Using Water Quality to Validate Groundwater Modeling Results

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Abstract. Conjunctive water use is the combining of surface water and groundwater into one system. One application of conjunctive use is to pump water from an alluvial aquifer into infiltration ponds under the premise that the water will return to the river at times when the flow is needed.

Such a site exists at Tamarack Ranch State Wildlife area near Crook, Colorado along the South Platte River. Tamarack contains 7 pumping wells that pump water from the alluvial aquifer into two up-gradient infiltration ponds. By pumping water from the alluvial aquifer into these ponds, streamflow is augmented at times when additional water is needed. It is important to understand the timing of the return flow in order to know when and how long to pump water from the aquifer. Groundwater modeling is one method used to quantify the return of water to the river. By examining the water table elevation of the site and using particle tracking the flow of water during pumping can be determined. The information obtained from the groundwater model can be compared to water table elevation maps field data.

In addition, water quality data can be used to gain further information about the flow of recharge water. Water quality data show two distinct source waters: river water (which is dominated by sodium, calcium and sulfate) and groundwater (which is dominated by calcium and bicarbonate). By analyzing water quality data collected from a network of wells, the amount of mixing between the two waters can be quantified. These data can be compared to concentrations calculated with a numerical groundwater model to see if mixing of source waters can be predicted by the model. By combining results gathered in the field with numerical groundwater modeling results the model can be validated.

Preliminary results show that water table elevation mapping agrees with the flow calibrated model. However, water quality changes occur before particle tracking movement suggesting faster subsurface transport than modeled. Conversely, water quality changes occur slower than transport modeled breakthrough curves.