

Purple Coneflower

Echinacea purpurea



PLANT NOTES

A variety of bees, butterflies, and birds (including the American Goldfinch) utilize the coneflower's nectar. Larvae of the silvery checkerspot feed on the leaves and larvae of several moths feed on flowers. Petals tend to droop downward as the flower matures. Flowering stalks, up to 8" long; daisy-like flowerheads with 10 to 20 petals. Blooms in the mid to late summer months.

Photos: Shutterstock



Chapter 2

Evaluating Soil Conditions

▼ The Importance of Good Soils

Healthy soils have good pore space, minimal compaction, high organic matter and microbial activity, and a sufficient supply of nutrients. These characteristics factor into a soil's ability to drain water. Rain gardens rely on good soils for this reason.

Rain gardens typically hold water for 12 hours or less. For example, if it rains in the afternoon, a rain garden should not have standing water by morning. Standing water for a long period of time in a rain garden can create low oxygen conditions in the subsurface soils. This can lead to a variety of issues, including plant death and odor problems.

There are three soil tests that should be done at the proposed rain garden location. The first test is simply to view the color of the subsurface soils. The second test is a soil ribbon test and the third is a **percolation** test. These three tests help determine if soils have adequate drainage for the installation of a rain garden.

While the soil tests may appear conclusive regarding the soil type and drainage patterns of an area, seasonal variations such as soil moisture content and temperature can change the testing outcomes. Seek technical assistance from a local Soil and Water Conservation District (SWCD) office if there are questions about the suitability of the soil at a proposed rain garden site.



Terms to Know

Percolation: The movement of water through the soil. Percolation rate is the rate that water moves downward through the pores in the soil profile, and is measured in inches per hour. Sandy soils tend to have high percolation rates and clay soils tend to have slower rates.

Water Table: In subsurface soils, it is the top level below which the pore spaces in soil are saturated with water.

Photo: Polk SWCD



Healthy soils allowed for a basic rain garden to be installed at this residence.



Soil Color Test

Various soil colors are indicators of drainage conditions. Soils that are too wet can have a gray color. Reddish dots of color indicate that there may be a seasonally high **water table**. This typically is an unsuitable location for a rain garden. The soil color test can be completed when excavating soils for the soil ribbon and percolation tests.

Photo: MN Pollution Control Agency



Gray color indicating high levels of moisture in the soil.



Soil Ribbon Test

The soil ribbon test estimates the amount of clay in the soil, which indicates how quickly rainfall will percolate through the soil. Follow these steps to complete a soil ribbon test:

1. Select three locations within the proposed rain garden area. Try to pick the center of the rain garden and upslope and downslope locations. These holes will also be used for the soil percolation test.
2. Once all underground utilities have been marked, use a soil probe, shovel, or clamshell posthole digger to dig three holes within the proposed rain garden location. The upslope hole should be about three feet deep, the downslope hole about 1.5 feet deep, and the center hole in between those depths. You may have to pre-wet the area if the soil is dry by slowly pouring a bucketful of water on the area and allowing the water to soak into the soil.
3. At every half foot increment in depth, grab a handful of soil and roll it into the shape of a cigar with your hands.
4. Squeeze the soil between your thumb and forefinger into a flat ribbon. Measure the approximate length of soil that ribbons out before breaking.
5. Refer to "How to Interpret Soil Ribbon Test Results" on the following page.

Photo: ISWEP



Accessing subsoils using a soil probe.

How To Interpret Soil Ribbon Test Results



If the soil won't ribbon outward and breaks off as you squeeze it, the soils have a low clay content and good percolation rates.



If the soil extends out between one and two inches before breaking off, the clay content should still be low enough for adequate percolation rates.



If the soil ribbons out two inches or more before breaking off, the clay content is too high. Percolation rates will likely be too slow for a rain garden to adequately drain.

How To Determine Soil Type With a Soil Ribbon Test

Low Clay Content

If the soil does not form a ribbon or forms a ribbon less than one inch, the soil is **sandy** or **loamy**. These types of soils are best suited for rain gardens because they have high percolation rates.

Photo: Polk SWCD



Medium Clay Content

If you are able to form a ribbon that is between one and two inches before it breaks off, you likely have a **clay loam** type soil. These soils have moderate percolation rates and may still work for rain gardens.

Photo: Design With Natives



High Clay Content

If you are able to form a ribbon that is longer than two inches before it breaks off, the soil has a high **clay** content. These types of soils have slow percolation rates. Select an alternative site or consider installing a bioretention cell.

Photo: RainscapingIowa



Refer to Appendix C for more information on infiltration rates in natural soil types that mimic percolation rates.

While medium to high clay content is not preferable for rain gardens, it is not impossible to overcome. Native plants, once established, grow deep roots that have the ability to open pore space. The rain garden may need to be designed with additional amounts of amended soils and a subsurface perforated subdrain to ensure adequate drainage and for vegetation to succeed.

✓ Soil Percolation Test

A percolation test indicates whether water will drain fast enough through the soils beneath the rain garden. Follow these steps to conduct the percolation test:

1. Use the same areas where you did the ribbon test to conduct the percolation test. If you used a soil probe to do the ribbon test, you will need to dig the holes larger with a shovel or clamshell posthole digger.
2. If dry soil conditions exist, slowly pre-wet (pour water) the areas with a pail of water. Wait a couple of hours for the water to drain through the soil.
3. Have a tape measure on hand for measuring water depths. Fill each hole with 12 inches of water.
4. Measure how far the water drops in height (inches) after 12 and 24 hours.
5. Calculate how many inches of water have percolated after 12 and 24 hours.
6. Calculate the average percolation rate by adding the rates together and dividing by two.
7. After 24 hours, fill each hole with another 12 inches of water and repeat the percolation test to validate the results from the first test.

Photo: ISWEP



Using a clamshell posthole digger to create a hole for the perc test.

Use the "How To Interpret Percolation Test Results" table on the following page to determine if there is adequate drainage for a rain garden. Generally, a basic rain garden can be installed when percolation rates are greater than one-half inch per hour. Ideally, rain gardens are most suitable where soils percolate water at a rate greater than 1 inch per hour. Jot down the measured percolation rate as it will be utilized when designing the size and depth of your rain garden in Chapter 4.

How To Interpret Percolation Test Results



If water drains completely from the hole within 12 hours for both tests, percolation rates should be **greater than 1 inch per hour**. This is a good percolation rate for a basic rain garden installation.



If water drains completely from the hole within 24 hours for both tests, percolation rates should be **between 0.5 and 1.0 inches per hour**. This is an acceptable percolation rate for both basic and enhanced rain garden installations.



If water does not completely drain from the hole within 24 hours for either test, percolation rates are **less than 0.5 inches per hour**. This percolation rate is too slow for a basic rain garden and likely an enhanced rain garden as well. Consider installing a bioretention cell or other stormwater practice, such as a native plant garden or soil quality restoration.

Example Percolation Test

In this example, water height was measured at 4 inches (8 inches drained) after 12 hours and at 1 inch (11 inches drained) after 24 hours. The average percolation rate among the measured rates is 0.57 inches per hour. This site is suitable for a basic rain garden.

$$8'' / 12 \text{ hours} = 0.67'' / \text{hour}$$

$$11'' / 24 \text{ hours} = 0.46'' / \text{hour}$$

$$(0.66'' + 0.46'') / 2$$

$$= 0.57'' / \text{hour}$$

Photo: Polk SWCD



Photo: Polk SWCD

