



**Simple and inexpensive best practices for shoreland property owners.**

Wisconsin's Healthy Lakes & Rivers Action Plan goal is to protect and improve the health of our lakes and rivers by increasing shoreland property owner participation in habitat restoration and runoff and erosion control projects.

To find fact sheets about the practices and an overall review of the Healthy Lakes & Rivers program, go to [healthylakeswi.com](http://healthylakeswi.com).



LISA REAS

**DECISION TOOL:**

# MANAGING RUNOFF WITH HEALTHY LAKES & RIVERS PRACTICES

Healthy Lakes & Rivers practices such as fish sticks, native shoreline plantings, diversions, rock infiltration, and rain gardens help to meet various goals to improve waterbody health. This decision tool will direct you to the appropriate practice to meet *your* healthy lakes and rivers goals. If your main concern is managing runoff from hard surfaces, you will learn how to map your property, calculate runoff, and size and position Healthy Lakes & Rivers practices on your property.

**What goals do you have for your property?**

Create fish and wildlife habitat.	➤ <b>CHOOSE FISH STICKS</b> (lakes only)
Improve wildlife habitat, natural beauty and privacy, and decrease runoff.	➤ <b>CHOOSE NATIVE SHORELINE PLANTING</b>
Prevent runoff from getting into your lake or river or direct water to an infiltration practice.	➤ <b>CHOOSE DIVERSION PRACTICE*</b>
Capture and clean runoff.	➤ <b>CHOOSE ROCK INFILTRATION*</b>
Create wildlife habitat and natural beauty while capturing and cleaning runoff.	➤ <b>CHOOSE A RAIN GARDEN*</b>

*\*Eligible for shoreland properties within 1000 feet of a lake or 300 feet of a river.*

**Are Healthy Lakes & Rivers practices right for your property?**

**Can you manage erosion and runoff concerns on your own with support of Healthy Lakes & Rivers?**

- Water flows evenly or in small channels (not more than an inch or two deep) from hard surfaces to the waterbody.
- The hard surface that drains to a single area is 1,000 square feet or less. Larger areas of hard surface may generate too much runoff for a Healthy Lakes & Rivers practice to adequately capture and control.

If you answered yes to both points, then continue on to get started.

**OR**

**Are your runoff and erosion concerns likely beyond the scope of the Healthy Lakes & Rivers?**

Healthy Lakes & Rivers practices are designed for projects that can be installed with \$1,000 or less of grant support either as a do-it-yourself project or with contractor installation. Design guidance is provided through Healthy Lakes & Rivers. Some projects require more sophisticated design and are likely to be considerably more expensive to install.

**Some projects are not only beyond the scope of Healthy Lakes & Rivers, but may require engineering assistance. Professional assistance is recommended where one or more of the following occur:**

- Construction occurs on slopes >20%.
- More than 20,000 square feet are cleared.
- More than two acres drains to an eroded area.
- Severe gully erosion (at least one foot deep) is present.
- You are not comfortable implementing solutions on your own.

## Make a base map of your property to get started

To begin, draw the dimensions of your property on graph paper. Be sure to leave enough room to locate the shoreline.

### Property features

Measure and plot your property's features on your plan. You could use symbols, patterns and colors like those shown here or create your own legend.

Include the following:

- existing structures: home, garage
- planned new features: structures, paths, gardens
- hard surfaces: sidewalks, driveways, patios
- water flow from hard surfaces, downspouts
- water flow across land
- streams, running water
- septic tank, drain field
- well
- buried electric and utility lines (call Diggers Hotline (800) 242-8511, or go to [diggershotline.com](http://diggershotline.com))
- wet soil or saturated areas
- soil types
- erosion areas
- natural areas
- flatter areas (<10% slope)
- pathways
- play areas
- shoreline
- pier or dock, swimming area

Measure the hard surfaces you want to capture and map them on the grid, including dimensions. Once mapped, you can calculate square footage, mark the direction of water flow and indicate any rain gutter pipe or downspout.

### Placing practices on your map

Use the tools on pages 4-7 to calculate the size of diversion and infiltration practices for the areas of hard surface. Consider soil type when positioning the practices. Don't forget that diversion and infiltration practices can be attractive landscaping features for your property (see page 8).

