The Basics

All subsurface Water is Groundwater.

Most of Florida's water supply comes from Groundwater

Gainesville's Groundwater comes from the Floridan Aquifer

The Floridan Aquifer is under stress due to overuse, overdevelopment and contamination.

The Basics

Groundwater is often viewed as flowing rivers beneath the ground, but this is only rarely the case.

Most water is contained in tiny pore spaces in the rock

Porosity= Fraction of the rock that is pore space.

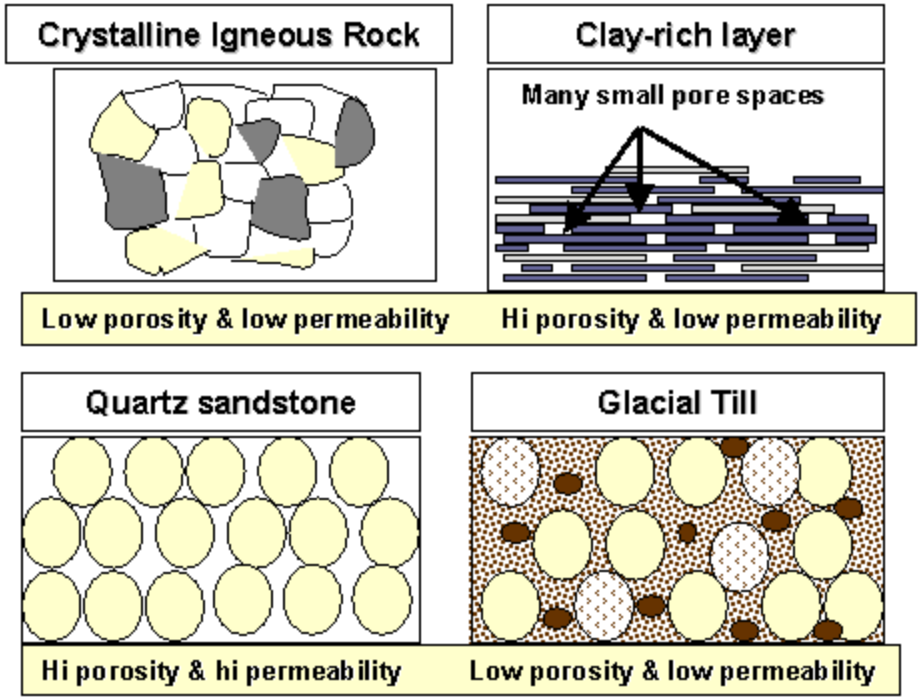
Primary Porosity= Voids formed when the rock was consolidated

Secondary Porosity= Voids formed after the rock was consolidated. For example, in limestone acid dissolved the rock forming larger and larger voids (caves)

Permeability

Rocks can have many pore spaces, but if they are not connected water can only be stored in the rock and not moved.

Volume of interconnected pore spaces is known as permeability



Aquifers

Aquifer= Body of rock that stores and transmits useful quantities of Water.

Aquiclude: Body of rock that does not store or transmit useful quantities of Water (sometimes called aquitard).

Partly a matter of Scale: A body of rock may be both.

Types of Aquifers

Water Table Aquifer= Unconfined Aquifer= Open to the Surface

Confined Aquifer= Artesian Aquifer= Separated from surface by an aquiclude.

