

Sizing a Rain Garden

Activity Overview

Students calculate the size of a rain garden using measuring tools, tables, and formulas.

Objectives

Students will:

- Determine the drainage area through observation and data collection.
- Measure the area draining into the rain garden using measuring tools.
- Use strategies in real-world situations to solve multiplication problems.

Subjects Covered

Math, Science, and Geography

Grades

4 through 12

Activity Time

Two 50-minute class periods

Season

Any

Materials

Measuring tapes, map of schoolground including location of buildings and paved surfaces; information about soil type (from Earth Partnership for Schools activity, “Getting to Know Your Soil for Rain Gardens” or “Infiltration Test: Exploring the Flow of Water Through Soils”), slope (from Earth Partnership for Schools activity, “Measuring Slope for Rain Gardens”); sizing a rain garden worksheet

State Standards

Math: A.4.1, A.4.3, A.4.5, A.8.1, A.12.1, B.4.5, B.8.1, B.8.7, D.4.1, D.4.2, D.4.3, D.4.4, D.4.5, D.8.1, D.8.2, D.8.3, D.8.4

Science: C.4.3, C.4.5, C.8.1

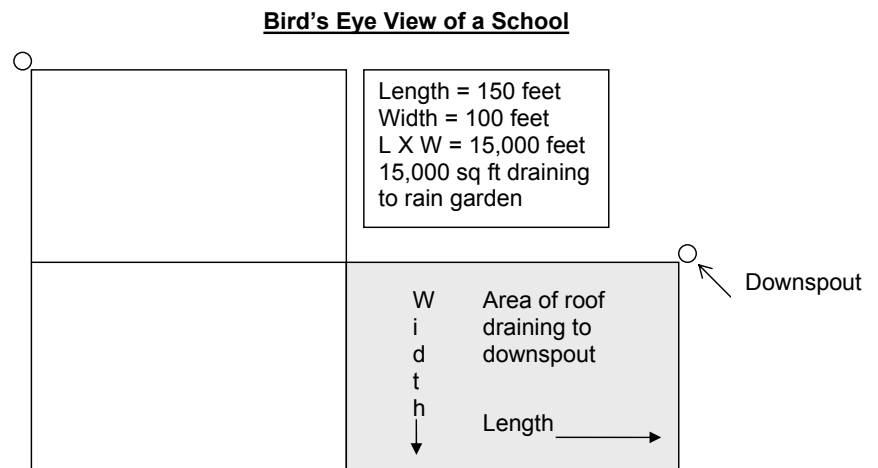
Background

Determining the size of a rain garden is not an exact science. Experts have different opinions. With that said, how big will you build your rain garden? There are two answers: any size you want, or if you want 100% runoff control, you need to make calculations. The first answer may seem like an odd response. But it means that a rain garden of any size will reduce the amount of precipitation that becomes surface runoff. Each water drop that stays on the school property is one less drop that potentially carries pollutants to lakes, rivers and streams. The second answer involves learning how large the drainage area is, what type of soil is in the garden, and what is the percent slope of the site. Next take this information and plug it into formulas to obtain a square foot area for the garden. The following activity description covers each step of the process for sizing a rain garden.

Activity Description

Calculate Drainage Area

1. Go out to the area designated for the rain garden. Identify the section of roof that will drain into the downspout. Measure the length and width of this area. Take measurements of other hard surfaces such as driveways, parking areas, or sidewalks that may drain into the rain garden. Repeat measurements of lawn that noticeably drain into the proposed rain garden. (It is not necessary to include the lawn area between the building and the garden site. Insert these numbers in the “Sizing a Rain Garden” worksheet.
2. Calculate areas draining into the rain garden. See Figure 1 showing the drainage area for one downspout on a school roof.



Sizing a Rain Garden (cont.)

3. Add all drainage areas together if more than one area drains into your proposed rain garden. Otherwise continue to the next step.

