margins, ultimately leading to leaf drop, poor vigor, or death. No plant is immune to salt damage but some plants are more tolerant than others. Plants may accumulate salt from the soil over a number of years without revealing any overt sign of the problem until the accumulation reaches a toxic level. In winter, the road salt - ice water solution is whipped into fine droplets by passing vehicles and may be carried considerable distances by the wind. When selecting plants to install along paved roads, sidewalks, or in areas where snow runoff might become an issue, choose species that are tolerant of salt.

Mature Height:

This is the height that the plant will reach when mature if planted in its ideal conditions.

Exposure:

FS = Full Sun; PSH = Part Shade; SH = Shade

Exposure refers to the amount of light a plant will receive. Plants assigned "full sun" (FS) should receive at least one-half day of sun meaning at least six hours or more of direct sunlight. Plants assigned "partial shade" (PSH) should receive full or dappled shade during the hottest part of the day or 4-6 hours of direct sun. Plants assigned "shade" (SH) should be protected from the sun, with no or little direct sun exposure, usually less than 2 hours.

Ferns, Grasses, & Perennials (suitable for all hardiness zones in VT)

Latin Name	Common Name	VT Native	Tolerant to Salt	Mature Height	Exposure	Seasonal Interest	Pollinators	Comments
FERN								
<i>Athyrium filix-femina</i>	Lady Fern	x		1-3'	PSH/SH			Light-green, finely-divided fronds, can tolerate full sun if kept moist
<i>Deparia acrostichoides</i>	Silver False Springwort	x		1-3'	PSH/SH			Fronds have a silvery sheen when young
<i>Dryopteris filix-mas x marginalis</i>	Vermont Wood Fern			1-3'	PSH/SH			Hybrid between Marginal Wood Fern and Male Fern
<i>Matteuccia struthiopteris</i>	Ostrich Fern	x		3-5'	PSH/SH			Medium-green, feathery fronds (hence common name)
<i>Onoclea sensibilis</i>	Sensitive Fern	x		1-3'	PSH/SH			Bright green fronds, leathery triangular leaflets, drought sensitive
<i>Osmunda cinnamomea</i>	Cinnamon Fern	x		2-3'	PSH/SH	F		Yellow-green erect fronds, cinnamon color fibers near frond base, can tolerate full sun if kept moist
<i>Osmunda claytoniana</i>	Interrupted Fern	x		1-4'	PSH/SH			Broad fronds "interrupted" in the middle by spore-bearing leaflets, can tolerate full sun if kept moist
<i>Osmunda regalis</i>	Royal Fern	x		2-3'	PSH/SH	F		Broad fronds, large well separated leaflets, brown tassel-like fertile clusters, can tolerate full sun if kept moist
<i>Polystichum acrostichoides</i>	Christmas Fern	x		1-3'	PSH/SH	W		Evergreen, leathery, lance-shaped fronds, fountain like clumps, full sun ok if kept moist
<i>Thelypteris noveboracensis</i>	New York Fern	x		1-2'	PSH/SH	F		Yellow-green fronds that grow in tufts, can form ground cover
GRASS								
<i>Agrostis stolonifera</i>	Creeping Bentgrass			3-5'	FS	S		Not showy
<i>Andropogon gerardii</i>	Big Bluestem	x		3-7'	FS	F/W	BM	Purple, good for erosion prevention due to large root system
<i>Andropogon virginicus</i>	Bushy Broomsedge			3-4'	FS	S/F		Ideal for growing in masses or meadows, orange golden color, graceful
<i>Bouteloua curtipendula</i>	Side-oats Grama Grass			1.5-2.5'	FS	S/F		Ideal for growing in masses or meadows, bright purple flowers
<i>Calamagrostis acutiflora</i>	Feather Reed Grass		x	3-5'	FS			Good as specimen plant, tolerates clay soils
<i>Carex flacca</i>	Blue Sedge			6-8"	FS/PSH	Sp		Forms a mat of gray-blue foliage, very drought tolerant
<i>Carex flaccosperma</i>	Blue Wood Sedge		x	1-1.5'	FS/PSH	Sp		Slow spreading blue-green textured leaves
<i>Carex grayi</i>	Gray Sedge	x	x	2-3'	PSH	S		Pale green spiked seed heads
<i>Carex muskingumensis 'Oehme'</i>	Variiegated Palm Sedge		x	2-3'	PSH/SH	S		Subtle yellow variegation, showy seeds, can tolerate full sun if kept moist
<i>Carex vulpinoidea</i>	Fox Sedge	x	x	1-3'	FS/PSH	S		Not showy
<i>Cinna latifolia</i>	Drooping Woodreed	x		1-5'	FS/SH	S/F		Not showy
<i>Juncus effusus</i>	Common Rush		x	2-3'	FS/PSH	Sp/S/F		small, non-showy yellowish cymes in summer
<i>Panicum virgatum</i>	Switch Grass	x	x	3-6'	FS	Sp/S/F		Quick growing, spring wild life cover
<i>Schizachyrium scoparium</i>	Little Bluestem	x	x	3-4'	FS	F		Turns reddish orange in fall, loose clusters
<i>Sorghastrum nutans</i>	Indiangrass	x		4-6'	FS/PSH	S/F	BM	Golden-brown
PERENNIAL								
<i>Acorus americanus</i>	Sweetflag	x		2-4'	FS	S	B/BM	Vertical interest
<i>Actaea rubra</i>	Red Baneberry	x	x	1-3'	PSH	Sp		White flowers, berries are toxic
<i>Agalinis purpurea</i>	Purple False Foxglove		x	3-6'	FS	S	B	White, red, purple flowers
<i>Agastache foeniculum</i>	Lavender Hyssop			2-4'	PSH	S	BM	Blue flowers, self seeds readily
<i>Alchemilla mollis</i>	Lady's Mantle			1.5-2.5'	PSH	Sp	L	Yellow-chartreuse flowers
<i>Allium cernuum</i>	Nodding Onion		x	1-3'	FS	Sp	B	Pink flowers, edible fruit
<i>Amorpha canescens</i>	Leadplant			2-4'	FS/PSH	S	BM	Purple flowers, favorite of deer, rabbit and livestock
<i>Anemone canadensis</i>	Windflower	x	x	1-2'	PSH	Sp	B/L	Pure white blossoms, tuber
<i>Aquilegia canadensis</i>	Columbine	x	x	1-2'	FS/PSH	Sp/F	BM	Showy red and yellow, beautiful foliage
<i>Arisaema triphyllum</i>	Jack-In-The-Pulpit	x		2'	PSH/SH	Sp		White flowers, poisonous to cattle
<i>Aruncus dioicus</i>	Goatsbeard	x		5'	PSH	Sp	B/BM	White flowers, plant males with females for better bloom
<i>Asarum canadensis</i>	Wild Ginger	x		0.5-1'	PSH/SH	Sp	L	Purple-brown cup-shaped flower, ginger aroma
<i>Asclepias incarnata</i>	Swamp Milkweed	x		2-3'	FS/PSH	Sp/S/F	B/BM	Orange, suitable for a dry or wet garden

