Rain Garden Site Selection and Installation

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Water Resources Program
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A rain garden was constructed at the Ulster Municipal Building in 2008 by the Master Gardeners of Ulster County.

**GOAL:** To have the rain garden serve as a model for county residents who are interested in controlling polluted runoff and to help recharge the groundwater.

This rain garden captures stormwater runoff from 1,566 square feet of impervious surface. For every 1.25 inches of stormwater runoff, it captures 1,200 gallons.

As of September 2008, the rain garden has received 13.24 inches of stormwater runoff… **which equals 12,924 gallons of stormwater runoff being recharged!**
What is a Rain Garden?

• Shallow landscaped depression that treats stormwater runoff
• Designed to merge two important goals: aesthetics and water quality
• Can be blended into the landscape and made to look natural
• Water is directed into them by pipes, swales, or curb openings
Benefits

• Designed to intercept, treat, and infiltrate stormwater at the source before it becomes runoff

• Provides very high pollutant removal efficiencies

• Can be incorporated into the landscapes of many locations
The Parts of a Rain Garden

Grass Buffer  This surrounds a rain garden and reduces runoff velocities, filtering out particulates.

Depression  The depression stores runoff awaiting treatment, presettling particulates that have not been filtered out by the grass buffer.

Plants  Plants are selected on their ability to cycle and assimilate nutrients, pollutants, and metals.

Ponding Area  Surface must be level for maximum infiltration.

Planting Soil Layer  The soils provide needed nutrients while absorbing heavy metals, hydrocarbons, and other pollutants.

Organic or Mulch Layer  This layer acts as a filter for pollutants, protects the soil from eroding, and provides an environment for microorganisms to degrade petroleum-based products and other pollutants.

Sand Bed  A sand bed further slows runoff, spreading the water over the basin. The sand helps to prevent anaerobic conditions in the planting soil and enhances exfiltration from the basin.
The Science Behind Rain Gardens

• Absorption to soil particles
  – Removes dissolved metals and soluble phosphorus

• Plant uptake
  – Removes small amounts of nutrients

• Microbial processes
  – Removes organics and pathogens

• Exposure to sunlight and dryness
  – Removes pathogens

• Sedimentation and filtration
  – Removes total suspended solids, floating debris, trash, soil-bound phosphorus, some soil-bound pathogens

• Infiltration of runoff
  – Provides flood control, groundwater recharge, and nutrient removal

NOTE: 90% of all storm events produce less than 1 inch of rain. Therefore, the key to reducing pollutant loads is to treat the runoff associated with the first 1 inch of rain (Clayton & Schueler, 1996).
How much water does a typical rain garden treat in a year?

- 90% of rainfall events are less than 1.25"
- New Jersey has approx. 44” of rain per year
- The rain garden will treat and recharge:
  - $0.9 \times 44” = 40”/\text{year} = 3.3 \text{ ft/year}$
- The rain garden receives runoff from 1,000 sq. ft.
- Total volume treated and recharged by the rain garden is
  - $1,000 \text{ sq. ft.} \times 3.3 \text{ ft/year} = 3,300 \text{ cubic feet/year}$, which is 25,000 gallons/year
- **Build 40 rain gardens and we have treated and recharged 1 million gallons of water per year!**
How To Install a Rain Garden
Steps

1. Planning

2. Installation

3. Maintenance

Mendham Township Elementary School, Morris County
Planning Steps

1. Planning

- Identify Site
- Site Visit
- Design Calculations
Things to Remember

• The rain garden should be at least 10 feet from the house so infiltrating water doesn’t seep into the foundation.

• Do not place the rain garden directly over a septic system.

• Do not put rain garden in places where the water already ponds or the lawn is always soggy.

• Place in full or partial sunlight as a first option

• Select a flat part of the yard for easier digging as a first option.

