

***RAIN GARDEN
LANDSCAPE DESIGN
MANUAL***

The natural solution to stormwater pollution



south zumbro watershed partnership

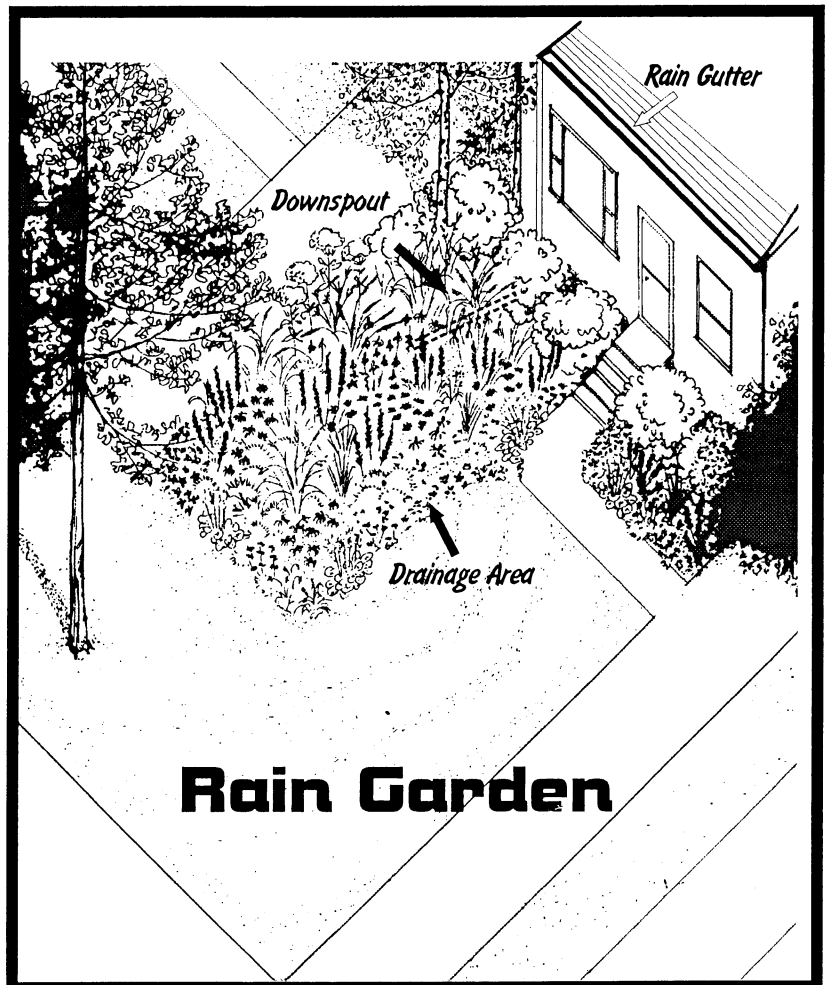


WHAT IS A RAIN GARDEN?

Every time it rains, gallons upon gallons, of polluted runoff flows from our yards, sidewalks, and driveways into storm sewers or road ditches. This polluted runoff is carried as conduit flow directly into our lakes, rivers, and streams. You don't think about it but around every home and yard there are spots of pollutants on the landscape that are waiting to be washed away. Nutrients are found around the yard as lawn fertilizer, grass clippings, and pet waste left on the landscape. Heavy metals and complex organic compounds are deposited in the lawn from roofing materials, metal plating in downspouts, and pesticide applications. Even exposed soil on the landscape can wash down storm sewers causing sedimentation problems in surface waters. The runoff carrying pollutants from our yards may not cause much harm but the pollutants washing into our storm sewers and drainage ditches from all of our yards has a cumulative effect on our water resources.

Rain Gardens use native and locally adapted plants to retain and treat stormwater on the landscape before it reaches a storm drain or road ditch. The plants used in Rain Gardens have deep root systems which allows them to retain runoff and filter pollutants in stormwater. Basically, the plants capture and treat runoff from your yard and allows the water to infiltrate into the subsurface rather than having it flow across the landscape as stormwater where it has the ability to pick up additional pollutants. Rain Gardens are placed at the end of downspouts or in low-lying areas of a yard where water collects. The native and locally adapted plants used in these gardens are able to tolerate a mix of dry and wet conditions and even prosper when they are regularly flooded. These gardens are cost effective, too. Rain Gardens require less maintenance than your typical turfgrass. This means less mowing, no watering, and no fertilizer or pesticide applications. They can also provide a great habitat for birds and butterflies.

Rain Gardens are a way of using nature to protect our natural resources. They are attractive landscapes that treat and filter stormwater.



Several communities around the nation and in Minnesota are promoting the use of Rain Gardens for the purpose treating urban stormwater. The city of Maplewood, a northern suburb of St. Paul, used Rain Gardens to retrofit a 1950's era subdivision during a street resurfacing and storm sewer construction project. The city used the gardens to downsize storm sewer piping and street gutters in a suburban neighborhood that was under construction. The University of Minnesota estimated a cost saving of \$13,000 for the community in the two-block area where the residents installed Rain Garden amenities rather than using the conventional stormwater system approach that uses street gutters and underground piping.¹ In addition, the neighborhood was interested in protecting a downstream wetland from pollutants associated with urban runoff. The existing piping from the storm sewer system emptied near an existing wetland complex. The gardens will benefit the wetland area by allowing runoff water to infiltrate into the subsurface rather than directing it towards the sensitive ecosystem. Rain Gardens provided the city of Maplewood with an overall cost saving and assisted the neighborhood with an environmental alternative to reduce pollution

into a sensitive body of water. Prince George's County, in eastern Maryland, promotes the use of Rain Gardens for new development projects. It is part of the County's comprehensive stormwater management program for new subdivisions.

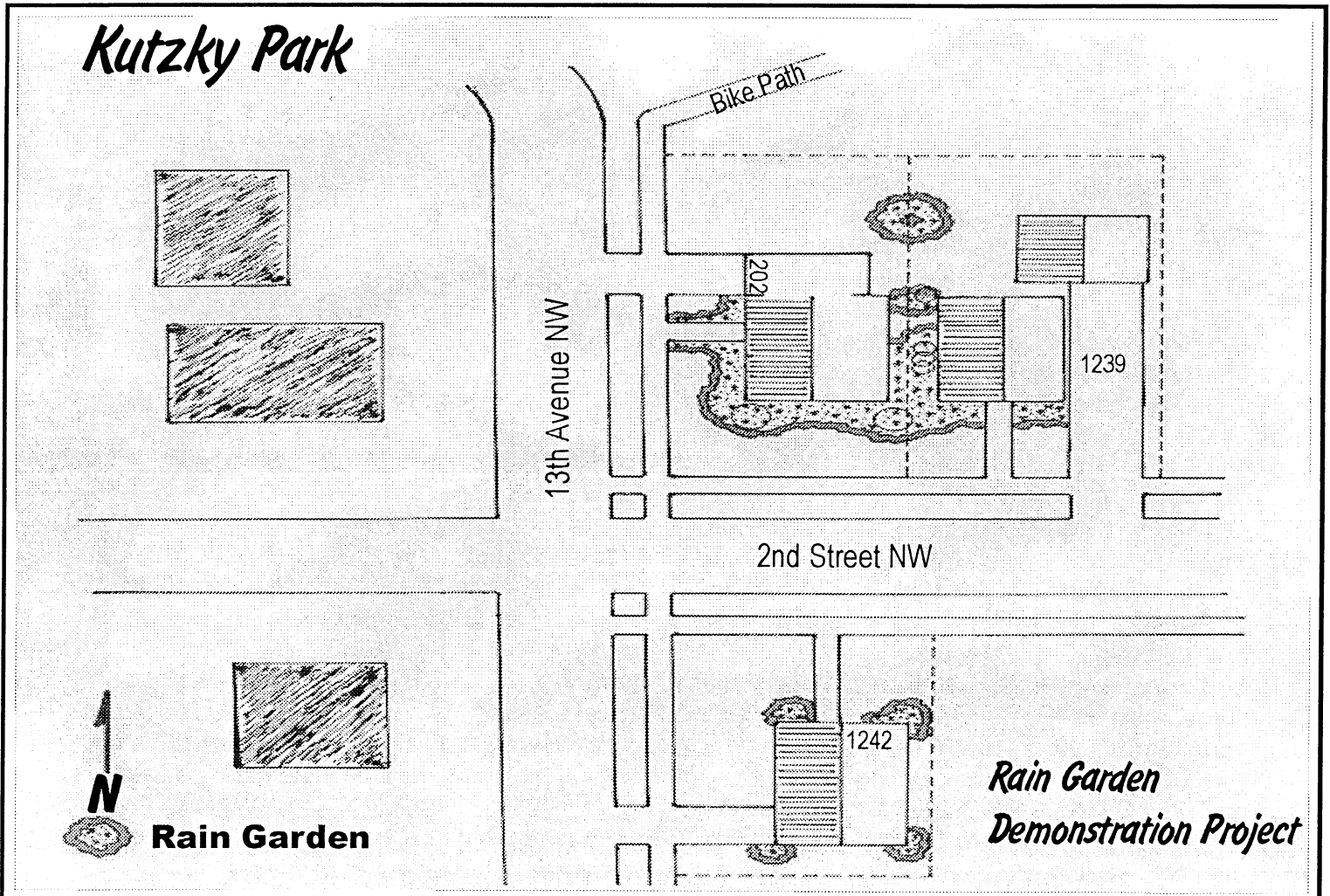
A GUIDE FOR CITIZENS

The purpose of this manual is to assist homeowners, landscape designers, engineers, water planners, and landscape contractors in understanding and applying basic Rain Garden design principals to home landscapes. The use of this manual is intended to illustrate how you can retrofit your yard or install a Rain Garden in a new development project in order to make the landscape more attractive while benefitting the local environment. A yard planted with a Rain Garden receives many benefits: it enhances watershed ecology, restores native plant communities, and contributes to biodiversity. Rain Garden amenities bring real nature, with real ecological meaning, back to urban environments.

