

Addendum No. 1 June 20, 2007  
Specification 07-189  
Rain Gardens, Rain Barrel/s and Fertilizers

Addendum # 1 to spec. 07-189 for Construction of Rain Gardens, installation of Rain Barrels & provide No/Low Phosphorus Fertilizer, bids to be opened Wednesday June 27, 2007.

Note the following items were discussed at the pre-bid meeting on June 19, 2007.

Additional draft guidelines were handed out (available with this addendum) to help prospective bidders understand what we want to accomplish .

**Question:**        **What size packages for the fertilizer do you want? Some come in 40lb bags and others come in 50 lb.**

Answer:            As long as people can come in to pick up enough to do 5,000 sq. ft. it doesn't matter. Bidder is to state on the new proposal page the size of package and bid per pound.

**Question:**        **How do people apply and how are they selected?**

Answer:            There will be a application process resulting in the City passing them on to the contractor to evaluate. The Contractor shall get back to the City with their recommendations. The City will approve who get the rain gardens.

**Question:**        **Will all the rain gardens need modifications to the soils?**

Answer:            The City believe all rain gardens will require modifications to the soil, some modifications will be minor and others more intensive reacquiring drains. The new proposal form will address it.

**Question:**        **What does the home owner pay for?**

Answer:            The Home owner only pays 10% of the cost of the rain garden and it is up to the contractor to collect that portion. There is no cost for the rain barrels or the fertilizer.

**Questions:**       **When does the City anticipate this project starting?**

Answer:            It is anticipated to start some time in the middle of August. There will be a Public meeting on July 26<sup>th</sup> and a press release.

All other terms and conditions shall remain unchanged.

Dated this 20<sup>th</sup> day of June, 2007

Purchasing Department

Vince M. Mejer  
Purchasing Agent

Amended Proposal Page

Company Name \_\_\_\_\_

**SPECIFICATION NO. 07-189**  
**BID OPENING TIME: 12:00 NOON**  
**DATE: June 27, 2007**

The undersigned bidder, having full knowledge of the requirements of the City of Lincoln for the below listed items and the contract documents (which include Notice to Bidders, Instructions to Bidders, this Proposal, specifications, Contract, and any and all addenda) and all other conditions of the Proposal, agrees to sell to the City below the listed items for the performance of this Specification, complete in every respect, in strict accordance with the contract documents at and for unit prices listed below.

**ADDENDA RECEIPT:** The receipt of addenda to the specifications numbers \_\_\_\_\_ through \_\_\_\_\_ are hereby acknowledged. Failure of any bidder to receive any addendum or any interpretation of the specifications shall not relieve the bidder from obligations specified in the bid request. All addenda shall become part of the final contract document.

**REQUIREMENTS FOR**  
**Design & installation of rain gardens**  
**Provide & install rain barrels &**  
**Provide no/low phosphorus fertilizer**

**WORK REQUIREMENTS**

**PRICE**

Provide and install rain barrel of 50 gallon or greater capacity at home owner site (Up to 20 barrels)	Price per Barrel	\$ _____/barrel
Site investigation to determine suitability for rain garden feature. (Up to 40 sites)	Price per site	\$ _____/site
Design and construct rain gardens at home owner sites (Up to 20 gardens)	Without drain Price per sq. ft.	\$ _____/sq. ft.
	With drainage Price per sq. ft.	\$ _____/sq. ft.
Provide up to 1000 bags of no/low phosphorus (2% or less) fertilizer. (Bag size to cover 5000 sq. ft. of lawn)	Price per LB	\$ _____/bag size

**Contract period is through June 2008**

BID SECURITY REQUIRED: YES \_\_\_ NO X

Contract Extension Renewal is an Option (Subject to mutual consent by Contractor and City)

YES \_\_\_\_\_ NO \_\_\_\_\_

TERM PRICE CLAUSE:

Bid prices firm for the full contract period: \_\_\_\_\_

**Amended Proposal Page**

**AFFIRMATIVE ACTION PROGRAM:** Successful bidders will be required to comply with the provisions of the City's Affirmative Action Policy (Contract Compliance, Sec. 1.16). The Equal Opportunity Officer will determine compliance or non-compliance, upon a complete and substantial review of successful bidder's equal opportunity policies, procedures, and practices.

The undersigned signatory for the bidder represents and warrants that he has full and complete authority to submit this proposal to the City, and to enter into a contract if this proposal is accepted.

**RETURN TWO (2) COMPLETE COPIES OF PROPOSAL AND SUPPORT MATERIAL.  
MARK OUTSIDE OF BID ENVELOPE AS FOLLOWS: SEALED BID FOR SPEC. 07-189,  
ALONG WITH COMPANY NAME AND ADDRESS**

