

SOURCES OF HIGH-CHLORIDE WATER IN A COASTAL SOUTHERN CALIFORNIA AQUIFER

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The U.S. Geological Survey currently is assessing the regional ground-water resources in the San Diego area. The Sweetwater Authority, a local retailer, provides ground water from wells penetrating the San Diego Formation, which underlies alluvial deposits in the Sweetwater River channel. Water from a number of these municipal supply wells exceeds the U.S. Environmental Protection Agency Secondary Maximum Contaminant Level for chloride of 250 milligrams per liter (mg/L). A major goal of the regional assessment is to gain a better understanding of the sources of high-chloride ground water to wells in the San Diego Formation.

Tritium and carbon-14 age-dating techniques indicate most of the ground water in the San Diego area was recharged prior to about 1950. The stable isotopes of hydrogen and oxygen in ground-water samples collected from 4 multi-level monitoring wells suggest three distinct sources of recharge distinguishable by: (1) isotopic values that are comprised of a mixture of ground water and seawater; (2) lighter (more negative) ground-water isotopic values that are characteristic of recharge which originates in the mountains to the east of the San Diego area; and (3) intermediate isotopic values that are characteristic of local runoff.

Percentages of major ions indicate the chemical composition of the ground water in the San Diego area can be characterized as mixed cation-Cl to Na/K-Cl type, with the percentages of major ions in several water samples resembling the chemical character of seawater. Simulations of changes in ground-water chemistry using the computer program PHREEQC, along with ratios of selected minor ions to Cl⁻ as a function of Cl⁻, were used to distinguish between high-Cl⁻ water from marine rocks and seawater. These results suggest that the dissolution of soluble salts characteristic of the underlying marine deposits is the predominant source of high-Cl⁻ ground water in the San Diego Formation.