

Underground Water Level Falling at a Dramatic Rate

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Picture, for a moment, a vast, freshwater sea, stretching endlessly beneath the sunbaked crust of California. There are billions of gallons lurking in this subterranean reservoir, a seemingly inexhaustible supply.

Now imagine a straw, poked downward from the surface. Imagine it's a homesteader, sinking a well.

Time passes, and soon there are two straws. Then 200. Then 200,000. Before long, burgeoning cities, farmers and industries are dipping into this underground source, lustily lapping up waters pooled through the ages.

In a world of plenty, this might not be a problem. But decades of unrestricted pumping have left many of California's ground-water basins seriously overdrafted-drained beyond nature's ability to refill them in the near future.

This year the pace of that siphoning is accelerating at a dramatic rate-perhaps five times that of normal. Many farmers, deprived of water usually shipped to them from the Sierra Nevada, have turned to their wells to stay afloat through the tenacious drought. As a result, experts say, the state's sunken reservoirs could be drained of a record 10 million acre-feet of water this year-an amount that would meet the needs of Los Angeles through 2005 and can only be replenished by a long string of wet seasons.

In the fertile Salinas Valley, excessive pumping has allowed briny water from the sea to invade the ground-water basin, contaminating municipal and agricultural supplies. The situation is so grim this year that some growers are advocating a solution long fought in the farm belt-the installation of meters to monitor how much water is drawn from wells.

Scientists warn of another risk. Suck out too much ground water, they caution, and the land will sink, a process called subsidence. In years past, collapsing land has caused millions of dollars in damage. Geologists are convinced that subsidence will recur in the vulnerable San Joaquin Valley this year, but how much is anyone's guess; the U.S. Geological Survey stopped tracking the phenomenon there in 1972.

"We simply cannot continue this overdrafting indefinitely," said Kenneth Tanji, a professor of water science at UC Davis. "Think of our ground water like a savings account. If you keep dipping into it-without making deposits-sooner or later you run out."

If ground-water basins are continually over-tapped, the water ultimately drops so deep that the cost of pumping it out becomes prohibitive, essentially rendering it useless.

A falling water level can also release brackish water that is trapped in layers of rock beneath the fresh water. As a basin is depleted, the "poor-quality water can flow in and ruin the supply," said Carl Hauge, chief hydrogeologist for the state Department of Water Resources. "We know these things can happen," he added. "What we don't know is when."

The predicament should come as little surprise to California.

For half a century or so, assorted experts and blue-ribbon commissions have studied the problem and issued thick reports exhorting the Legislature to take a hand in regulating the underground supply. In a normal year, ground water accounts for close to half the water used in California-much more during times of drought. Such a vital resource, many have argued, should be carefully husbanded.

But each call for action has prompted farmers and their allies to rise up in fury, declaring the unfettered right to pump to be a sacrosanct freedom. Such opposition has squashed occasional legislative attempts to seize a role for the state in ground-water management.

"We studied this problem for two years, and it was clear that the answer was to put some sort of check on the demand," said Harrison Dunning, a law professor at UC Davis who directed an exhaustive study of water issues commissioned by then-Gov. Edmund G. Brown Jr. in the late 1970s. "But the Farm Bureau-types did not appreciate our conclusions, and so nothing happened. . . . It was very discouraging."

Ground water-which accumulates in soil and rock formations called aquifers-has fulfilled a major portion of California's water needs for more than a century. About 40% of the state sits atop ground-water basins, which together hold an estimated 250 million acre-feet of usable water-about six times what the state's surface reservoirs contain.

Many of the 50 major basins, particularly those north of Sacramento, are full to the brim with water. But at least 11-most of them in the San Joaquin Valley, California's agricultural heartland-were declared "critically overdrafted" by the state Department of Water Resources in 1980. Many others may deserve that designation, but a lack of funding-just 2% of the department's budget is allocated to ground-water research-has prevented scientists from taking a fresh look.

Experts blame all the trouble on California's laissez-faire approach to ground-water management. With its intricately controlled network of dams, canals and reservoirs, the state justly ranks as a world leader in capturing rain and snowmelt and moving it across the surface of the Earth. But when it comes to regulating the crucial reserve of water hidden below ground, it's a different matter entirely.

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"It's the old out-of-sight, out-of-mind problem," said Assemblyman Phillip Isenberg (D-Sacramento), one of many who lament that ground-water management

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has been a cause without a constituency in California. "I'll bet you there aren't but 5,000 people in the state who understand that 40% of our water supply comes from underground."

