# Part 7

# GEOTEXTILE FILTER FABRICS

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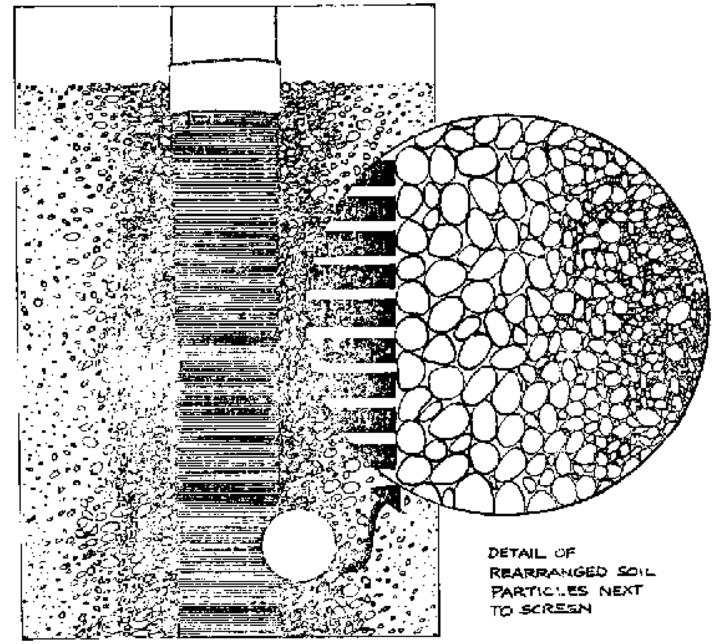
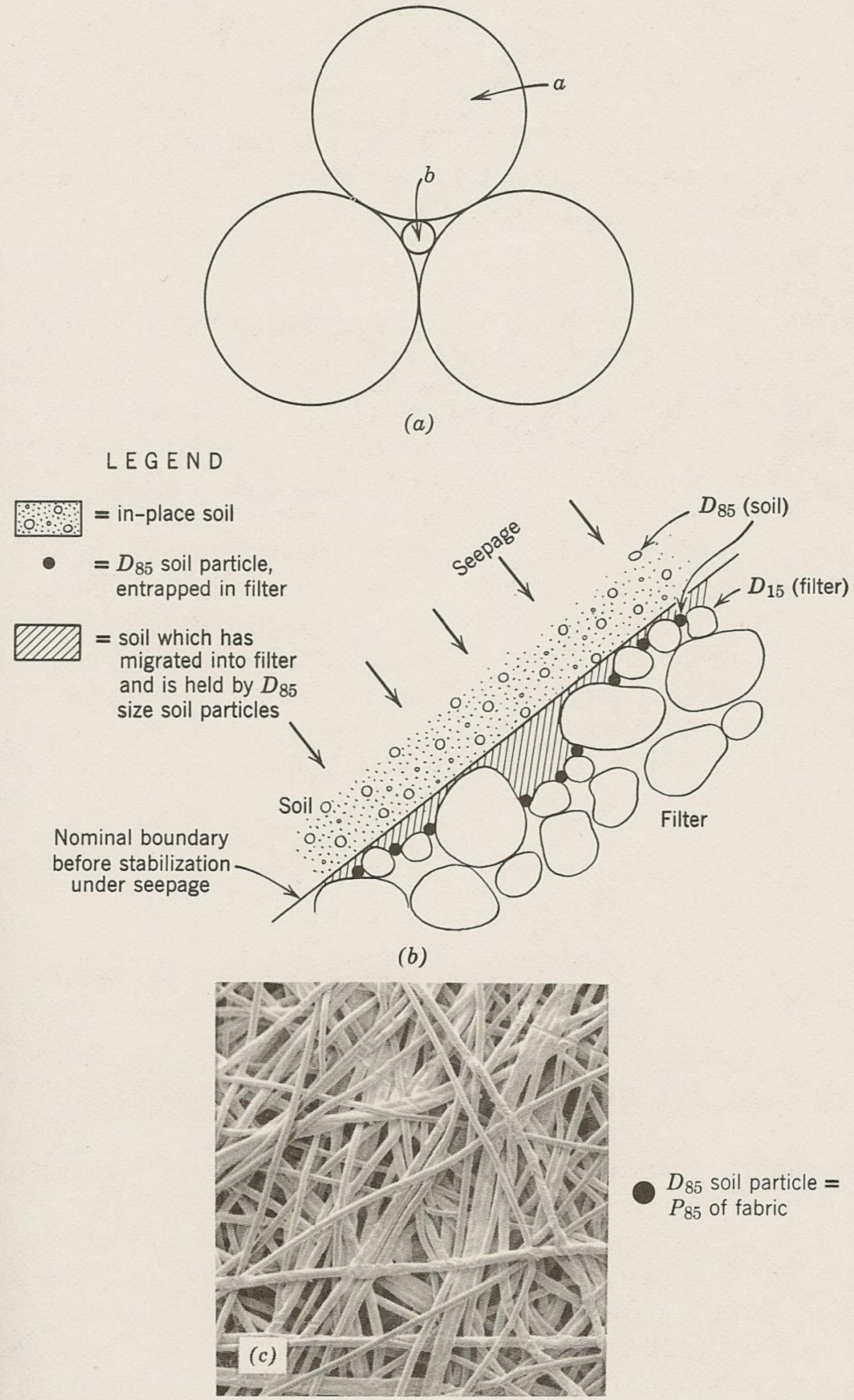
# Well Screens

