DRAINAGE AND EROSION CONTROL

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GE 441 Geotechnical Construction Practice

Part 1

PHYSICAL FACTORS CONTROLLING EROSION

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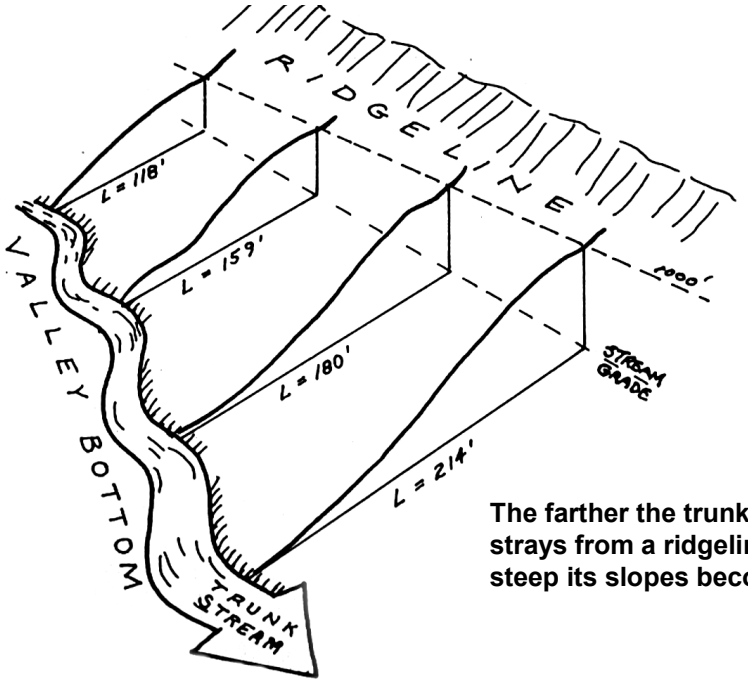
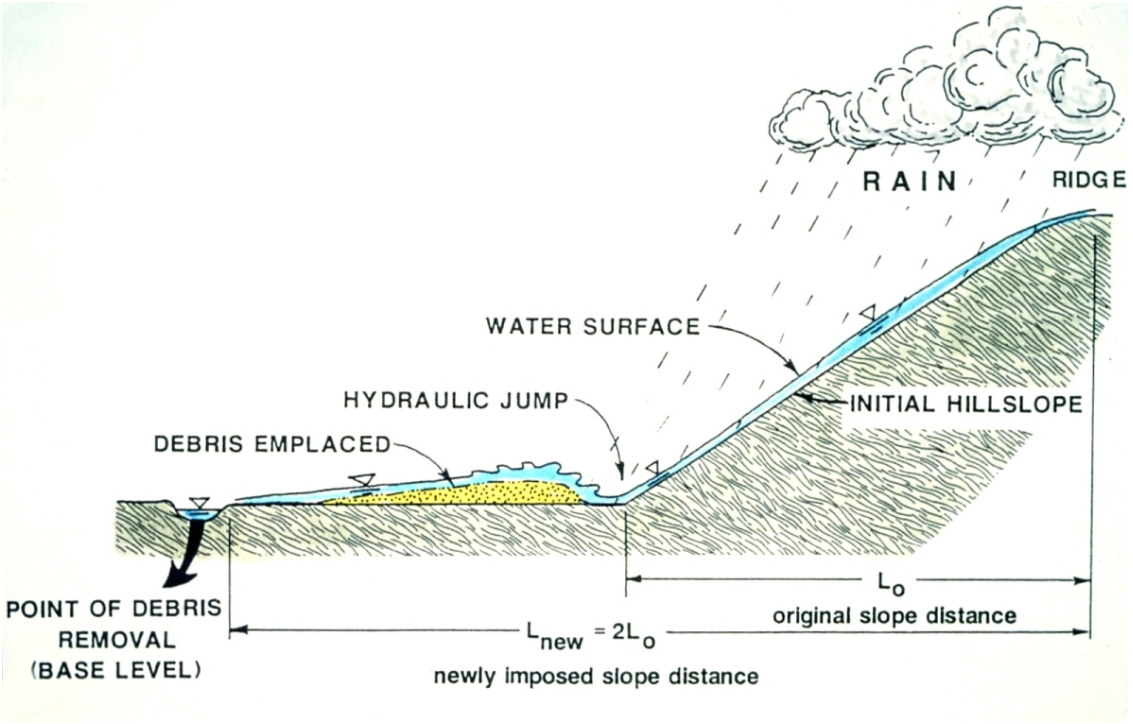
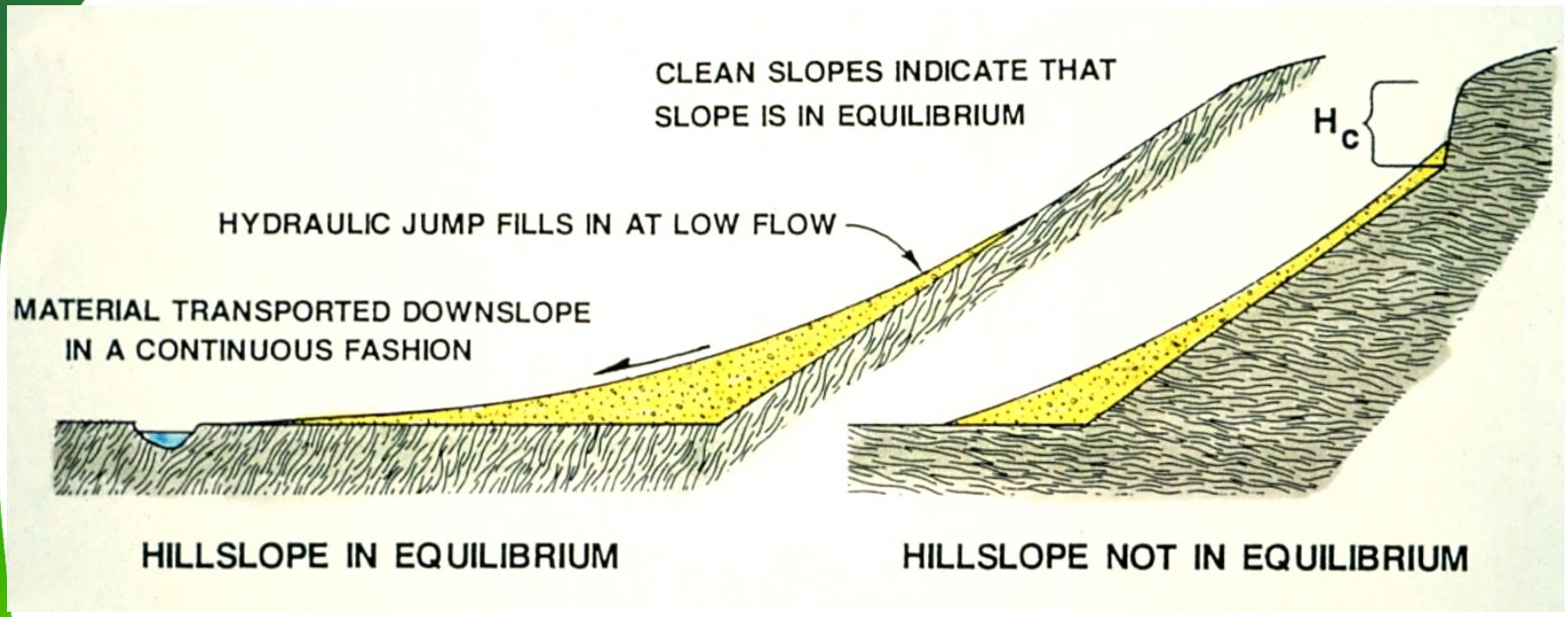
- **Slope profile** is proportional to imposed runoff, distance to point of debris removal, and material properties of the slope
- When an embankment is constructed with an *abrupt change* in slope at its toe, eroded material will tend to infill the transition area during low flow, depositing material to create a more gradual transition.



