

# Investigating Groundwater and Surface-water Interaction Using Stable Water Isotopes in the Bitterroot Valley, Montana

## Ground-Water Investigation Program



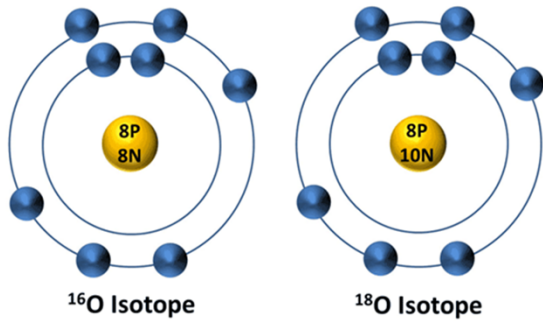
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Montana Bureau of Mines and Geology



**2017 Water Symposium**  
**Bitterroot College**  
**Hamilton, MT**  
**April 28, 2017**

# Isotopes of Oxygen and Hydrogen

## Oxygen Isotopes



## Hydrogen Isotopes

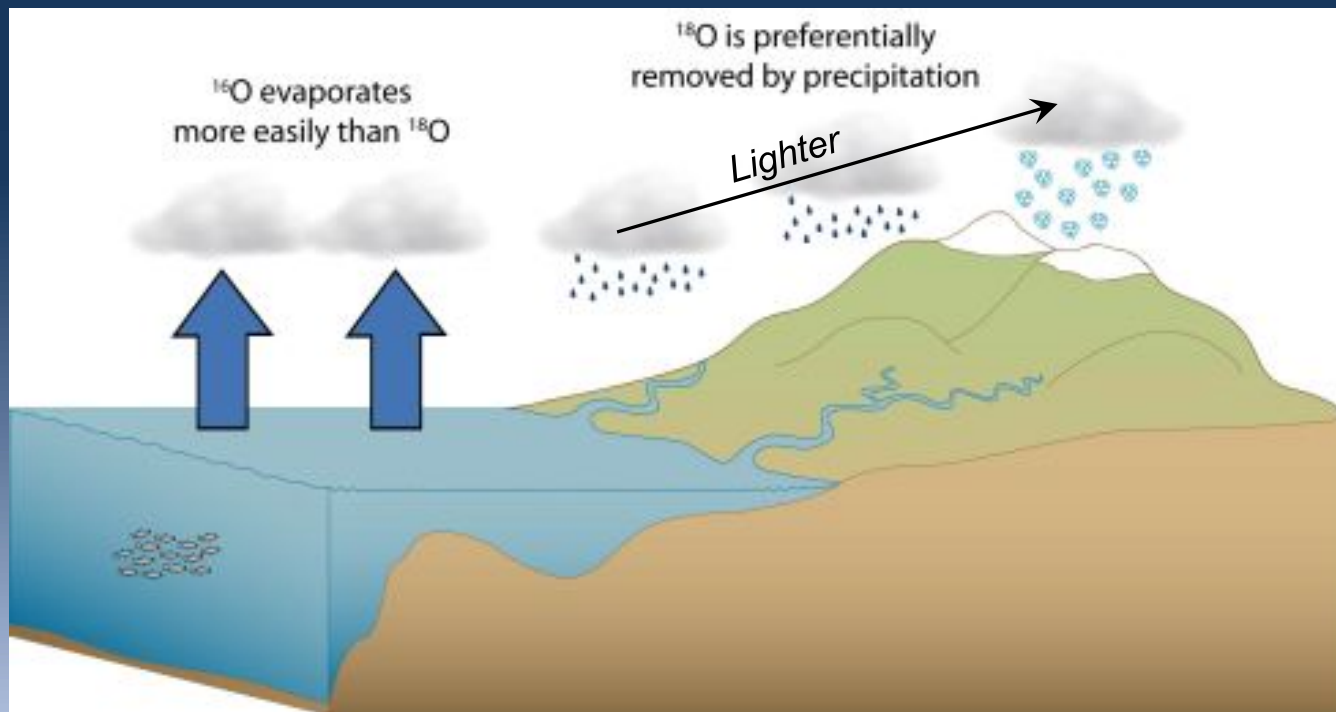
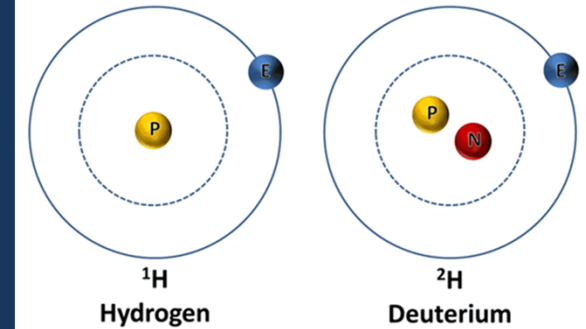
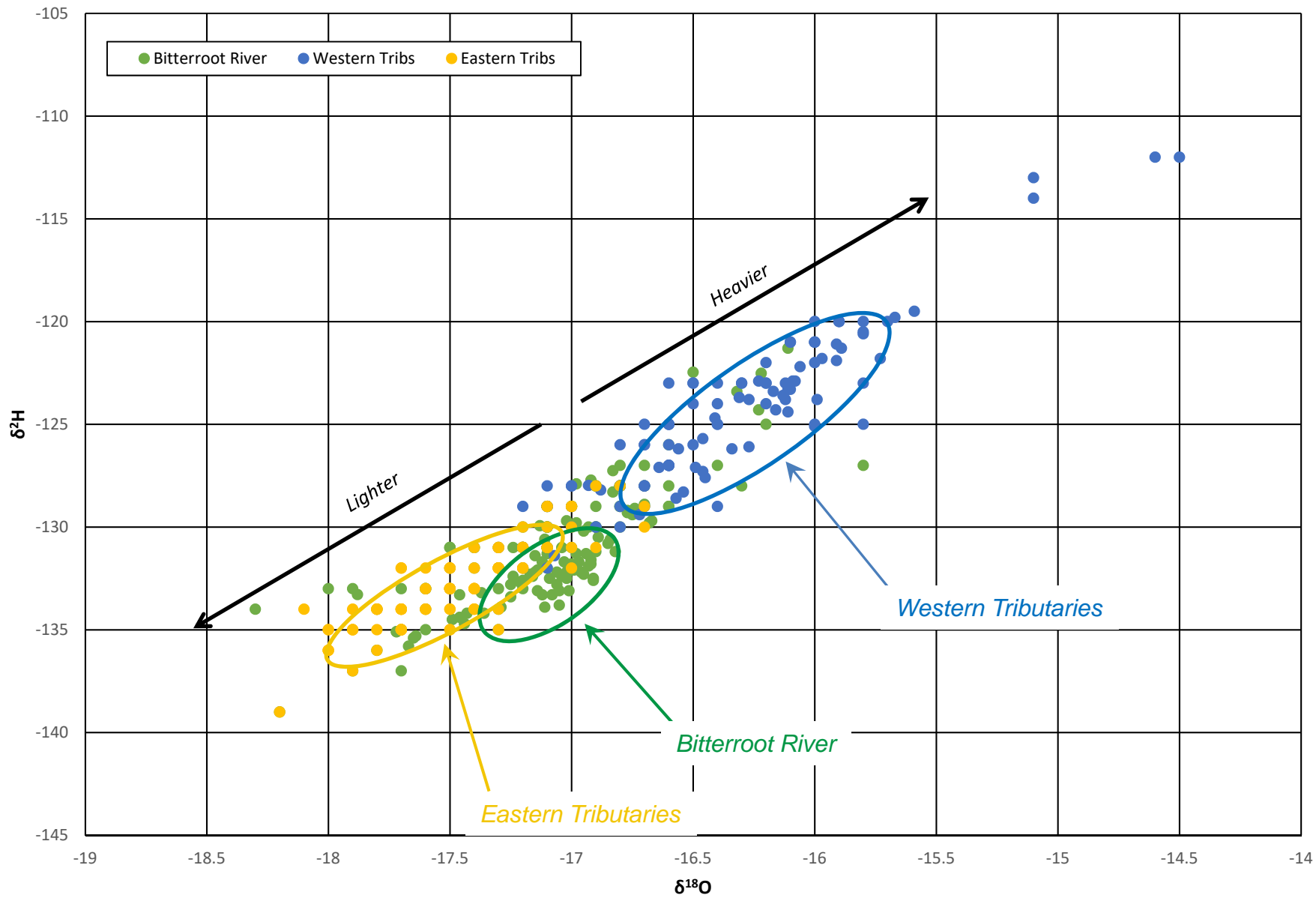
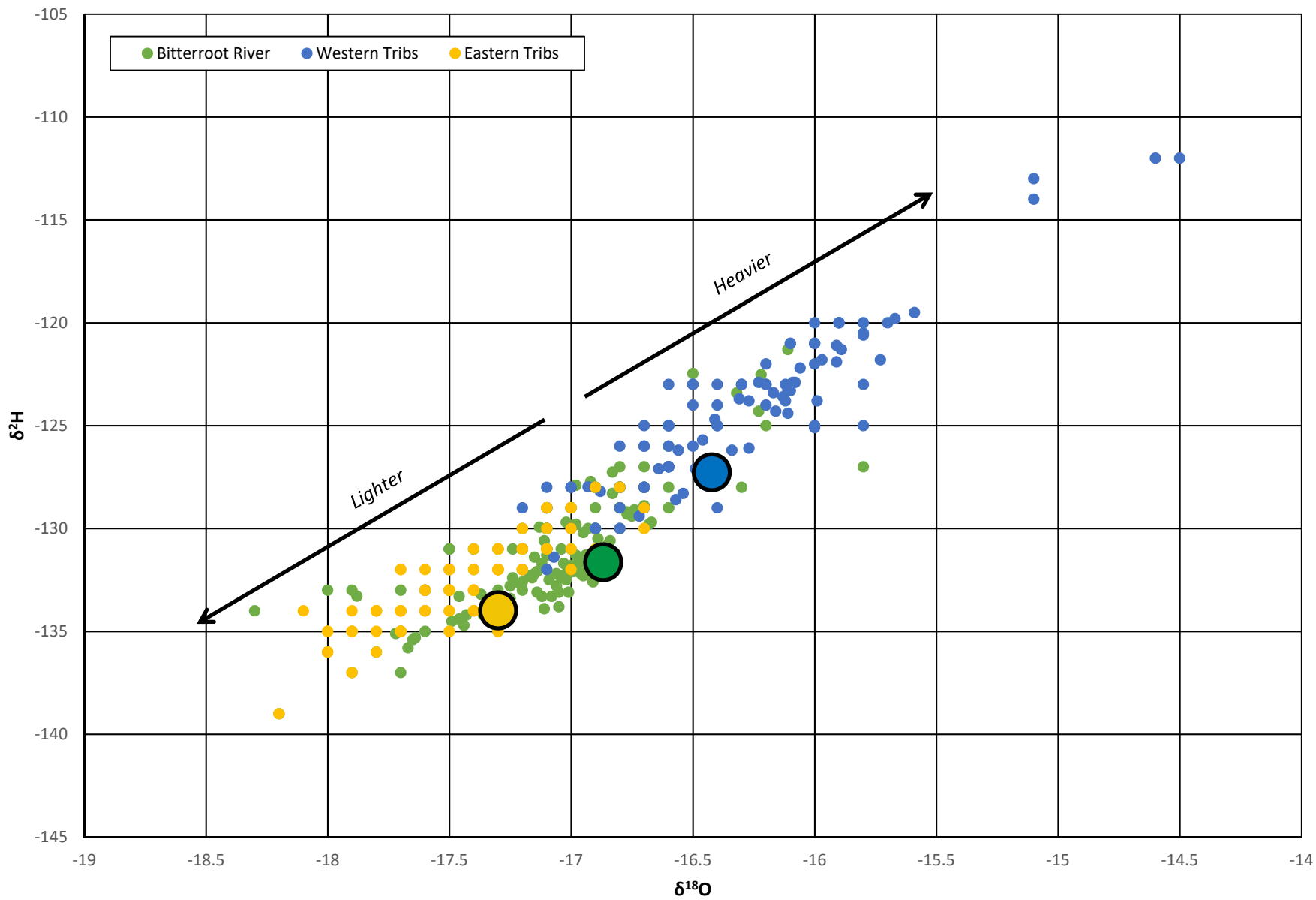


