



## Chapter Two

# Rain Gardening and Storm-water Management

A Landscaping Guide for Missouri

## Introduction

### The Problem

Government studies have shown that up to 70 percent of pollution in aquifers, rivers, lakes and coastal areas is carried there by storm-water runoff coming from rooftops, roads, driveways, sidewalks and mowed lawns. These impervious surfaces have taken the place of soil that readily absorbs rainwater. The result is an increase in storm-water volume and velocity, creating an increase in water pollution, stream-bank erosion and flooding.

### A Natural Solution

In nature, storm water flows down the hill-sides into streams, riverbanks, and low-lying wetlands that form a watershed. In a healthy watershed, the roots of grasses, perennial plants, shrubs and trees capture rainwater, aerate soil and help water percolate into the ground, reducing erosion and flooding. Unfortunately, healthy watersheds and their associated plant communities have been damaged and/or destroyed by urbanization.

Rain gardens function like miniature natural watersheds. They slow water flow by using elements similar to those in nature: plants, rocks, shallow swales and depressions that hold water temporarily rather than let it quickly escape. Rain gardens minimize flooding and loss of soil and improve water quality in lakes and rivers by reducing silt. Use of rain gardens also can save tax dollars by reducing the need for communities to build larger storm-water retention facilities.

Rain gardens provide beauty, natural diversity and wildlife habitat in areas that otherwise would be a monoculture of lawns, pavement, concrete culverts and storm drains. This landscaping style is increasingly used by homeowners, commercial and residential developments, and by cities for park beautification.

## Elements of a rain garden



Natural creek bank.



Eroding creek bank.

# Introduction

### Retention Area

A shallow depression (or series of depressions) that is planted with wetland plants and temporarily holds water. A rain garden may be an existing low area that holds water, or it may be dug and shaped to hold water. Its purpose is to reduce storm-water runoff and the potential pollution and erosion associated with runoff. Rain gardens range from small, conventional, homeowner gardens, to large, engineered wetlands. In either case, they are placed to intercept water runoff near its source and retain it long enough to allow percolation into the soil. In addition, natural "filtering" takes place as water moves through the root systems of plants.

### Berm

Soil excavated from the uphill side of a rain gar-

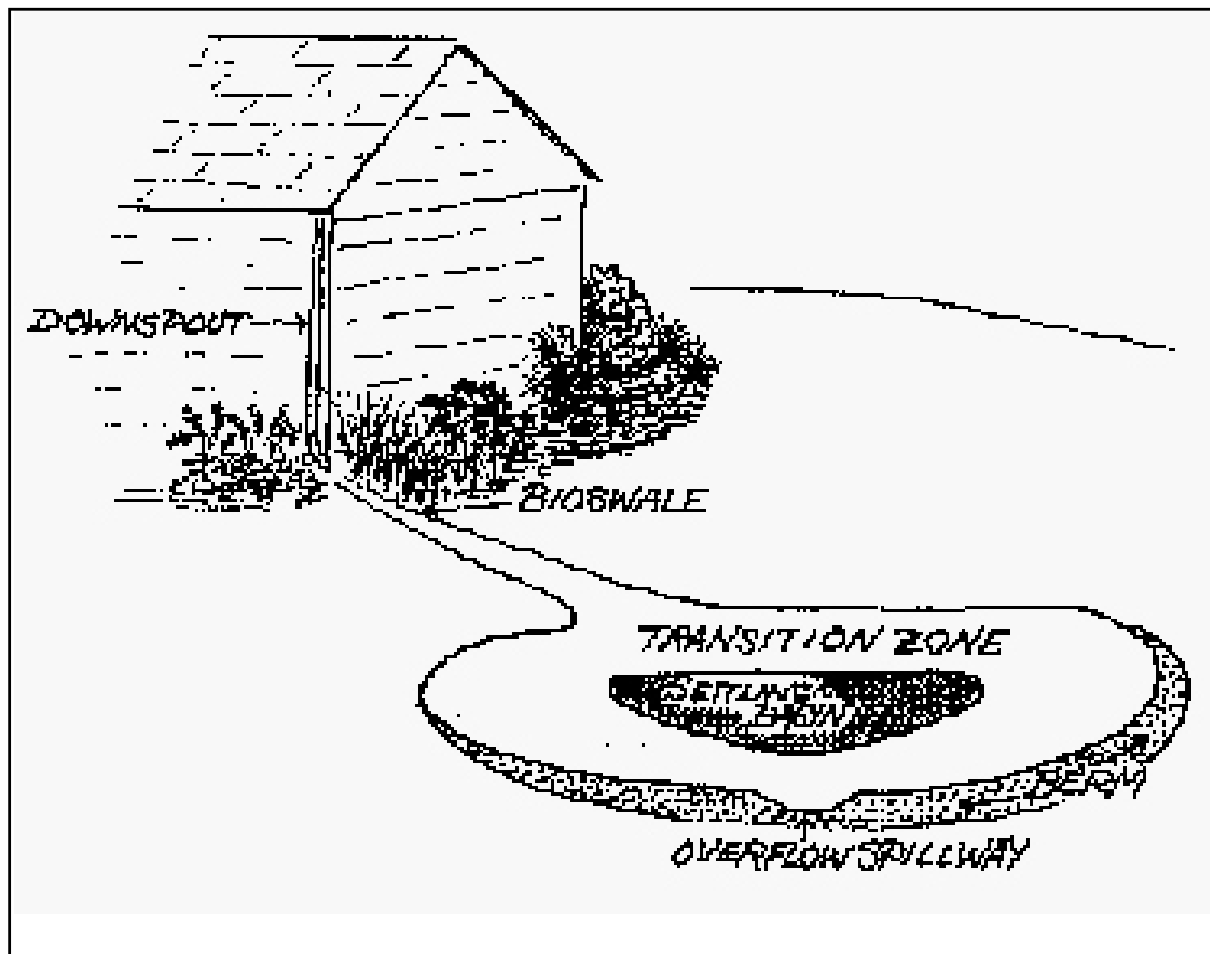
den is moved to the downhill side to create a dam. Water is retained for a longer period of time, allowing for better percolation into the ground as well as uptake by plants. If the rain garden is on flat ground, the berm will surround the area.

### Settling Basin or Ponding Area

An area that is deeper than the rest of the rain garden (six to ten inches deep). The majority of the water is held in this basin, especially when soil is saturated. Most sedimentation and evaporation take place in the settling basin. If the soil contains more clay, infiltration will be slow. The settling basin may need to be larger to allow for more water storage capacity.

### Transition Zone

The area that surrounds the settling basin will



dry out first. Take this into consideration by selecting plants that tolerate dry conditions at times. Many beautiful native plants have evolved with alternating wet and dry periods and are good choices for this region. (See Species Selection Guide).

#### Bioswale (input)

A shallow channel (swale) is constructed to direct storm-water runoff from its source (rooftop, pavement, or lawn) to the rain garden. It is planted or seeded with moisture-loving plants. The plants reduce the flow rate of runoff and encourage soil absorption of water even before it enters the rain garden retention area. Bioswales can be constructed independently of a rain garden if space is limited. In this case, they guide runoff to existing storm-water systems.

