

Groundwater Use



Essential Standard 2.4

Evaluate how humans use water.

Learning Objective 2.4.1

Evaluate human influences on freshwater availability

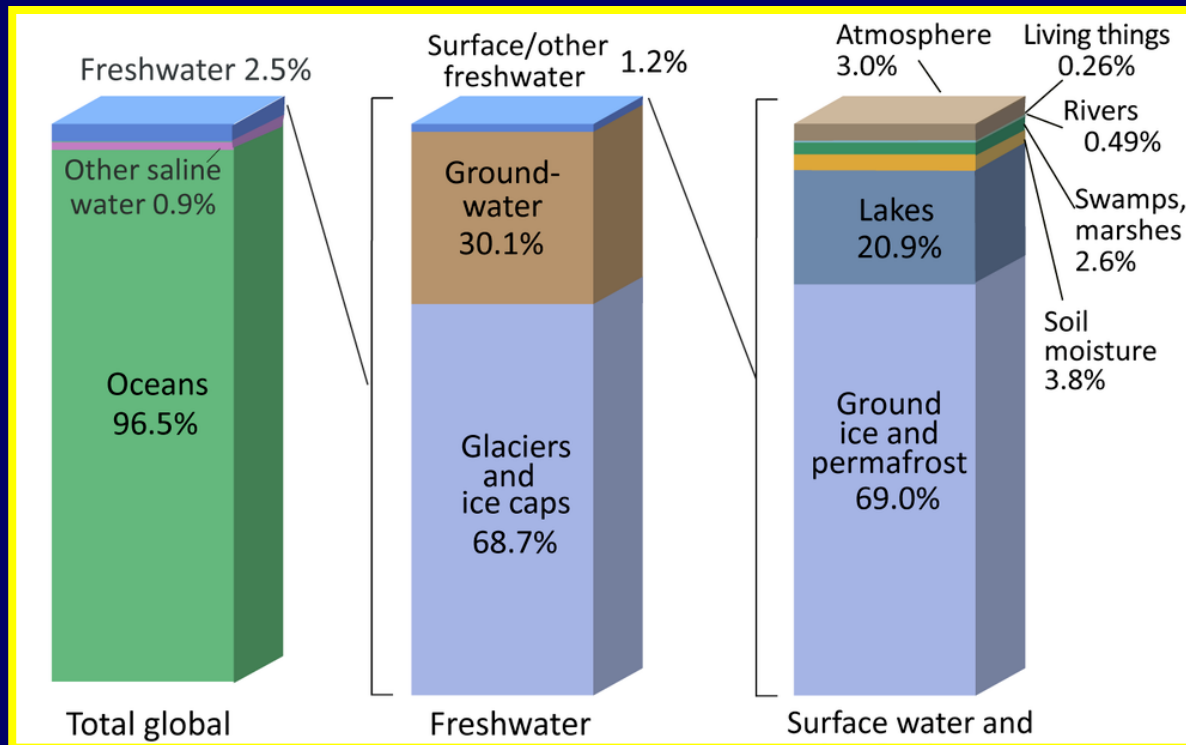
I Can Statements

At the end of this lesson, you should be able to say, with confidence:

- I can describe how groundwater is used for human activities.
- I can explain how groundwater is obtained for use and distinguish between various types of wells.
- I can list and explain five ways that overuse of groundwater impacts the environment.
- I describe the impact an increasing human population will have on groundwater and the environment.

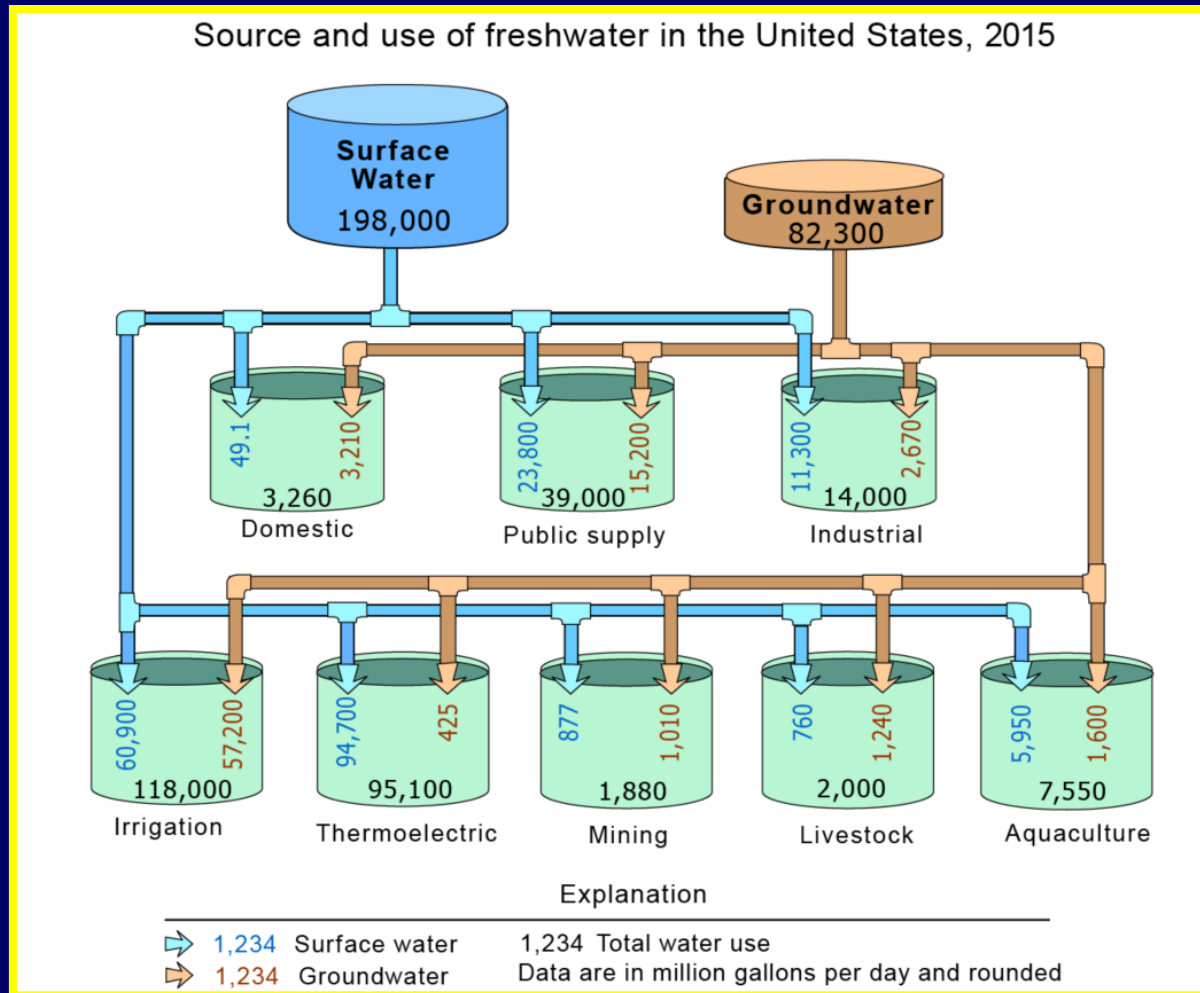
Distribution of Earth's Water

Only 2.5% of Earth's water is freshwater and of that amount, 30.1% is groundwater, which makes groundwater the largest supply of freshwater that is available for use.



