

Beaverhead River Valley West Ground Water Investigation Program



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Project Purpose

Is groundwater drawdown and stream depletion occurring due to high-capacity irrigation pumping from aquifers?

Evaluate possible impacts to sloughs and the Beaverhead River from future groundwater development.

Topics

- Groundwater movement and groundwater trends
- Water budget (More details)
- Quantify groundwater recharge from canals and irrigated fields
- Groundwater/surface-water interaction
- Evaluate potential stream depletion
- Water chemistry
- Vertical movement
- Aquifer testing



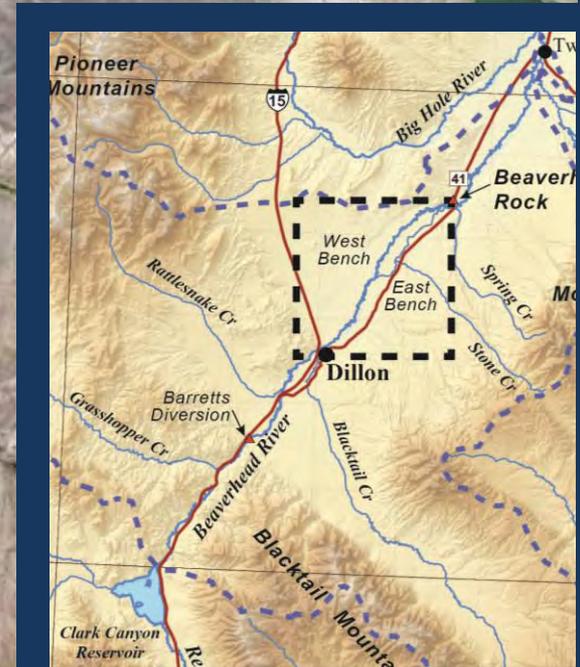
Beaverhead Rock

West Side Canal

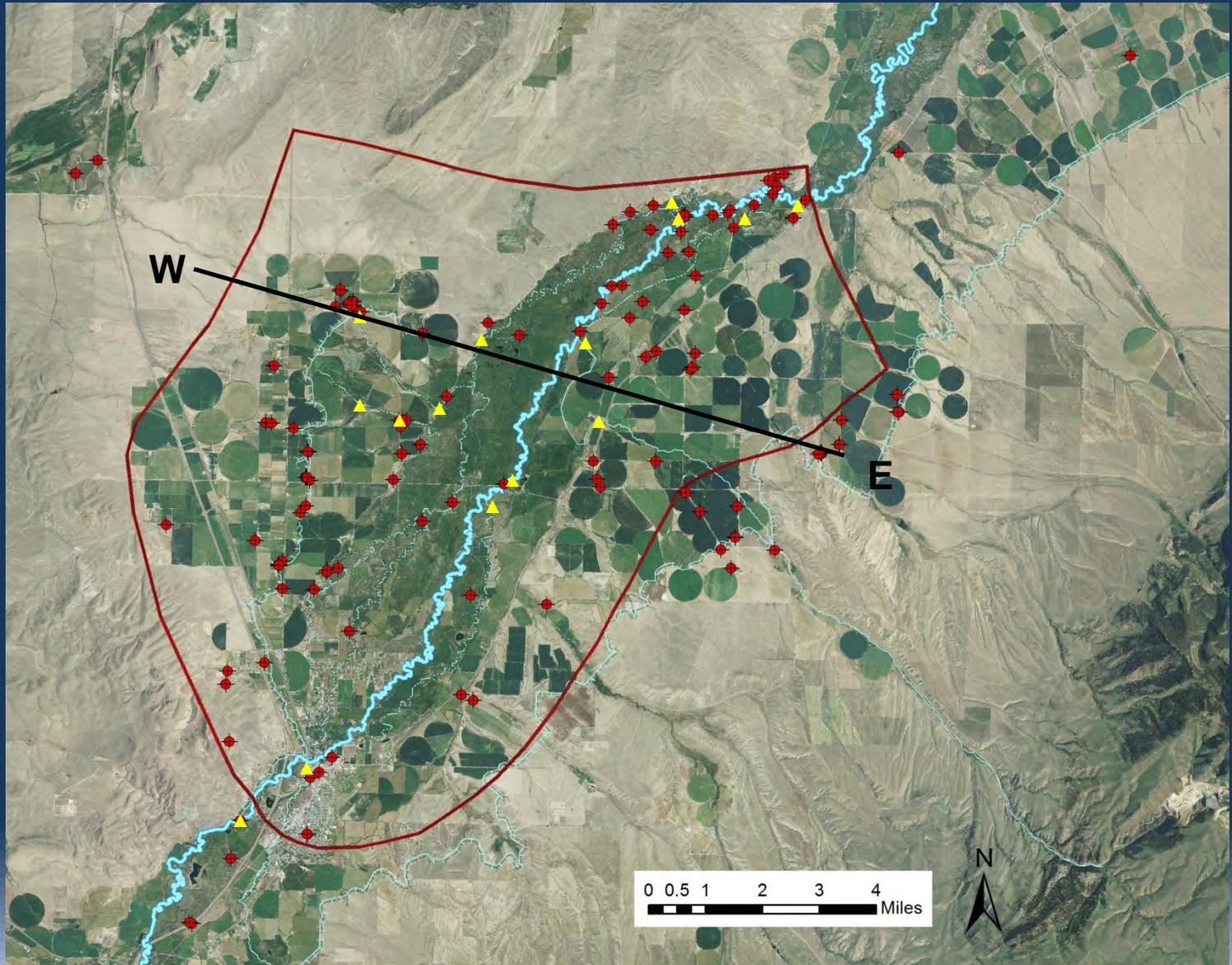
East Bench Canal

Dillon

3.01 mi



Monitoring Network



Hydrogeologic Framework

Tertiary Sediment Aquifer

400 - 2,900 ft²/day

Volcanic Rock Aquifer

42,000 - 75,000 ft²/day

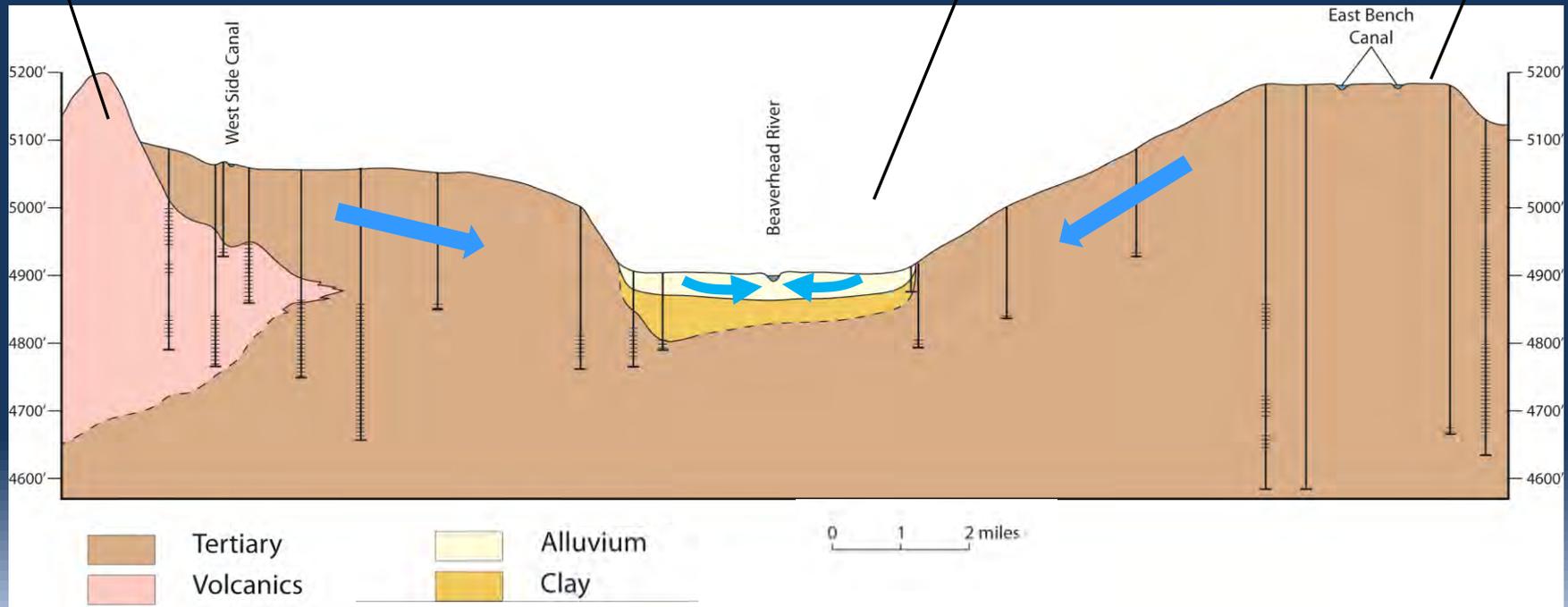
Alluvial Aquifer

18,000 - 37,000 ft²/day

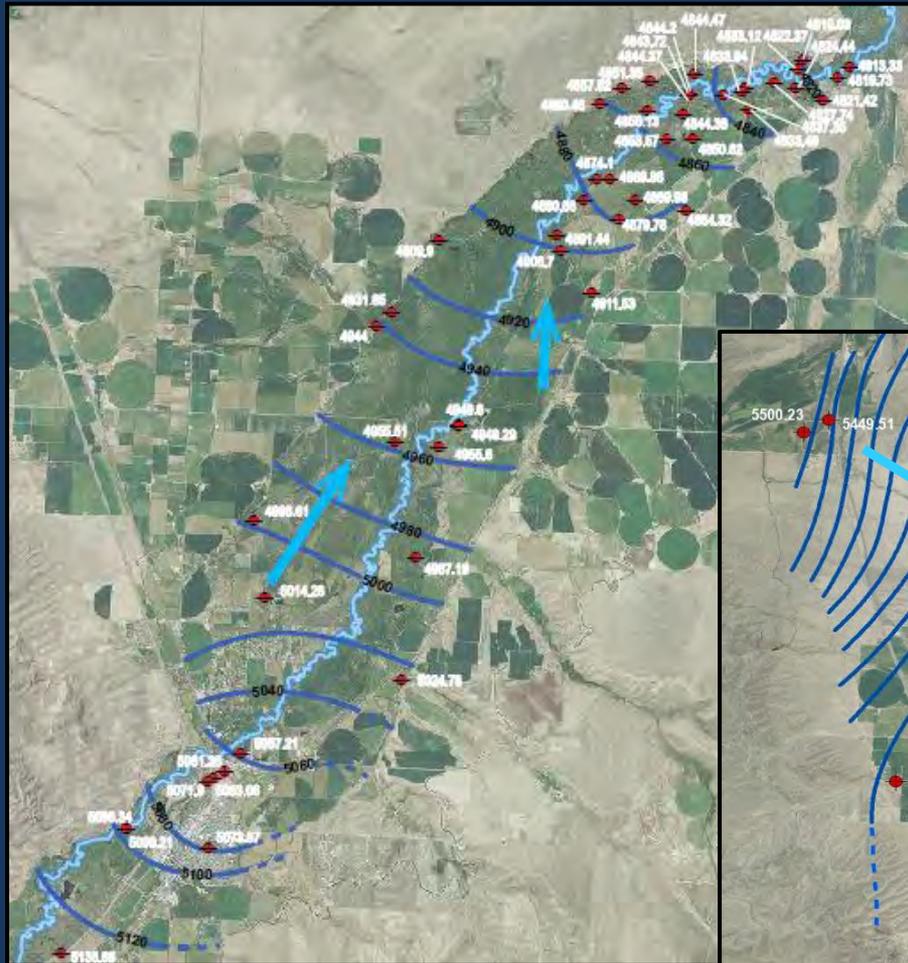


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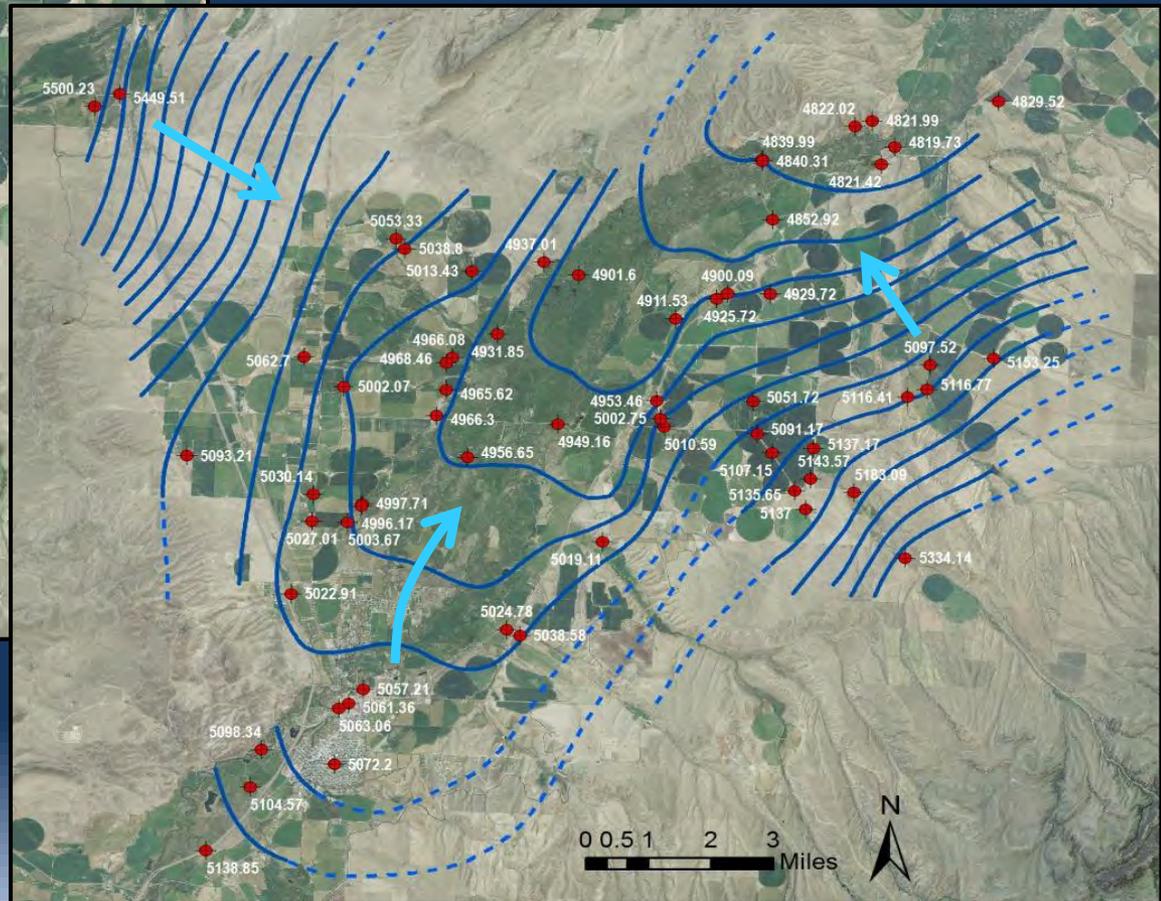