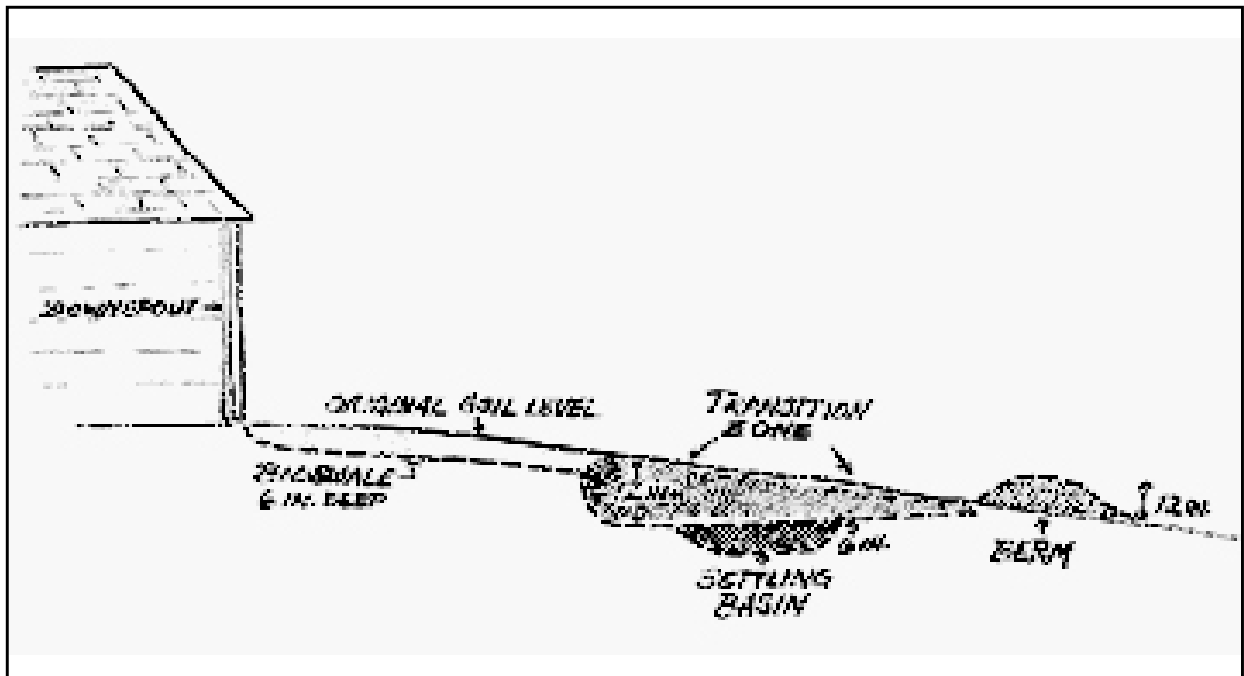
#### Overflow Spillway (output)

A small area in the berm should be somewhat

lower, creating an outlet for water. In the event of a major downpour and a full rain garden, a bioswale below the overflow is used to direct water to the storm-water system.

Please Note: Overflow spillways may not be necessary in some situations. If you have not altered the flow patterns of the yard, the rain garden should not create any further runoff than before and the existing drainage path should be adequate.

## Determine Goals



Before beginning rain garden construction, evaluate the site. Ask yourself why you are building a rain garden and what objectives you have. The answers will help with the decisions on site location, layout, size and plant choices.

## Storm-water Containment and Erosion Control

Consider these five reasons to build a rain garden:

### Erosion Control

Soil loss can be reduced or eliminated by installing water-retaining rain gardens. They help prevent water from quickly running off a site, reducing water volume and rate of flow.

### Maintenance

Poorly drained sites are difficult to mow and care for in rainy seasons because of standing water. Mowing can be eliminated by planting moisture-loving native plants in low-lying areas.



Swamp Milkweed and rose mallow in bloom

Rain gardens planted with wildflowers and sedges bloom throughout the season, attracting a variety of colorful birds, butterflies and insects.

### Education

Over 85 percent of Missouri's wetlands are gone. A rain garden provides opportunities to teach the importance of water cycles, storm-water containment, and biological diversity.

### Wildlife Habitat

A rain garden with a diversity of native plants attracts many insects, birds, amphibians and mammals, providing opportunities to observe nature up close.

## Site Evaluation

Map the area.

Note the size and shape of the site. Add structures, location of utility lines and traffic use.



Next, note the north-south aspect, soil types, vegetation, patterns of shade and sunlight. Slope, soil moisture, drainage and the potential for erosion also are important. A map, drawn to scale, will help decide where to locate the rain garden and what size and shape it will be. A scale drawing will help determine the number and placement of plants. This map will be useful in explaining the project to neighbors, city officials or maintenance crews.

#### Survey vegetation.

A plant survey of the area may reveal remnants of the plant community that previously existed on the site. For example, if native wetland grasses and forbs grow nearby or on the site, include those in the plant list. Seeds of these plants could be collected and used in the project. The site may be covered with shrubs, vines or weedy vegetation. If so, determine what vegetation should be removed.

#### Research land use history.

(Call 1-800-DIG-RITE or local utility companies to locate underground pipes and power lines.)

Are there existing low depressions, swales, or ponds? Sometimes damaged ponds are difficult to see since they no longer hold water, but they have the potential to make excellent rain gardens or overflow areas. Look for evidence that a wetland existed on the site. Do neighbors talk about wet areas, flooding, or standing water? Do wetland plants exist in the area?

#### Soil Types

Determine if soil is sand, loam, or clay by digging a test hole one foot deep. Fill it with

water and observe how quickly the water disappears.

- If water drains in less than an hour, soil is sandy or rocky.
- If water drains in less than 6 hours, soil is loamy.
- If water remains in the hole after 24 hours, soil is clay.

Sandy or loamy soils are more porous and therefore drain better than less porous clay soils. The goal of a rain garden is to encourage rain infiltration into the ground. Sandy, rocky or loamy soils are ideal because they drain quickly. If you have poorly drained clay soils you will need to compensate by digging a larger rain garden. (See "How to Calculate Size" ahead).

Case Study: Shooting Star Nursery, Frankfurt, Kentucky.

## Planning and Design

### Location and Layout

Observe topography and water flow during periods of heavy rainfall. Ideal sites have



Left: Downspouts on building flow underground to rain garden. Middle: Rain garden with building in background. Right: Rain garden overflows through rock spillway to lower pond.

Case Study: Missouri United Methodist Church, Columbia, Missouri.



Left: Water flows off roof and into bioswale. Middle: Water runoff from parking lot enters bioswale. Right: Rain garden basin with wetland species and river gravel.

Case Study: Missouri Department of Conservation, Columbia, Missouri.



Left: Rain water enters rain barrel from downspout. Rain barrel overflows into basin. Middle: Rain garden basin with pickerel weed. Right: Overflowing into parking lot.

a gentle slope and a naturally occurring low area or an area where downspouts and other runoff can be directed. You may need to direct runoff from its source to the rain garden by reshaping existing soil contours.

A good rule of thumb is to locate your rain garden at least 10 feet away from buildings. Direct the overflow spillway into existing drainage ditches, storm-water sewers, ponds or creeks and away from neighboring houses, driveways, or sidewalks. (See rain garden illustration starting on p. 4)

### Size and Shape

Rain garden size is related to soil type and the amount of impervious surfaces (rooftops, driveways, sidewalks or mowed lawns). The larger the surface, the larger the rain garden. Also, clay soils require larger rain gardens.

### How to Calculate Size

According to many years of rainfall data collected in Missouri, the typical rain event produces one half-inch of water (there are thirty of these each year). Because of this, the following recommendations are based on a half-inch rain event.

Let's begin with a house that has 1,100 square feet (50 feet x 22 feet) of impervious roof surface area.

It receives 342 gallons of water per half-inch rain event (one cubic foot holds 7.5 gallons of water). That is about 80 gallons per downspout (assuming 4).



So a  
rain  
garden

Above: Examples of natural style rain gardens.

receiving water from one downspout that has sand or loam soil needs to be about 4 by 5 feet wide and six inches deep to capture one half-inch rainfall on your house. If you run two downspouts into a single rain garden, make sure it is 8 by 10 feet and six inches deep.

A rain garden with clay soil should be slightly larger or about 6 by 8 feet and six inches deep per downspout.



Above: Examples of traditional style rain gardens.

## Design Elements

Determine the design style.