### Potential practices with calculated size

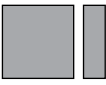











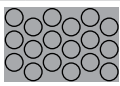


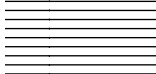
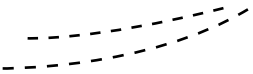

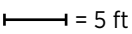
- fish sticks
- native shoreline plantings (350 ft<sup>2</sup> minimum)
- diversion
- rock infiltration
- rain garden

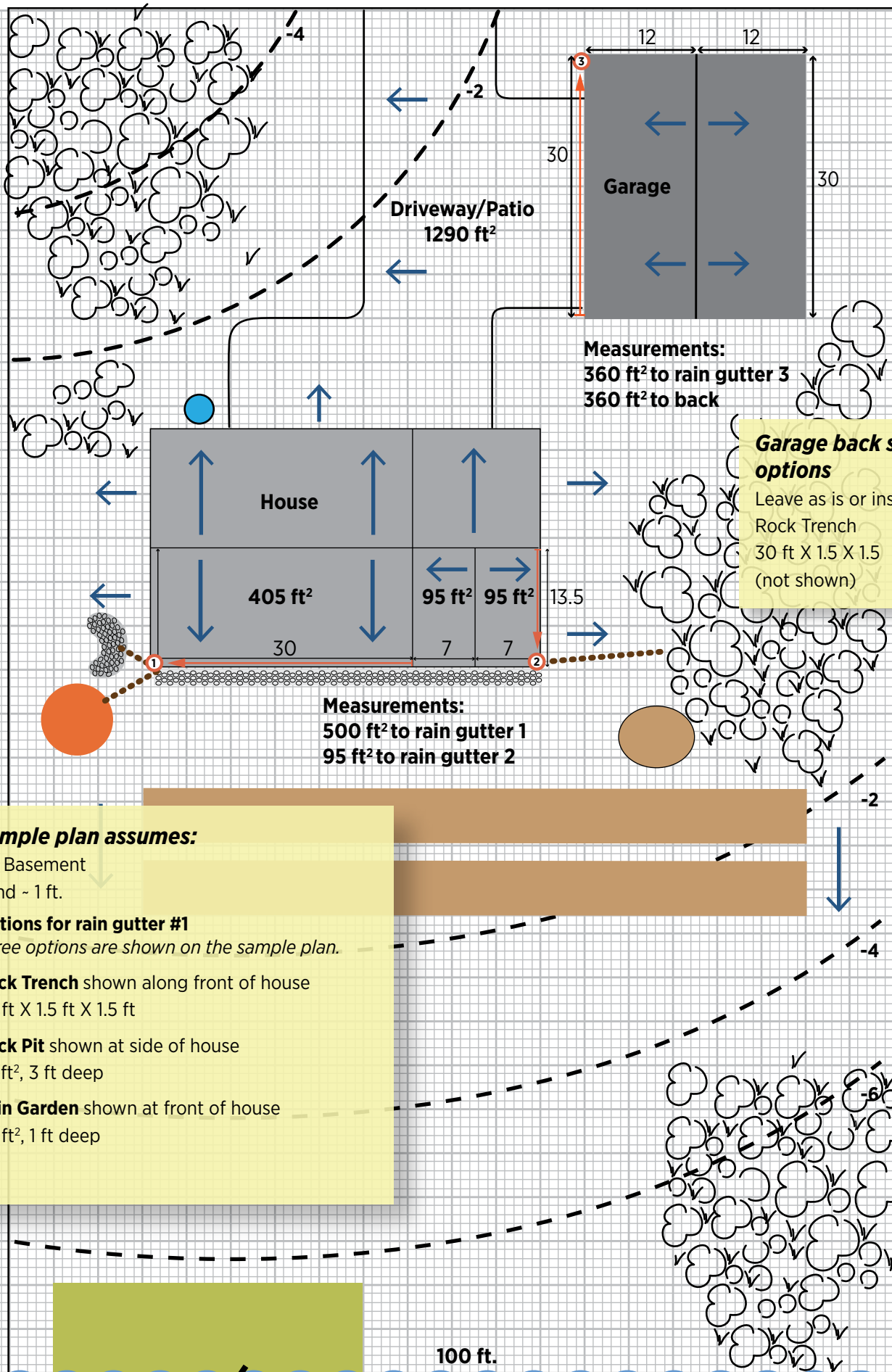
### Tips for creating your plan

- Consider existing property features when siting practices.
- Direct rain gutters away from the lake or river.
- Take advantage of natural slopes to direct water flow.
- Place practices in flat areas (slope <10%).
- If you have a basement, allow 10 feet distance from house to infiltration practice.
- Place rock infiltration practices at least 50 feet from shallow (<25 ft. deep) drinking water wells.
- Consider soil types and soil depth to sand for each practice.
- Locate fish sticks away from high use swimming or boating areas.
- Use a ruler or straight edge to draw your plan.

**Turn to the following pages to further design your Healthy Lakes & Rivers practices.**

### Sample plan legend

Hard surfaces 	Note soil types for various areas 
Water flow 	
Downspouts 	Shoreline 
Streams, running water over soil 	Fish sticks 
Septic, drain field 	Native shoreline planting 
Well 	Diversion 
Erosion area 	Rock infiltration 
Natural area 	Rain garden 
Flat area (slope <10%) 	Grade 
Flow in gutter to downspout 	Map scale  = 5 ft



**Measurements:**  
 360 ft<sup>2</sup> to rain gutter 3  
 360 ft<sup>2</sup> to back

**Garage back side options**  
 Leave as is or install a  
 Rock Trench  
 30 ft X 1.5 X 1.5  
 (not shown)

**Measurements:**  
 500 ft<sup>2</sup> to rain gutter 1  
