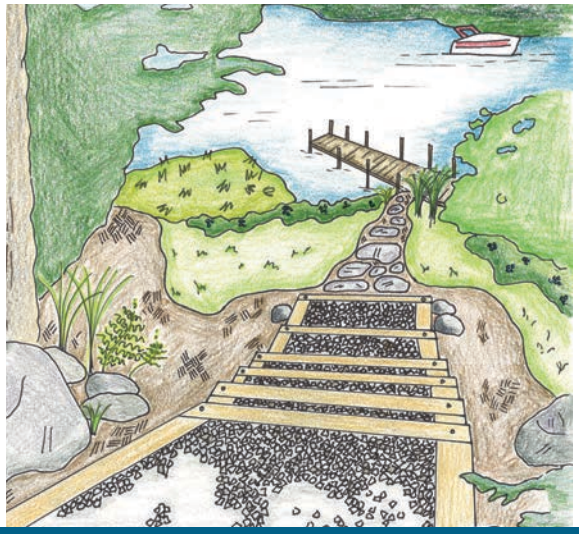
INFILTRATION STEPS



Boxed-out, stone-filled steps designed to define pathways on moderate slopes. They help to reduce erosion, promote infiltration and are well suited for shorefront properties.

SIZING AND DESIGN

STEP 1 – **Measure the slope**. Measure the overall rise and run of the area in inches (Figure 1).

STEP 2 – **Determine the number of steps needed**. Divide the rise of the slope (measured in Step 1) by the height of the timber (six inches unless you are using different sized timbers) and round to the nearest whole number. This is the number of steps you will need.

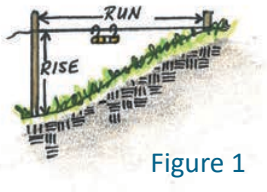


Figure 1

RISE ÷ TIMBER HEIGHT = NUMBER OF STEPS

STEP 3 – **Determine step depth (tread).** Divide the run of the slope by the number of steps (figured in Step 2). The depth of the step tread is flexible, but should be at least 15 inches to be comfortable to walk up and down.

RUN ÷ NUMBER OF STEPS = DEPTH OF STEP TREAD

STEP 4 – **Determine the width of the steps.** A comfortable width is usually four feet, but depending on the topography, trees or other site conditions, a wider or narrower step may be desired.

EQUIPMENT & MATERIALS

- Measuring tape
- Shovel
- Sledge hammer
- 4 Wooden stakes
- String or spray paint
- $^{3}/_{4}$" Washed stone or pea stone
- Non-woven geotextile fabric
- 6" x 6" Pressure treated timbers (or similar sized material such as granite or logs)
- 18" long pieces of $^{1}/_{2}$" diameter steel rebar
- Level
- Power drill with $^{1}/_{2}$" drill bit
- 12" Galvanized spikes

STEP 5 – **Determine materials needed.** Once you know the number of steps that you need, their width and tread depth, you can determine the length of timber and the amount of steel rebar that you will need.

Timbers: If you are using side timbers (see Figure 5, page 27), add the length of each side timber (the tread depth) to the step width to get the total length of timber you'll need per step. As a guide, use the following equations to estimate the length (in feet) of timber material you will need:

TIP: Side timbers may not be needed if the steps are in a pathway where the surrounding land is higher. If so, extend the timbers into the adjacent banks so water will not go around the steps.

STEP WIDTH + (2 X TREAD DEPTH) = TIMBER LENGTH PER STEP

TIMBER LENGTH PER STEP X NUMBER OF STEPS = TOTAL TIMBER LENGTH

Rebar: If you piece any of the side timbers together, plan to install rebar at each end of the timber where the pieces join.

STEPS: Two 18-inch lengths of $^1/_2$-inch diameter steel rebar for each step.

SIDE TIMBERS (IF USING): Six 18-inch lengths of $^1/_2$-inch diameter steel rebar for each step.