The farther the trunk stream strays from a ridgeline, the less steep its slopes become





- **Physical factors controlling erosion include:**
- **Slope height and inclination, material type (cohesion and friction), distance to controlling base level (nearest drainage course)**

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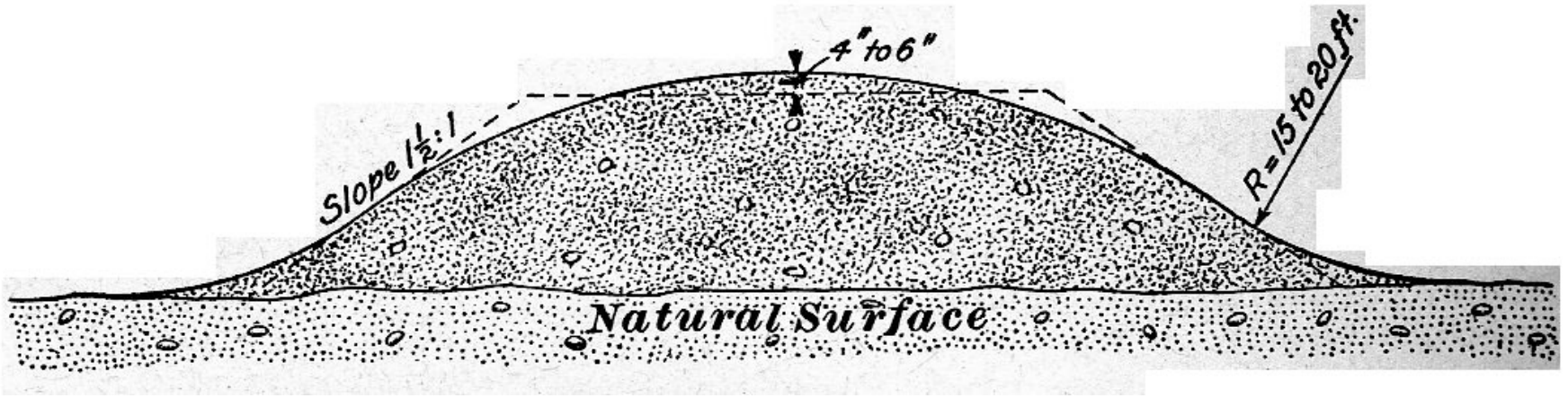
Rounding Slopes



- Suggested standards taken from a general civil engineering text for highway engineering in 1900.
- Note 4 to 6 inch crowning of embankment to promote good drainage; and
- Suggested transition at base of embankment with the native ground surface; with a radius of 15 to 20 ft.
- This transition is important for reducing unnecessary erosion at the base of the fill slope.

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- Hillsides that are out-of-equilibrium will generally experience sporadic erosion problems, generally during periods of sustained intense precipitation, when more water infiltrates the slope than is able to percolate through the weathered regolith

