Saltwater from the Pacific Ocean is seeping into some Los Angeles Basin coastal aquifers and replacing freshwater. Without treatment, this ground water does not conform to drinking-water or agricultural standards.

This problem is significant because much of the water used by the nearly 10 million residents of Los Angeles County comes from ground-water sources. Although not all coastal aquifers in the region are at risk, the existing resources are vital and must be protected to maintain adequate supplies of potable water.

In the 1950’s, construction began on the first of three “barriers” in an attempt to halt saltwater intrusion. Each barrier consists of a series of injection wells that essentially form a subsurface wall of freshwater designed to keep saltwater from penetrating further into aquifers. The barriers are only partly effective; saltwater continues to infiltrate in some areas.

New studies show that the ground-water geohydrology of the coastal aquifers is more complex than previously imagined. U.S. Geological Survey (USGS) scientists, working in cooperation with local water agencies, are studying the connection between coastal aquifers and the offshore geology to better understand the processes and pathways of saltwater intrusion.

Potential pathways for saltwater intrusion include hydraulic connection to aquifer beds exposed at the sea floor, flow along buried ancient stream channels, and flow through crushed rock in fault zones. The USGS and its cooperators are focusing their efforts on (1) conducting geologic and hydrologic studies on land and (2) surveying and mapping the sea floor near the coast.

To investigate the marine connection to saltwater intrusion in coastal areas of Greater Los Angeles, scientists are using a variety of techniques to study the geology offshore. An acoustic technique, known as reflection seismology, produces vertical profiles that provide information on the layering of strata in the subsurface and also on the geometry of geologic structures and buried erosional features, such as ancient stream channels. Another system uses laterally directed acoustic pulses to create detailed three-dimensional images of the sea floor. In addition to providing accurate
In the late 1800s, water wells pumped by wind power were first used to tap into the ground water of the Los Angeles Basin (A). This technology provided abundant freshwater for residents of the parched coastal region, allowing for expansive growth of both population and agriculture. Increased pumping through the early 1900s caused potentiometric levels (the levels to which pressure in the aquifer would make water rise in cased wells) along the coastline to drop below sea level. As a result, a landward-directed pressure gradient caused saltwater to begin invading coastal aquifers as early as the 1920s (B).

In the 1950s, sets of closely spaced wells were drilled to inject high-quality freshwater into the ground, creating hydraulic pressure ridges or “barriers” to saltwater intrusion (C). Ideally, these barriers would stem the flow of saltwater into coastal aquifers. However, the barriers are not completely effective.

New studies by the U.S. Geological Survey and its cooperators show that the geology of the Los Angeles Basin is much more complex than originally conceived. A seismic profile from the Port of Long Beach (D) shows the complex geology of the area. The sediment layers, shown as different colors, provide many potential pathways for saltwater intrusion. By understanding this geology, scientists can better determine where and how fast water moves within the various beds of sediment both onshore and offshore.

Bathymetric and high-resolution seismic data allow scientists to create accurate maps of the offshore Los Angeles region. This map shows the San Gabriel Canyon, faults, and sediment-filled ancient stream channels that cross the offshore shelf areas in the region. The ancient stream channels and faults are potential pathways for the infiltration of saltwater into coastal aquifers. New studies focus on mapping the seaward extent of coastal aquifers below the sea floor, locating underwater rock outcrops, and understanding the physical properties and porewater chemistry of sediments.

SALTWATER INTRUSION INTO COASTAL AQUIFERS IN THE LOS ANGELES BASIN

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