Latin Name	Common Name	VT Native	Tolerant to Salt	Mature Height	Exposure	Seasonal Interest	Pollinators	Comments
PERENNIALS CONTINUED...								
<i>Asclepias tuberosa</i>	Butterfly Plant, Milkweed	x		1-2.5'	FS	S	BM	Orange flower
<i>Aster novae-angliae</i> (<i>Doellingeria umbellata</i>)	New England Aster	x	x	2-6'	FS/PSH	S/F	B/BM	Pink-purple flowers
<i>Aster umbellatus</i>	Flat-topped Aster	x	x	3-7'	FS/PSH	F	B/BM	White to yellowish-centered flowers
<i>Astilbe ssp.</i>	Astilbe		x	3-6'	PSH	S	B/L	White, light pink, and dark pink flowers, spires, does not like pm sun/dry soil
<i>Baptisia australis</i>	Blue False Indigo	x	x	3-4'	FS	Sp/S	BM	Blue, interesting seed pods
<i>Boltonia asteroides</i>	False Aster	x		6-8'	FS/PSH	S/F	BM	White to pink, needs staking, pest free
<i>Caltha palustris</i>	Marsh Marigold, Cowslip	x		2'	FS/PSH	S	B	Glossy heart-shaped leaves, bright yellow flowers, poisonous leaves
<i>Camassia leichtlinii</i>	Camass			3-4'	FS/PSH	Sp		Spikes of white, cream, blue or purple flowers, beautiful choice for wet areas of the garden, bulb
<i>Campanula americana</i>	Tall Bellflower		x	3-4'	PSH	S/F	H	Blue-purple flower
<i>Cassia hebecarpa</i>	Wild Senna, American Senna	x		3-6'	FS/PSH	S/F	BM	Yellow flowers, toxic, tolerates clay, showy leaves, drought tolerant
<i>Caulophyllum thalictroides</i>	Blue Cohosh	x		1'-2'	PSH/SH	S	BM	Blue berries, yellow-green, non-showy flowers
<i>Chelone ssp.</i> (Native: <i>Chelone glabra</i>)	Turtlehead	x		3-6'	FS/PSH	S/F	BM	White, shade from afternoon sun
<i>Cimicifuga ramosa</i>	Purple-leaf Bugbane			5'	PSH/SH	F	B/L	White flowers, purple foliage
<i>Clintonia borealis</i>	Blue Bead Lily	x		1'	PSH/SH		B	Yellow flower, young leaves can be used to make a pleasant addition to a salad, cluster of dark blue shiny berries (mildly toxic) by midsummer
<i>Convallaria majalis</i>	Lily of the Valley	x		6"	FS/SH	Sp	B	White fragrant bell shaped flowers followed by red berries, slow but aggressive spreader
<i>Coreopsis lanceolata</i>	Coreopsis	x		1-2'	FS	S	BM	Yellow flower, good cut flower
<i>Desmodium canadense</i>	Canada Tick-Trefoil	x	x	4'	FS	S	BM	Pink-purple pea like flowers
<i>Dicentra spectabilis</i>	Bleeding Heart			2-3'	PSH/SH	Sp	B/H	Pink heart-shaped flowers, good cut flower
<i>Echinacea purpurea spp.</i>	Coneflower	x		1-2'	FS/PSH	S		Varieties include purple and white flowers
<i>Epilobium angustifolium</i> (<i>Chamaerion</i>)	Fireweed		x	4-6'	FS/PSH	S	B	Purple spiky flowers, colonizes
<i>Erythronium americanum</i>	Trout Lily	x		6"	FS/PSH	Sp	B	Yellow flowers
<i>Eupatorium coelestinum</i>	Blue Mist Flower		x	2-3'	PSH/SH	S	BM	Blue flowers, can be invasive
<i>Eupatorium maculatum</i> (<i>Eutrochium</i>)	Spotted Joe-Pye Weed	x		4-6'	FS/PSH	S/F	BM	Pink flowers, deer resistant
<i>Eupatorium perfoliatum</i>	Boneset	x		4-6'	FS/PSH	S	BM	Flat-topped clusters of small, fluffy, white flowers
<i>Euthamia graminifolia</i>	Flat-top Goldentop	x		3-6'	FS	S/F	BM	Yellow flowers
<i>Filipendula rubra</i>	Queen of the Prairie	x		4-5'	FS/PSH	S	B/L	Showy pink flowers, deer resistant, one of the best wild flowers
<i>Gaylussacia baccata</i>	Black Huckleberry	x		2-4'	PSH	Sp/S		White flowers, edible fruits
<i>Gentiana andrewsii</i>	Closed Gentian, Bottle Gentian	x		2'	FS/PSH	F	B	Deep blue bottle shaped flowers
<i>Geranium maculatum</i>	Wild Geranium	x		1-2'	FS/PSH	Sp/S	B	Pink flowers, Deer resistant
<i>Helenium autumnale</i>	Sneezeweed	x		3-5'	FS	F	B/BM	Yellow flowers, cutting flower
<i>Helianthus angustifolius</i>	Swamp Sunflower			3-6'	FS/PSH	S/F	BM	Yellow flowers
<i>Heliopsis helianthoides</i>	Smooth Oxeye	x	x	3-5'	FS	S/F	BM	Yellow flowers
<i>Hemerocallis ssp.</i>	Daylilies	x	x	2.5'-3.5'	FS/PSH	S	BM	Purple, yellow, orange flowers
<i>Heuchera 'Chocolate Ruffles'</i>	Coral Bells			1-2'	FS/PSH	Sp/S		White flowers and showy, coppery-pink to dark chocolate/deep purple leaves
<i>Hibiscus moscheutos</i>	Swamp Rose, Mallow		x	4-6'	FS	S	BM	White and pink flowers
<i>Hosta ssp.</i>	Hosta		x	1-2'	PSH/SH	S	BM	White and purple flowers
<i>Hydrophyllum virginianum</i>	Eastern Waterleaf	x		1-3'	PSH/SH	Sp/S		White-lavender flowers
<i>Iris versicolor</i>	Blue Flag Iris	x	x	2-3'	FS/PSH	Sp/S	B	Blue-violet flowers
<i>Isopyrum biternatum</i>	False Rue Anemone			0.5-1'	FS/PSH	Sp		White flower, great groundcover

Seasonal Interest:

Sp = spring; S= summer; F= fall; W = winter

In designing your rain garden, plant selection is key in creating an inspiring landscape. Choosing plants that bloom at different times over the course of the growing season give the garden an ever-changing impact. Some plants may provide a dramatic array of flowers for only a week, but others may carry a smattering of flowers throughout the season. Characteristics such as flower color, bloom time, shape, fruit, decorative bark, dramatic fall foliage color, or showy foliage should be considered when selecting plants. However, remember that neutral plants provide the background and unity for a comfortable yet interesting garden. A description of the seasonal interest is included in the "comments."

Pollinators:

B = Bee; BM = Butterfly & Moth;

H = Hummingbirds; L = Ladybugs

Pollinators increase the genetic diversity of a plant community and are therefore an important ally. Many plants have evolved to depend upon the assistance of specific insects and other animals to complete the act of pollination and seed dispersal. Nearly 90% of all flowering plants require pollination by animals or insects. Plants have developed specific characteristics to attract potential pollinators. Creating a diverse garden that attracts a variety of pollinators will supply a food source for these important animals and insects while enhancing the rain garden. Different pollinators are attracted to specific characteristics of flowering plants:

Bees (B): are attracted to brightly-colored flowers with sweet scents and ample nectar and pollen.

