

**Montana Bureau of Mines and Geology
Groundwater Demonstration**

**Presented to:
Water Policy Interim Committee
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HYDROGEOLOGIC CONCEPTS

The purpose of this demonstration is to explain and reinforce hydrogeologic concepts using physical "sand-tank" models. It has been said that groundwater would be much easier to understand if one could just see inside the aquifer and sand-tank models allow us to do just that.

To assist the WPIC in their work, MBMG answers questions and presents groundwater and groundwater/surface water concepts using PowerPoint slides, handouts and talks. Some of these concepts are clarified when they can be demonstrated interactively and visualized with the sand-tank models. Keep in mind, however, that sand-tank models present idealized examples, whereas in nature there is far more complex.

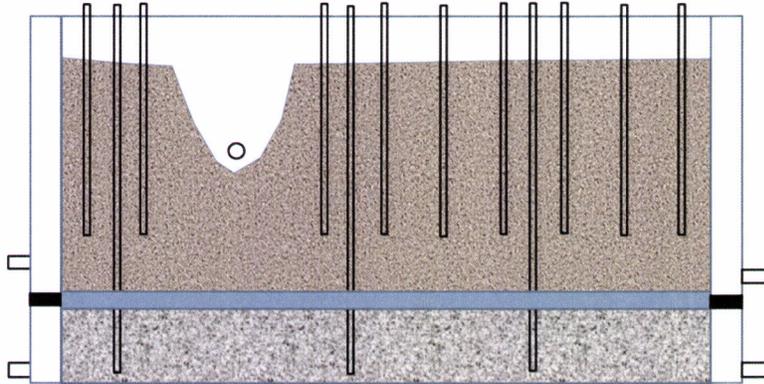
We have prepared several demonstrations to illustrate key hydrogeologic concepts. The committee is also encouraged to ask questions and, hopefully, we can use the sand-tank models to show the answers.

There is also equipment on display to give you an idea of how we collect some of our data. The following two pages highlight some concepts that we will present.



**WATER POLICY INTERIM
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Unconfined and confined aquifers sand-tank model



Aquifer types:

Unconfined or water-table aquifer: The top of the aquifer is the top of the saturated material, or the water table.

Confined aquifer: Directly on top of the aquifer is a low permeability, or confining layer. Water levels in wells rise above the top of the saturated aquifer because water in the aquifer is under pressure and the confining layer restricts vertical movement.

Yield to a well:

Unconfined aquifers yield water to a well by draining the pores. The pores are voids in the aquifer material.

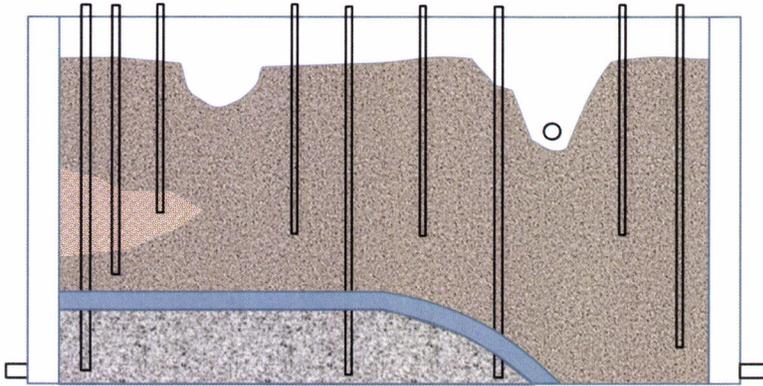
Confined aquifers yield water to a well through reduction in pressure and pore space is not drained.

Groundwater/surface-water interaction:

Unconfined aquifers adjacent to a stream are normally in direct connection with that stream. Changes in groundwater affect the stream, and changes in stream flow affect the aquifer.

Confined aquifers typically have little interaction with surface water bodies.

Mixed aquifers sand-tank model



Recharge:

Unconfined aquifers are recharged by vertical percolation of precipitation and by lateral inflow.

Confined aquifers are not directly recharged by vertical percolation above the aquifer, but by infiltration at some distance away. There is some vertical movement through confining layers, though it is typically minor.

Aquifer Storage and Recovery (ASR):

ASR is the intentional recharge of water into an aquifer for later recovery or use. It is used as a management tool to store surface water at times when it is available, and withdraw that stored groundwater at times of higher demand. Artificial recharge can be accomplished with irrigation canals, infiltration basins, or injection wells.