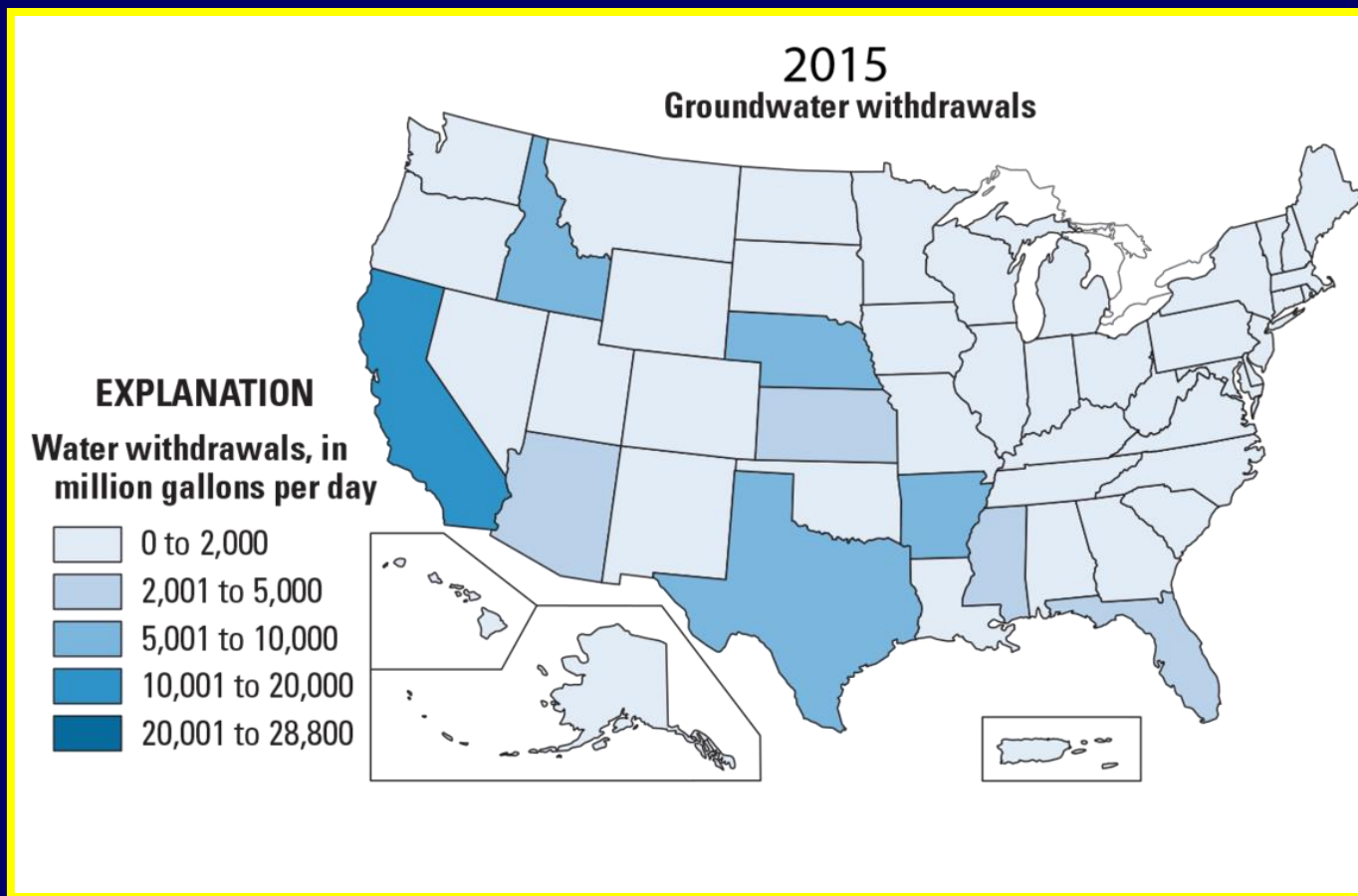
Groundwater Use

About 24% of all the freshwater used in the USA comes from groundwater.