Groundwater Flow

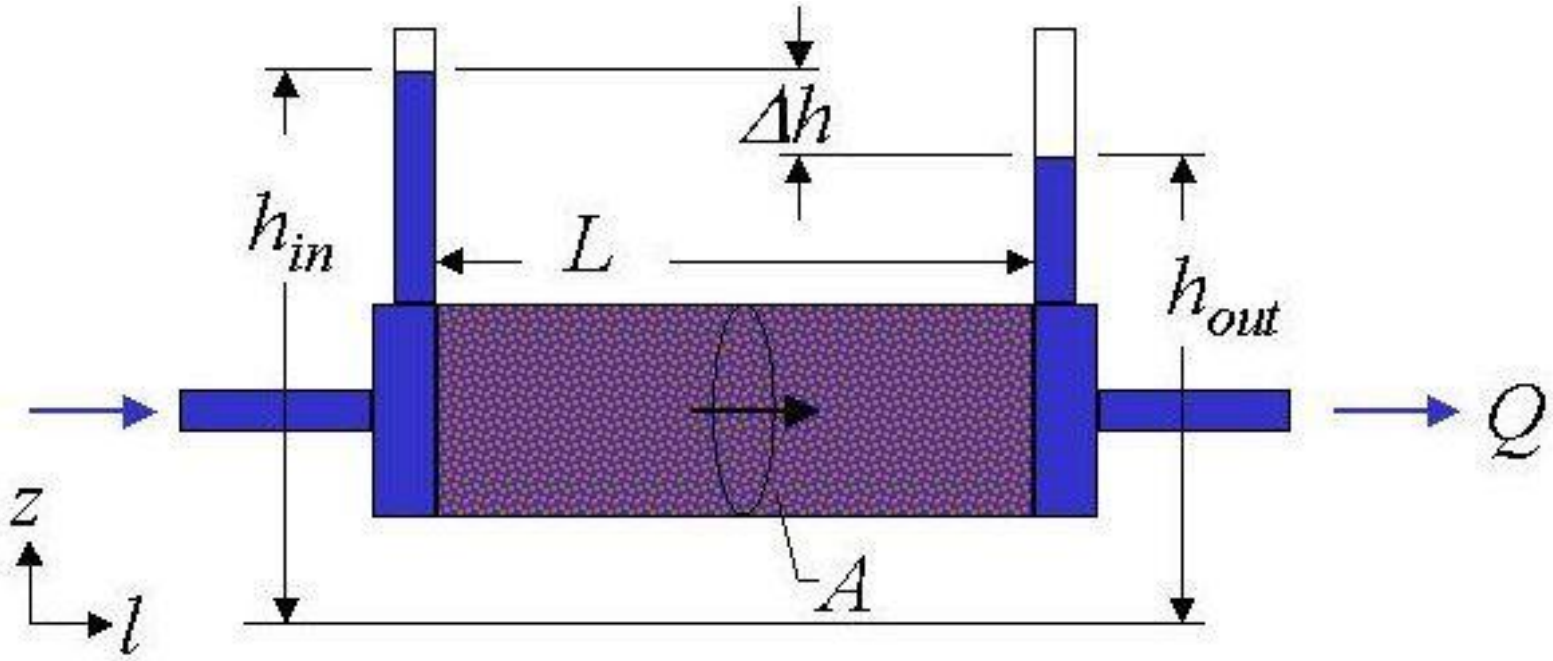
Groundwater flows due to differences in 'head' or pressure.

Groundwater flows from zones of higher pressure to zones of lower pressure

D'Arcy (French guy) came up with the governing equation for Groundwater Flow:

$$Q = -Ak\,dh/L$$

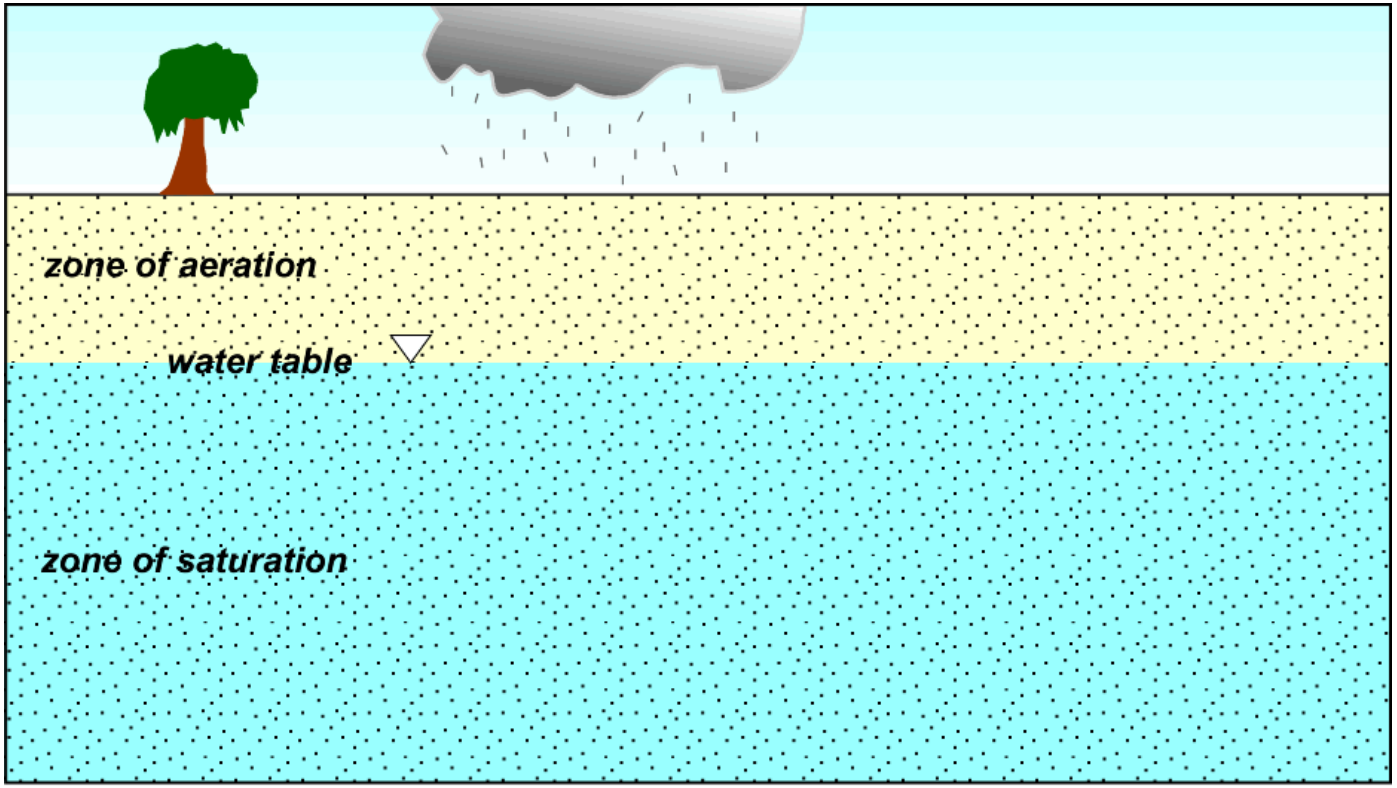
Q= Flow (m^3/sec)
L=Length of flow path (m)
A= Area perpindicular to L (m)
K= Hydraulic Conductivity (m/s)
dh= differential change in head (m)

