Characterization of Salinity Fluxes in the Lower South Platte River Basin, Northeastern Colorado

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Abstract. The maintenance of a proper salt balance is essential to the long-term sustainability of irrigated soils. The salt balance of the lower South Platte River Basin was evaluated through the development of a reach-by-reach discharge and dissolved solids budget for the river and associated irrigated lands. The budget provides insight into the origin, transport, and ultimate destination of dissolved solids in the basin. Daily discharge values were compiled for major tributary inflows, point source inputs, irrigation diversions, and upstream and downstream gaging stations for six segments of the river from Denver, CO to Julesburg, CO. Daily dissolved solids loads were estimated for these components using the discharge values and available total dissolved solids (TDS) or specific conductance data. Water and salt mass balance calculations were performed on a monthly and annual basis for each reach and the entire study area to determine the residual hydrologic and dissolved solids loads. The mass balance residuals are assumed to be primarily ground water contributions, but will also reflect ungauged inflows and outflows as well as measurement errors. Long-term dissolved solids loads at river gaging stations in the upper study area were compared to downstream loads to determine sources and sinks of dissolved solids and to quantify the flux of dissolved solids within and out of the basin. The rate of accumulation of salts within the basin serves as an indicator of the long-term sustainability of irrigation in the region. For water years 1951 to 2004, the mean deposition was 150 metric tons per day. If evenly distributed on the 93,000 hectares of irrigated land, the mean accumulation would be 0.58 metric tons per hectare per year. For the period 1991 to 2004, the mean deposition rate was somewhat lower with a mean deposition rate of 88 metric tons per day or 0.35 metric tons per hectare per year. On a yearly basis, the rate of net deposition was found to be highly variable and inversely correlated with streamflow at Julesburg. Dissolved solids tend to be retained in the basin during years with low mean streamflow at Julesburg and exported from the basin in years with higher mean streamflow.

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