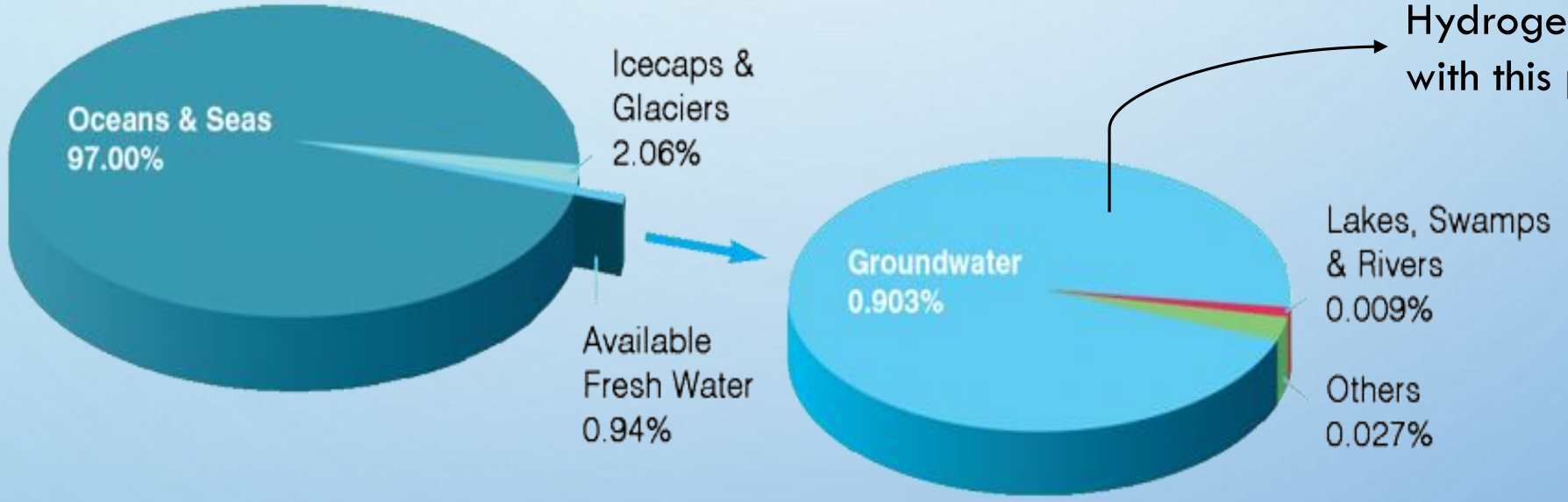
GROUNDWATER

- HYDROLOGY AND HYDROGEOLOGY – SAME OR DIFFERENT?

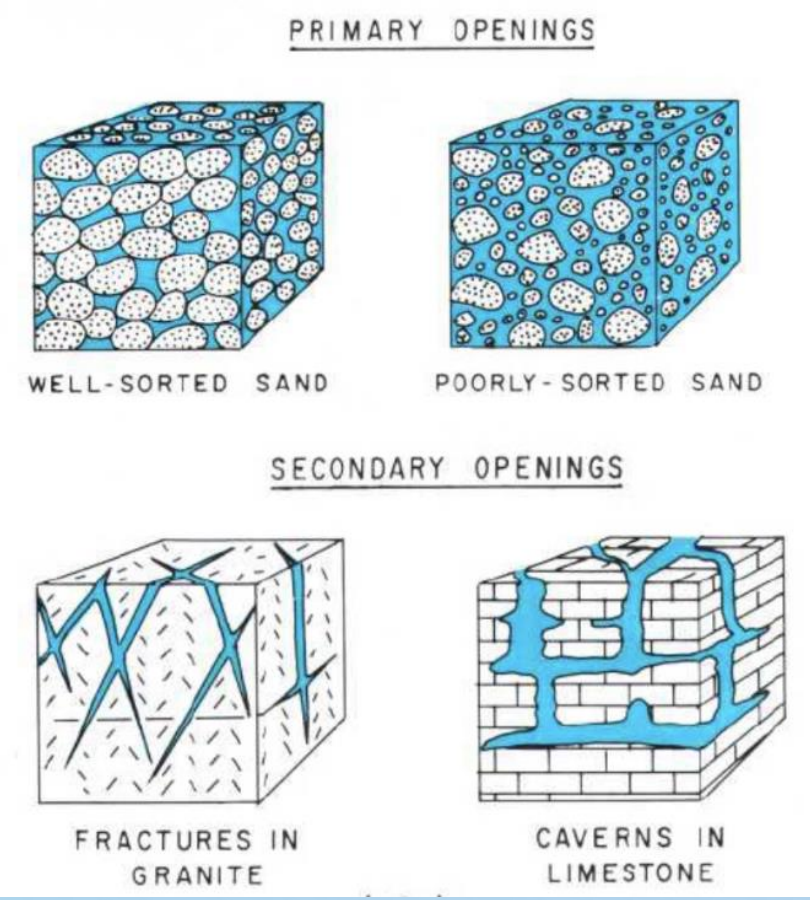
➢ **Hydrogeology** is the subdivision of the science of hydrology that deals with the occurrence, movement, and quality of water beneath the earth's surface i.e. the subsurface groundwater not the atmospheric or oceanic water.