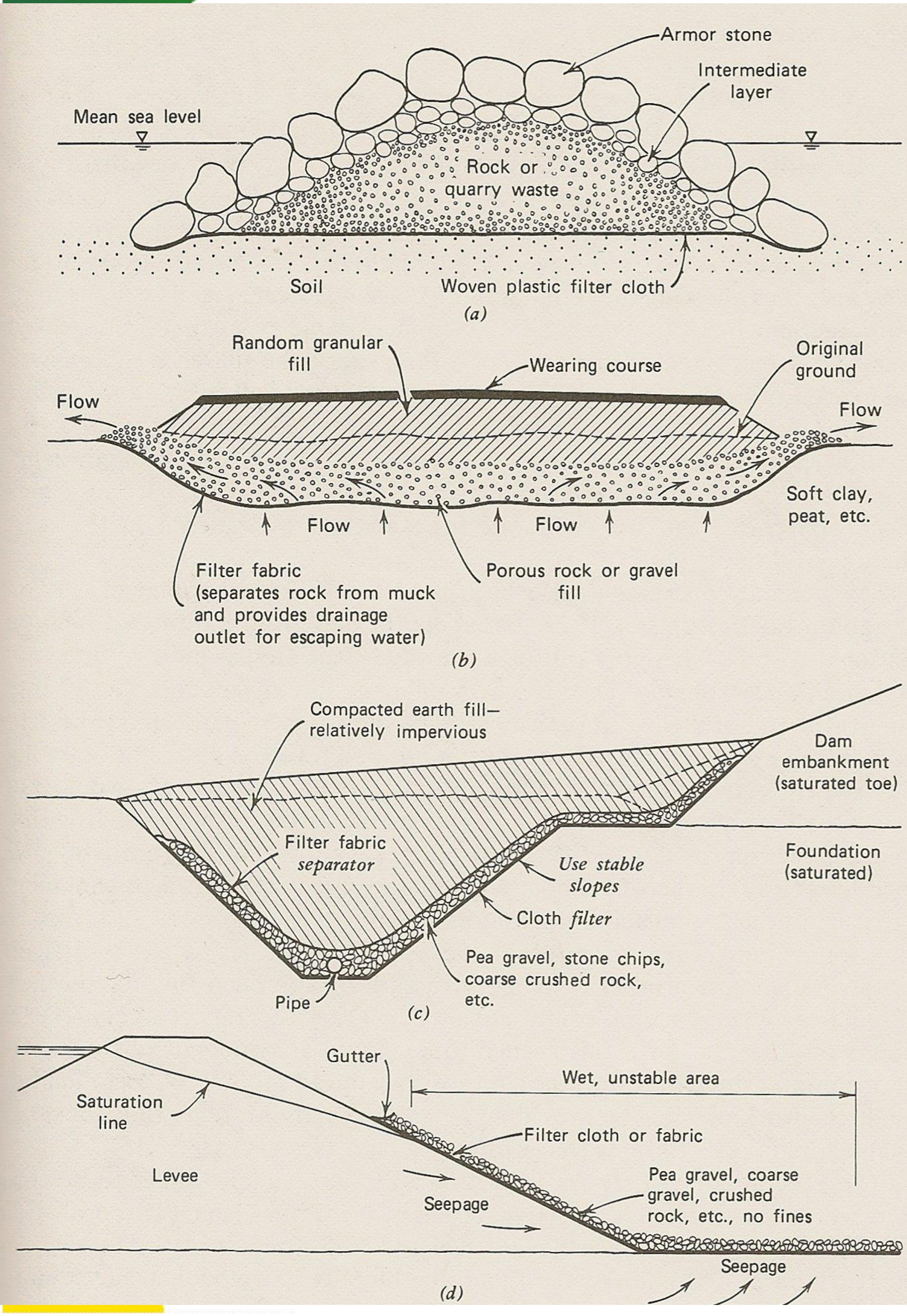



- Slotted casings are normally employed as **well screens** within the ***aquifers*** being taped by water wells. The width of the slots should allow 50 to 60% of the sand grains to enter the well and be removed, creating an ***inverted filter*** (see drawing above). An envelope of well graded granule gravel & coarse sand is usually placed around the casing.




# Filter Fundamentals

- **Upper Left: Filters prevent hydraulic piping if spherical particle b can just pass between three adjacent spheres 6.5X the diameter of b.**
- **Middle Left: Boundary condition between soil and protective filter layer: Note how $D_{85}$ soil particles which migrate into the filter media are captured by the $D_{15}$ filter material**
- **Microphotograph of Mirafi 140 nonwoven geotextile filter cloth, illustrating the $D_{85}$ size of the fabric, which could be expected to be caught and retained in the fabric.**




# Common Filter Fabric Applications

- **Upper Left: Woven cloth (for greater strength) beneath a riprap breakwater or jetty**
- **Second from top: beneath the drainage baserock course over swampy ground or permafrost-prone ground.**
- **Third from top: Under the toe drain of an embankment, levee, or dam.**
- **Under riprap facing or drainage berm of a levee (often essential for sandy levees)**

## field examples

# Filter Fabric Applications

- Upper left: Levees being eroded by hydraulic piping on land-side toe by emergent seepage
- Lower left: After treatment by filter fabric overlain by protective riprap, to retard migration of fines
- Below: Rock dike laid across soft marshy ground over a woven geotextile to prevent fines from migrating up into the dike


- **Rubber tired skip loader placing 12” x 18” armor rock over a geotextile filter cloth as part of a small slope repair**

