

Mass Balances of Irrigation-Induced Salinity and Selenium in Reaches of the Arkansas River

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Abstract. Mass balances of salinity were developed for an upstream reach and a downstream reach of the Arkansas River in southeastern Colorado. A mass balance for selenium (Se) was also developed for the downstream reach. Electrical conductivity (EC) measurements were collected along the Arkansas River in the upstream reach from 1999-2004 and in the downstream reach from 2002-2004. The EC measurements were converted to concentrations of total dissolved solids (TDS). Surface water samples were collected along the Arkansas River in the downstream reach from 2003-2004, and the Se concentration in each sample was determined by an analytical laboratory.

After the EC measurements were converted to TDS concentrations, daily loading rates of salts were calculated by multiplying the TDS concentrations by the daily average flow rate for each location with a gauging station. The instantaneous EC measurement was assumed to be the daily average EC value for the date it was measured. An uncertainty analysis, which included calculations of percent errors and residual values, was performed to evaluate the accuracy of this assumption. Daily loading rates of Se were calculated by the same method using the Se concentrations and the daily average flow rates for each location with a gauging station.

The mass balances were used to illustrate daily loads of salts and Se coming into and going out of the river system for the two designated reaches. In developing the salinity and Se mass balances, the control volume was the river with boundaries at the beginning and end of each reach. By developing the mass balances, the quantities of daily unaccountable loads were determined. The daily unaccountable loads were calculated as the difference between the sum of the inflow daily loads and the sum of the outflow daily loads for each day of data collection. Results of the salinity mass balances show that there were less salts coming into each system than salts going out of each system. Results of the Se mass balance also show that there was less Se coming into the system than Se going out of the system. The loads of salts and Se coming into each system that were not being accounted for in the developed mass balances were likely due to groundwater recharge into the river.