OCCURRENCE OF GROUNDWATER

- Subsurface water occurs in the void spaces of earth materials that range from consolidated rocks (igneous, metamorphic and sedimentary rocks) to unconsolidated materials like Clay, sand or boulders.
- Groundwater is that part of subsurface water in which the interstices are completely saturated with water
- Sedimentary rocks contain greatest amounts of water due to their greater porosity.

SUBSURFACE OPENINGS

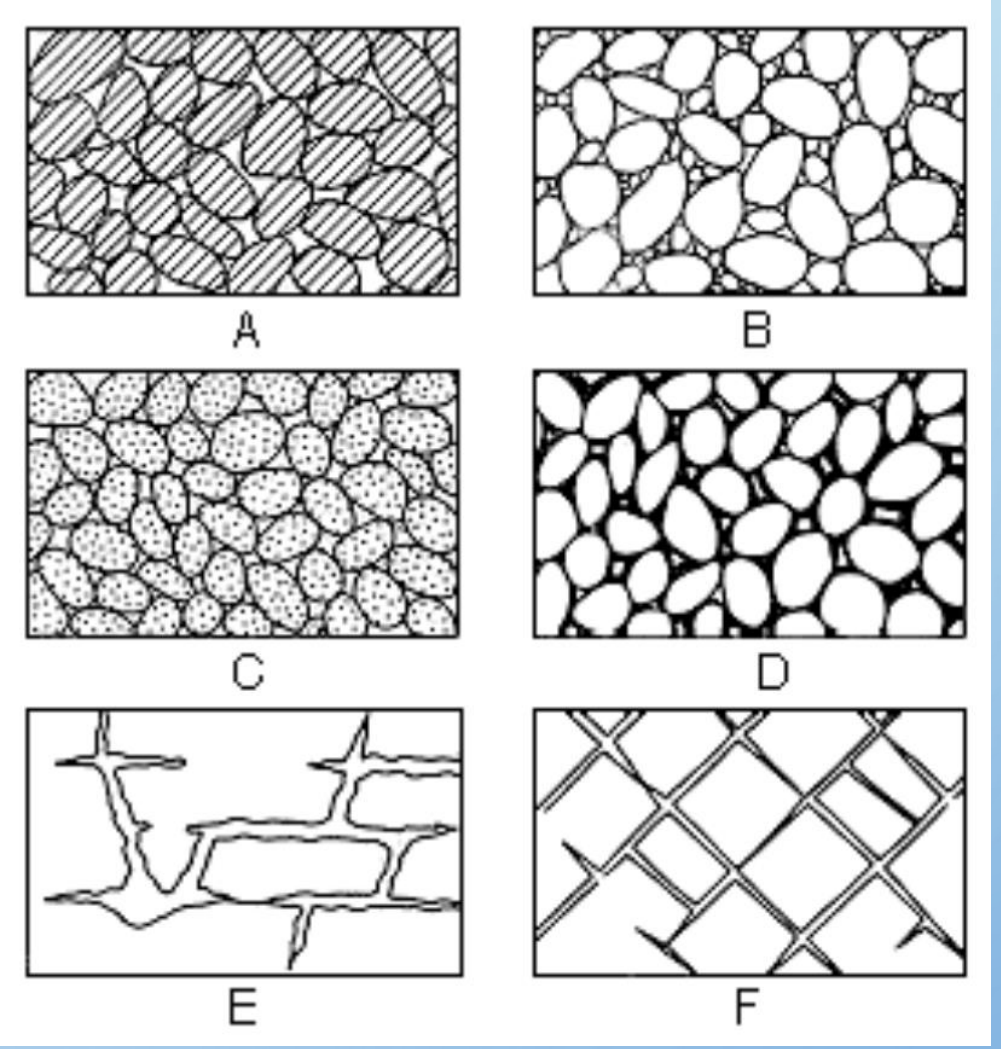


Primary Openings:
If the void or pore spaces are developed during the formation of the rock are called as Primary opening. Such type of opening can be seen in sedimentary rock.

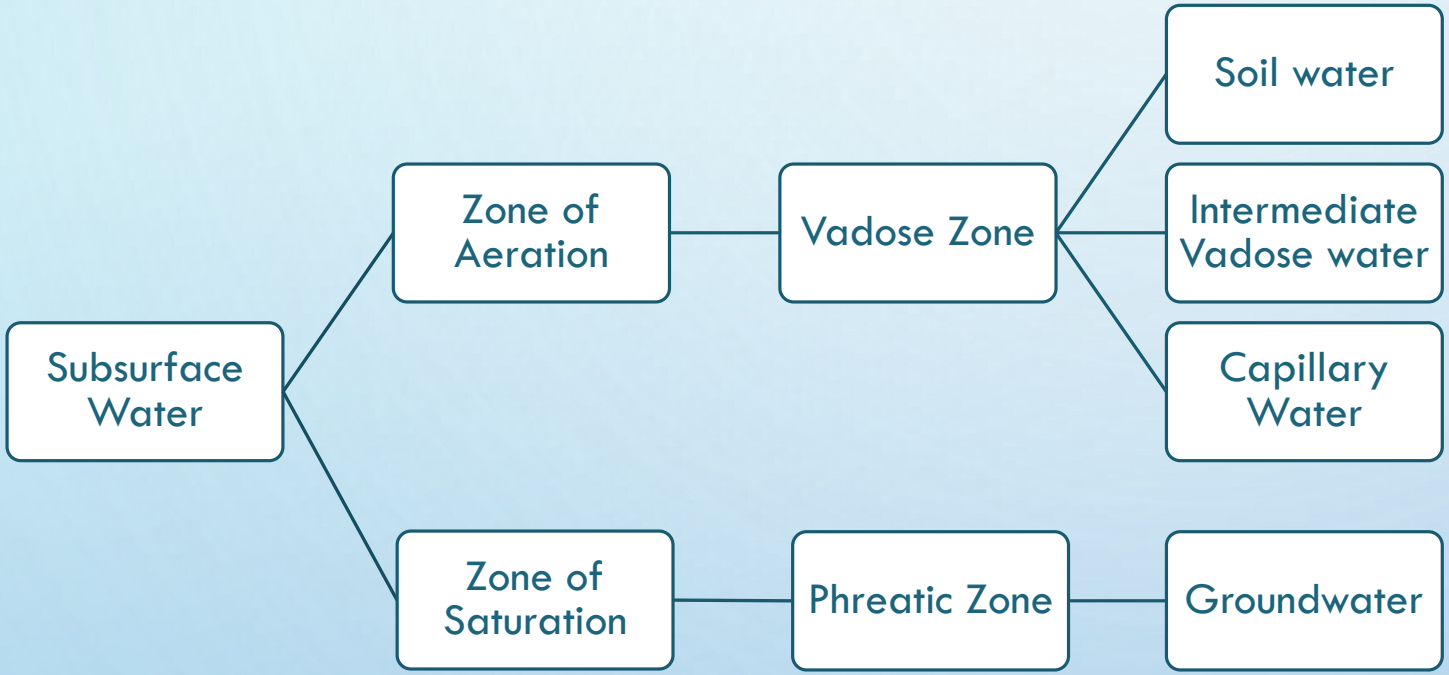
Secondary Opening:
If the void spaces are developed due to some external effect after he formation of the rock are known as Secondary Opening.