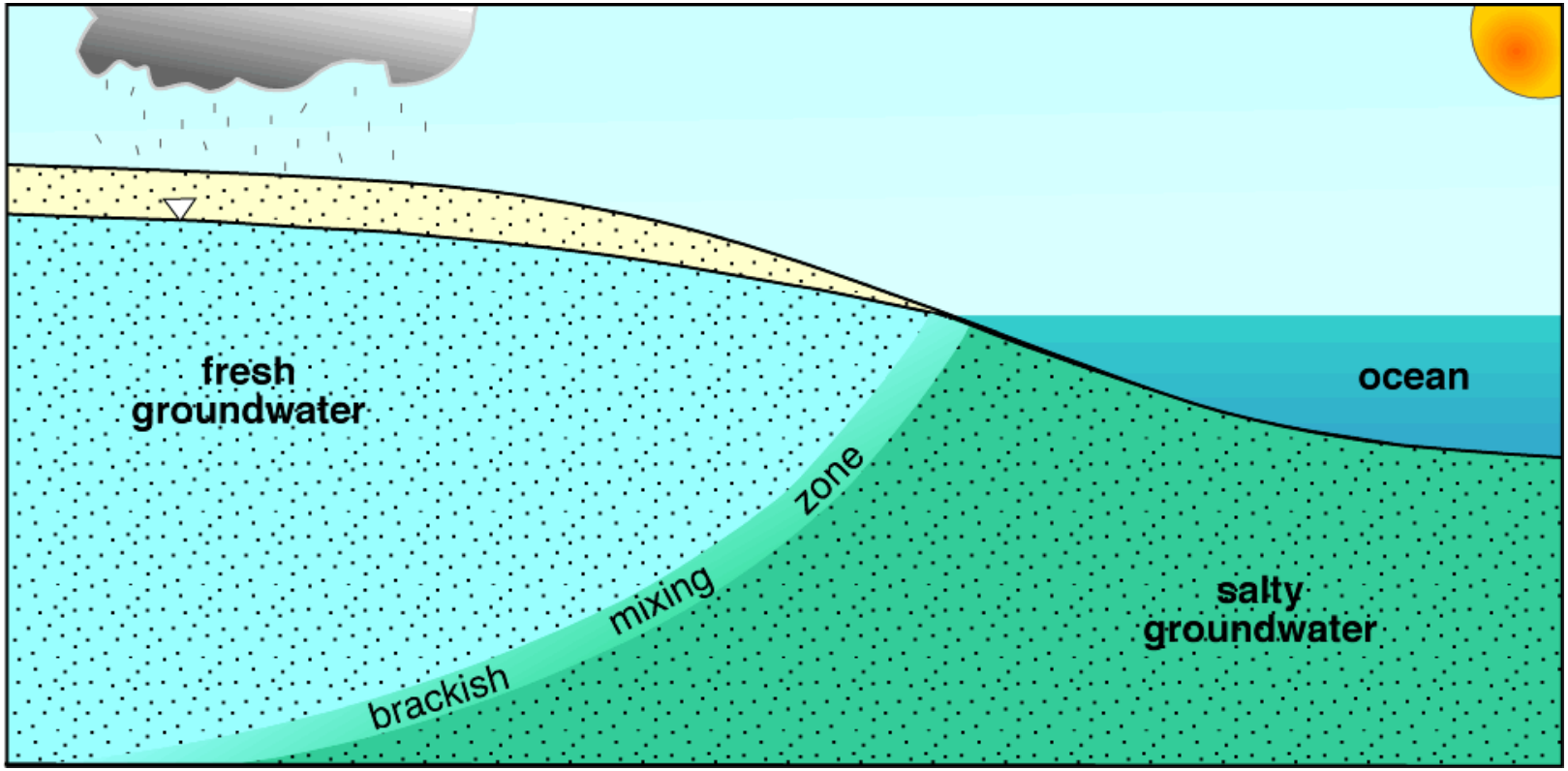

Δh
h_in
L
h_out
Q
z
l
A

Water Table Aquifer

Aquifers that are ‘connected’ to the surface above them

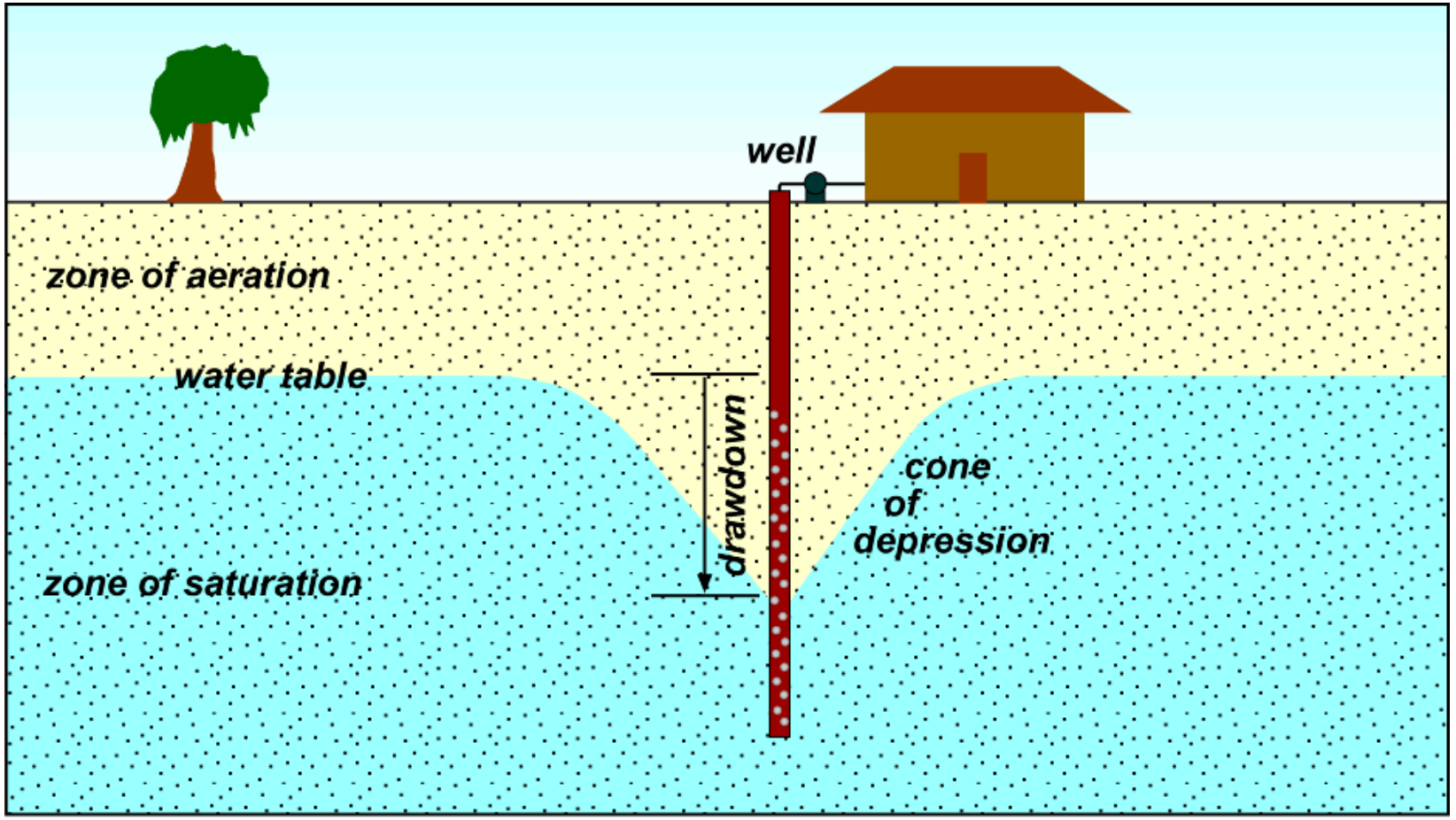
Water Table: Zone where the rock or soil becomes saturated. In general, it follows the topography.




fresh
groundwater
ocean
brackish
mixing
zone
salty
groundwater

Cone of Depression

Because the flow of water through the rock/soil is slower than the amount of water being pumped a well will cause a ‘cone of depression’ to form.