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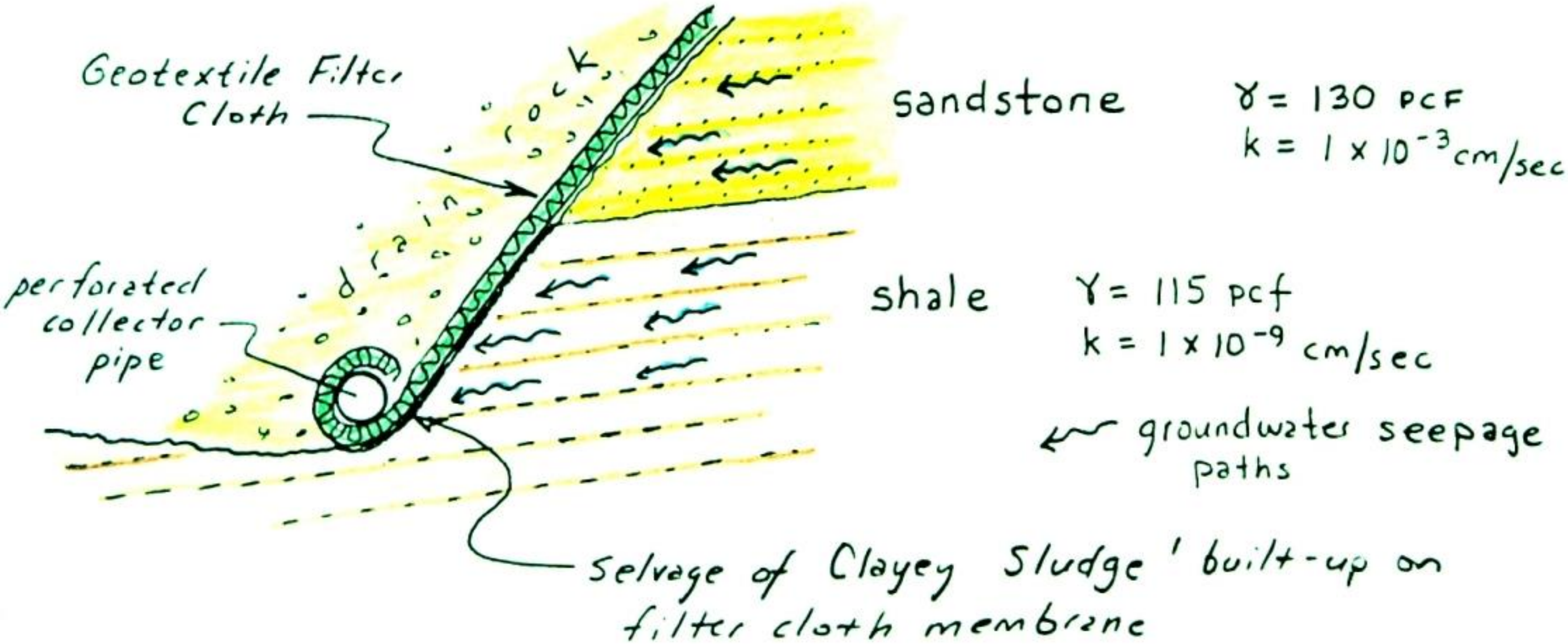
- If clean rock is readily available, it can often be utilized as a free-draining backfill for slope failures
- This view shows a geotextile filter