Most states in the Union have the power to restrict the use of ground water, either by a permit system, a tax on pumping or other devices. But California's guiding principle has remained virtually unchanged since the settlers came West: dig a well and pump as much as you like. Some limitations on ground-water rights have been defined by the courts, but essentially, owners of land above the basin may pump to their heart's content, so long as the water is put to a continuous "beneficial use."

Critics say such conditions all but invite exploitation.

"The trouble with (California's law) is that individuals have no incentive to restrain their consumptive behavior," said Henry Vaux, director of the University of California Water Resources Center. "Anything you don't pump is simply made available to some other guy down the way. So, many people figure they might as well pump it themselves."

And pump they have.

Between 1935 and 1968, mounting demand in the San Joaquin Valley caused the ground-water level to steadily drop. That required farmers to dig ever deeper wells, and drove energy costs up, as pumps were forced to lift water greater distances.

More important, the overdraft caused a 5,200-square-mile section of land to sink-up to 30 feet in some spots. The subsidence destroyed wells and required growers to continually re-level their fields, causing damages totaling as much as \$60 million annually during much of the period, said Gilbert Bertoldi, a hydrogeologist with the U.S. Geological Survey who studied the episode.

In cities, slumping land can wreak much greater havoc. The San Jose area, once totally reliant on ground water, sank 12 feet during a 35-year period ending in 1967. Sewer lines ruptured, roadways crumpled, railroad grades sank and hundreds of acres of land were devalued when they fell below sea level, becoming prone to flooding.

Closer to home, 70 cracks have materialized recently on a swath of desert scheduled for development near Lancaster, and at nearby Edwards Air Force Base, a 12-foot-deep fissure stretching for half a mile has forced the closure of a runway. Scientists blame the cracks on extensive ground-water pumping, which has caused some sections of the rapidly growing Antelope Valley to sink more than five feet in 20 years.

California's two massive surface-water projects-the federal Central Valley Project, built in the 1940s, and the sprawling State Water Project, which opened 20 years later-were billed in part as an antidote to overdraft in the farm belt. With a new supplemental source of imported water available, the theory went, growers could rely less on their wells, and ultimately the endangered basins would refill.

The imported water did ease the strain on the ground water, but it also opened up new farmland in the western San Joaquin Valley, a once-barren land belonging to jack rabbits. As a result, the valley still extracts 1.3 million acre-feet of water more each year than is replenished by rain and runoff from the fields. Statewide, 2 million acre-feet more is pumped from underground basins each year than can be replenished.

"There is very little doubt in my mind that we will see subsidence again this year, particularly in the San Joaquin Valley, but we have no measurement stations so we have lost the ability to predict and keep track of this," Bertoldi said. Because the valley is more urbanized than it was during the last period of subsidence, he believes substantial damage to "roads, pipelines, bridges and industries" is possible.

While dramatic, subsidence is only one of many known consequences of overtaxing a ground-water basin. Another is the deterioration of water quality, and the Salinas Valley-which produces vegetable crops valued at \$1.3 billion annually and is completely dependent on wells-is suffering more than any other region, state officials said.

For decades, farmers and other valley residents have been using more water than is returned to their basin naturally. As cities grew, the problem intensified, and five years of drought have now exacerbated the problem nightmarishly. Last year, the amount of overdraft was 300,000 acre-feet-six times the recent annual average for the valley.

If too much ground water is pumped from a coastal basin, the water level dips below sea level, allowing saltwater to migrate in. The intrusion has forced the closure of hundreds of irrigation and municipal wells in the Salinas Valley, and poor water quality is affecting crop yields.

Now, a task force including the valley's major growers is tackling the problem, and one proposal before them would require the registration and metering of wells.

"Obviously, we need to start managing our water, and we need to do it right away," said Martin Johnson of Dole Vegetables, who estimates that his company has spent about \$500,000 annually to close and replace contaminated wells in recent years. "(Metering) is a controversial idea . . . but everybody agrees we have a big problem."

With no statewide framework for the management of ground-water basins, local agencies have been forced to go it alone when problems-like seawater intrusion or excessive demand on supplies-appear. There are seven basins in the state where management districts have been formed; another 12 basins have been adjudicated-meaning the rights to the ground water have been divvied up by a court.

In some of these basins, managers have done a commendable job protecting supplies, and most that have are in Southern California. The Orange County Water District-which was formed in the 1930s and was the first in the state to levy a tax on pumping-is often cited by the state as a model for farsighted ground-water management.

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Despite such standouts, many water planners complain that a haphazard, case-by-case approach to the problem is a poor way to treat such a vital resource.