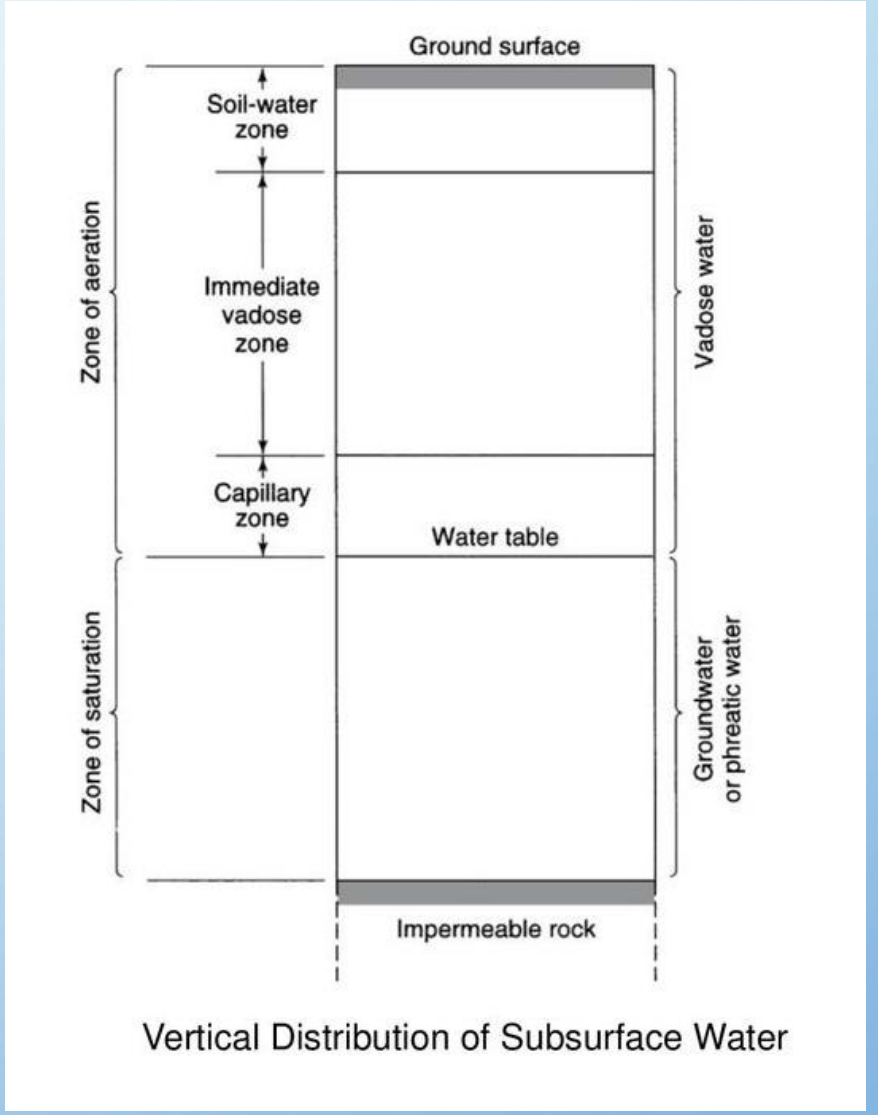
SUBSURFACE OPENINGS

(a) Well-sorted sedimentary deposit having high porosity
(b) poorly sorted sedimentary deposit having low porosity
(c) well-sorted sedimentary deposits consisting of fragments of rock that are themselves porous, so that the deposit has a very high porosity
(d) well-sorted sedimentary deposit whose porosity has been diminished by the deposition of mineral matter in interstices
(e) rock rendered porous by solution
(f) Rock rendered porous by fracturing