### Natural style

This style emulates a natural wetland. Plants are randomly placed, approximately one plant per square foot. The design should include elements such as groundcover or mowed turf edges, split-rail fencing, boulders, birdhouses or feeders to give the garden an intended appearance. Natural gardens often have equal portions of forbs (showy flowering plants) to grasses and sedges. These gardens are often seeded or planted with small plugs.

### Traditional style

This style is considered a conventional approach to garden design. It may involve massing single species, repetition or planting in regular lines or curves. Also, a larger portion of flowers to grasses results in a more conventional appearance. This style of garden is planted with three inch to one gallon size plants. For a dramatic effect, choose plants whose leaf textures and forms have good contrast. In other words, combine plants with large coarse leaves next to those with narrow fine leaves. Also include plants that flower during spring, summer, and fall for color all season.

### Layout

Use rope or garden hose to define the basic shape. Mark the final layout with stakes before digging.

### Piping

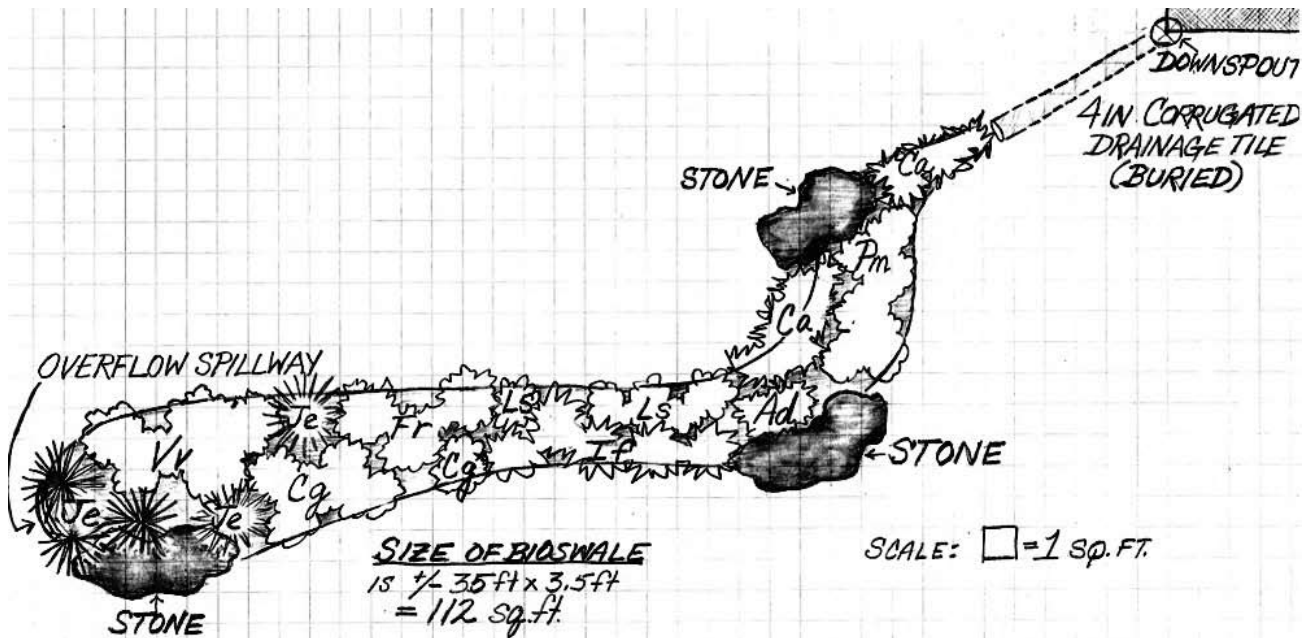
Replace, repair or relocate gutters and downspouts where necessary. If you choose to run water underground to a bioswale or rain garden, connect downspouts to 4-inch, corrugated drainage tile (6-inch or larger for commercial applications).

## Typical Schedule

Before going further, create a step-by-step schedule so each step is done in sequence.

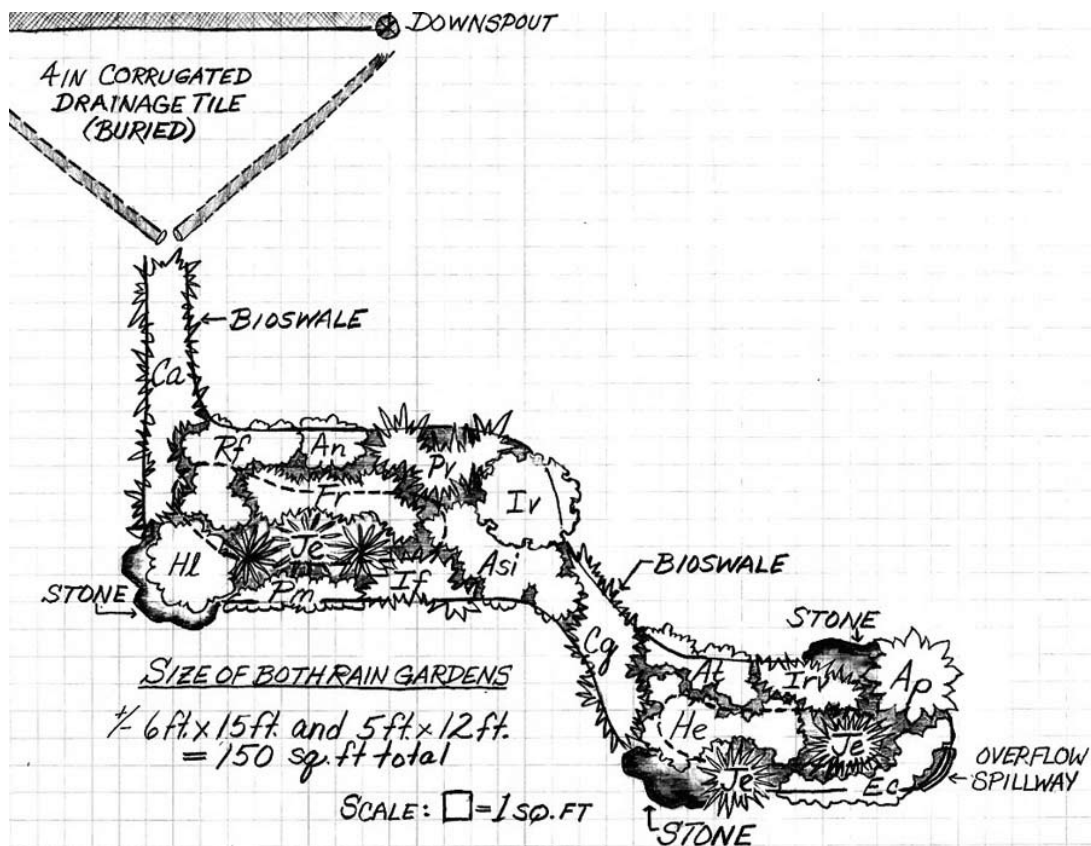
Rain Garden Construction Schedule	
If planting...	Gardens less than 300 square feet
Winter	Evaluate site, create design, select plants, call 1-(800)-DIG-RITE.
Winter/Spring plants.	Layout garden, lay pipe, shape soil, construct berm, acquire
Spring/Summer	Plant, mulch, water, weed. Cut back plants that grow faster than others. During the first growing season, vigorous plants will take over if not pruned.
If seeding...	Gardens more than 300 square feet
Year 1	
Winter	Evaluate site, select plants, design space.
Winter/Spring	Lay out garden, lay pipe, shape soil, construct berm, acquire plants.
Summer/Fall	Eliminate weeds with repeated applications of herbicide. Follow label recommendations carefully. Acquire seed collecting or purchasing. See sample seed mix on p. 17 + 18.
Winter	Seed rain garden. No tilling, discing, or harrowing required. Sow seed on bare soil and press it in with tractor tires or cultipacker. When sowing on slopes, follow recommendations for dealing with slopes below.
Year 2	
Spring	Seedlings germinate. Water during dry spells or drought.
Spring/Fall	Mow area to a height of 6 inches with string trimmer, lawn mower, or brush-hog. Prevent weeds from growing taller than
14 inches.	
Year 3	
	Many species mature and flower. Follow the recommended maintenance on p.19.