DEMONSTRATION SITE

In the fall of 2000, the South Zumbro Watershed Partnership funded a Rain Garden demonstration project in the Kutzky Park Neighborhood in Rochester. The purpose of the demonstration site is to have a working model that illustrates the concept and functions of these gardens and to allow homeowners to take ideas back their own properties.

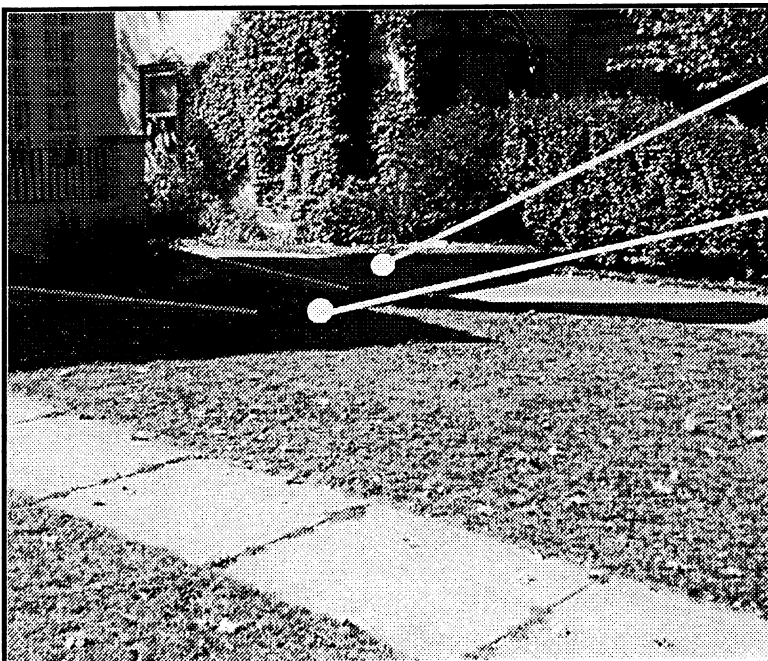
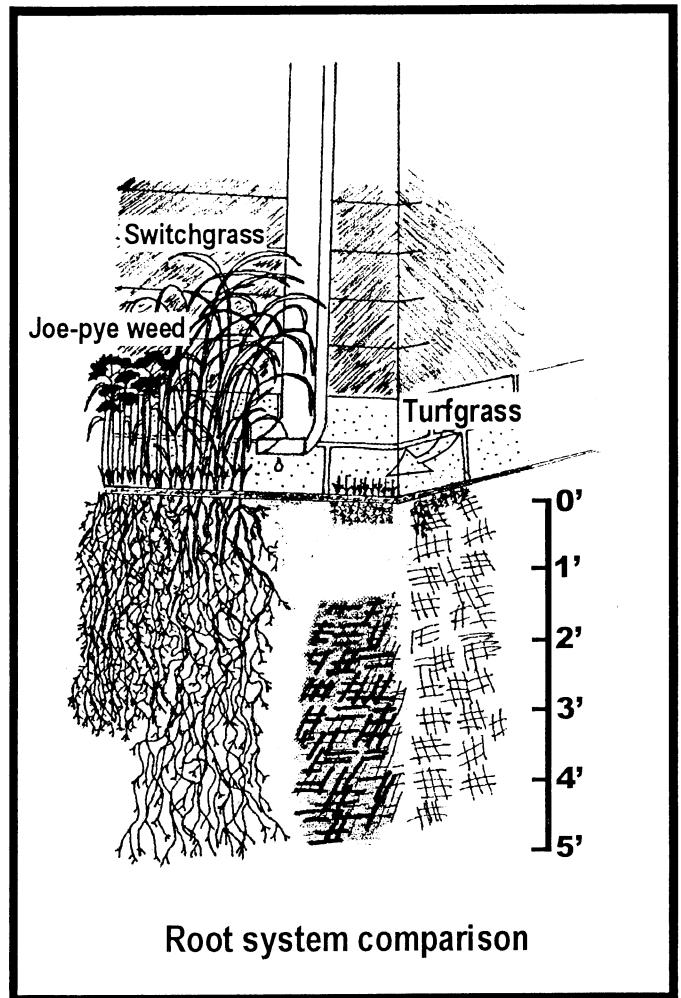
The demonstration project features three homes near the Kutzky Park entrance, located at the intersection of 2nd Street and 13th Avenue Northwest. This area was selected for the project based on the following: (1) its proximity to Cascade Creek, (2) high pedestrian and motor traffic, (3) represented a typical urban landscape, and (4) an active and supportive neighborhood association. The first stage in the demonstration project was to identify the wet areas of the sites and identify the downspouts and their location. The next



step was to developed a design plan using the plant list identified for our area and a “reading” of the landscape. The final stage was installation of the plants and ground cover material, and the redirection of the downspouts away from hard surfaces towards the Rain Gardens.

Most of the lots in the neighborhood are typical of older downtown settings. The majority of the area is comprised of hard surfaces (homes, driveways, and sidewalks) with little green space to treat or retain stormwater. The average lot size is about 7,000 square feet with the majority of the yard established in turfgrass. Downspouts are usually pointed into small front or back yard areas or onto driveways. During rain events the runoff water from the property is pushed out of the downspouts into the small turfgrass areas or onto the driveways where the stormwater is able to pick up additional pollutants as it makes its way to the nearest storm drain.

Traditional lawn grasses, such as the common Kentucky bluegrass, do not allow for as much infiltration or treatment of runoff water as compared to the deep rooted native and locally adapted plants that are used in Rain Gardens. Traditional turfgrasses have root systems that reach between 4 to 8 inches while the grasses and forbs installed in these gardens have root systems that expand down between 1.5 to 8 feet. The role of the plant species in these gardens is to remove the excessive nutrients and pollutants in the runoff and take up the extra water in the soil through evapotranspiration. While filling this role, plants must be low maintenance, tolerate urban stresses, and prosper when they become regularly flooded. The plant species recommended for Rain Gardens in our Ecoregion are detailed on starting on page 10. These plants are native to the area or have adapted to the local climate. They have been shown to tolerate urban runoff, endure wet and dry moisture regimes, and remove pollutants from stormwater.



Downspout directed towards pavement

Runoff water can pick up oil, antifreeze, gasoline, fertilizer, metals from your car, de-icing material and litter.

Downspout directed towards turfgrass

Traditional lawn grasses allow for some water to soak into the subsurface and treatment of the stormwater, however it does not provide as much infiltration or treatment as a Rain Garden. For one thing, turfgrasses have short root systems as compared to Rain Garden plants. Also, the soils in urban areas with turfgrass covers tend to become more compacted over time. This compaction leads to poor health of the grass and allows for runoff water to flow over the top of it, acting almost like pavement. Runoff water flowing into turfgrass can pick up fertilizer, pesticides, grass clippings and pet waste.

THE DESIGN PROCESS

Developing a Rain Garden on your property should not be complicated or a scientific undertaking. With a simple understanding of the landform, soil, plant community, water, and climate characteristics, you can confidently work in harmony with the natural factors of your site to create Rain Garden amenities. The design process for a Rain Garden can be used by individuals who may be changing or redoing their landscape for an existing home property as well as those who may be planning to build a new home. The process to be followed and the principals to be considered are similar in both cases. An understanding of environmental influences, design principals, and the basic design process will help you create a functional and easy-toinstall Rain Garden.

The first stage in the design process includes a survey and analysis of your site, and construction of a design. Before developing a design for your lawn, study the site carefully, considering the following points: (1) current property conditions, (2) topographic and drainage features, (3) flow of water across the landscape, (4) quality of the soil, and (5) summer shading conditions. A logical, step-by-step approach, combined with a clear understanding of the project, can greatly improve the usefulness of the design and function of your landscape.

