Hookston Station and Adjacent Areas

Groundwater Basics
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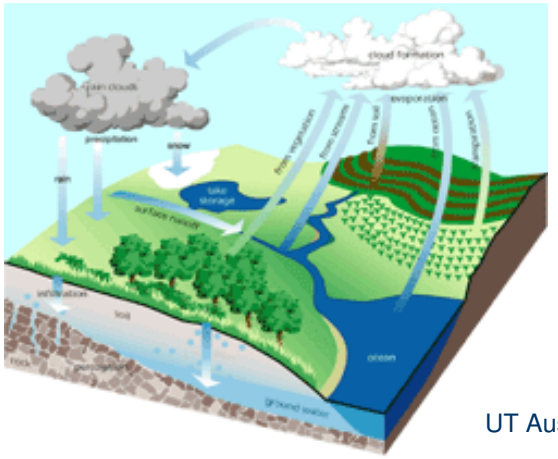
Hydrologic Cycle



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2

Diagrams from Texas perspective, but generally good and useful.

Groundwater is water that is found underground. In this area, it generally occurs in spaces in the soil or unconsolidated sediments.

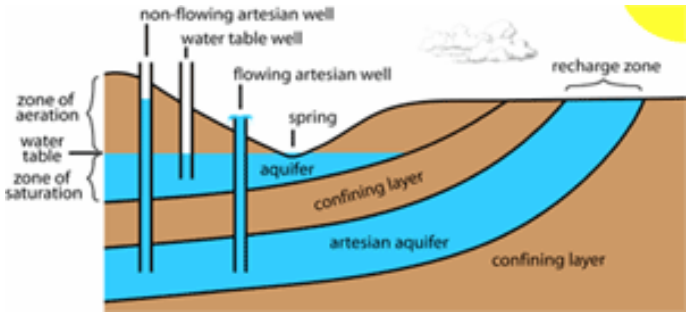
Groundwater can be replenished by either precipitation or surface water (even irrigation). Available information indicates that groundwater beneath Colony Park discharges to the Walnut Creek. Pumping groundwater can remove it faster than it can be replaced. This has occurred in the Central Valley and some areas of Santa Clara County. Also, overpumping can cause saltwater intrusion in coastal areas (e.g., Los Angeles, Alameda County, Monterey County).

There is a finite supply of water on the earth, but it is continually recycled naturally. About 1/3 of the earth's fresh water is locked up in the form of ice.

About half the population of the US gets drinking water from groundwater.

Historically, groundwater has influenced the locations of human populations. Springs discharging along the Hayward fault became population centers beginning with native americans. Today, development can be regulated to protect groundwater resources.

Aquifer



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An aquifer is a body of rock (or sediment) that can store and transmit significant quantities of water. The characteristics vary according to porosity and permeability. Porosity is the percentage of open space; permeability is the degree to which fluids can be transmitted through the pore spaces.

Looking at the recharge area: Groundwater travels through the rock and sediment by percolation, moving by gravity and pressure. Natural circulation can purify water, cleaning some contaminants. Where gravity and pressure are equal forms the Water Table. Large areas of impervious cover, such as parking lots, do not allow infiltration and disrupt the water cycle. This has led to new trends in landscaping and reducing the footprint of large paved areas.

Where the water table intersects the ground surface: Spring

4

This is a photo of an artesian well.

Rivers & Streams – Fluvial Sediments

5

The aquifer beneath Colony Park is formed of sediments that have been shed off Mount Diablo since it began rising about a million years ago. Rivers and streams transport sediment of various sizes. Coarse-grained sediments are deposited in the channels, and finer grained sediments at the edges and as overbank deposits. Over many years, the channels change course, causing the sediment packages to shift in space and time.

Rivers & Streams – Fluvial Sediments

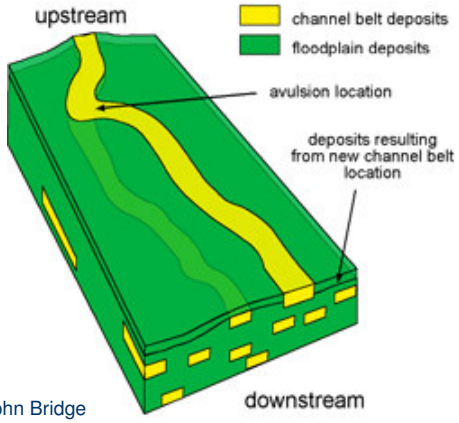

Diagram from John Bridge

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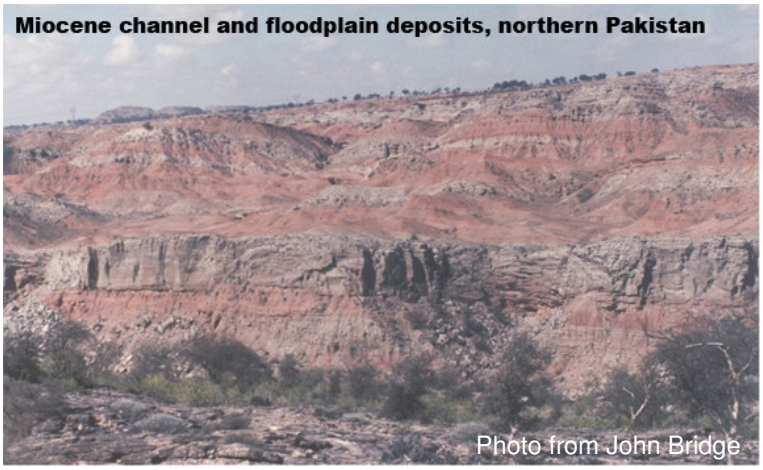
This cross section illustrates the locations of many stream channels through the time during which the sediments were deposited. Where there are lots of coarse-grained sediments and little fine-grained sediment, the sediment package has lots of porosity and permeability. This would be Zone B. Where there are more fine-grained sediments, the porosity and permeability are lower. This would be Zone A.

