How to Construct a Swale

WHAT IS IT?

A swale is a ditch that runs on a contour line. Swales are used to manage water across a site. Water that runs into them can be sunk into the ground or diverted to a nearby area.

In the Permagarden Approach, small swales are often placed above garden beds to capture water that can be used for cultivation within the beds. In addition to the ditch, swales have a berm on the downslope side that captures water and a spillway that permits the overflow of any extra water.

WHY DO WE DO IT?

The Permagarden Approach uses swales dug on contour to slow, spread, and sink water on the site. Capturing and storing water in the soil ensures it is consistently available to plants. Swales can also protect gardens from flooding or heavy water flows that cause erosion.

TERMS USED

A-frame: A tool used to identify the contour of the land. Often used by smallholder farmers from materials found within their local community.

Berm: A small raised barrier of soil placed downslope of a water harvesting structure, or around a mulch basin, to stop water from flowing downhill. The berm allows water to sink into the ditch so that it can be stored in the soil. Berms are planted and mulched to prevent them from eroding.

Biointensive: Refers to 'Biointensive Agriculture': An organic agriculture system that focuses on sustainably maximizing output with minimal land, while also increasing biodiversity and maintaining soil fertility.

Contour: The contour of the land refers to the points within the landscape that are all at an equal elevation. An A-frame can be used to mark these points and join them into a line, which can be used to dig a water harvesting structure that is "on contour". By being on contour, the water is encouraged to infiltrate into the soils rather than running downslope.

Dry mulch: Dried organic material, such as leaves or grasses, that can be used to cover bare soil. Mulch can regulate soil temperatures, protect soil from erosion, suppress weed growth, and add organic material to the soil.

HOW TO

Construct a Swale

TERMS USED

Green mulch: Cover crops, such as desmodium or mucuna, that are planted to enrich the soil. Cover crops protect bare soil and are incorporated into the soil when green to build soil organic matter.

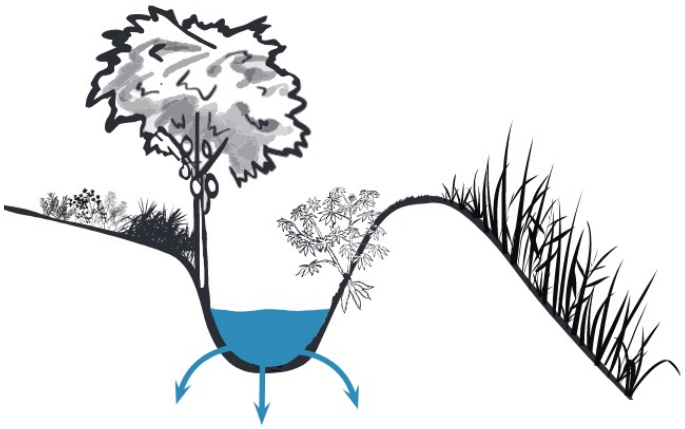
Overflow: Excess water exiting a water harvesting structure that has filled to capacity. Overflow water is directed by a spillway to a safe and productive location, such as a banana plantation, additional garden, or another water harvesting structure.

Soil amendments: Any materials added to soil to improve its fertility, water holding capacity, or structure. For example, compost, organic material, fertilizer plants, or green mulch.

Spillway: The channel through which the overflow water in a water harvesting structure travels. Spillways lead overflow water to a safe and productive location, such as a banana plantation, additional garden, or another water harvesting structure.

Swale: A ditch dug on contour, with a berm on the downslope side created with the soil from the ditch. Swales are used to capture rainwater and should be placed where they can slow down water that is damaging the landscape as it runs downhill. The water that is collected in a swale can be used for a productive purpose, such as in a permagarden.

Waterline: The waterline is the maximum height within the berm that water will reach before it overflows through its designated spillway. The waterline is found by marking the contour that is at the height of the spillway on the inside of the berm. Measuring the waterline ensures that the water will flow through the spillway as intended rather than through a depression in the berm or an uncapped end.