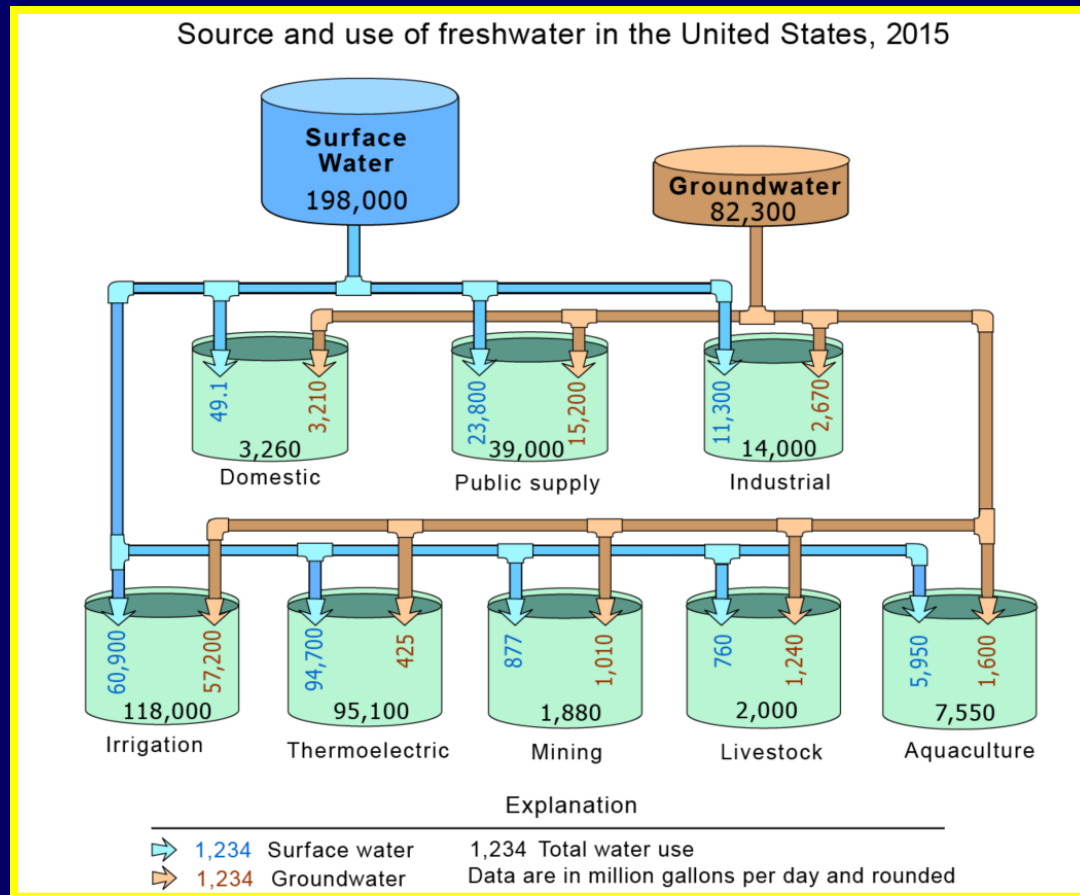
Groundwater Use

California uses the most groundwater, followed by Texas, Nebraska, Idaho, and Arkansas.



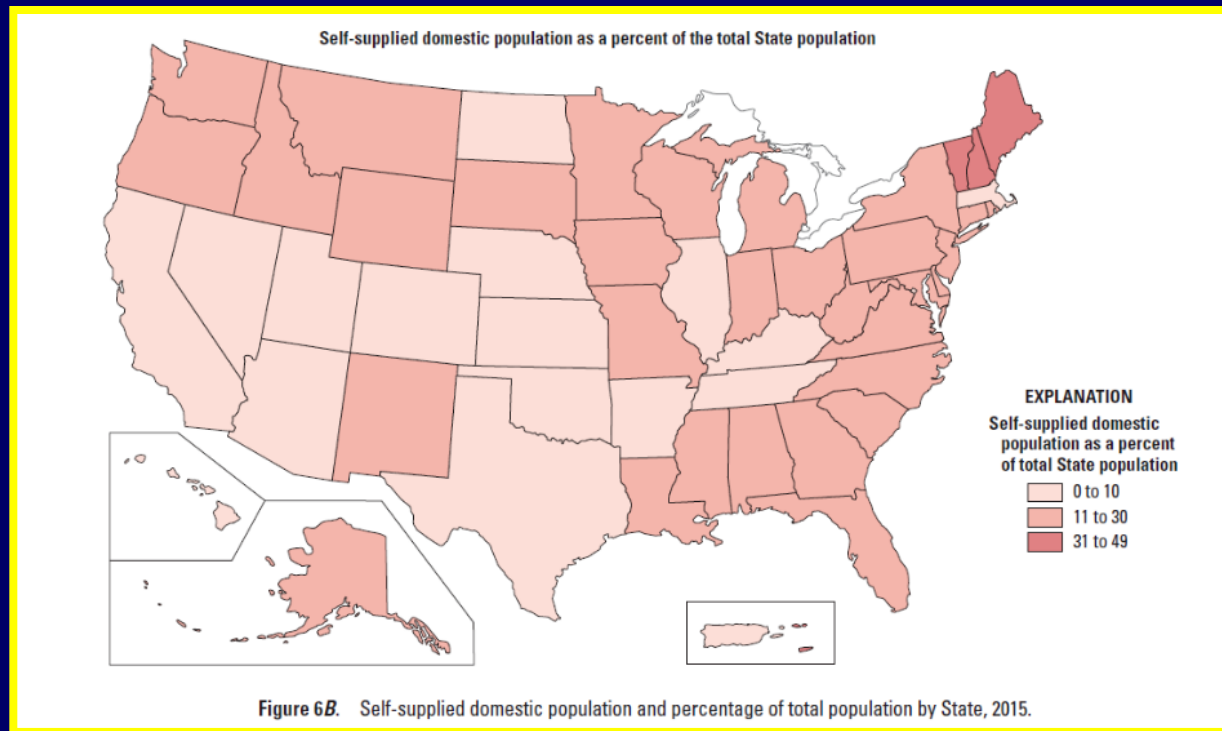
Most Common Use - Irrigation

The most common use of groundwater is for irrigation, followed by thermoelectric or to produce steam at electrical power plants.



Homes Dependent Upon Wells

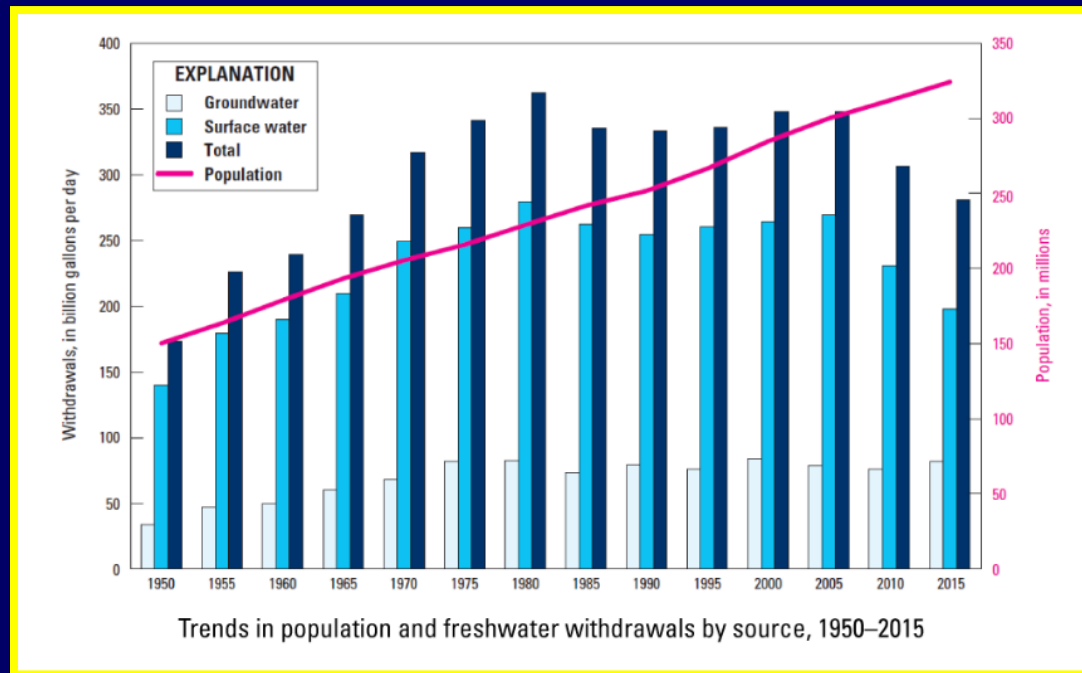
Many homes, especially in rural areas, depend upon wells to meet their water demands.



