Lecture 5

SUBSURFACE DRAINAGE

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for the course

GE 441 Geotechnical Construction Practice

Part 1

FUNDAMENTAL CONCEPTS OF SHALLOW SUBSURFACE FLOW

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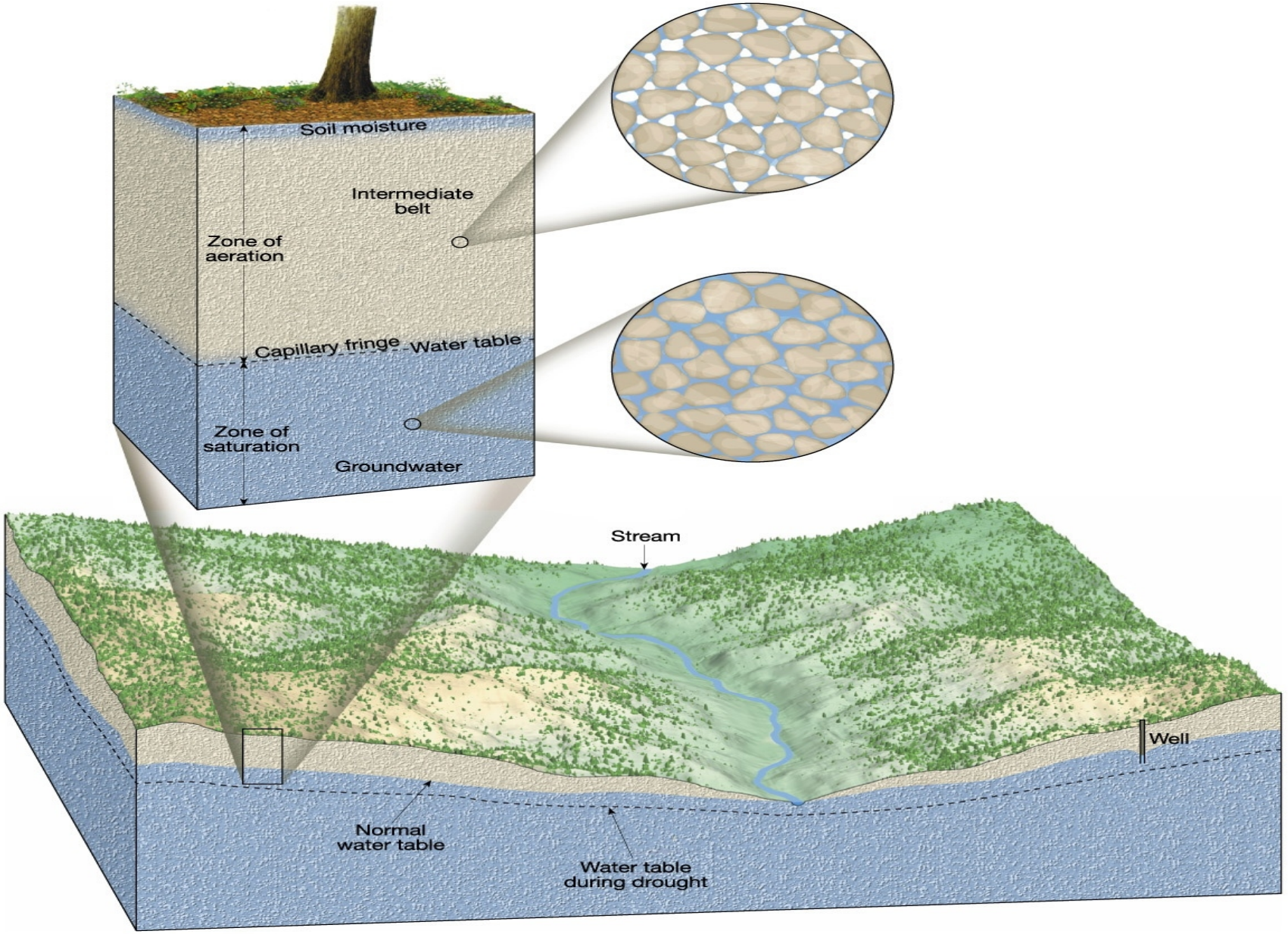
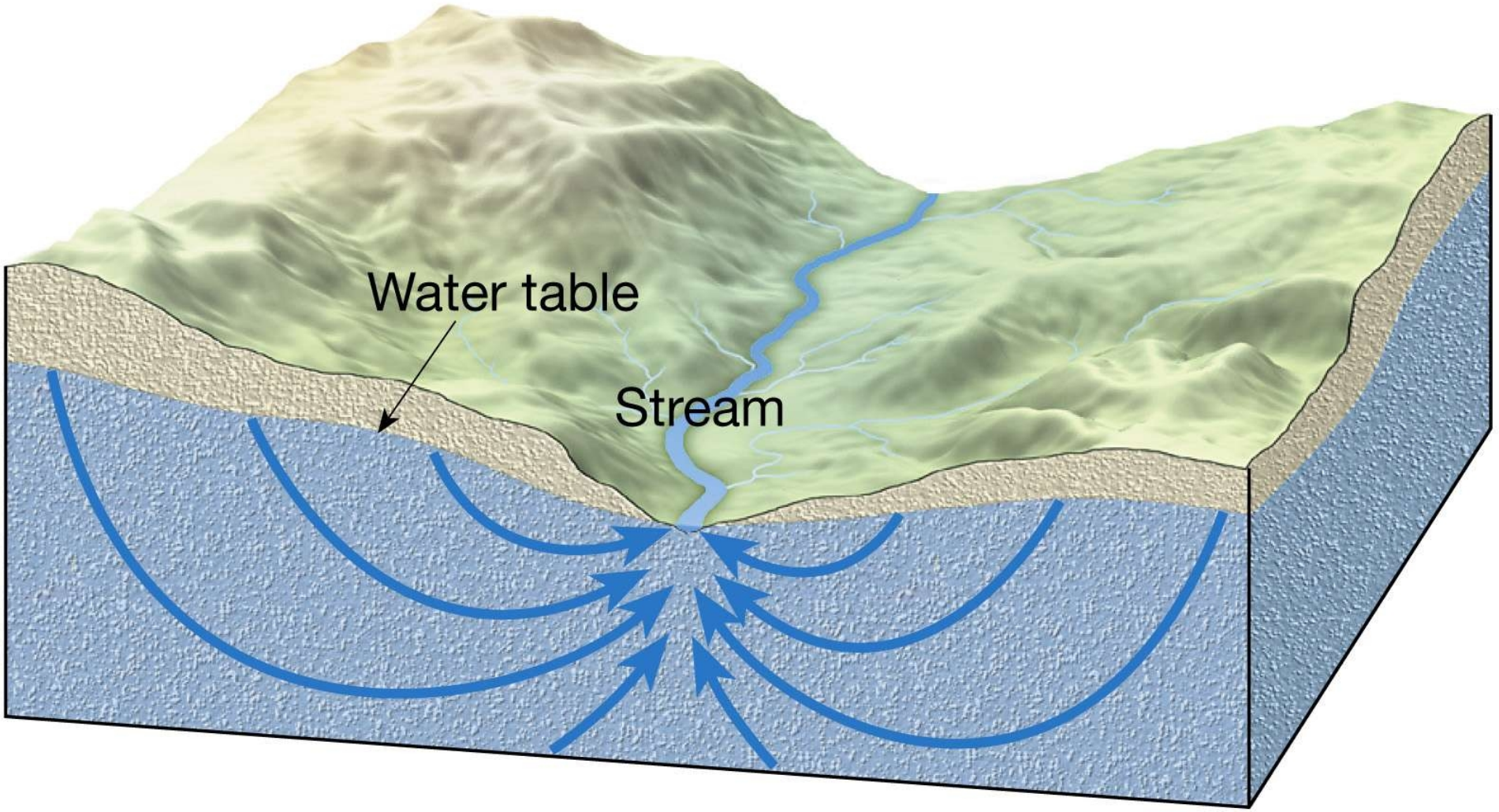
Groundwater Terminology