Constructing the swale and berm

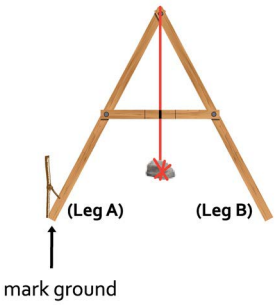
STEP 1

Determine where the swale should be placed. The swale should spread water out over a broader part of the compound and/or protect a growing system from upslope water flows.

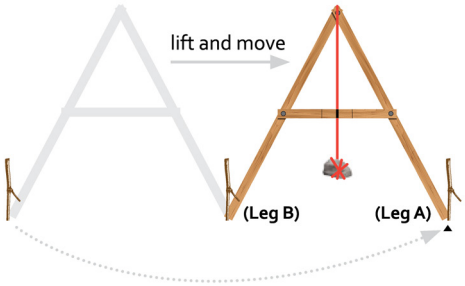
STEP 2

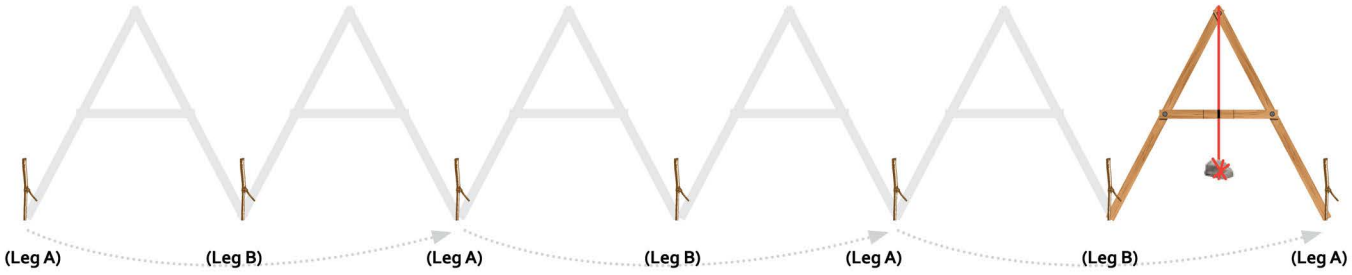
Determine the size of the swale. Larger swales should be located at the top of a compound to accommodate larger water and sediment flows. Smaller swales should be located above garden beds and other planting areas to protect the growing area and provide it with water.

STEP 3
Use a recently calibrated A-frame to mark the contour across the slope.



After marking Leg B, lift and rotate the A-frame 180° around Leg B to find the next position to peg. Do not rotate with legs resting on the ground to avoid the A-frame grinding into soil.





Repeat the lift, move, mark process

STEP 4
Before digging the swale, remove any topsoil from where the ditch and berm will be constructed and save it downslope.

STEP 5
Start digging the swale by digging a ditch on the downslope side of the contour line, using the line as a guide. Pile the excavated soil on the downslope side of the ditch to create a berm.

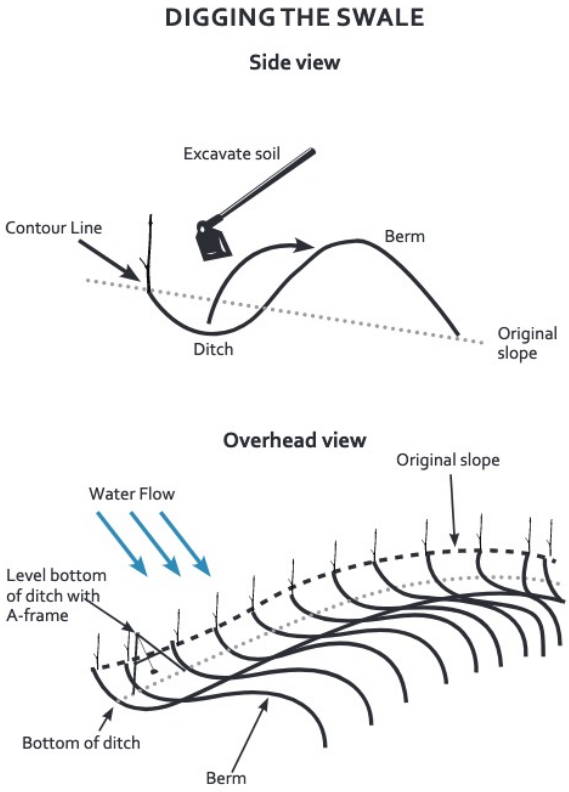
1 CONSTRUCTING THE SWALE AND BERM | 2 CONSTRUCTING A SPILLWAY | 3 FINISHING THE BERM