\_\_\_\_\_  
COMPANY NAME

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
STREET ADDRESS OR P.O. BOX

\_\_\_\_\_  
PRINT NAME

\_\_\_\_\_  
CITY, STATE                      ZIP CODE

\_\_\_\_\_  
TITLE

\_\_\_\_\_  
TELEPHONE

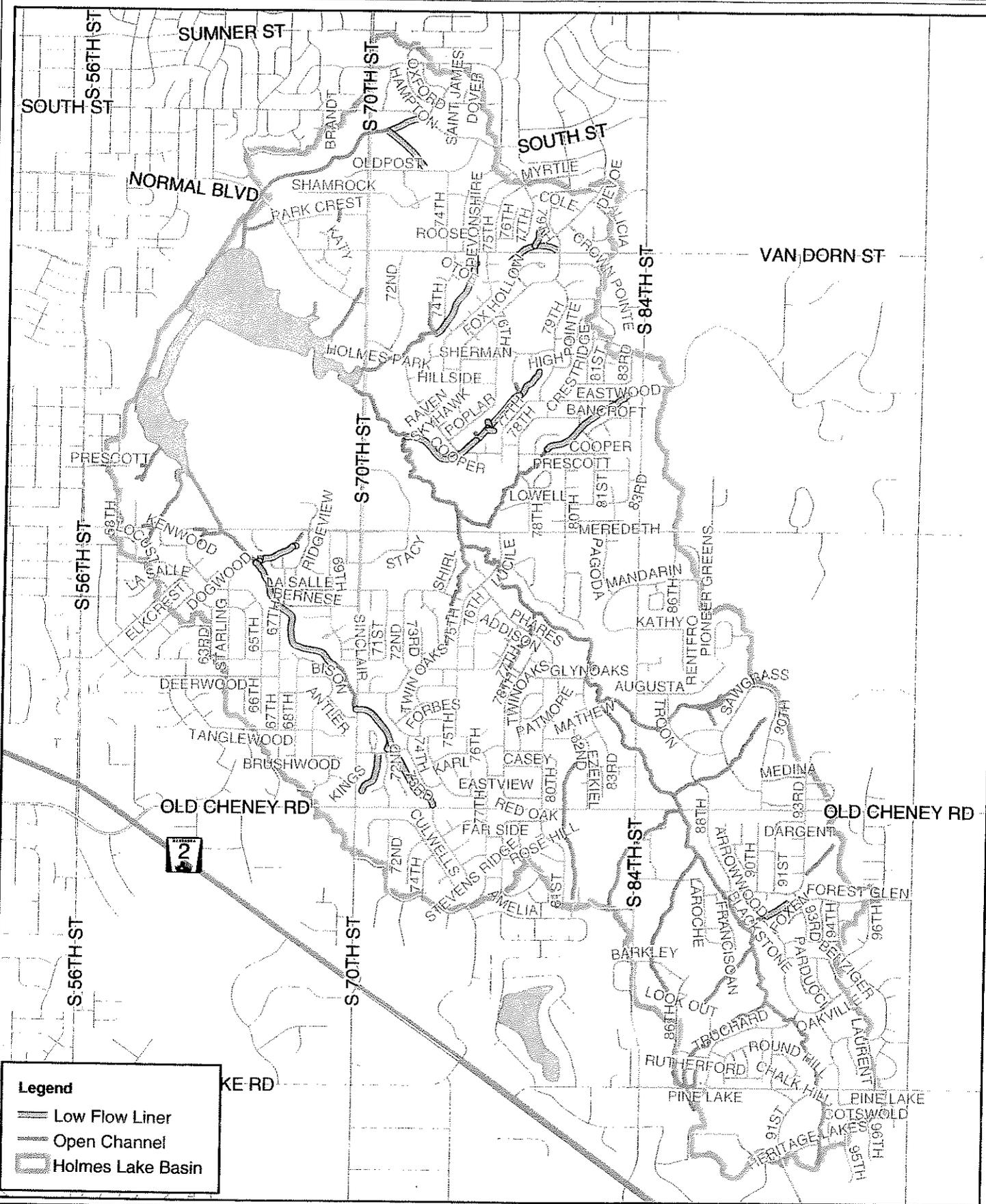
\_\_\_\_\_  
DATE

\_\_\_\_\_  
E-MAIL ADDRESS

\_\_\_\_\_  
TERMS OF PAYMENT

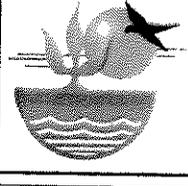
Bids may be inspected in the Purchasing Division during normal business hours after tabulation and review by a Purchasing Agent. Bid tabulations can be viewed on our website at: [lincoln.ne.gov](http://lincoln.ne.gov) Keyword: **Bid**

The Intent to Award will be listed on the website when a recommendation is received from the Department.



**Legend**

- Low Flow Liner
- Open Channel
- Holmes Lake Basin



# Holmes Lake Watershed

1 inch equals 2,500 feet

Printing Date: January 17, 2007

File: \\WSM\GIS\Map\PrintMap\PrintMap-HolmesLake.mxd



**Application for Participation in Water Quality Improvement Program**

**Holmes Lake Watershed**

Name: \_\_\_\_\_

Address: \_\_\_\_\_ Zip Code: \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**I am applying for:**

\_\_\_ Installation of a rain garden, 90% of cost covered by The City of Lincoln

\_\_\_ Installation of a FREE rain barrel

**What is your soil composition?**

Mostly Sand   Mostly Silt   Mostly Clay   Don't Know

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**By my signature above I agree:**

**-THAT IF I RECEIVE A RAIN GARDEN OR RAIN BARREL I WILL:**

- Maintain it for at least 5 years
- Fill out annual surveys on the success of my garden/barrel
- Allow the City of Lincoln to photograph my garden/barrel
- Contact the landscaper and notify the City of Lincoln if problems arise with my garden/barrel

Please mail completed application to:

Ed Kouma  
Lincoln Public Works & Utilities  
Watershed Management Division  
901 N. 6<sup>th</sup> St.  
Lincoln, Nebraska 68508



Funding for this program is provided by Nebraska Department of Environmental Quality  
This program is offered for a limited time only as funds allow. Rain garden installation is  
dependant on site evaluation.

**LAWN CARE SURVEY**      *Please mail completed survey. Thank You*

*The City of Lincoln Watershed Management Division is working to reduce pollution and increase water quality to area lakes and water bodies. Lawn chemicals and care practices can have big impacts on water quality. Please fill out this survey to help City of Lincoln better understand common practices in Holmes Lake Watershed.*

1. How many times per year is your lawn fertilized?    A. 1    B. 2    C. 3    D. 4    E. 5 or more
2. Has your soil been tested to determine how much fertilizer you need?    A. yes    B. no
3. Most soils in Eastern Nebraska contain all the phosphorus plants need to grow healthfully. Would you be willing to switch to a no phosphorus fertilizer?    A. yes    B. no    C. I already use no/low phosphorus fertilizer
4. From May to October, how many times per week is your lawn watered?    A. 1-2    B. 3-4    C. 5-7    D. Never
5. What type of lawn mower is used on your property?    A. Mulching mower    B. Bagging mower    C. N/A
6. How are your grass clippings disposed of after mowing?    A. In a trash bag    B. In the nearest creek, stream, or waterway    C. In the storm drain    D. Leave them on my lawn    E. Compost Pile/Mulch    F. N/A
7. Are you interested in working these lawn care practices into your property to increase water quality?

*Please check all that apply*

- Rain Garden       Leaving grass clippings on the lawn       Applying no/low phosphorus fertilizer  
 Rain Barrel       Using grass clippings as garden mulch or compost



*\*As a resident of the Holmes Lake Watershed, you are eligible for a FREE bag of no phosphorus fertilizer. Please visit XXXXXXXXXXXXXXXXXXXXXXXXXXXX with the attached coupon to obtain your free bag. Individuals are limited to 2 bags per household per coupon. Supplies are limited to 1,000 free bags of fertilizer and awarded on a first come, first serve basis.*



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 DETACH COUPON FROM SURVEY  
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*This coupon entitles the bearer to a limit of no more than*

**2 FREE BAGS OF  
 NO PHOSPHORUS  
 FERTILIZER**

*Each bag will cover up to 5,000 square feet.*

To redeem this coupon, please visit XXXXXXXXXXXXXXXXXXXX  
 XX

*This coupon is good while supplies last and may not be redeemed with any other offer. Bearer of this coupon must live and intend to use free fertilizer within the Holmes Lake Watershed area. Funding for this program is provided by the Nebraska Department of Environmental Quality.*

City of Lincoln  
Public Works and Utilities Department  
Watershed Management Division  
901 North 6th Street  
Lincoln, NE 68508



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## **FUN LAWN FACTS**

- \* Contrary to popular belief, leaving grass clippings on your lawn **DOES NOT** contribute to thatch build up. When left on your lawn, grass clippings will contribute to 25% of your annual lawn fertilizing needs.
- \* One pound of phosphorus will produce more than 300 pounds of blue-green algae.