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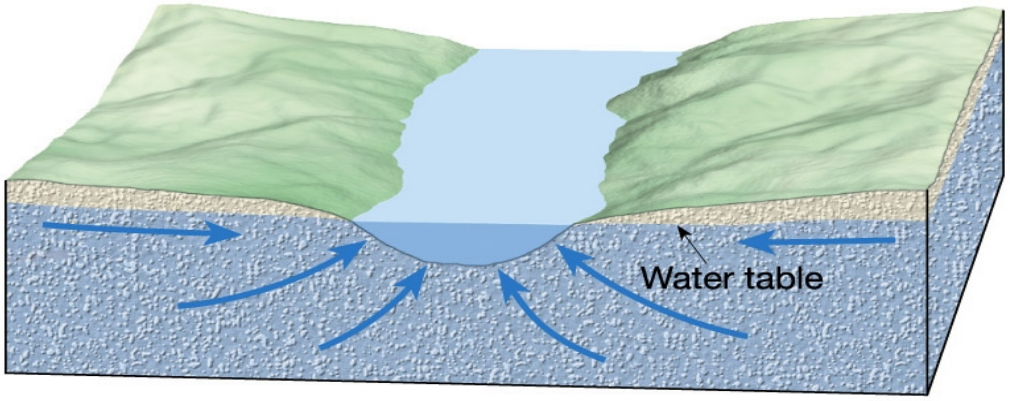
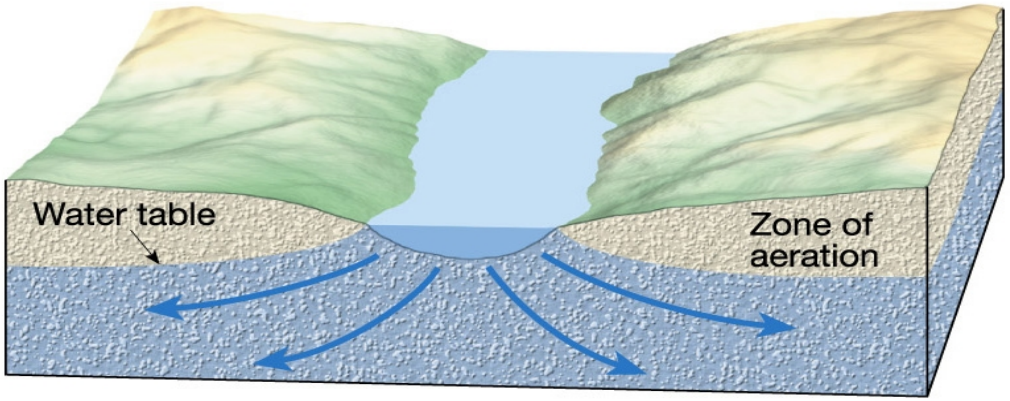
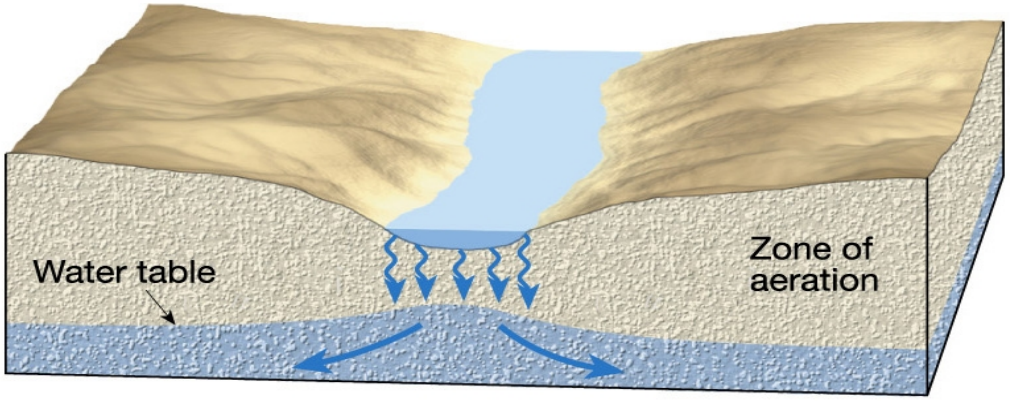
- **Theoretical movement of groundwater through uniformly permeable material**



