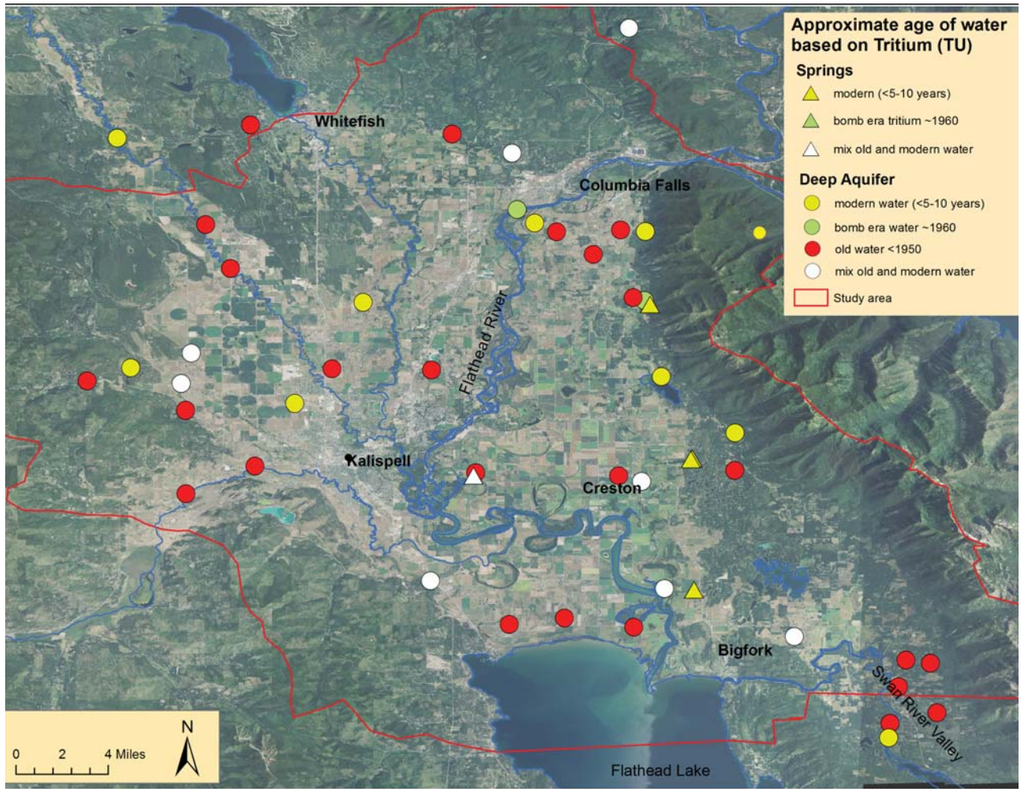
Tritium Evaluation of Recharge Areas

Tritium is used to date water and identify recharge areas. Rainwater carries atmospheric concentrations of tritium into the groundwater. Naturally occurring tritium levels in rainwater are estimated at 5 to 10 tritium units (TU). Levels increased as a result of nuclear testing from 1953 to 1963. Since the mid-1960s tritium levels in the atmosphere have steadily declined and are approaching those of pre-bomb era.

Tritium data from the deep aquifer generally indicate very low concentrations, suggesting that the water infiltrated the groundwater system prior to 1953 (red markers). The presence of modern water is indicated in bedrock wells and in large springs along the east valley margin. The west side of the valley has older water, suggesting very little recharge occurs in this area.



Project Status

- Water-level data have been collected from wells
- Springs have been inventoried
- Water-quality samples have been collected and analyzed for isotopes and noble gases
- Conceptual groundwater flow model has been re-evaluated
- A preliminary transmissivity map of the valley has been generated
- Barometric efficiency data are being analyzed
- Groundwater flow in the Echo Lake area is being documented
- The quantity of groundwater added to the Kalispell valley deep aquifer has been identified as a critical issue and is being analyzed

The new data collected and interpreted during this project will be used to understand the groundwater flow systems. All data and interpretations will be published and will be publicly available to all interested parties, including water users, managers, regulators and scientists.