Rivers & Streams – Fluvial Sediments



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This photo shows how the different sediment packages respond to weathering. Coarse-grained resist erosion and stand out; fine-grained are easily eroded and form the slopes

Rivers & Streams – Fluvial Sediments

Carboniferous channel bar deposits, NW Germany
Photo from John Bridge

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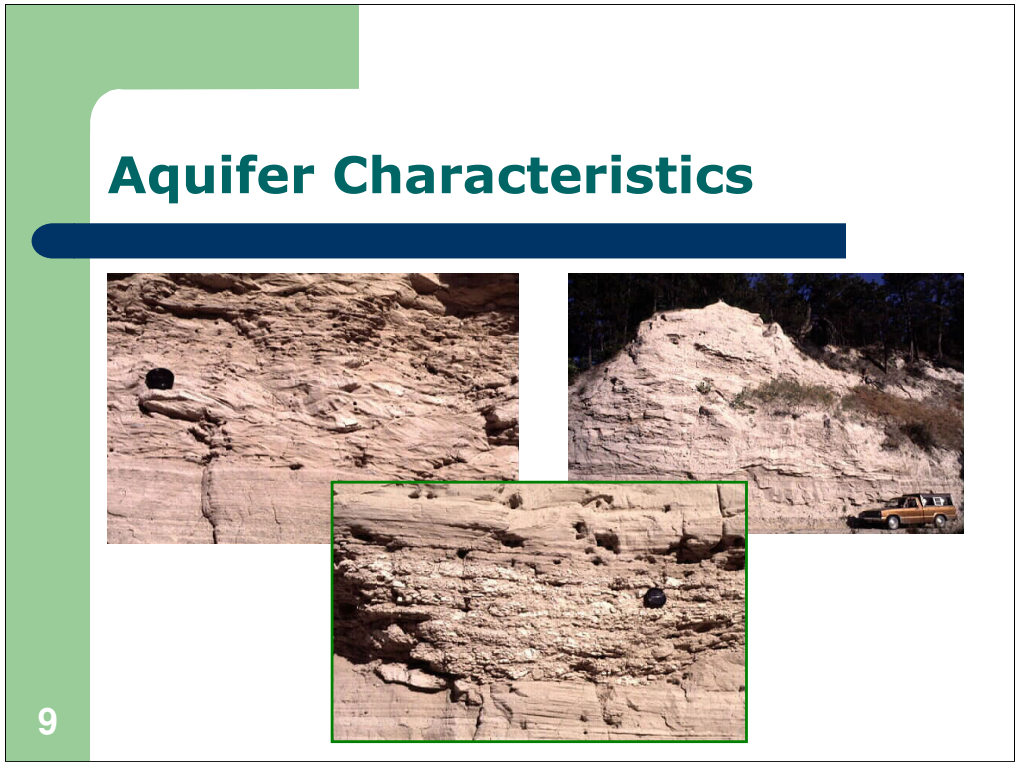
Another photo showing different river or fluvial sediments. “A Zone” – left; “B Zone” – right.



Closeup photos showing sedimentary structures associated with stream channel deposits. Note car and lens cap for scale

Aquifer Characteristics

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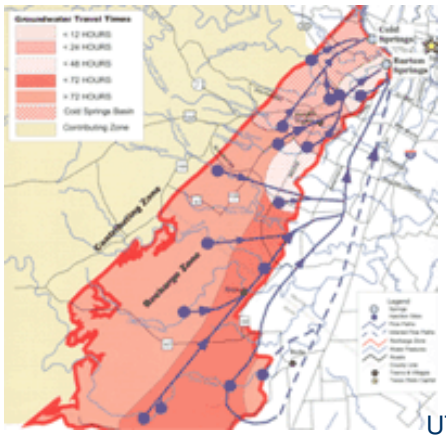
Photos showing finer-grained sediments between layers of coarse-grained sediments. In aquifers such as this, the coarse-grained sediments would be expected to transmit most of the water (and contamination). This is why it's important to determine where to inject amendments or extract groundwater. Outcrop photo left; close-up with lens cap right.

Groundwater Flow



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Groundwater flows under the influence of gravity, pressure, and molecular attraction. Groundwater generally moves from an area of high pressure to an area of lower pressure (like the weather).

In sedimentary or CLASTIC aquifers, the water flows around individual grains in a winding path. Rates of flow might be inches or feet per year. This is to some extent determined by the ratio of coarse-grained sediments to fine-grained sediments (sorting). Also determined by particle shapes and how they are packed together. Porosity can typically be up to about 30%.

Groundwater Contamination

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This figure shows various sources of groundwater contamination.

In the 1980s the Water Board started to focus on cleanup of pollution from underground storage tanks, aboveground storage tanks, chemical sumps, and other sources.

In addition to leaks and spills related to corrosion or handling practices, disturbances such as earthquakes and landslides can also contribute to groundwater pollution by disrupting pipelines and landfill liners. Floods can carry pollutants and containers of chemicals in floodwaters, which might then seep back into the ground. Fires can remove vegetation that slows groundwater infiltration, reducing the time available for natural cleansing processes.

Your handout contains a list of groundwater contaminants that you can also be aware of and possibly take steps to prevent (e.g., excess organic matter, exces nitrates)