A. Gaining stream



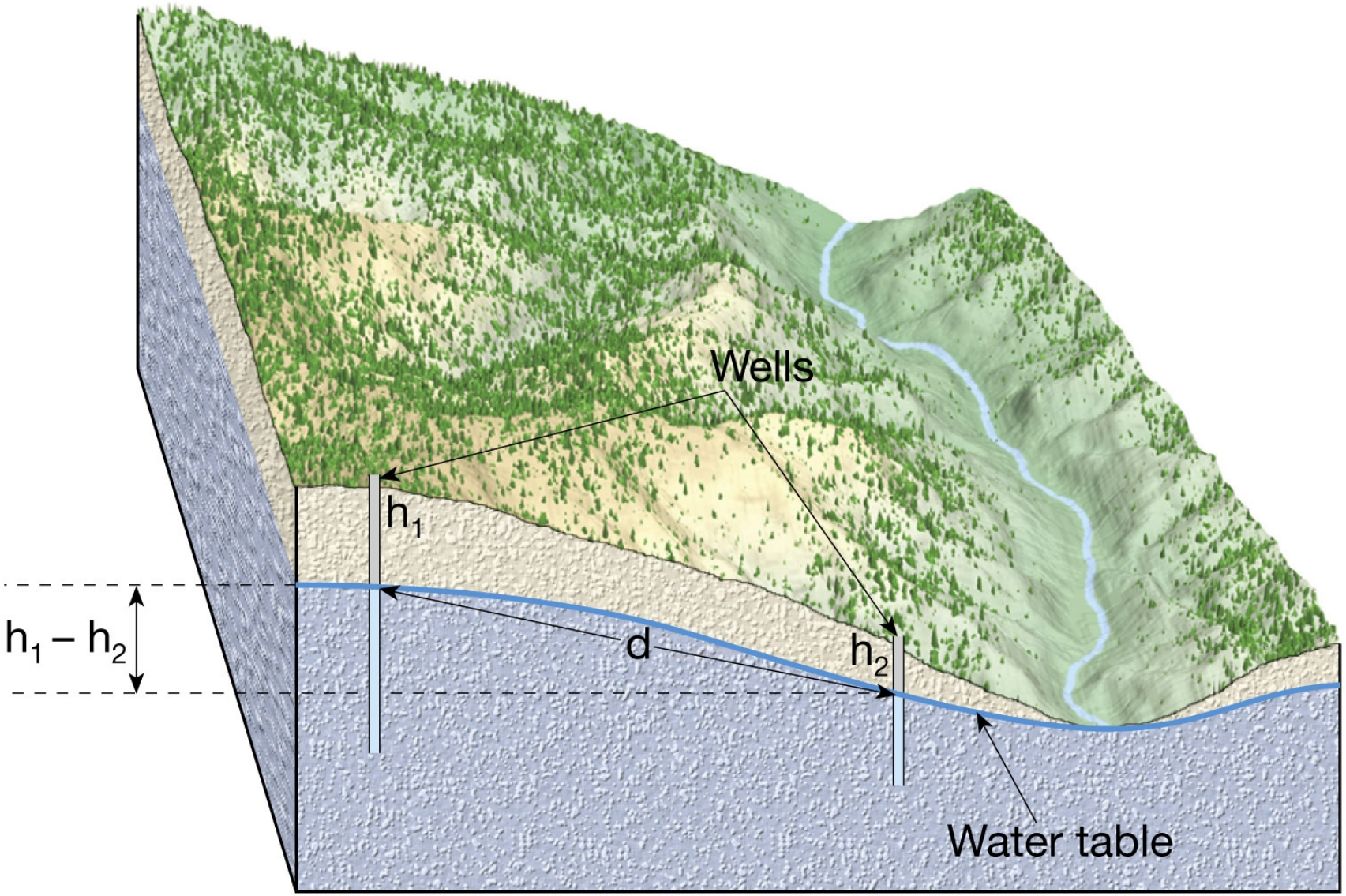
B. Losing stream (connected)