## Sample Designs for Rain Gardens



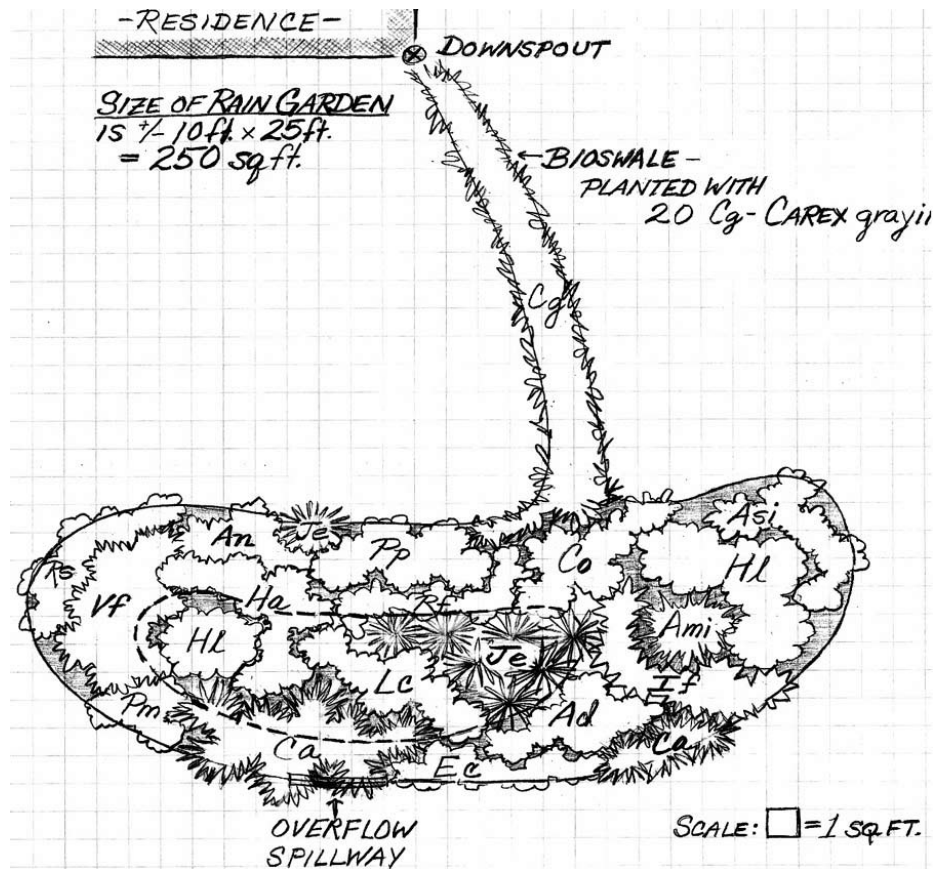
### Plant List: Bioswale

Code	Quantity	Scientific Name	Common Name
Ad	1	Aster drummondii	Drummond's aster
Ca	6	Carex annectans	Yellow-fruited sedge
Cg	5	Chelone glabra	White turtlehead
Fr	3	Filipendula rubra	Queen of the prairie
If	5	Iris fulva	Copper iris
Je	5	Juncus effusus	Soft rush
Ls	5	Lobelia siphilitica	Blue lobelia
Pm	6	Phlox maculata	Meadow phlox
Vv	5	Veronicastrum virginicum	Culver's root



### Plant List: Bioswale and Rain Garden

An	1	Aster novae-angliae	New England aster
Ap	1	Aesculus pavia	Red buckeye
Asi	5	Asclepias incarnata	Swamp milkweed
At	3	Amsonia tabernaemontani	Bluestar
Ca	10	Carex albicans	White tinged sedge
Cg	7	Carex grayii	Bur sedge
Ec	5	Eupatorium coelestinum	Wild ageratum
Fr	6	Filipendula rubra	Queen of the prairie
Ha	8	Helenium autumnale	Sneezeweed
HL	1	Hibiscus lasiocarpus	Rose mallow
If	3	Iris fulva	Copper iris
Irv	3	Iris virginica	Southern blue flag
Iv	1	Ilex verticillata	Winterberry
Je	3	Juncus effusus	Soft rush
Pm	3	Phlox maculata	Meadow phlox
Pv	3	Panicum virgatum	Switch grass
Rf	6	Rudbeckia fulgida	Orange coneflower



### Plant List: Bioswale and Rain Garden

Code	Quantity	Scientific Name	Common Name
Ad	5	Aster drummondii	Drummond's aster
Ami	1	Amsonia illustris	Shining bluestar
An	3	Aster novae-angliae	New England aster
Asi	5	Asclepias incarnata	Swamp milkweed
Ca	11	Carex albicans	White tinged sedge
Co	5	Chelone obliqua	Rose turtlehead
Ec	6	Eupatorium coelestinum	Wild ageratum
Ha	8	Helenium autumnale	Sneezeweed
HL	4	Hibiscus lasiocarpus	Rose mallow
If	7	Iris fulva	Copper iris
Je	8	Juncus effusus	Soft rush
Lc	6	Lobelia cardinalis	Cardinal flower
Pm	3	Phlox maculata	Meadow phlox
Pp	5	Phlox paniculata	Garden phlox
Rs	6	Rudbeckia subtomentosa	Sweet coneflower
Rf	6	Rudbeckia fulgida	Orange coneflower
Vf	5	Vernonia fasciculata	Prairie ironweed

## Site Preparation

Call 1-(800)-Dig-Rite at least three days before any digging, excavation or bed prep, to have underground pipes and cables located and marked. Stay two feet away from utility lines.

### Soil Shaping

Soil dug from the bioswale, rain garden, and settling basin typically is used to construct the berm. Step back from time to time to observe elevation and slope. Use a line-level when you are close to the final grade to ensure your rain garden base and berm are level. The overflow spillway should be a few inches lower than the top of the berm.

of humus, gypsum or sand.

## Dealing with Slopes

Steep slopes pose problems. Slopes with a grade above 10 percent may need to be stabilized. There are several materials available to keep seed, plugs, and soil in place while plants become established.

### Rock Placement

Place large gravel, rocks or boulders in the bioswale to slow waterflow and create visual interest. Place rocks or a flat stone beneath downspouts or at point where drainage tile enters the rain garden to prevent erosion. Rocks also may be placed in the rain garden and within the overflow spillway.

### Soil Compaction

Water infiltration rates can be increased in clay soils by loosening compacted soil with hand-digging, tilling, plowing or with the addition



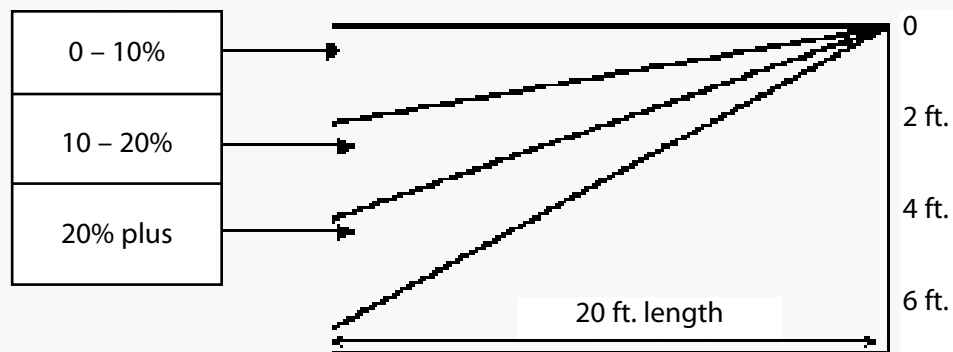
Above: Wood shavings erosion control mat shown interplanted with sedges.