cloth, a gravel subdrain with cleanout riser and Class B armor rock being employed in a slope repair

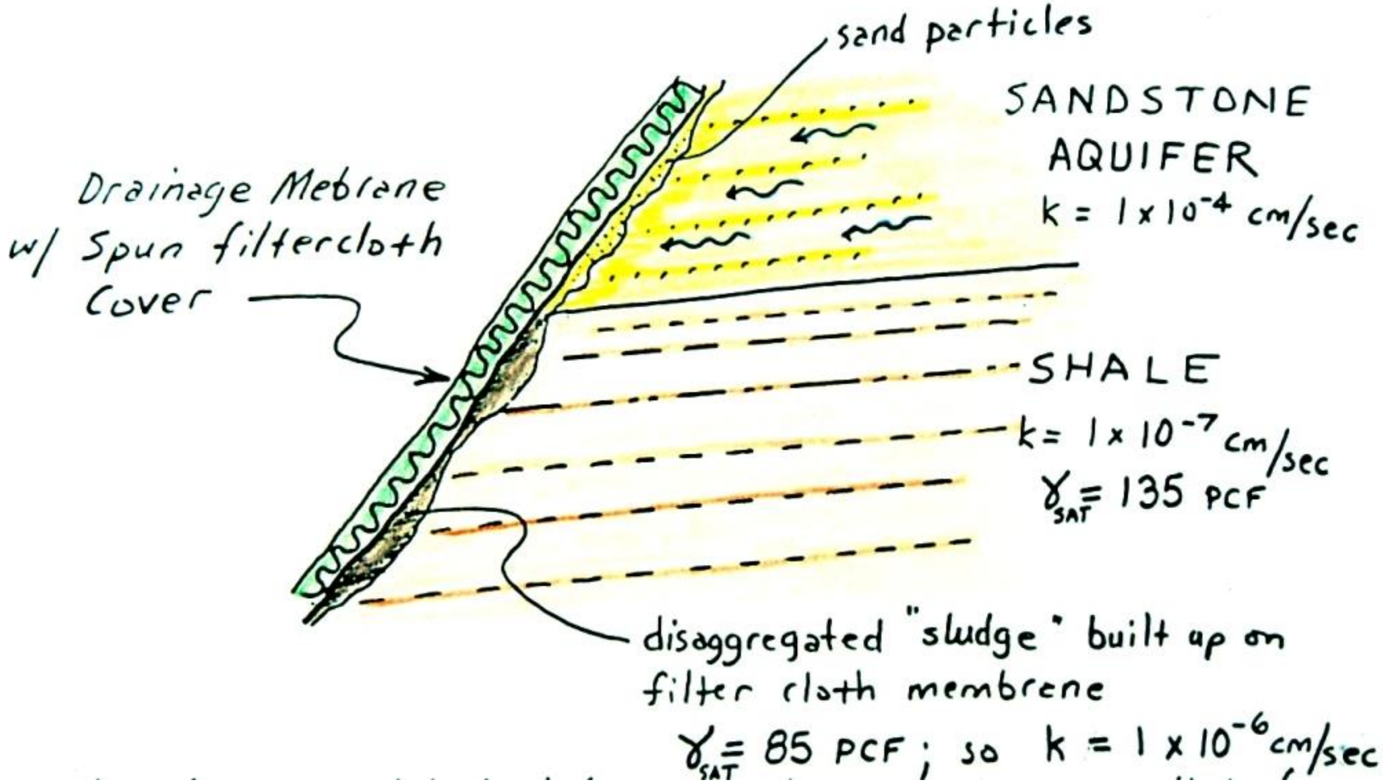
- Overview of the same repair, generally referred to as “rockfill shear keys” or “rock buttresses”