# Rain Gardens

## What is a Rain Garden?

A rain garden is a small garden planted in a depression with native shrubs, perennials, and flowers. It is designed to temporarily hold and soak in rain water runoff that flows from roofs, driveways, patios or lawns. Rain gardens are effective in removing up to 90% of nutrients and chemicals and up to 80% of sediments from the rainwater runoff. Compared to a conventional lawn, rain gardens allow for 30% more water to soak into the ground. It is not a pond or wetland, but is dry most of the time and typically holds water during and preceding a rainfall event.

## Why is rainwater runoff a problem?

Every time it rains, water runs off impermeable surfaces, such as roofs or driveways, collecting pollutants such as particles of dirt, fertilizer, chemicals, oil, garbage, and bacteria along the way. The pollutant-laden water enters storm drains untreated and flows directly to nearby streams and ponds. EPA estimates that pollutants carried by rainwater runoff account for 70% of all water pollution. Rain gardens collect rainwater runoff, allowing the water to be filtered by vegetation and percolate into the soil. These processes filter out pollutants.

## Is there a difference between a rain garden and a regular garden?

In the design of a rain garden, typically six to twelve inches of soil is removed and altered with tillage, compost and sand to increase water infiltration. The type of alteration to the soil depends on the current soil type, so it is a good idea to obtain a soil test. Rain gardens are generally constructed on the downside of a slope on your property and collect rainwater runoff from the lawn, roof and/or the driveway. Once water collects in the rain garden, infiltration may take up to 48 hours after a major rainfall. Also, rain gardens incorporate native vegetation; therefore, no fertilizer is needed and after the first year, maintenance is usually minimal.

## What are the benefits?

- Improves water quality by filtering out pollutants
- Aesthetically pleasing
- Preserves native vegetation
- Provides localized stormwater and flood control
- Attracts beneficial birds/butterflies/insects
- Easy to maintain after establishment



## What is the Average Size and Placement of a Rain Garden?

A rain garden should have an area about 20% the size of the roof, patio, or pavement area draining into it. A typical residential rain garden is between 100 and 300 square feet. If a smaller rain garden than recommended for a lot is chosen, it will still function, as any size garden can make an impact.

Rain gardens are longer than they are wide and are perpendicular to the slope, in order to catch the maximum amount of rainfall. Rain gardens should be placed at least 10 feet away from building foundations and should not be located where water ponds for an extended period of time.

### What types of plants are used?

As a rule, native vegetation should be incorporated into a rain garden. Native plants don't require fertilizer, have good root systems, and are better at utilizing the water and nutrients available in their native soils than non-native species. Perennials, shrubs, wildflowers, or a mixture of all three can be planted. Avoid planting trees, as trees generally absorb more water than surrounding plants. Also, never plant invasive or noxious species in a rain garden, such as purple loosestrife.

### What is the cost of a rain garden?

The cost of a rain garden is dependant on the property's soil type, the size of roof/driveway/patio draining into a rain garden, and the types of plants chosen. If the soil is high in clay content, it may be a good idea to install a French drain system to increase infiltration rates.

For a self-built rain garden, expect to pay between \$3 and \$5 per square foot in plant costs and soil amendments. Digging the garden is the most time consuming task, as 6-8 inches of soil depth is typically removed to add amendments.

When working with a landscaping company to design and install a rain garden, the cost will significantly increase to around \$10 to \$12 per square foot.

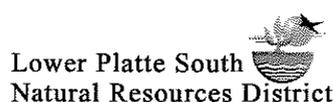
### What kind of maintenance is involved?

Rain gardens do not require fertilizer, if native vegetation is used. During the first few years after the installation of a rain garden, the weeds will need to be removed periodically. After the plants in the rain garden have become established and grown larger, they will eventually out-compete the weeds. As the rain garden is establishing during the first and second year or during periods of little to no rainfall, occasional watering of the plants will be necessary.

### Why is the City of Lincoln promoting rain gardens?

The main function of a rain garden is improving water quality. Communities around the country have experienced dramatic reductions in stormwater pollution, due to many homeowners installing rain gardens on their property. According to the EPA, 70% of all water pollution comes from pollutants carried in rainwater runoff and other non-point pollution sources. Rain gardens are effective in removing up to 90% of pollutants and 80% of sediments from individual properties. Not only are rain gardens beautiful additions to any landscape, the amount of pollution leaving yards and entering nearby streams, lakes, and wetlands can be reduced. Constructing, installing, and maintaining a rain garden will be helping to reduce pollution and keep our streams and lakes healthy.

*Thinking of Installing a Rain Garden? Let us know! We'd be interested in your comments, the success of your garden, and pictures of your progress. Please send information to Ed Kouma, Watershed Management Division, Public Works and Utilities Department, 901 North 6<sup>th</sup> Street, Lincoln, NE 68508, 402-441-7018.*



# Rain Barrels

## What are they?

A rain barrel is any above ground container modified to receive, store, and distribute rooftop runoff for non-drinking uses. The typical size of a rain barrel is 55 gallons. The main components of a rain barrel are a connection to the downspout, a filter to prevent mosquitoes from entering, a faucet to allow for regulated usage, and an overflow pipe to divert the excess water.

## What are the benefits of rain barrels?

- Rain water is naturally soft, oxygenated, and more acidic than tap water.
- Rain water is free of chlorine, fluoride, salts, and other minerals from tap water.
- Saves water for dry spells.
- Reduces runoff and stormwater pollution.
- Can reduce your water bill, especially in the summer.

## How can the water collected be used?

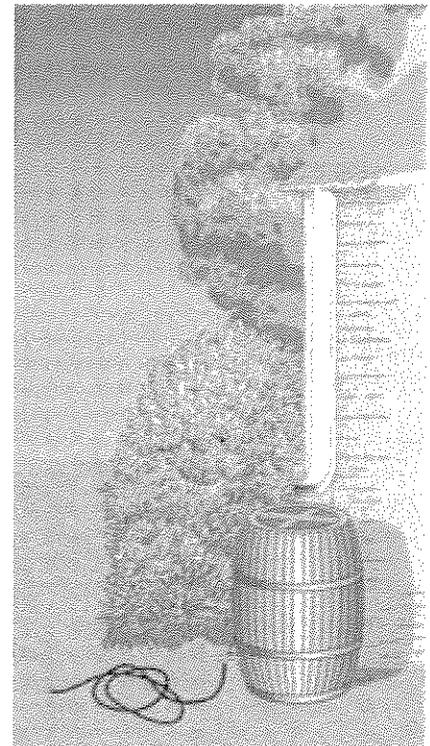
The rainwater collected can be used to water lawns and gardens or wash cars and bicycles. Rainwater collected within the barrel is safe for plants because the typical minerals and pollutants trapped in the rainwater are filtered out by plant roots. Rainwater collected in the rain barrel is not for drinking; rainwater is more acidic than tap water and may contain particulate matter from air pollution.

## How much do they cost?

Rain barrels cost anywhere from \$20 to \$300. The fancier the rain barrel, the more the cost. Costs can be reduced if the barrel is installed by the homeowner. In the summer, lawn and garden watering account for 40% of average household water usage. By adding a rain barrel, the need for municipal water is reduced. According to the US Environmental Protection Agency, a rain barrel can potentially save most homeowners about 1,300 gallons of water during the peak summer months.