Groundwater Movement



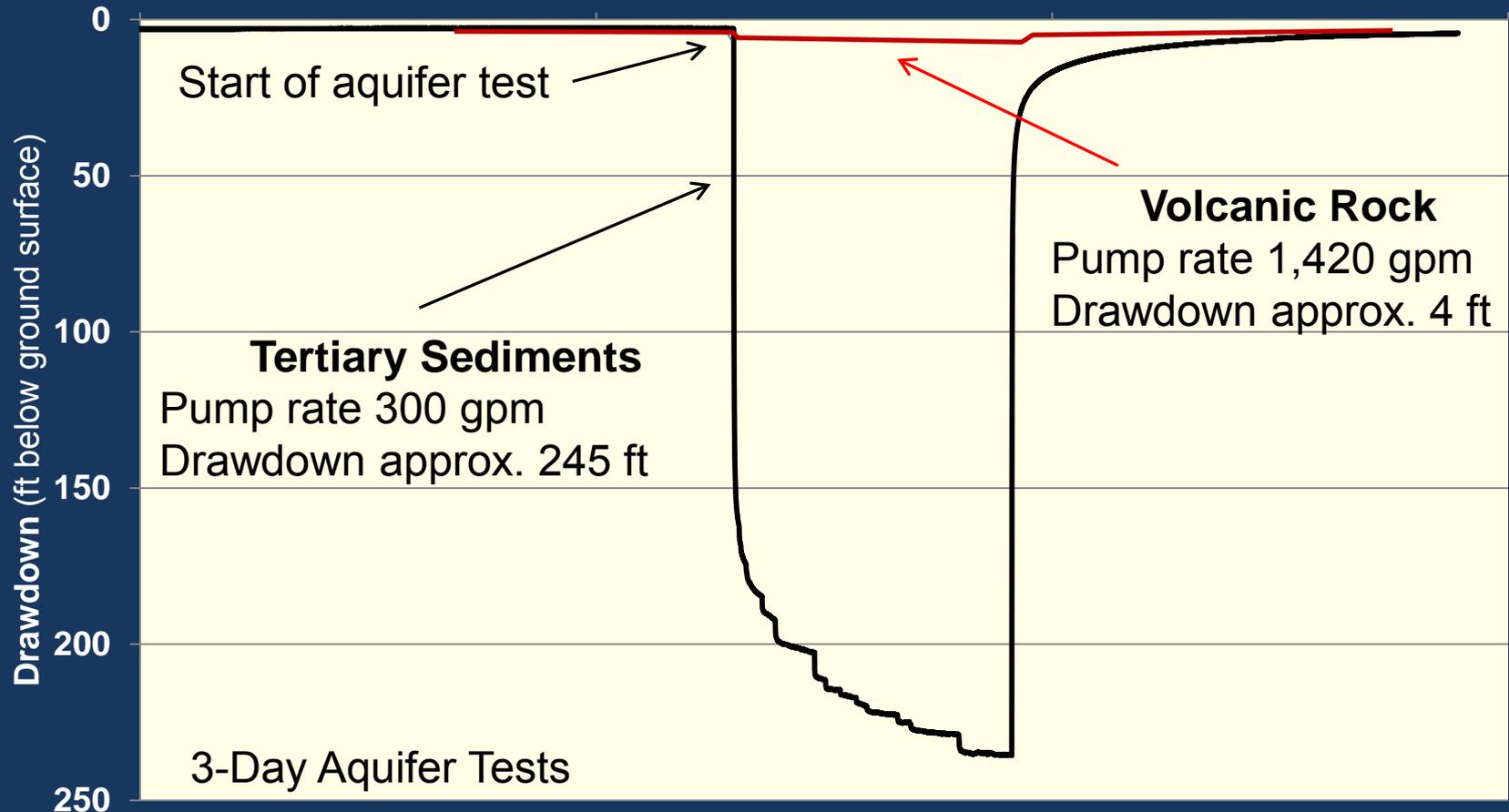
Alluvial Aquifer

Tertiary Aquifer

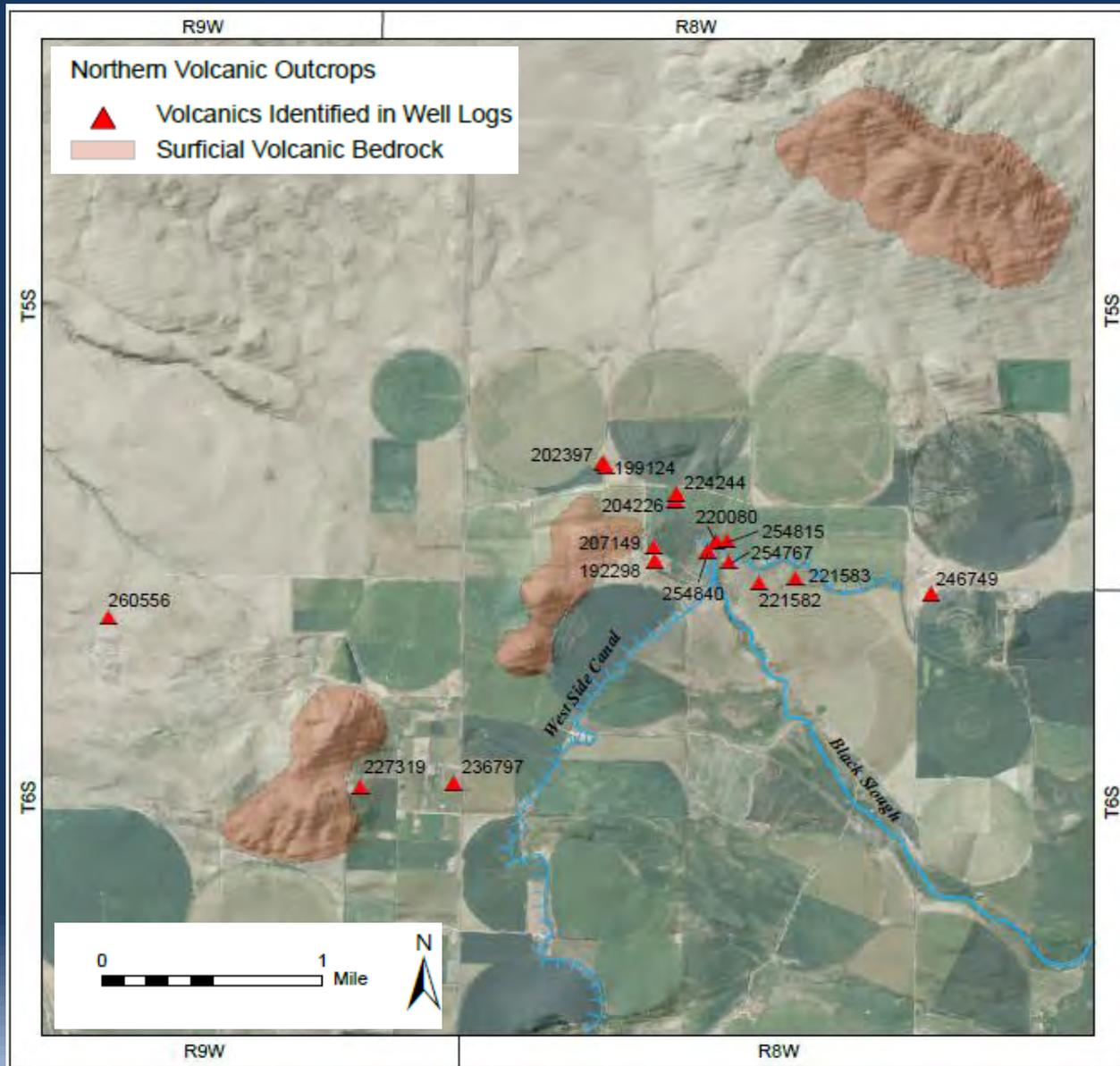


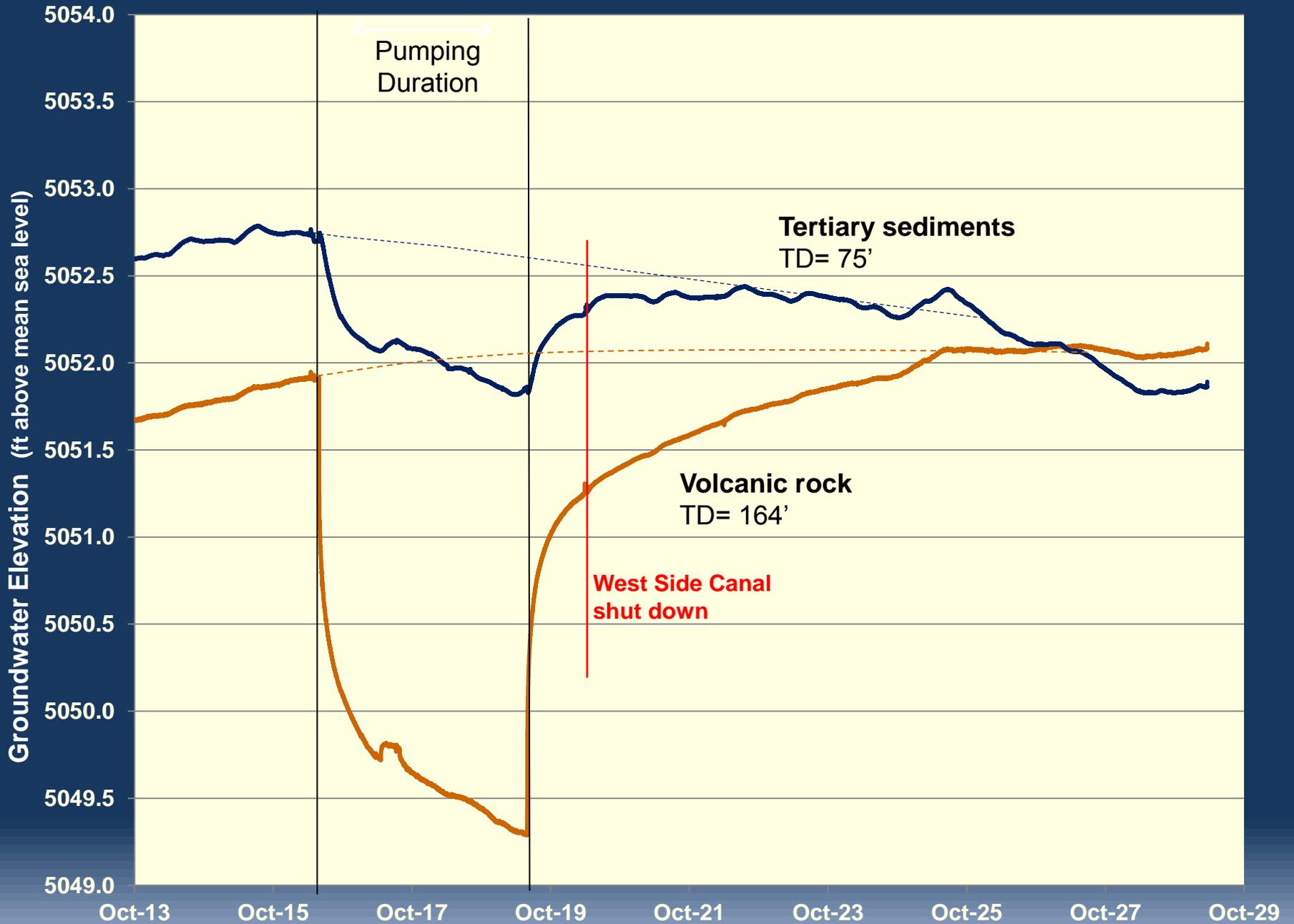
Drawdown

Volcanic rock and Tertiary sediment aquifers