Butterflies & Moths (BM): prefer tubular flowers. Butterflies tend to be attracted to the bright colors whereas moths prefer duller colors (typically red or purple). The difference in colors is likely due to the fact that butterflies are diurnal whereas moths are nocturnal.

Ladybugs (L): are natural enemies to pesky insects, including aphids and other sap feeders. Like other beetles, ladybugs are attracted to flowers that are white to yellow or green, and open during the day with a bowl/cup-like shape.

Hummingbirds (H): are site feeders and have little to no sense of smell so they are attracted to brightly colored (especially red) trumpet shaped flowers with ample nectar. These flowers are designed to dust the bird's head and back with pollen.

Tolerance to Drought (Trees & Shrubs only)

H = Tolerant; M = Intermediate; L = Intolerant

A species drought tolerance indicates its comparative ability to survive drought stress, or lack of water. This category is included for trees and shrubs because these plants have deep rooting systems and are therefore more sensitive to this limiting factor.

Tolerance to Poor Drainage (Trees & Shrubs only)

H = Tolerant; M = Intermediate; L = Intolerant

Poorly drained (wet) sites, often with a percentage of clay, will not allow water to drain freely and can often limit the availability of oxygen to the roots. Choosing a species that can survive in this environment will often lead to long term success. Conversely, well drained sites, often with a high percentage of sand, has very limited water holding capacity and may be too dry for some species, if not watered regularly. To determine soil type, conduct the “ribbon test” on page 4. This category is included for trees and shrubs because these plants have deep rooting systems and are therefore more sensitive to this limiting factor.

Hardiness Zone:

The coldest zone where each plant is judged to survive is indicated in this column. Before purchasing a plant, determine which hardiness zone the rain garden is located in by referring to the Plant Hardiness Zones map on the back cover of this manual. It is especially important to consider hardiness zones when planting trees and shrubs since they are exposed to the winter environment.

Plant survival depends on numerous factors, but winter temperature is often the greatest challenge to a plant’s performance. Hardiness zones are affected by elevation, snow cover, nearness to large bodies of water, and cold drainage. Remember that the hardiness zones represent only averages. In some years, temperatures will fall well below the average annual minimum. Plants surviving and growing well for several years may be severely injured or killed when this happens. Talking to experienced neighbors or local nursery personnel may help to determine the likelihood of success for your desired plants.

Latin Name	Common Name	VT Native	Tolerant to Salt	Mature Height	Exposure	Seasonal Interest	Pollinators	Comments
PERENNIALS CONTINUED...								
<i>Liatriis spicata</i>	Dense Blazingstar		x	2-4'	FS	S	BM	Purple flowers, good for drying
<i>Lilium canadense</i>	Canada Lily	x		3-8'	FS/PSH	S	H	Yellow, difficult to start
<i>Lobelia cardinalis</i>	Cardinal Flower	x	x	2-4'	FS/PSH	S	BM/H	Vibrant Red spiky flowers, tricky, short lived
<i>Lobelia spicata</i>	Spiked Lobelia	x	x	3-5'	FS/PSH	Sp/S	BM	Blue or white flowers
<i>Lysimachia ciliate ssp.</i>	Fringed Loosestrife	x		1-3'	PSH	S	BM/H	Yellow flowers, can tolerate clay soils, good for edging, the cultivar 'Firecracker' has stunning bronze-purple leaves
<i>Mentha arvensis</i>	Wild Mint	x		1-2'	FS/PSH	S	B	White flowers
<i>Mertensia virginica</i>	Virginia Bluebells			2-3'	PSH/SH	Sp	BM/H	Blue flowers
<i>Mimulus ringens</i>	Monkey Flower	x		1-3'	FS	Sp/S/F	BM/H	Blue-purple flowers
<i>Mitella diphylla</i>	Bishop's Cap, Miterwort	x		1-3'	PSH/SH	Sp	B	White flowers
<i>Monarda didyma</i>	Bee Balm, Oswego Tea	x		3'	FS/PSH	S	BM	Red, pink, salmon colored flowers, aggressive
<i>Parthenium integrifolium</i>	Wild Quinine			2-4'	FS	S/F	BM	White flowers, aggressive
<i>Penstemon digitalis</i>	Foxglove, Beardtongue	x		3-4'	FS/PSH	Sp/S	BM/H	Purple flowers
<i>Phlox divaricata</i>	Woodland Phlox	x		2-3'	FS/PSH	S	BM/H	Groundcover
<i>Polemonium reptans</i>	Jacob's Ladder	x		0.5-2'	FS/SH	Sp	BM	Blue flower
<i>Polygonatum biflorum</i>	Smooth Solomon's Seal	x		1-3'	PSH/SH	Sp	B	Greenish-white flower
<i>Pycnanthemum virginianum</i>	Virginia Mountain Mint	x		2-3'	FS	S/F	B	White flowers, mint-like fragrance, aggressive
<i>Ratibida pinnata</i>	Pinnate Prairie Coneflower	x		3-4'	FS	Sp/S	BM	Yellow flowers
<i>Rhexia virginica</i>	Meadow Beauty	x		1-2'	PSH	S/F		Pink flowers
<i>Rodgersia henrici</i>	Rodgersia			3-4'	FS/PSH	S		Large showy leaves; reddish purple spires with large airy plumes of soft-pink to rose-purple flowers
<i>Rudbeckia hirta</i>	Black-Eyed Susan	x	x	1'	FS/PSH	S/F	B/BM	Orange-yellow flowers, short lived, deer resistant
<i>Salvia verticillata</i>	Lilac Sage	x		2'	FS	S	B/BM	Purple flowers, long blooming
<i>Sanguinaria canadensis</i>	Bloodroot	x		6-10"	PSH/SH	Sp	B	White flower, toxic
<i>Sanguisorba tenuifolia</i>	Japanese Burnet			4-5'	FS/PSH	S/F		Pink flowers, yellow and red fall foliage
<i>Solidago ssp.</i>	Goldenrod	x	x	3-4'	FS/PSH	S/F	B/BM	Yellow flower
<i>Streptopus roseus</i>	Rosy Twisted Stalk	x		1.5'	PSH/SH	Sp/S		Prefers light (sandy) and medium (loamy) soils
<i>Tiarella cordifolia</i>	Foamflower	x		1-3'	PSH/SH	Sp	BM/H	White flowers
<i>Tradescantia ohiensis</i>	Spiderwort			1-3'	FS/PSH	Sp/S	BM	Blue flowers, aggressive
<i>Trillium undulatum</i>	Painted Trillium	x		0.6'-1.5'	PSH/SH	Sp/S		White flowers
<i>Veratrum viride</i>	False Hellebore	x		2-5'	FS	S	B/BM	Green flowers, toxic, considered a pest plant by livestock farmers
<i>Verbena hastata</i>	Blue Vervain	x		2-6'	FS	S/F	BM	Purple spires
<i>Vernonia noveboracensis</i>	NY Ironweed		x	3'-6'	FS/PSH	S/F	BM	Intense purple flowers, good cut flower
<i>Veronicastrum virginicum</i>	Culver's Root	x		2-6'	FS/PSH	S	BM	White flowers