Contamination

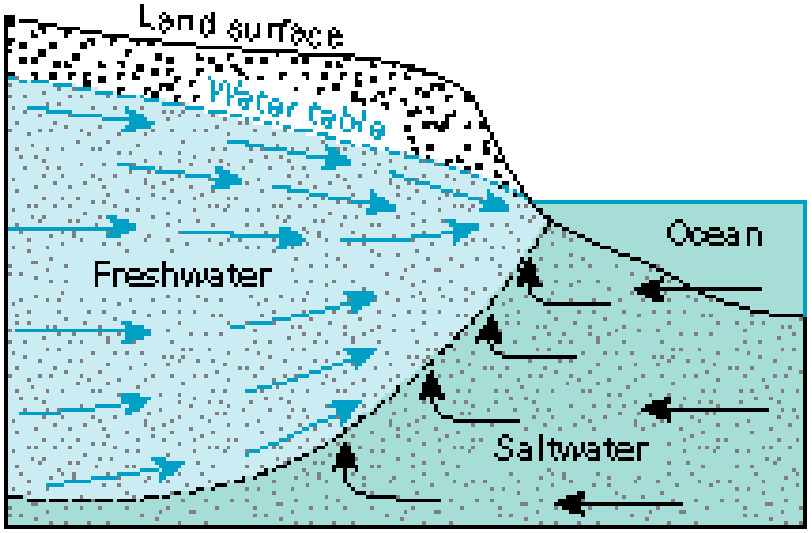
Because there is no impermeable zone on top of a water table aquifer, it is easily contaminated

Examples:

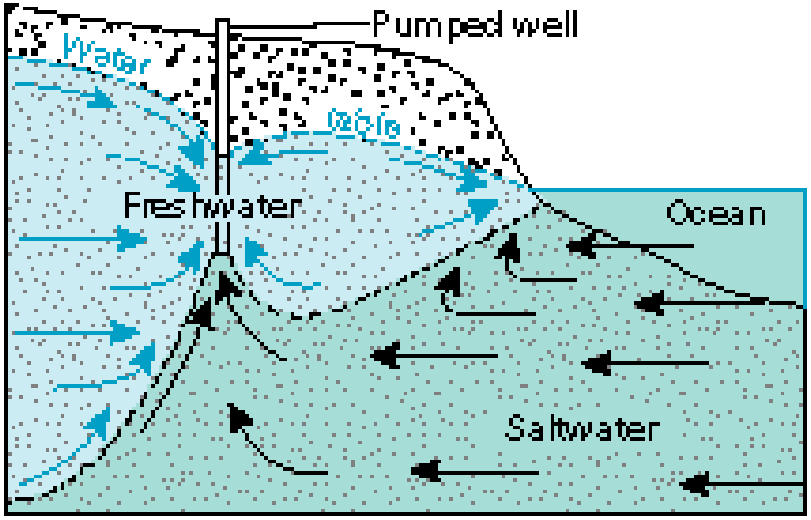
Dumping trash into sinkholes
Gasoline holding tanks at gas stations
Salt Water Intrusion into the well.

