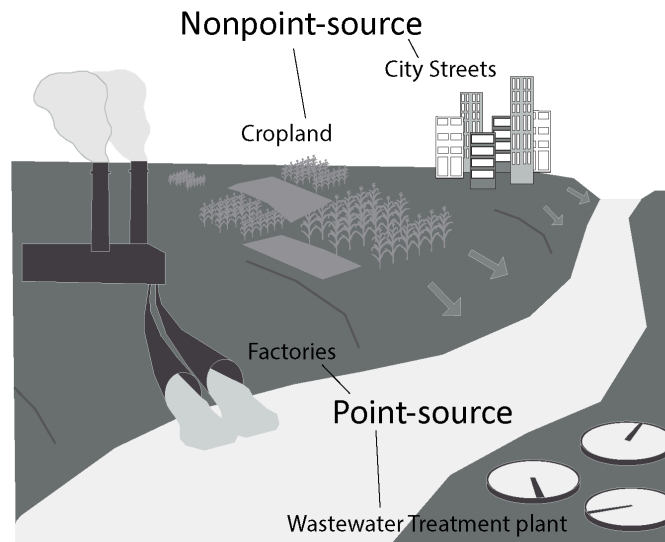


First some review of Groundwater Contamination:

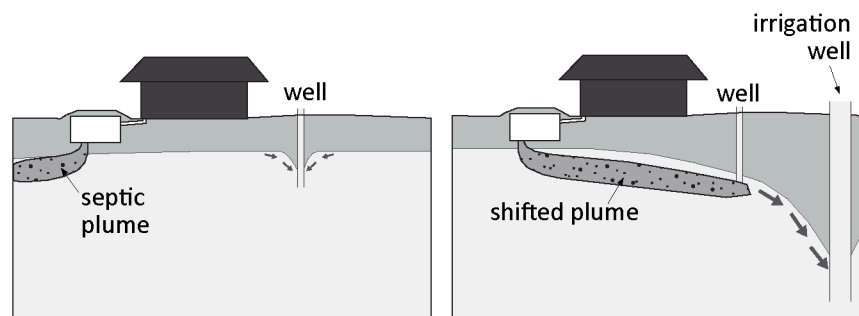
Contaminates

Groundwater is typically relatively pure, and as it is an important drinking water resource, it is important to maintain that purity. However, contaminants may infiltrate the groundwater and this can be extremely costly or next to impossible to clean up in certain situations. A number of substances can infiltrate groundwater locally, including: pesticides and herbicides, sulfuric acid (acid mine drainage), heavy metals, radioactive waste, landfill pollutants, bacteria and viruses, gasoline.



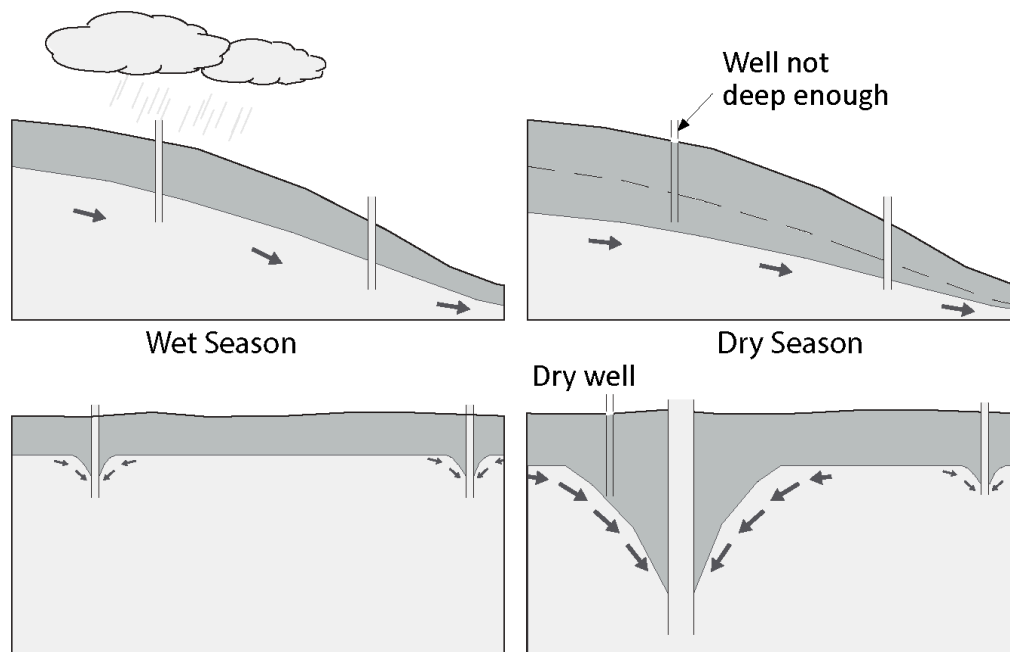
Contamination occurs as point-source or nonpoint-source pollution. Examples of surface contamination are above. Groundwater contaminate point sources include landfills, leaking gasoline and septic tanks, and accidental spills. Groundwater contaminate nonpoint sources are similar to surface water including city street runoff that infiltrates into groundwater.