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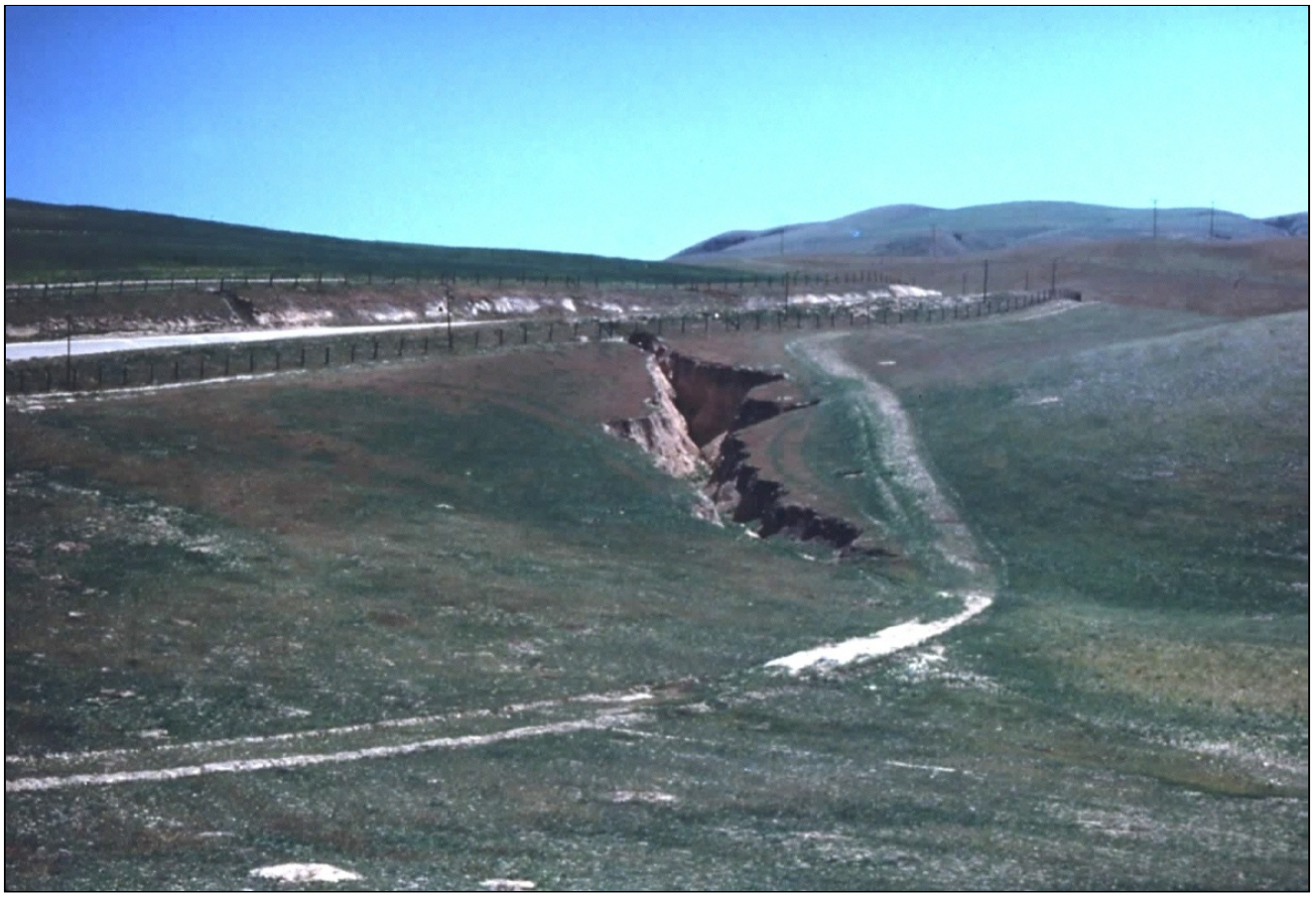

- **Unnatural concentration of surface runoff often causes severe erosion, usually emanating from hardened surfaces, such as streets, parking lots, roofs and paved drainage ditches.**

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- This erosion gully was created from concentrated runoff spilling off the upper parking lot. Simple grass cover cannot always prevent erosion.

