



# **Flow Equations**

# **Boundary Conditions**

# **Flow Nets**

# Steady and Transient flow

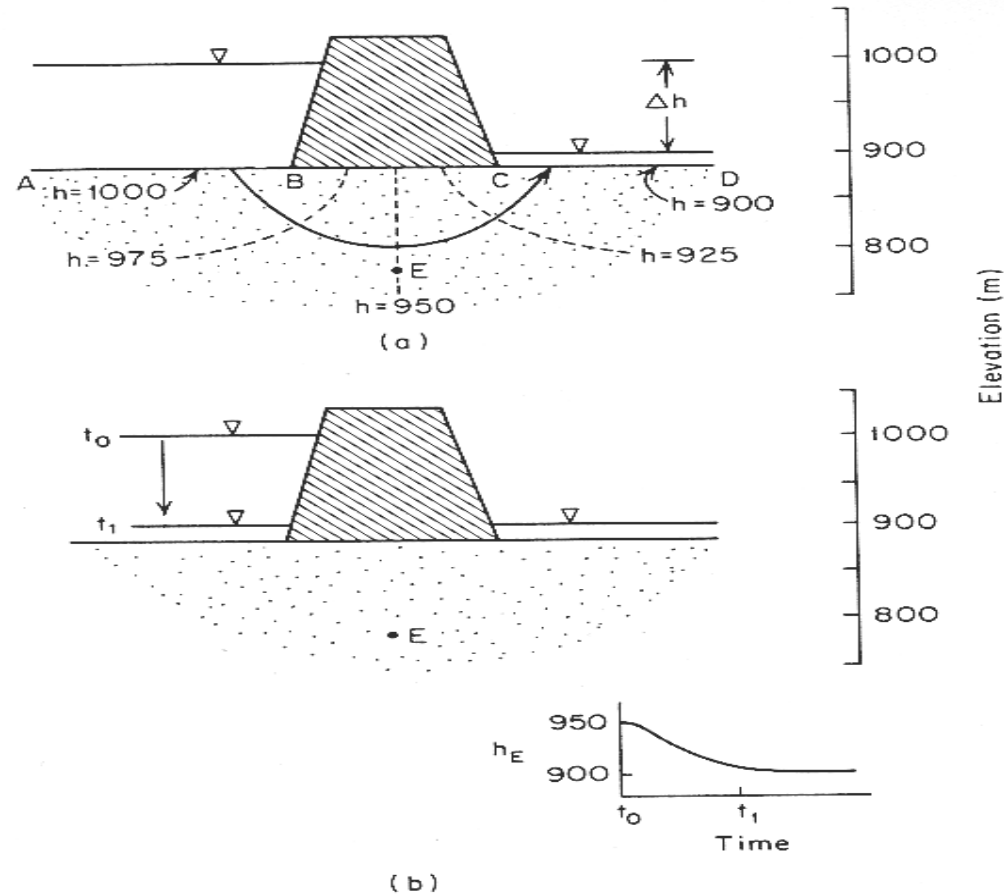


Figure 2.17 Steady-state and transient groundwater flow beneath a dam.