MBMG Ground Water Investigations Program

Flathead Valley Study Area—
Flathead County

Introduction

The population in the Flathead Valley has increased by more than 25 percent in the past decade. The current population of about 70,000, with the exception of Whitefish, relies on groundwater. The deep confined aquifer in the Flathead Valley is the most utilized aquifer in the valley, supplying high-capacity municipal and irrigation wells in addition to thousands of domestic wells. Continued growth and localized water-level declines in the deep aquifer have raised concerns about the long-term sustainability of the water supply.

Project Issues

This investigation will characterize the hydrologic relationship among surface water, shallow aquifers, and the deep confined aquifer. The study is designed to address the following questions:

- Is increasing water withdrawal from the deep aquifer sustainable in the Kalispell valley?
- How does the deep aquifer interact with surface water, including Flathead Lake?
- What is the geologic configuration of the confining unit and deep aquifer?
- What are the characteristics and areal extent of the overlying confining unit?
- What is the source and mechanism of recharge to the deep aquifer?

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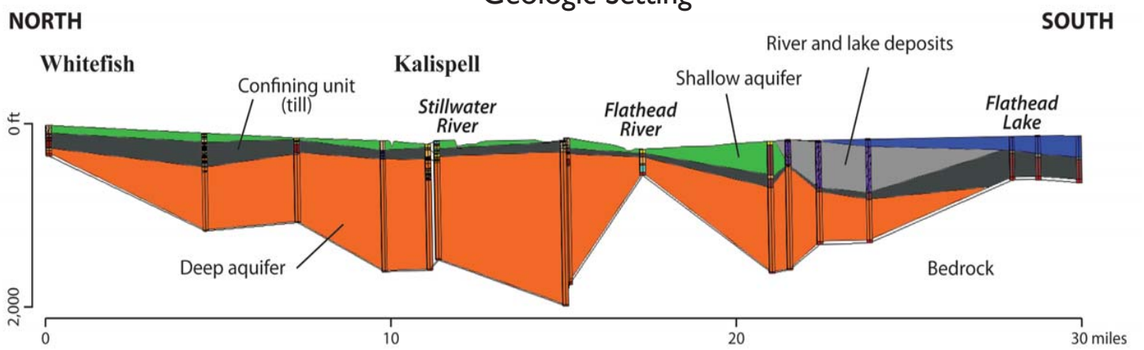
Approaches

- Monitor groundwater elevations at select locations
- Drill to define lithology and install monitoring wells
- Perform aquifer tests to define aquifer physical properties
- Water-chemistry analyses to evaluate aquifer vulnerability and flow paths, including groundwater dating, and isotope and noble gas data
- Correlate groundwater level changes with surface-water flow and stage, spring discharge, and precipitation
- Evaluate continuity of confining unit using barometric efficiency methods
- Develop maps of the confining unit, thickness of deep aquifer, groundwater flow direction, and hydraulic conductivity variations
- Identify primary recharge areas for the deep aquifer

