SITE DEWATERING

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Sources

- Dr Mostafa Abu-Keifa Notes and Lectures
- Dr Manal Salem Lectures
- Construction Industry Research and Information Association (CIRIA)
- Egyptian Code of Practice

De-Water-ing

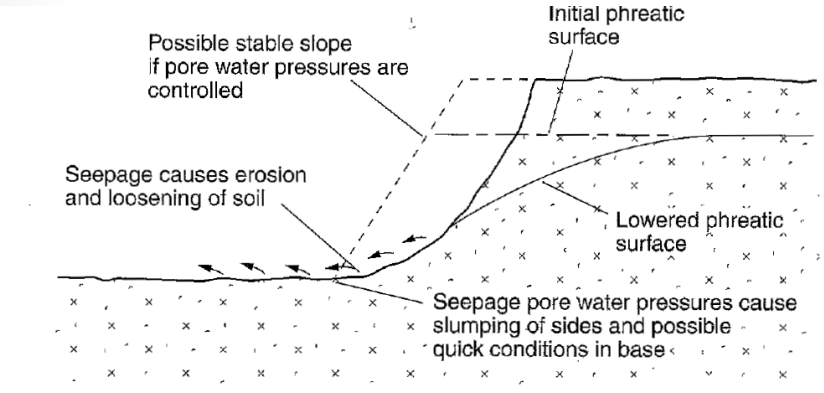
Lowering Ground Water Levels in Construction Areas by Water Extraction