C. Losing stream (disconnected)

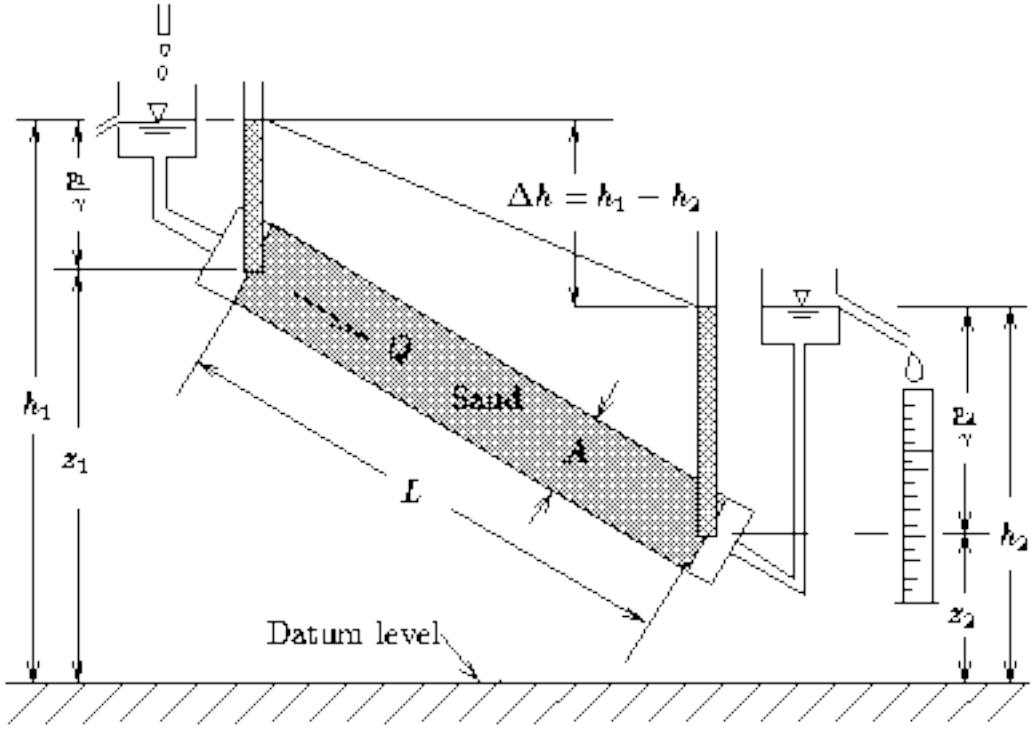
Gaining and losing streams

Hydraulic gradient – linear approximation



$$\text{Hydraulic gradient} = \frac{h_1 - h_2}{d}$$

Darcy's Law is useful for providing approximations of groundwater flow



$$Q = K A \frac{h_1 - h_2}{L}$$

- Where $\frac{h_1 - h_2}{L}$ is the ***hydraulic gradient***

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Interflow

- **Springs**
  - Springs occur where the ground water table intersects the Earth's surface
  - Natural outflow of groundwater
  - Can be caused by an aquitard, creating a localized zone of saturation, which is called a perched water table
  - **Ephemeral springs present the greatest engineering challenge, because they can be very difficult to detect**