 95 ft<sup>2</sup> to rain gutter 2

**Sample plan assumes:**  
 No Basement  
 Sand ~ 1 ft.

**Options for rain gutter #1**  
 Three options are shown on the sample plan.

**Rock Trench** shown along front of house  
 44 ft X 1.5 ft X 1.5 ft

**Rock Pit** shown at side of house  
 34 ft<sup>2</sup>, 3 ft deep

**Rain Garden** shown at front of house  
 50 ft<sup>2</sup>, 1 ft deep

150 ft.

100 ft.

Scale: 1" = 5 ft

**Sample plan**

# Choose a practice and location to reduce runoff

## What are your site conditions?

### Is there standing water or is the area wet throughout the growing season?

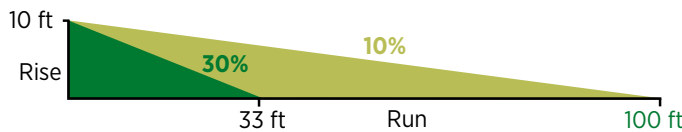
Option: choose native shoreline plantings. Infiltration practices like rain gardens and rock trenches do not work where it is wet because the water has no place to go.

**IMPORTANT:** Native shoreline plantings must be at least 350 ft<sup>2</sup> and located adjacent to or partially within 35 feet of the waterbody.

### How steep is the slope?

Slope is measured by rise over run or vertical over horizontal distance and is expressed as a percentage.

#### Measuring slope by percentage



$$\text{Slope Percent} = \frac{\text{Rise}}{\text{Run}} \times 100$$

Slopes greater than 20%	➤ Not suitable for a Healthy Lakes & Rivers practice.
Slopes between 10% and 20%	➤ Choose native shoreline plantings. Not suitable for rain gardens.
Slopes between 0% and up to 10%	➤ Choose native shoreline plantings, diversions, rock infiltration, rain gardens.

### What are the soil conditions?

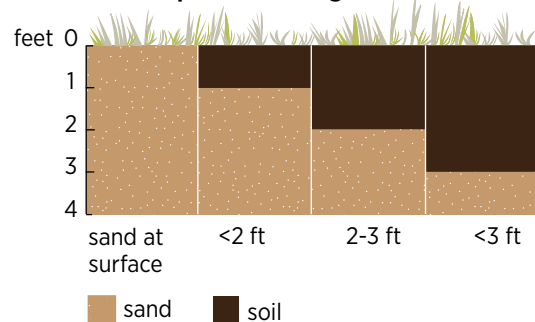
Soil assessment tools are included in the [Runoff Guide](#) linked to [healthylakeswi.com](http://healthylakeswi.com) (see page 19-21).

