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Abstract: Detailed hydrologic and water-chemistry data were collected that document the movement of bank-storage water during March 7-April 17, 1990, in an alluvial aquifer adjacent to the Cedar River, Iowa. Hydrologic data included 745 daily ground-water-level measurements from 27 observation wells. Water-chemistry data indicate that bank-storage water had smaller specific conductance and larger concentration of atrazine than ambient ground water. To quantify the movement of the bank-storage water, a two-dimensional ground-water flow model was constructed, and the resulting calibrated model accurately observed conditions. Analysis of water chemistry and model results indicate that a 2-meter rise in the river stage caused bank-storage water to move horizontally at least 30 meters into the aquifer and vertically about 4 meters below the river bottom, whereas the remaining 30 percent moved laterally through the riverbank. The model also showed that bank storage caused the ground-water flux to the river to increase by a factor of five during the first three weeks of base flow after runoff and that it required about five weeks for bank-storage water to discharge from the alluvial aquifer after the peak river stage. These results quantitatively demonstrate the importance of bank storage as a source of recharge to the alluvial aquifer and as a source of water to the river during early base-flow conditions.