• Avoid large tree roots.

http://clean-water.uwex.edu/pubs/raingarden/rgmanual.pdf
Determine Existing Utility Lines

http://www.digsafelynewyork.com/

Dig Safely New York NY One Call: 811
Planning Steps
Identify Site

Identify the Drainage Area

Parking Lot/Driveway

Roof

Before

Union County Vocational School

Hockman Farm, Winchester, Virginia
Planning Steps
Identify Site

Parking Lot/Driveway

After

Roof

Union County Vocational School

Hockman Farm, Winchester, Virginia
Parking Lot/ Driveway with a Curb Cut

Before

After

Planning Steps
Identify Site
Determine Current Stormwater Flow

If the area is prone to flooding, it may be difficult to improve the drainage.
Identify Drainage Problems

Property Flooding

Union County Vocational School
Current Landscaping Practices

Union County Vocational School
Measure Drainage Area

Surface Area = \((L1 \times W) + (L2 \times W)\)

\((15' \times 20') + (10' \times 20')\)

\((300') + (200')\)

= 500 square feet
Make observations during storms to estimate the drainage area

Or use survey equipment
Measure Drainage Area

# Rain Garden Sizing Table
for New Jersey’s Water Quality Design Storm

<table>
<thead>
<tr>
<th>Surface Area of Impervious Surface to be Treated (sq. ft.) or (LxW)</th>
<th>Size of 6” deep Rain Garden (sq. ft.) or (LxW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 sq. ft.</td>
<td>100 sq. ft. or 10’x10’</td>
</tr>
<tr>
<td>750 sq. ft.</td>
<td>150 sq. ft. or 15’x10’</td>
</tr>
<tr>
<td>1,000 sq. ft.</td>
<td>200 sq. ft. or 20’x10’</td>
</tr>
<tr>
<td>1,500 sq. ft.</td>
<td>300 sq. ft. or 30’x10’</td>
</tr>
<tr>
<td>2,000 sq. ft.</td>
<td>400 sq. ft. or 20’x20’</td>
</tr>
</tbody>
</table>
Determine Slope

**Planning Steps**

**Site Visit**

**Figure 3** The string should be tied to the base of the uphill stake, then tied to the downhill stake at the same level.

\[
\text{Slope} = \frac{H_1 - H_2}{L} \times 100 = \frac{9'' - 3''}{10'} = \frac{0.75' - 0.25'}{10'} \times 100 = 5\% \text{ slope}
\]
Determine Slope

*The depth of your rain garden depends upon the slope of your lawn.*

<table>
<thead>
<tr>
<th>Slope</th>
<th>Rain Garden Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4%</td>
<td>3” – 5”</td>
</tr>
<tr>
<td>5% – 7%</td>
<td>6” – 7”</td>
</tr>
<tr>
<td>8% – 12%</td>
<td>8”</td>
</tr>
<tr>
<td>&gt; 12%</td>
<td>Consider Another Location</td>
</tr>
</tbody>
</table>
Percolation Test

Steps:
1. Dig a hole 12 inches deep by 6 inches in diameter.
2. Fill hole with water and let stand until all the water has drained into the ground.
3. Refill the empty hole with water again. Measure the depth of water with a ruler.
4. Check the depth of water with a ruler every hour for 4 hours.
5. Calculate how many inches of water drained per hour.

~1 inch of water draining per hour is good
Water should be completely drained within 24 hours.
Soil Test

• Sample the soil and send to the Rutgers Soil Testing Lab for:
  • Nutrient analysis/ recommendations
  • pH analysis/ recommendations
  • Percent sand/ silt/ clay

• **Soil Texture Test**
  Roll soil into a ball in hand and see how it forms
  • Hard ball – Clay/Silt soil
  • Soft ball – Loamy soil
  • No ball – Sandy soil

But, don’t worry – clay/silt and sandy soils can be amended to get the preferred loamy soil texture
Planning Steps
Site Visit

Take Photographs

Burlington County Community Agricultural Center
General Soil Amendments Amounts for a 100 sq ft Rain Garden that is 6 Inches Deep

<table>
<thead>
<tr>
<th>Soil Amendment</th>
<th>Amount for 100 sq ft Rain Garden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>1 cubic yard</td>
</tr>
<tr>
<td>Compost</td>
<td>1 cubic yard</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>Follow Soil Test Result Recommendations</td>
</tr>
<tr>
<td>Lime</td>
<td>Follow Soil Test Result Recommendations</td>
</tr>
</tbody>
</table>

Gloucester County 4-H Fairgrounds
## Approximate Amount of Plants Based on Future Mature Size