# How to observe hydraulic head?

- Piezometer and Observation wells

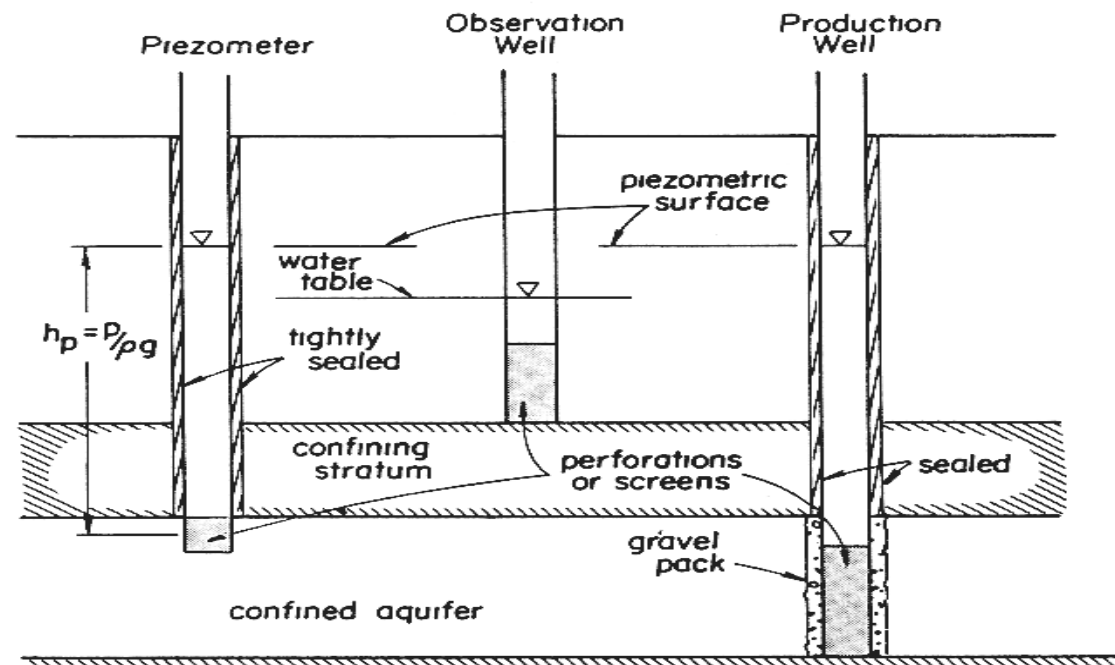
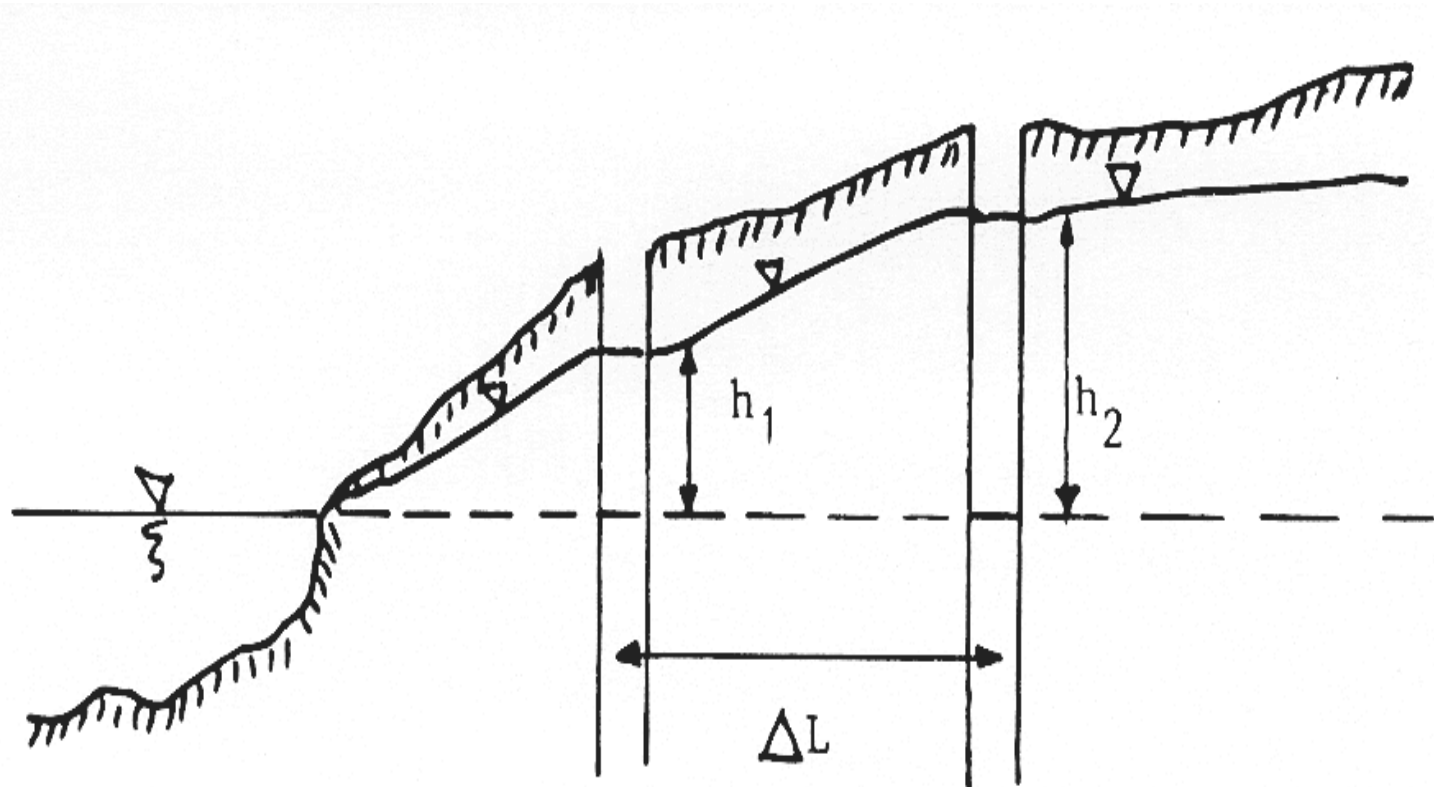


Figure 1-5. Common facilities for observing water levels in aquifers.



