

A METHOD FOR ESTIMATING GROUND-WATER RETURN FLOW TO THE LOWER COLORADO RIVER IN THE YUMA AREA, ARIZONA AND CALIFORNIA

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ABSTRACT

Substantial quantities of water diverted from the lower Colorado River in the Yuma area, Arizona and California, return to a reach of the river as ground-water flow. A method for estimating these quantities involves the computation of ground-water return-flow rates using hydraulic analyses of ground-water flow at 18 cross sections normal to the river. The cross sections are spaced about 1 mile apart over a reach of the river adjacent to irrigated land in the Yuma area.

The hydraulic-analysis method uses average annual gradients that are based on measurement of river stage and ground-water heads. Ground-water heads are measured in piezometers, which are about 100 and 500 feet from the river and near the top, middle, and bottom of a 100-foot-thick sand, silt, and clay aquifer that commonly overlies a highly permeable river-gravel bed. The method also uses estimated hydraulic-conductivity distributions to compute return-flow quantities. Hydraulic-conductivity distributions are estimated in part by trial-and-error calibration of transient cross-sectional models using the response of the aquifer to changes in river stage. Storage characteristics of the aquifer were inferred in part from soil-moisture studies using a neutron probe.

The average annual return flow for 1975-78 was estimated to be 44,000 acre-feet from lands on the Arizona side of the river and 38,000 acre-feet from lands on the California side. Estimates of total return flow for the Yuma reach compare favorably with estimates made using surface-water-budget and salinity-budget methods.

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