Uses of Dewatering Systems

Improve excavating and hauling

Uses of Dewatering Systems

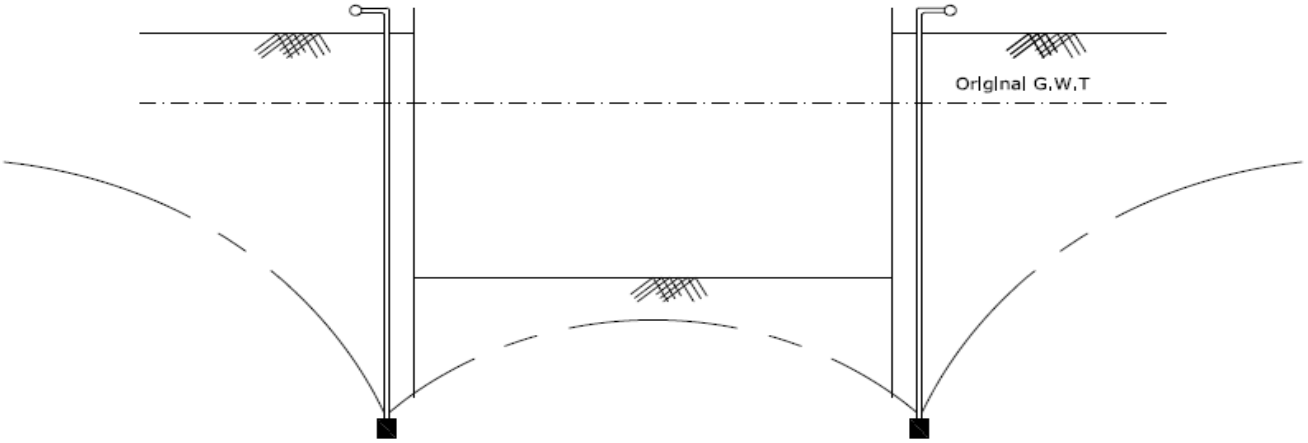
Increase stability of excavated slopes



Uses of Dewatering Systems

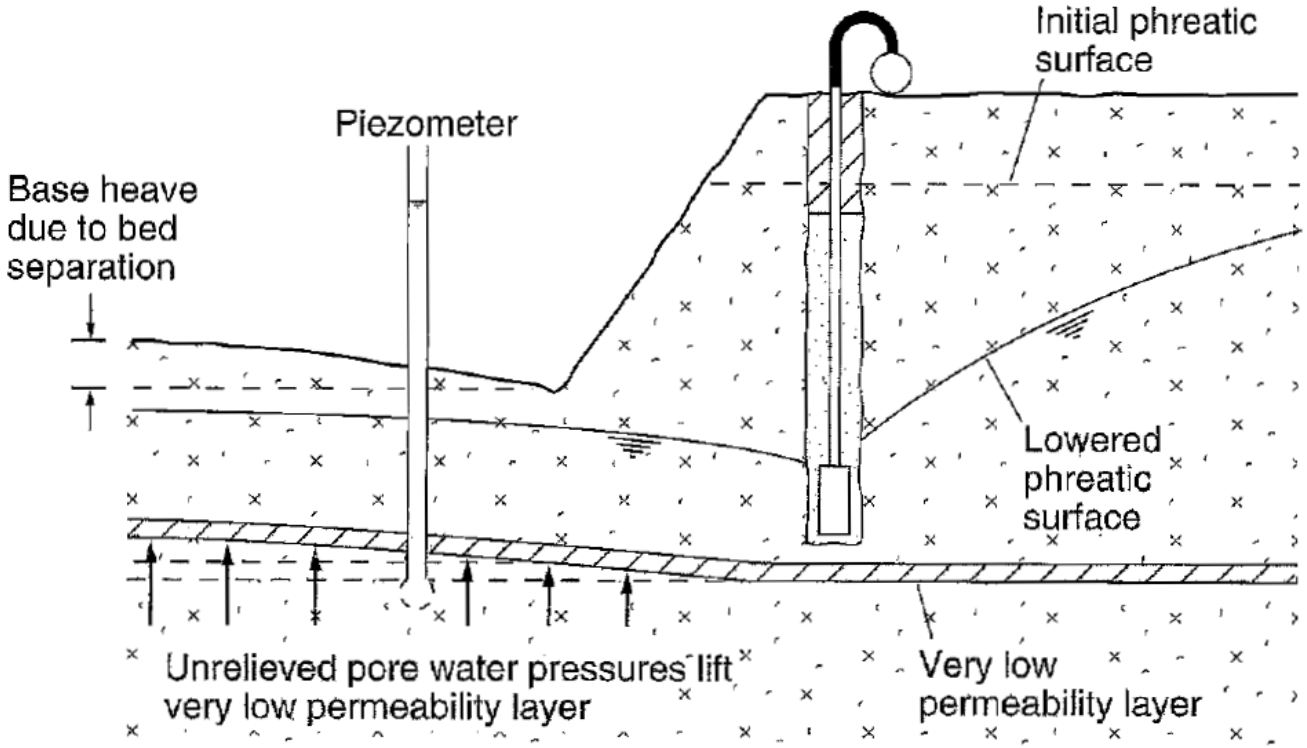
Reduce lateral loads on bracing

And Prevent rupture of the bottom of the excavation



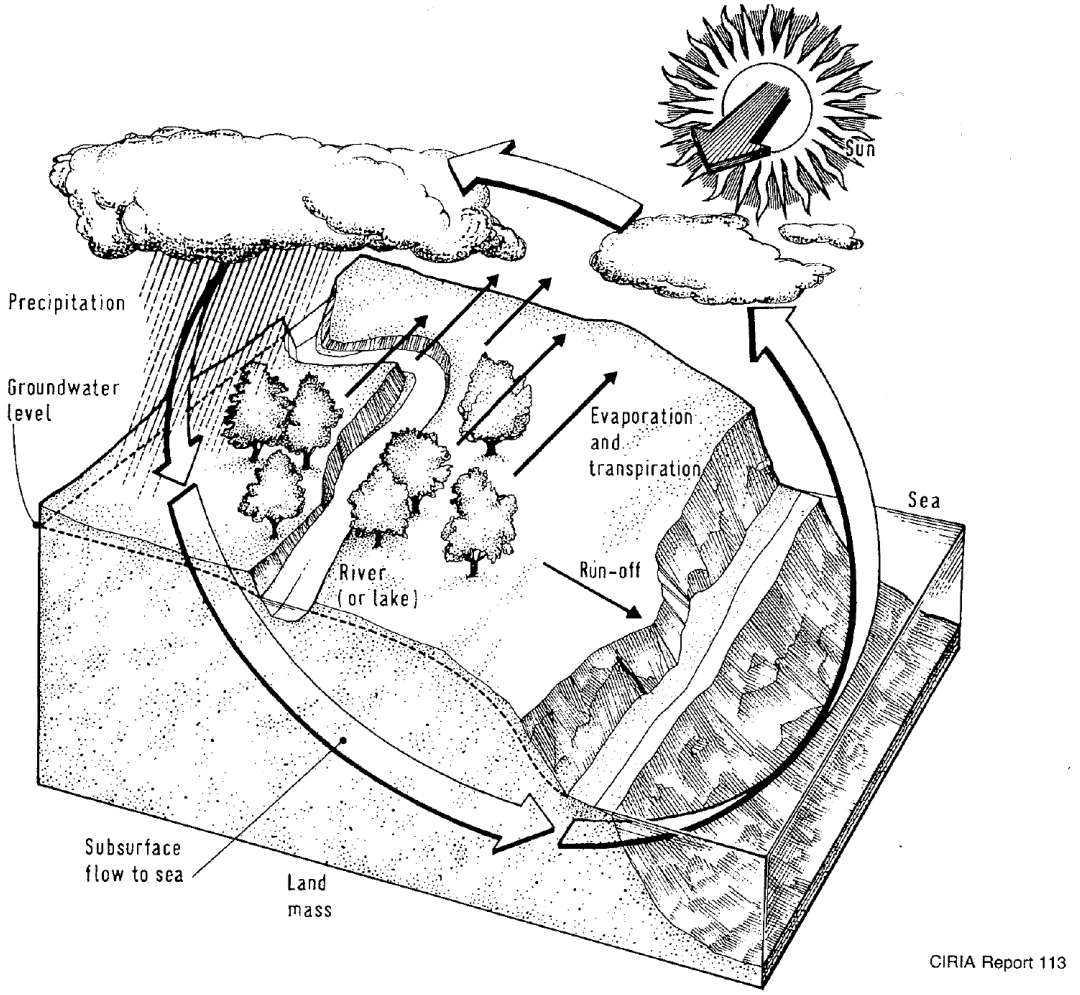
Uses of Dewatering Systems

Prevent Base Heave using Relief Wells



Where does GW come from?

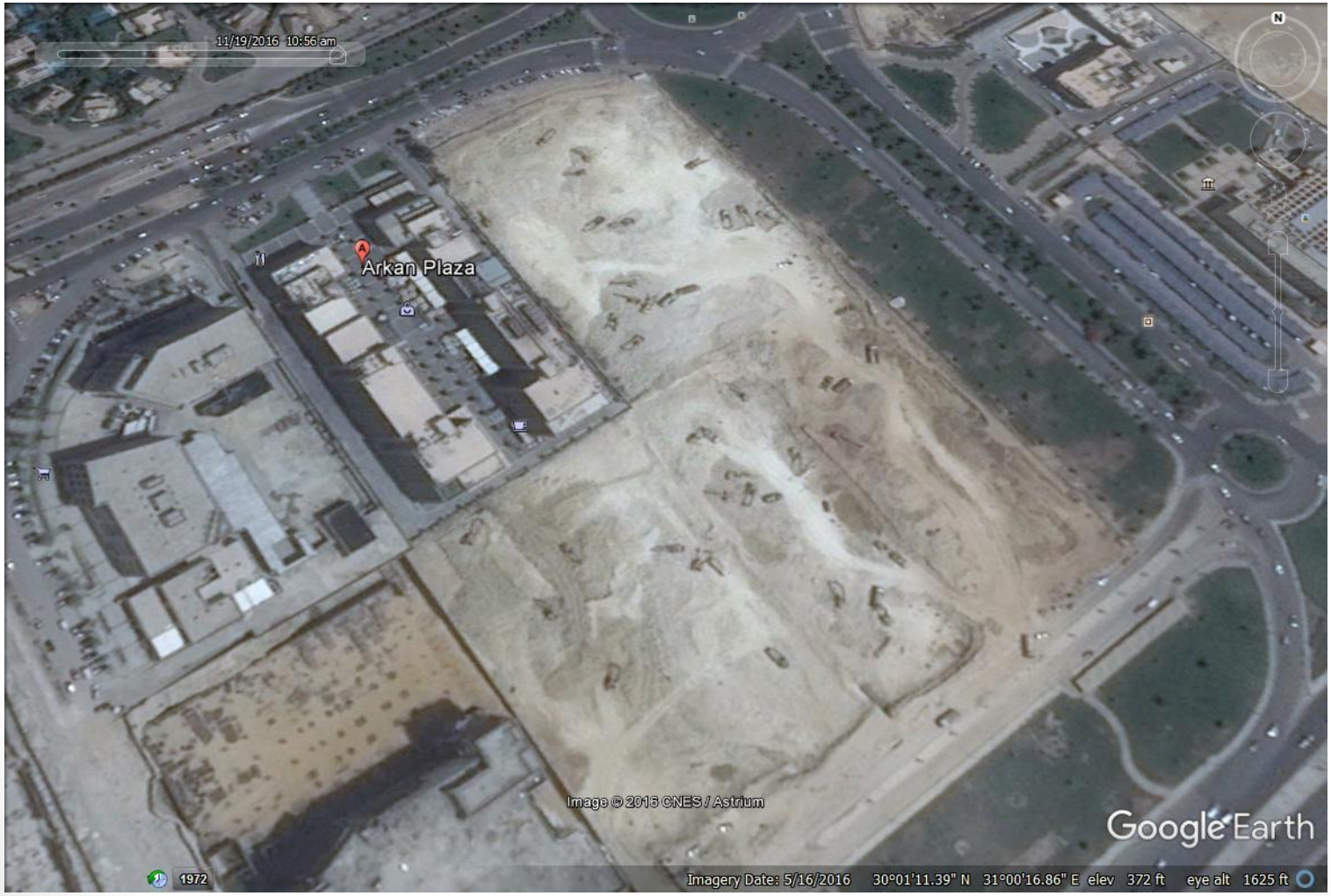
Near By Water Bodies, Precipitation, Sewage, Leakage,……..



Where does GW come from?

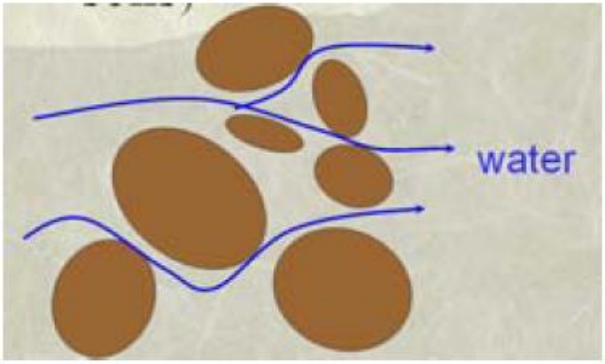
Effect of Urbanization

Arkan Plaza Case Study

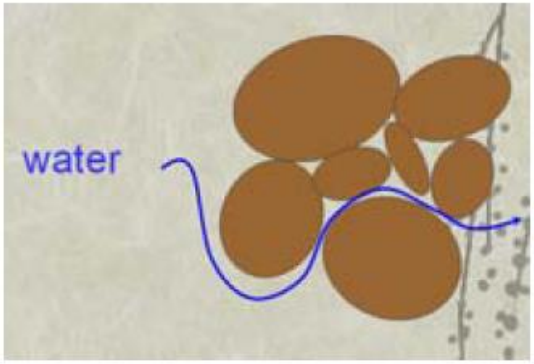


Permeability

- Is a measure of how easily a fluid (water) can pass through a porous medium (soil).