Image credits: Oxygen and hydrogen isotopes from <http://www.ces.fau.edu/nasa/module-3/how-is-temperature-measured/isotopes.php>, <https://silentwitnesss.wordpress.com/2012/08/06/oxygen-isotopes/>

# Bitterroot Valley Isotopes



### Bitterroot Valley Isotopes



# Shallow Aquifer Investigation

## Stevensville Area



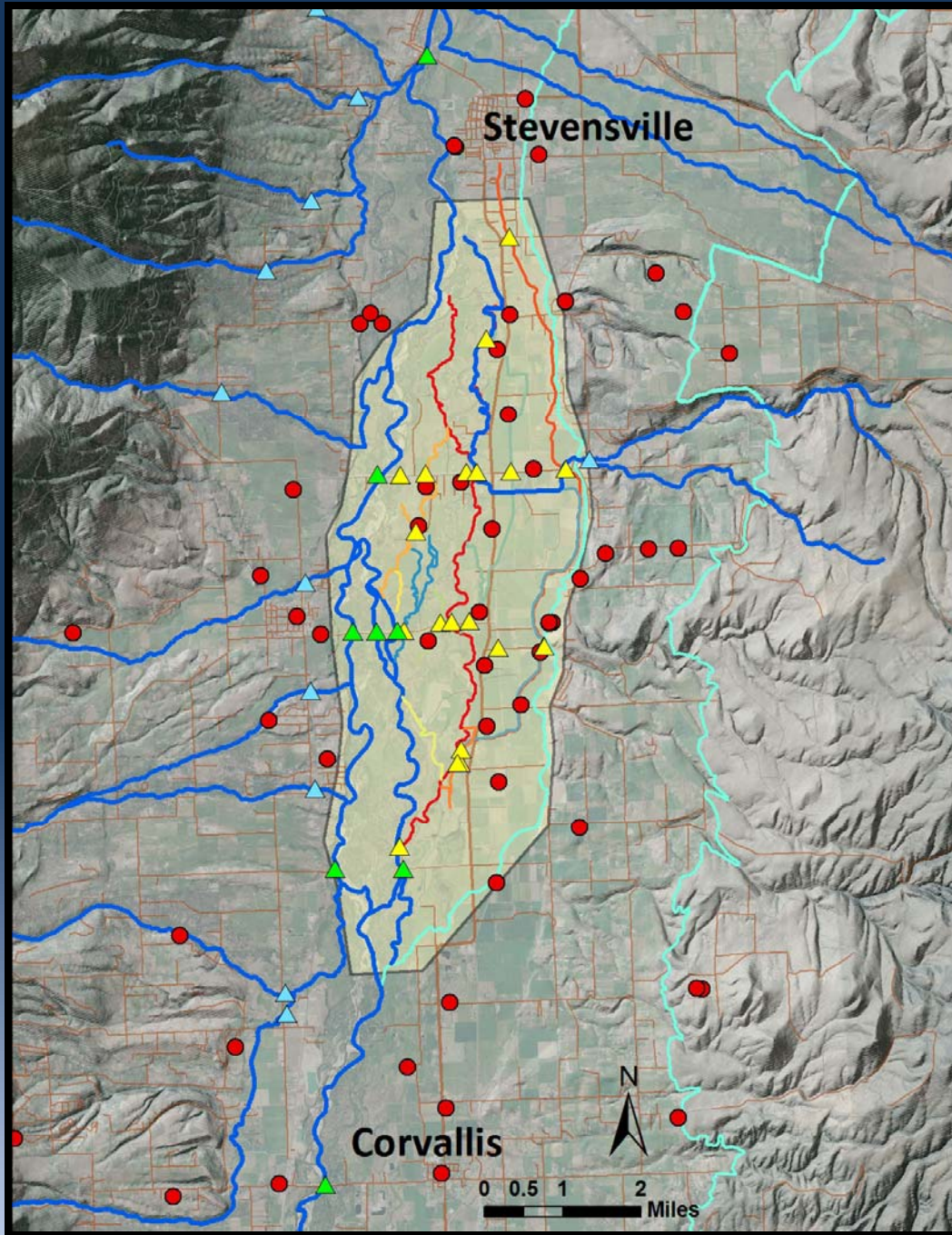
### Purpose

Examine the feasibility of supplementing surface water irrigation supplies with groundwater.