About 2.4 million North Carolinians depend upon well water as their primary drinking source.

Effect of Increasing Populations

The increasing US population has corresponded to an increase in groundwater use.

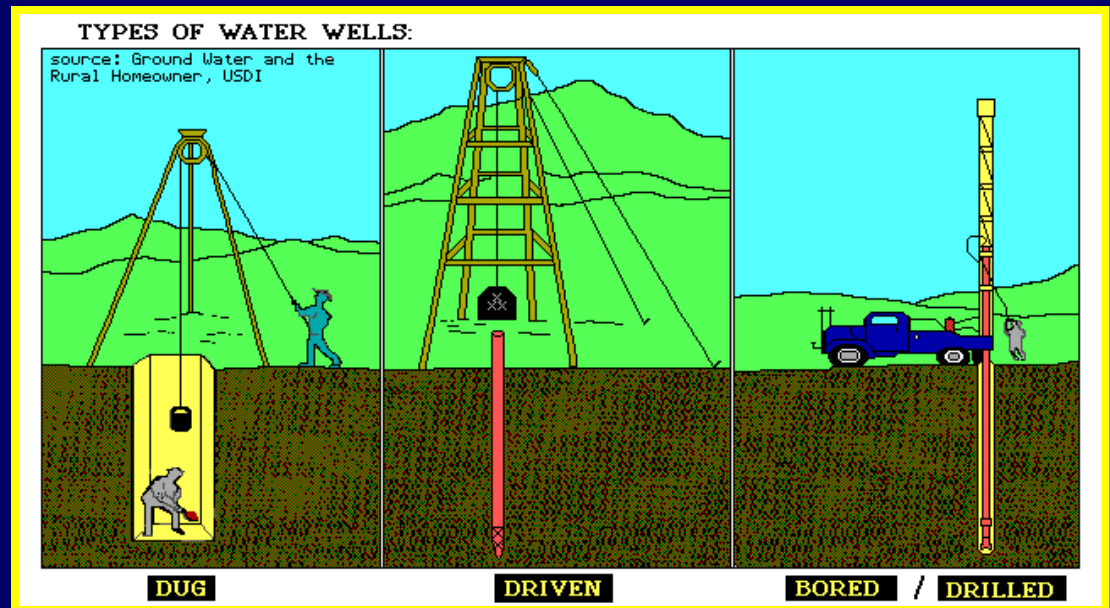
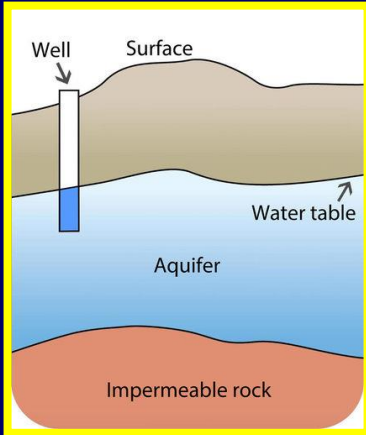


Since 1950, the use of groundwater has more than doubled, from 34 billion gallons per day to 83 billions gallons per day.

Obtaining Groundwater

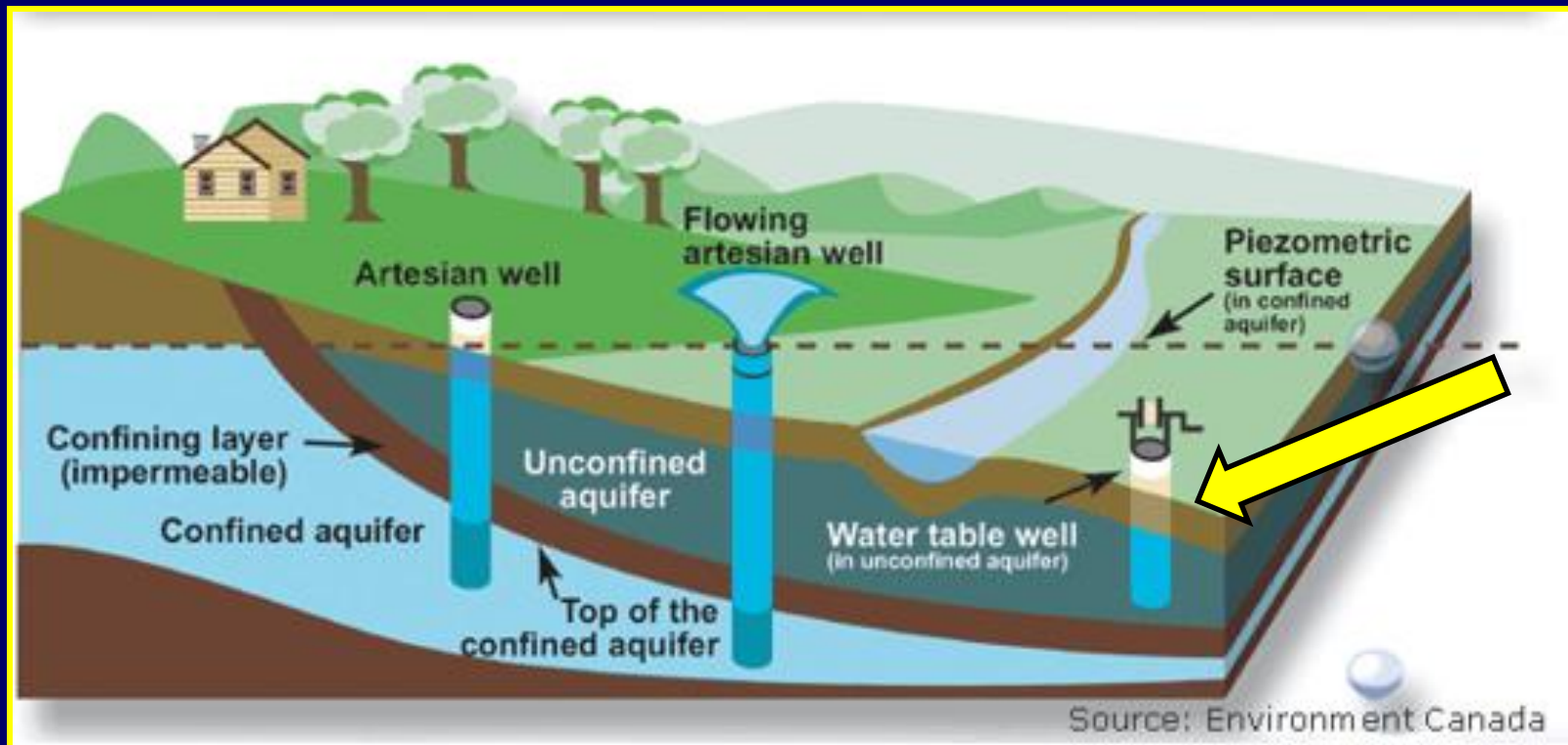
Groundwater is obtained with the use of wells.