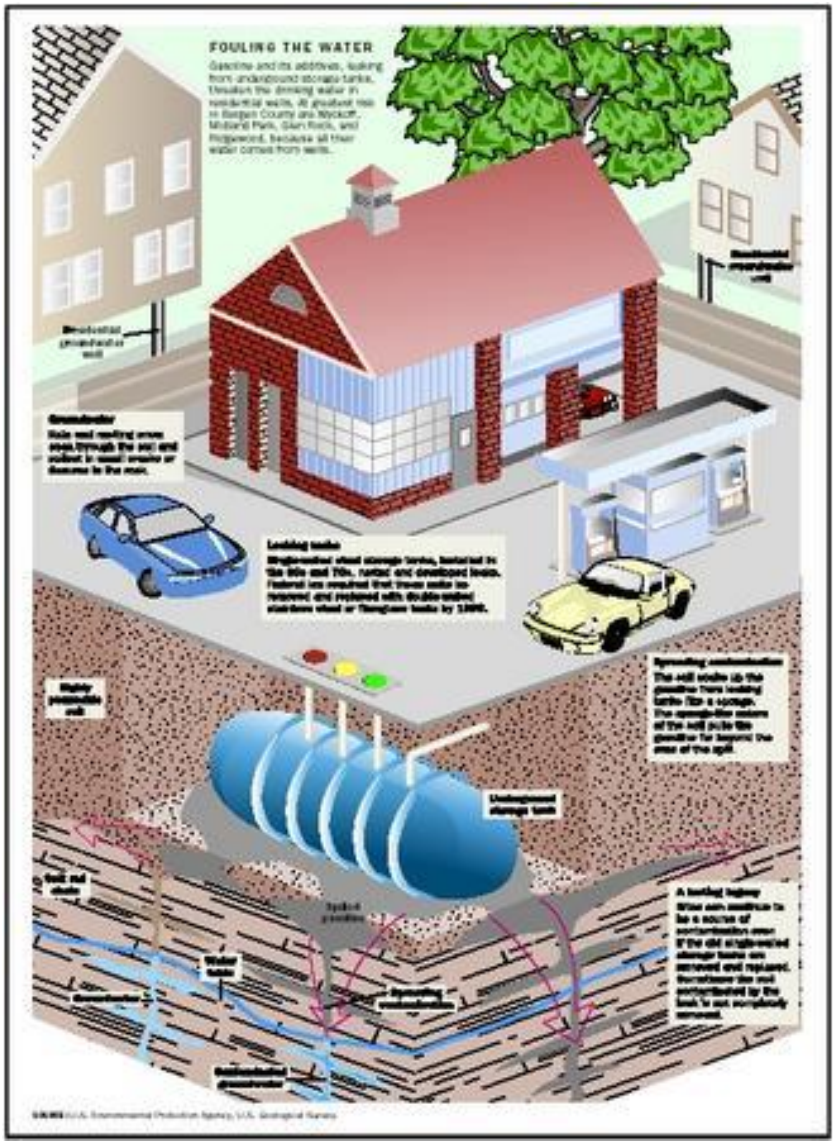
Pumping the shallow unconfined aquifers can accelerate the contamination due to the cone of drawdown.