SUBDIVISIONS OF SUBSURFACE WATER





Vertical Distribution of Subsurface Water

SOURCES OF SUBSURFACE WATER

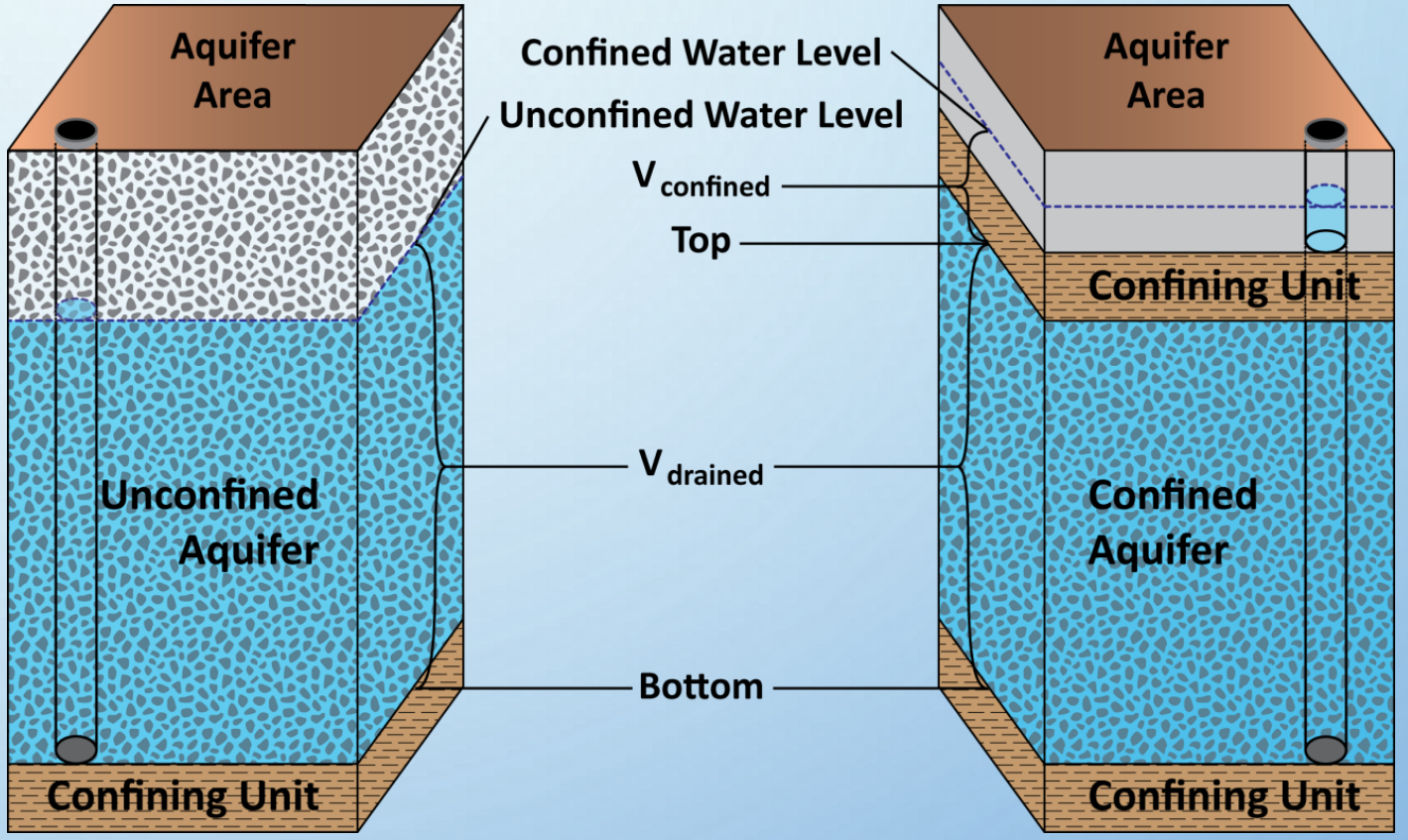
- **Connate water:** interstitial water in the zone of saturation, but entrapped in sediments or igneous rocks at the time of their deposition (in unconnected pores).
- **Juvenile water:** water created by chemical reactions in volcanic and other geothermal activities.
- Almost all groundwater can be thought as a part of the hydrologic cycle including surface and atmospheric water. **Thus, practically all groundwater originates as surface water.**

AQUIFERS CLASSIFICATION

- An **Aquifer** is a geologic unit that can store and transmit water at sufficient rates to supply wells. This requires an intrinsic permeability of 10-2 darcy and above
- A confining layer is a geologic unit that has low to no intrinsic permeability(which is a measure of the how water flows through the rock layer) (e.g. 10-2 darcy or less), such as in clays and till.
- Confining layers are subdivided into **Aquifuges** (absolutely impermeable) and **Aquitards** (impermeable relative to the adjacent units)