**Figure 4** Field setup for hydraulic gradient.

# Mapping Flow in Geologic Systems

- **Flow Net**
- Equipotential line
- Flow line

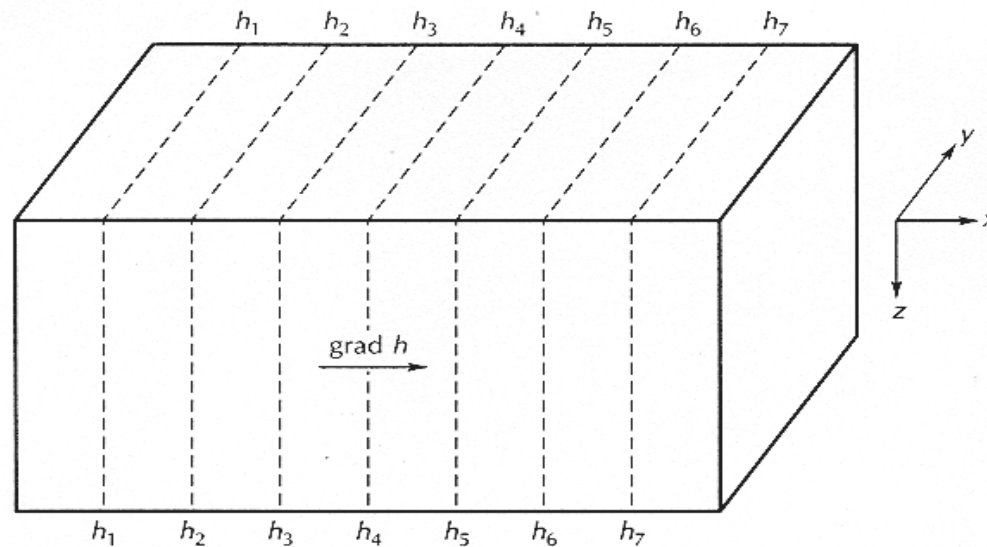
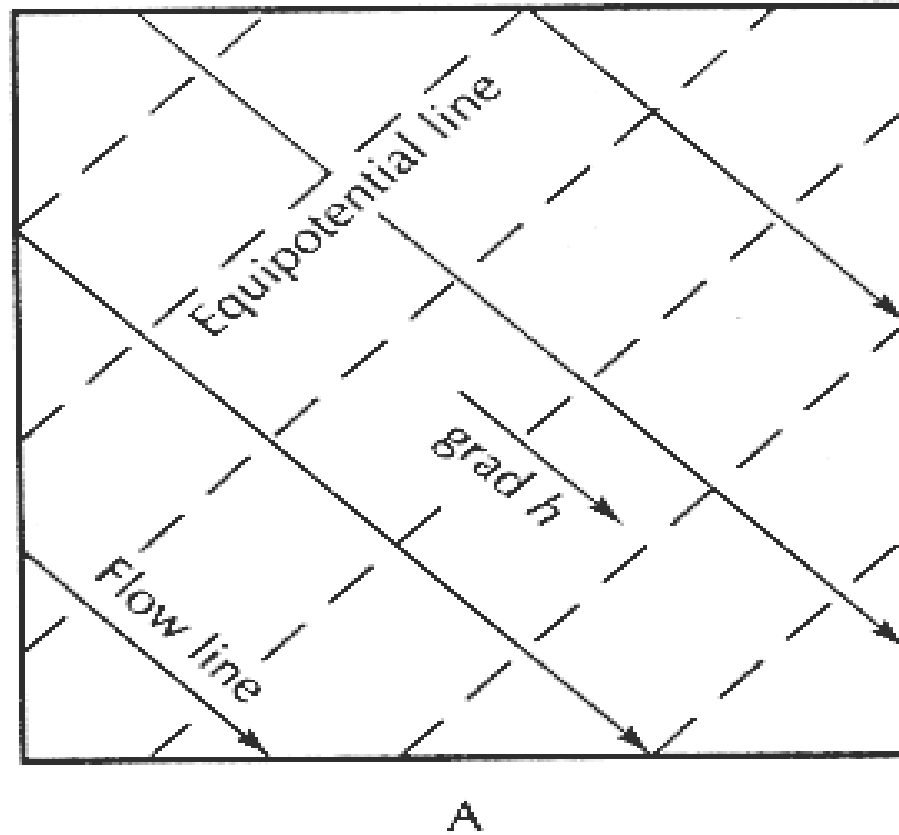
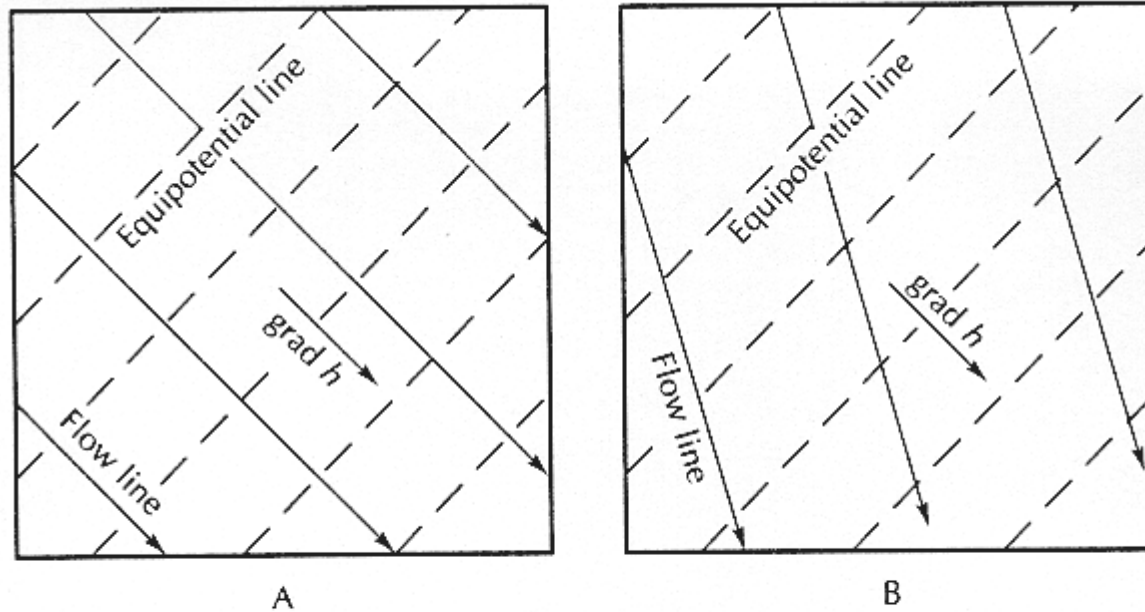