"The level of ground-water management in California is now a big zero, and that's bad news for every district that wants to do something creative with a basin," said Walter Bishop, acting general manager of the East Bay Municipal Utility District in Oakland. "What it means is that each of us has to work out our own contract or get our own special legislation . . . (and) that's a very costly and time-consuming process."

The five-year drought has renewed debate over the desirability of regulating ground water, but so far there appears to be little support for significant change. Legislation introduced this year by Assemblyman Jim Costa (D-Fresno) would authorize the creation of local ground-water management districts in the 11 imperiled basins, but even supporters concede that the bill is unlikely to have much effect.

"It's OK as far as it goes, but it's too permissive," said Assemblyman Richard Katz (D-Sylmar). "It's like, 'Please guys, it would be nifty if you did this.' But there are no penalties if they don't address the problem. And historically, the agricultural areas have resisted this."

In response, Costa defends his bill-which was vetoed twice by former Gov. George Deukmejian-as a "realistic first step. There is a strong, provincial feeling among the agricultural landowners that free use of the ground water is their right, not to be fettered by any government. So there has to be some flexibility."

Stephen Hall, executive director of the Farm Water Coalition, agreed.

"We understand that this 2 million acre-feet a year overdraft that the state faces can't go on forever," Hall said. "But you can't solve the problem by just telling people to pump less, because that's going to drive them out of business. . . . What you need to do is use the basins in a way that maximizes supplies."

Examples of this approach already exist in many water districts. In the southern San Joaquin Valley, for example, agencies routinely carry out "artificial recharge" programs, which collect water in spreading ponds during wet years, and then allow it to percolate into the depleted basins.

The state is pursuing a similar project, called the Kern Water Bank. Under contracts with water districts near Bakersfield, the state will essentially borrow storage space in an underground basin during periods when water is plentiful and then pump out its share during dry years.

Many experts believe that projects like these could be the cornerstone of the state's future water policy. Construction of major new dams is unlikely because of environmental and financial costs, they note, and the innovative use of ground-water basins will thus be crucial to help stretch the existing water supply.

But without a system for controlling who is pumping what, experts say, this strategy is all but meaningless.

"This will only work if the people putting money in the (underground water) bank know who has all the checkbooks," said Bishop, the East Bay utility manager. "Right now, we don't."

State's Ground Water: An Overtapped Supply

Here is a look at California's groundwater, which gathers in soil and rock formations called aquifers. In a normal year, groundwater meets 40% of the state's water needs. But in times of drought, it fulfills a much greater proportion as farmers deprived of water imported from the Sierra Nevada switch to wells.

Depleted Basins

The state Department of Water Resources has declared these 11 groundwater basins "critically overdrafted." That means much more water is pumped out each year than is replenished naturally. 1. Santa Cruz-Pajaro Basin 2. Cuyama Valley Basin 3. Ventura County Basin 4. Eastern San Joaquin County Basin 5. Chowchilla Basin 6. Madera Basin 7. Kings Basin 8. Kaweah Basin 9. Tulare Lake Basin 10. Tule Basin 11. Kern County Basin

The Ground-Water Cycle: California's ground-water reserve can be described as an overdrawn bank account. In an average year, pumping withdraws 2 million acre-feet of water more than can be returned by nature. Two million acre-feet is three times more than the water Los Angeles consumes in a year. Here's how the cycle works: A. Streams and rainfall pour 5.8 million acre-feet of water into underground basins each year. B. Runoff from agricultural fields and landscaping adds 7.4 million acre-feet. And another 1.4 million acre-feet percolates down through unlined canals and artificial replenishment programs managed by water agencies. C. Farmers, cities and other users pump out 16.6 million acre-feet of water a year. The result is a deficit of 2 million acre-feet. D. Evaporation occurs, and water is lost to the atmosphere, when the sun heats water from lakes, fields, ponds, streams and the leaves of plants. Source: California Dept. of Water Resources

[Illustration]

PHOTO: Water Worry: Many of California's ground-water basins are seriously depleted after decades of unrestricted well pumping. This year the pace of such pumping is accelerating at a dramatic rate-perhaps five times that of normal-as farmers turn to their wells to cope with the drought. Above, San Joaquin Valley farmer Craig Fulwyler irrigates his field. / AL SEIB / Los Angeles Times; DRAWING: The Ground-Water Cycle, MICHAEL HALL / Los Angeles Times; MAP: Depleted Basins in California, MICHAEL HALL / Los Angeles Times

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