<table>
<thead>
<tr>
<th>Size of Rain Garden</th>
<th>Approximate Amount of Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 square feet</td>
<td>1 Small Tree (Optional) 7 Shrubs 24 Herbaceous Species</td>
</tr>
<tr>
<td>200 square feet</td>
<td>1 Small Tree (Optional) 14 Shrubs 48 Herbaceous Species</td>
</tr>
</tbody>
</table>

Leonard Park, Morris County
Types of Plants

- Facultative Wetland (FACW)
- Facultative (FAC)
- Facultative Upland (FACU)

Planning Steps
Design Calculations

http://plants.usda.gov
Amount of Mulch Required for a Three Inch Thick Layer

<table>
<thead>
<tr>
<th>Size of Rain Garden</th>
<th>Approximate Amount of Mulch</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 square feet</td>
<td>0.25 cubic yard</td>
</tr>
<tr>
<td>50 square feet</td>
<td>0.50 cubic yard</td>
</tr>
<tr>
<td>100 square feet</td>
<td>1.0 cubic yard</td>
</tr>
<tr>
<td>200 square feet</td>
<td>2.0 cubic yards</td>
</tr>
</tbody>
</table>

*Triple-shredded Hardwood with No Dye*
Optional Supplies

Supplies may include:

- River rock
- PVC pipe
- Deer fencing
Installation Steps

• Remove existing grass
• Excavate to the desired elevation and grade
• Add soil amendments
• Prepare the berm

2. Installation

• Prepare the overflow
• Level the lowest zone/ponding area
• Plant the native plants
• Apply the mulch
• Water the native plants
Installation Steps

Remove Existing Grass

Gloucester County 4-H Fairgrounds
Installation Steps

Excavate to the Desired Elevation and Grade

Leonard Park, Morris County

Gloucester County 4-H Fairgrounds
Add Soil Amendments
Prepare the Berm

Installation Steps

a. Between 3% and 8% slope lawn

b. Greater than 8% slope lawn

Leonard Park, Morris County
Prepare the Overflow

Installation Steps

Gloucester County 4-H Fairgrounds

Overflow

Leonard Park, Morris County
Level the Lowest Zone/ Ponding Area

Figure 4. Plants at base of a 6-inch deep Rain Garden
Plant the Native Plants

Cut the Root Ball

Ulster County, New York
Installation Steps

Plant the Native Plants

Planting Hole
Same Depth as Root Ball

Ulster County, New York

Hockman Farm, Winchester, Virginia
Apply the Mulch

Installation Steps

Protect Small Plants when Mulching

Ulster County, New York
Water the Native Plants

Hockman Farm, Winchester, Virginia
3. Maintenance

Short-Term Maintenance

Long-Term Maintenance

Madeline will discuss this later…
Frequently Asked Questions

- Will my rain garden cause a mosquito problem?
- Will my rain garden cause flooding?
- What about deer?
- How do I slow down the speed of water as it enters the garden?
Will my rain garden cause a mosquito problem?

- There shouldn’t be a mosquito problem if the garden is properly sited and designed. Rain gardens should drain in less than two days.
- Mosquitoes have a 10 day life cycle from egg to adult.
- Mosquitoes that carry most diseases do not live in ponds. They prefer small amounts of standing water such as holes in trees, old tires or bird baths.
Will my rain garden cause flooding?

If your rain garden does not drain out the water after ~24 hours, it is time to re-evaluate your rain garden. Maybe try:

• Building berms and/or adding plants

• Adding COARSE sand (not sandbox sand) with organic mulch to the rain garden to help infiltrate the water
What about deer?

Try fencing, deer resistant plants, or deer retardant sprays.
How do I slow down the speed of water as it enters the garden?

Try one or more of the following:

1. Attach a perforated plastic diffuser to the end of your gutter/downspout

2. Use river rock at the entrance point of the rain garden

3. Site your rain garden within a 10 – 15 foot grass buffer between the garden and the gutter/downspout. Use native grasses and let them grow tall.
Rain gardens are designed to intercept, treat, and infiltrate stormwater at the source, before it becomes runoff.

The plants are native to the region and help retain contaminants that could otherwise harm nearby waterways.

Rain gardens are beautiful, inexpensive and low-maintenance gardens that you can easily install at home.
Saugerties Municipal Building, Town of Saugerties, NY
Any Questions?

Essex County Environmental Center, Essex County

http://water.rutgers.edu