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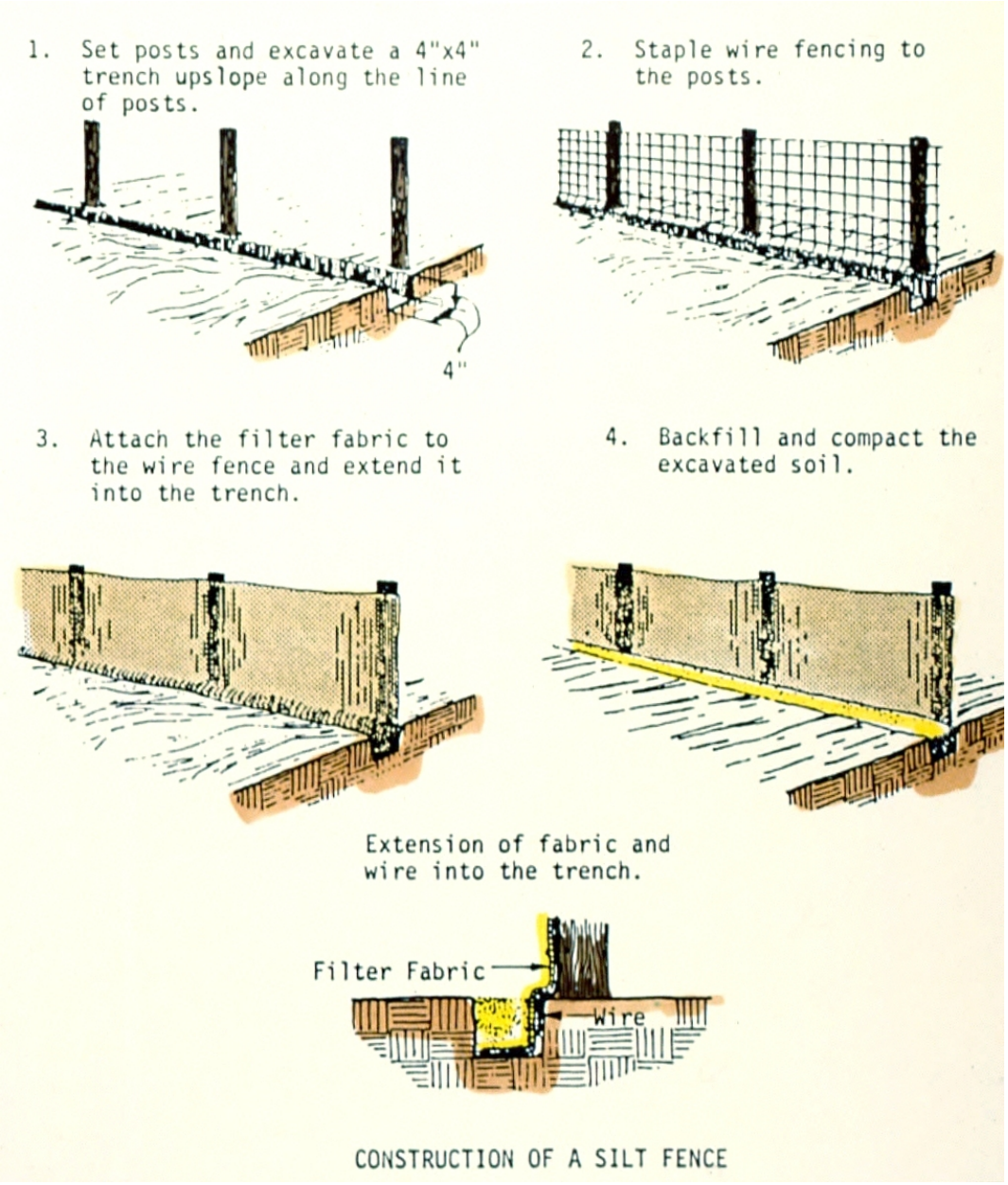

- **Silt fences are used as temporary catchment devices, usually during construction and months thereafter, until a healthy cover of vegetation can take root.**
- **Silt fences are now made of geotextiles, but can be reinforced with welded wire mesh**

- This view shows a typical application of a silt fence below a construction site. The fence is intended to restrict migration of eroded sediment into drainage improvements of natural watercourses

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- A series of six silt fences were overwhelmed by intense rainfall that befell a job site over a weekend, rendering it unworkable. This is what happens if you don't reinforce the silt fences with welded wire mesh and pipe posts.