Wells are either dug, driven, or drilled into the ground to reach an aquifer well below the water table.



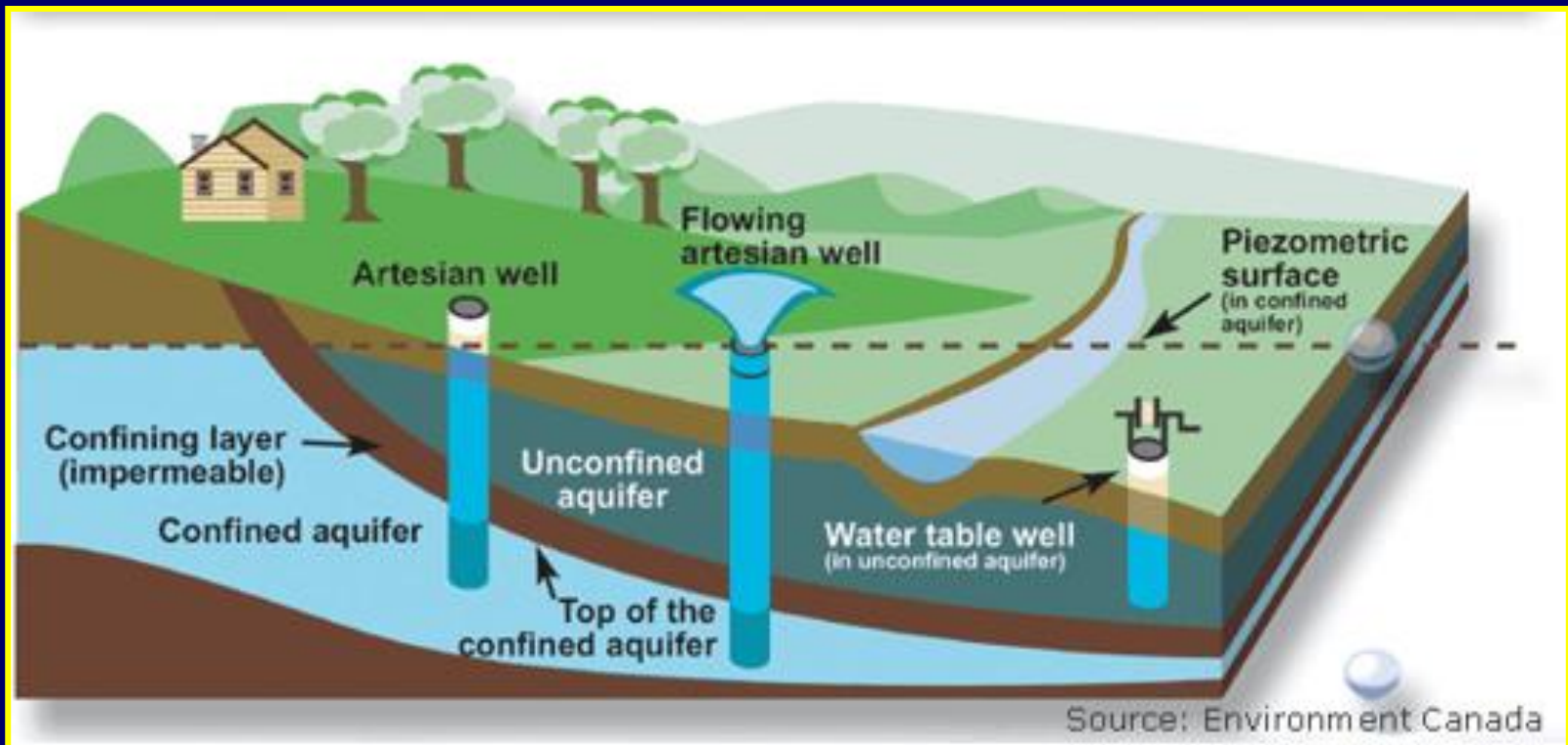
Water Table Wells

Water table wells obtain water from unconfined aquifers and need electrical pumps in order to operate.



Artesian Wells

Artesian wells obtain water from confined aquifers and do not need a pump due to the water being under pressure from the weight of the above rock layers.



Artesian Wells

Artesian wells can flow freely, without any pump needed, for hundreds of years.



Whitewater, Wisconsin

Ogallala Aquifer

The Ogallala aquifer is the largest aquifer in the United States and supplies irrigation water to 1/5 of the irrigated land in the nation.



Ogallala Aquifer

The Ogallala aquifer is replenished by rain and melting snow, but it only gets between 2" – 5" of precipitation a year.

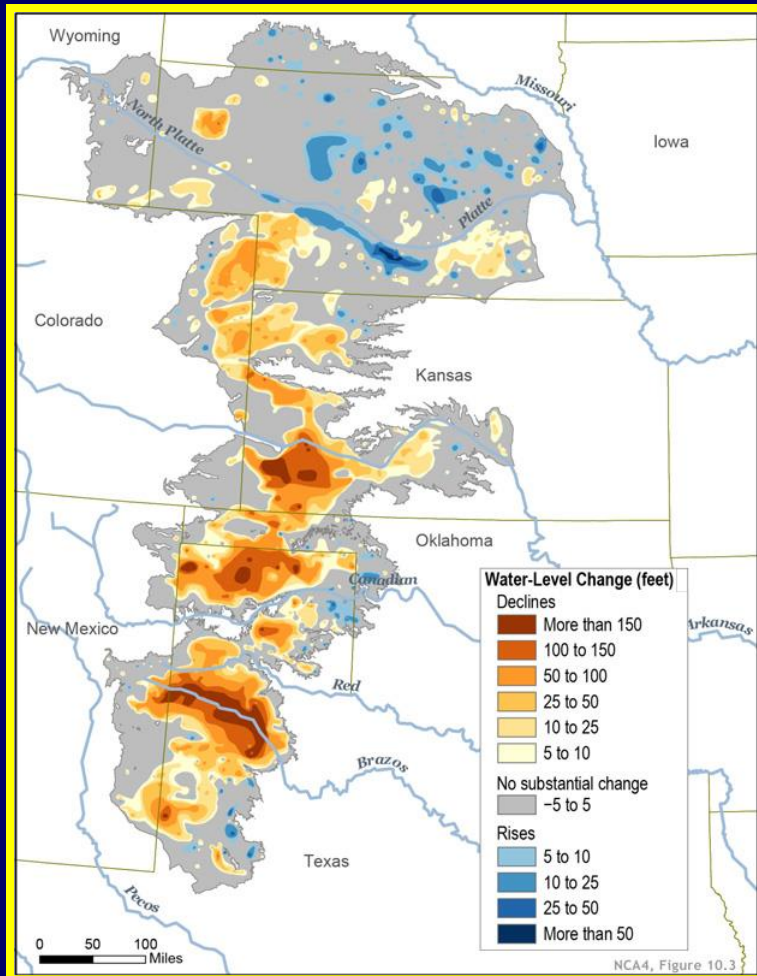


Most of the water the aquifer holds was absorbed thousands or millions of years ago.