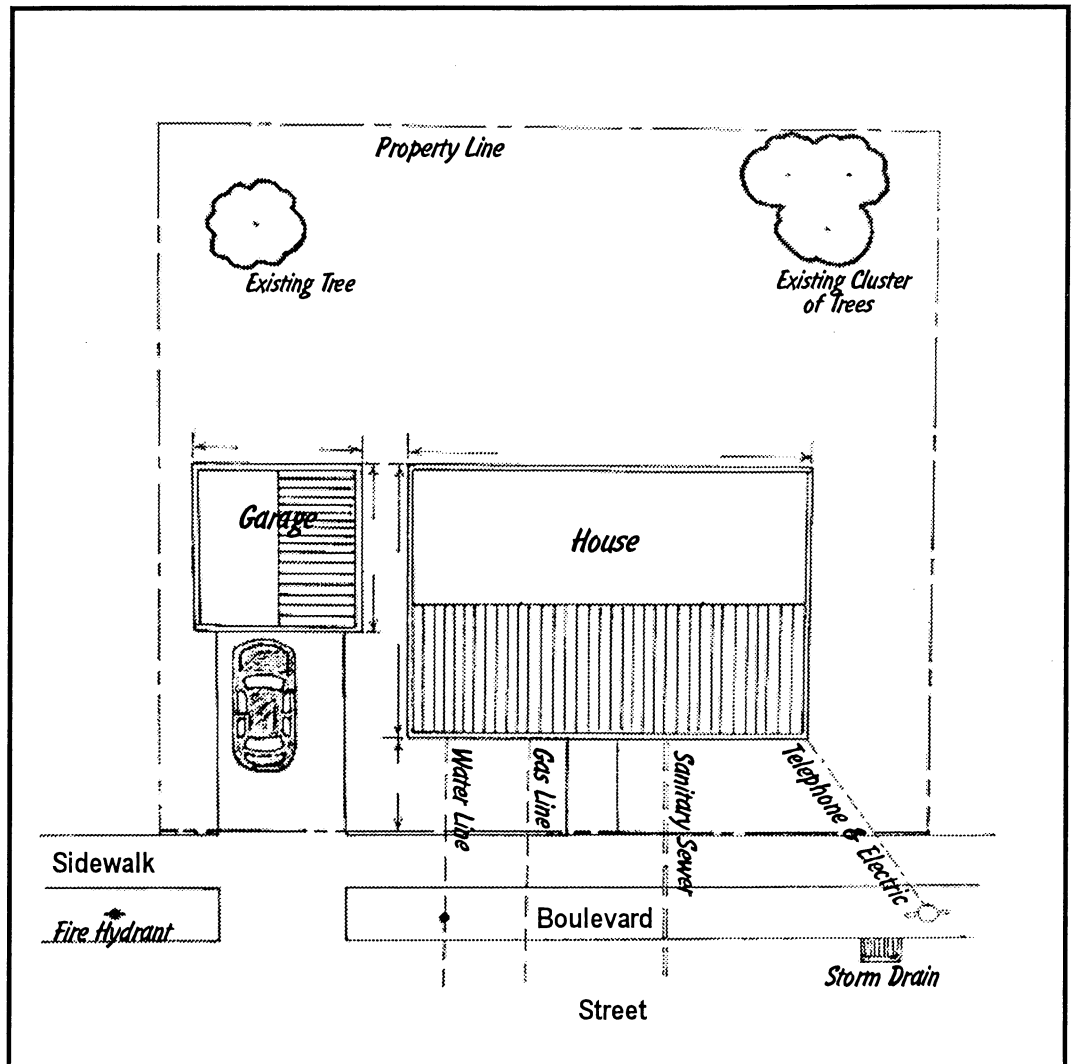
STEP 1 - SURVEY YOUR SITE

To understand the characteristics of your property, you need to study the existing framework of your site. It is important to understand the man-made elements of your property including buildings, walls, fences, paving, and underground/overhead utilities. Using a piece of paper, identify and mark the existing conditions of your property. Field measurements should include all existing natural and man-made elements such as trees and shrubs, structures, paving, overhead and buried utilities, and wet areas.

PLANTS: trees, scrubs, lawn, ground cover	
EXISTING STRUCTURES	
UTILITIES: poles, lines, pipes, below ground	
PAVEMENT: driveway, sidewalks, paths	
PROPERTY LINES	
LOCAL ORDINANCES*	

* City of Rochester requires a permit for any plantings in the boulevard. You can obtain a permit by calling Rochester Park & Rec at 281-6160.

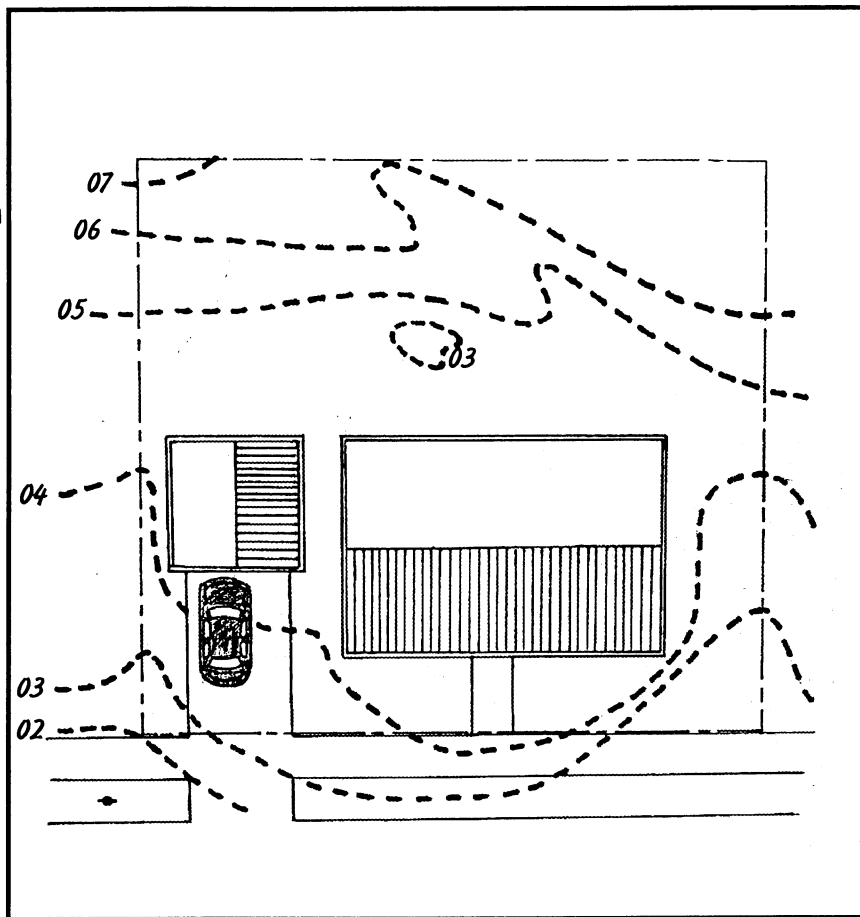
Call before digging to locate underground utilities. You can reach Minnesota Gopher State One at 1-800-252-1166. Call 48 hours in advance.



LANDFORMS

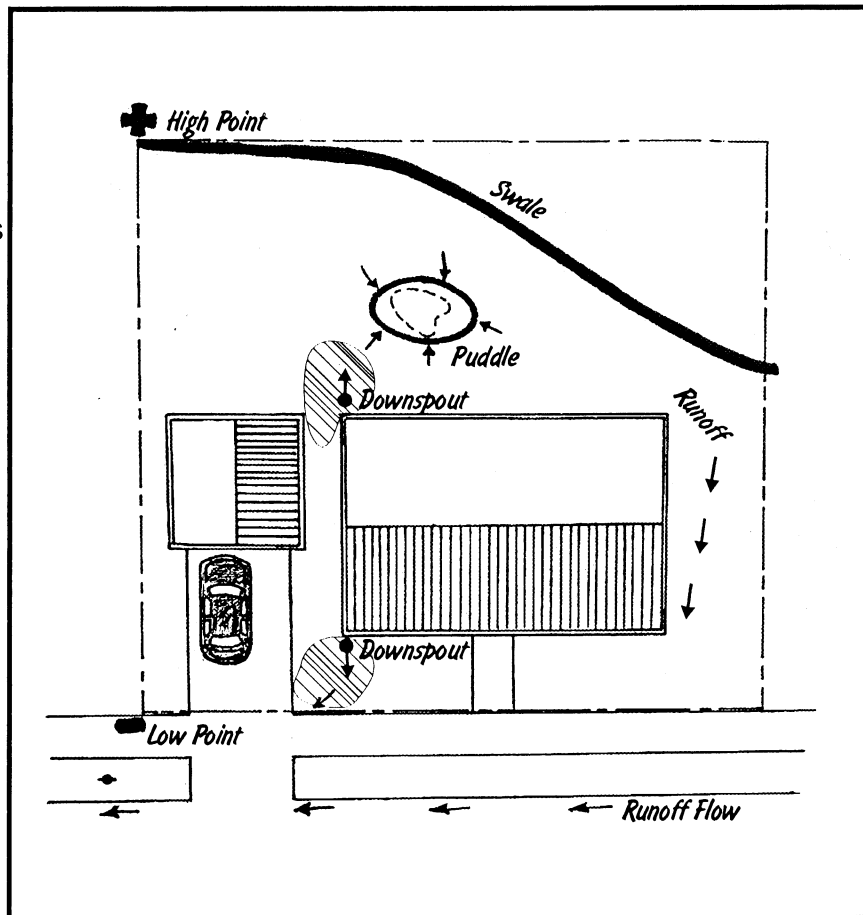
The form of the land or topography largely determines the layout of your landscape. The steepness or flatness of your property determines the drainage pattern of the site. It also influences the design pattern of your Rain Garden. Use a line level, string line or your eyes to approximate the grade change of your site. Note the high and low points of your property and locate any slopes or depressions.

Two-foot contour maps can be requested by calling the South Zumbro Watershed Partnership at 285-8982.



FLOW OF WATER

Understanding the natural water system of a site is of major factor in creating a functioning Rain Garden. During a rainfall, plot the areas of runoff concentration and follow the water to where it leaves your property. Note the location of the downspouts, puddles, and lines that divide areas of separate runoff direction. After the rainfall, identify the areas that are poorly drained. This includes all areas of standing water on your lawn. Measure the area and direction of runoff flow from your downspouts.