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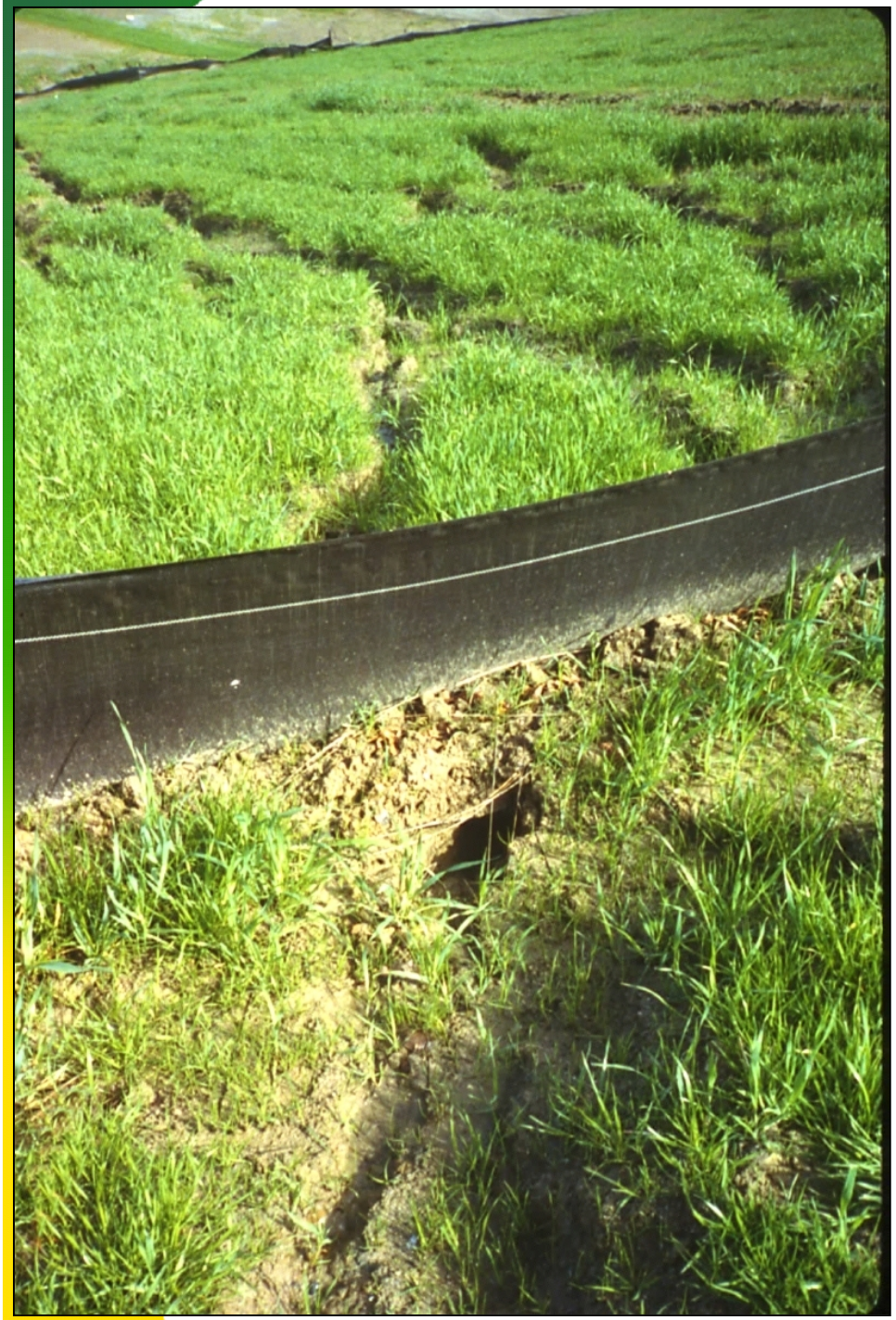
- Silt fences cannot prevent rill erosion
- Long slopes allow concentration of runoff, even on gradual inclinations (e.g. 3:1)
- Concave shaped slopes, like that shown here, tend to concentrate runoff by areal accretion



- The effectiveness of a silt fence is tied to how well it is anchored to the slope.
- This slope was hydroseeded and supported a lush growth of fescue grass; and the silt fence was embedded into the slope
- Despite these precautions, rill erosion occurred

- **Silt fences that are placed on slopes or intended to be placed in use for more than a month should be reinforced with welded wire mesh and either steel fence posts or steel pipe posts**

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- **Temporary siltation ponds provide a mechanism for catching and holding eroded sediment. The pond should be equipped with a perforated riser and armored spillway**

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- **Left unchecked, erosion of the weathered slope mantle may continue until such a time that mass movements initiate, as shown here**