FIGURE 5.8. Equipotential lines in a three-dimensional flow field and the gradient of  $h$ .

# Mapping Flow in Geologic Systems



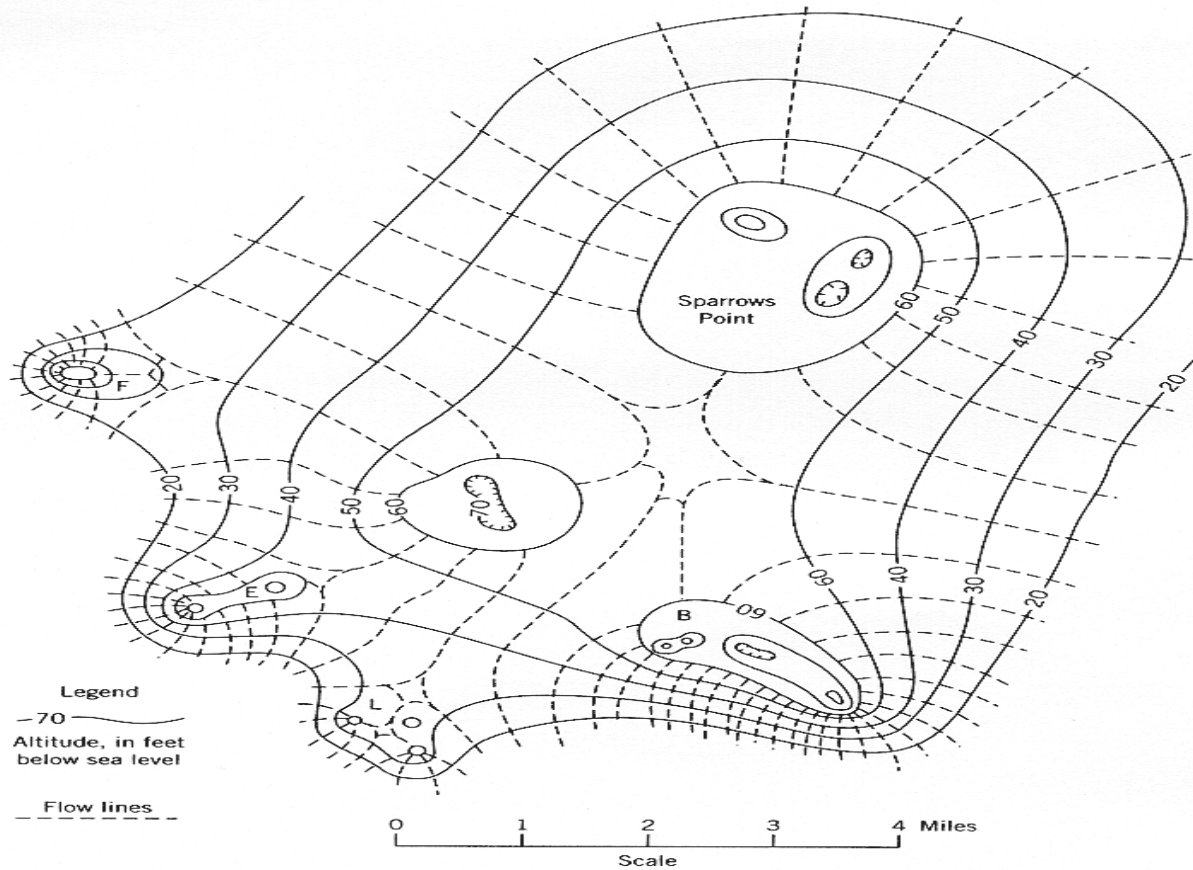
# Mapping Flow in Geologic Systems



**FIGURE 5.10** Relationship of flow lines to equipotential field and  $\text{grad } h$ . **A.** Isotropic aquifer. **B.** Anisotropic aquifer.