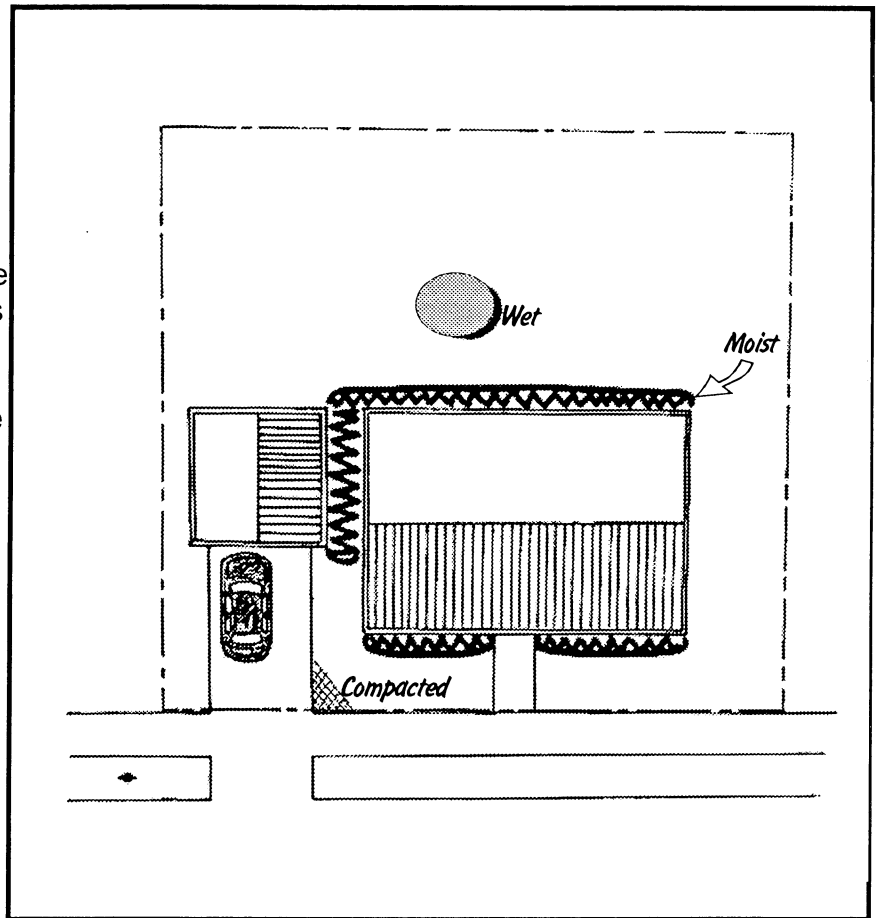


SOILS

An understanding of the soils on your site is a factor in determining the character of the landscape. The proportion of major components of soil - clay, sand, silt, and organic matter - will determine the porosity, water holding capacity, and general physical quality of your lawn. You can easily determine the quality of your soil by identifying the plants and wet areas of your landscape. If you would like to find out more about the water dynamics of your soil, the information on page 19 will assist you. To increase your general understand of your soils, you can also purchase a soil test kit that measures the phosphorus, potassium, organic matter, and pH levels in your lawn.

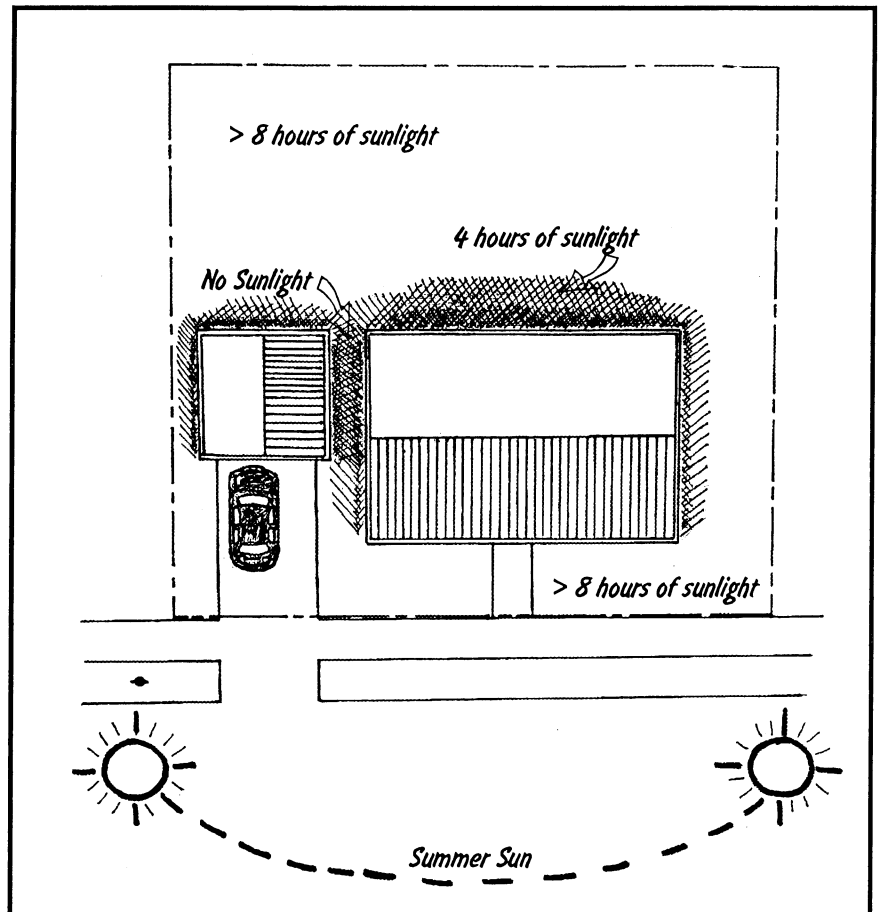


For more information about purchasing a soil test kit or for assistance with plant identification, please call the University of Minnesota Extension Service at 285-8250.



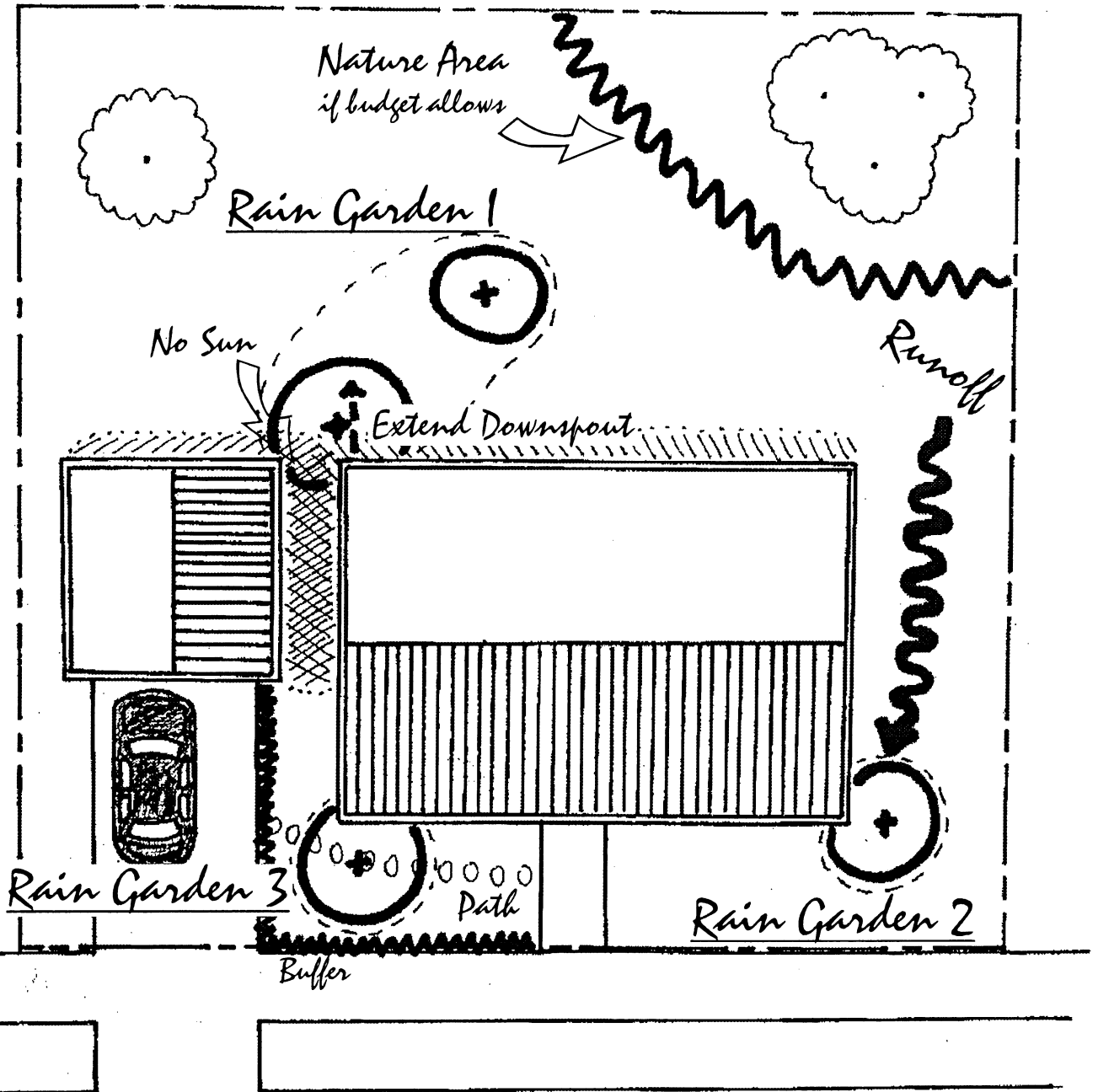
CLIMATE

Whether you are making changes in an existing home or siting a new one, your plans should include consideration of solar orientation and identifying areas of partial or full shading. Determine the angle of summer sunlight by marking the areas of shade around your property. Plants grow best when they obtain their optimal sunlight. Some plants prefer a full eight hours of sun while others do best in full shade with no direct sunlight. The type of plants you use in your Rain Gardens will be determined by the amount of light the area receives. For further site study, you can also locate the direction of prevailing summer and winter winds. This might help you determine location for other landscape features such as windbreaks.