- Find and use Existing information
- Collect groundwater and surface-water elevations to characterize the groundwater flow regime
- Groundwater Flow Model



# Monitoring Network





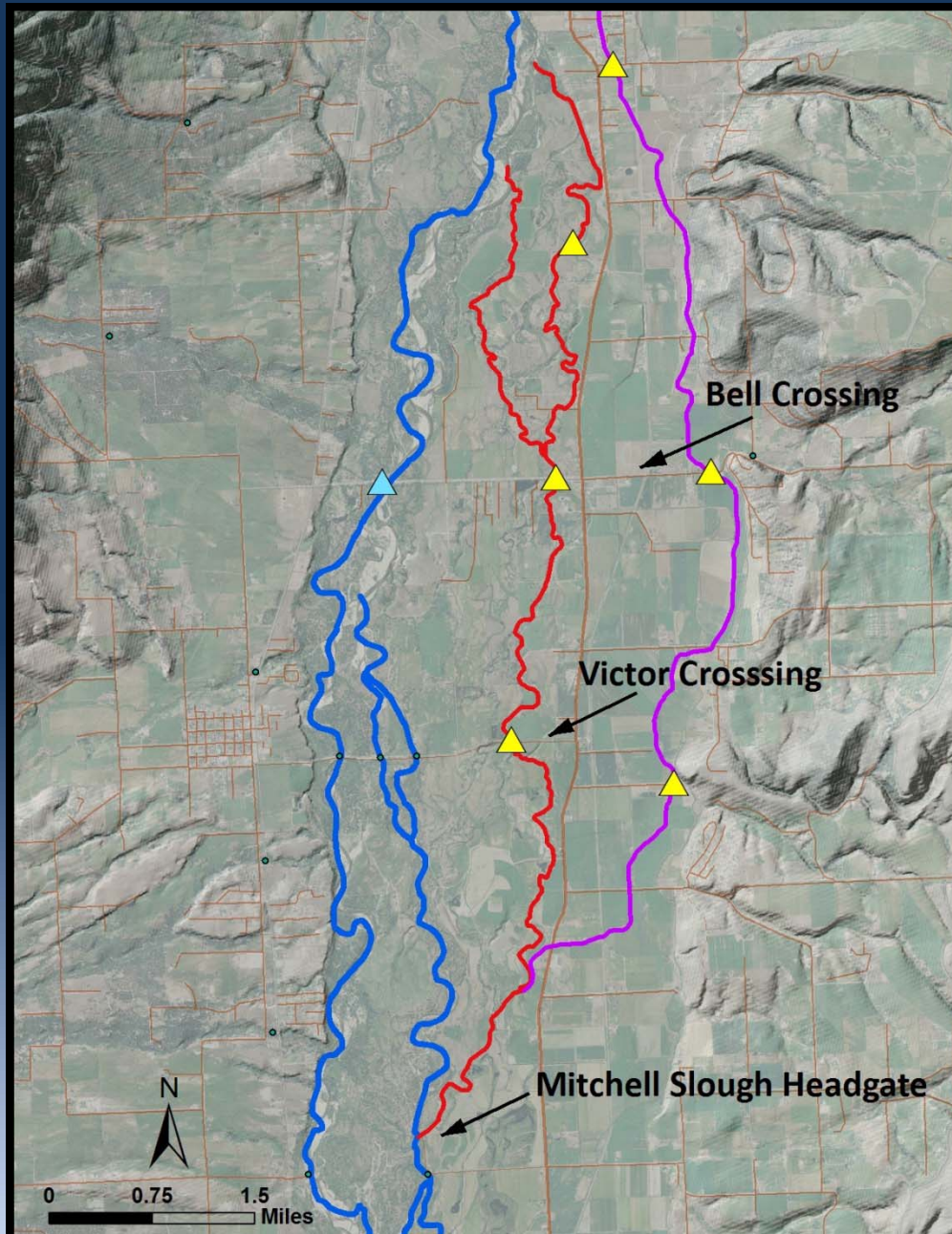
# Data Collection Efforts



- Groundwater Data
- Surface-Water Data
- Installation of Wells
- Groundwater Sampling
- Isotope Sampling
- Canal Losses/Gains