Sandy (coarse and gritty)	➤ All options OK. Works especially well for rock infiltration.
Loamy (smooth and spongy)	➤ Best for native shoreline plantings, diversions, rain gardens.
Clay soils (stiff and sticky)	➤ Not suitable for rock infiltration. Rain gardens are OK, but may need to be very large unless soil is removed and replaced.
Wet, saturated soils	➤ Not suitable for infiltration practices. The water table should be at least 3 feet below the base of any infiltration practice.

### How deep is it to sandy soil?

Sand at surface	➤ Suitable for all practices: native shoreline plantings, rock infiltration, rain garden.
<2 feet to sand or sand and gravel	➤ Choose native shoreline plantings, rock trench, rain garden.
2-3 feet to sand or sand and gravel	➤ Choose native shoreline plantings, rock pit, rain garden.
>3 feet to sand or sand and gravel	➤ Choose native shoreline plantings, rain garden.

#### Estimate soil depth to sand or gravel

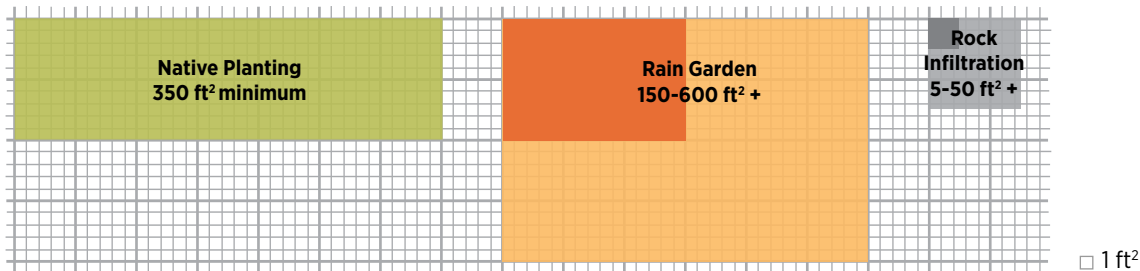


If it isn't practical to dig to the depth of sand or sand and gravel, it is best to consider a rain garden because infiltration rates are likely too slow for rock. Soil amendments such as yard waste compost are beneficial for rain gardens to increase water holding capacity for sandy soils and drainage for clay soils.

## Where can you install infiltration?

- Infiltration should be installed at least 10 feet from your dwelling — especially if you have a basement.
- Do not construct infiltration practices over a septic system drain field.
- The flattest area of your lot is generally the best location for an infiltration practice.

### Typical surface area needed



## Is a diversion practice needed?

Diversions such as trenches, berms, or pipes direct water to an infiltration area. Also consider solid 4-6" PVC pipes to get water to your practice if the water is already in a rain gutter or drainage tube. Do not install diversions across very steep slopes (>10%). See fact sheet at [healthylakeswi.com](http://healthylakeswi.com) for more information about constructing diversions.

### What's a diversion practice?

A diversion practice redirects runoff that would otherwise move downhill into the lake or river to a dispersion area where it can soak into the ground. It may also be used in connection with a rock infiltration or rain garden practice.

## Is there existing natural growth nearby on your property?

Diverting water to a natural area may be the simplest, most cost effective option to control runoff. However, it is not appropriate to divert water to a neighbor's property without their written permission.

## Does water flow to the area where you wish to install your rock infiltration practice or rain garden?

If not, a diversion will be very important to your infiltration practice. Carefully examine how water flows before you choose where your practice will be installed.

Diversions are needed where it is not possible to place a practice where water already flows. Install a diversion to direct the water where you need it to go. The last thing you want to do is build a beautiful rain garden that runoff water never reaches.

## What are your preferences?

- Do you like to garden? Choose a native shoreline planting or rain garden.
- Are you willing to carry out simple maintenance such as keeping rain gutters and rock areas free of debris?  
If not, don't bother to install infiltration practices. Some minimal maintenance is required for practices to function well.
- Healthy Lakes & Rivers practices must remain in place and be maintained for a minimum of 10 years if grant funded.