STEP 2 - ANALYZE THE SITE

The most important part of site analysis is to determine the natural and man-made factors that are really important to the layout of your property. Analyze your property survey, let the site dictate the placement of the Rain Gardens. Knowledge about the landforms, water conditions, soils, and climate of your site will facilitate the overall layout of your design.



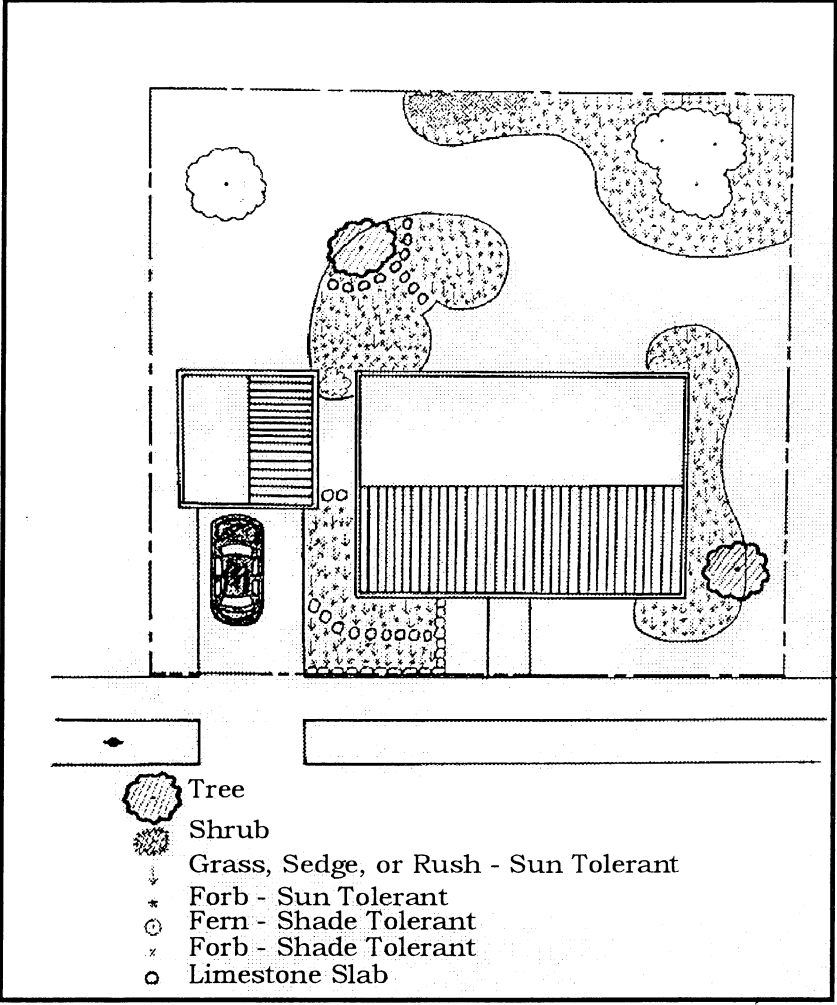
STEP 3 - DEVELOP A DESIGN PLAN

Develop the concept plan and determine where plants are needed to treat and filter the runoff from your property. The plants should be located in the wet areas of your site in order to provide a real functioning landscape.

Begin by identifying the wet areas of your property and drainage area from your downspouts. Next, determine the types of plants that can be used for those specific locations. What works well is to identify the quantity and variety of species you will need. Use the measurements in your site analysis to develop the plan. Take the measurements of the wet areas using square feet and design the Rain Garden for one plant per 1.5 square feet. By dividing, you will know how many plants you will need. In your planting design you can mix the grasses and forbs by spacing the grasses about 3 feet apart then fill in the area with an array of different forbs between them.

Try to plan for a mix of one-half grasses and one-half forbs and plant as many different species as you can purchase. This variety will ensure a better functioning landscape and provide for a continuous bloom throughout the summer. The forbs will establish a show of color and attract birds and butterflies. If you have a favorite species you can plant extra but remember to plant it in the right type of setting where it typically grows. The plant list (pages 10-14) will help you make these decisions. Remember, no matter how carefully you place the plants, nature will most likely rearrange some.

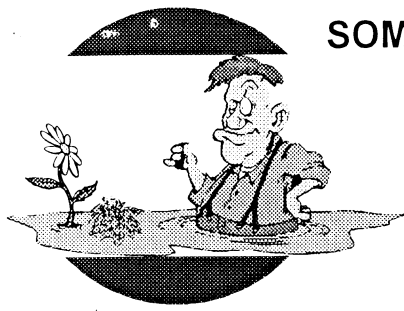
FINAL DESIGN PLAN



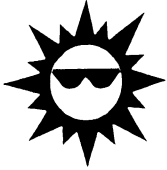
Woody plantings can also be added to your gardens; however they should be used sparingly. Trees and shrubs add to the overall character of garden and even enhances the potential of the site to attract wildlife. However, when planting them you must take into account the full spread of the plants when they reach their mature size. Shrubs should be planted about 6 feet apart. Also, design an understory of shade-tolerant grasses and forbs below the trees and shrubs.

The importance of design and planning can not be stressed enough. To meet your needs and avoid frustration, a little planning goes a long way. With a good design, you can budget, determine the amount of time it will take to prepare the site and install the plants, and guide the development of a desirable and functioning landscape.

SOME SUGGESTED PLANTS FOR RAIN GARDEN PROJECTS



Plants for Poorly Drained Sites



Plants that need full sun at least 8 hours per day

FORBS

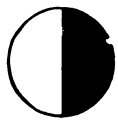
Common Name	Scientific Name	Spacing (ft)	Height (ft)	Flower Color	Blooming Time
Turtlehead	Chelone glabra	2	1-3	White	July - September
Marsh milkweed	Asclepias incarnata	2-3	3-4	Pink	June - August
Marsh marigold	Caltha palustris	1.5	0.5-2	Yellow	April - June
Panicled aster	Aster lanceolatus (simplex)	2-3	2-4	White	August - October
Joe-pye weed	Eupatorium maculatum	3	3-6	Pink	July - September
Greenhead coneflower	Rudbeckia laciniata	3	3-10	Yellow	June - July
Rough blazing star	Liatris aspera	1.5	1.5-4	Rose	August - Sept.
Riddell's goldenrod	Solidago riddellii	1.5	2-4	Yellow	July - September
Black-eyed susan	Rudbeckia hirta	1.5	1-3	Golden	July - August

GRASSES, SEDGES, AND RUSHES

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Notes
Big blue stem	Andropogon gerardii	3	3-7	Bronze fall color
Switchgrass	Panicum virgatum	2-3	3-5	Gold fall color and clump-forming
Blue joint grass	Calamagrostis canadensis	1	3-6	Flowers in the fall
Bottlebrush grass	Elymus justrix	1	2-4	Use at the edge of trees or shrubs
Crested sedge	Carex crisatella	2	1-2	Clump-forming
Bebb's sedge	Carex bebbii	1	1-2	Fine textured
Fox sedge	Carex vulpinoidea	1.5	1-3	Easy to grow from seed
Soft rush	Juncus effusus	1-2	2-4	Dark green stems; forms clumps
Path rush	Juncus tenuis	1	2	Tolerates drought, compacted soils

TREES AND SHRUBS

Common Name	Scientific Name	Height (ft)	Notes
Black ash	Fraxinus nigra	50-75	Golden-yellow fall color
Silver maple	Acer saccharinum	75-100	Yellow fall color and fast growing
River birch	Betula nigra	50-70	Golden-yellow fall color; exfoliating bark
Gray dogwood	Cornus racemosa	6-15	Maroon fall color
Redosier dogwood	Cornus sericea (stolonifera)	6-12	Red limbs in winter
Highbush Cranberry	Viburnum trilobum	6-15	Red fruit holds through winter



Plants that need part sun at least 4 hours per day

FORBS

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Flower Color	Blooming Time
Boltonia	Boltonia asteroides	3	4-8	White	August - Sept.
Fireweed	Epilobium angustifolium	3	2-6	Magenta	June - August
Great St. John's wort	Hypericum pyramidatum	1	2-4	Yellow	July - August
Michigan lily	Lilium michiganense	2	2-6	Orange	July - August
Blue cohosh	Caulophyllum thalictroides	2-3	1	Yellow	May - June
Bottle gentian	Gentianna andrewsii	1	1-2	Blue	August - October
Stargrass	Hypoxis hirsuta	1	1-2	Yellow	May - June
Blue-eyed grass	Sisyrinchium campestre	1	1	Blue	May - June
Ironweed	Vernonia fasciculata	2-3	2-6	Magenta	July - September