Shrubs

Latin Name	Common Name	VT Native	Tolerant to Salt	Mature Height	Exposure	Seasonal Interest	Tolerance to Drought	Tolerance to Poor Drainage	Hardiness Zone	Comments
<i>Alnus rugosa</i>	Speckled Alder	x		10-16'	PSH	Sp	L	H	2	Yellow flowers
<i>Aronia arbutifolia</i>	Red Chokeberry		x	4-8'	FS	Sp/S	L	M	4	Dark purple flowers
<i>Aronia melanocarpa</i>	Black Chokeberry	x	x	3-4'	SH	Sp	M	M	3	White to pink flowers
<i>Cephalanthus occidentalis</i>	Buttonbush	x		10-20'	SH	S/F	M	M	5	White flowers
<i>Clethra alnifolia</i>	Summersweet, Sweet Pepperbush		x	6-12'	PSH	S	L	M	3	Fragrant white flowers
<i>Comptonia peregrina</i>	Sweetfern	x		1-2'	FS	Sp	H	L	2	White flowers, heavily scented when crushed

Latin Name	Common Name	VT Native	Tolerant to Salt	Mature Height	Exposure	Seasonal Interest	Tolerance to Drought	Tolerance to Poor Drainage	Hardiness Zone	Comments
Shrubs Continued...										
<i>Cornus amomum</i>	Silky Dogwood	x		5-10'	PSH	Sp	L	H	5	White flowers
<i>Cornus sericea</i>	Red Osier Dogwood	x		6-12'	FS	Sp/S	L	H	3	White flowers, red stems in winter, provides food and cover
<i>Diervilla lonicera</i>	Low Bush Honeysuckle	x		1-2'	PSH	S	H	L	3	Yellow flowers
<i>Ilex glabra</i>	Inkberry		x	6-12'	FS	S	L	M	4	Inconspicuous white flowers, black berries, non-edible
<i>Ilex verticillata</i>	Winterberry Holly	x		6-10'	PSH	S	L	M	3	White flowers, showy orange winter berries
<i>Kalmia latifolia</i>	Mountain Laurel	x		5-6'	FS	Sp	H	M	4	Purple flowers
<i>Lindera benzoin</i>	Spicebush	x		6-12'	PSH	Sp	L	M	4	White flowers
<i>Physocarpus opulifolius</i>	Ninebark	x		5-10'	FS	Sp/S	H	L	2	Purple flowers
<i>Rhododendron canadense</i>	Rhodora	x		6-12'	SH	Sp	L	H	2	Purple flowers, tolerates wet, acidic soil.
<i>Rhododendron maximum</i>	Great Rhododendron	x		10-20'	SH	Sp	H	M	4	Red flowers
<i>Rhododendron periclymenoides</i>	Rosebud Azalea	x		4-10'	SH	Sp	M	M	4	Purple flowers
<i>Rosa palustris</i>	Swamp Rose	x		6-8'	SH	Sp	L	M	3	Red flowers
<i>Salix discolor</i>	Pussy Willow	x		20-40'	SH	W/Sp	L	H	4	White flowers, silky grey catkins
<i>Salix humilis</i>	Small Pussy-Willow	x		5-10'	PSH	Sp	L	L	4	Inconspicuous yellow flowers, green catkins
<i>Salix purpurea</i>	Purple Osier Willow	x		5-8'	FS	Sp	L	M	4	Red catkins
<i>Sambucus canadensis</i>	American Elderberry	x		4-7'	FS	S	M	M	3	White flowers
<i>Spiraea latifolia</i>	Bridalwreath Spiraea	x	x	4-7'	FS	Sp	H	H	3	White flowers
<i>Vaccinium corymbosum</i>	Highbush Blueberry	x	x	6-12'	PSH/SH	Sp/S	H	H	3	White flowers, edible fruit
<i>Viburnum cassinoides</i>	Witherod	x		8-15'	FS/PSH	S/F	H	H	3	Creamy white flowers
<i>Viburnum lentago</i>	Nannyberry	x		10-20'	FS/PSH	Sp	H	H	2	Creamy white flowers

Trees

Latin Name	Common Name	VT Native	Tolerant to Salt	Mature Height	Exposure	Tolerance to Drought	Tolerance to Poor Drainage	Hardiness Zone	Rooting Space	Comments
<i>Acer rubrum</i>	Red Maple	x		70-90'	FS/SH	M	H	3	L	Several cultivars available
<i>Amelanchier ssp.</i>	Serviceberry, Shadblow	x	x	15-25'	PSH	M	L	4	S	Early white flowers
<i>Betula nigra</i>	River Birch		x	35-80'	FS	L	H	4	M	Can be single or multi-stemmed
<i>Carpinus caroliniana</i>	Musclewood	x		20-30'	FS/SH	H	M	3	M	May be hard to locate at local nurseries
<i>Celtis occidentalis</i>	Hackberry	x	x	40-60'	FS/PSH	H	H	2	M	Ornamental bark with age
<i>Fraxinus americana</i>	White Ash	x	x	40-90'	FS	M	M	3	M	Susceptible to Emerald Ash Borer, should be planted in limited numbers, several cultivars available
<i>Fraxinus pennsylvanica</i>	Green Ash	x	x	35-70'	FS	H	H	3	L	Susceptible to Emerald Ash Borer, should be planted in limited numbers. Several seedless cultivars available
<i>Hamamelis virginiana</i>	Witch Hazel	x	x	10-15'	FS/SH	L	H	3	S	Bright fragrant yellow flowers appear mid to late fall
<i>Juniperus virginiana</i>	Red cedar	x	x	25-50'	FS/PSH	H	H	3	M	Pale blue fruits on female plants
<i>Nyssa sylvatica</i>	Black Tupelo	x	x	35-90'	FS	H	H	5	M	May be hard to locate at local nurseries, red fall foliage.
<i>Ostrya virginiana</i>	Hop Hophornbean	x		25-50'	FS/SH	H	M	4	S	May be hard to locate at local nurseries
<i>Quercus bicolor</i>	Swamp White Oak	x	x	35-100'	FS/PSH	M	H	3	L	Acorns can be a nuisance
<i>Quercus palustris</i>	Pin Oak			50-75'	FS	M	H	4	M	Low tolerance for alkaline soils, acorns can be a nuisance
<i>Quercus rubra</i>	Red Oak	x	x	35-100'	FS/PSH	H	L	4	L	Acorns can be a nuisance
<i>Thuja occidentalis</i>	Eastern White Cedar	x		3-50'	FS	M	M	3	M	Grows slowly reaching an age of 400 years or more

Rooting Space (Trees only):

L = 1200 cubic ft; M = 800 cubic ft; S=400-450 cubic ft
 Lack of rooting space is one of the most common ailments of urban trees. Heavily compacted soils, underground utilities, sidewalks, and pavement can all affect the amount of soil volume available to a tree's root system. Insufficient soil volume can lead to limited nutrient, water, and oxygen gathering capacity. In order to estimate the available rooting volume of a planting site, measure the length and width of available soil, then multiply the area by the estimated depth of rooting. Remember that compacted soil will have a very shallow rooting depth. Even small trees need a minimum of 56 square feet to survive, assuming a 3 foot deep rooting area. Take a close look at your rain garden area and measure out the potential rooting space for a tree. The more rooting space that is available to your tree, the healthier it will be.

Is this Site Appropriate for a Tree?