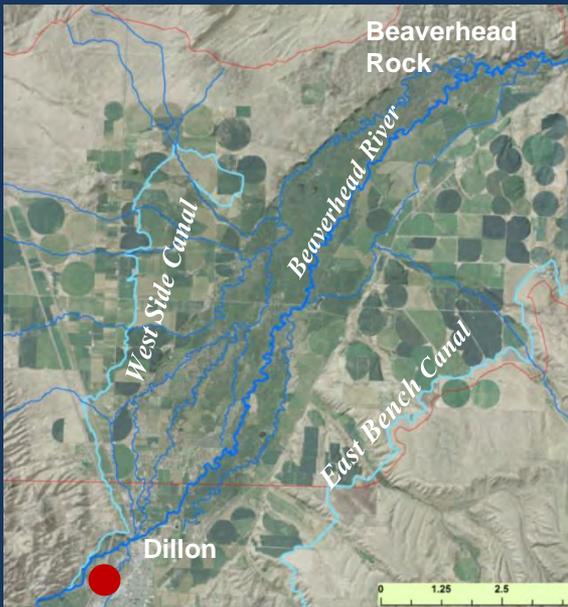


Volcanic Rock Aquifer





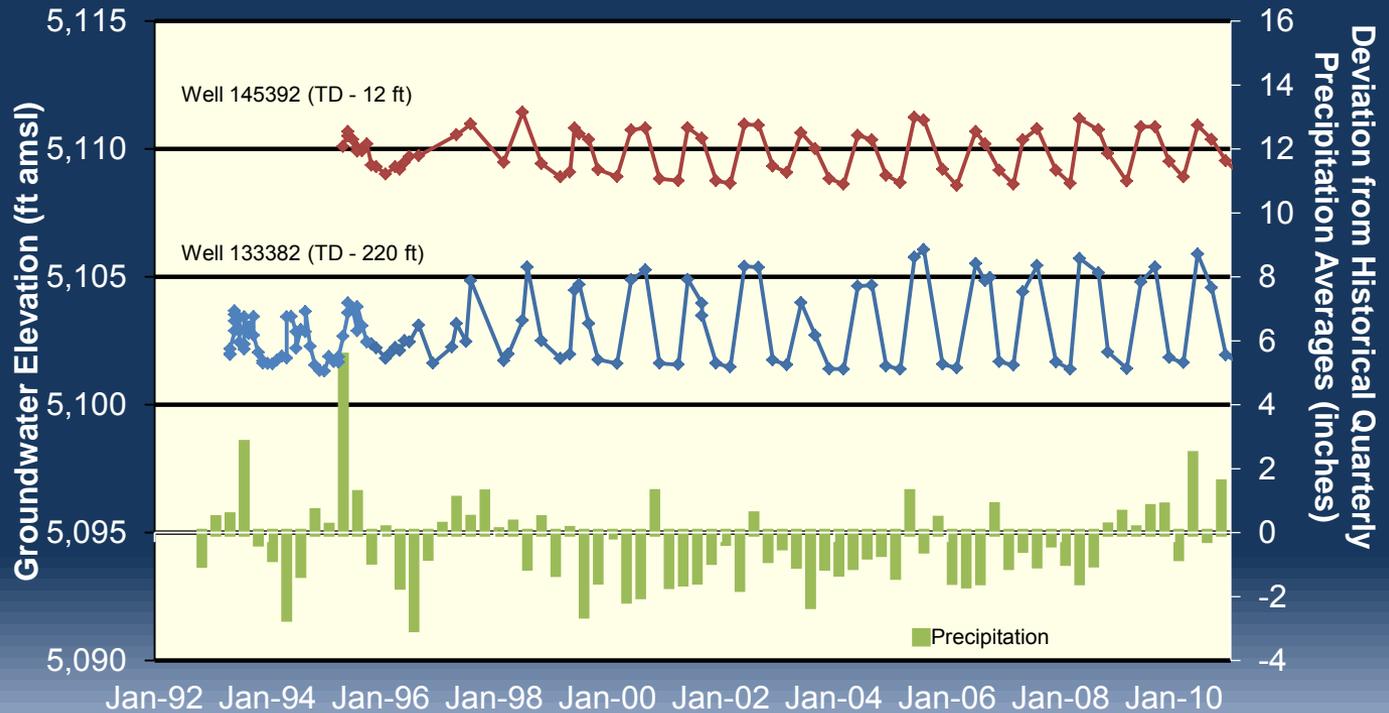
Groundwater Trends

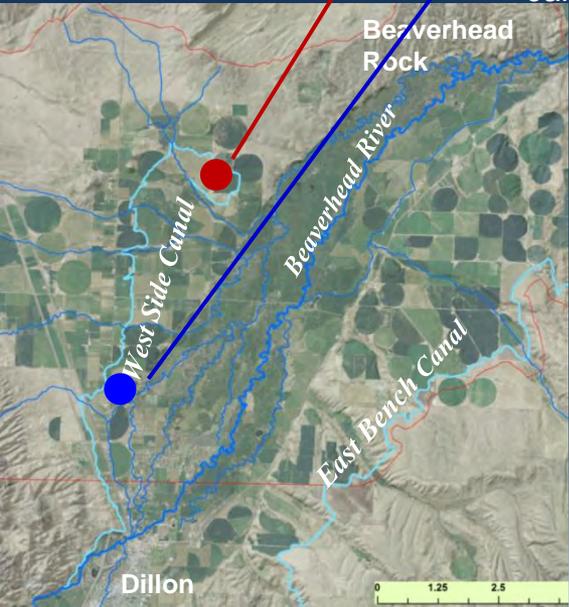
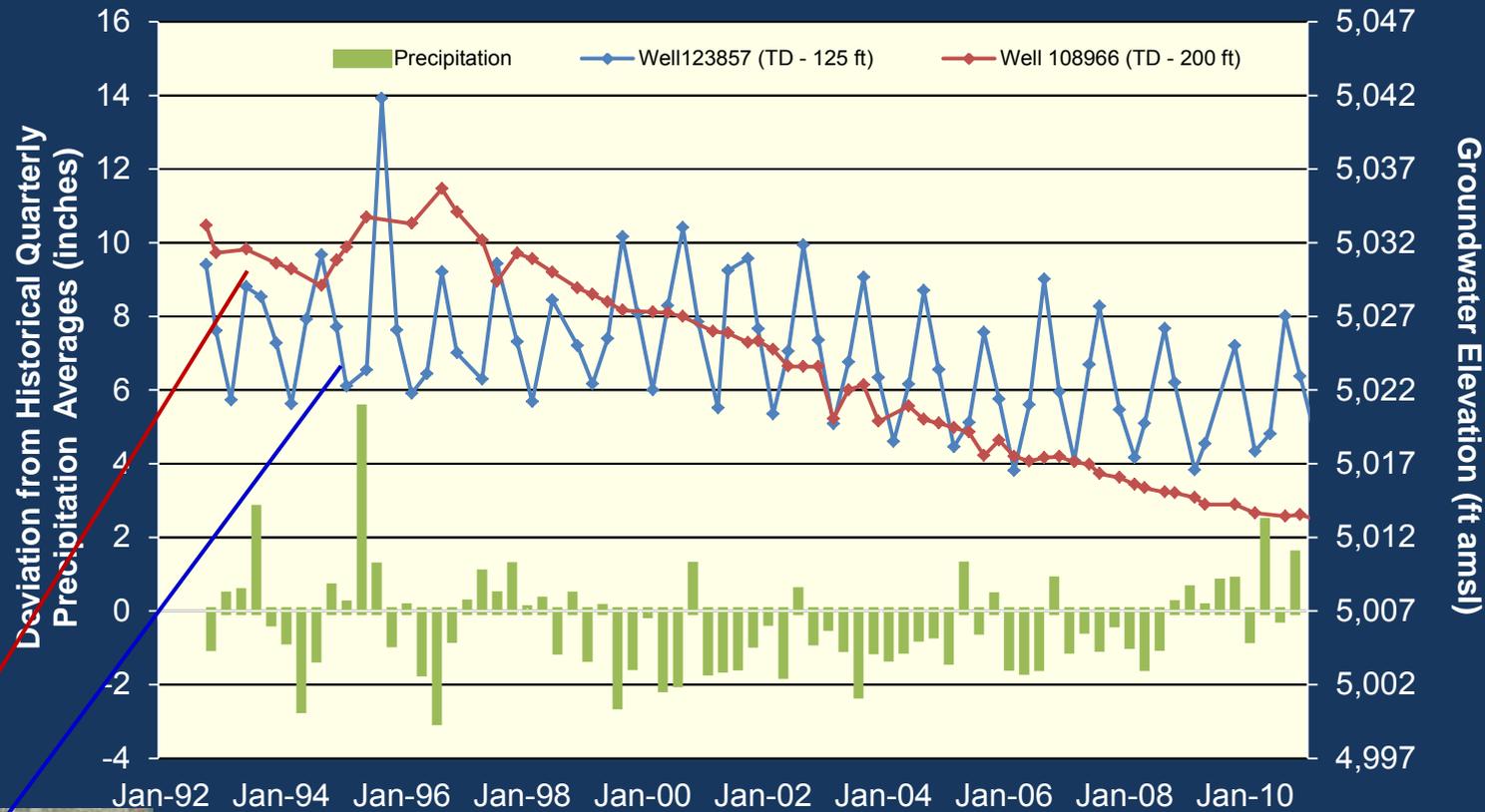