Sandhills in North Dakota
Recharge Area for the Ogallala Aquifer

Overuse of Groundwater

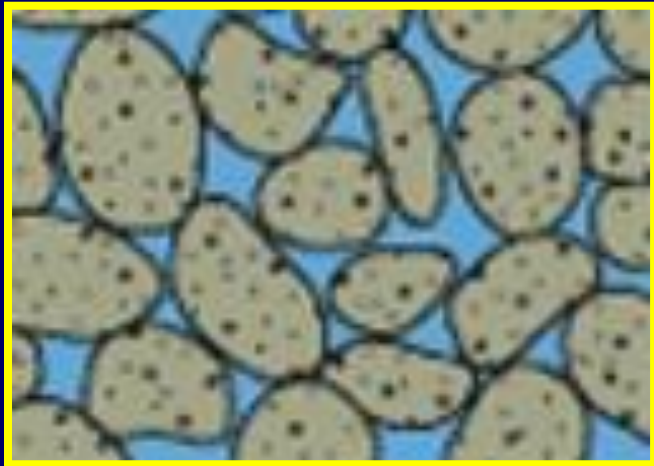
Currently, the water in the aquifer is being withdrawn faster than it can be recharged.



The water table, in the aquifer, has dropped 200 feet, since it was first tapped into, and continues to drop 2 feet a year.

Overuse of Groundwater

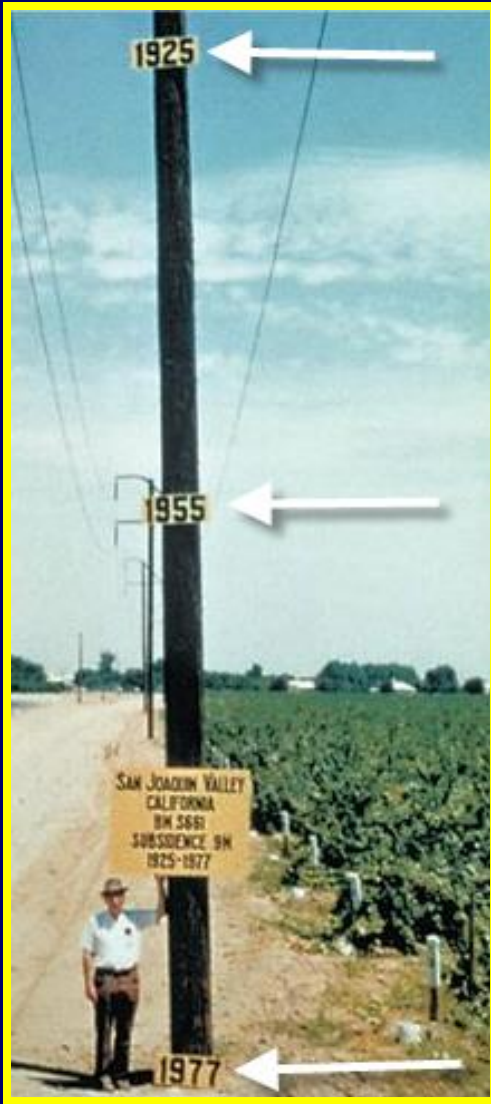
Groundwater fills the pore spaces between individual sediments.



If the water is removed, the sediments are no longer supported by the water and will resettle and become more compacted.

As the sediments resettle and become more compacted, the surface of the land sinks or decreases in elevation.

Land Subsidence



Land subsidence is the term used to refer to the lowering of elevation of the land surface due to the overuse of groundwater.

In California, which relies heavily on groundwater for irrigation, the land elevation has dropped over 30 feet between 1925 and 1977.

The photo on the left shows the change in land elevation in California between those years.

Increased Flooding

Land subsidence not only creates problems due to unstable ground surface, but also increases the threat of flooding as the land elevation drops closer to sea level.



Several homes in an area of Baytown, Texas, have been permanently flooded by bay waters, due to land subsidence.