Trees can be a valuable addition to any rain garden. To give your new tree(s) the best chance for long-term survival, proper selection of tree species and planting site is crucial. Careful planning should ensure that the "right tree" is established in the "right place." Consider the following questions, before determining which tree you want to plant:

- What is the purpose and use of the planting?
- What are the site conditions above and below ground?
- What type of maintenance will be required?
- What is the best tree(s) species for long-term success?

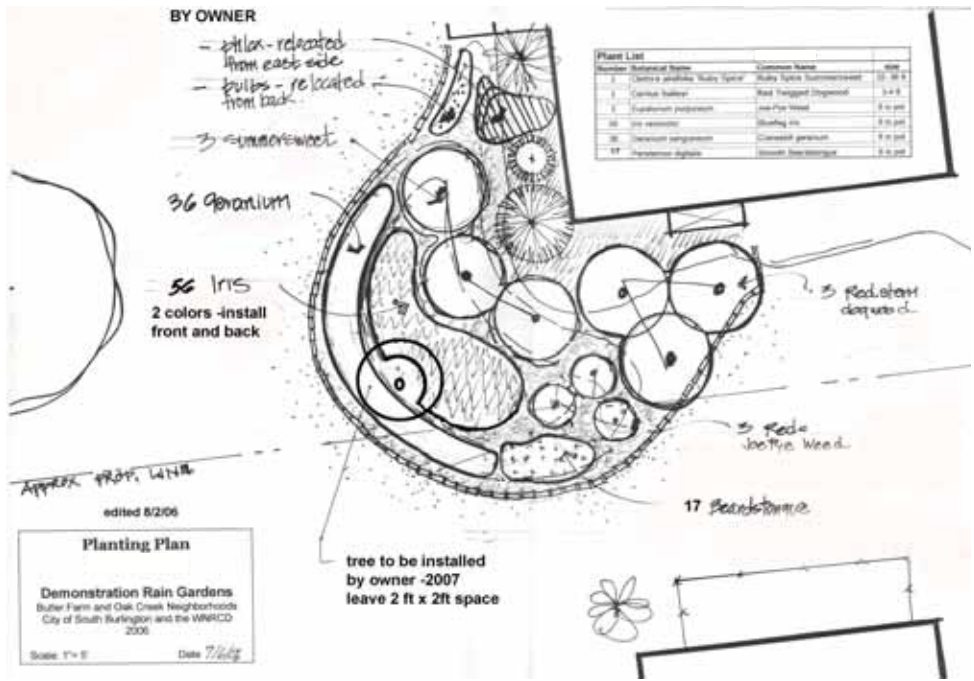
Rarely will you find the perfect tree that will fit an entire list of selected criteria, yet answering these important questions can avoid many unforeseen pitfalls. Remember by planting a tree in, or near your rain garden, you may be increasing the amount of shade over the garden area- choose perennials and shrubs accordingly.

Clay/Shade Rain Gardens

Building a rain garden in clay soil in the shade can be a challenge. Few plants can tolerate the extreme conditions found in this type of landscape. See page 18 for a list of rain garden plants that have been proven to tolerate or even thrive in these conditions.

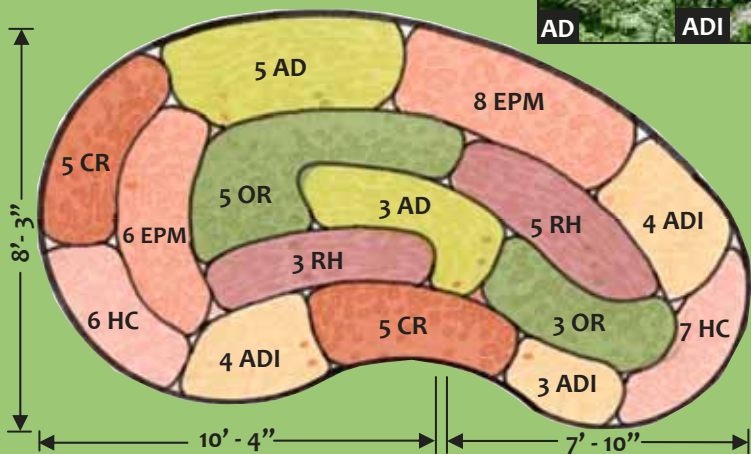
Sample Rain Garden Planting Plans

A well thought out planting plan will increase the success rate of each plant and will make installation easier. The placement of each plant should be based on a plant's moisture tolerance, height, and complimentary plant combinations. The following planting plans are designed for a 150 square foot rain garden. Each planting plan includes light exposure, a planting schedule, plant photos, a plant layout diagram, and a sizing chart. The sizing chart can be used to plan for gardens greater or less than the 150 square foot template provided. Recommended plant installation sizes indicated in the planting schedules include 1 gallon, 2 gallon, and 4" pots. Smaller plants can be installed if needed; however, increase the quantity of each plant and water and monitor the rain garden more frequently.



The Enchanted Garden - Part Shade

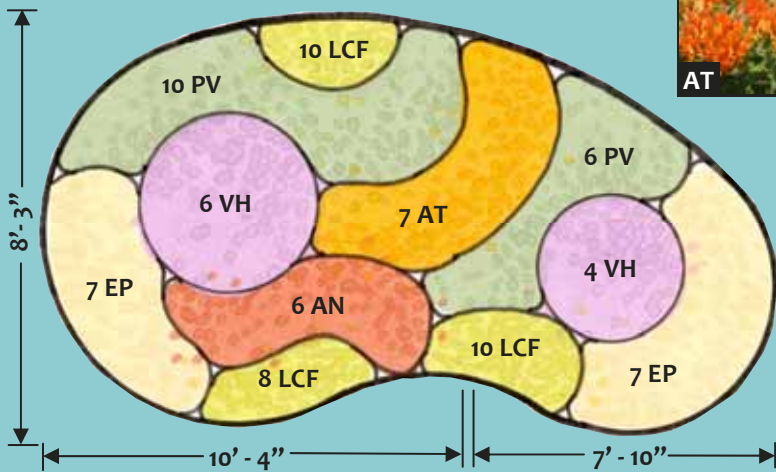
Abr	Qty	Botanical Name	Common Name	Height	Spread	S. Interest	Spacing	Install Size
AD	8	<i>Aruncus dioicus</i>	Goatsbeard	5'	2-4'	Spring	22-30"	1-2 Gallon
ADI	11	<i>Astilbe 'Diamant'</i>	Astilbe	30"	1.5-2'	Summer	22"	1 Gallon
CR	10	<i>Cimicifuga ramosa 'Brunette'</i>	Purple-leaf Bugbane	3-4'	2-3'	Sp, Su, Fall	22"	1 Gallon
EPM	14	<i>Echinacea purpurea 'Magnus'</i>	Coneflower	2.5-3'	1-1.5'	Summer	15-22"	1 Gallon
HC	13	<i>Heuchera 'Chocolate Ruffles'</i>	Coral Bells	1-2'	1-1.5'	Summer	15-22"	1 Gallon
OR	8	<i>Osmunda Regalis</i>	Royal Fern	3-4'	2-3'	Sp, Su, Fall	22-30"	1 Gallon
RH	8	<i>Rodgersia henrici</i> Sub. <i>Rodgersia aesculifolia</i>	Rodgersia	3-4'	3-4'	Summer	34-38"	1-2 Gallon