Below: Rolling out erosion control mat.

0 – 10% slope: 2 ft. or less drop in a 20 ft. distance. Gentle slopes are ideal and easy to work with and do not require erosion control fabric.

10 – 20% slope: 4 ft. or less drop in a 20 ft. distance. Steeper slopes can present a challenge and use of erosion control fabric should be considered.

Above 20% slope: 5 ft. or less drop in a 20 ft. distance. Once the percent slope is above 20%, erosion control is strongly recommended.



### Slope-Stabilization Mats For Erosion Control

Type	Brand name	Description
Fiber mat	Geojute	Open mesh construction allows plants to grow with ample light to pass through. Absorbs almost five times its weight. Decomposes in two years or less.
Wood shavings mat facing page)	Curlex No.1	Expands when wet, causing the material to adhere to the surface and releases moisture to germinating seeds. Product is entirely biodegradable in 6-10 months. (See photo
Straw mat	North American Green, S75 Single Net Straw Blanket	Interwoven strands can move independently of each other, providing better moisture absorption, flexibility, and conformance with the soil surface. Decomposes in one year.



expensive than seeding, plants mature and



not recommended until spring rains end

#### How to Calculate an Acre of Land

An acre contains 4,840 square yards or 43,560 square feet. If your plot is about 200 feet by 200 feet then you have 40,000 square feet or just under one acre.

During the first growing season, vigorous species will take over if not kept pruned.

### Seeding

Seeding is recommended for large areas (from 300 square feet to several acres) because planting plugs on this scale can be cost-prohibitive. Seeding should be done in early winter. Seeding requires three years to mature and flower, so patience is needed. For detailed instruction on seed collection, cleaning, storage, mixing, sowing, maintenance, and seedling identification, see [Chapter One: Prairie Reconstruction](#).

### Maintenance

Maintenance of a mature rain garden is considerably less than a comparable area of lawn.

#### Pruning and dead-heading

Leave stems and seed heads standing in fall and winter to add visual interest to the landscape and to provide food and cover for birds. Remove dead vegetation in spring with a string trimmer or pruner.

#### Fertilizing

Don't fertilize a rain garden. It is not necessary and will stimulate weed growth. Light annual application of compost improves soil fertility and is beneficial.

#### Mulching

Annual one to two-inch applications of compost in late fall or early winter are beneficial in first growing season. An annual application of mulch is not necessary once plants

## Sample Seed Mix for a One-acre Wetland

Scientific Name	Common Name	Weight Per Acre
Sedges, Rushes & Grasses		
Mixed Sedges		
Carex spp.		3.5 lbs. total sedges if you use mixed sedges
C. annectens	Yellow-fruited sedge	2 oz.
C. complinata		4 oz.
C. cristatella	Crested sedge	2 oz.
C. crus-corvii	Raven's foot sedge	4 oz.
C. frankii	Frank's sedge	4 oz.
C. hyalinolepis	Shoreline sedge	4 oz.
C. lanuginosa	Wooly sedge	4 oz.
C. lupulina	Hop sedge	8 oz.
C. lurida	Sallow sedge	8 oz.
C. muskingumensis	Palm sedge	3 oz.
C. shortiana	Short's sedge	4 oz.
C. squarrosa	Squarrose sedge	4 oz.
C. stipata	Sawbeak edge	4 oz.
C. vulpinoidea	Fox sedge	2 oz.
Rushes		
Juncus effusus	Common rush	1 oz.
Juncus biflorus	Two-flowered rush	1 oz.
Scirpus atrovirens	Dark-Green rush	1 oz.
S. cyperinus	Wool grass	1 oz.
S. pendulus	Reddish bullrush	1 oz.
Grasses		
Andropogon gerardii	Big bluestem	8 oz.
Chasmanthium latifolia	Northern creek oats	8 oz.
Spartina pectinata	Prairie cordgrass	2 oz.
Total Sedges, Rushes and Grasses		80 oz. or 5 lbs.

## Sample Seed Mix for a One-acre Wetland (continued)

Scientific Name	Common Name	Weight Per Acre
<b>Forbs</b>		
<i>Alisma plantago-aquatica</i>	Water plantain	1 oz.
<i>Asclepias incarnata</i> or <i>A. sullivantii</i>	Swamp milkweed	5 oz.
<i>Aster novae-angliae</i> or <i>A. puniceus</i>	New England aster	2 oz.
<i>Bidens aristosa</i> or <i>cernua</i>	Marsh marigold	1 oz.
<i>Boltonia asteroides</i>	False aster	1 oz.
<i>Chelone glabra</i> or <i>C. obliqua</i>	Turtlehead	1 oz.
<i>Eupatorium coelestinum</i>	Mist flower or wild ageratum	2 oz.
<i>E. perfoliatum</i> or <i>E. purpureum</i>	Joe Pye weed	3oz.
<i>Helenium autumnale</i>	Sneezeweed	2 oz.
<i>Hibiscus lasiocarpus</i>	Rose mallow	5 oz.
<i>Hibiscus laevis</i>	Rose mallow	5 oz.
<i>Heuchera richardsonii</i>	Alum root	2 oz.
<i>Iris virginica</i>	Southern blue flag	8 oz.
<i>Lobelia cardinalis</i>	Cardinal flower	1 oz.
<i>Lobelia siphilitica</i>	Blue lobelia	1 oz.
<i>Ludwigia alternifolia</i>	Seedbox	1 oz.
<i>Lycopus americanus</i>	Water horehound	1 oz.
<i>Lythrum alatum</i>	Loosestrife	1 oz.
<i>Mimulus ringens</i> or <i>alatus</i>	Monkey flower	1 oz.
<i>Monarda fistulosa</i>	Wild bergamot	2 oz.
<i>Pedicularis lanceolata</i>	Swamp wood betony	3 oz.
<i>Penstemon digitalis</i>	Foxglove beard-tongue	3 oz.
<i>Phlox paniculata</i> or <i>P. maculata</i>	Meadow phlox	5 oz.
<i>Pycnanthemum incanum</i>	Mountain mint	2 oz.
<i>Rudbeckia fulgida</i>	Orange coneflower	3 oz.
<i>R. subtomentosa</i>	Sweet coneflower	3 oz.
<i>Silphium perfoliatum</i>	Cup plant	5 oz.
<i>Solidago ridellii</i> or <i>S. patula</i>	Goldenrod	2 oz.
<i>Verbena hastata</i> or <i>V. stricta</i>	Blue vervain	3 oz.
<i>Vernonia altissima</i>	Prairie ironweed	3 oz.
Total Forbs:		80 oz. or 5 lbs.
Grand Total:		10 lbs. PLS per acre

\*PLS means pure live seed, which is seed that has been tested for purity and viability. This is done by most seed nurseries and should be included in your seed order.

are established. However, mulch does add a manicured look and provides a “garden” appearance.

#### Weeding

Most weed seedlings cannot survive periods of flooding, a definite advantage in weed control. Weeds that persist after flooding should be pulled manually. By the third year, plants should be mature enough to compete and crowd out most weed species so weeding will be minimal.

#### Maintaining edges



Borders are important. A border defines the edge of the garden just as a frame defines a painting. A strip of mowed turf, buffalo grass, or a walking path at the edge of a rain garden helps set the area apart. Borders may include split-rail fences, low walls, shrub masses or a simple trellis.

for more than a few days, which is not long enough for mosquitoes to complete a life cycle. Gardens that have a settling basin planted with a diversity of native plants will attract mosquito predators such as aquatic insects, dragonflies, tadpoles, frogs, toads, some bird species and bats. (See facing page).

If your rain garden develops a population of mosquitos in the early phases of installation, a good commercial product to use is Mosquito Dunks™. Top minnows are very effective control. They are available at bait shops, pet stores and garden centers who specialize in aquatic plants.