# Mapping Flow in Geologic Systems

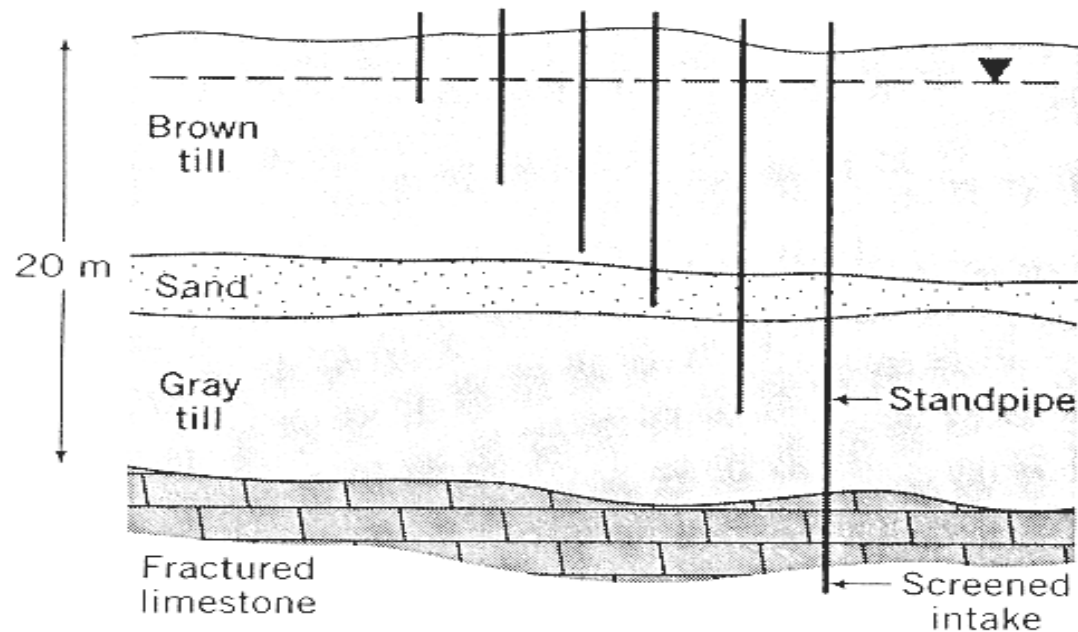
## Flow net



**Figure 4.10** Flow net for the Patuxent Formation (from Bennett and Meyer, 1952).



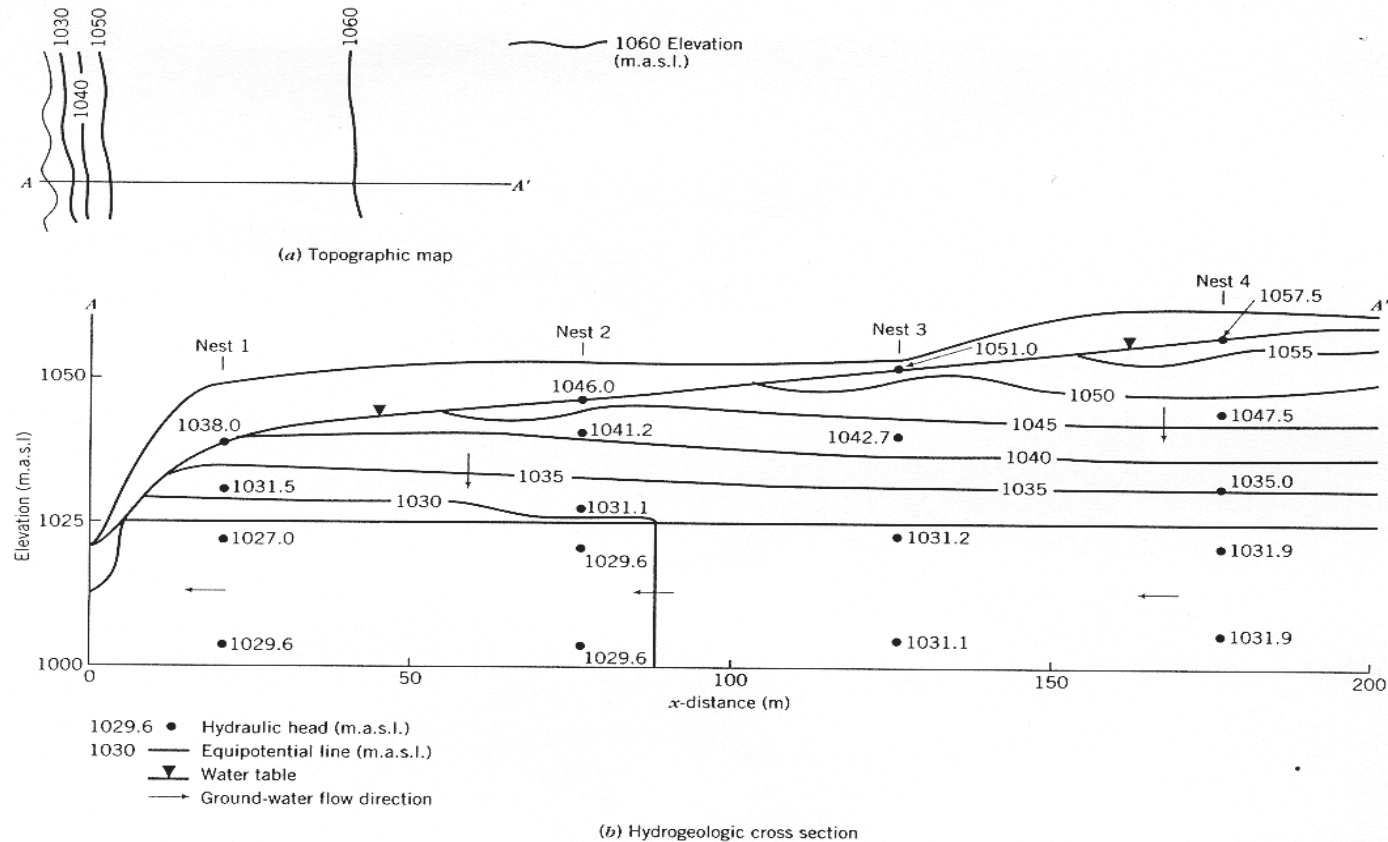
# Mapping Flow in Geologic Systems



**Figure 3.11** Illustration of a piezometer nest including a water-table observation well. Piezometers are employed in both high- and low-permeability units.

# Mapping Flow in Geologic Systems

## Cross-section



**Figure 3.12** Panel (a) shows the orientation of the cross section in relation to a hill slope. Panel (b) is an example of a hydrogeologic cross section describing the pattern of ground-water flow.