Loose Soil
High permeability



Dense Soil
Low permeability

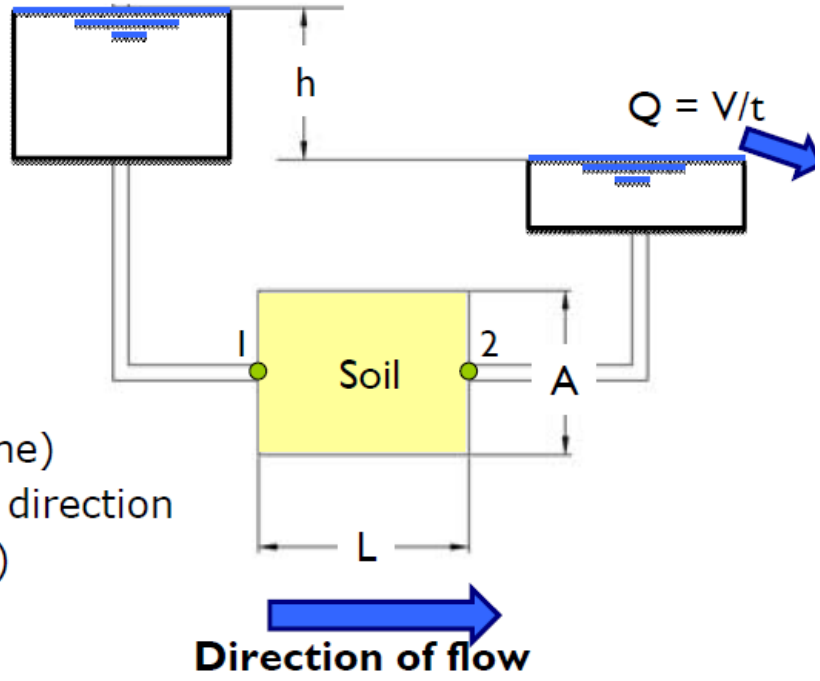
Darcy's Law

- Water moves through soil with discharge Q, and velocity v.
- $Q = A.v$
- $v \propto i$

  $v \propto h/L$

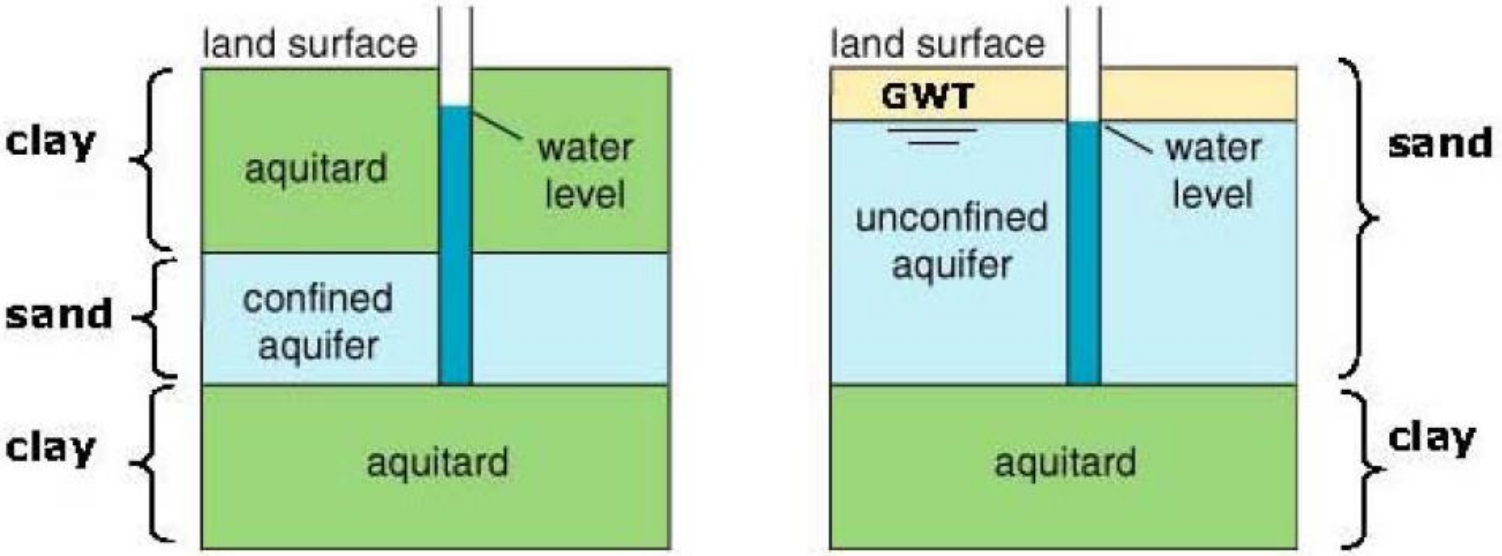
  $v = kh/L$
- $Q = Akh/L$

  where:
  - Q = water discharge (volume/time)
  - A = area ***perpendicular*** to flow direction
  - v = velocity of flow (length/time)
  - i = hydraulic gradient = h/L
  - h = total head difference
  - L = length ***parallel*** to flow direction
  - k = coefficient of soil permeability