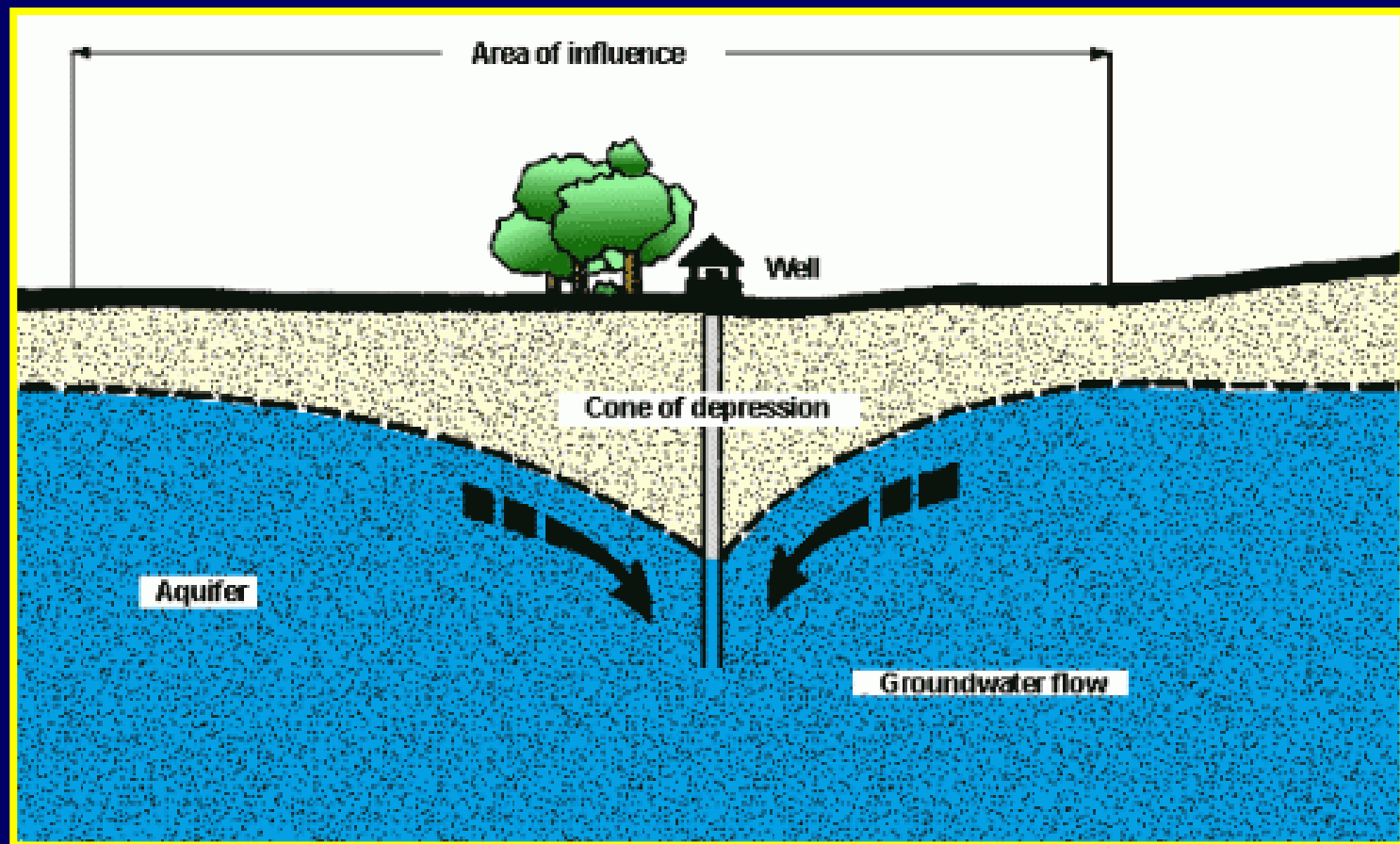
Sinkholes

The overuse of groundwater and compaction of the sediment can also result in cracks in the land surface, as well as the formation of sinkholes.



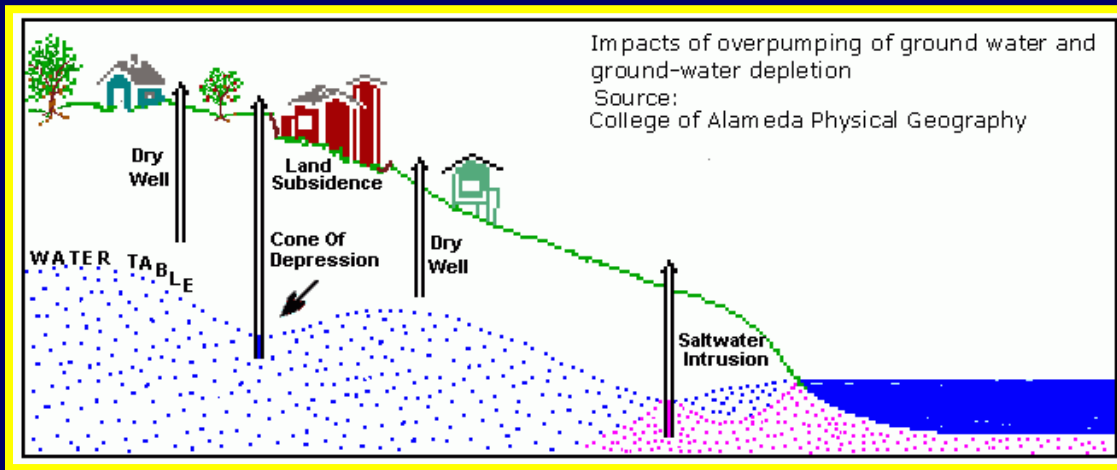
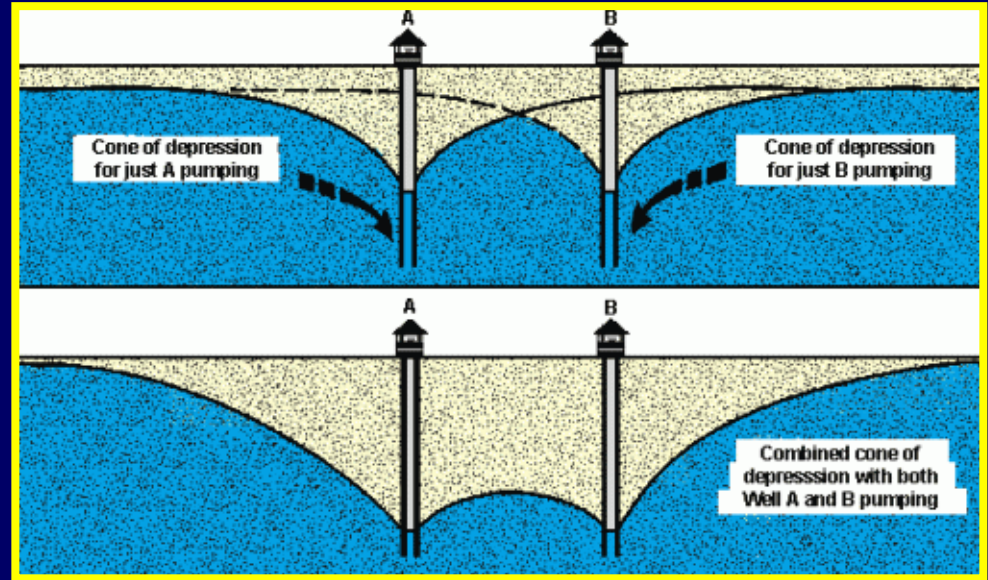
Cone of Depression

As water is drawn out of a well, the water table drops around the well, producing a cone of depression.



Dry Wells

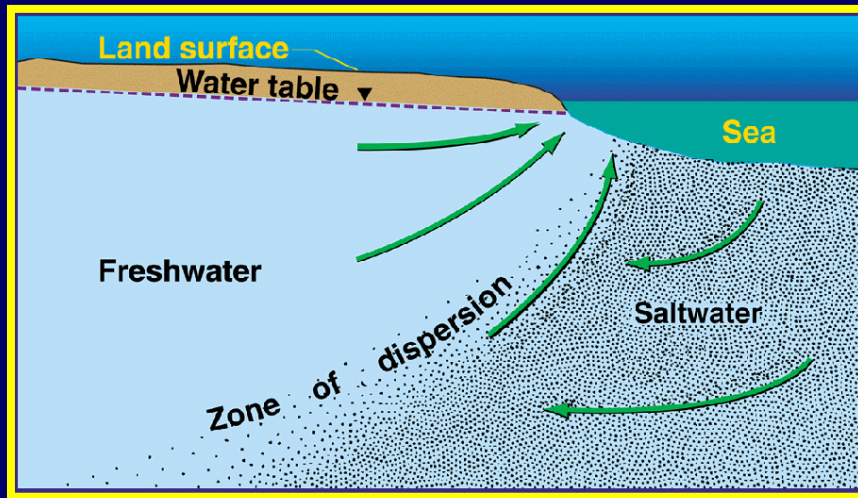
As more wells tap into the same aquifer, the cone of depressions combine and lower the water table even further.



