ROHINI
COLLEGE OF ENGINEERING AND TECHNOLOGY
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DEPARTMENT OF AGRICULTURAL ENGINEERING

AI3402 SOIL AND WATER CONSERVATION ENGINEERING

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1.41 Gully Erosion: Rills are small in size and can be leveled by tillage operations. When rills get larger in size and shape due to prolonged occurrence of flow through them and cannot be removed by tillage operation, these are called gullies (Fig. 1). Large gullies and their network are called ravines. It is the advanced and last stage of water erosion. In other words it is the advanced stage of rill erosion. If the rills that are formed in the field are overlooked by the farmers, then they tend to increase in their size and shape with the occurrence of further rainfall. Some of the major causes of gully erosion are: steepness of land slope, soil texture, rainfall intensity, land mismanagement, biotic interference with natural vegetation, incorrect agricultural practices, etc. Gully erosion gets initiated where Soil and Water Conservation Engineering 24 www.AgriMoon.com the longitudinal profile of an alluvial land becomes too steep due to sediment deposition. Gullies advance due to the removal of soil by the flowing water at the base of a steep slope, or a cliff at the time of fall of stream. High intensity of flow of the runoff increases the gully dimensions. In the absence of proper control measures, slowly the gullies extend to nearby areas and subsequently engulf the entire region with a network of gullies of various sizes and shapes.

Fig. 1. Gully erosion.

1.42 Stream Bank Erosion: Stream bank erosion is defined as the removal of stream bank soil by water either flowing over the sides of the stream or scouring from there (Fig.2). The stream bank erosion due to stream flow in the form of scouring and undercutting of the soil below the water surface caused by wave action is a continuous process in perennial streams. Stream bank erosion is mainly aggravated due to removal of vegetation, over grazing or cultivation on the area close to stream banks. Stream bank erosion is also caused by the occurrence of flood in the stream. Apart from scouring, the sloughing is also a form of stream bank erosion which is caused when the stream water subsides after reaching the peak. Sloughing is mainly due to movement of underground water from side into the stream due to pressure difference.

Fig. 2. Stream bank erosion

1.43 Classification of Gullies

Gullies can be classified based on three factors viz. their size, shape (cross section) and formation of branches or continuation. The detailed classification is discussed below.

1. Based on Size (depth and drainage area)

Gully classification based on the size is presented in Table 1.

Table 1. Gully classification based on size

Classification	Drainage area (ha)	Depth (m)
Small	< 1	< 2
Medium	1 to 5	2 to 20
Large	> 5	> 20

3 Based on Shape The classification of gullies based on shape is shown in

Fig 3. **U-Shaped**: These are formed where both the topsoil and subsoil have the same resistance against erosion. Because the subsoil is eroded as easily as the topsoil, nearly vertical walls are developed on each side of the gully.

V-Shaped: These gullies develop where the subsoil has more resistance than topsoil against erosion. This is the most common form of gully.

Trapezoidal: These gullies are formed where the gully bottom is made of more resistant material than the topsoil. Below the bottom of gully, the subsoil layer has much more resistance to get eroded and thus the development of further depth of gully is restricted.

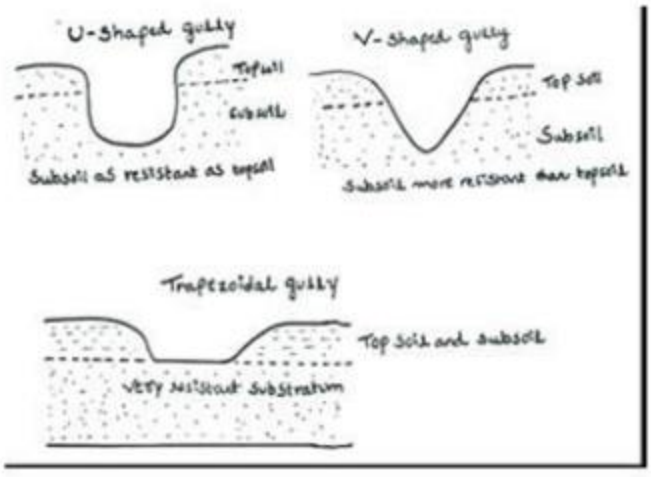

Fig. 3. Gully classes based on the shape of gully cross-section

1.44 Based on the Formation of Branches or Continuation Continuous Gullies:

These gullies consist of many branches.

Continuous gully has a main gully channel and many mature or immature branch gullies. A gully network is made up of many continuous gullies. A multiple-gully system may be composed of several gully networks.

Discontinuous Gullies: These may develop on hillsides after landslides. They are also called independent gullies. At the beginning of its development, a discontinuous gully does not have a distinct junction with the main gully or stream channel. Flowing water in a discontinuous gully spreads over a nearly flat area. After some time, it reaches the main gully channel or stream. Independent gullies may be scattered between the branches of a continuous gully, or they may occupy a whole area without there being any continuous gullies.

1.45 Classification of Gully – Gully Control Structures: Drop Spillway, Drop Inlet, Chute Spillways

1. **Drop Spillway:**
    - **Purpose:** Drop spillways are designed to control the energy of flowing water and reduce erosive forces. They are often used in gully control to dissipate the energy of runoff, preventing further erosion downstream.

- **Design:** A drop spillway is a structure where water flows over a vertical or near-vertical drop. The sudden change in elevation causes the water to lose velocity and energy, minimizing the potential for erosion.
- **Materials:** Drop spillways can be constructed using various materials, including concrete, riprap, or other erosion-resistant materials.

2. **Drop Inlet:**

- **Purpose:** Drop inlets are structures designed to collect and redirect runoff water from a higher elevation to a lower elevation in a controlled manner. They are commonly used to prevent gully formation by efficiently managing concentrated flows.
- **Design:** A drop inlet typically consists of a vertical pipe or structure that collects water and directs it to a lower level, minimizing the erosive potential of concentrated flows. The inlet may include features such as grates or filters to prevent debris from entering the drainage system.
- **Applications:** Drop inlets are often used in urban and rural areas where concentrated flows can lead to erosion and gully formation.

3. **Chute Spillways:**

- **Purpose:** Chute spillways are designed to safely convey water over a slope, often on a channelized path, to reduce erosion and control the velocity of flowing water.
- **Design:** Chute spillways can take various forms, including lined channels, concrete chutes, or vegetated channels. The design aims to provide a controlled path for water flow, minimizing the potential for erosion and gully formation.
- **Applications:** Chute spillways are commonly used in natural watercourses, stormwater management systems, or other areas where concentrated flows need to be managed to prevent erosion.

These gully control structures are essential components of erosion control and water management strategies. The selection of a specific structure depends on factors such as the topography of the area, the intensity of water flow, and the desired level of erosion control. Proper design and construction are crucial to ensure the effectiveness of these structures in preventing and mitigating gully erosion. Additionally, consideration should be given to maintenance practices to ensure the continued functionality of these structures over time.