## Mosquitos

Rain gardens typically don't have standing water

## Species Selection Guide



Stepping stone path at edge of rain garden.



Gravel path edge.



Split-rail fence and prairie dropseed edge.

Rain gardens are full of water during storms and dry out during dry weather. The plants recommended in this manual generally tolerate both extremes.

There are three descriptions in the 'Light and Moisture Requirement' column that merit attention. They are defined below to aid in your decisions on placement of species within the zones of a rain garden.

#### Wet to mesic

These species are well suited to the alternating wet and dry zones of a rain garden, specifically the bioswale, the transition zone and the overflow spillway.

#### Wet to submerged



A diversity of native plants promotes insect diversity which is the best control of mosquitos.



Amphibians and aquatic insects help control mosquitos naturally.

These species grow at the consistently moist margins of ponds and rivers. They require an area of constant moisture and are suitable for the settling basin of a rain garden.

### Submerged

These species grow in the water zone of ponds and rivers. Their roots consistently are under water. The settling basin can be made to permanently hold water by constructing the bottom out of compacted clay or a pond liner.



Sun to shade/

Wet to mesic.

Northern creek oats  
3-4 ft.

Sun to part shade

Wet to mesic.

Sun/Wet to mesic  
spreads

by rhizomes

Sun to part shade

Switch grass  
4-5 ft.

Prairie cordgrass  
4-8ft. Quickly

White-tinged sedge  
12 inches.

Right (top to bottom): Arrowhead, Copper Iris, Swamp Aster and Touch-me-not. Below: Fringed Sedge.



## Grasses, Sedges and Rushes

Scientific Name	Common Name	Light & Moisture Requirement	Height, etc.
Grasses			
<i>Chasmanthium latifolium</i>		Dry to mesic	Clump-forming
	Yellow-fruited sedge	Sun to part shade Wet to mesic	2-3 ft. Clump-forming
<i>Panicum virgatum</i>			
	Brown bog sedge by rhizomes.	Sun/Wet to mesic	1-2 ft. Quickly spreads
<i>Spartina pectinata</i>			
	Prairie sedge	Sun/Wet to mesic	1-2 ft. Clump-forming
Sedges & Rushes			
<i>Carex albicans</i> var <i>albicans</i>	Fringed sedge	Sun to part shade Wet to mesic	2-3 ft. Clump-forming
<i>Carex annectens</i>	Crested sedge	Sun/Wet to mesic	2-3 ft.
	Raven's foot sedge	Sun to part shade Wet	Clump-forming initially then spreads by rhizomes.
<i>Carex buxbaumii</i>			
	Davis's sedge	Sun to Shade/Wet to mesic	1-2 ft. Clump-forming
<i>Carex bicknellii</i>			
	Emory's sedge	Sun to part shade	Quickly spreads by
<i>Carex crinita</i>			
		Wet to mesic	rhizomes.
<i>Carex cristatella</i>			
	Fescue sedge	Sun to part shade Wet to mesic	1-2 ft. Clump-forming
<i>Carex crus-corvi</i>			
	Frank's sedge	Sun to part shade Wet to mesic	2 ft. Clump-forming
<i>Carex davisii</i>			
<i>Carex gravida</i>	Heavy sedge	Sun/Wet to mesic	2-3 ft. Clump-forming
<i>Carex emoryi</i>			
<i>Carex grandis</i>	Meadow sedge	Sun to part shade Wet to mesic	2 ft. Clump-forming
<i>Carex festucacea</i>			
<i>Carex grayi</i>	Bur sedge	Sun to part shade Wet to mesic	2 ft. Clump-forming
<i>Carex frankii</i>			
<i>Carex hyalinolepis</i>	Shoreline sedge	Sun/Wet	Quickly spreads by rhizomes.

Scientific Name	Common Name	Light & Moisture Requirement	Height, etc.
<i>Carex lanuginosa</i> ( <i>Carex pellita</i> )	Woolly sedge	Sun/Wet	Quickly spreads by rhizomes.
<i>Carex louisianica</i>	Louisiana sedge	Sun to part shade Wet	2-3 ft. Clump-forming
<i>Carex lupulina</i>	Hop sedge	Sun to part shade Wet	2-3 ft.
<i>Carex lurida</i>	Shallow sedge	Sun to part shade Wet	2 ft. Clump-forming
<i>Carex muskingumensis</i>	Palm sedge; swamp sedge	Sun to part shade Wet to mesic	2-3 ft.
<i>Carex normalis</i>	Straw sedge	Sun to part shade Wet	1-2 ft. Clump-forming
<i>Carex shortiana</i>	Short's sedge	Sun to part shade Wet to mesic	2-3 ft. Clump-forming
<i>Carex squarrosa</i> <i>Carex stricta</i>	Squarrose sedge Tussock sedge	Sun/Wet to mesic Sun/Wet to mesic	2-3 ft. Clump-forming 2-3 ft.
<i>Carex tribuloides</i>	Blunt broom sedge	Sun/Wet	2 ft. Quickly spreads by rhizomes.
<i>Carex vulpinoidea</i>	Fox sedge	Sun to part shade Wet to mesic	2-3 ft. Clump-forming
<i>Juncus dudleyi</i>	Dudley's rush	Sun/Wet	2 ft.
<i>Juncus effusus</i>	Soft rush	Sun/Wet to mesic	2-3 ft. Clumping initially, then spreads by rhizomes.
<i>Juncus torreyi</i>	Torrey's rush by rhizomes.	Sun/Wet	2-3 ft. Quickly spreads
<i>Scirpus atrovirens</i>	Dark green rush	Sun/Wet	3-4 ft. Clump-forming
<i>Scirpus cyperinus</i>	Wool grass	Sun/Wet	3-4 ft. Clump-forming

Scientific Name	Common Name	Light & Moisture Requirement	Height, etc.
<i>Scirpus pendulus</i>	Nodding bulrush	Sun/Wet	2-3 ft. Clump-forming
<i>Scirpus validus</i> ( <i>Schoenoplectus taebarnaemontani</i> )	Great bulrush	Sun/Wet	3-4 ft. Quickly spreads by rhizomes
<i>Amsonia illustris</i>	Shining bluestar	Sun to part shade Wet to mesic	3 ft. Lt. blue fls. April-May
<i>Amsonia tabernaemontana</i>	Bluestar	Sun to part shade Wet to mesic	2-3 ft. Blue fls. May-June
<i>Asclepias incarnata</i> source for butterflies;	Swamp milkweed	Sun/Wet to mesic July-Oct.; nectar	2-4 ft. Pink to wht. fls.  larval food for monarch butterfly



Rain garden in Whitmire Wildflower Garden.



Private rain garden.

## Forbs

Scientific Name	Common Name	Light & Moisture Requirement	Height, Bloom, etc.
<i>Asclepias sullivantii</i> source for butterflies;	Prairie milkweed	Sun/Wet to mesic June-July; nectar	2-3 ft. Salmon pink fls.  larval food for monarch butterfly. Spreads by rhizomes.
<i>Aster drummondii</i> ( <i>Symphiotrichum drummondii</i> )	Drummond aster	Sun to part shade Wet to mesic	2-3 ft. Lt. blue fls. Aug.-Oct.
<i>Aster novae-angliae</i> ( <i>Symphiotrichum novae-angliae</i> )	New England aster	Sun to part shade Wet to mesic	3-4 ft. Purple fls. Aug.-Oct.; good nectar source for butterflies
<i>Aster puniceus</i> ( <i>Symphiotrichum puniceum</i> var <i>firmus</i> )	Swamp aster	Sun to part shade Wet to mesic	3-5 ft. Lavender fls. Aug.-Sept.
<i>Athyrium filix femina</i>	Lady fern	Shade to part shade/Wet to mesic	2 ft. Finely textured fronds
<i>Boltonia asteroides</i>	False aster	Sun to part shade Wet to mesic	4-7 ft. Large clusters of white fls. Aug.-Sept.
<i>Chelone glabra</i>	White turtlehead	Sun to part shade Wet to mesic	2-3 ft. White fls. Aug.-Sept.
<i>Chelone obliqua</i>	Rose turtlehead	Sun or shade/Wet to mesic	3 ft. Rosy-purple fls. Aug.-Sept.
<i>Eupatorium coelestinum</i>	Mist flower; wild ageratum	Sun to shade/Wet to mesic	1-2 ft. Lavender fls. Aug.-Sept.
<i>Eupatorium fistulosum</i>	Joe Pye weed	Sun to part shade Wet to mesic	5-8 ft. Pink fl. clusters Aug.-Sept.
<i>Eupatorium purpureum</i>	Joe Pye weed clusters June-July	Sun/Wet to mesic	4-6 ft. Mauve-pink. fls.
<i>Filipendula rubra</i>	Queen of the prairie	Sun/Wet to mesic	3-4 ft. Pink. fls. June-July
<i>Gentiana andrewsii</i>	Bottle gentian	Shade to part	1-2 ft. Cobalt blue fls.