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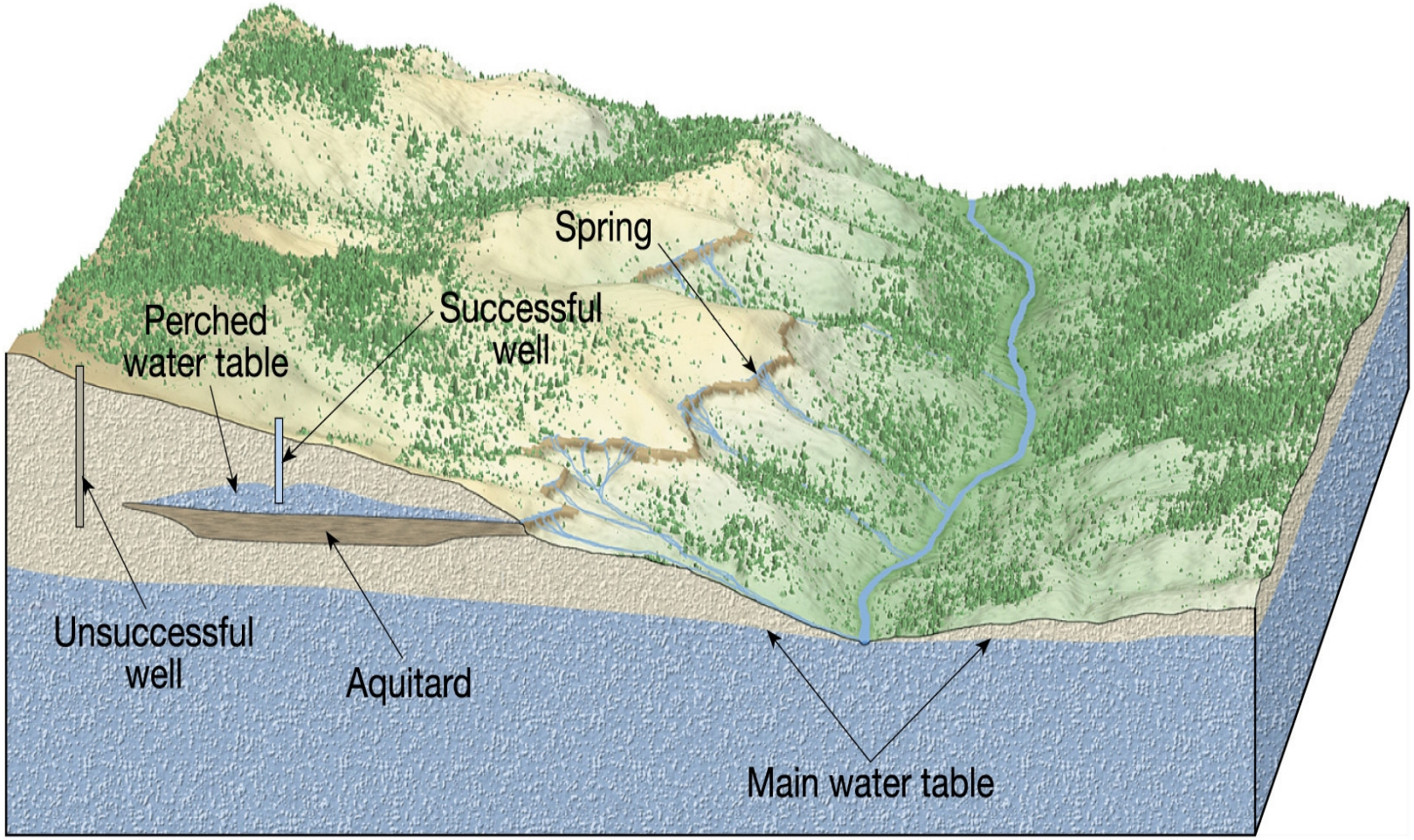
Springs resulting from a perched water table



Perched water tables are common to the Ozarks, much of the Midwest, and the Appalachian Mountains/Piedmont areas