Sizing Chart			
Sq Ft	Qty of Diff. Species	Total Plant Qty	Ex. Garden Dimensions
50	3	24	6' x 4'-6"
100	5	48	8'-6" x 6'-4"
150	7	72	18'-2" x 8'-3"
200	7	96	12' x 9'
250	7	120	13'-5" x 10'

The Bird & Butterfly Meadow - Sun

Abr	Qty	Botanical Name	Common Name	Height	Spread	S. Interest	Spacing	Install Size
AT	7	<i>Asclepias tuberosa</i>	Butterfly Plant	1-2.5'	1-1.5'	Summer	15-22"	1 Gallon
AN	6	<i>Aster novae-angliae</i>	New England Aster	18"	1.5-2'	Fall	22"	1 Gallon
EP	14	<i>Echinacea purpurea 'Alba'</i>	Coneflower	30"	1-2'	Summer	15-22"	1 Gallon
LCF	11	<i>Lysimachia ciliate 'Firecracker'</i>	Fringed Loosestrife	1-3'	2-2.5'	Summer	22-30"	1 Gallon
PV	16	<i>Panicum virgatum</i>	Switch Grass	3-4'	2-3'	Sp, Su, Fall	22-30"	1-2 Gallon
VH	10	<i>Verbena hastate</i>	Blue Vervain	2-6'	1-1.5'	Su, Fall	15-22"	4" Pot

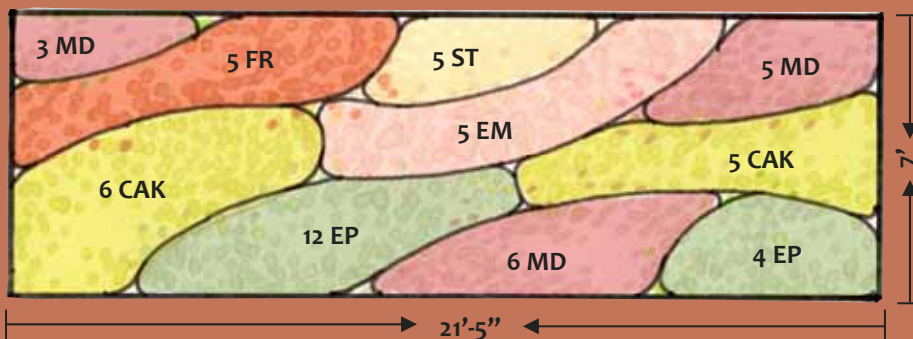
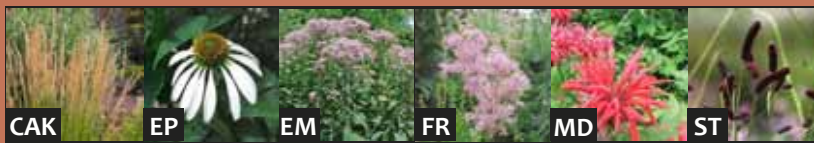


Sizing Chart

Sq Ft	Qty of Diff. Species	Total Plant Qty	Ex. Garden Dimensions
50	4	21	6' x 4'-6"
100	4	42	8'-6" x 6'-4"
150	6	64	18'-2" x 8'-3"
200	6	85	12' x 9'
250	6	106	13'-5" x 10'

The Bold Color Garden - Sun

Abr	Qty	Botanical Name	Common Name	Height	Spread	S. Interest	Spacing	Install Size
CAK	11	<i>Calamagrostis acutiflora 'Karl Foerster'</i>	Feather Reed Grass	3-5'	1.5-2'	Sp, Su, Fall	22-30"	1-2 Gallon
EP	16	<i>Echinacea purpurea 'Alba'</i>	Coneflower	30"	1-2'	Summer	15-22"	1 Gallon
EM	5	<i>Eupatorium maculatum</i>	Joe Pye Weed	4-6'	2-4'	Summer	30"	1-2 Gallon
FR	5	<i>Filipendula rubra 'Venusta'</i>	Queen of the Prairie	4-5'	3-4'	Sp & Su	30"	1 Gallon
MD	14	<i>Monarda didyma 'Jacob Cline'</i>	Bee Balm	3'	1-2'	Sp & Su	15-22"	1 Gallon
ST	5	<i>Sanguisorba tenuifolia</i>	Japanese Burnet	4-5'	1.5-2'	Su & Fall	22"	1 Gallon

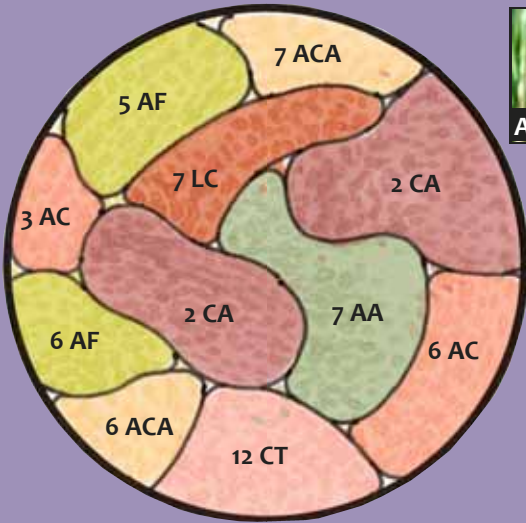


Sizing Chart

Sq Ft	Qty of Diff. Species	Total Plant Qty	Ex. Garden Dimensions
50	3	19	5' x 10'
100	5	37	16'-8" x 6'
150	7	56	21'-5" x 7'
200	7	75	25' x 8'
250	7	93	20' x 12'-6"

The Native Woodland & Wildlife Garden - Part Shade

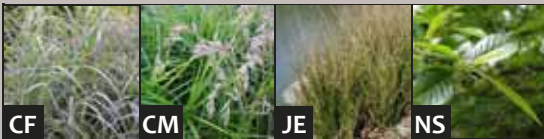
Abr	Qty	Botanical Name	Common Name	Height	Spread	S. Interest	Spacing	Install Size
AA	7	<i>Acorus americanus</i>	Sweet Flag	3'	1.5-2'	Sp, Su, Fall	22"	1 Gallon
AC	7	<i>Anemone canadensis</i>	Windflower	1-2'	2-2.5'	Spring	22-30"	1 Gallon
ACA	13	<i>Aquilegia canadensis</i>	Columbine	2-3'	1-1.5'	Spring	15-22"	1 Gallon
AF	11	<i>Athyrium filix-femina</i>	Lady Fern	2-3'	1-1.5'	Sp, Summer	22"	1 Gallon
CT	12	<i>Caulophyllum thalictroides</i>	Blue Cohosh	1-2'	0.5-1'	Summer	22"	1 Gallon
CA	4	<i>Cornus sericea 'Arctic Fire'</i>	Red Osier Dogwood	3-4'	3-4'	Sp, Su, Fall	4-5'	2-3 Gallon
LC	7	<i>Lobelia cardinalis</i>	Cardinal Flower	2-4'	1-2'	Summer	22"	1 Gallon



