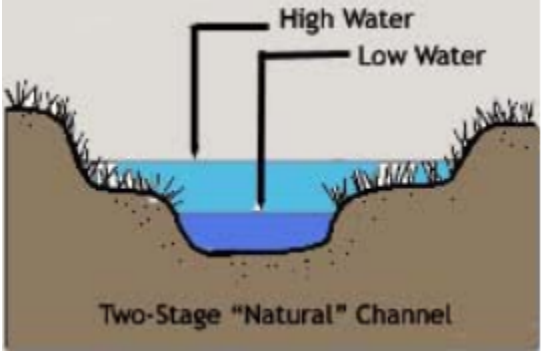
Two-Stage Ditch Design

In a Nutshell

When drainage issues affect farmland or large developments, a two-stage ditch can be an effective strategy to handle rainwater runoff while reducing the risk of erosion in areas where a stream has already been developed. A two-stage ditch design is comprised of a main stream for the standard amount of water in the stream. A second larger ditch is built around the main ditch to handle any surge in water. The two-stage ditch design increases water capacity while reducing erosion on the surrounding land. Other benefits include less flooding, and slower-moving water and opportunities for natural riparian habitat restoration.

The “How To”



The above diagram provides a good illustration of the two-stage design. The main channel is the lowest part of the stream, and it is meant to hold the normal amount of water running through the stream. A second wider ditch is constructed above the stream. As water rises, the second ditch becomes the main ditch and provides a channel for the high water. Specific dimensions for a ditch is situation dependent.

An obvious benefit to this system is that it reduces the likelyhood of the stream overflowing its banks and flooding the surrounding land. The design also slows the stream down, thus preventing erosion in the ditch.

This design can be built on existing streams, and it can be made when building new ditches. This PDF from Kosciusko County, Indiana gives a good summary of the two-ditch design.

Planning & Zoning

Two-stage ditch design falls under the realm of the Environmental Protection Agency's Section 319 program. More information on this can be found here. The benefits of Section 319 include financial incentives.

Dollars & Cents

The cost of construction for a two stage ditch is dependent upon the length and depth of the ditch to be constructed. The greater the amount of materials that need to be removed, the greater the cost will be. Initial costs of two-stage ditches tend to be higher because of the greater width and also greater amount of earthwork.

In order to create a low bench, greater top width is generally required. Assuming that a two-stage ditch is roughly 10-20 feet wider than a typical ditch, there is a potential loss of 1-3 acres per mile of ditch design, depending on the size of the watershed of that area and also the existing ditch. The greater width of the channel allows for an increase of 25%-100% in the flow capacity of the channel. According to the Nature Conservancy, the typical cost of two-stage construction is $8-$12 per linear foot. The factors that affect the cost of installation for a two stage ditch are as follows:

1. Depth of the ditch from the top of the bank to the waterline
2. Width of the ditch channel and benches
3. Amount of natural benches already starting to form
4. Absence or presence of adequate area to spread soil
5. The number of tile outlets to be addressed
6. Presence of greater velocities which would require erosion control blanket

Measuring Success

The benefits of a two-stage ditch design are an improved drainage function for the ditch and improved ecological function. By reducing water flow speed, the stability of the ditch improves and the need for maintenance is also reduced, which saves money in labor and also additional resources. The two-stage ditch design improves the habitats for both terrestrial and marine species. Because the flow speed is reduced, the amount of sediment and also nutrients that are transported downstream is reduced. Nutrients such as phosphorus and nitrogen remain in the ditch and improve the overall water quality. The two-stage ditch design also causes sedimentation to occur differently, with finer silts depositing onto the benches and courser materials forming within the bed.

Two-stage ditch design will also help improve water quality by reducing erosion in the waterway. Water Quality is one of the performance measures being tracked by OneSTL. OneSTL is also measuring the percent of watersheds with a current and up-to-date plan. This may provide a good indication of who in the community has actually considered two-stage ditch design.

Case Studies

Miami Two Stage Ditch Project

Contact

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Description

http://www.miamiconservancy.org/water/documents/factsheet.pdf