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# Soil and water Conservation Engineering

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Process of gully formation depends on:

- Resistance offered by top soil & underlying hard layer.
- Rainfall characteristics that favors to increase volume of runoff over the land surface.
- Vegetation cover on the soil surface.
- Topography of the area including land slope.



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- Creating land surface without vegetation.
- Faulty tillage practices.
- Overgrazing
- Absence of vegetative cover
- Not smoothening of rills, channels or depressions present on the ground surface.
- Improper construction of water channels, roads, rail lines, cattle trails etc.



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# Process of gully development

After initiation, gully development is accelerated by,

- Erosion of the bed & sides (scouring of soil by flowing water plus debris & abrasive materials carried by it).
- Sliding and mass movement of the sides (due to seepage, alternate freezing and thawing and under cutting of flow).
- Water-fall erosion at the gully head (resulting cutting of gully bank).



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# Stages of gully development

1. Stage 1 (Formation Stage)
2. Stage 2 (Development Stage)
3. Stage 3 (Healing Stage)
4. Stage 4 (Stabilization Stage)



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# Formation stage

## Stage 1 (Formation Stage)/ Initiation Stage

- Initiation of gully erosion
- Channel erosion
- Deepening of gully bed
- Depends on top soil & other factors
- This stage proceeds slowly if top soil is resistant



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# Development stage

## Stage 2 (Development Stage)

- Major formation of the gully and erosion takes place
- Upstream movement of the gully head
- Enlargement of gully in width and depth
- Gully banks are eroded to maximum and width becomes maximum
- Gully cuts to C-horizon and parent material is removed rapidly



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# Healing stage

## Stage 3 (Healing Stage)

- Local vegetation starts growing in the gully and get stabilized
- No significant erosion in any form from gully section
- Healing process starts





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# Stabilisation stage

## Stage 4 (Stabilisation Stage)

- Last stage of gully development
- Gully gets fully stabilised
- Gully reaches a stable gradient
- Gully walls attain stable slope
- Sufficient vegetation cover develops over the gully surface to anchor the soil and permit development of new top soil
- No further development of gully unless healing process is disturbed



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# Classification of gully

## Based on

- ➔ Shape of the gully
- ➔ State of the gully
- ➔ Dimension of the gully



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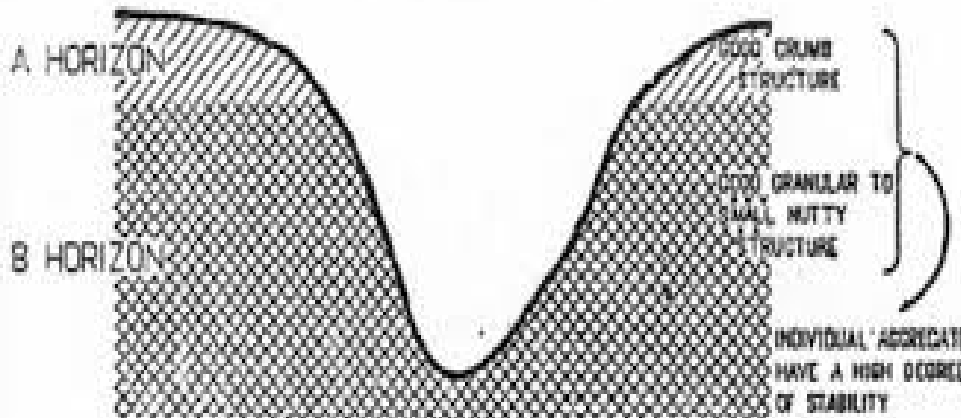
# Based on shape

## Based on Shape of the gully

- U-shaped
- V-shaped

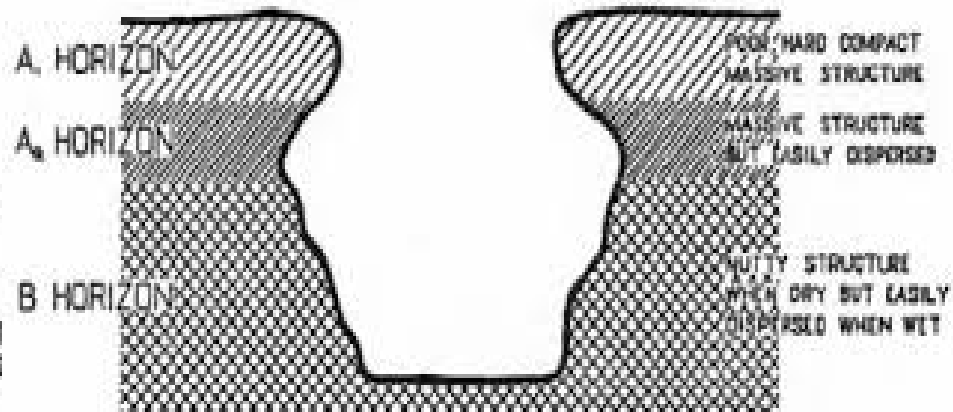
### V - SHAPED GULLY

CHARACTERISTIC OF THE DOOKIE AND CASHEL SERIES



### U - SHAPED GULLY

CHARACTERISTIC OF THE GOWANGARDIE AND CANIAMBO SERIES





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## **U-shaped**

- Found in alluvial plains where surface and sub-surface soil are easily erodible
- Runoff flow undermines and gully banks collapse
- Formation of vertical side walls in U shape

## **V-shaped**

- Where sub-soil are tough to resist the rapid cutting of soil by runoff flow
- Resistance to erosion increases with depth
- Common in hilly regions accompanied with steep slope



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# Based on state

## Based on State of the gully

### ▶ Active gullies :

Whose dimensions are enlarged with time. Size enlargement is based on soil characteristics, land use and volume of runoff passing through the gully. Found in plain areas.

### ▶ Inactive gullies :

Whose dimensions are constant with time. Found in rocky areas.



# Based on dimension

<i>S. No.</i>	<i>Symbol</i>	<i>Description</i>	<i>Specification</i>
1.	$G_1$	Very small gullies	Upto 3 meter deep, bed width not greater than 18 m, side slope varies.
2.	$G_2$	Small gullies	Upto 3 meter deep, bed width greater than 18 m, side slope varies.
3.	$G_3$	Medium gullies	Depth ranges between 3 to 9m, bed width not less than 18m, sides are uniformly sloping between 8% to 15%.
4.	$G_4$	Deep and Narrow gullies	(a) 3 to 9 m deep, bed width less than 18m, side slope varies.  (b) Depth greater than 9 m, bed width varies, side slope varies, mostly steep or vertical.



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## **Small Gully :**

- ➔ Can easily be crossed by farm implements
- ➔ Removed by ploughing and smoothing operations
- ➔ By stabilizing the vegetation

## **Medium Gully :**

- ➔ Cannot be easily crossed by farm implements
- ➔ Can be controlled by terracing and ploughing operations
- ➔ Sides are stabilised by creating vegetation on them

## **Large Gully :**

- ➔ Cannot be reclaimed
- ➔ Tree planting is done as an effective method