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*Diverting water to a natural area on your property may be the most cost effective option to control runoff. Consider the distance from your dwelling, location of your septic system, slope, soil conditions, flat areas, and how water flows across your lot.*

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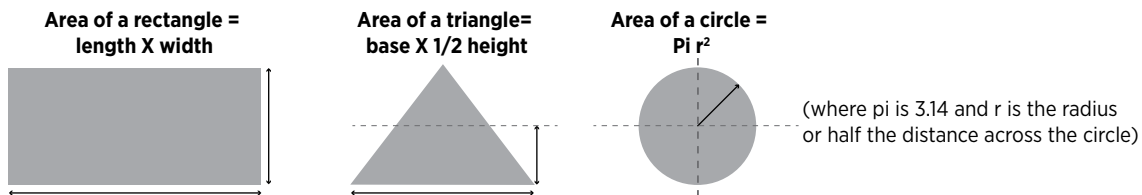
# How much hard surface creates runoff?

## Measure drainage area

Measure hard surfaces like roof tops and driveways that drain to the area selected for infiltration (you don't need to measure everything, just the area you plan to capture). This is critical information for your project.

To measure drainage area, look uphill to find the source of water. For Healthy Lakes & Rivers practices, consider hard surfaces such as roofs and driveways on your lot. If you have considerable amounts of runoff coming from a neighbor's property or a larger area, a Healthy Lakes & Rivers practice will probably not be adequate to capture the amount of runoff flowing through your property.

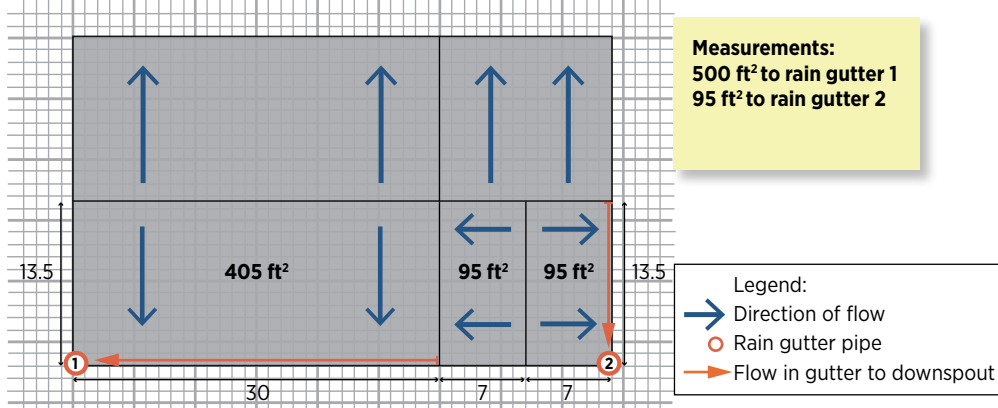
Use the map you created with guidance on page 2 to help you complete calculations. Divide the area into shapes so the area is easy to estimate. (Here's where you get to use your sixth-grade math!)



### Measuring roofs:

- Use your property map which shows how water flows.
- No need to consider roof slope, assume rain falls straight down.
- Include roof overhang (but don't measure twice).
- Indicate where rain gutters bring water in a pipe.

Roof area, flow and rain gutter pipe



This illustration shows all five Healthy Lakes & Rivers practices together at one property: fish sticks, native shoreline planting, diversion, rock infiltration, and rain garden.

# Sizing your infiltration practice

## Calculating rock volume needed

$$\frac{\text{Hard surface area (ft}^2\text{)} \times \text{inch(es) rain}^*}{12 \text{ inches}} = \text{Water storage volume needed (ft}^3\text{)}$$

Rock has about 40 percent void space if rocks are generally uniform in size (e.g. 3/4" to 1-1/2" rock is good; when rocks vary in size, smaller rocks fill in the void space between larger rocks).

$$\frac{\text{Water storage volume needed}}{.40} = \text{Rock volume needed (ft}^3\text{)}$$

### Simplified calculations for rock volume:

For a 1 inch rain:  
Hard surface area (ft<sup>2</sup>) X 0.2

For a 2 inch rain:  
Hard surface area (ft<sup>2</sup>) X 0.4

### Example: Collect water that drains from a 500 ft<sup>2</sup> roof

Water storage volume needed	Rock volume needed
$\frac{500 \text{ ft}^2 \times 1 \text{ inch rain}}{12 \text{ inches}} = 41.67 \text{ ft}^3$	$\frac{41.67 \text{ ft}}{.40} = 104.17 \text{ ft}^3$

\*Decide how big of a storm event you wish to capture. Generally 1-2.5 inches are captured, sometimes 1/2 inch for sandy soils with very rapid infiltration.