Floodplain



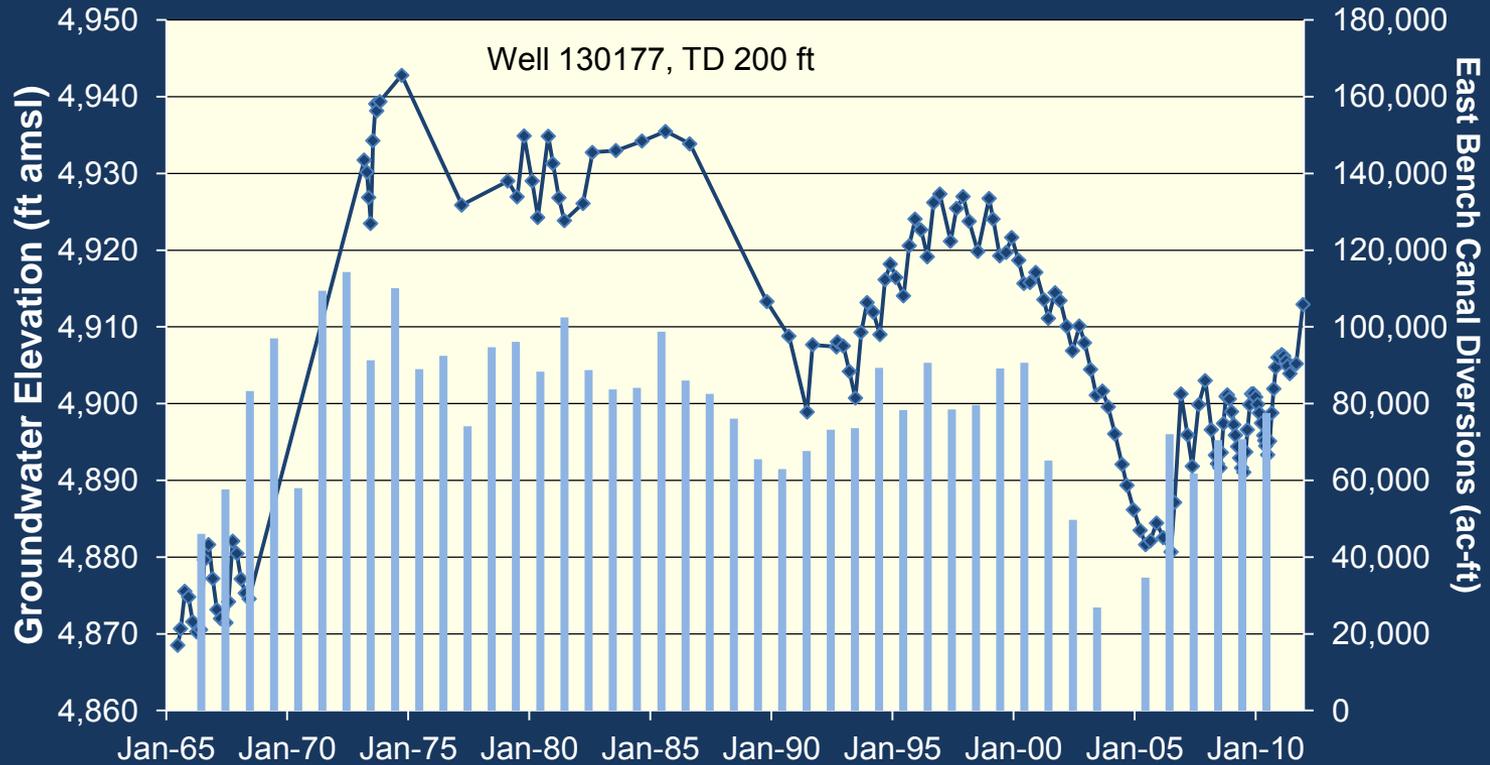
Near stream hydrographs





West Bench Tertiary Sediment Aquifer

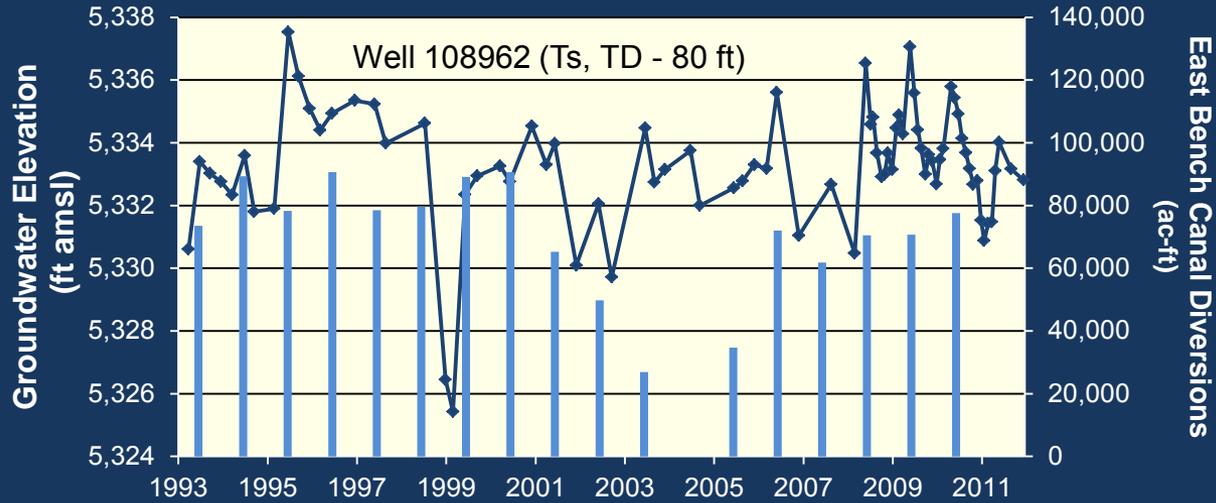
East Bench Canal and Tertiary Sediment Aquifer