## Are there different colors, designs, and types of rain barrels?

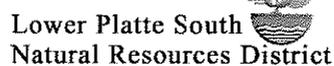
Rain barrels come in essentially any design or style. However, most regular rain barrels are usually black or blue plastic. Since only a ½ inch rainfall on a 160 square foot roof will fill a 55 gallon rain barrel, some people choose to get a tandem barrel (2 barrels at 1 downspout) or another barrel at a different downspout.



## What type of maintenance is required?

The barrel will require periodic cleaning. A safe cleaning solution is 2 teaspoons of castile soap and 2 teaspoons of vinegar per gallon of water or 2 teaspoons of lemon juice per gallon of water. In the winter, the barrel will need to be emptied and disconnected from the downspout.

*Thinking of Installing a Rain Barrel? Let us know! We'd be interested in your comments, the success of your barrel, and pictures. Please send information to Ed Kouma, Watershed Management Division, Public Works and Utilities Department, 901 North 6<sup>th</sup> Street, Lincoln, NE 68508, 402-441-7018.*





# Rain Garden Design for Homeowners

Thomas G. Franti, Extension Surface Water Management Specialist

Homeowners can reduce water runoff from their yards by using a functional and aesthetic practice called a Rain Garden. A rain garden is a small area in a residential yard or neighborhood planted to flowers and ornamental grasses designed to temporarily hold and soak in rain water that comes from a house roof, driveway or other open area. A rain garden is not a pond or wetland. It is dry most of the time and holds water after a rain. Water collected in the rain garden slowly infiltrates into the soil to support plant growth. In a properly sited and designed rain garden standing water disappears in less than 48 hours.

## *Benefits of Rain Gardens*

Roof tops, sidewalks, driveways and patios do not allow rainfall to infiltrate into the soil. These impervious areas increase the amount of runoff from urban areas which can cause flooding, and carry pollutants to surface water. Rain gardens can capture runoff from these areas and reduce the effect of flooding and runoff pollution. Landscaping benefits of rain gardens include diverse plantings of flowers, grasses and ornamental plants, berms

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that add contrast and texture to level areas and the possibility of including stones and rock or other features for a pleasing garden view (Figure 1).



Figure 1. Residential rain garden

Rain gardens add an aesthetic and functional feature to a yard or landscape, are relatively inexpensive and can be installed by a homeowner with minimum training. This NebGuide describes designing a rain garden for your yard. NebGuide G-XXXX *Installing Rain Gardens in Your Yard*, describes the steps for installing a residential rain garden by a homeowner. NebGuide G-XXXX *Plant Selection For Rain Gardens in Nebraska*, provides plant selection tips and a list of plants suitable for Nebraska. Alternately, local landscape companies may have experience building rain gardens, or be willing to try installing one with the help of these NebGuides.

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### *Design Considerations*

Rain gardens are placed to capture runoff from a house roof, driveway or other impervious surface in a yard, such as a large patio. Depending on the layout of the gutter system on a home, or the size of the property, more than one rain garden may be needed to collect all runoff. The type of soil under the lawn is the key to an effective rain garden. Soil must be able to infiltrate water fast enough when the rain garden is full so that it will drain in 24 to 48 hours. For the rain garden to work properly the infiltration rate into the soil should be 0.25 inches per hour or greater. This is not a problem for soils containing large amounts of sand, but could be a problem for soil high in clay. If the soil does not meet this criterion a rain garden may not be right for that site. How to determine the infiltration characteristics of the soil will be described later in this NebGuide.

Because rain gardens are designed to hold water temporarily they are not a breeding ground for mosquitoes, or other pests. They require some routine maintenance, such as removing weeds, replacing dead plants, and watering if no rainfall occurs.

### **Rain Garden Design**

*Determine if Soil is Suitable* – Not all soils are suitable for a rain garden. As a rule the infiltration rate should be greater than 0.25 inches per hour. Soils with rates less than this drain too slowly to be an effective rain garden. Soil is made up of three particle types – sand, silt and clay – each in differing amounts. Soils high in sand and silt will usually



provide good drainage. Soils high in clay will not drain well and may not be suitable for a rain garden.

Soil survey maps available from the USDA Natural Resources Conservation Service can provide an estimate of soil infiltration rate; however, soils vary dramatically from location to location, and can vary within the same yard. Also, topsoil is typically removed from many home sites before construction begins. This exposes the subsoil, which in many locations has a greater clay content and a slower infiltration rate. Therefore, it is necessary to determine the soil's suitability at the site where the rain garden will be built.

Two simple methods can be used to determine a soil's suitability. For the first method dig a hole in the ground 6 inches deep and fill it with water. If the water drains away in less than 24 hours the soil is suitable. If it takes more than 24 hours to soak in the site is not suitable. Do this test in the spring, or in the typical rainy season, not in the middle of the summer or fall when soil is dry and cracked and may give an erroneous result.

The second method is the feel method to determine if the soil is a clay soil. Take about a half cup of soil and add a few drops of water and begin kneading it into a ball. Add a few more drops if the soil is still dry. If the soil crumbles apart and will not stay together in a ball it is suitable for a rain garden. If the soil forms a ball then rub the soil between your thumb and index finger to squeeze out a ribbon of soil of uniform thickness. Allow the



ribbon to grow out from your fingers until it breaks off. If the ribbon is greater than an inch long before it breaks, and the soil feels more smooth than gritty, the soil is not suitable for a rain garden.

If your soil is not suitable for a rain garden there are alternatives you can use to improve the soil's infiltration capacity, capture runoff, or improve drainage. NebGuide G-XXXX *Installing Rain Gardens in Your Yard*, contains ideas for deep aeration, soil amendment, rain barrels and drainage systems that may be used for heavy soils.

*Selecting a Location* – Place a rain garden along a gentle slope where it can capture the most runoff from the roof or other impermeable areas. Examine the layout of down spouts from the roof and determine which ones drain the most roof area. Also, look at the lay of the land on the lawn and determine if water collects and flows to certain spots. Rain gardens can be placed near a single down spout, or can be located away from the house to capture runoff from more than one downspout and from other impervious areas in the yard, such as a patio. Also, consider how a proposed location fits into the overall landscape features of the yard. This is a garden and should be located to compliment the house and other yard features and be a source of enjoyment for the homeowner and others.

Locate rain gardens at least 10 feet away from the house to avoid water draining toward the foundation. Rain gardens should be located on gently sloping ground or flat ground. If the land slope is greater than 12 percent select an alternate location. If your selected



location is greater than 30 feet from the house and additional yard area will drain to the rain garden, be sure water from downspouts will reach the rain garden. Often a small swale can be constructed for this purpose. If a swale is not desirable, then a buried pipe can transport water from a downspout to the rain garden.