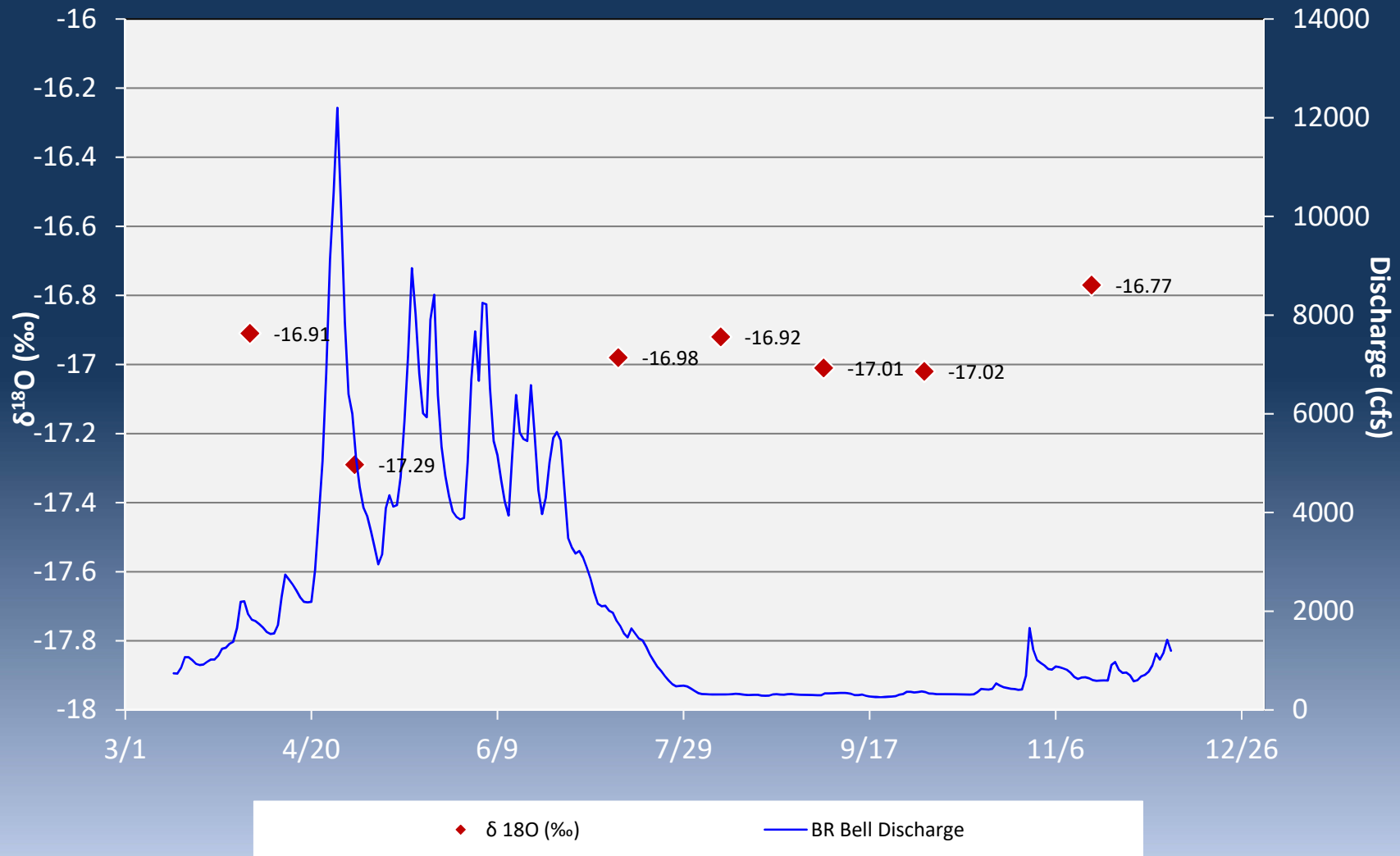
# Bitterroot River, Mitchell Slough, and Union Ditch