Departure from Annual Average Precipitation

Tertiary Sediment Aquifer

Above canal



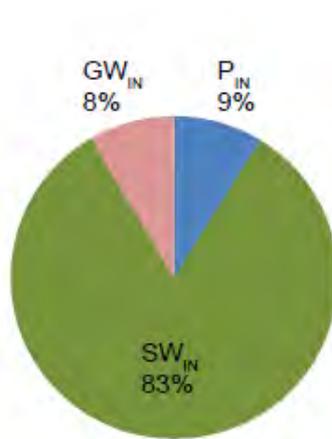
Below canal



Water Budget

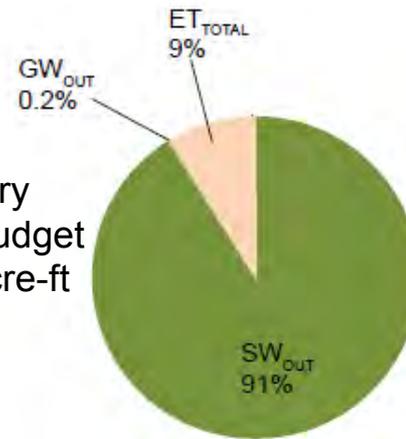
Annual Budget

475,000 acre-ft

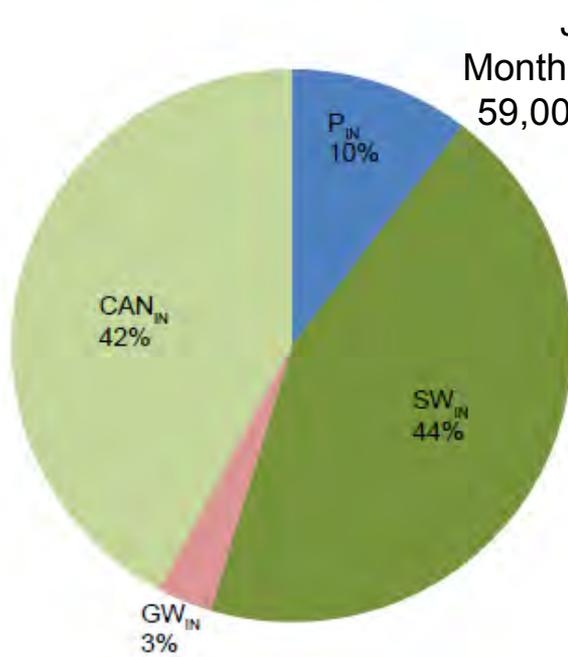


INFLOW Feb, 2010

February
Monthly Budget
20,000 acre-ft

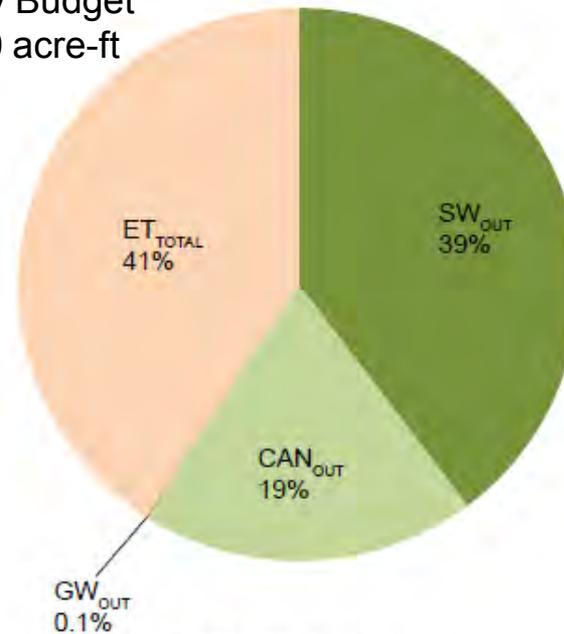


OUTFLOW Feb, 2010



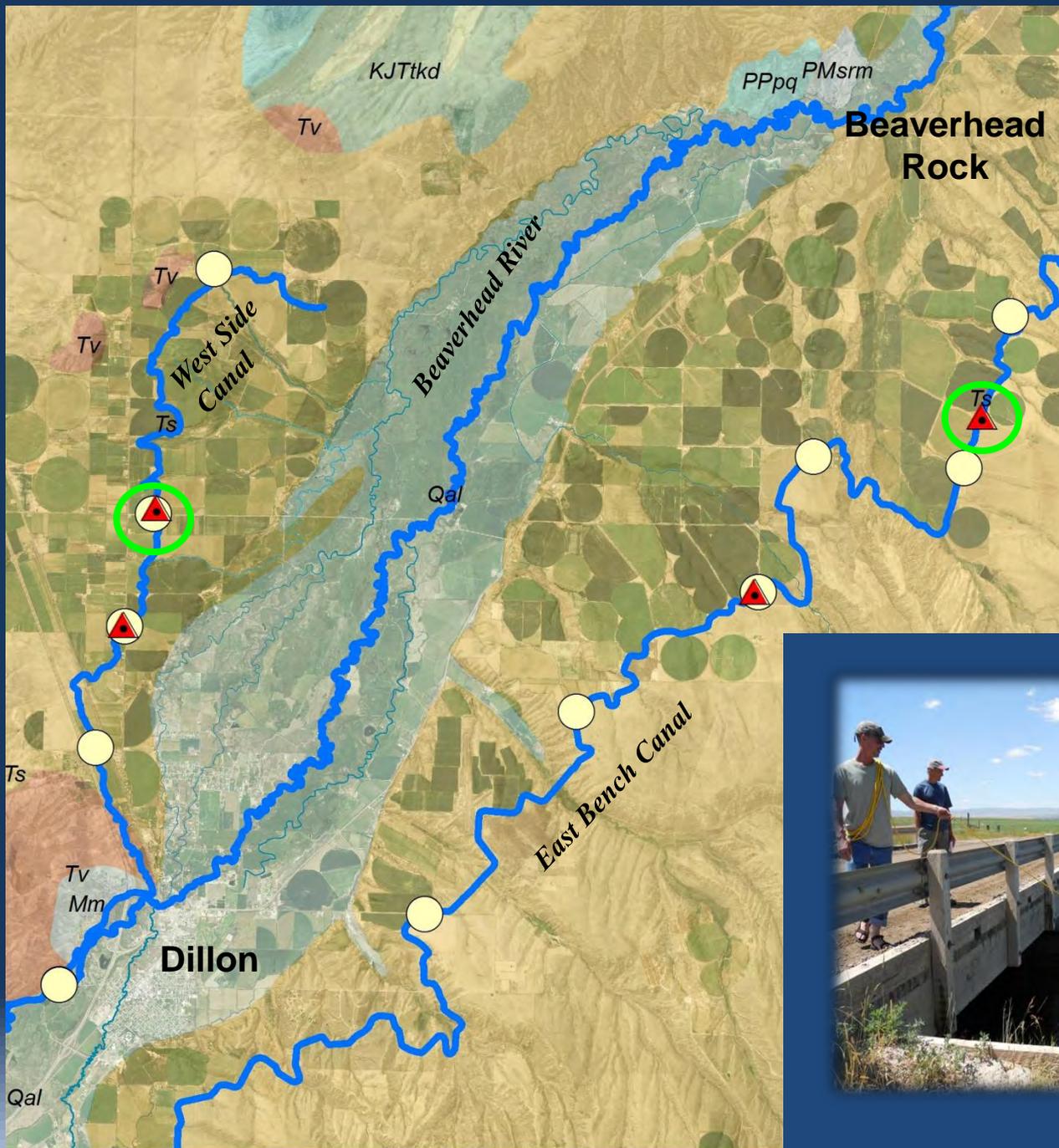
INFLOW July, 2010

July
Monthly Budget
59,000 acre-ft



OUTFLOW July, 2010

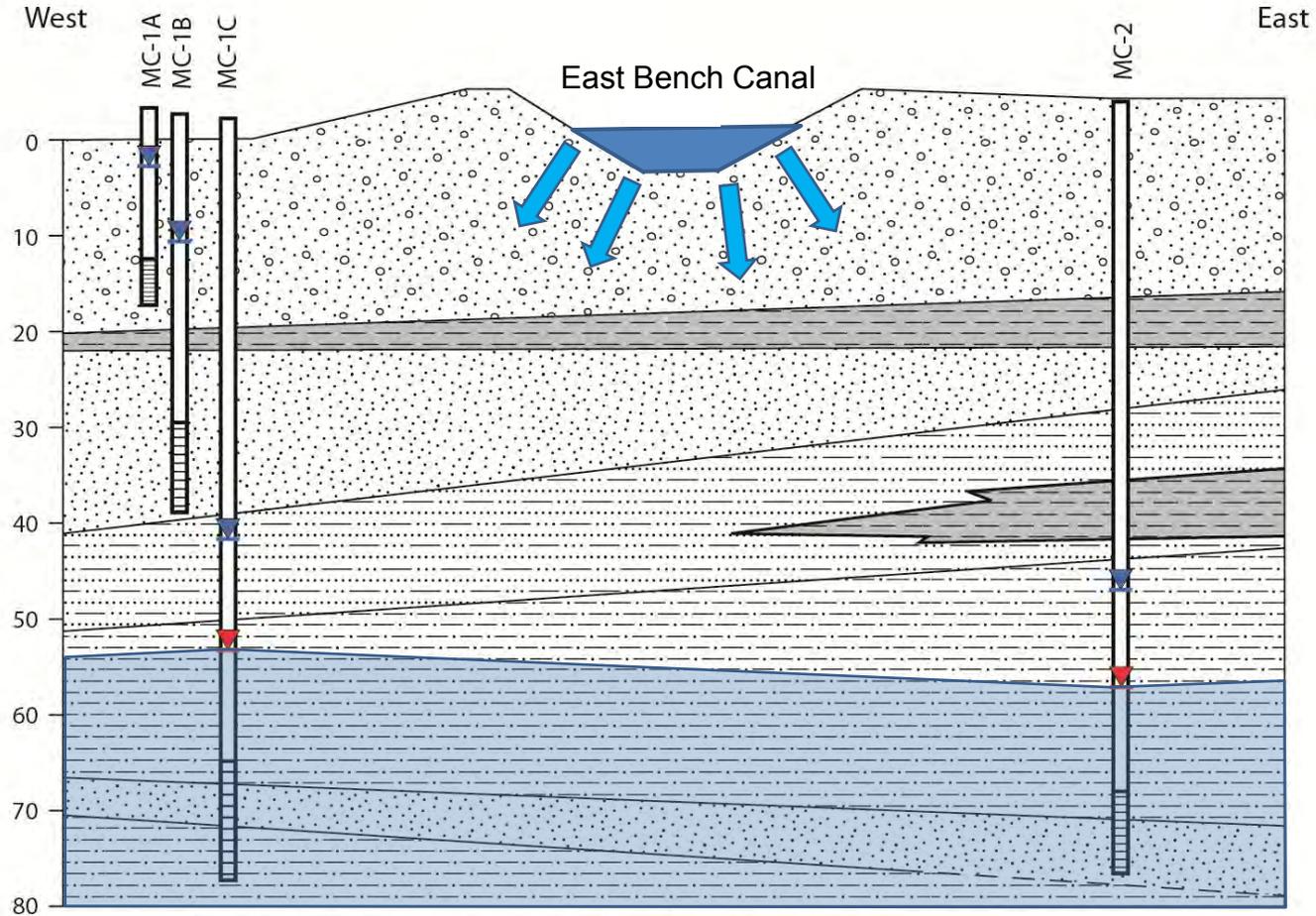
Canal Seepage



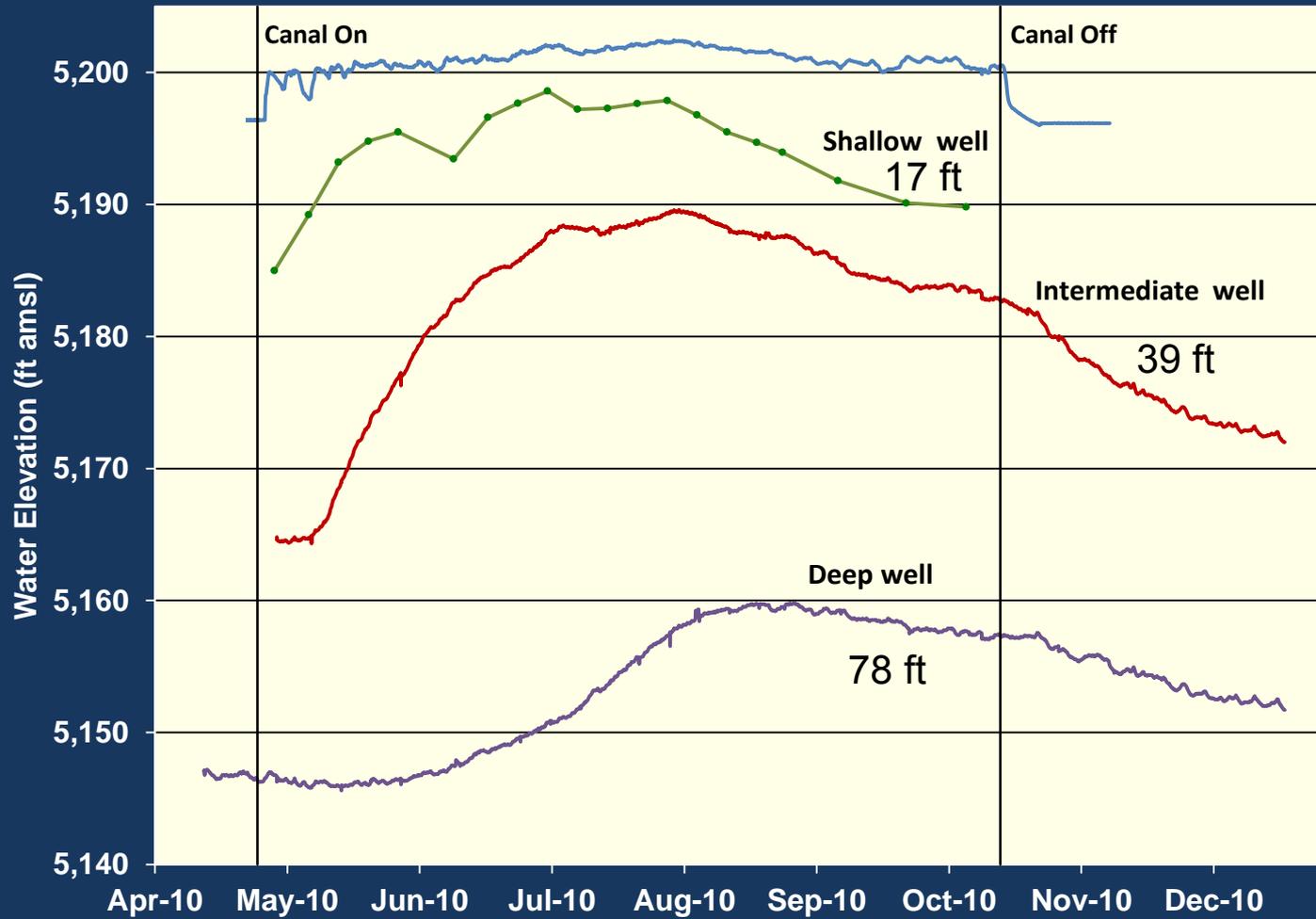
- West Side Canal
1.2 cfs/mile
- East Bench Canal
2.2 cfs/mile