Contaminate Plume



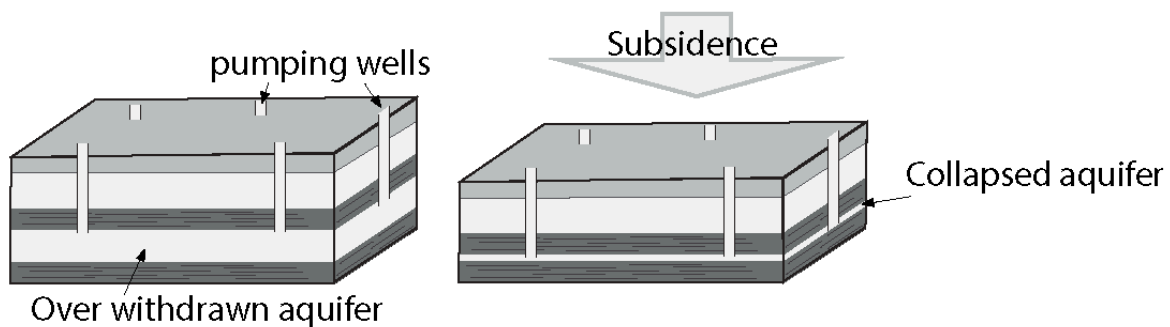
A plume of contamination will travel in the direction of groundwater flow. If the slope of the water table is altered, it can shift the direction of groundwater flow with disastrous consequences.

Wells



We access groundwater through wells. Wells need to be installed carefully to avoid becoming dry during drought periods, and also to avoid overwhelming an aquifer locally, with a drawdown (cone of depression) that overcomes nearby wells.

Withdrawal and Recharge



If water is pulled from an aquifer at a rate greater than its ability to recharge naturally, then it will eventually become depleted. When an aquifer is depleted it may collapse without the water support, and the overlying ground surface will subside.

Now, test your knowledge:

Briefly define the following terms:

contaminate -

plume -

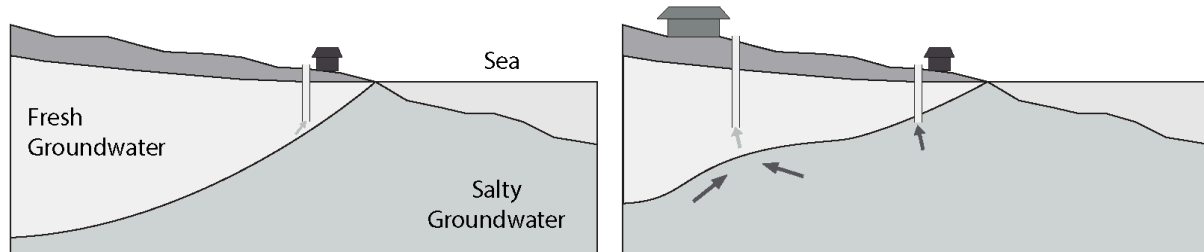
withdrawal -

recharge -

Answer the following:

1. True/False. Water can be 'purified' of contaminants by travelling through an aquifer made of sand or permeable sandstone.
 - A. True
 - B. False
2. Contaminants are termed *hazardous* if they are:
 - A. Flammable
 - B. Corrosive
 - C. Explosive
 - D. Toxic
 - E. All of the above
3. True/False. Often, a volume of contaminated groundwater would be so expensive to clean, that it is simply abandoned as a water source for many years to allow it to clean naturally.
 - A. True
 - B. False
4. True/False. A contaminate plume will travel throughout an aquifer, mixing with groundwater in all directions from the source.
 - A. True
 - B. False
5. True/False. Luckily, subsidence caused by over-pumping of water from an aquifer is easily reversed by hydraulic fracking the aquifer back into its original shape.
 - A. True
 - B. False

6. Currently, radioactive waste is being stored _____.
- A. In a permanent national facility called Yucca Mountain in Nevada, selected because the site does not contact the local groundwater, and there is very little rain.
 - B. In oil barrels marked with radioactive waste symbols, dumped at the bottom of lakes located in proximity to nuclear power plants.
 - C. Above ground, at individual nuclear power facilities, avoiding contact with the groundwater.



7. In the above image, the boundary between salty groundwater and fresh groundwater is curved, with salty groundwater underneath the fresh water. This is because _____.
- A. Salty Groundwater is older, emplaced first, and according to the principle of superposition, the older units are on the bottom.
 - B. This is not a realistic scenario.
 - C. Salty groundwater is denser relative to fresh groundwater, therefore it rests on the bottom.

Now, think deeper:

On your own:

8. Think about the last time you had a drink of water today. What do you imagine is the ultimate source of that water? Was it from a well, or from surface water?

1. Although likely below safe drinking levels, your water may have contained very low levels of contamination. What are the most likely contaminants that may have been in this water? What was the source of that contamination?

Working in groups of 2 or 3:

2. Compare your answers to questions 9 and 10. You're likely to have very different answers if one of you drank local tap water and another drank bottled water most recently. If this is not the case, discuss the possibilities of whichever possibility was missing.