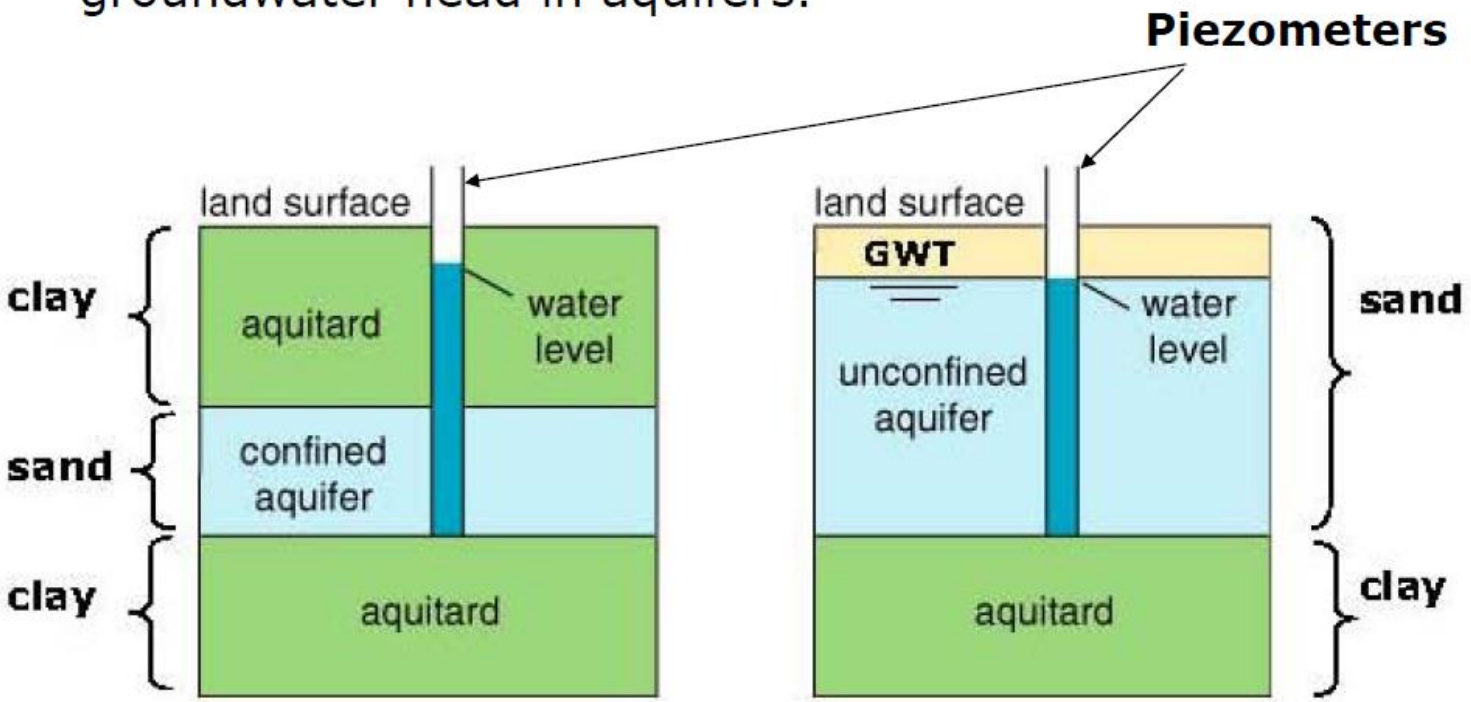
In the field

- Definitions:
  - Aquifer: a water-bearing layer of soil with considerable amount of water.
  - Confined versus unconfined aquifers.



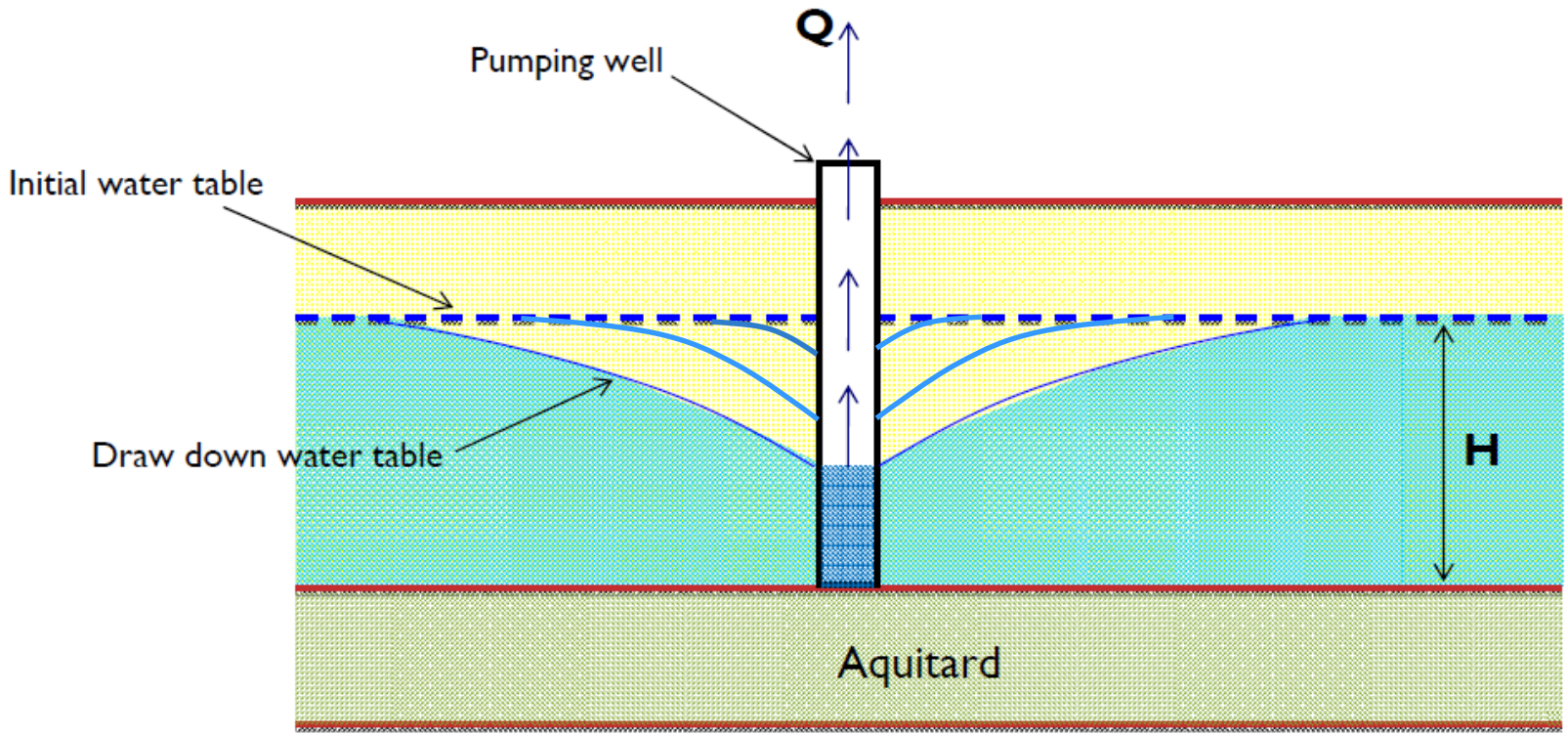
Field Investigation

- Piezometer: a small-diameter pipe used to measure the groundwater head in aquifers.