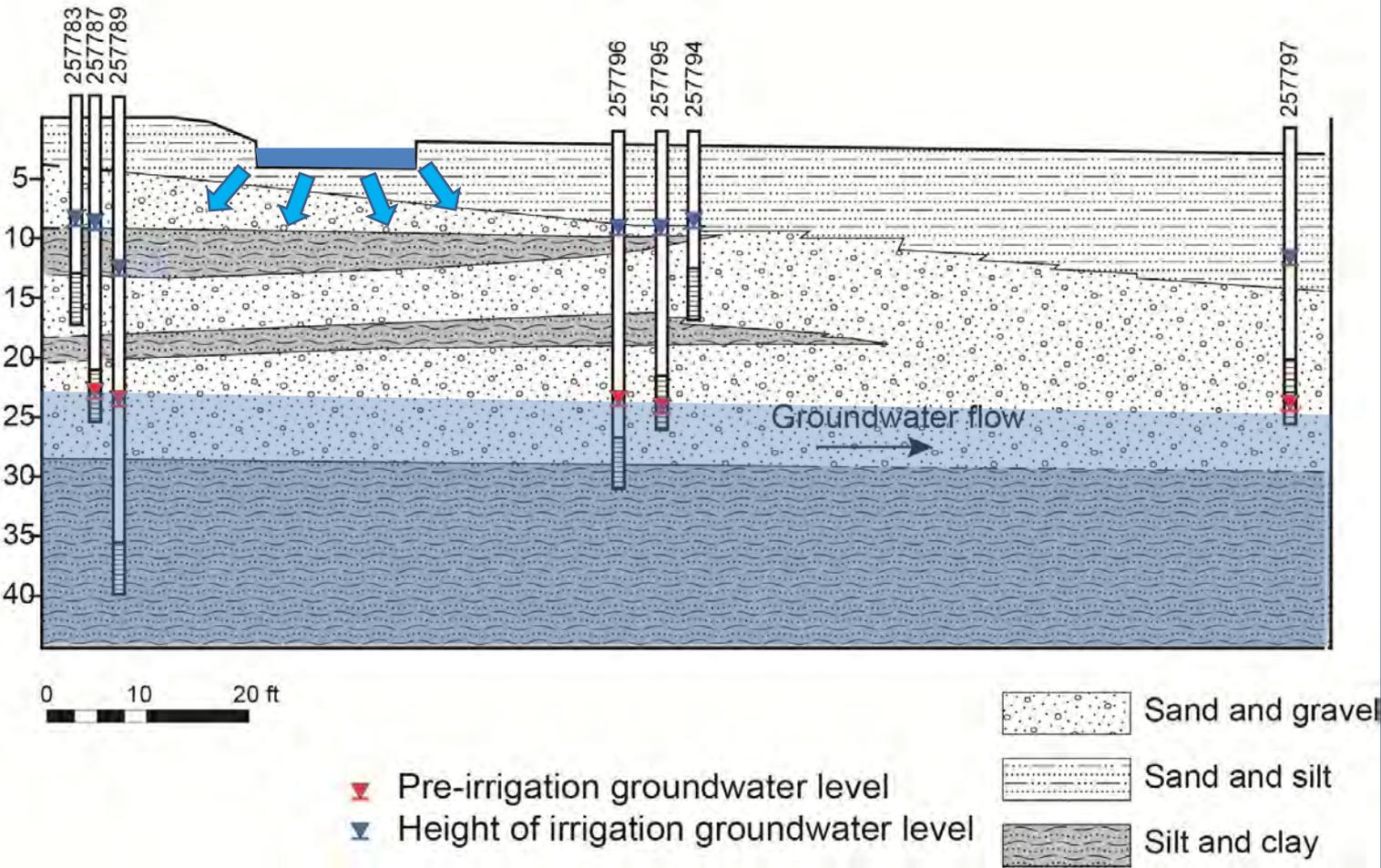
Canal Seepage



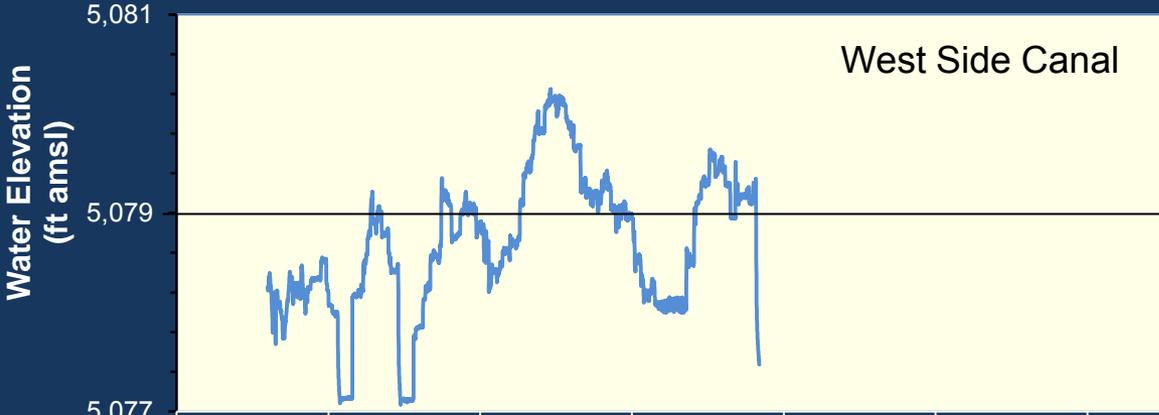
East Bench Canal



West Side Canal



Hydrographs

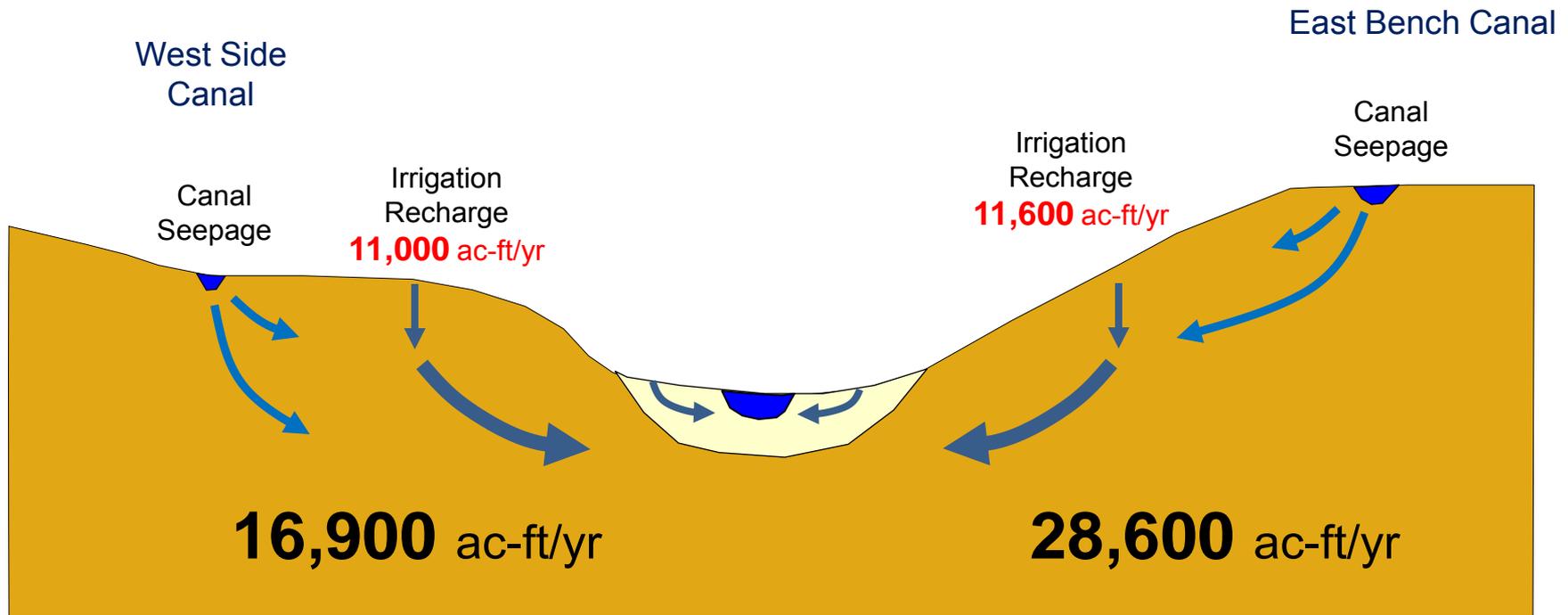


Groundwater Recharge from Irrigation and Canal Seepage

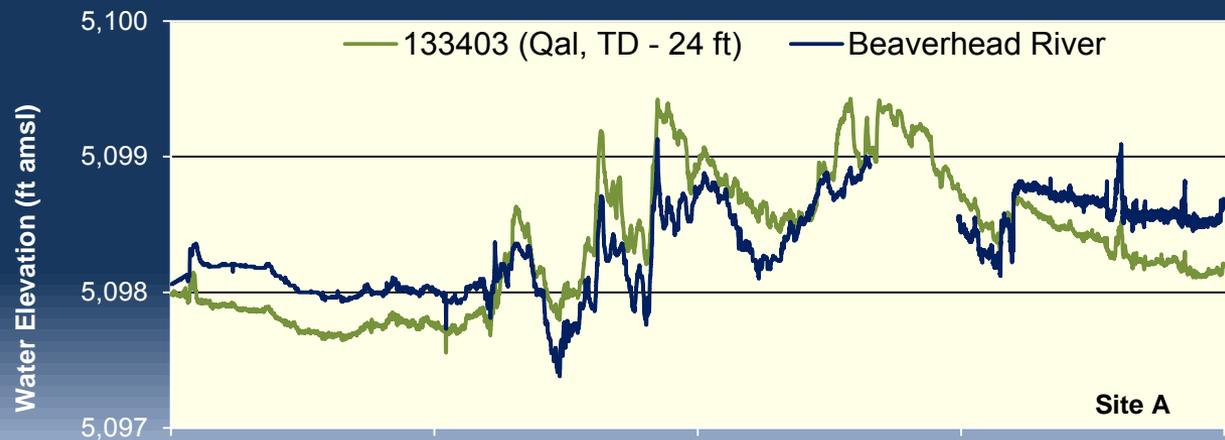
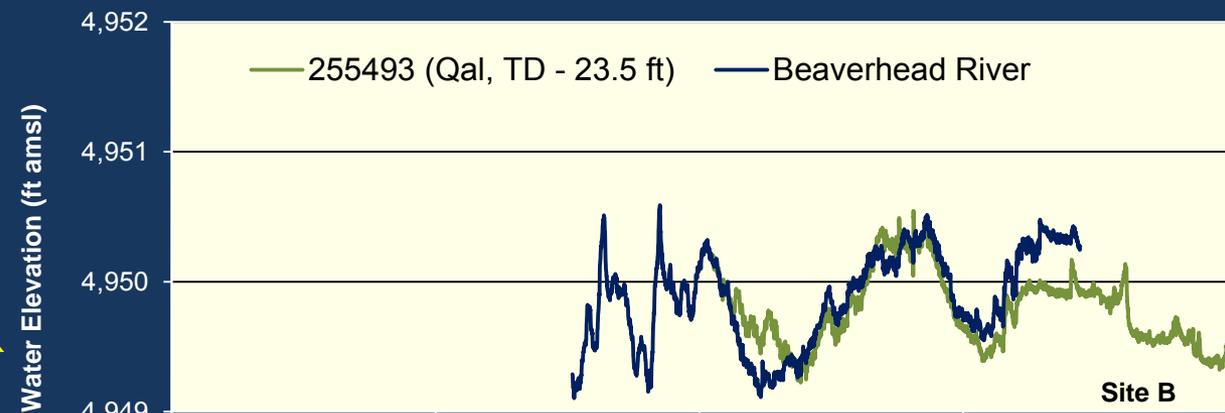
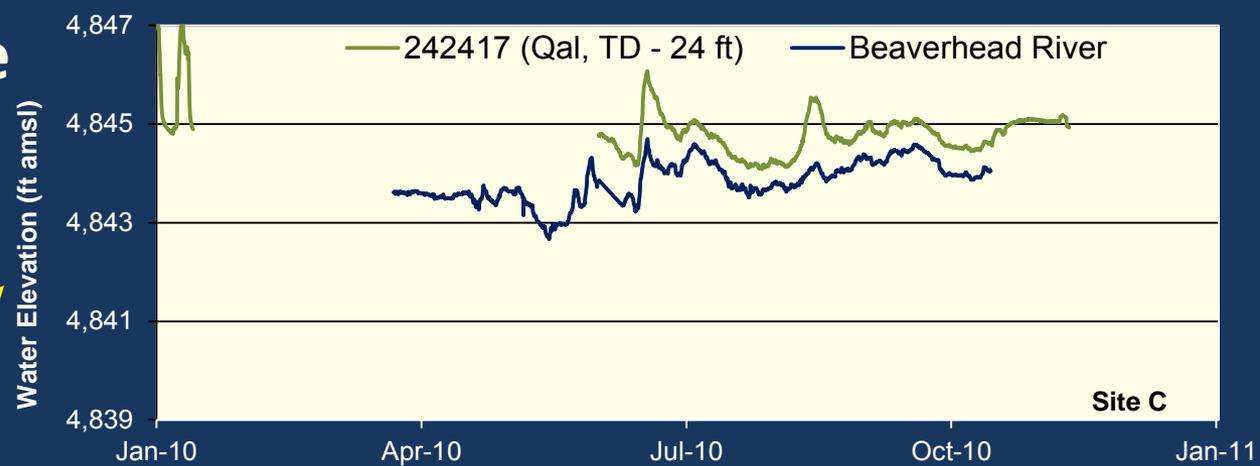
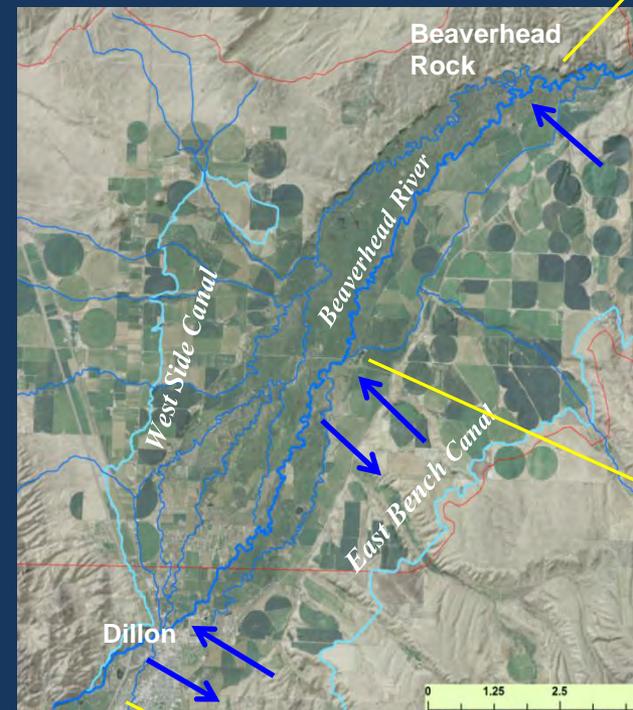
2010