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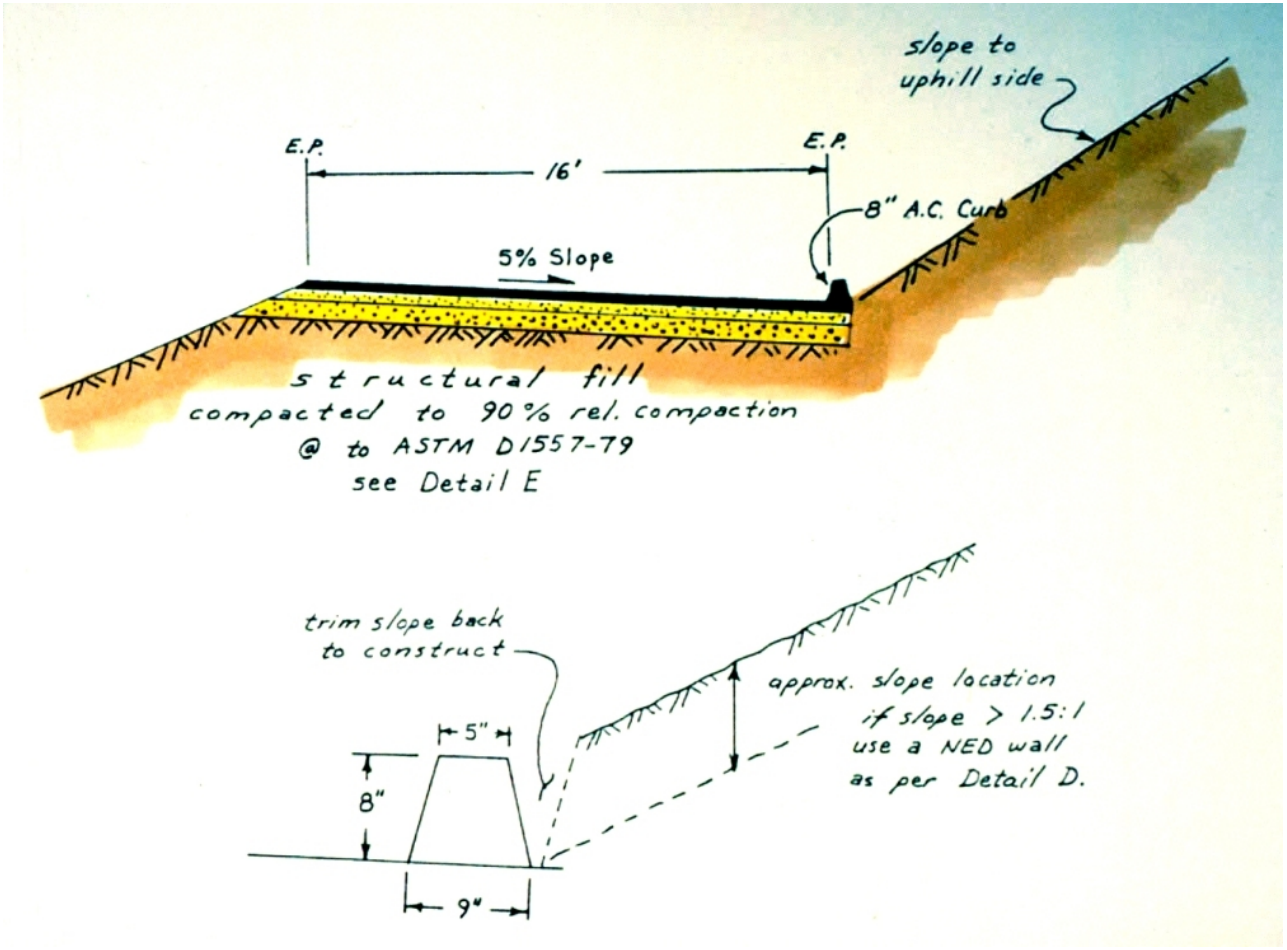

- **A 5% cross slope is a wise precaution on hillside roads, especially when constructed on cut-fill prisms, which are subject to long-term settlement.**

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A strong cross slope trains runoff to the inboard side of the road and promotes self-cleaning through supercritical flow along the gutter line, as shown here. The drop inlet needs to be provided with debris catchment so it won't easily clog.

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- **Drop inlets for storm drains are always subject to clogging by organic debris, especially during the first few storms of the rainy season or after prolonged droughts**

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