

Quantifying Irrigation Return Flow to the South Platte River, Colorado: Stable Isotope Methodology

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Abstract. As the South Platte River flows from Denver to the Nebraska border it crosses urban and agricultural settings which can affect water quality and quantity. These changes are produced by diverse sources such as irrigation return flow, urban runoff and wastewater discharges. Much of the water diverted from the river is used for irrigation. A significant portion of this water returns to the river as irrigation return flow, often during times of low stream flow. The goal of this research is to determine if the ratios stable isotopes of water ($\delta^{2}\text{H}$ and $\delta^{18}\text{O}$) in the river can be used to identify and quantify groundwater return flow to the river. Water samples are being collected and analyzed for their isotopic signature at 17 sites from Denver to Julesburg. These sites represent major hydrologic control points. Four rounds of samples have been collected since June 2009. Well defined linear patterns of isotope ratios are observed on individual sampling events which suggests that irrigation return flow increases moving downstream. These preliminary results indicate that it may be possible to discern irrigation return flow to the South Platte River using the stable isotopes of water.

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