Seepage Loss
5,900 ac-ft/yr

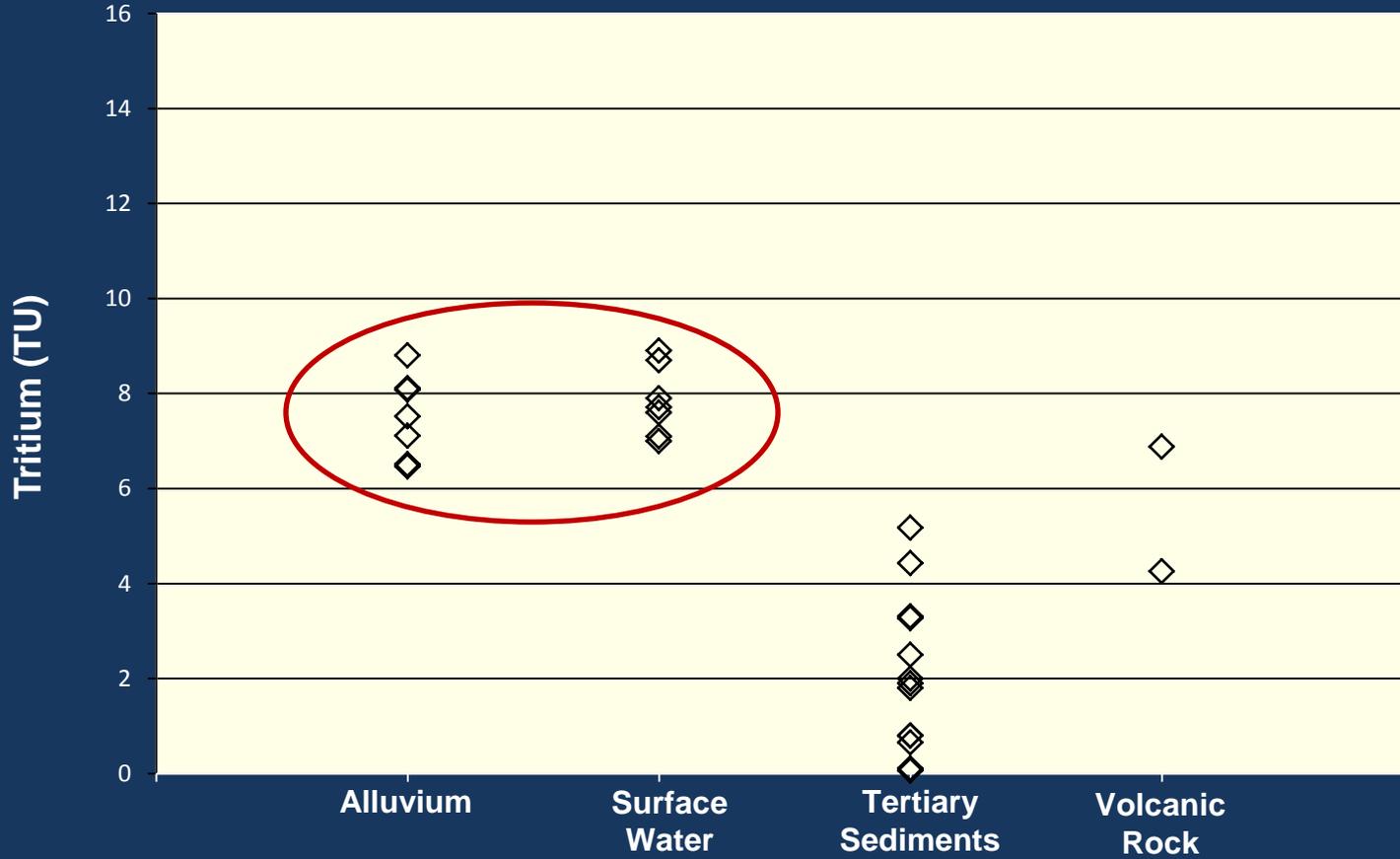
Seepage Loss
17,000 ac-ft/yr



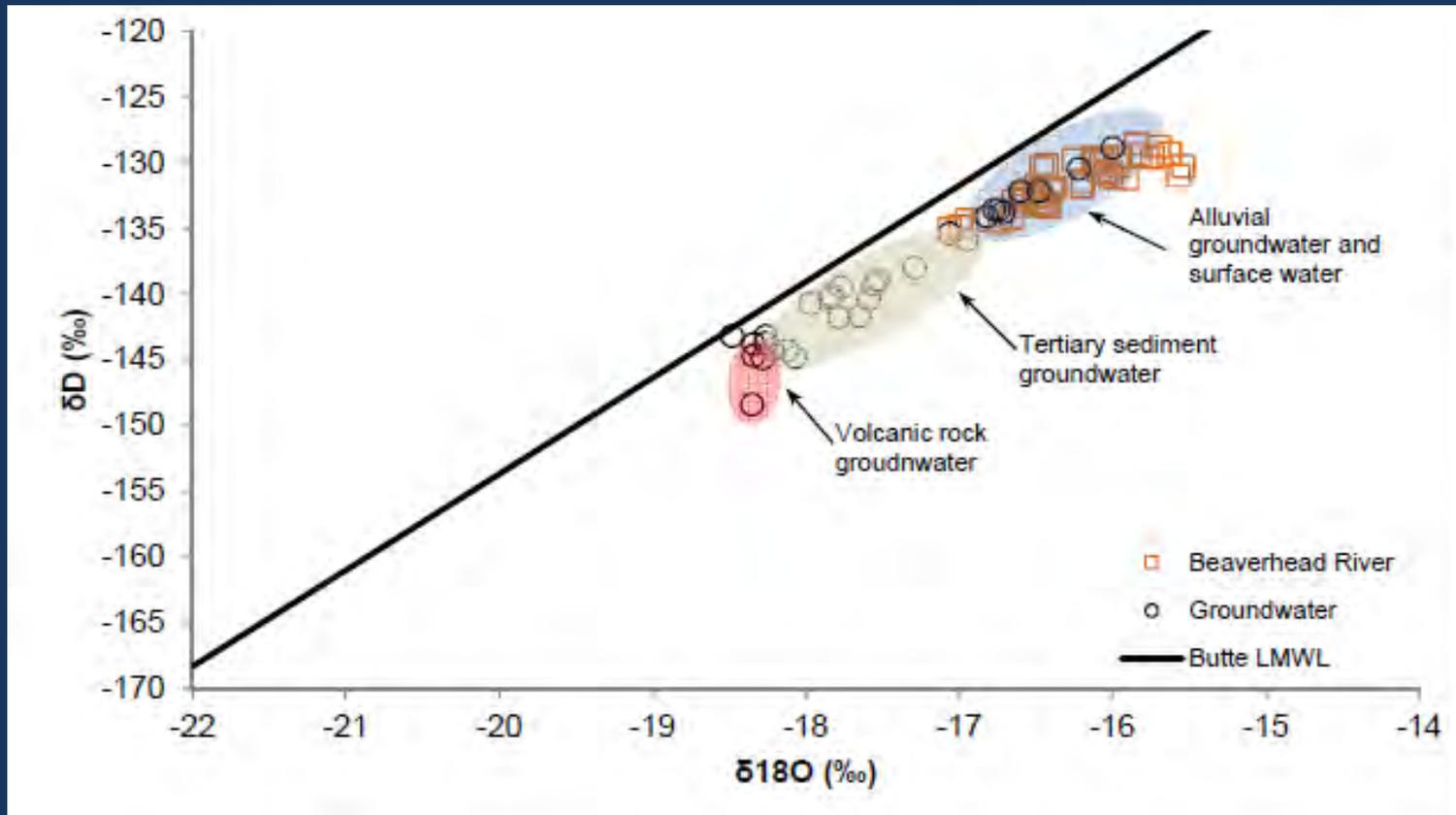
Groundwater-Surface Water Interaction



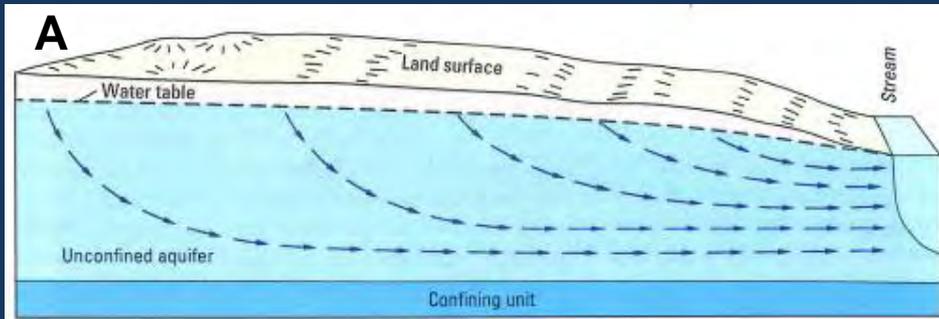
Groundwater Age Dating - relative



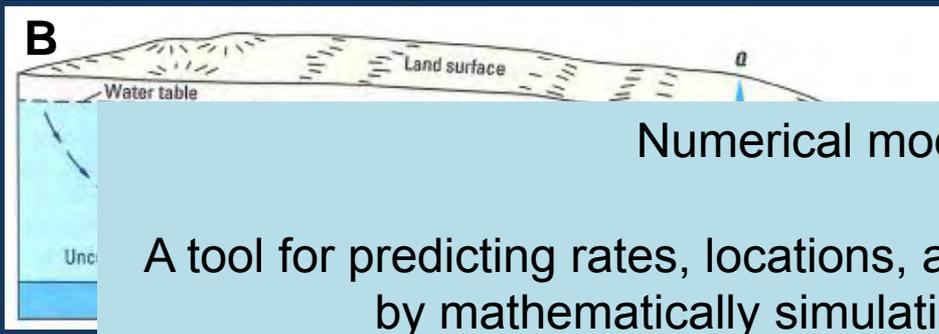
Isotopic Composition of Groundwater and Surface Water



Stream Depletion

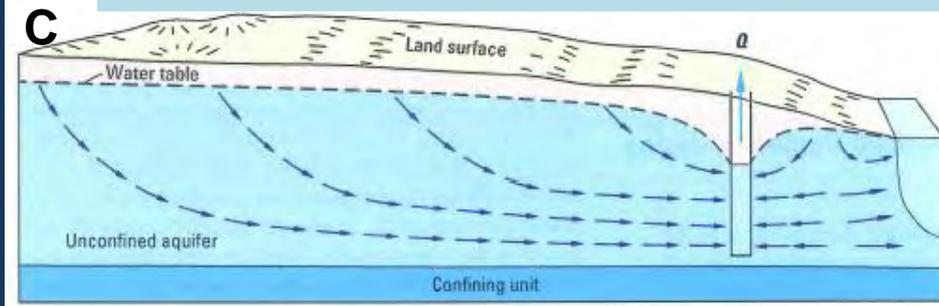


Natural conditions

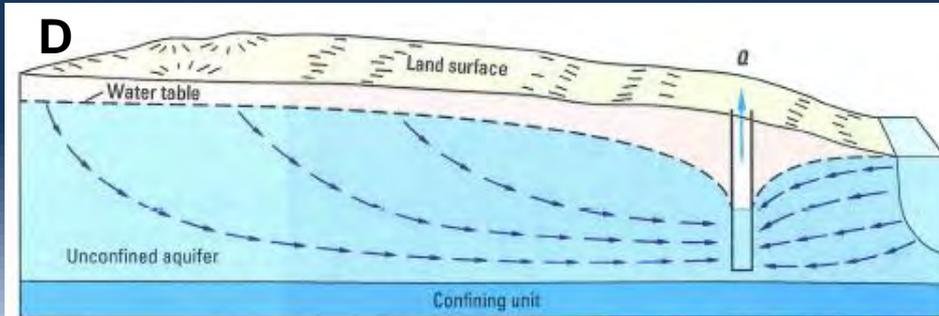


Numerical modeling:

A tool for predicting rates, locations, and timing of stream depletion by mathematically simulating the flow system



Well begins to capture groundwater that would otherwise discharge to the stream; baseflow decreases



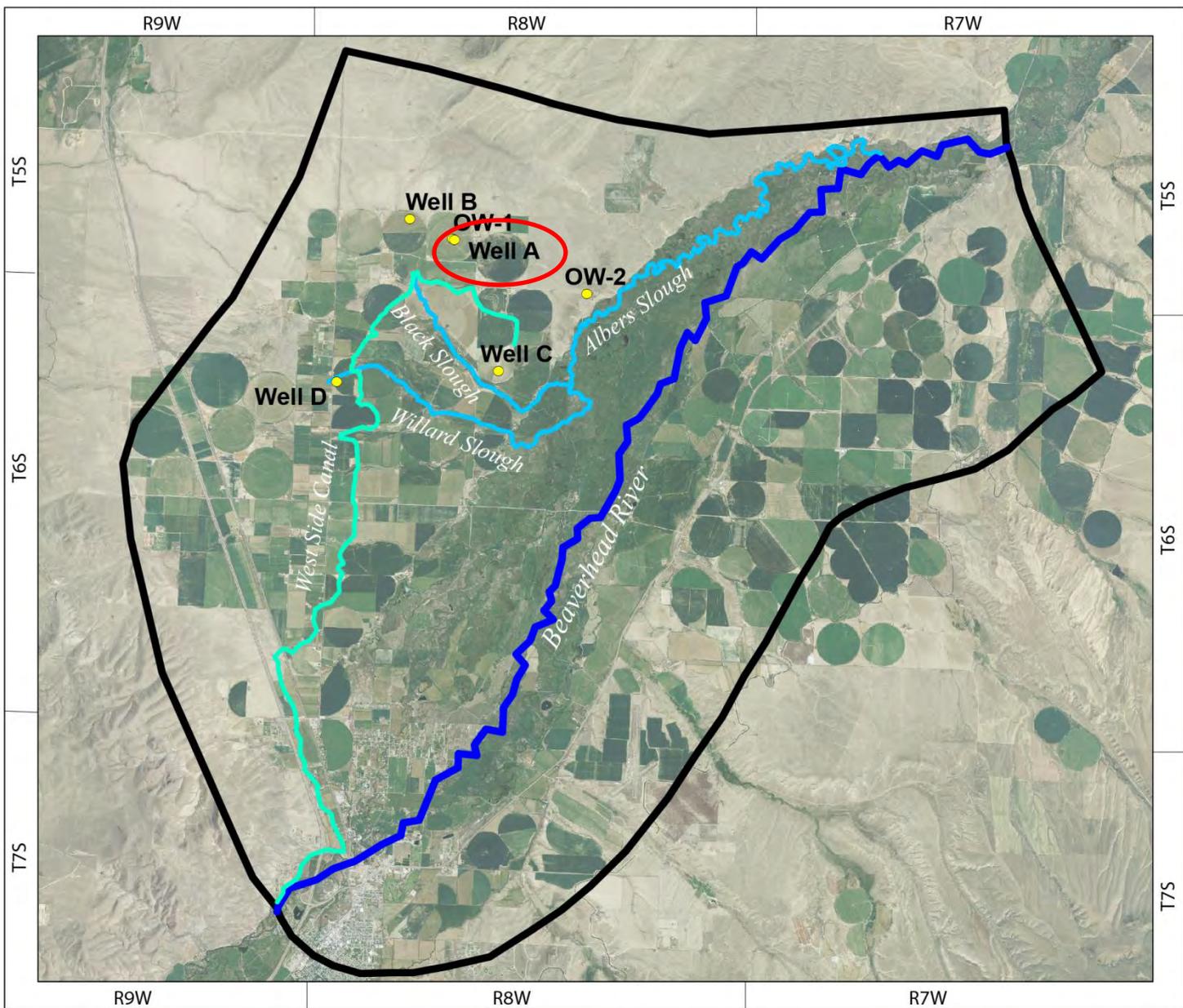
Pumping rate may be large enough to cause water to flow from the stream to the aquifer

What is a groundwater flow model?