Key points for locating a rain garden

- At least 10' from house foundation
- Be aware of rights of way, underground service lines and utilities
- Not directly beneath a tree
- Not directly over septic system (25' away)
- 25' from a wellhead
- Water table at least 2' below soil
- Not where water tends to pool
- Flattest part of yard (< 12% slope)

*Determining the Depth* - The typical depth for a rain garden is 4 to 8 inches, not to exceed 8 inches, and it depends on the slope of the lawn. A rain garden greater than 8 inches deep will take too long to drain. A rain garden that is too shallow will need to be excessively large to provide enough water storage. The bottom of the rain garden should be approximately level, which will ensure good water distribution. For steeper lawns,



earth berms will need to be constructed to hold rainwater and to create a level bottom. Typically, soil dug from the upslope side of the site is used to create the downslope berm. Soil may need to be imported if enough is not available.

To determine the lawn slope at the site place a stake vertically in the ground at the uphill location of the proposed rain garden. Then place a second vertical stake 100 inches directly down slope from the first stake. Next tie a string to the first stake at the ground surface. Then attach the other end of the string to the second stake so that it is level. Use a mason's string level or a carpenter's level to make sure the string is level, not parallel to the ground. Finally, measure the length in inches along the second stake from the ground to the string. This measurement is the slope of the lawn in percent. For example, if you measure 6 inches from the ground to the string then the slope of the lawn between the stakes is 6 percent.

For shallow sloped lawns less than 4% the rain garden depth should range from 3 to 5 inches. For lawns sloped from 5% to 7% a depth of 6 to 7 inches is recommended. For lawns sloped 8% to 12% the depth should be 8 inches. If the lawn slope is greater than 12% select a different site for the rain garden.

*Size and Shape* – The shape of the rain garden can be left to the eye of the homeowner. Shapes such as a crescent, oval, teardrop, or kidney shape are generally more appealing than a rectangle. A general rule is to keep the ratio of length to width at least 2:1, with



the longer length dimension running perpendicular to the water entering the rain garden.

This orientation maximizes the amount of water the rain garden can hold. The maximum width should not exceed 15 feet on lawns with a slope of 8 percent or greater.

A typical size for a residential rain garden is 100 to 300 ft<sup>2</sup>. The size is based on the amount of roof and lawn area that is draining to the rain garden. A rain garden that has an area of 5 to 8 percent of the drainage area is sufficient. Two ways of computing the design area are described below.

University of Wisconsin Extension recommends using a rain garden size factor that is based on the soil type, depth of the rain garden and the location relative to the house. The size factors are given in Table 1. The first step in the sizing process is to estimate the footprint area of the home. This can be done with a tape measure or by pacing with a known pace length to estimate the length and width of the structure. Or, if you know the square footage of the first floor rooms in the house, and the attached garage, etc., these can be added together to estimate the total footprint.

The next step is to estimate the percentage of the roof area draining to each downspout that will contribute water to the rain garden. For example, if the house has four downspouts and each drains one fourth of the roof, then each receives drainage from 25% of the footprint area. Divide the estimated percentages by 100, then multiply this fraction by the footprint area to get the area contributing to the rain garden. If the rain garden is



greater than 30 feet from the house estimate the patio or lawn area that will drain to the rain garden. This will require an estimate of the length and width of the area draining to the rain garden. Multiply the length and width and add this area to that drained from the roof to get the total drainage area.

**Table 1.** Rain Garden Sizing Factors. Multiply the drainage area by the size factor for the soil type and location of the rain garden. If the recommended size is greater than 300 square feet, divide it into smaller rain gardens.

	For locations less than 30 feet from downspout			For locations more than 30 feet from downspout
	3-5 in. Deep	6-7 in. Deep	8 in. Deep	For all depths
Sandy soil	0.19	0.15	0.08	0.03
Silty soil	0.34	0.25	0.16	0.06
Clayey soil	0.43	0.32	0.20	0.10



Multiply the total drainage area by the size factor for the design depth and soil type (Table 1). The value obtained is the design area of the rain garden. Note that a single size factor is used for rain gardens located more than 30 feet from the house. It is also recommended that if this area is more than 300 square feet that the area should be divided into smaller rain gardens.

For soils that are well drained, a second method for estimating the size of a residential rain garden is to use the general rule of thumb that the rain garden area should be 5 to 8 percent of the area draining to it. Use the method described above to compute the area draining to the rain garden. Multiply the area by 5% for sandy soils and by 8% for silt soils. Note that if a rain garden is on a steeper slope it can be deeper and thus can have a smaller area to hold the same amount of water. Therefore, rain gardens placed on flat slopes of 4% or less, should use the 8% estimate to calculate the rain garden area.

*Plant Selection and Placement* – A rain garden planted with a variety of native plants and flowers will provide years of enjoyment to homeowners. Consider variety and seasonality when selecting plants for your rain garden. The most aesthetically pleasing gardens have plants and flowers with a variety of shapes, textures, heights and colors, as well as plants that bloom at various times of the year to provide season-long interest. Because a rain garden is designed to hold water after a rain, as well as be dry when rainfall is scarce, it is important to select plants that will thrive in a wet or dry environment. NebGuide G-XXXX *Plant Selection For Rain Gardens in Nebraska*,



provides a list of flowers, grasses, and other plantings suitable for rain gardens in Nebraska. Local nurseries may also be able to give some guidance on plant selection.

When laying out your plantings group similar species together to create broad strokes of shape, texture and color, but try to avoid a uniform, checker board-like appearance.

Finally, consider adding stone, fencing or other ornamentals to your rain garden.

However, avoid trees in or too near to the rain garden. This will allow the flowers and grasses to use the root space and extra water available in rain gardens.

### **Additional Resources**

Installing Rain Gardens in Your Yard, University of Nebraska-Lincoln Extension, NGXXXX.

Plant Selection For Rain Gardens in Nebraska, University of Nebraska-Lincoln Extension, NGXXXX.

Rain Gardens: A how-to manual for homeowners. University of Wisconsin Extension.

UWEX Publication GWQ037, 31 pp.



# Installing Rain Gardens in Your Yard

**Thomas G. Franti, Surface and Water Management Specialist**

A rain garden can provide many benefits. Rain gardens collect runoff water, primarily from home roofs and other impervious surfaces; reduce downstream flooding, and prevents water pollution from degrading water quality. They provide an aesthetically pleasing landscape feature to your lawn. And they can provide you with the satisfaction of a do-it-yourself project that enhances your property value. This NebGuide will instruct you how to install and plant a rain garden in your yard. Neb Guides *GXXX Rain Garden Design for Homeowners* and *GXXX Plant Selection for Rain Gardens in Nebraska* describe how to design and select plants for a rain garden and should be read first and referred to as needed during the design and installation process.