GRASSES AND RUSHES

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Notes
Indian grass	Sorghastrum natans	2-3	3-5	Gold-brown fall color
Prairie dropseed	Sporobolus heterolepis	1-2	2-4	Bronze fall color; fountainlike clumps
Mexican satin grass	Muhlenbergia mexicana	1	1-3	Gold fall color
Canada wild rye	Elymus canadensis	1	2-3	Showy spikes
Wood rush	Luzula acuminata	1	1.5	Clump-forming
Soft rush	Juncus effusus	1-2	2-4	Dark green stems; forms clumps

TREES AND SHRUBS

Common Name	Scientific Name	Height (ft)	Notes
Red maple	Acer rubrum	40-60	Red-yellow fall color
Paper birch	Betula papyrifera	40-50	Yellow fall color; prefers cool soil
Swamp white oak	Quercus bicolor	75-100	Nice summertime color; poor fall color
White ash	Fraxinus nigra	60-70	Orange fall color
Nannyberry	Viburnum lentago	15-35	Purple-red fall with black fruit
Downy Arrowhead	Viburnum rafinesquianum	3-6	Maroon-purple fall color



Plants that require full shade (no direct sunlight)

FORBS AND FERNS

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Flower Color	Blooming Time
White baneberry	Actaea pachypoda	1.5-2	1-3	White	May - July
Cardinal flower	Lobelia cardinalis	1.5	2-4	Red	July - September
Spring beauty	Claytonia virginica	0.5	0.5	Pink	April - May
White trout lily	Erythronium albidum	1	1	White	April - May
Jacob's ladder	Polemonium reptans	1	1	Pale Blue	May - June
Jack-in-the-pulpit	Arisaema triphyllum	1	0.5-2	Brown	April - June

FORBS AND FERNS (Continued)

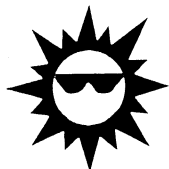
Common Name	Scientific Name	Spacing (ft)	Height (ft)	Flower Color	Blooming Time
False Solomon's seal	Smilacina racemosa	1.5-2	1-2	Cream	May - June
Heart-leaved aster	Aster cordifolius	1	1-2	White	June - August
Lady fern	Athyrium angustum	1-2	1-3		
Ostrich fern	Matteuccia struthiopteris var. Penslyvanica	3	2-4		
Cinnamon fern	Osmunda cinnamomea	3	3-4		

TREES AND SHRUBS

Common Name	Scientific Name	Height (ft)	Notes
Winterberry	Ilex verticillata	3-12	Yellow fall color; red berries in fall and winter
Bunchberry	Cornus canadensis	0.5-1	White flowers with red berries
Redberry elder	Sambucus pubens	8-10	White flowers with summer red fruits



Plants for Well Drained Soils



Plants that need full sun at least 8 hours per day

FORBS

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Flower Color	Blooming Time
Prairie sage	Artemisia ludoviciana	3	1-3	Yellow-green	July - September
Aromatic aster	Aster oblongifolius	2-3	1-2	Purple	August - Sept.
Purple prairie clover	Dalea purpureum	1	1-2	Purple	June - July
Bracted spiderwort	Tradescantia bracteta	1	1-2	Blue	June
Maximilian sunflower	Helianthus maximiliani	5	2-9	Yellow	August - October
Dotted blazing star	Liatris punctata	1	0.5-1	Rose	August
Woodland sunflower	Helianthus strumosus	3	2-6	Golden	August - Sept.
Gray goldenrod	Solidago nemoralis	1-2	1-2	Yellow	August - Sept.

GRASSES

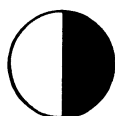
Common Name	Scientific Name	Spacing (ft)	Height (ft)	Notes
Little bluestem	Schizachyrium scoparium	1-2	1-3	Copper-red fall color
Sideoats grama	Bouteloua curtipendula	1	1-3	Not competitive with taller grasses
Blue grama	Bouteloua gracilis	1	1	Not competitive with taller grasses

GRASSES (Continued)

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Notes
Hairy grama	Bouteloua hirsuta	1	1	Not competitive with taller grasses
Junegrass	Koeleria macrantha	1	1.5	Not competitive with other species
Kalm's bromegrass	Bromus kalmii	1	1-3	Bronze flowers; high pH soils

TREES AND SHRUBS

Common Name	Scientific Name	Height (ft)	Notes
Hawthorn	Crataegus mollis	15	Small tree with fall fruit
Bur oak	Quercus macrocarpa	70-80	Yellow-brown fall color
Red cedar	Juniperus virginiana	20-60	Yellow fall color; neutral to acidic soil conditions
Wild plum	Prunus americana	10-15	Spring bloom; fruit used in jellies
Old field juniper	Juniperus communis var Depressa	2-6	Evergreen; good in shallow soils
Western snowberry	Symphoricarpos occidentalis	2-4	Pink flowers; spreads nicely on dry sites



Plants that need part sun at least 4 hours per day

FORBS

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Flower Color	Blooming Time
Rue-anemone	Anemonella thalictroides	0.5	0.5-1	White	April - June
Pussytoes	Antennaria neglecta	1	0.5	White	April - June
Butterfly weed	Asclepias tuberosa	2	2	Orange	June - August
Whorled milkweed	Asclepias verticillata	1.5	1	White	June - August
Heath aster	Aster ericoides	2-3	1	Blue	September
Harebell	Campanula rotundifolia	1	1-2	Blue	June - September
Stiff goldenrod	Solidago rigida	1	1-5	Yellow	August - Sept.
Starry Solomon's seal	Smilacina stellata	1	1	Cream	May - June
Rough blazing star	Liatris aspera	2	2-4	Rose	July - September

GRASSES AND SEDGES

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Notes
Porcupine grass	Stipa spartea	1	3-4	Not competitive with taller grasses
Sun sedge	Carex pensylvanica	1	0.5	Excellent ground cover for dry sites

TREES AND SHRUBS

Common Name	Scientific Name	Height (ft)	Notes
Ironwood	Ostrya virginiana	35-60	Yellow fall color; common understory tree
Black cherry	Prunus serotina	75	Red fall color; edible fruit
Pin cherry	Prunus pensylvanica	10-30	Yellow-red fall color; fruit used in jellies
American hazel	Corylus americana	8-15	Yellow fall color; edible nuts
American hornbeam	Carpinus caroliniana ssp Virginiana	20-30	Evergreen; good in shallow soils
Blueberry	Vaccinium angustifolium	2-4	Orange-red fall color; edible fruit



Plants that require full shade (no direct sunlight)

FORBS

Common Name	Scientific Name	Spacing (ft)	Height (ft)	Flower Color	Blooming Time
Wild sarsaparilla	Aralia nudicaulis	1-2	0.5-1	Green	May - June
Bearberry	Arctostaphylos uva-ursi	2-3	0.5	Pink	May - June
Wintergreen	Gaultheria procumbens	1.5	0.5	White	June - August
Wild oats	Uvularia sessilifolia	1	0.5	Yellow	April - May
Canada mayflower	Maianthemum canadense	1	0.5	White	May
Partridge-berry	Mitchella repens	2	0.5	White	June - July
Zig-zag goldenrod	Solidago flexicaulis	2	1-3	Yellow	May
Rose twisted-stalk	Streptopus rosues var longipes	2	0.5	White	May - July

TREES AND SHRUBS

Common Name	Scientific Name	Height (ft)	Notes
White oak	Quercus alba	60-80	Purplish-red fall color
Smooth juneberry	Amelanchier laevis	20-30	Orange fall color
Serviceberry	Amelanchier arborea	20-30	Great understory tree
Bush honeysuckle	Diervilla lonicera	1-4	Does well on shaded slopes
Snowberry	Symphoricarpos albus	3-6	White fruit; forms colonies

Most of the plants can be viewed at the National Plant Data Base Center website: <http://npdc.usda.gov/npdc/index.html>

Some plants can be viewed at the University of Minnesota Extension Service website: <http://www.sustland.umn.edu>

SITE PREPARATION AND PLANT INSTALLATION

Eliminating Turf

The first step in establishing a Rain Garden is to remove the turf, unwanted plants, or other material in the areas that you have identified for plant installation. Most areas will require the removal of turf. Removing the existing turfgrass will produce a more attractive site plus it reduces competition with your Rain Garden plants, and prevents the encroachment of weeds into your garden.

One method of turf removal is to directly dig up the sod using a shovel or a gas powered sod cutter. This method is labor intensive, but very effective in small areas of your lawn. When cutting sod, your blade should be placed so that it reaches the roots of the grass. Any turf roots or fragments left behind may regenerate and sprout, making your site weedy and less unattractive. Avoid trampling the site too much during the removal process. Once the soil becomes too compacted, plants are difficult to establish because oxygen is forced out of the area making it difficult for the root system to collect air. Cut sod should be composted on-site or used to fill in open soil areas of your lawn. If you only have a few strips of sod, the Olmsted County Composting Facility will accept it on a limited basis.

A second method of turf removal avoids the heavy work but requires patience. You can smother your turfgrass with black polyethylene plastic, or old carpet. Stake the material down over the turf, and leave it in place for one entire growing season (five to six months). It takes this long to kill the extensive root system of the grass. After this period, you can plant directly on the dead turf. If you are seeding, till the dead sod before spreading the seed. Leaving the grass in place will add valuable organic material to the soil and saves on the labor of hauling the dead sod around.