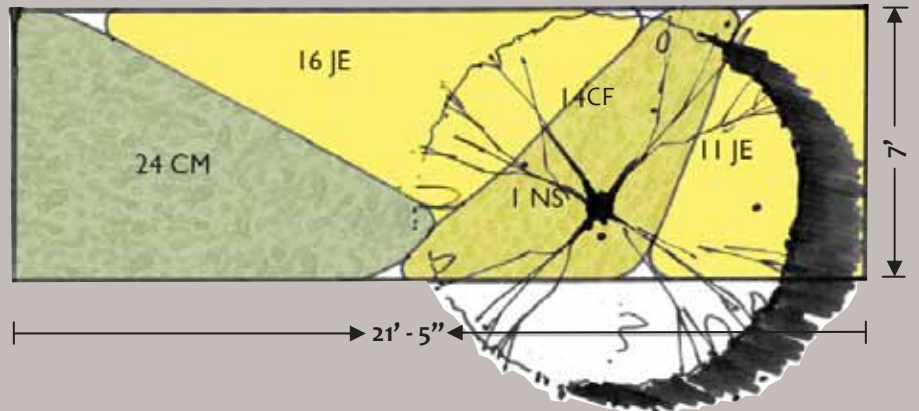
Sizing Chart			
Sq Ft	Qty of Diff. Species	Total Plant Qty	Ex. Garden Dimensions
50	3	20	8' Diameter
100	5	41	11'-4" Diameter
150	7	61	13'-9" Diameter
200	7	82	16' Diameter
250	7	103	17'-10" Diameter

Urban Curb-Cut Rain Garden - Sun/Part Shade

Abr	Qty	Botanical Name	Common Name	Height	Spread	S. Interest	Spacing	Install Size
CG	14	<i>Carex flacca</i>	Blue Sedge	1-1.5'	1-1.5'	Sp, Su, Fall	18"	1 Gallon
CM	24	<i>Carex muskingumensis 'Oehme'</i>	Variegated Palm Sedge	2-3'	2-3'	Sp, Su, Fall	18"	1 Gallon
JE	27	<i>Juncus effusus</i>	Common Rush	2-3'	2-3'	Sp, Su, Fall	18"	1 Gallon
NS	1	<i>Nyssa sylvatica</i>	Tupelo, Black Gum	35'	25'	Fall	-	2-2.5 Caliper

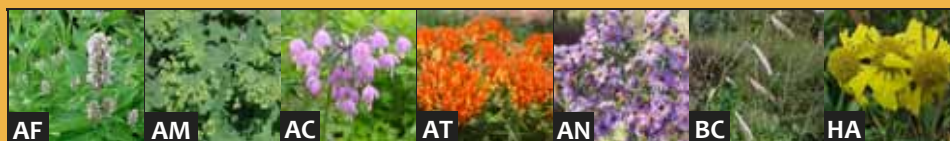
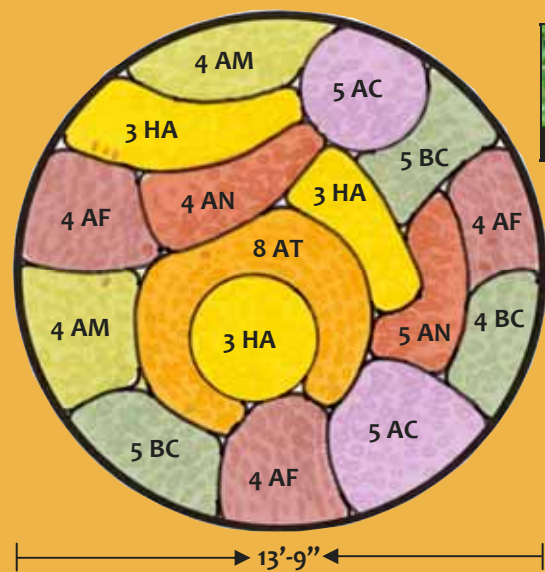


Sizing Chart			
Sq Ft	Qty of Diff. Species	Total Plant Qty	Ex. Garden Dimensions
50	2	19	5' x 10'
100	2 to 3	37	16'-8" x 6'
150	4	56	21'-5" x 7'
200	4	75	25' x 8'
250	4	93	20' x 12'-6"



The Children's Discovery Garden - Sun

Abr	Qty	Botanical Name	Common Name	Height	Spread	S. Interest	Spacing	Install Size
AF	12	<i>Agastache foeniculum</i>	Lavender Hyssop	2-4'	1.5-2.5'	Summer	18-24"	1 Gallon
AM	8	<i>Alchemilla mollis</i>	Lady's Mantle	18-30"	1.5-2'	Spring	15-22"	1 Gallon
AC	20	<i>Allium cernuum</i>	Nodding Onion	1-3'	3-6"	Spring	1'	1 Gallon
AT	8	<i>Asclepias tuberosa</i>	Butterfly Plant	1-2.5'	1-1.5'	Summer	15-22"	1 Gallon
AN	7	<i>Aster novae-angliae</i>	New England Aster	18"	1.5-2'	Fall	22"	1 Gallon
BC	10	<i>Bouteloua curtipendula</i>	Side-oats Grama Grass	1.5-2.5'	1.5-2'	Su, Fall	22"	1-2 Gallon
HA	9	<i>Helenium autumnale 'Moerheim Beauty'</i>	Sneezeweed	3-4'	2-3'	Su. Fall	22-30"	1 Gallon



Sizing Chart			
Sq Ft	Qty of Diff. Species	Total Plant Qty	Ex. Garden Dimensions
50	3	22	8' Diameter
100	5	45	11'-4" Diameter
150	7	68	13'-9" Diameter
200	7	90	16' Diameter
250	7	113	17'-10" Diameter

Rain Gardens and the Vermont Stormwater Management Manual

Property owners subject to a State Stormwater Permit can integrate rain gardens into their stormwater management plan by following the guidelines listed in the Vermont Stormwater Management Manual (VSMM). Property owners that would require permits include residential and commercial developers developing 1 acre or more of impervious surfaces and members of a home owners or condominium association in stormwater impaired watersheds that currently have no or failing stormwater treatment systems. In the VSMM, "rain garden" is a laymen's term for a bio-retention system that treats what is called the water quality volume (0.9 inches of rain) of a storm event or around 90% of the annual rain fall. Rain gardens are designed to capture and temporarily store the water quality volume and infiltrate the stormwater through a soil matrix bed designed to filter out pollutants. Rain gardens as described in this manual differ from the bio-retention systems in the VSMM because they are not designed to provide channel protection (Cpv) or extended detention (Qp) storage.

If stormwater runoff is collected from a road or parking lot, it will typically need to be pretreated prior to entering a rain garden. To prevent the rain garden from being clogged by excess sediment, the VSMM requires three forms of pretreatment including: 1) a grass filter strip below a level spreader or a grass channel before water enters the rain garden, 2) a gravel diaphragm (similar to a curtain/french drain for even flow of water across the rain garden), and 3) a mulch layer. Pretreatment is not required for rain gardens treating stormwater runoff from roofs.

Rain gardens are encouraged in Section 3, Voluntary Stormwater Credits (VSC), of the VSMM (Volume I). VSC's can be acquired when rain gardens are installed within a development. The use of VSC's can reduce the required water quality and recharge volumes, therefore reducing the size and cost of the structural stormwater treatment practices. Such a reduction will help to reduce the overall stormwater treatment costs and space requirement. Specifically, rain gardens are encouraged for rooftop disconnects (Section 3.2) and non-rooftop disconnects such as driveways and sidewalks (Section 3.3), and for Environmentally Sensitive Rural Development Credit (Section 3.6).