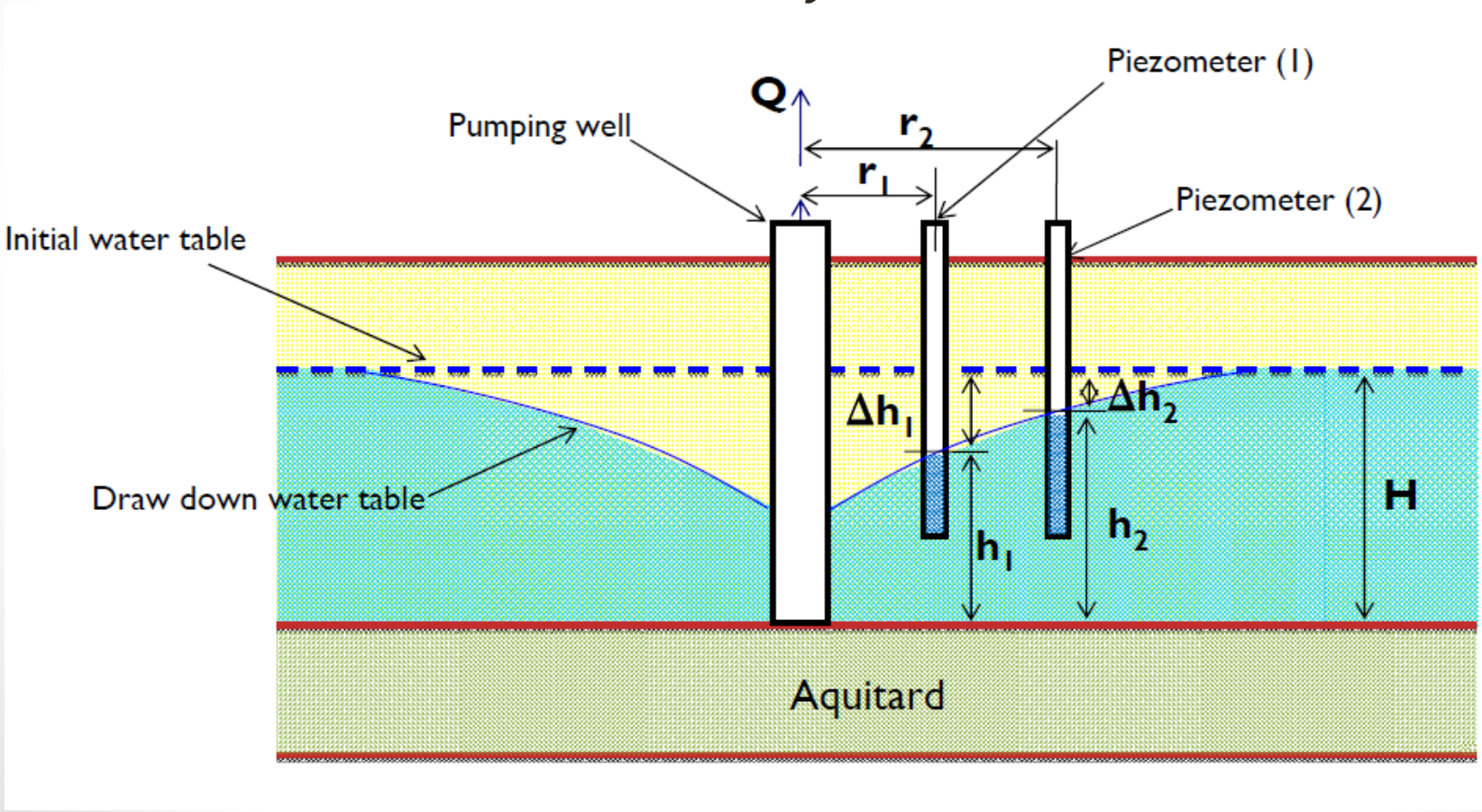
Transient Flow

$$\frac{\delta^2 h}{\delta x^2} + \frac{\delta^2 h}{\delta y^2} + \frac{\delta^2 h}{\delta z^2} = \frac{S}{T}\frac{\delta h}{\delta t}$$



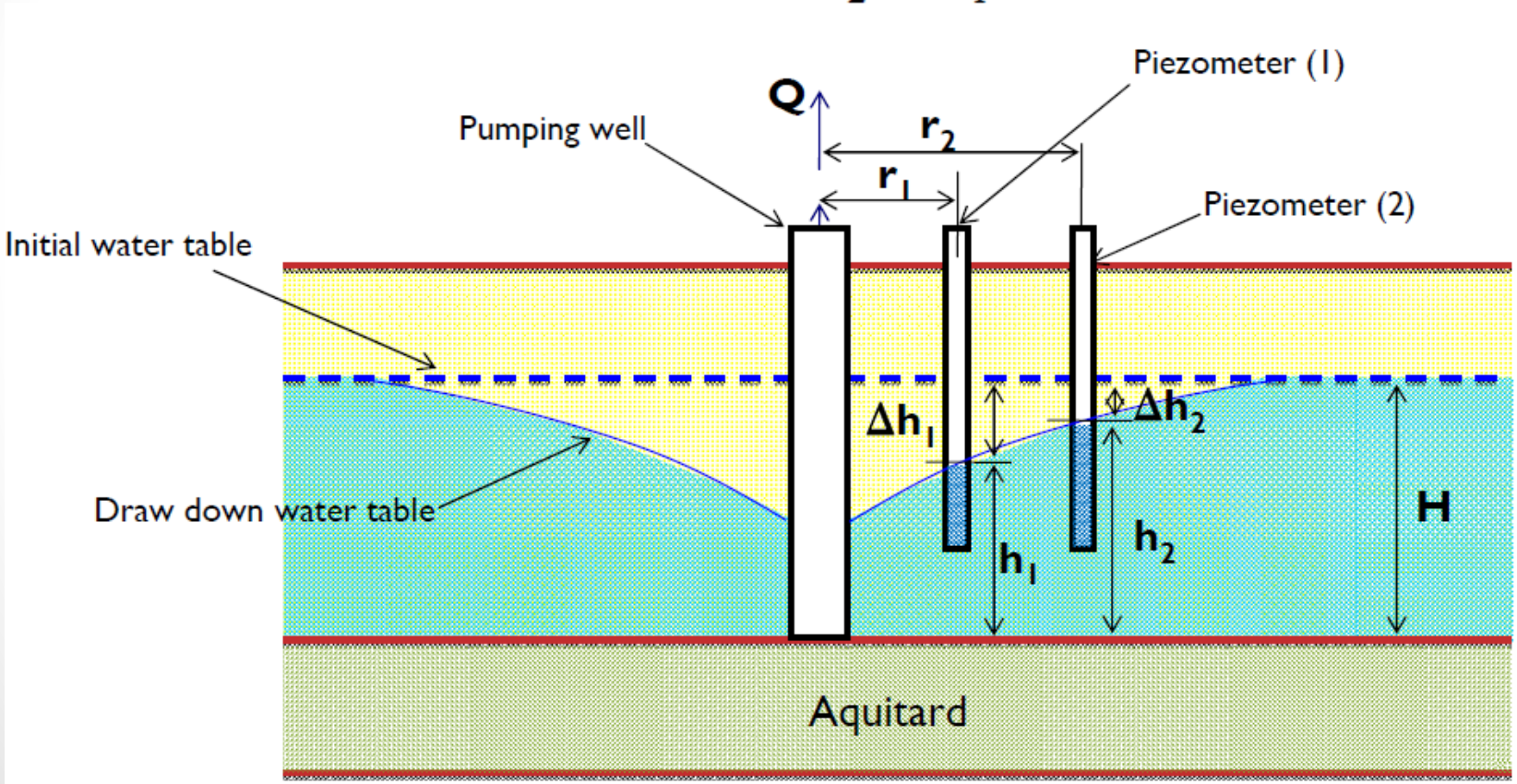
Steady State Flow

$$\frac{\delta^2 h}{\delta x^2} + \frac{\delta^2 h}{\delta y^2} + \frac{\delta^2 h}{\delta z^2} = 0$$