Landscape Fabric: Multiply the number of steps by the square footage needed for each step to estimate the total square footage of fabric needed. Add several inches to your planned width and tread depth to allow for extending the fabric up the sides of the timbers.

For example: four steps X 4' width X 1.5' tread = 24 ft^2 of landscape fabric needed.

Stone: Multiply the number of steps to be back-filled by the volume of step. Calculate the volume for each step by multiplying the step's width, tread depth and timber height.

For example: four steps X 4' width X 1.5' tread X 0.5' high = 12 ft^3 of stone. You can convert cubic feet to cubic yards by multiplying by 0.037.

INSTALLATION

STEP 1 – **Stake perimeter**. Stake out the perimeter of the stairway by driving a stake into the ground at each corner of the stairway and stretching string between them (Figure 2).

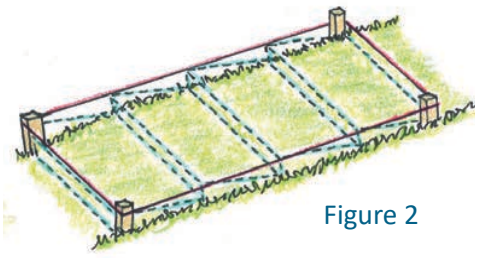


Figure 2

STEP 2 – **Mark areas to be excavated**. Determine the areas that need to be excavated for each step. Using a measuring tape and starting from the string at the bottom of the slope, measure and mark the depth of each step until you reach the string at the top of the slope. Use spray paint, sand or flour to mark the depth of each step (Figure 2).

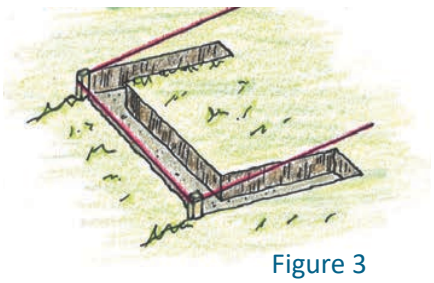


Figure 3

STEP 3 – **Excavate first step**. Starting at the bottom, dig a trench for the first riser timber (this will be more like a shallow groove in the ground). Next, if using side timbers, dig trenches for the side timbers, which should be long enough to extend six inches past the next step's riser. Check to make sure the trenches are level (Figure 3).

NOTE: Be careful not to excavate deeper than needed as this will create loose material under the timbers, which may cause washout during storms.

STEP 4 – **Prepare materials**. Cut the timbers to the appropriate length. For each step, cut one riser timber

as long as the step width and two timbers as long as the step depth for the side timbers (remember that each step should extend six inches past the next step's riser.) Drill $^1/_2$-inch diameter holes approximately six inches from the ends of each timber (Figure 4).

TIP: Most lumber supply stores have a cutting station to cut timbers to the correct length if you do not have a saw.

STEP 5 – **Position timbers**. Position the timbers in the step and remove or add soil as needed to level them (Figure 4).

STEP 6 – **Anchor timbers**. Drive the steel rebar through the drilled holes on the end of each timber and into the ground. Make sure the rebar is level with the timber surface, or slightly recessed, since the edges may be sharp (Figure 4).

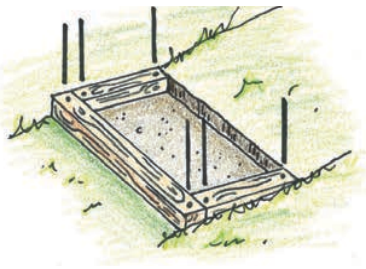


Figure 4

STEP 7 – **Dig and level inside step**. Shovel out the soil inside the step to create a surface roughly level with the bottom of the timbers. Additional soil can be removed to provide more area for infiltration if desired. Make sure to dispose of excavated soil in a place where it will not wash away (Figure 4).

STEP 8 – **Build second step**. To build the next step, measure from the front of the first riser timber and mark the tread depth on the side timbers with a pencil. Align the front of the second step riser timber with the pencil lines on the side timbers of the step below. Secure the riser timber to the side timbers using 12-inch galvanized spikes (Figure 5). To make it easier to drive the galvanized spikes into the timber, you can pre-drill holes to about five inches deep.