Scientific Name	Common Name	Light & Moisture Requirement	Height, Bloom, etc.
		shade/Wet to mesic	Sept.-Oct.
<i>Helenium autumnale</i>	Sneezeweed	Sun to part shade Wet to mesic	2-3 ft. Yellow fls. July-Sept.
<i>Hibiscus lasiocarpus</i>	Rose mallow	Sun to part shade Wet to mesic	4-5 ft. White and pink fls. Aug-Sept.
<i>Hibiscus laevis</i>	Rose mallow	Sun to part shade Wet to mesic	3-5 ft. Pink fls. July-Sept.
<i>Iris brevicaulis</i>	Short-stemmed Iris	Sun to shade Wet to mesic	6-12 in. Blue fls. April-May
<i>Iris fulva</i>	Copper Iris	Sun to part shade Wet to mesic	3 ft. Red-copper fls. June-July
<i>Iris virginica</i> var. <i>shrevei</i>	Southern blue flag	Sun/Wet to mesic	2-3 ft. Blue fls. May-June
<i>Lobelia cardinalis</i>	Cardinal flower	Sun or shade Wet to mesic	2-4 ft. Red fls. July-Aug.; source of nectar for hummingbirds
<i>Lobelia siphilitica</i>	Blue lobelia	Sun or shade/Wet to mesic	2-3 ft. Blue fls. Aug.-Oct.
<i>Matteuccia struthiopteris</i>	Ostrich fern	Shade to part shade/Wet to mesic	3-4 ft. Produces cinnamon-colored spore fronds in late summer. Spreads by rhizomes.
<i>Mimulus ringens</i>	Monkey flower	Sun/Wet to mesic	1-2 ft. Lavender fls. July-Sept.
<i>Monarda fistulosa</i>	Wild bergamot	Sun to part shade Wet to mesic	3-4 ft. Pink fls. June-Aug. Butterfly magnet.
<i>Nuphar luteum</i> July-Sept.; leaves float	Spadderdock	Sun/Submerged 1-3 ft.; Yellow fls.	Needs water depth of on surface of water
<i>Nymphaea odorata</i>	Fragrant water lily	Sun/Submerged 1-3 ft.; White fls.	Needs water depth of

Scientific Name	Common Name	Light & Moisture Requirement	Height, Bloom, etc.
			July-Sept.; leaves and flwr. float on water surface
<i>Onoclea sensibilis</i>	Sensitive fern	Shade to part shade/Wet to mesic	2-3 ft. Spreads by rhizomes.
<i>Oenothera pilosella</i>	Prairie sundrops	Sun/Wet to mesic	1-2 ft. Yellow fls. June
<i>Penstemon digitalis</i>	Foxglove beard tongue	Sun to part shade Wet to mesic	2-3 ft. White. fls. May-July.; nectar source for hummingbirds
<i>Phlox glaberrima</i>	Smooth phlox	Sun/Wet to mesic	2-3 ft. Pink fls. May-June; nectar source for butterflies and hummingbirds
<i>Phlox maculata</i>	Meadow phlox	Sun to shade Wet to mesic	3-4 ft. Rose-pink fls. June-July; nectar source for butterflies and hummingbirds
<i>Phlox paniculata</i>	Garden phlox	Sun to shade Wet to mesic	3-5 ft. Purple-pink fls. July-Oct; nectar source for butterflies and hummingbirds
<i>Physostegia virginiana</i>	False dragonhead	Sun to part shade Wet to mesic	3-4 ft. Pink fls. July-Sept.
<i>Pontaderia cordata</i>	Pickereel weed	Sun to part shade Submerged	2-3 ft. Lavender fls. July-Sept.
<i>Pycnanthemum virginianum</i>	Mountain mint	Sun to part shade Wet to mesic	3-4 ft. White fls. July-Sept.; excellent nectar source for butterflies and bees.
<i>Rudbeckia fulgida</i>	Orange coneflower	Sun or part shade Wet to mesic	2-3 ft. Yellow fls. July-Aug.
<i>Rudbeckia subtomentosa</i>	Sweet coneflower	Sun to part shade Wet to mesic	3-4 ft. Yellow fls. June-Aug.
<i>Sagittaria</i> sp.	Arrowhead	Sun to part shade	2-4 ft. white fls.

Scientific Name	Common Name	Light & Moisture Requirement	Height, Bloom, etc.
<i>Saururus cernuus</i>	Lizard's tail	Submerged Sun to part shade Submerged	In spikes July-Sept. 3-4 ft. long white fls. bend over like a tail. June-Aug.
<i>Senecio aureus</i>	Golden ragwort	Shade to part shade/Wet to mesic	6-12 in. Yellow fls. April-May; spreads vigorously by rhizomes.
<i>Silphium perfoliatum</i>	Cup plant	Sun/Wet to mesic	5-12 ft. Yellow fls. July-Sept.; birds drink water from leaves.
<i>Solidago patula</i>	Swamp goldenrod	Sun/Wet to mesic	4-6 ft. Yellow fls. Aug.-Oct.
<i>Solidago riddellii</i> ( <i>Oligoneuron riddellii</i> )	Riddell's goldenrod	Sun/Wet to mesic	3 ft. Yellow. fls. Sept.
<i>Thalia dealbata</i>	Wild canna	Sun/Submerged	4-7 ft. Purple fls. July-Sept.
<i>Vernonia fasciculata</i>	Prairie ironweed	Sun to part shade Wet to mesic	3-5 ft. Purple fls. Aug.-Oct.
<i>Veronicastrum virginicum</i>	Culver's root	Sun - part shade Wet to mesic	3-4 ft. White to pink fls. June-Aug.
<i>Aesculus pavia</i>	Red buckeye	Sun to part shade Wet to mesic	10-15 ft. Red fls. April-May; favorite of hummingbirds.
<i>Alnus serrulata</i>	Smooth alder	Sun to part shade Wet to mesic small cones in Sept.	20 ft. Fls. are catkins March-April; produces
<i>Amorpha fruticosa</i>	False indigo	Sun to part shade Wet to mesic	8-12 ft. Purple fls. May-June
<i>Aronia melanocarpa</i> fall attracts birds	Black chokecherry Wet to mesic	Sun to part shade April-May. Blk fruit in	6-9 ft. White fls.
<i>Asimina triloba</i>	Pawpaw	Shade to part shade/Wet to mesic	20-30 ft. Reddish- purple fls. March-May; edible fruit in Sept.