- **Rockfill buttresses are occasionally criticized for being unsightly or a personal injury hazard, in case someone tried to walk across the angular uneven surface! They can be very effective.**

- **Blanket drains** are used beneath embankments in areas where clean rock is readily available and thorough underdrainage is desired.



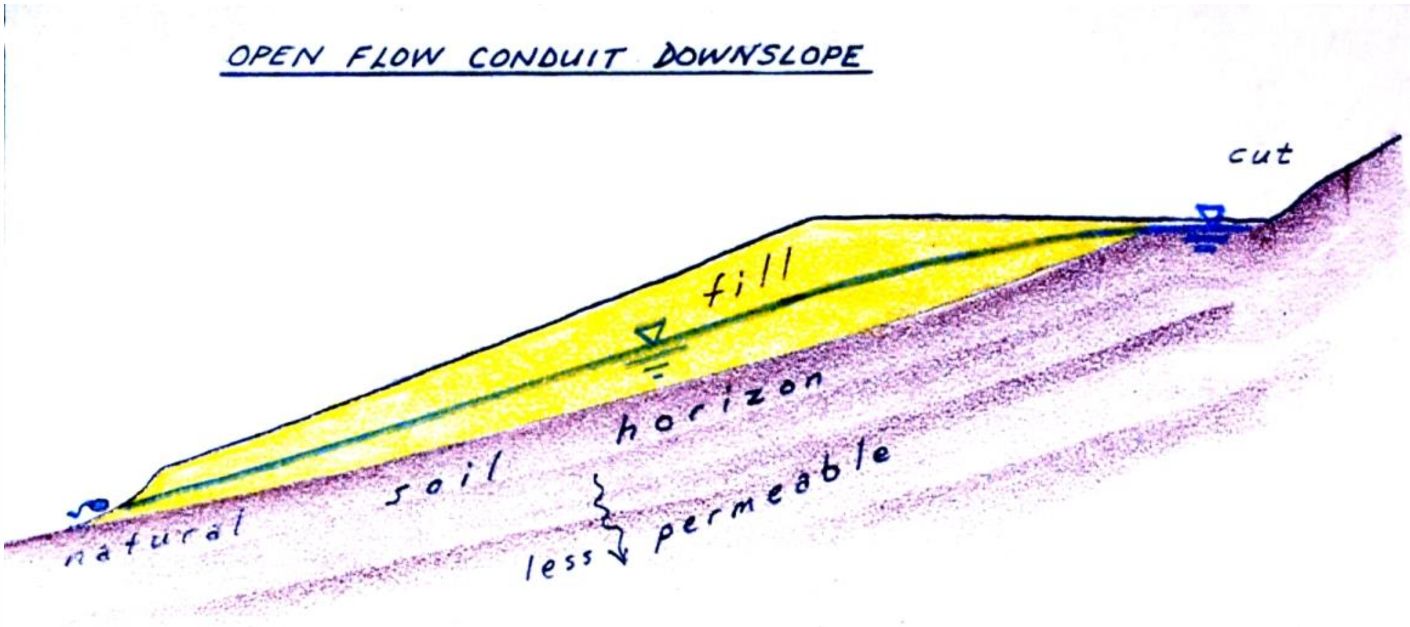

- **Filter cloths prevent infiltration of fines into subdrain media. A selvage of fine grained sludge can be expected to accumulate against the filter cloth, but this should not prevent infiltration**