The last available option is to use an organic herbicide such as Scythe or Superfast Weed Killer to destroy the turfgrass. They are made from naturally occurring fatty acids and kill the plants by dehydrating the foliage. These herbicides are considered acceptable by most organic certification programs.² Roundup™,

a chemical herbicide, can also be used. However, use precaution when applying herbicides. Read the label carefully and dispose of the product properly. Consider the amount of turfgrass that you will need to kill before purchasing a herbicide. Most areas are small enough where mechanical measures will suffice; however for those large or hard to get at sites, herbicides provide an option for killing sod.

Use proper care when applying herbicides to an area. Herbicides tend to destroy any plant with which they come in contact with. It takes approximately 10 to 14 days for the turfgrass to die. If green areas remain after the two week waiting period, you can spot apply the herbicide. Wait a couple of days to plant in those areas where you spot applied the herbicide. Make sure the turf is completely eradicated before planting. You can plant directly on the dead turf and seeding will require that you till the area before spreading.

Soil Preparation

Limited soil preparation is required for establishing a Rain Garden. Incorporation of soil amendments are not needed for most Rain Garden plantings. In fact, the addition of peat moss, black dirt, and fertilizer could be detrimental in some locations. In some areas of your lawn, soil amendments can enrich the soil causing increased weed growth. However, additional soil amendments might be necessary in areas that receive little to no sunlight. A little compost or manure will add needed nutrients to these sites. Remember to spread the compost or manure evenly throughout the shaded area.

Downspouts

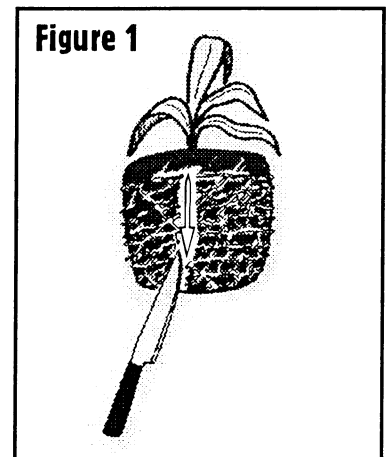
Downspouts should be directed towards your Rain Garden. Elbows can easily be redirected and extensions added to force the runoff water to specific areas of your lawn. Extensions to your downspouts can assist in moving the runoff water further from your house or a structure, and allow you to establish a Rain Garden further into your lawn. Elbows and extensions can be purchased at retail home centers or local hardware stores.

Planting

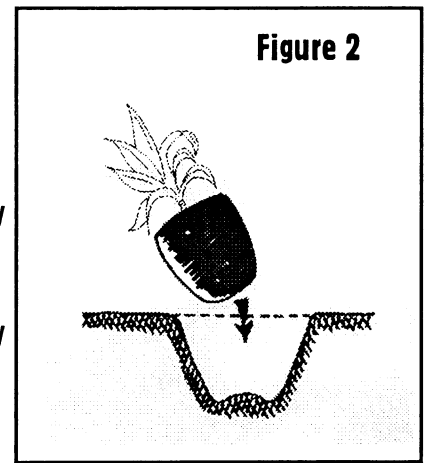
Before you disturb any ground for planting, make sure that you will be able to obtain your plants that you have selected. Some native plants can be difficult to obtain so begin by contacting your local garden centers early in the season. To protect the quality of your garden, it is best to purchase local-organ plants from area nurseries. This is especially true for native plants. The source of the native plants should not be more than 200 miles from Rochester. Native plants purchased from areas beyond this distance can have a different genetic makeup from the local species even though they look alike. The local plants have a built in balance with their environment and their companion species. When plants are taken out of their native region, they often have difficult time surviving and competing with the local species.³ A listing of local sources is provided on page 18.

Detailed planting instructions for your plants can be obtained from the nursery or garden center where you purchased the plants. Here are a few important points when planting a Rain Garden.

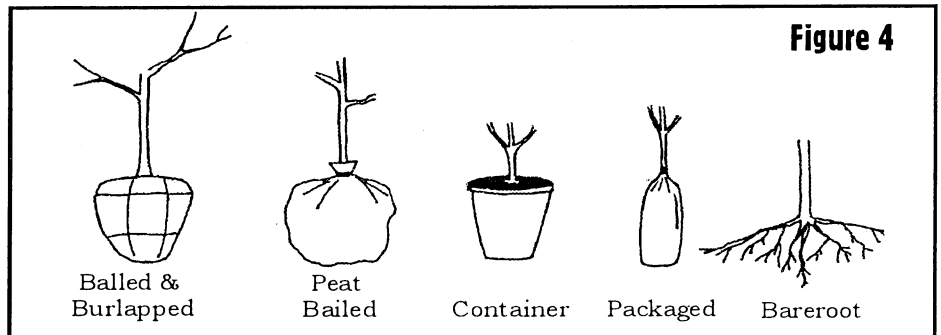
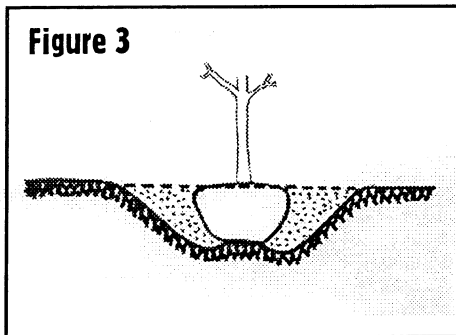
- ***Thoroughly soak the containerized plants before taking them out of their pots or cells. Dry roots when planted tend to repel water even when they are soaked after installation.***
- ***Native plants are often grown in containers called cell packs and usually form a mass of interwoven roots in their compartment. Gently pry apart the roots in the bottom half of the root ball. This will assist in stimulating root growth. For larger plants in pots, use a knife to cut the coiled roots around the edges in two or three places along the root ball. The knife should not be pressed too deep and should move down the sides of the root ball (Figure 1). This will encourage lateral root growth. If you have a massive root-bound plant, cut a very thin slice of the root mass of the bottom. You can also make an incision up root ball to the crown of the plant. The crown is point where the plant emerges from the soil.***
- ***When installing plants, first dig a wide hole that is not too deep. Remember that plants will establish quicker in large planting holes. The hole should be about twice as wide as the root ball. Within the hole***



create a small mound of soil. Break away the soil from the root ball to loosen the roots. Place the plant in the hole and bury (Figure 2) Firmly press the soil around the plant then water thoroughly. It is important to remember to soak the plants after installation. Poorly watered plants will not establish quickly or can even die if not watered properly. This is especially important on well drained sites. During the first season, your plants might need a little watering once a week if it does not rain. A good soaking once a week (a sprinkler in the garden for an hour) will assist in the development of the plants.



- **Trees and shrubs should be installed using similar methods as described above. Remember, plants will establish quicker in a large planting hole. The hole should not be too deep, but it should be at least two times as wide as the root ball. The hole should be shaped like a saucer, not as deep around the edges (Figure 3). After you plant your woody species, carefully fill in the hole. Add no more than 25 percent compost or backfill to the soil and water as you fill in the excavation. This will settle the soil, eliminate air pockets, and provides enough water to stimulate plant growth. During the rest of the summer, the plants will need to be checked often and watered when necessary. However, avoid over watering because you can drown the plant roots. A useful measure is to stick your finger about 2 inches into the soil, if they are dry water the tree or shrub thoroughly.**
- **Trees and shrubs can be purchased as bareroot, balled and burlapped (B&B), potted, packaged or peat balled (Figure 4). Bareroot plants tend to be less expensive than the other types of stocks and can make your project more affordable. However, precaution must be exercised when using bareroot trees and shrubs. Bareroot plants have had the soil washed from the roots after being excavated. Since there is no soil to keep the roots moist, the roots can dry out very quickly. They need to be stored in a cool, moist location, and roots covered in saw dust, damp straw, soil, or wet burlap when holding them on-site for planting. They are sold in the spring when dormant and must be planted before they leaf out and while temperatures are still moderate.**



Seeding

The major advantages to seeding your garden is that it is less expensive than installing plants and does not require as much labor. However, the garden will take more time to establish itself. It will take about three years for the Rain Garden plants to become established. By installing plants, you will have fully functioning Rain Garden by the first season.

- **Begin by tilling up the area that you have prepared (see eliminating turf on page 13). Make sure area is clear of roots from perennial weeds. Seed can be planted from early May to mid July. For the best results, plant from mid May to mid June. The use of moist stratified forb seed will improve germination during the springtime. Ask the nursery or garden center for assistance in determining the best planting conditions for each particular species when purchasing your forb seed. If the forb seed is sown untreated, it may not germinate until the following spring. Most grass species do not need to be moist stratified and can be planted with excellent results during the springtime.**
- **Fall planting in our area is from mid October to mid November. Native grass sown earlier than October may germinate if the weather is unseasonably warm. If this occurs, the seedling may germinate and be destroyed by the colder weather. It is important not to plant too early in the fall. The major advantage of a fall planting is the high percentage of forb germination. The "winter overing" of fall planted seed helps break down the inhibitors to the seeds germination and the native plants that require cool soil temperatures will also be favored.**

- *Spreading the seed can be done by hand or in larger areas a cyclone seeder can be used. Scatter the seed slowly and be sure not to run out before you have completely covered the site. Adding some moistened sawdust as a filler can make your job easier because it will clearly show you the area that you have already covered with the seed.*
- *All hand seeding should be followed by a light raking.*

Mulching

If you are using plants, you should apply a thin layer of mulch around your garden. This will help reduce weed competition and holds moisture in the soil. It will also help to make your Rain Garden look more attractive. Shredded hardwood works very well and can be used for both woody and herbaceous plantings. When applying mulch to herbaceous plants you should keep about a ½ inch separation distance from the plants and apply no more than 1 inch on the surface. Trees and shrubs should be mulched with at least 3 inches over the surface. You can also label your plants. This will allow you to monitor their success and prevent you from accidentally weeding them out later.