- A numerical representation of an aquifer system
- A numerical model mathematically approximates the system
- Field data calibrate and reduce uncertainty of model results

Objectives

- Develop predictive tools
 - Evaluate effects of groundwater development on stream flow
 - *Difficult to measure in stream*
 - Evaluate effects of canal leakage on stream impacts
- Improve management of the aquifer system

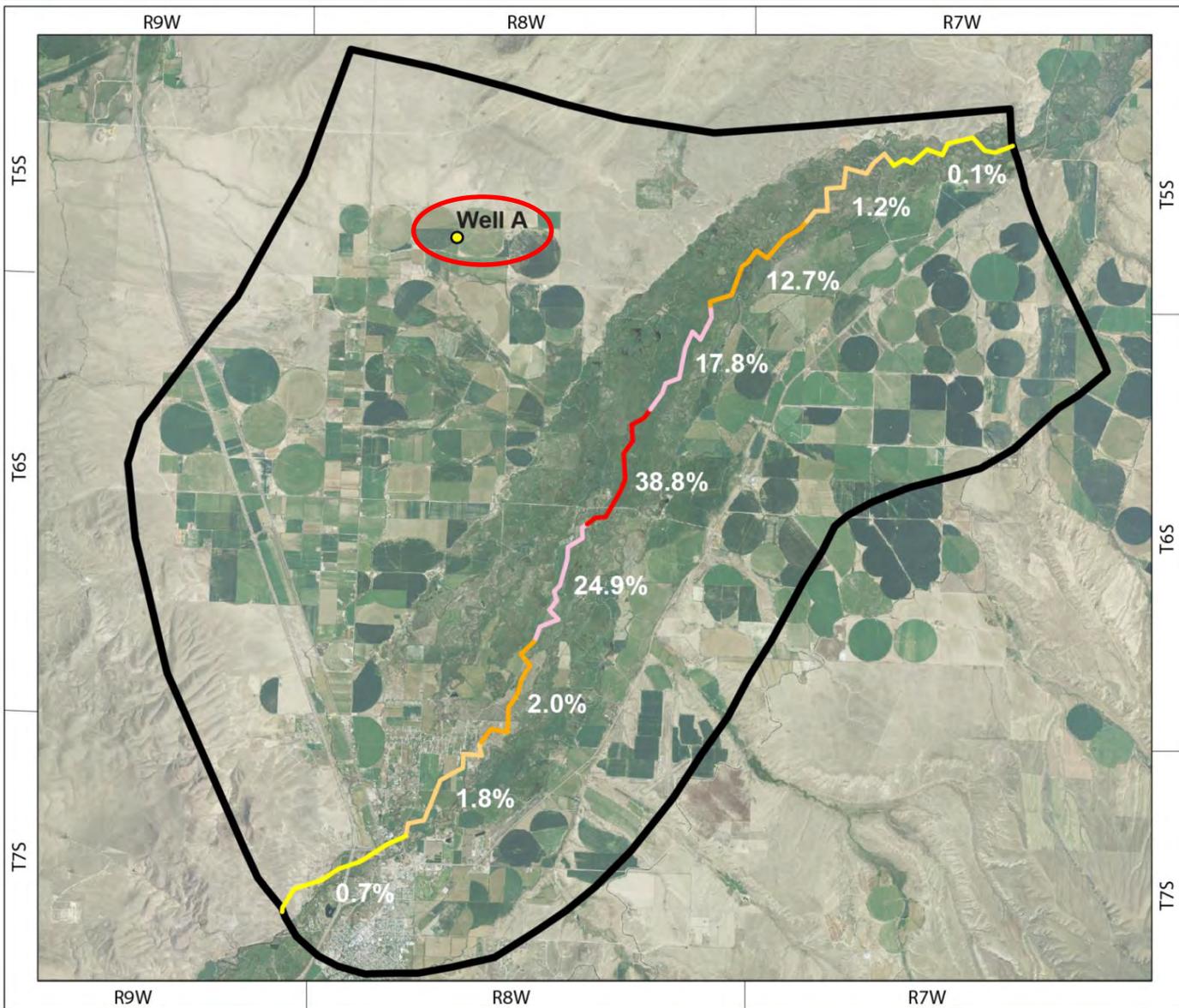


Explanation

- Well locations
- Model Border





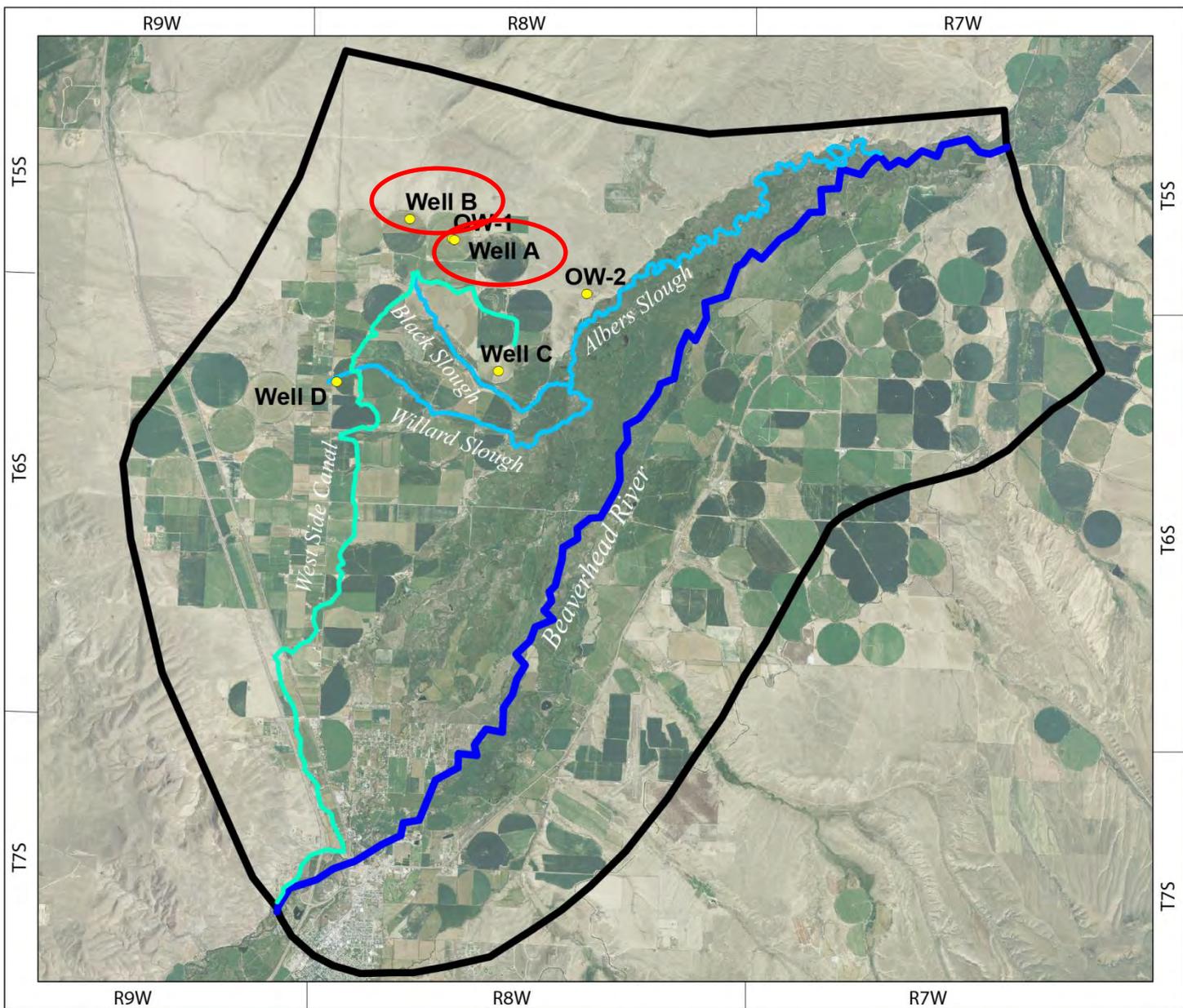


Explanation

- Well locations
- Model Border

Distribution of the decrease in groundwater discharge to river



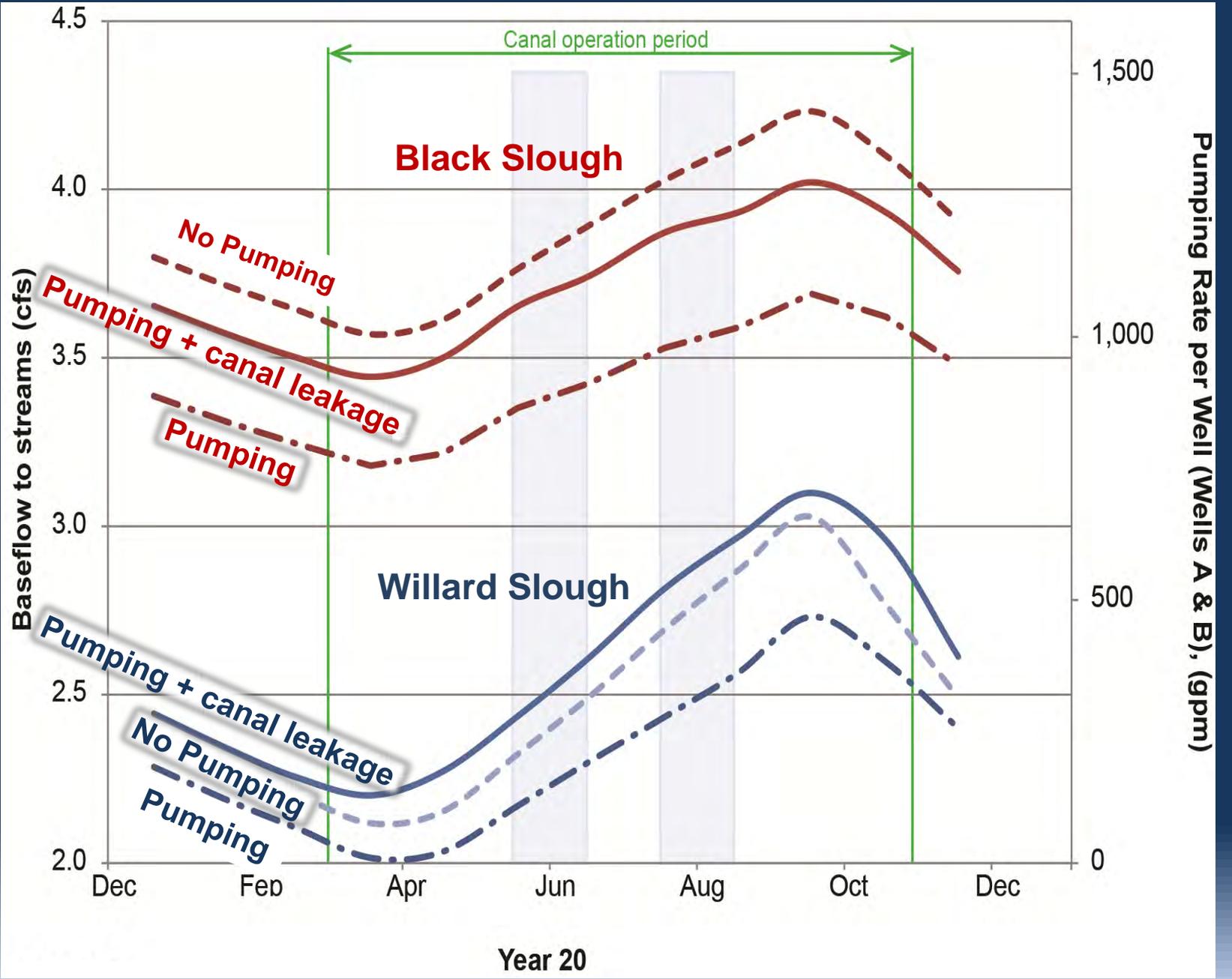


Explanation

- Well locations
- ▭ Model Border



Offsetting stream depletion with additional canal seepage



Limitations

- Scale (temporal and spatial)
- Parameter uncertainty
- Short-term data record

Project Summary

- The volcanic rock aquifer is a good producer.
- Groundwater levels fluctuate seasonally. Long-term groundwater trends primarily responded to climate, irrigation recharge, and canal seepage losses.
- Irrigation and surface water dominate inflows while surface water and evapotranspiration dominate water budget outflows.
- Irrigation water and canal seepage are a significant source of groundwater recharge.
- Groundwater and surface water interact along the Beaverhead River.
- Numerical modeling illustrated stream depletion and that it could be offset with additional groundwater recharge.

Applications of Results

- Numerical modeling, part of an aquifer management plan
 - Use as a tool for predicting pumping and canal recharge scenarios
 - Apply other tools in certain circumstances
 - Incorporate long-term and/or site-specific data
- Consider canal leakage as recharge in water management planning
- Consider the timing of stream depletion responses from pumping when designing a mitigation plan

Recommendations

- Better characterize the extent of the volcanic rock aquifer
- Collect long-term groundwater and surface water monitoring data