If the water table drops below the depth of a well, the well will go dry.

Coastal Issues

Wells located near the coast face an even greater threat from over pumping of groundwater.

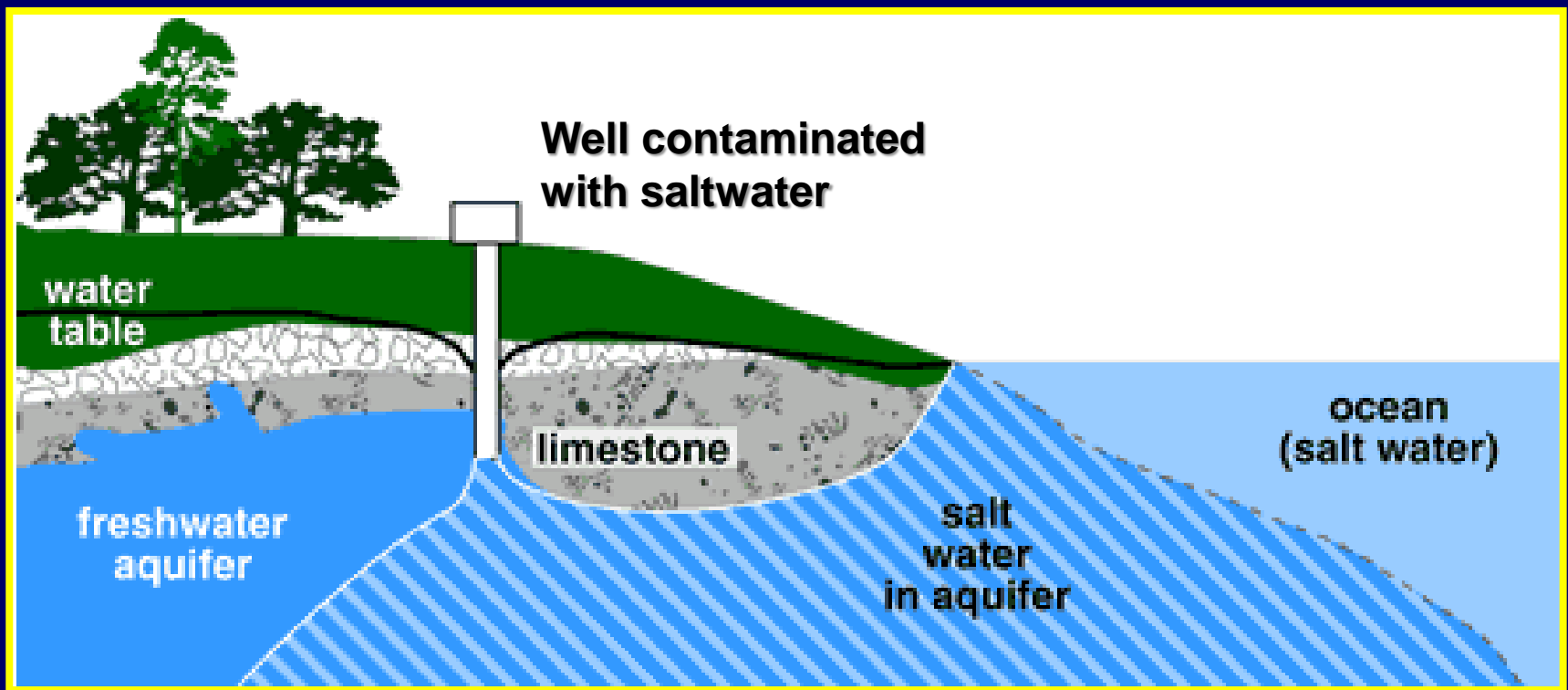


Under oceans and seas, the groundwater is made up of saltwater.

Along the coast, the saltwater from the ocean groundwater mixes with the freshwater from the land groundwater at an interface called the zone of dispersion.

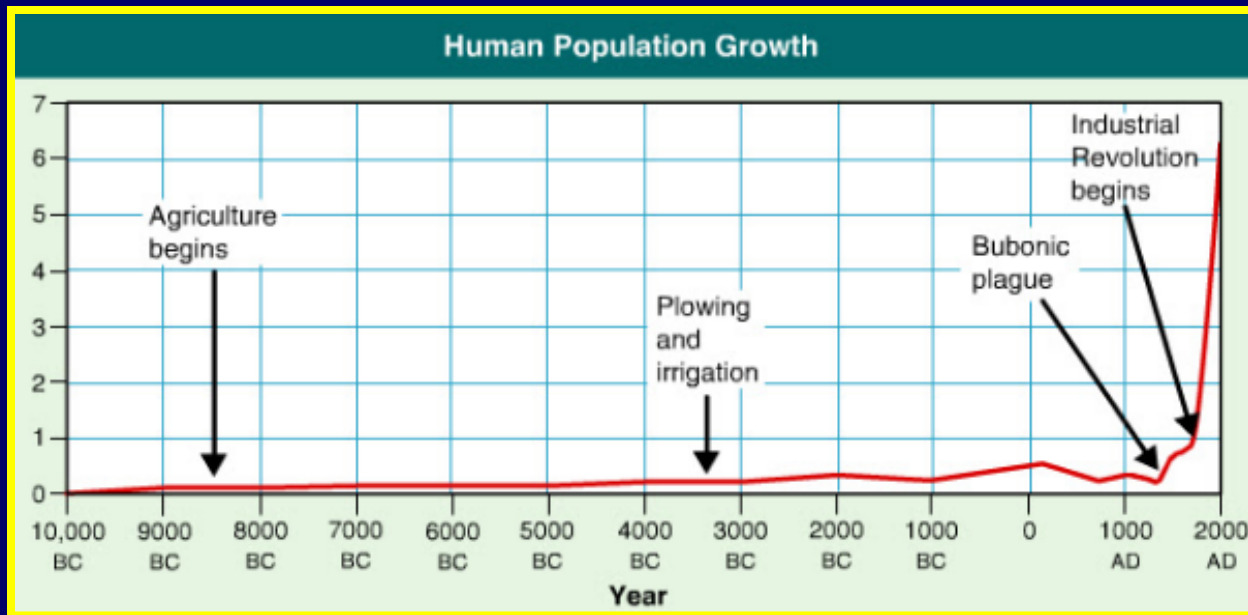
Saltwater Intrusion

As more water is drawn from the freshwater aquifer, the zone of dispersion shifts and salt water is drawn into the freshwater aquifer in a process called saltwater intrusion.



Future of Groundwater Use

As human population continues to increase, the demand for water also increases.



As a result, the issues that arise from using groundwater faster than it can be replenished will also increase.

The End