## **Design and Site Selection**

Key factors for designing and locating a rain garden are soil type, drainage area (roof area) and lawn slope. If your soil does not meet minimum infiltration criteria your yard may not be suitable for a rain garden. The size and location of your rain garden will depend on the lawn slope and the roof and lawn area that drain to the garden. NGXXX, *Rain Garden Design for Homeowners*, explains how to determine if your soil is suitable and how to determine garden size based on drainage area and lawn slope. If the drainage



area contributing to the location you have selected is too large, consider installing more than one rain garden or re-routing some downspouts. Finally, if your soil does not meet the minimum criteria for infiltration some alternative design features or alternative rainwater management systems may be useful. Some of these are described at the end of this NebGuide.

### **Preparation**

After the size and location has been selected, preparations can be made to build your rain garden. Building a rain garden requires moving soil by hand (shovel and rake) or with a small backhoe. If you are doing the work by hand be sure your health and strength are adequate for the job. Consider inviting friends and family to assist to make the work easier and more fun. Before beginning, check that your proposed location is not over a septic system or buried water line, or buried cable (electric power line, telephone line, TV cable line). Be sure to call and have all utilities marked before digging in your yard. Make note whether the site will be in a majority sun or shade location. This will help determine plant selection.

### **Layout**

Create an outline of your proposed shape using a rope, string, marking paint, or flexible garden hose. Be sure the area within the shape is approximately the design size. Odd shapes like crescent or kidney shapes can be subdivided into approximate squares, rectangles, triangles or half circles to measure and compute the area. The berm of your

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rain garden will be constructed on the downhill and outside of the area (i.e. outside the string outline – see Figure 1). The width of the berm is dependent on lawn slope and garden size. Finally, note where runoff will flow into the rain garden. This needs to be on the uphill side. If water naturally flows to the garden that is good. If not, consider creating a shallow swale or channel to encourage water from the downspout to enter the rain garden properly. Finally, be sure you know the overflow point and route so that if water overtops the berm it is not directed back toward the house or toward another structure.

### **Moving Soil**

The tools you will need are listed in the side bar. Soil moving can be done with a small backhoe, but some hand shoveling and leveling will be needed for finishing. If you use a backhoe be sure your backhoe operator is qualified and experienced.

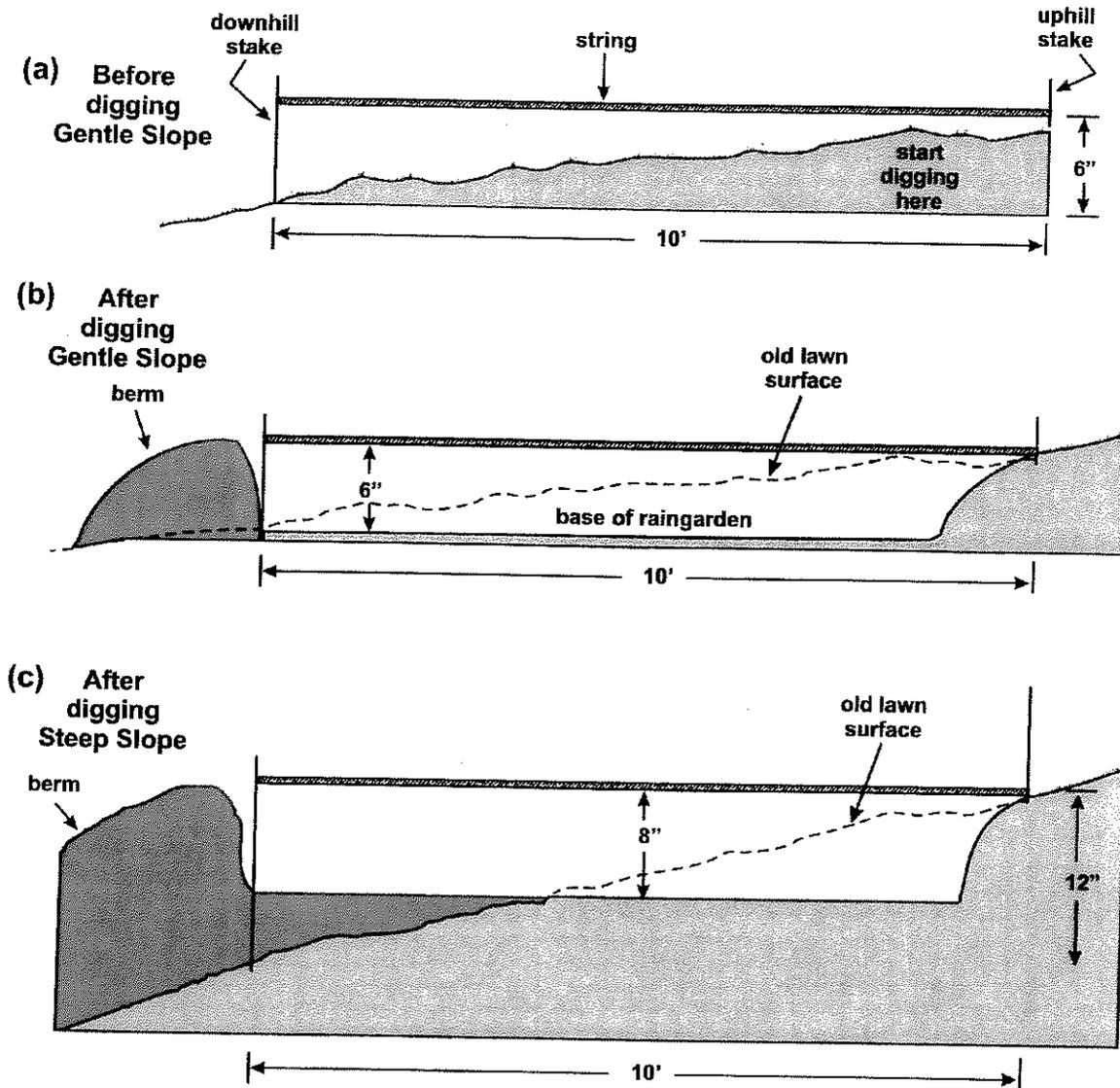
The first step is removing sod. Use a sod cutter or shovel to remove sod and all roots from the area outlined. Leave sod in areas where berms will be built. Sod may be used elsewhere, composted or discarded. Do not use the sod for filling or berming around the rain garden. An example of the amount of soil to be moved and size of berm to be constructed is illustrated in Figure 1, for both a shallow sloped and steeper lawn. Use these figures as guides for construction.



*Tools needed for building your rain garden:*

- *Tape measure*
- *Stout string or rope (layout)*
- *Leather work gloves*
- *Shovel and rakes*
- *Hand Trowel*
- *Carpenter level (4-foot preferred)*
- *String Level*
- *Wood stakes, at least 2 feet long*
- *String*
- *Hand Tamping Device*
- *2x4 board approx 6 feet (optional)*
- *Small backhoe with caterpillar*

Use a level string to measure the depth to the base (Fig. 1). Divide the garden into five foot wide sections and dig these independently, moving the string as needed. Start digging at the uphill point and move soil downhill to level the base and build the berm. The steeper the lawn slope the more soil will need to be moved downhill to create a level



**Figure 1.** Rain Garden cross section for gentle slope (a and b) and steep slope (c). Set string level and move in five foot increments along length of garden to aid digging to proper depth. (Adapted from *Rain Gardens: A how-to manual for homeowners*. UWEX Publication GWQ037)



surface and to create the berm. In some cases additional soil may be need to be brought in to construct an adequate berm.