Natural Conditions



Salt-Water Intrusion



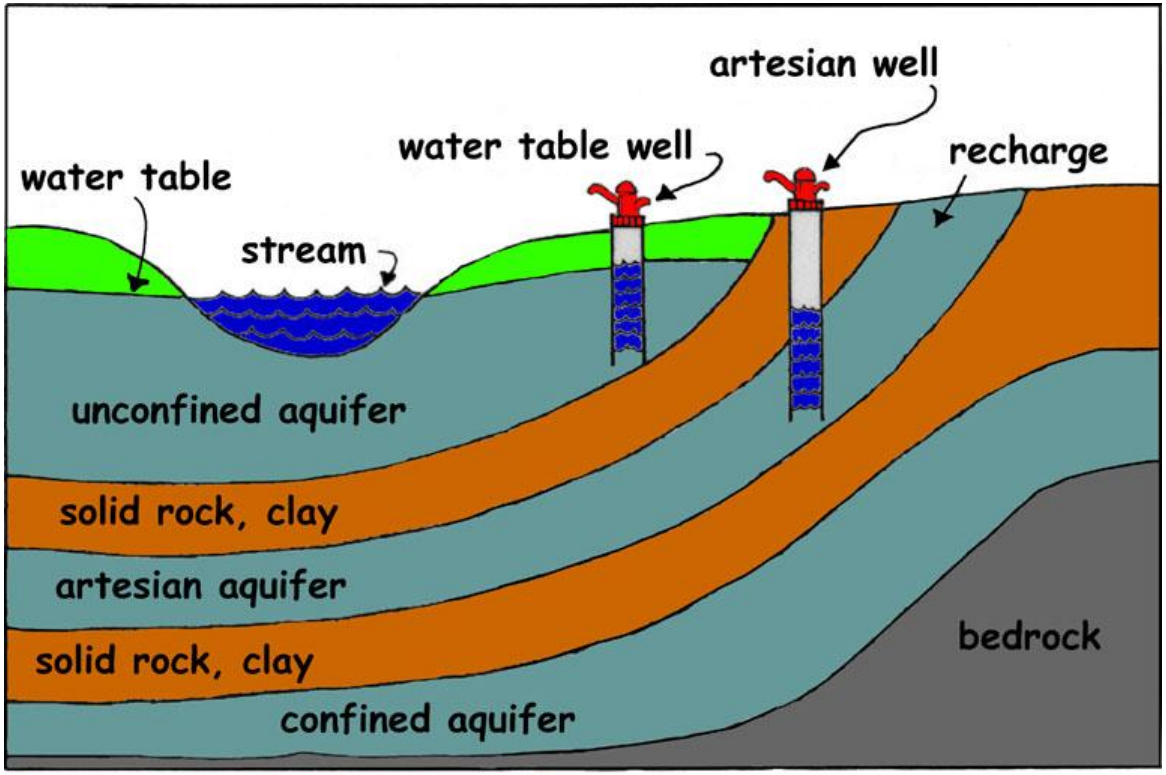


Recharge and Discharge

Recharge of an unconfined aquifer comes from rainfall (or maybe streams and lakes)

Water table levels fluctuate with supply

Discharge of an unconfined aquifer comes from pumping or discharge into lakes, streams or oceans.



Stream or Lake levels higher than water table will recharge the water table

Stream or Lake levels lower than the water table with receive discharge from the water table.