Determine Rain Garden Depth

1. The existing slope of the proposed rain garden site determines how deep to dig your garden. The bottom of the garden needs to be flat so that water spreads out and does not puddle. When digging your garden you will be removing soil from the top of the slope and adding it to the bottom end. See Figure 2. Because of this change in grade you must calculate the depth of the garden based on the slope. Generally the greater the slope the deeper the garden. A 4% slope equals a 3 – 5 inch deep garden, while a 12% slope equals an 8 inch deep garden. Use the results from Earth Partnership for Schools activity, “Measuring Slope for Rain Gardens,” to learn what the existing slope is for your proposed rain garden. Add this number to the worksheet.

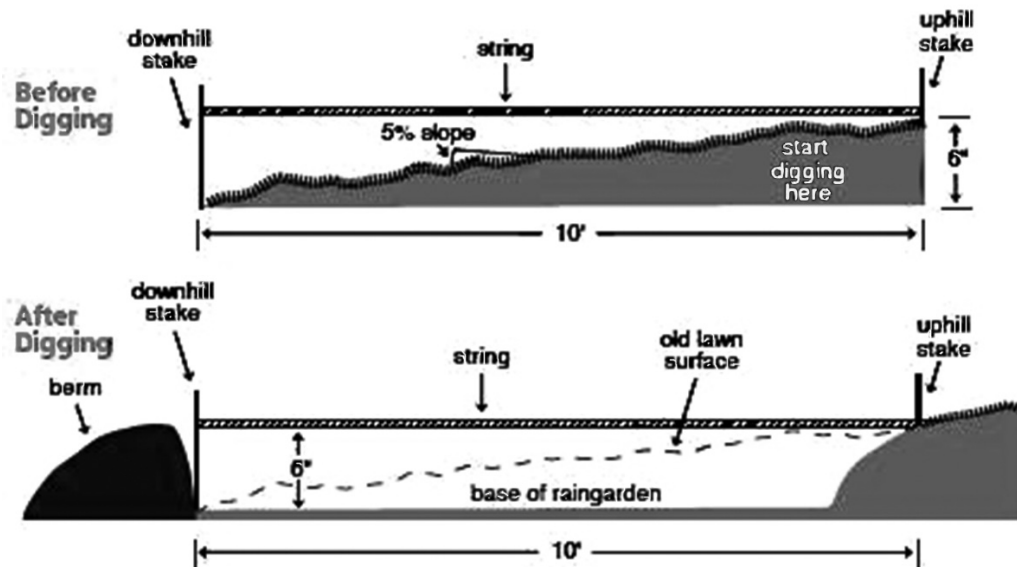


Figure 2: Schematic for digging a rain garden. Illustration from UW-Extension Basin Education Rain Garden Educator's Kit.

Identify Soil Type

1. Soil type influences the time water takes to soak into the ground and the ultimate size of the rain garden. Sandy soil with large particle sizes drains quickly so that a garden can be built deep and small. Slow-draining clay soil requires a large and shallow garden so that the water can spread out over a big surface area. Circle the soil type—sand, silt (loam) or clay—on the worksheet. Learn how to identify your soil type in Earth Partnership for Schools activities, “Identify Your Soil for Rain Gardens” or “Infiltration Test: Exploring the Flow of Water Through Soils.”

Determine the Soil Factor

1. The soil factor is a number derived from soil type and rain garden depth. Locate the correct soil factor on the tables to use as the multiplier with drainage area.

Sizing a Rain Garden (cont.)

2. The worksheet has two sets of factors. Use the table #1 for rain gardens closer than 30 feet from the downspout. Use table #2 for rain gardens 30 feet or more from the downspout and rain gardens collecting water from lawn areas. The two tables are different because some water will infiltrate as it flows over the lawn for 30 feet or more.

Determine Rain Garden Size for 100% Runoff Control

1. Multiply total drainage area by the soil factor. This gives you the size to build the rain garden in square feet.
2. For the next steps in the planning process, go to Earth Partnership for Schools activities, “Designing a Rain Garden” and “Rain Garden Species Selection.”

Extensions

- Determine the size of a rain garden for a community building such as your local library or post office.
- Compare rain garden sizes using different soil types, drainage areas and slopes. Discuss how the differences may affect the landscape.