STEP 6
Shape the swale by ensuring the walls of the ditch are gently sloped and the bottom of the ditch is flat.

STEP 7
Ensure the berm is well rounded, i.e. does not have vertical edges, and follows the contour. Once the berm is well shaped, the previously saved topsoil can be spread over the berm.

STEP 8
Close, or cap, the ends of the swale by digging an infiltration pit in the bottom of the ditch and using the excavated soil to create an extended berm that wraps up slope and closes the end of the swale. Do this on both sides.

STEP 9
Use an A-frame to check that the flat bottom of the ditch is level across the entire swale. Adjust the depths as necessary for high points. Low points will eventually fill with silt and can be left.



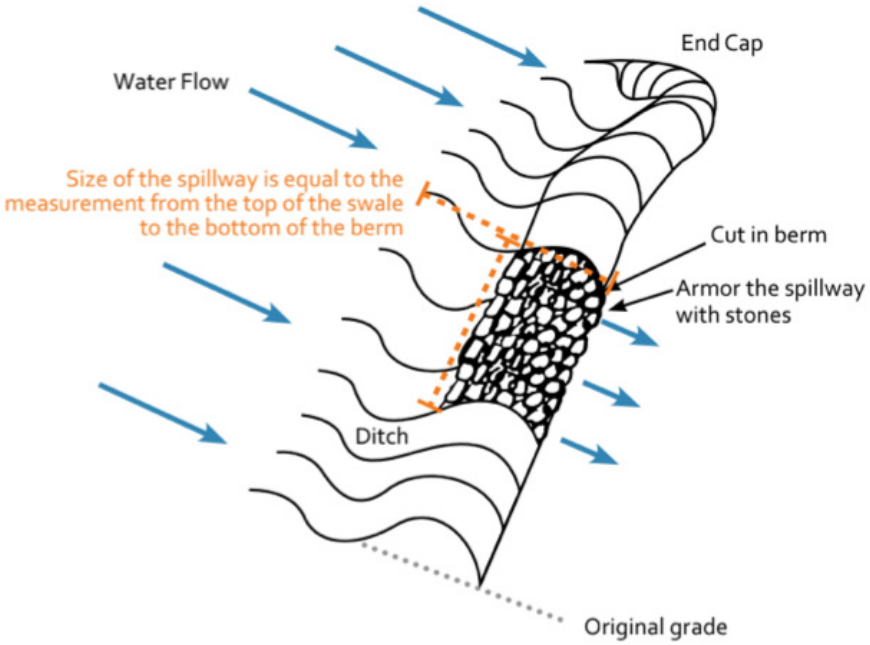
NOTE
Sometimes there are obstacles, like tree stumps, along the contour line. Go around obstacles by either going downslope from the obstacle and raising the A-frame's legs with stones to the proper height or going upslope behind the obstacle and digging into the ground where the legs would go to maintain contour then continue until you arrive back to the contour at the original grade.

Constructing a Spillway

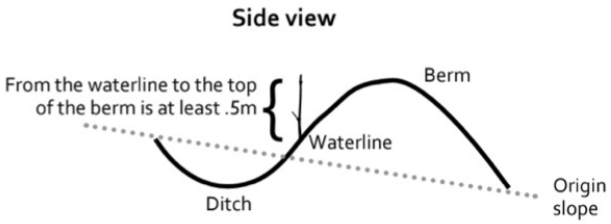
STEP 1
Determine where to locate the spillway. Identify where there is a natural downslope path below the berm where water can overflow to the next water harvesting structure.