Steady State Flow

$$k = \frac{Q}{\pi} \frac{\ln(r_2 / r_1)}{h_2^2 - h_1^2}$$



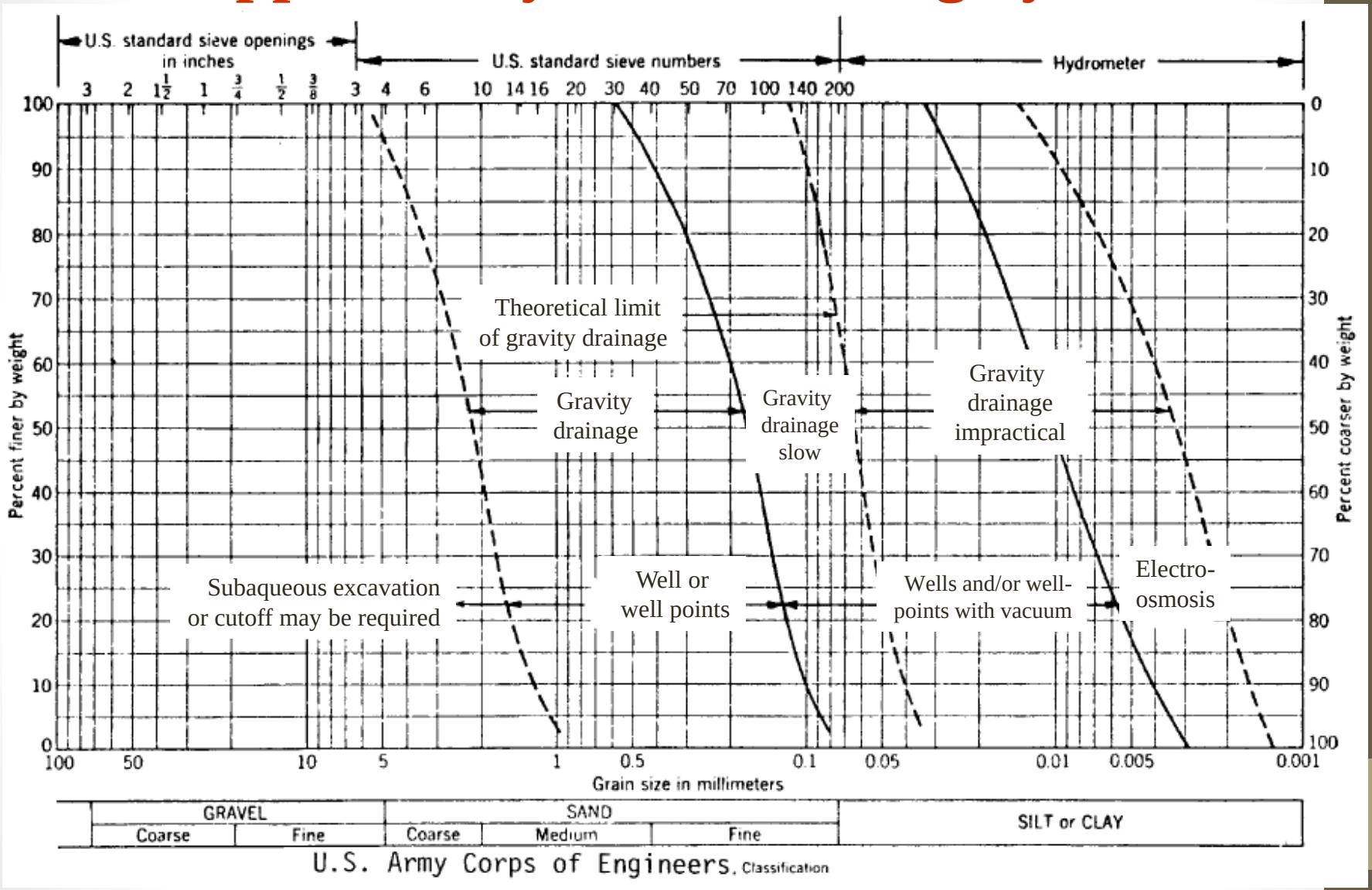
Typical Permeability of Soils

Soil or rock formation	Range of k (cm/s)
Gravel	1 - 5
Clean sand	10^{-3} - 10^{-2}
Clean sand and gravel mixtures	10^{-3} - 10^{-1}
Medium to coarse sand	10^{-2} - 10^{-1}
Very fine to fine sand	10^{-4} - 10^{-3}
Silty sand	10^{-5} - 10^{-2}
Homogeneous clays	10^{-9} - 10^{-7}
Shale	10^{-11} - 10^{-7}
Sandstone	10^{-8} - 10^{-4}
Limestone	10^{-7} - 10^{-4}
Fractured rocks	10^{-6} - 10^{-2}

Our Goals!!!

- How to **Choose** a suitable Groundwater Control System?
  - How far you want to lower the ground water?
  - What are the soil conditions?
  - How will the dewatering system affect the surrounding structures and the environment?
- Learn how to **Design** a simple groundwater control system

Applicability of Dewatering Systems



U.S. Army Corps of Engineers Classification

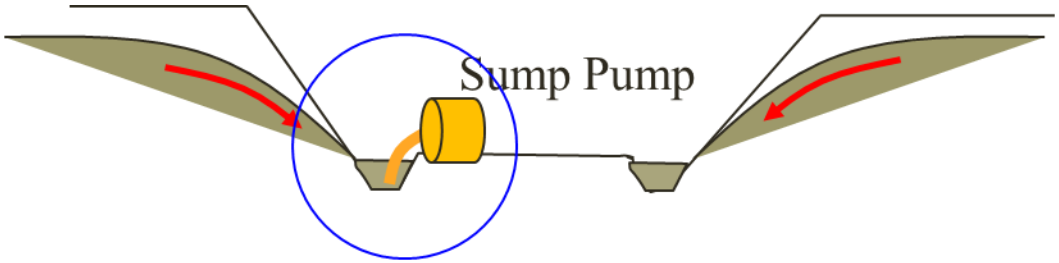
Dewatering Systems

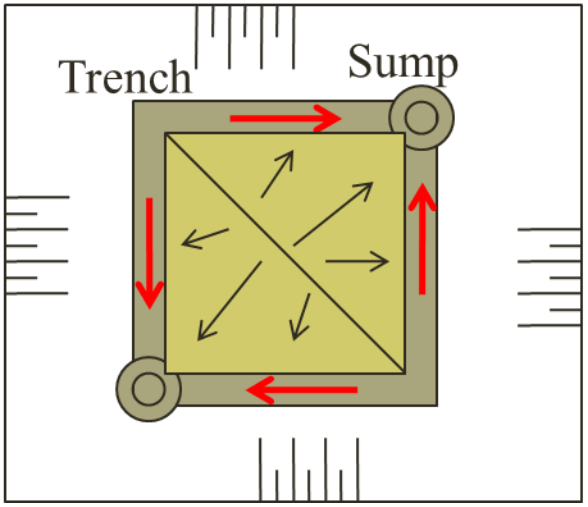
1. **Sumps, Trenches, and Pumps**
2. **Well Point Systems**
3. **Deep Well Systems**