Additional Resources

- ... *Build your own rain garden*. Chesapeake Bay Foundation. http://www.cbf.org/site/DocServer/rain_garden_guide-web.pdf?docID=2869
- ... *How to install a rain garden* (Instructional Flyer). South River Federation and Center for Watershed Protection. http://www.cwp.org/Community_Watersheds/brochure.pdf
- ... *How to build a rain garden*. Dane County Lakes and Watershed Commission. Madison, WI. www.co.dane.wi.us/commissions/lakes/
- ... (2005). Rain garden educator’s kit. UW-Extension Basin Education Program and the WI DNR Runoff Management Section.
- ... *Rain gardens: A how-to manual for homeowners*. (DNR Publication PUB-WT-776 2003, UWEX Publication GW0037) Available at Dane County’s Extension Office: (608) 266-4106 or through Rock River Basin Educator, UW-Extension, Jefferson County, 864 Collins Road, Jefferson, WI 53549-1976; Phone: 920-674-8972; order on the Web at <http://cecommerce.uwex.edu> or <http://dnr.wi.gov/education/> Download at http://myfairlakes.com/what_more.asp#yardgarden_raingardens
- ... *Rain gardens: A household way to improve water quality in your community* (UWEX Publication GWQ034). Available at Dane County’s Extension Office: (608) 266-4106 or through Rock River Basin Educator, UW-Extension, Jefferson County, 864 Collins Road, Jefferson, WI 53549-1976; Phone: 920-674-8972; order on the Web at <http://cecommerce.uwex.edu> or <http://dnr.wi.gov/education/> Download at http://myfairlakes.com/what_more.asp#yardgarden_raingardens

Web sites:

- How to Build a Rain Garden. Rain Gardens of West Michigan. www.raingardens.org
- Native Plant List for Wisconsin Rain Gardens (Interactive HTML) <http://www.dnr.state.wi.us/bioweb/raingardens/>

Sizing a Rain Garden (cont.)

[wi.us/org/water/wm/nps/rg/plants/PlantListing.htm](http://www.wi.us/org/water/wm/nps/rg/plants/PlantListing.htm)

- Dane County Lakes and Watershed Commission: Rain Garden Information. <http://www.co.dane.wi.us/commissions/lakes/raingardens.html>
- ... A Web based homeowner guide for building and maintaining a rain garden. Rain Garden Network: <http://www.raingardennetwork.com/index.htm>

Assessments

- Describe the process of sizing a rain garden.
- Develop two rain garden scenarios and calculate the final rain garden sizes.

Sizing a Rain Garden Worksheet*

To size a rain garden, you will need to measure your drainage area, determine the percent slope of your lawn, and identify your soil type. This worksheet will walk you through these steps. Use Earth Partnership for Schools activities, "Identifying Your Soil for Rain Gardens" and "Measuring Slope for Rain Gardens" to determine your soil type and percent slope.

1. Drainage Area: Measure your drainage area.

a. Roof area: _____ feet X _____ feet = _____ square feet

b. Lawn area: _____ feet X _____ feet = _____ square feet

c. Paved surfaces: _____ feet X _____ feet = _____ square feet

d. Total drainage area: _____ **square feet**

2. Rain Garden Depth: Find the slope of your rain garden site to determine how deep to dig your garden.

a. Less than a 4% slope = 3 – 5 inch deep rain garden

b. 5 – 7% slope = 6 – 7 inch deep rain garden

c. 8 – 12% slope = 8 inch deep rain garden

_____ **inches deep**

3. Soil Type: Determine your soil type.

a. Soil Type: (*Please circle*) sand silt (loam) clay

4. Soil Factor: Use the appropriate table below to find your soil factor. The soil factor is derived from soil type and rain garden depth.

a. **Soil factor:** _____

Table #1: Rain gardens up to 30 feet from a downspout.

	3 – 5 inches deep	6 -7 inches deep	8 inches deep
Sandy soil	0.19	0.15	0.08
Silt/loam soil	0.34	0.25	0.16
Clayey soil	0.43	0.32	0.20

Table #2: Rain gardens more than 30 feet from the downspout.

Sandy soil	.03
Silt/loam soil	.06
Clayey soil	.20

5. Rain Garden Size: Multiply total drainage area (#1) by the soil factor (#4).

_____ (sq ft.) total drainage area X _____ soil factor = _____ **(sq ft.) rain garden**

*Based on Rain Gardens: A how-to manual for homeowners