STEP 2
Measure the size of the swale ditch and berm from the upslope side of the ditch (beginning at the cut) to the downslope toe of the berm. Make a cut in the berm for the spillway that is equivalent to this measurement. See the image below for more detail. This distance is best measured and marked with sticks even before the ditch is dug and the berm created. Preserving the soil, and any plants or grasses growing in the soil where the spillway will be, will help reduce erosion of the spillway in the future.

STEP 3
Reinforce the spillway with stones, replanted grass or grass seeds, or other materials that will help protect the spillway from erosion.

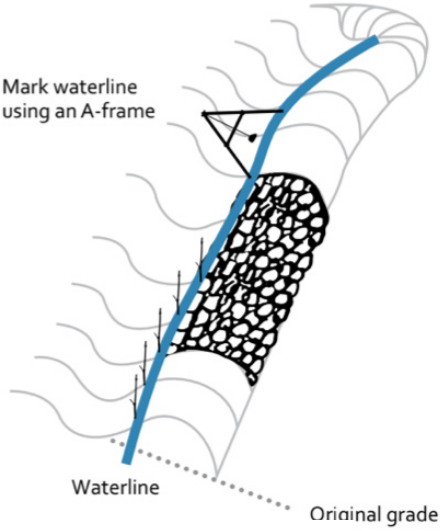


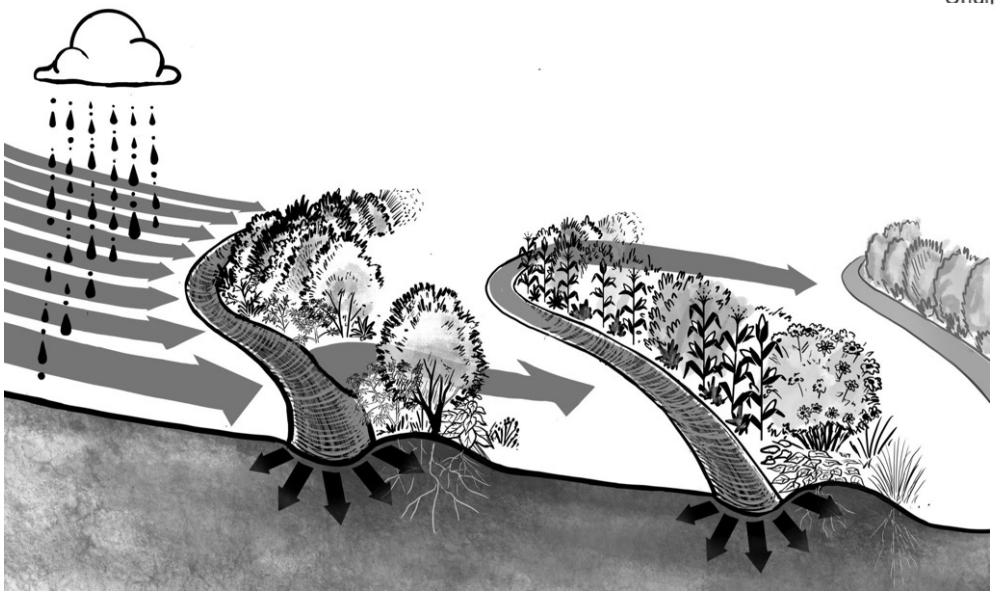
Finishing the Berm



STEP 1
Once the spillway is constructed, determine the waterline by marking a contour line that starts at the flat part of the spillway, i.e. the original grade, and continues along the inner side of the berm. Check that the height of the berm above the waterline is a minimum of half a meter all the way along the berm.

STEP 2
Amend, plant, and mulch the berm. Make sure the soil is not too dry or too wet for planting. Incorporate any soil amendments to be used, remove rocks and break up large soil clods, and then plant seedlings or seeds along the length of the berm. Biointensively plant the berm to help its long-term structural integrity. Water any seedlings or seeds as needed. Apply mulch to all parts of the berm, including the bottom of the ditch. Mulch materials can include animal manures, cut branches, leaves, grasses, sticks, other organic matter, or stones.





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