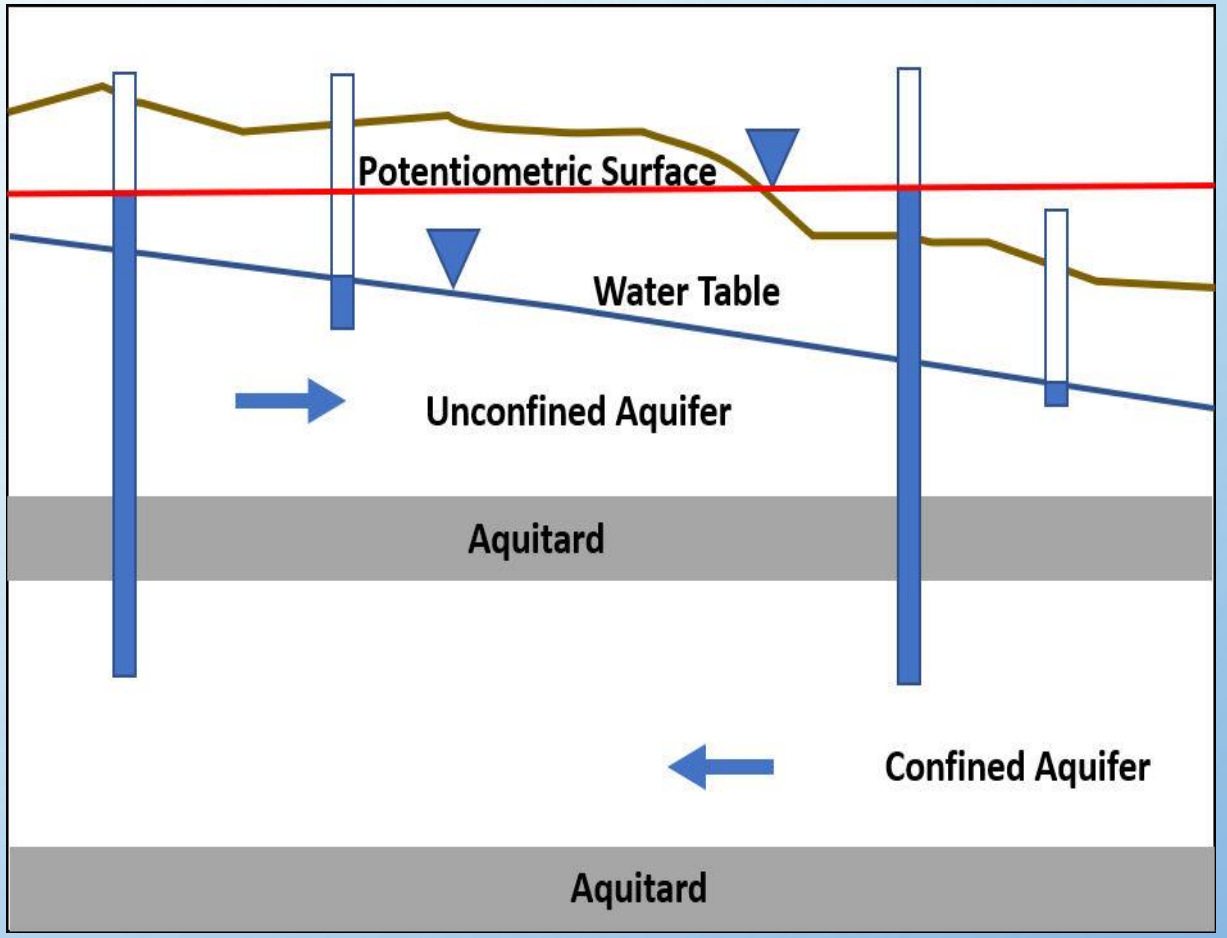
CONFINED & UNCONFINED AQUIFERS

- Aquifers with no confining layer above, are called **Unconfined aquifers.**
- Aquifers overlain by a confining layer are called **Confined aquifers**



WATER TABLE AND POTENTIOMETRIC SURFACE

- If the water levels in wells tapped in a confined aquifer are plotted on a map and contoured, the resulting surface, which is actually a map of the hydraulic head in the aquifer, is referred to as a potentiometric surface.
- If the aquifer is unconfined, the contour map is referred to as the map of the water table.
- Groundwater will flow in the general direction that the potentiometric surface is sloping, i.e., From higher hydraulic head to lower hydraulic head



- In some cases, a layer of low-permeability material will be found as a lens in more permeable materials. Water moving downward through the unsaturated zone will be intercepted by this layer and will accumulate on top of the lens. A layer of saturated soil will form above the main water table, termed a **Perched aquifer**.