The finished base of the rain garden should be level and at the depth determined by your design. Use a 2x4 to smooth out the bottom. Also, place the 2x4 across the bottom at various locations and angles, and using the carpenter level check the base for level. Use a shovel or trowel to cut down high spots or fill low spots to create a level base. An unlevel base might cause water to run to low spots and reduce the water infiltration benefits over the whole area.

The berm should be constructed with its height equal to the uphill top of the garden. A string with two stakes can be placed level to help establish the height (Fig. 1). The top of the berm should be level as it encircles the garden. Use a carpenter's level or string level to check this.

Shape the berm to a ridge about a foot across at the top and a few inches deep. Then stomp on it or use a hand tamper to compact the soil. A well compacted berm is important for the longevity of the rain garden. The sideslopes should be gently sloping, especially on the outside slope. Add additional soil layers if needed to increase the height. Compact all layers and be sure the berm creates a bath



tub-like rim around three sides of the rain garden on the downhill side. The berm should be protected from erosion with a mulch, straw mat or geo-fabric mulch and planted to grass.

Before your base is leveled consider adding compost to the soil and aerating the soil. Organic compost is a great additive to the soil to increase infiltration and improve growing conditions. If you add 2" of compost (depth across entire base) dig the base about 2" deeper to allow for this additional volume. Also, aerating soil by tilling with a rototiller will increase soil volume, so dig the base deeper depending on depth of aeration.

### **Planting**

Select plants that will thrive in your rain garden. NGXXX, *Plant Selection for Rain Gardens in Nebraska*, provides planting tips and a list of potential plant selections for Eastern and Central Nebraska. Select plants based on the amount of shade or sun available at your rain garden's location. Native species are preferred as they are usually more adapted to the local climate and soil. Lay out the plantings in a random or jigsaw-puzzle layout. Follow suggestions for grouping form and color. Draw out a plan on paper before starting to plant. Adjust plant location based on suggested spacing.



Using plugs or potted plants provides a jump start to your rain garden. Purchase healthy stock with a well established root system. Avoid using root bound plants. Transplant according to instructions for the plant or as suggested by the nursery. If you will not be using a mulch soil cover, dig a hole about twice the width of the root mass, and deep enough to bury roots, without folding them over, leaving the plant's root crown at the finished soil surface. If you plan to use a mulch soil cover the root crown should be left  $\frac{1}{2}$  -  $\frac{3}{4}$  inch above the soil surface for increased plant vigor. The mulch will prevent the root crown from drying out, while planting a little above the soil allows for adequate oxygen to reach the plant roots. Lightly tamp around plants as you refill the hole. Add mulch to the surface up to 3" deep to retain soil moisture and protect young plants; however, avoid mounding mulch around the crown of the plant.

Keep the soil mulched with an organic mulch to prevent the soil from drying too much and improve survival and health of plants. Do not use straw as the mulch because it attracts mice. Instead use a bark or other wood-based mulch. It is best to use shredded bark or tree branch mulch rather than chips. Chips will tend to float when the rain garden is full. Shredded mulch will interweave and resist floating.

Water transplants well when planted and add at least 1 inch of water per week – in two waterings – unless adequate rainfall occurs. Do not let plants get drought stressed in the first year or two. Once plants have established root systems adequate rainfall should provide sufficient moisture. However, watering may be needed if rainfall does not occur.



Weed control (hand picking) will help growth in the first year or two. Be sure you know the desired plants from the weeds. Herbicide use is not recommended for rain gardens. Be careful with herbicide applied to adjacent turf to prevent it from washing into your rain garden.

### **Maintenance**

Weeding is especially important in the first one to two years until plants are well established. After that mature plants will out compete most weed species. After the growing season stems and seed heads can be left for the winter to attract birds, as wildlife cover, and to provide winter interest. In the spring remove last year's plant growth to about 6-8 inches above the ground . Hand cut thick stemmed species. Use a string trimmer or shears for other plants. Compost or dispose of cuttings and debris rather than leaving them in the garden.

If plants become too thick burning may be an option. Burning removes old material and invigorates plant growth. This is especially true for native prairie species. Be sure to check local fire laws, get a permit, and inform your neighbors that you plan to burn. You don't want an unexpected visit from the fire department. An alternative to burning is mowing. Do this only if your mower deck can be raised to 6" or higher, if driving across the garden will not compact the soil, and if you can navigate safely over berms. If burning or mowing are not an option hand clippers and a string trimmer will be adequate.



Finally, check after a rain to see if standing water occurs longer than 1 or 2 days. Water standing too long may hurt or kill plants and is a sign the rain garden is not functioning properly. If this is a problem, one solution is to dig a small opening in the berm to allow drainage. Fill this opening with gravel to allow drainage through the berm, and leave it for a year or two to see if the problem disappears. If not, redigging and releveling a portion of the garden may help. If you do this consider amending soil with compost in the wet area to improve infiltration.

### **Alternatives for Heavy Clay Soil**

A soil infiltration rate of 0.25 inches per hour is needed to create an effective rain garden. NGXXXX, *Rain Garden Design for Homeowners*, describes how to estimate whether your soil meets this limit. In Eastern Nebraska many developed neighborhoods have had their topsoil removed and the current soil surface is high in clay, and may not be acceptable for a rain garden. Below are a few alternative ideas if your soil is not acceptable.

### **Deep Aeration**

Aerating the soil 2 to 4 feet deep can loosen soil and significantly increase infiltration. Plant root penetration will improve infiltration, and a deep rooting system can help rebuild soil structure. Be sure the area is clear of all utilities before tilling this deep.



### **Rain Barrels**

A rain barrel collects rainwater directly from a downspout. Fifty-five gallon barrels are a typical size, and these can be linked together to increase storage. Rain barrels typically can not contain as much water as a rain garden. Rain barrels can be used on their own, or can supplement rain gardens by holding some water that can be released to the rain garden after a few days when the initial water has fully drained from the soil. Rain barrel water can also be used to water other flowers or garden plants. It is important that rain barrel openings be covered with screening to prevent mosquitoes from breeding in them if water stays in them for more than a few days.

### **Drainage Systems**

An underdrain, or French drain system could be used with a rain garden. These drainage systems consist of trenches in the ground below the surface of the garden, often 2-3 feet deep, with a drain pipe in the bottom that leads to a storm sewer or open drainage channel or ditch. The trench is back filled with gravel and encased with a geo-fabric to allow water to enter but prevent fine soil particles from filling the trench. Excess water in the rain garden will drain through this system, allowing for some additional infiltration, but most water passes through as drainage runoff.

### **Additional Resources**



*Rain Garden Design for Homeowners*, University of Nebraska-Lincoln Extension.