On the Web

This manual can be viewed and downloaded for free at:
www.vacd.org/winooski/winooski_raingarden.shtml
(color and black and white versions available)

Additional Resources

Visit the Lake Champlain Sea Grant website to learn more about rain gardens. The website includes educational materials that are available to view and print as well as information about who, where, and when rain gardens were installed in Vermont: www.uvm.edu/~seagrant

Information on tree selection, site assessment, tree planting, and care of young trees is available on the Vermont Urban and Community Forestry Program's website: www.vtcommunityforestry.org

For gardening information contact the University of Vermont Master Gardeners by phone: 1-800-639-2230 or email: master.gardener@uvm.edu

References

Bannerman, R., E. Considine, and J. Horwath, *Rain Gardens: A How To Manual for Homeowners*, UWEX Publications GWQ 037. University of Wisconsin-Extension, 2003

Calarusse, C., and C. Kloss, *Rooftops to Rivers: Green strategies for controlling stormwater and combined sewer overflows*, Natural Resources Defense Council, 2006

Gilbertson, M., and L. Wilson, *Adding Rain Gardens to Your Landscape*, Bulletin #2702, University of Maine Cooperative Extension, 2007

Pellett, N. E., and M. C. Starrett, *Landscape Plants for Vermont*, University of Vermont, 2002

Vermont Agency of Natural Resources, *Vermont Stormwater Management Manual*, Volume I and Volume II, 2002

Plant Photo Credits

With permission, the rain garden plant list photos were primarily provided by the following organizations:

Missouri Botanic Garden Plantfinder:
www.mobot.org/gardeninghelp/plantfinder/Alpha.asp

USDA, NRCS. The PLANTS Database, National Plant Data Center, Baton Rouge, LA 70874-4490 USA, 2007:
<http://plants.usda.gov>

Written & Designed By:
Winooski Natural Resources
Conservation District:
Jessica Andreoletti

Technical Guidance:
UVM Extension:
Emma Melvin

Plant List:
Master Gardeners:
Nancy Hulett, Marijke Niles, Don Hipes,
and Karl Doerner

Contributors
Winooski Natural Resources
Conservation District:
Anna Farmer

UVM Extension:
Kate Forrer, Bethany Hanna

Vermont Agency of Natural Resources:
Karen Bates, Danielle Fitzko, Jim Pease

Nordland Studio Landscape Architecture:
Deina Luberts

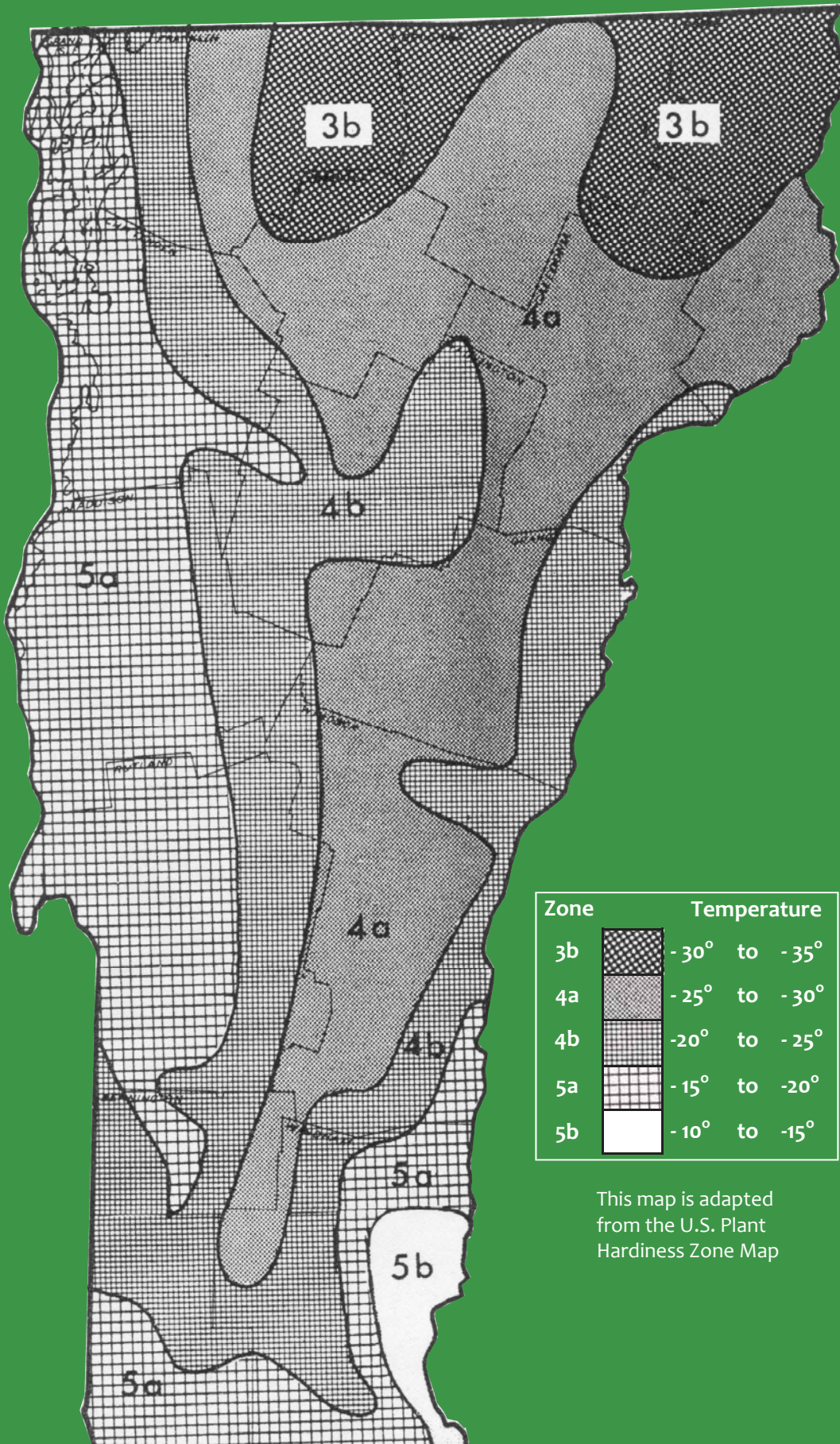
Kathleen Ryan, Landscape Architect

Fitzgerald Environmental:
Evan Fitzgerald

Eco Solutions:
Dave Whitney

Plant Hardiness Zones in Vermont

Average annual minimum temperatures



Zone	Temperature
3b	-30° to -35°
4a	-25° to -30°
4b	-20° to -25°
5a	-15° to -20°
5b	-10° to -15°

This map is adapted from the U.S. Plant Hardiness Zone Map

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The following local garden centers have demonstrated a commitment to protecting our local waterways by providing funding support and committing to carry rain garden specific plants and supplies.

Elmore Roots Nursery

"If it grows in Elmore it will grow where you are."



631 Symonds Mill Rd
Elmore, VT 05680
802-888-3305
elmoreroots.com

Arcana
175 Schillhammer Rd
Jericho, VT 05465
802-899-5123
www.arcana.ws

