

## Hydrologic Trade-Offs in Conjunctive Use Management

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### Ground Water

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An aquifer, in a stream/aquifer system, acts as a storage reservoir for groundwater. Groundwater pumping creates stream depletion that recharges the aquifer. As wells in the aquifer are moved away from the stream, the aquifer acts to filter out annual fluctuations in pumping; with distance the stream depletion tends to become equal to the total pumping averaged as an annual rate, with only a small fluctuation. This is true for both a single well and an ensemble of wells. A typical growing season in much of the western United States is 3 to 4 months. An ensemble of irrigation wells spread more or less uniformly across an aquifer several miles wide, pumping during the growing season, will deplete the stream by approximately one-third of the total amount of water pumped during the growing season. The remaining two-thirds of stream depletion occurs outside the growing season. Furthermore, it takes more than a decade of pumping for an ensemble of wells to reach a steady-state condition in which the impact on the stream is the same in succeeding years. After a decade or more of pumping, the depletion is nearly constant through the year, with only a small seasonal fluctuation:  $\pm 10\%$ . Conversely, stream depletion following shutting down the pumping from an ensemble of wells takes more than a decade to fully recover from the prior pumping. Effectively managing a conjunctive groundwater and surface water system requires integrating the entire system into a single management institution with a long-term outlook

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