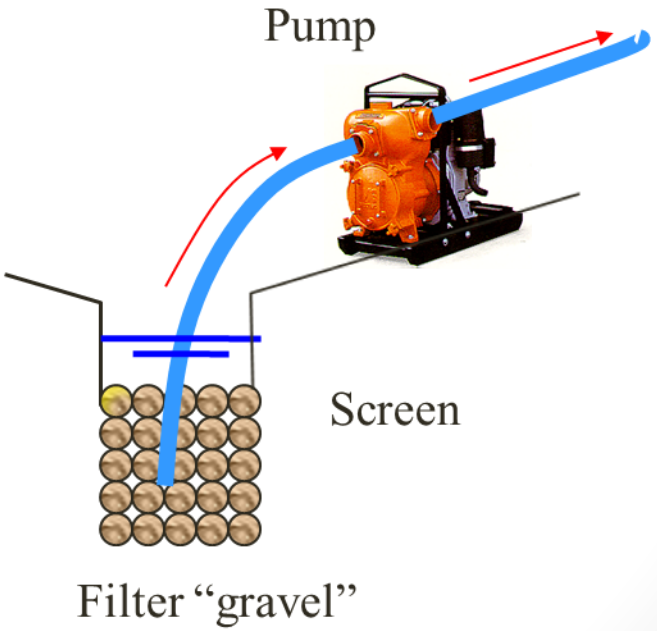
1- Sumps, Trenches, and Pumps

Sumps, Trenches, and Pumps

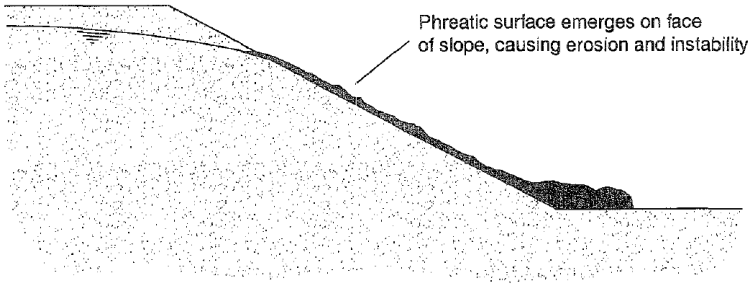
طلمبات خنادق بالوعات

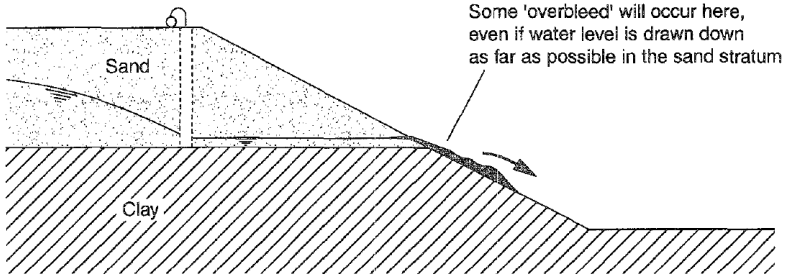


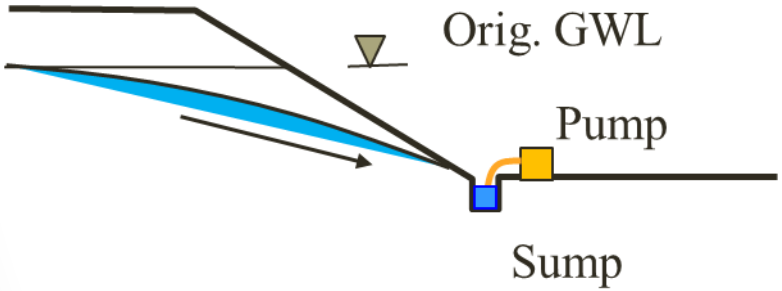


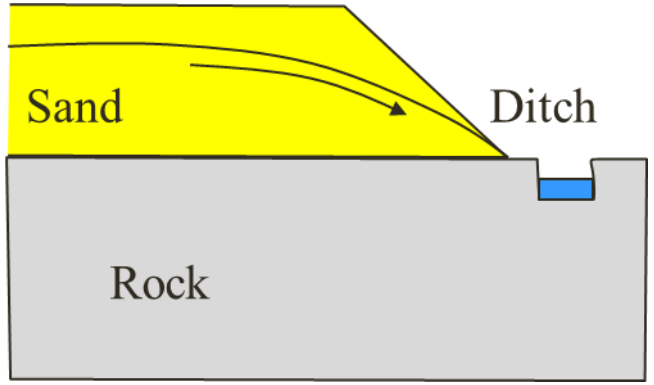


Dewatering Open Excavation by Ditch and Sump

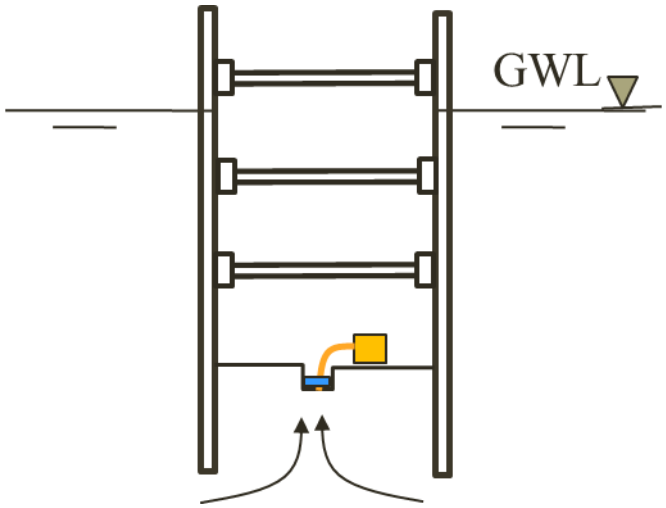




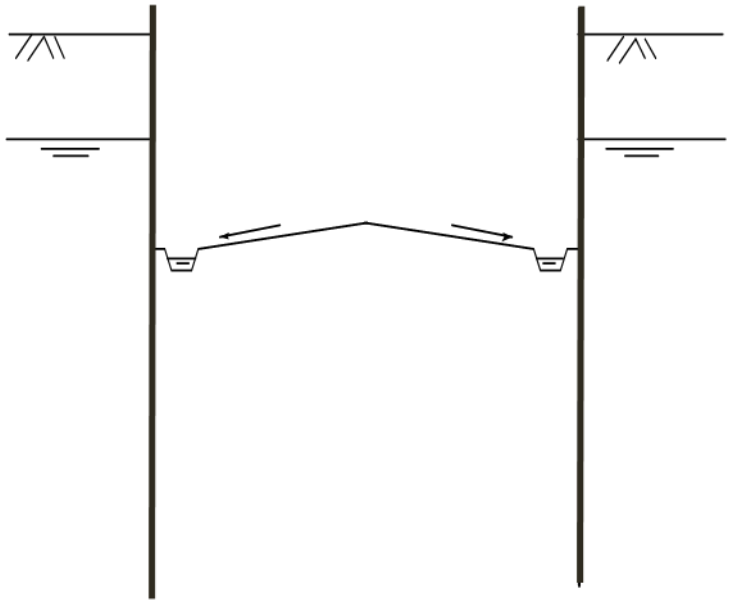