## Sizing a rock infiltration trench

Start with length. For example, 44 feet along the base of the front of the house.

$$\frac{104 \text{ ft}^3}{44 \text{ ft}} = 2.4 \text{ ft}^2$$

Trench would be 1.5 feet deep and 1.5 feet wide to capture a 1 inch rain event. (Be sure that 1.5 feet depth reaches sand or sand and gravel for adequate infiltration.)

## Sizing a rock infiltration pit

Start with depth to sand or sand and gravel: Assume depth to sand is 3 feet.

$$\frac{104 \text{ ft}^3}{3 \text{ ft}} = 34 \text{ ft}^2$$

Rock infiltration pit could be 6 ft X 6 ft at surface and 3 feet deep.

## Sizing a rain garden

To determine a rain garden surface area, multiply drainage area by the following for each soil type:

- Sandy: 10 percent
- Loamy: 20 percent
- Clay: 45 percent

### Reconsider: Have you selected the best Healthy Lakes & Rivers practice and location for your property?

Now that you know the surface area needed, consider locations and practices for your site map. Then reconsider... does the practice fit your site, or do you need to go back to the drawing board?



PPAMELA TOSHNER

# Healthy Lakes & Rivers practices

## Attractive landscape features that improve habitat and water quality.



PAMELA TOSHNER

### FISH STICKS

An in-lake practice (not eligible for rivers) of large woody habitat structures that utilize whole trees grouped together, resulting in the placement of more than one tree per 50 feet of shoreline. This fish and wildlife habitat best practice creates food, shelter, and breeding areas for all sorts of creatures: small aquatic insects, fish, turtles, ducks, and songbirds. Fish Sticks can also help prevent bank erosion—protecting lakeshore properties and your lake.



PAMELA TOSHNER

### NATIVE SHORELINE PLANTING

A transition zone practice, planting plans designed for a contiguous area of at least 350 ft<sup>2</sup>. There are six options with a corresponding list of native plants suited to the given soil conditions and function of the plan, including shoreline, bird/butterfly habitat, woodland, low-growing, deer resistant, and bare soil area plantings.



JIM GIFFIN

### DIVERSION

A transition or upland practice (within 1000 feet of lakes or 300 feet of rivers), a diversion redirects runoff that would otherwise move downhill into the lake or river to a dispersion area where it can soak into the ground. It may be used in connection with a rock infiltration or rain garden practice like in the above photo. By increasing the frequency of diversion practices, runoff volume can be kept low, decreasing erosion.

### ROCK INFILTRATION

An upland practice (within 1000 feet of lakes and 300 feet of rivers), this is an excavated pit or trench filled with rock that reduces runoff by storing it underground to infiltrate. This infiltration best practice captures, cleans, and infiltrates runoff that would otherwise move downhill into the lake or river. It is appropriate for sandy to loamy soils only (not clay!).



BILL GIESE



PAUL SKAWINSKI

### RAIN GARDEN

An upland practice (within 1000 feet of a lake or 300 feet from a river), a landscaped shallow depression with loose soil and native plants designed to collect and infiltrate roof, path, and driveway runoff while also creating wildlife habitat and natural beauty. Rain gardens collectively protect lakes and rivers by preventing polluted runoff from entering them. They provide habitat for birds, butterflies, and beneficial insects and promote natural beauty. Rain gardens are designed to drain within 1-2 days, which means they won't pond water long enough to grow more mosquitoes.



**Let's make Healthy Lakes & Rivers together!** The DNR has Healthy Lakes & Rivers grant funding available for lake or river organizations and local governments working with individual property owners like you. Thank you to our design tool contributors and reviewers, including the Healthy Lakes & Rivers team, Burnett County, Deer Lake Conservancy, and several citizen lake leaders.

Learn more at [www.healthylakeswi.com](http://www.healthylakeswi.com).

For more information [healthylakeswi@gmail.com](mailto:healthylakeswi@gmail.com).



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