- **Drainage membranes with filter fabrics may appear to become clogged with silt, or "sludge" on their up-gradient side. But this sludge is always more permeable (lower density) than the parent material from which it emanates.**

- A plethora of **geotextile filter fabrics** are available for employment beneath fills for structures, highways or landfills. They must be properly lapped and keyed into the subgrade

- Gravel bench drains being spread over geotextile filter fabric in a sanitary landfill. Impervious membranes are often placed beneath these drains to trap and convey seepage or leachates to a controlled point of discharge




- **With time, the underlying soils will consolidate under the fill surcharge and the coarse layer at the base of the fill gradually becomes clogged by the root mat that tends to grow around the seepage outfall at the base of the fill.**

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- Seepage-induced erosion at the base of a sandy fill embankment, illustrating piping erosion of low cohesion fill materials by emergent seepage pressures.

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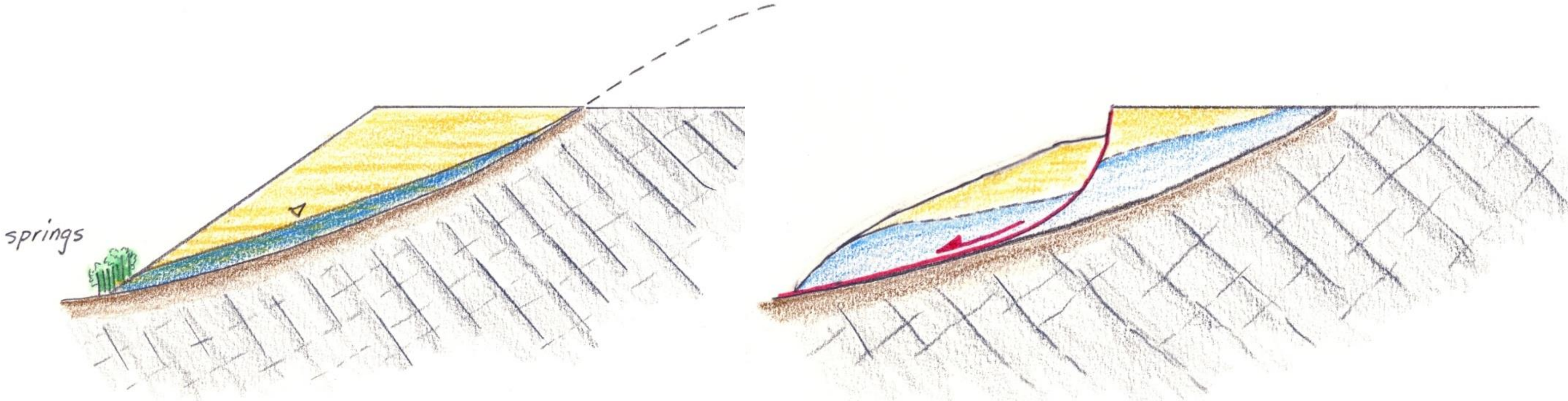
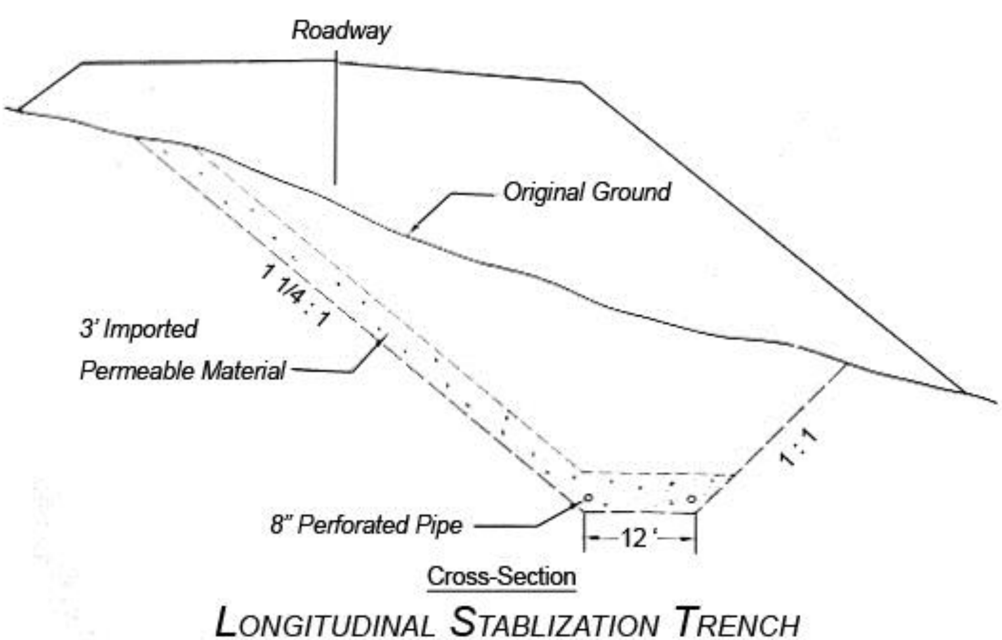