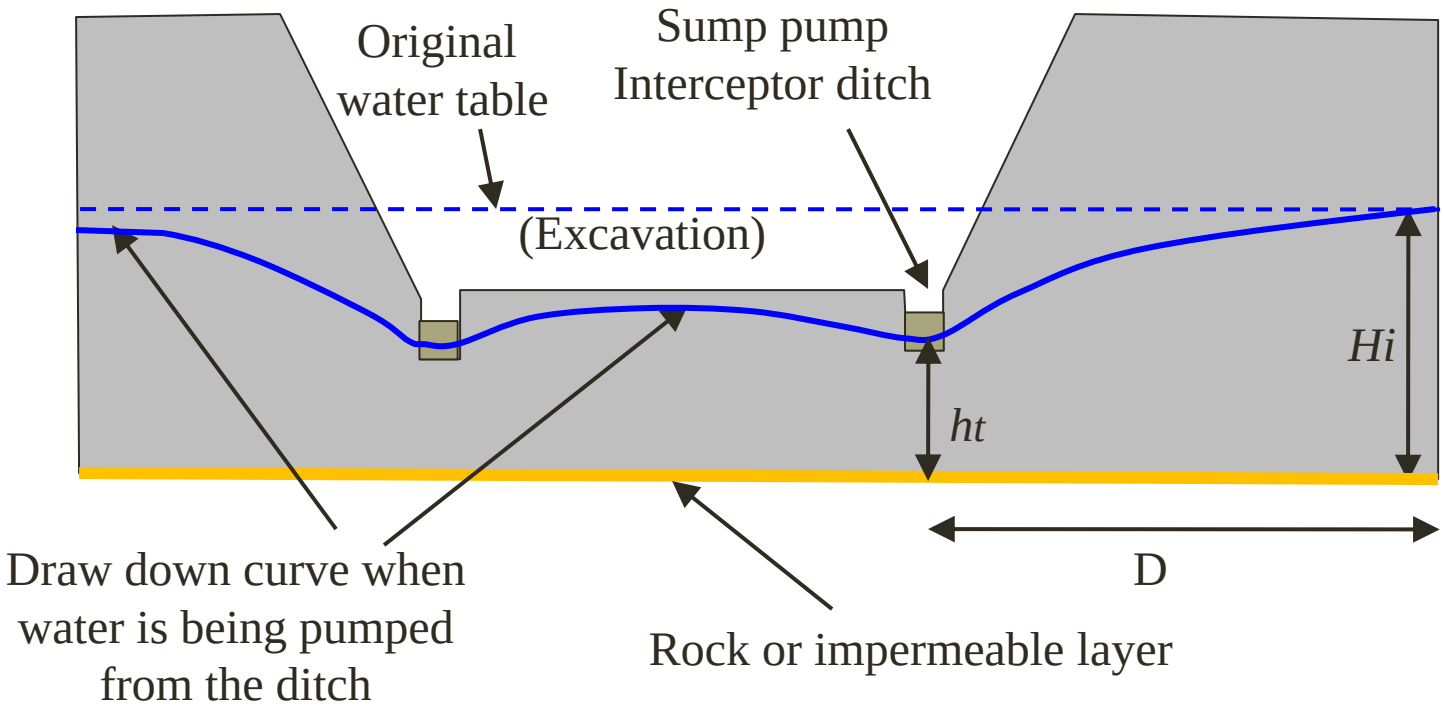
Temporary Excavations



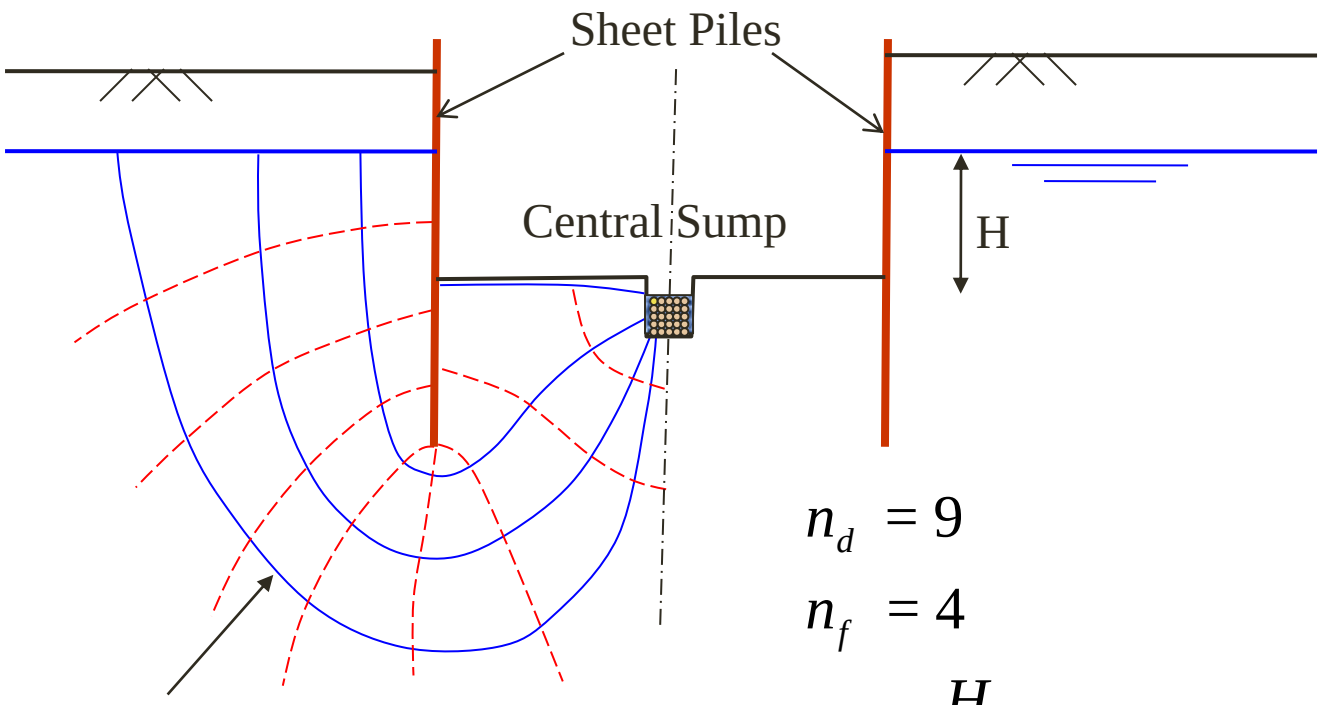
Seepage



How GWT is lowered?



How to get pump capacity



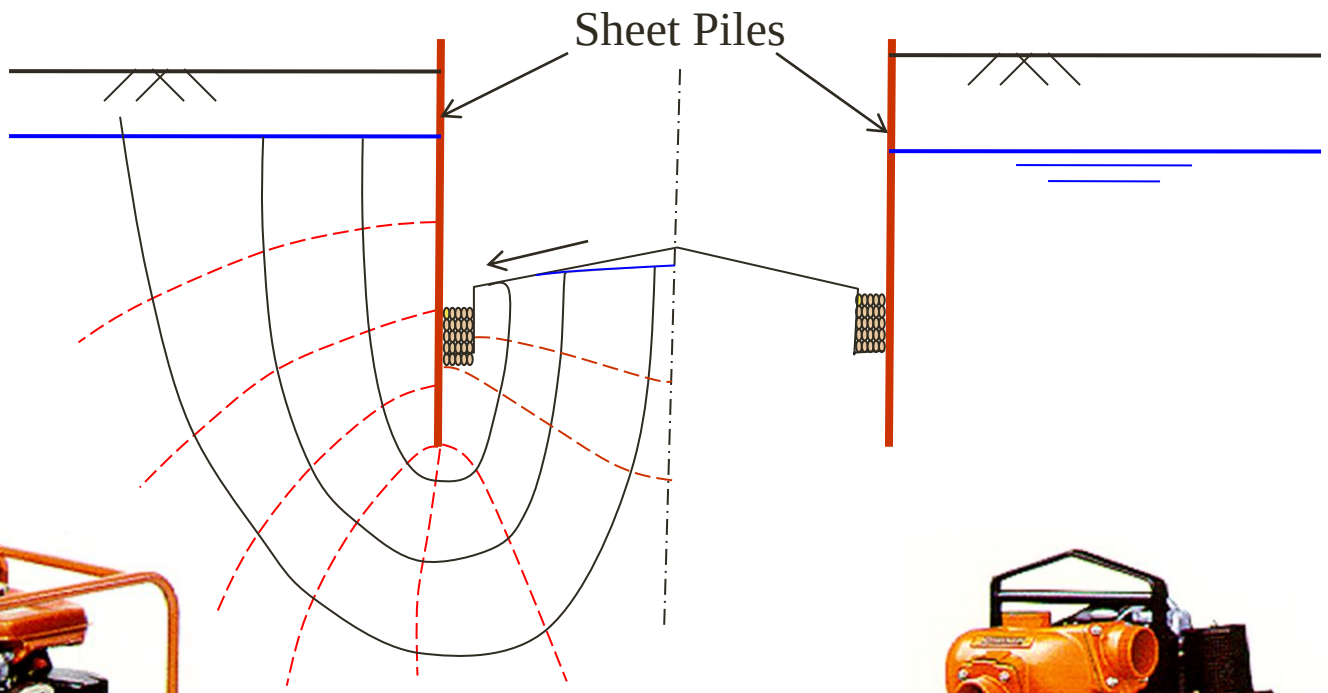
$$n_d = 9$$

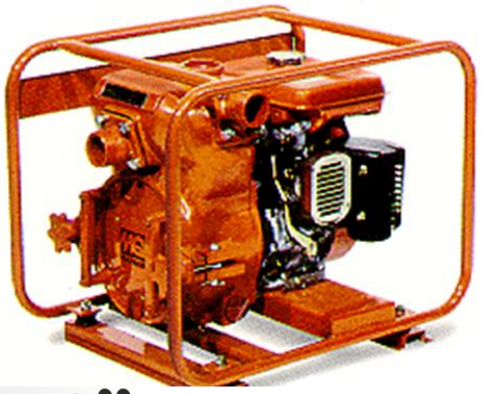
$$n_f = 4$$

$$\Delta h = \frac{H}{n_d}$$

$$Q = 2 \times n_f \times \Delta h \times k$$

Choosing appropriate Pump





2” gas powered

4” diesel powered