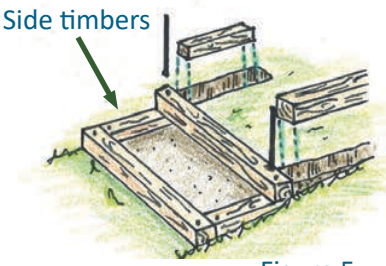


Figure 5

STEP 9 – **Excavate side timbers**. Set and anchor side timbers by driving the steel rebar through the drilled holes on the end of each timber into the ground (Figure 5).

TIP: Place the galvanized spikes where they will not interfere with the rebar.

STEP 10 – **Dig and level inside step**. Shovel out the soil inside the step to create a surface roughly level with the bottom of the timbers, the same as in Step 7.

STEP 11 – **Repeat**. Repeat Steps 8 through 10 for each remaining step. When installing the top step, cut the side timbers six inches shorter than the ones on the lower steps – these timbers do not need the extra length since no stairs will rest on them.

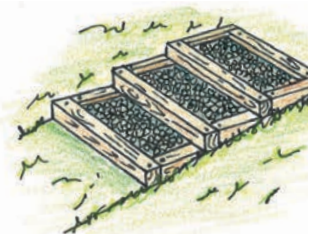


Figure 6

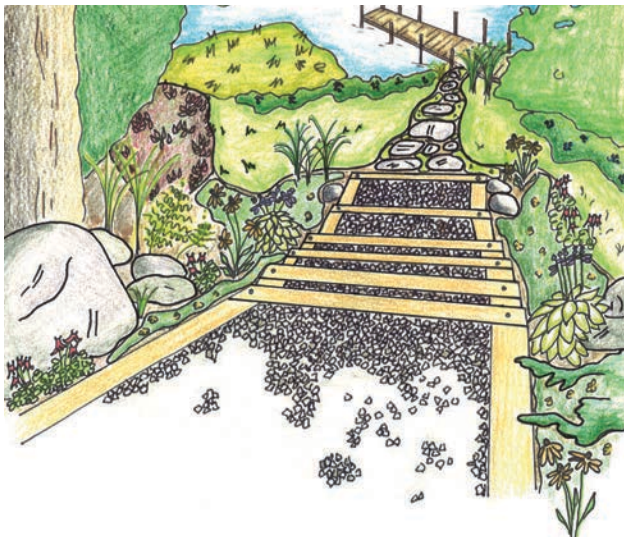
STEP 12 – **Fabric and backfill**. Lay down fabric and backfill with stone.

a. Line the area inside each set of timbers with non-woven geotextile fabric. Make sure the fabric is long enough to extend a few inches up the sides of the timbers.

b. Fill each step with stone until it is about one inch below the top of the timber (Figure 6). This will create a lip to encourage infiltration within each step.

c. Seed, mulch or vegetate bare soil adjacent to the steps.

TO RETROFIT EXISTING STEPS



Existing steps can be retrofit to improve infiltration by removing the existing material and filling in according to Step 12. TIP: If the timbers are not firmly secured, drill $^{1}/_{2}$-inch diameter holes six inches from the ends of each timber. Drive $^{1}/_{2}$-inch diameter, 18-inch long steel rebar through the holes with a sledge hammer. For gentle slopes, wooden stakes or large rocks can also secure the timbers.

MAINTENANCE

INSPECT: Seasonally and after large storms, look for signs of erosion or clogging such as ponding at the surface or accumulated sediment.

CLEAN OUT: If clogging occurs, remove and wash or replace stone and fabric. Remove any vegetation growing on the steps if not included in the design.

REPLACE: Replace timbers if damaged or rotted, as needed.

DESIGN REFERENCE

Maine Department of Environmental Protection. *Conservation Practices for Homeowners*. Fact Sheet Series. May 2006.

Figures adapted with permission from the Maine Department of Environmental Protection.