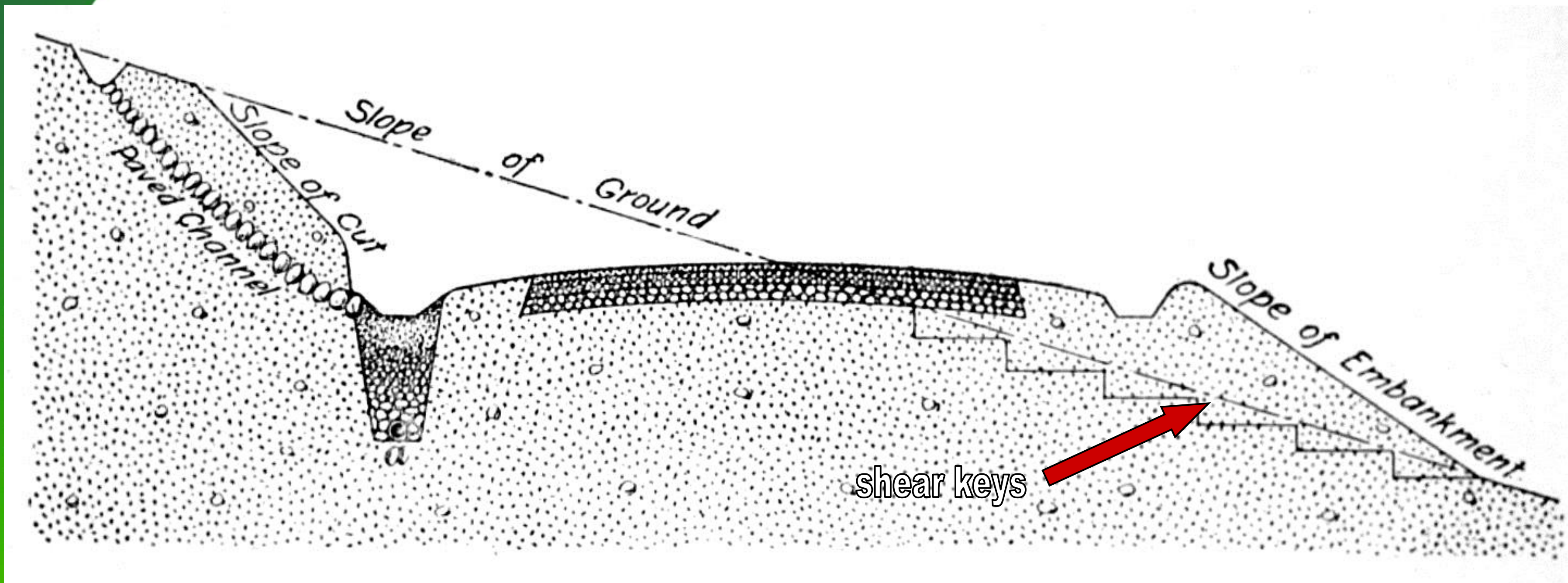

- **Upper Left: Shallow subsurface seepage tends to become perched within sidecast fill embankments because the base of such fills are usually comprised of larger diameter particles, and serve as a quasi subdrain, until blocked by vegetation or additional filling.**
- **Upper Right: If more water percolates into the sidecast fill than can flow out of its toe, pore pressures quickly elevate until the hydraulic gradient exceeds unity, and a slope failure occurs, as sketched here.**

# Subdrains under highway embankments

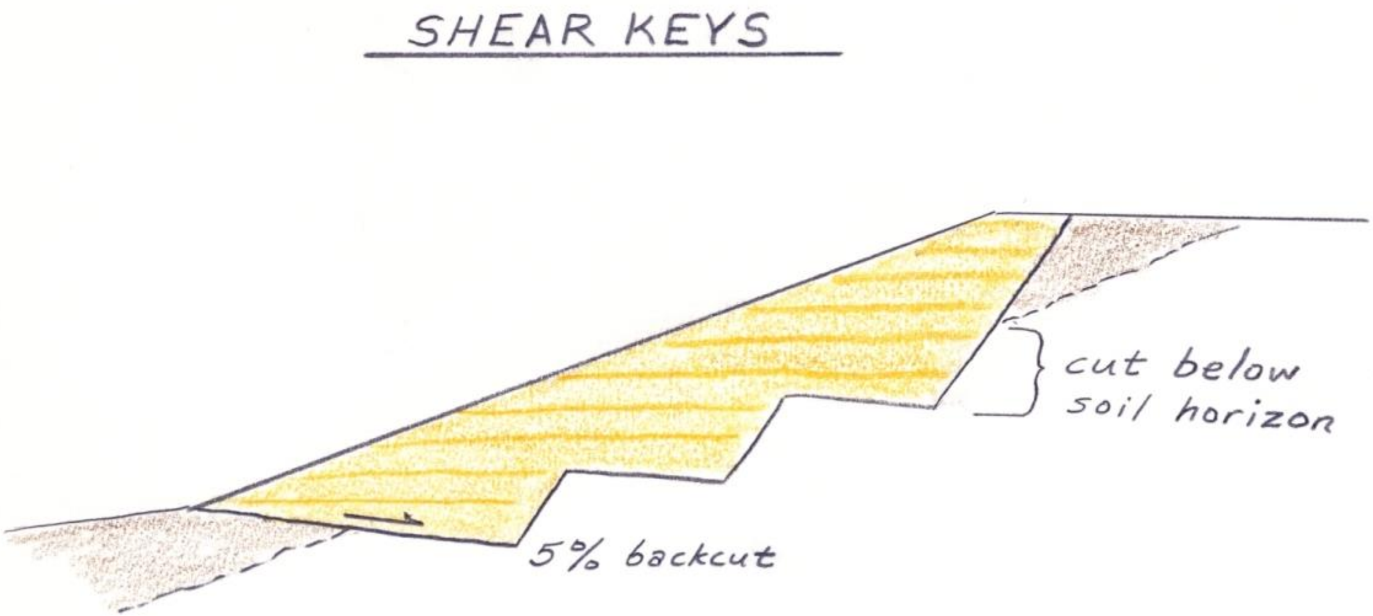
The California Division of Highways began using continuous subdrains on slide-prone embankments supporting the Los Gatos-Santa Cruz Highway in the Santa Cruz Mountains in 1938



Rotational slump-flow of a newly graded embankment along the westbound onramp of Interstate 44 in Rolla, MO. This slump was triggered by concentrated seepage along a single joint cluster, where they intersected a pervious bed




- **Shear keys have been recognized as an integral component of sidehill embankments for hundreds of years! This shows a typical section for a textbook published in 1893.**




- **Shear keys are intended to remove compressible fine grained, low permeability soils and provide additional mechanical interlocking with the subgrade. They were initially codified in the Los Angeles Grading Ordinance of 1952**

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