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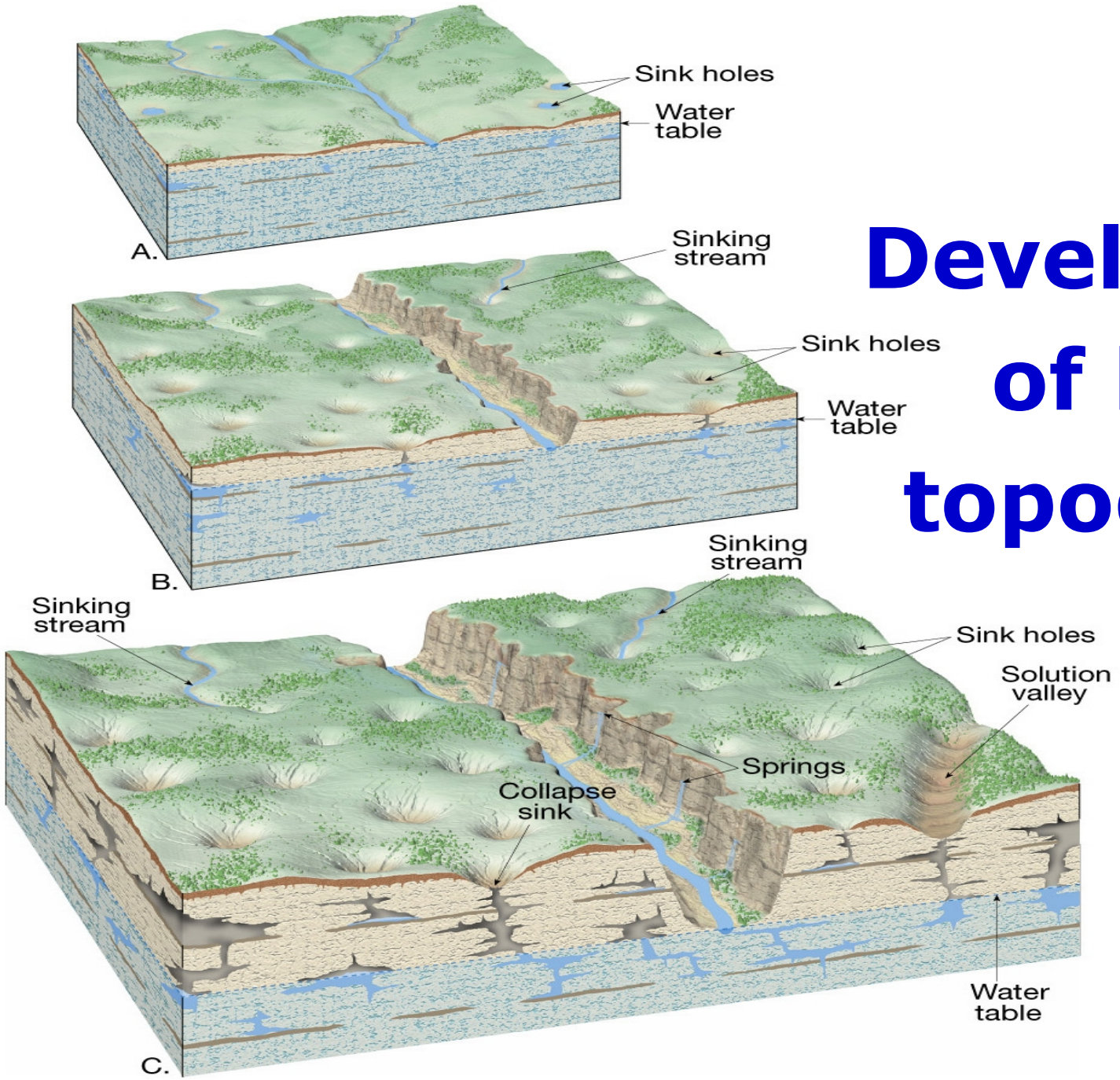
Development of karst topography



The slope of the groundwater table in karst is typically about ½ degree!