Confined Aquifers

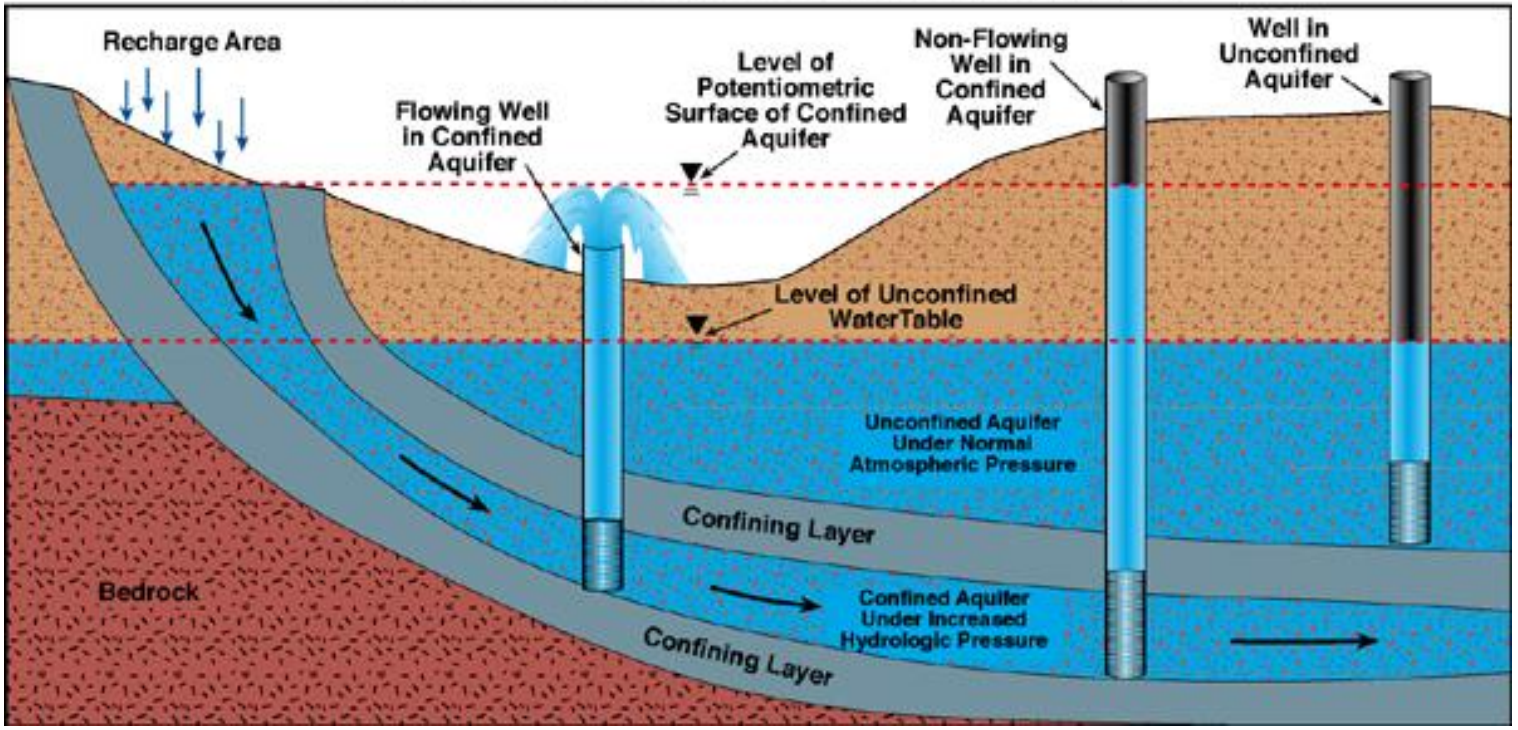
Terminology and Concept

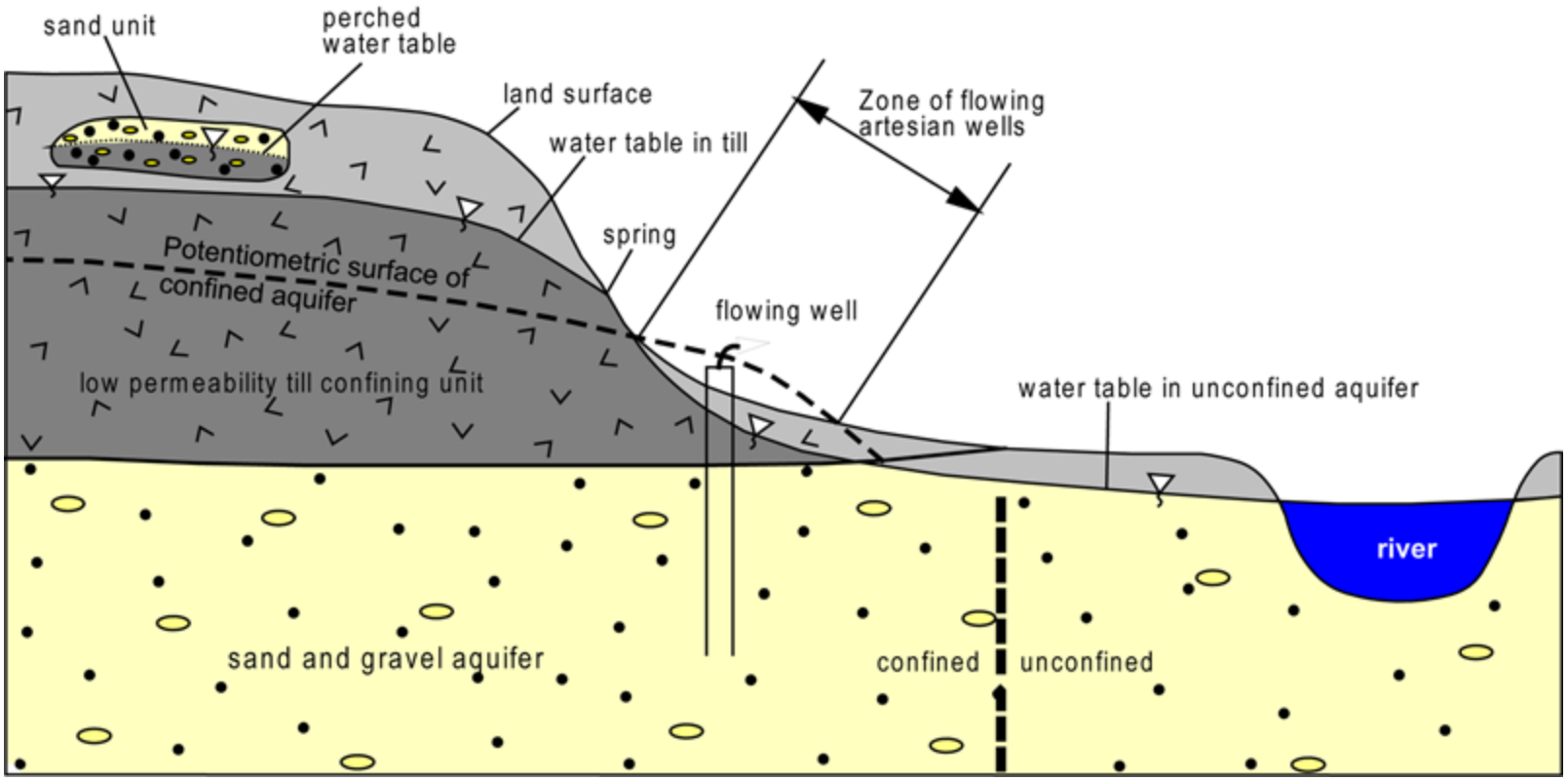
Recharge Zone- Zone where the aquifer receives its water supply. Here the aquifer is unconfined.

Potentiometric Surface= Piezometric Surface= Height to which water would rise if opened to the surface

Artesian Well= Well where water flows to the surface without pumping due to the high pressure

Potentiometric Surface and Flowing Wells




sand unit
perched
water table
land surface
water table in till
Zone of flowing
artesian wells
spring
Potentiometric surface of
confined aquifer
flowing well
low permeability till confining unit
water table in unconfined aquifer
river
sand and gravel aquifer
confined
unconfined