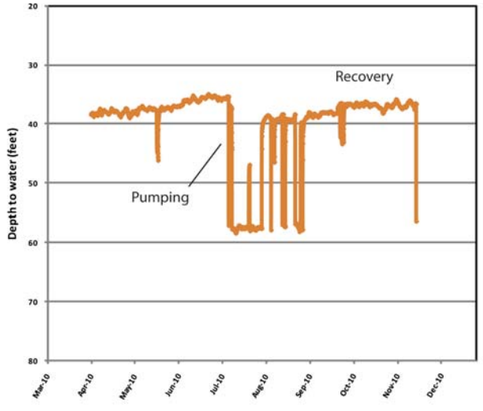
Geologic Setting

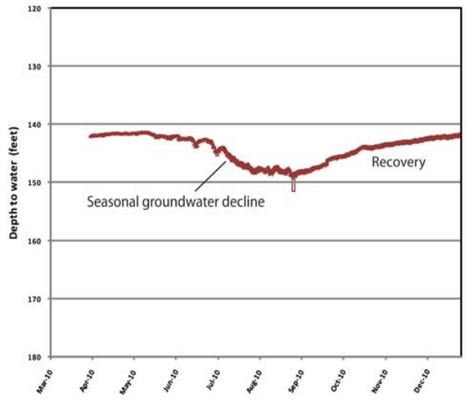


The deep aquifer (orange in this figure) underlies most of the Flathead valley, including at least a portion of Flathead Lake. The aquifer consists of gravel, sand, and silt and was deposited as outwash gravel during and following glacial scouring of the valley. Water production from wells in the deep aquifer reportedly can be 1,000 gpm or higher. The overlying confining unit (dark gray) separates the deep aquifer from surface water and the shallow aquifer (green) in much of the area. The confining unit consists of glacial till, which is finely ground rock left behind during glacial retreat. It thins and may allow vertical movement of water and even recharge in some locations.

Aquifer Response to Pumping

In the Flathead valley, water demand is highest during the summer growing months. Both domestic and irrigation use withdraw water from the aquifer, lowering water levels at producing wells. The combined effect of pumping in many wells in the deep aquifer is seen over much of the valley.





Barometric Efficiency

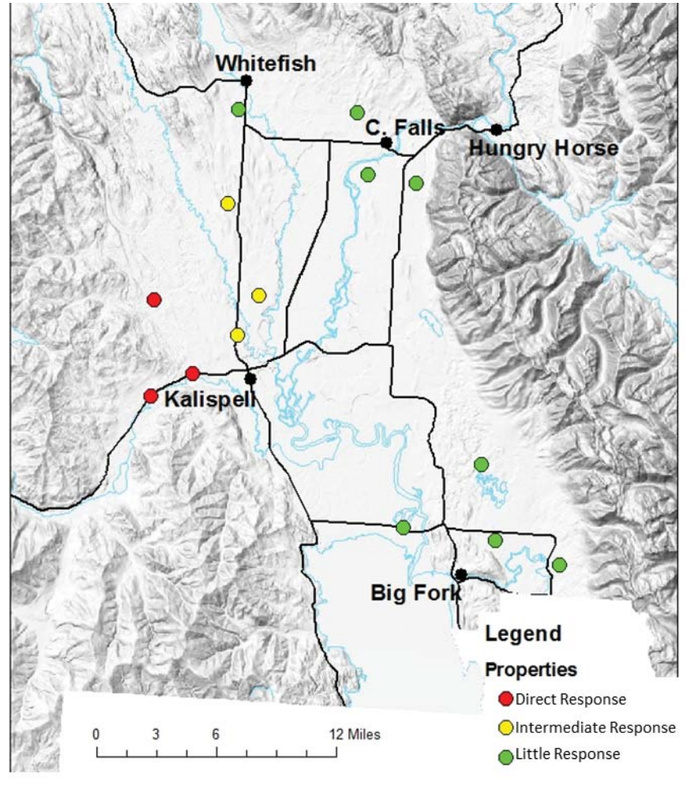
Aquifer barometric efficiency provides an insight into the extent and effectiveness of geologic confining units. Barometric pressure changes directly reach surface water and shallow unconfined aquifers over large areas, whereas deep confined aquifers are separated from atmospheric pressure by confining units. This separation, known as barometric efficiency, is being mapped to help understand confining unit effectiveness on a regional scale.

In the Flathead Valley, the confining unit, or till, separates the deep aquifer from shallow systems including the rivers. A critical component to managing the deep aquifer is understanding how effective the confining layer is in separating the deep from the shallow aquifer. The confining layer may:

- Block deep-aquifer recharge due to its low ability to transmit water
- Protect the deep aquifer from surface contamination
- Distinguish between water rights in the shallow aquifers or surface water from the deep aquifer
- Control deep groundwater flow directions, including discharge to Flathead River and Flathead Lake

Aquifer Responses to Precipitation

Within the deep aquifer in the Flathead Valley, several different rates and timing of groundwater recharge have been identified by comparing groundwater levels to precipitation.



This map shows deep aquifer responses to precipitation. Preliminary results indicate that groundwater fluctuations on the east side of the valley correlate directly to precipitation (green). In the central part of the valley, groundwater displays a delayed response to precipitation (yellow), while on the west side there is little or no response to precipitation (red).