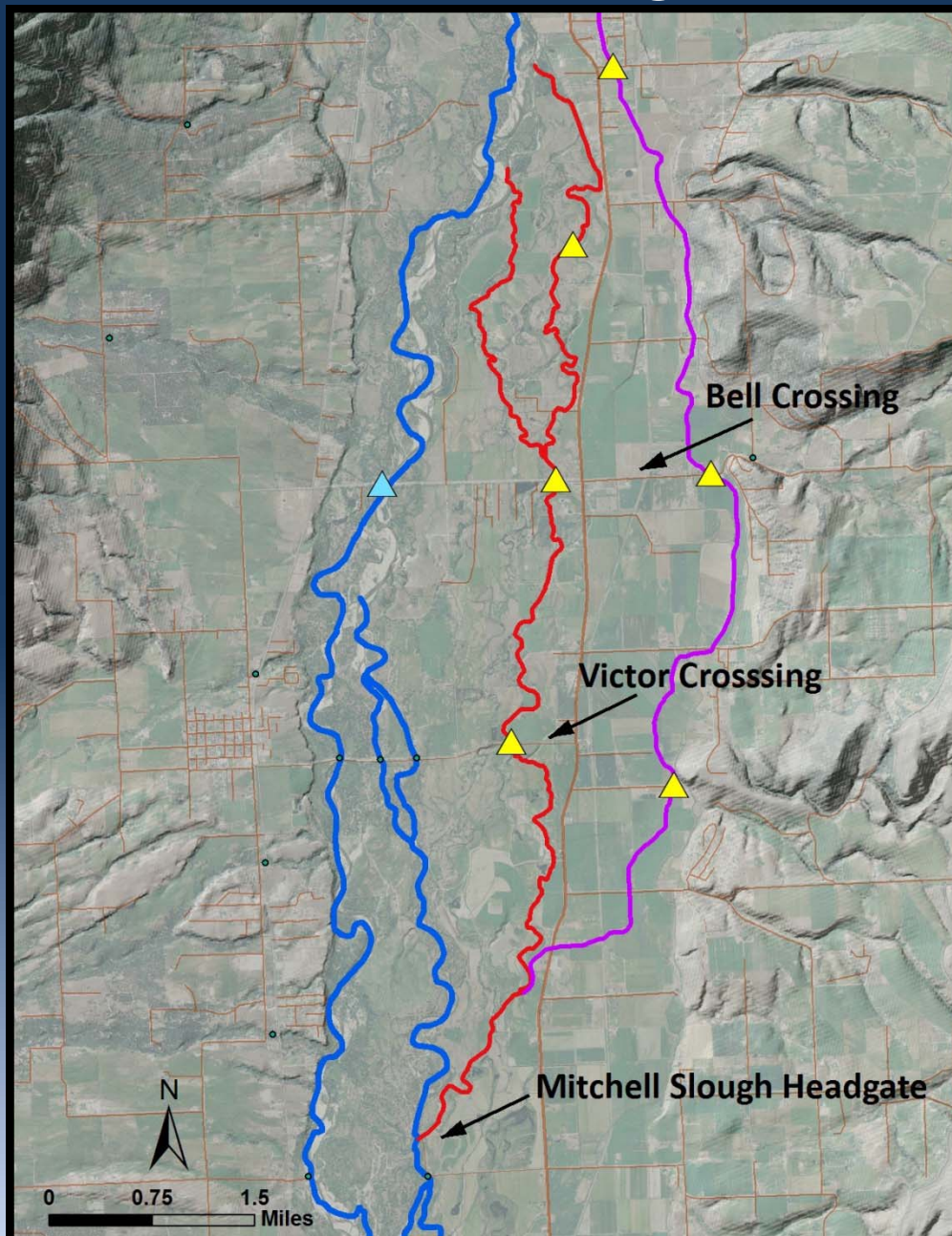


# Bitterroot River (Bells Crossing)

Seasonality:  $\delta^{18}\text{O}$  vs. Flow

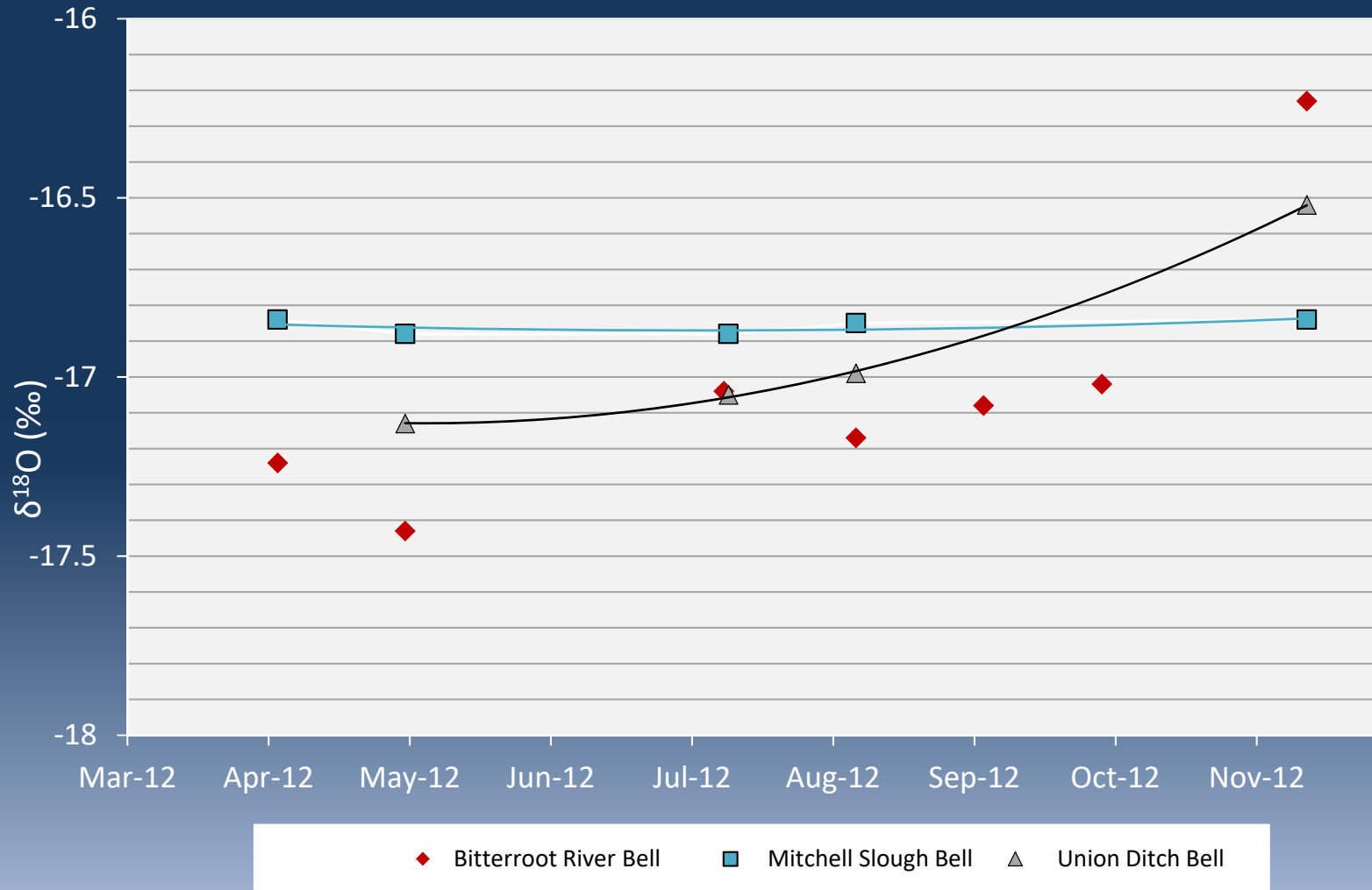


# Bitterroot River, Mitchell Slough, and Union Ditch



# Bitterroot Valley North-South Spatial and Temporal Trends

## Mitchell Slough and Union Ditch $\delta^{18}\text{O}$ Isotopes





# Acknowledgments

- Local land and well owners
- Area Ditch Companies
- Bitterroot Water Forum
- Al Pernichele – Water Commissioner
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- Allison Brown – MTECH Student



Thank you!