NebGuide GXXX

*Plant Selection for Rain Gardens in Nebraska*, University of Nebraska-Lincoln

Extension. NebGuide GXXX

*Rain Gardens: A how-to manual for homeowners*. University of Wisconsin-Extension.

UWEX Publication GWQ037



# Plant Selection for Rain Gardens in Nebraska

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Homeowners can reduce runoff from their yards by using a functional and aesthetic practice called a Rain Garden. A rain garden is a small area in a residential yard or neighborhood planted with flowers and ornamental grasses, and designed to temporarily hold and soak in rain water that comes from a house roof, driveway or other open area. Water collected in the rain garden slowly infiltrates into the soil to support plant growth, and can reduce pollutants in runoff water.

Design and installation for residential rain gardens is described in NebGuide G-XXXX, *Rain Garden Design for Homeowners*, and NebGuide G-XXXX, *Installing Rain Gardens in Your Yard*. This NebGuide provides tips on plant selection and layout, and a list of plants appropriate for rain gardens in eastern and central Nebraska.

## Plant Selection and Placement for Rain Gardens

A rain garden planted with a variety of native plants and flowers will provide years of enjoyment to homeowners. Consideration of the following factors will contribute to a well planned and aesthetically pleasing rain garden.

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*Variety* – Based on what the garden size will allow, select a variety of plant sizes, colors and species. Selecting plants of different heights, shapes and textures adds visual depth and dimension.

*Season of Bloom* – Select plants that bloom at different times of the year to provide season long interest.

*Species selection* – Select plants that can “have their feet wet” for short periods. Some plants do well in soils that are always wet, others do well in soils that are dry. Because a rain garden is generally drained but could have water ponded for a few days before the soil fully drains plants must be selected that are adapted to such conditions. Also, including various species of sedges, rushes and grasses along with flowers will add a variety of root sizes and structures. Such root competition helps all the plants grow healthy and avoids one species out competing the others and taking over the garden.

*Placement* – Plants of similar species and color should be grouped together and placed randomly within the rain garden. This clumping will provide strokes of color when the plants bloom and help break up the area visually. Consider working with a nursery or landscaper for optimizing the plant selection and placement.

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*Enhancements* – Adding landscape enhancements like rock, stonework, fences or other garden ornaments can add a unique feature to the rain garden for year round enjoyment.

### **Plants Suited for Rain Gardens**

The list of plants suitable for a rain garden has been adapted for eastern and central Nebraska from a list created by the Wisconsin Department of Natural Resources. Homeowners in western Nebraska should contact local nurseries or the County Extension office for suggested plantings for your area.

When selecting plants be aware that moving westward in Nebraska may mean an increase in periods of dryness and increase in soil pH that may make some of the plants listed below unsuitable for use in rain gardens. Finally, tree planting is not recommended for residential rain gardens. Trees compete for needed water, root space and sun light, and will reduce the vigor of the rain garden plantings.

An on-line source that may help with plant selection in Nebraska is the Nebraska Statewide Arboretum plant information website that lists native species. Search the site at <http://arboretum.unl.edu/plantinfo.html> to find plants that may fit your needs.

### **References**

Wisconsin Department of Natural Resources



Table 1. Plants appropriate for rain gardens in eastern and central Nebraska.

**Perennial Flowers for Moist Soils, Sunny Areas:**

• Sweet Flag	<i>(Acorus calamus)</i>
• Giant Hyssop	<i>(Agastache foeniculum)</i>
• Canada Anemone	<i>(Anemone canadensis)</i>
• Marsh Milkweed	<i>(Asclepias incarnata)</i>
• New England Aster	<i>(Aster novaeangliae)</i>
• Joe Pye Weed	<i>(Eupatorium maculatum)</i>
• Boneset	<i>(Eupatorium perfoliatum)</i>
• Queen of the Prairie	<i>(Filipendula rubra)</i>
• Daylily	<i>(Hemerocallis spp.)</i>
• Blueflag Iris	<i>(Iris versicolor)</i>
• Yellowflag	<i>(Iris pseudacorus)</i>
• Siberian Iris	<i>(Iris sibirica)</i>
• Great Blue Lobelia	<i>(Lobelia siphilitica)</i>
• Wild bergamot	<i>(Monarda fistulosa)</i>
• Beebalm	<i>(Monarda didyma)</i>
• Prairie Phlox	<i>(Phlox pilosa)</i>
• Tall Meadow Rue	<i>(Thalictrum dasycarpum)</i>
• Spiderwort	<i>(Tradescantia bracteata)</i>
• Virginia Spiderwort	<i>(Tradescantia virginiana)</i>
• Culvers Root	<i>(Veronicastrum virginicum)</i>
• Golden Alexander	<i>(Zizia aurea)</i>

**Perennials Moist Soils, Shady Areas:**

• Wild Columbine	<i>(Aquilegia canadensis)</i>
• Caterpillar Sedge	<i>(Carex crinita)</i>
• Gray's Sedge	<i>(Carex grayi)</i>
• Cardinal Flower	<i>(Lobelia cardinalis)</i>
• Ostrich Fern	<i>(Matteuccia struthiopteris)</i>
• Virginia Bluebells	<i>(Mertensia virginica)</i>

**Grasses or Grass-like Plants for Moist Soil Areas:**

• Big Bluestem	<i>(Andropogon gerardii)</i>
• Feather Reed Grass	<i>(Calamagrostis acutiflora)</i>
• Fringed Sedge	<i>(Carex crinita)</i>
• Bottlebrush Sedge	<i>(Carex comosa)</i>
• Fox Sedge	<i>(Carex vulpinoidea)</i>
• Japanese Sedge	<i>(Carex morrowii)</i>
• Virginia wild rye	<i>(Elymus virginicus)</i>
• Horsetail	<i>(Equisetum hyemale)</i>
• Sweet Grass	<i>(Hierochloa odorata)</i>



- Soft Rush (*Juncus effusus*)
- Moorgrass (*Molinia caerulea*)
- Switchgrass (*Panicum virgatum*)
- Ribbongrass (*Phalaris arundinacea picta*)
- Indian Grass (*Sorghastrum nutans*)
- Prairie Cordgrass (*Spartina pectinata*)

**Shrubs for Sunny or Shady Areas, Moist Soil:**

- Indigo bush (*Amorpha fruticosa*)
- Black Chokeberry (*Aronia melanocarpa*)
- Red Osier Dogwood (*Cornus sericea*)
- Low Bush Honeysuckle (*Diervilla lonicera*)
- Winterberry (*Ilex verticillata cultivars*)  
Need male + female
- Pussy Willow (*Salix caprea*)
- Blue Arctic Willow (*Salix purpurea 'Nana'*)
- Redberried elder (*Sambucus s pubens*)
- Nannyberry (*Viburnum lentago*)
- Arrowwood Viburnum (*Viburnum dentatum*)
- American High Bush Cranberry (*Viburnum trilobum*)
- Blackhaw (*Viburnum prunifolium*)