SITE MAINTENANCE

First Season

For the first year herbaceous plants may need to be watered about an 1 inch per week if dry conditions exist over the summer. It is important that the plants receive a soaking because shallow watering can actually cause the root system remain near the surface and dry out. If an extended dry period occurs during the first year of the planting, put a sprinkler out for an hour or two once a week. Trees and shrubs will also benefit from a slow soaking once a week during the first growing season.

Weeding the first year is also important in order to give your plants a competitive edge. Pulling weeds while they are still small is a lot easier than eradicating them when they have become established. Try to scout for weeds in your garden about twice a month. In addition, your plantings should never be fertilized. If you find that a plant is struggling because of the lack of fertility, you have probably selected the wrong plant for the site. Look around your garden and determine what species are doing better in similar settings. You can try replanting or seeding those species that are propagating. Pesticides are also not needed. The few insect problems that do occur on native plants should be considered part of the natural process.

For seeded areas, mowing is the primary management tool used to prevent weeds from shading out the seedlings. During this first season, your garden may need to be mowed a couple of times. The mower blade should be set between 4-5 inches. A home lawn mower set at its highest cutting position should work well for your Rain Garden areas. You will need to mow each time the weeds reach over 6 inches in height. Try not to allow the weeds to set seed before mowing. Do not worry about crushing the seedlings, they will be hearty enough to restore themselves. If you have a larger area that needs weeding, use a flail type mower. Leave the cuttings on the ground because they will later serve as mulch for the plants. Also, try to time your last fall mowing so that the weeds grow to about 8 inches in height. The extra height on the weeds will help protect the young seedlings from frost and cold winters.

Second Season

During the second growing season, your maintenance tasks will ease. In the spring, you can cut back the dried herbaceous plants from the previous years growth. You can clip the plants back to about 2 to 3 inches from the ground. This will allow the plants to continue to grow while bringing about a neat appearance to your landscape. Only water during long periods of drought. Thoroughly weed your gardens in the spring. Pull any unwanted tree seedlings and undesirable plants during this period. Scout for weeds about every month after your initial spring weeding. By now you should be able to tell the difference between the plants you have installed and the invaders that need pulling. In the fall, all standing vegetation should be left in place. It provides food and cover for many different animals and mammals in the winter and brings some color to a rather bleak landscape.

If weeds are thick in your seeded areas, one mowing in the late spring or early summer will help with their

control. Set the mower blade height to 6-12 inches or use a garden sheer to cut back the plants back to about 2-3 inches from the ground.

Third Season and Beyond

Each spring, you can begin by cutting back the dried vegetation (if you desire a neat appearance) and conducting a walk thorough of your garden for weeds. No watering or fertilization is required or necessary. Inevitably, a few plants will not live through the first year or second year. Use this opportunity to replant or seed the area with species that are propagating. The cost of installing and maintaining a Rain Garden can be considerably less than installing or replacing turfgrass (*Table 1*). Remember, the goal is to have a functioning landscape that is enjoyable and attractive.

	<i>Installation Cost (estimated per acre)</i>	<i>Annual Maintenance Cost (estimated per acre)</i>
Sodded turf grass	\$18,700	\$1,210
Seeded turf grass	\$9,600	\$1,270
Rain Garden Planting or Prairie Restoration Project	\$2,500 - \$10,500	\$200

*Source: Landscaping for Wildlife & Water Quality
Minnesota Department of Natural Resources*

PLANT AND SEED SOURCES

The South Zumbro Watershed Partnership does not endorse any of the businesses listed below or their products. This is a resource list that should be used a guide for sources of Rain Garden plants and seeds. Every business that provides native plants or seeds is not listed below. Please contact your local garden center or nursery to determine if they carry the products that you need. Remember, the origins of your plants or seed should be within a 200 mile radius of Rochester.

Sargent's on Second
1811 2nd Street SW
Rochester
(507) 289-6068

Garden Marketplatz
5225 County Road 15 SW
Byron
(507) 281-1023

Jim Whiting Nursery & Gardens
3820 Hwy 63 North
Rochester
(507) 289-3741

Stangler's Farm & Seed Nursery
808 Broadway South
Rochester
(507) 289-2037

Nature's Way
1770 75th Street NE
Rochester
(507) 289-3039

Prairie Moon Nursery
Route 3 Box 163
Winona, MN 55987
(507) 452-1362

Landscape Alternatives
1705 St. Albans Street
Roseville, MN 55113
(651) 488-3142

Ion Exchange
1878 Old Mission Drive
Harpers Ferry, IA 52146
(800) 291-2143

Hilde & Associates
326 Glover Road South
River Falls, WI 54022
(800) 790-9495

Woods End
807 College Street
Northfield, MN 55057
(507) 663-1544

SOIL SAMPLING

Assessing the Soil Texture

The first step in the soil sampling process is to use a shovel or spade to dig into the ground. Your hole should be about 6 to 12 inches deep. Next, put a rounded tablespoon of soil in the palm one hand. Spray a little distilled water onto the soil and begin to knead it. Continue until the soil forms a round ball in the palm of your hand. Gently squeeze the soil between your thumb and index finger to form a ribbon that extends over the top of your index finger (*Figure 5*). Continue to form a ribbon until it breaks. Note how long the ribbon was when it broke and whether it feels gritty or smooth. Compare your findings with the chart below (*Table 2*).

The soil texture refers to the relative amount of mineral particles in the soil. Defining the texture will assist you in determining your soils ability to retain water. Soils with some clay content will hold more water than sandy or silty soils. Loamy soils tend to hold the most plant available water. Soils with poor water retention capacities become obvious during extended dry periods.

Figure 5

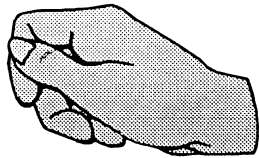


Table 2 - Ribbon Test

No Ball Formed: sand

Ball but No Ribbon: loamy sand

	Feels very gritty	Feels very smooth	Feels both gritty & smooth
1 inch ribbon	sandy loam	silty loam	loam
1 to 2 inch ribbon	sandy clay loam	silty clay loam	clay loam
2 inches or more	sandy clay	silty clay	clay

Infiltration Test

The coffee can perc test allows you to check water infiltration on your site. Infiltration rates are best determined when your yard is at or near its water capacity. This usually occurs 12 to 48 hours after the soil has been thoroughly wetted by a soaking rain. To do this infiltration test you will need the following equipment:

- a two pound coffee can
- a small flat plastic lid
- an empty plastic soda bottle (16 once or 20 once size)
- a ruler and permanent marker
- an extra jug of water

Before cutting out the bottom of the coffee can, stick a ruler in the can and measure up from the bottom. Use a permanent marker to identify the inch marks along the inside of the can. Next, pour enough water in the can to reach the first inch marking, then transfer the water to your plastic soda bottle. Make sure to mark the one inch line on your soda bottle. This is to ensure that you always use the same amount of water every time you do a perc test. Cut out the bottom of the can when you have finished marking.

At your sampling site, push the can into the soil to a depth of two to three inches, use your guidelines in the can as a reference. If the soil is hard, lay a board across the can and pound it with a hammer. Next, gently firm the soil around the inside edges of the can. By firming the edges, this will reduce water flow

water flow from escaping around the inside edges of the can. This will reduce water flow around the edge. Place the plastic lid on top of the soil inside the can. The plastic lid should not fill the entire inside area of the can. The lid is used to help protect the surface structure of the soil when you pour the water into the can.

After setting up the perc test, pour the water from the soda bottle into the can (you should have an inch of water in bottle) and make sure you pour the water onto the lid. The first inch of water will wet the soil and eliminates any variation in soil moisture. Pour a second inch of water into the can. This should be done immediately after the initial inch. Note how long it takes the soil to absorb this second inch of water. The second inch of water determines the infiltration rate of your soil (*Table 3*). Record the infiltration rate and class of your soil.

Infiltration Rate (minutes per inch)	Infiltration Rate (inches per hour)	Infiltration Class
<3	>20	Very Rapid
3 to 10	6 to 20	Rapid
10 to 30	2 to 6	Moderately Rapid
30 to 100	0.6 to 2	Moderate
100 to 300	0.2 to 0.6	Moderately Slow
300 to 1,000	0.06 to 0.2	Slow
1,000 to 40,000	0.0015 to 0.06	Very Slow
>40,000	<0.0015	Impermeable

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This manual was prepared and developed by Tony Hill for the South Zumbro Watershed Partnership. Any questions or comments can be received by calling (507) 285-8982 or writing the South Zumbro Watershed Partnership at 2116 Campus Drive SE, Rochester, MN, 55904.

The South Zumbro Watershed Partnership is a cooperative effort between Olmsted County, the City of Rochester, Olmsted Soil & Water Conservation District, University of Minnesota Extension Service, and the Minnesota Pollution Control Agency.

The use of trade names or references to specific companies or products does not imply endorsement by the South Zumbro Watershed Partnership or any organization associated with the Partnership. The intent of this manual is to be used as a guide for establishing a Rain Garden. For specific questions about your property, please contact a landscape professional for assistance.