## Native Shrubs and Small Trees

Scientific Name	Common Name	Light & Moisture Requirement	Height, etc.
<i>Cephalanthus occidentalis</i>	Buttonbush	Sun to part shade Wet to mesic	provides food for birds and mammals; larval food plant for Zebra swallowtail butterfly 6-10 ft. White fls. June-Aug.; favorite nectar plant for butterflies
<i>Cornus amomum</i> ssp. <i>obliqua</i>	Swamp dogwood	Sun to shade Wet to mesic	8-10 ft. white fls. May-July; blue fruit in late summer provides food for many birds
<i>Cornus racemosa</i>	Gray dogwood	Shade to part shade/Wet to mesic	6-10 ft. white fls. on red stem May-July; white fruit late summer; food for many birds
<i>Euonymus atropurpureus</i>	Eastern wahoo	Shade to part shade/Wet to mesic	10-15 ft. Purplish fls. May-June; attractive, rose-colored fruit Sept.-Oct. provides food for many birds
<i>Forestiera acuminata</i>	Swamp privet	Sun to part shade Wet	20-30 ft. Yellow fls. March-April
<i>Hamamelis vernalis</i> Wet to mesic	Vernal witch hazel fls. Jan-Feb.	Sun to part shade	8-9 ft. Fragrant yellow
<i>Hamamelis virginiana</i>	Eastern witch hazel	Sun to part shade Wet to mesic	6-10 ft. Fragrant yellow fls. Oct.-Nov.
<i>Ilex decidua</i>	Deciduous holly	Sun to part shade Wet to mesic	10-15 ft. White fls. April-May; red fruit in winter attracts birds
<i>Lindera benzoin</i>	Spicebush	Sun to part shade Wet to mesic	10 ft. Fragrant yellow fls. March-May; larval food for the spice bush swallowtail butterfly
<i>Ilex verticillata</i>	Winterberry	Sun to part shade Wet to mesic	6-12 ft. White fls. April-May; red berries in fall attract birds
<i>Itea virginica</i>	Sweetspire	Sun to part shade	6-10 ft. Fragrant white

Scientific Name	Common Name	Light & Moisture Requirement	Height, etc.
<i>Rosa setigera</i>	Prairie rose	Wet to mesic Sun/Wet to mesic	fls. May-June; excellent red fall color 6-10 ft. Pink fls. June-Aug.; long- arching branches
<i>Sambucus canadensis</i>	Elderberry	Sun to part shade Wet to mesic	6-10 ft. White fls. clusters June-July; black fruit in late summer attracts birds
<i>Betula nigra</i>	River birch	Sun to part shade Wet to mesic	To 40 ft. Produces catkins in spring; attractive exfoliating bark
<i>Celtis laevigata</i>	Sugarberry	Sun to part shade Wet to mesic	50-90 ft. Fls. inconspicuous; dark fruit in fall provides food for birds and small mammals
<i>Nyssa aquatica</i>	Water tupelo	Sun to part shade Wet to mesic	50-80 ft. Fls. inconspicuous; dark fruit in fall provides food for birds and mammals

### Native Shrubs and Small Trees

<p><i>Quercus bicolor</i></p> <p>Swamp oak</p> <p>Sun/Wet to mesic</p> <p>food for mammals</p> <p>50-80 ft. Fls. inconspicuous; pro duces acorns that are</p>			
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Local Ecotype Native  
Seed and Plant Sources

Native Nurseries

Bowood Farms  
4605 Olive St.  
St. Louis, MO 63108  
(native and non-native perennials,  
grasses, trees and shrubs)  
314-454-6868  
[www.bowoodfarms.com](http://www.bowoodfarms.com)

Bluestem Prairie Nursery  
13197 E. 13th Rd.  
Hillsboro, IL 62049  
(sedges, rushes, grasses and perennials)  
217-532-6344

Forrest Keeling Nursery  
P.O. Box 135  
Elsberry, MO 63343  
800-356-2401  
(native trees and shrubs, several oaks) [www.fknursery.com](http://www.fknursery.com)

Hamilton Seeds and Wildflowers  
16786 Brown Rd.  
Elk Creek, MO 65464  
(Bulk prairie and savanna seed and plants)  
417-967-2190  
<http://www.hamiltonseed.com/>

Missouri Dept. of Conservation  
P.O. Box 119  
Licking, MO 65542  
(native tree and shrub seedling bundles,  
mail order)  
800-669-3787

Missouri Wildflowers Nursery  
9814 Pleasant Hill Rd.  
Jefferson City, MO. 65109  
(Quart and plug containers and bulk  
prairie seed)  
573-496-3492  
<http://www.mowildflowers.net/>  
Prairie Hill Farm  
877 Country Rd. 263  
Auxvasse, MO 65231  
(Wetland plugs, quart containers and bulk prairie and wetland seed)  
573-387-4680

Pure Air Native Seed Co.  
2488 Prairie Grove Trail  
Novinger, MO 63559  
(Bulk prairie and savanna seed)  
660-488-6849  
[www.pureairseed.com](http://www.pureairseed.com)

## Rain Garden Design and Installation

Acorn Landscapes  
Mary Deweese RLA  
13 Forrester Dr.  
Manchester, MO 63011

Barker Horticultural Services LLC  
Simon Barker  
Clarksville, MO 63336  
573-242-3300

Cindy Gilberg  
2906 Ossenfort Rd.  
Wildwood, MO 63038  
314-630-1004

DJM Ecoscapes  
Jon Wingo  
Florissant, MO 63031  
314-974-4282

Intuition and Logic  
Mark Meyer  
Webster Groves, MO 63119  
314-432-2543  
[www.intuitionandlogic.com](http://www.intuitionandlogic.com)

Landscapes Alive  
Dianne O'Connell  
St. Louis, MO 63129  
314-892-8989  
New Urban Landscaping  
W. John Nekola  
Kirkwood, MO  
314-457-9936  
314-517-6053 cel.

Plantasia  
Karlene McAllister  
St. Louis, MO  
314-961-7515

## Web Site Resources

Shaw Nature Reserve  
[www.shawnature.org](http://www.shawnature.org)

Grow Native! Missouri  
 Department of Conservation  
[www.grownative.org](http://www.grownative.org)

Wild Ones Natural Landscapers  
[www.for-wild.org](http://www.for-wild.org)

Applied Ecological Services  
[www.appliedeco.com](http://www.appliedeco.com)

Rain Gardens of West Michigan  
[www.raingardens.org](http://www.raingardens.org)

Rain Garden Network  
[www.raingardennetwork.com](http://www.raingardennetwork.com)

Local Ecotype Seed  
<http://www.forwild.org/download/LocalEcotypeBrochure.pdf>

Ten Thousand Rain Gardens  
[www.rainkc.com](http://www.rainkc.com)

Hinkson Creek Watershed  
[www.helpthehinkson.org](http://www.helpthehinkson.org)

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 Fish and Wildlife Service; University of Missouri,  
 Columbia, MO 65211

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 Grow Native! Missouri Department  
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Prairie Raingardens: Joining Habitat  
 Restoration and Watershed Health  
 by Scott Hamilton. Winter 2005. Missouri Prairie

Journal Vol. 26, Number 1. Pg. 12-17.

Rain Gardens  
 by Janet Marinelli. Spring 2004. Brooklyn Botanic  
 Garden Plants & Gardens News,  
 Vol. 19, Number 1

Rain Gardens – A How-to Manual for  
 Homeowners  
 by Roger Bannerman and Ellen Considine. 2003.  
 University of Wisconsin-Extension and Wisconsin  
 Department of Natural Resources. (This pub-  
 lication can be viewed and printed from pdf  
 format at Rain Gardens – A How-to Manual for  
 Homeowners PDF)

Raingardens: A Return to the Natural Ways  
 by Barbara Perry Lawton. Nov/Dec 2005.  
 The Gateway Gardener. Pg. 4

Water Plants for Missouri Ponds  
 by James R. Whitley, Barbara Bassett, Joe G.  
 Dillard and Rebecca A. Haefner. 1999.  
 Missouri Department of Conservation



The Landscaping Guide is a collaborative effort between Shaw Nature Reserve and the Missouri Department of Conservation's Grow Native! Program.



