

In Era of Drought, Phoenix Prepares for a Future Without Colorado River Water

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By [Jim Robbins](#) / [Photography by Ted Wood](#) • February 7, 2019

The Central Arizona Project canal carries water from the Colorado River to neighborhoods in North Phoenix. Ted Wood

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The Hohokam were an ancient people who lived in the arid Southwest, their empire now mostly buried beneath the sprawl of some 4.5 million people who inhabit modern-day Phoenix, Arizona and its suburbs. Hohokam civilization was characterized by farm fields irrigated by the Salt and Gila rivers with a sophisticated system of carefully calibrated canals, the only prehistoric culture in North America with so advanced a farming system.

Then in 1276, tree ring data shows, a withering drought descended on the Southwest, lasting more than two decades. It is believed to be a primary cause

of the collapse of Hohokam society. The people who had mastered farming dispersed across the landscape.

The fate of the Hohokam holds lessons these days for Arizona, as the most severe drought since their time has gripped the region. But while the Hohokam succumbed to the mega-drought, the city of Phoenix and its neighbors are desperately scrambling to avoid a similar fate — no easy task in a desert that gets less than 8 inches of rain a year.

“We are fully prepared to go into Tier 1, 2, and 3 emergency,” said Kathryn Sorensen, Phoenix’s water services director, referring to federally mandated cutbacks of Colorado River water as the levels of Lake Mead, the source of some of the city’s water, continue to drop. And what of the dreaded “dead pool,” the point at which the level in the giant man-made lake falls so low that water can no longer be pumped out?

Kathryn Sorensen, director of Phoenix Water Services.

“I can survive dead pool for generations,” says Sorensen, pointing to a host of conservation and water storage measures that have significantly brightened the city’s water outlook in an era of climate change and drought.

These days, Phoenix’s alternative water supplies are not dependent on the Colorado. But there’s a caveat. Phoenix may have enough water to secure its near-term future, but it still needs to build \$500 million of infrastructure to pipe it to northern parts of the city that now rely on Colorado River water. And Phoenix may need the water sooner than it planned. “You could hit dead pool in four years,” Sorensen said. “That’s worst case.”

Many cities and towns in the Southwest — including Los Angeles, San Diego, and Albuquerque — are trying to figure out solutions to a dwindling Lake Mead, the key reservoir on the Colorado. One of the most ambitious efforts is a new \$1.35 billion, 24-foot-wide tunnel — the so-called Third Straw — that Las Vegas drilled at the very bottom of Lake Mead to function like a bathtub

drain. Las Vegas gets 90 percent of its water from the Colorado via the lake, which is located just east of the gambling and tourist mecca. In 2000, as the lake's level dropped, the city placed a second, deeper straw to replace the original outtake. As the region moved into its second consecutive decade of drought and lake levels continued to drop, Las Vegas officials got more nervous and the third straw was completed in 2015; it should continue to siphon off water unless the lake dries up completely.

Supplying enough water to sustain a city this size in the desert has long been controversial.

In Arizona, the modern equivalent of the Hohokam irrigation system is the 17-foot-deep and 80-foot-wide concrete aqueduct called the Central Arizona Project, which carries water from the Colorado River to Phoenix, Tucson, and elsewhere. It was a feat of engineering when it was finished in 1993, snaking across the sere desert landscape for 336 miles as it pumps water up 2,900 feet in elevation. So much power is needed to flush this water along its route that the massive coal-fired Navajo Generating Plant was built to provide it.

Supplying enough water to sustain a city this size in the desert has long been controversial, and as Phoenix and its neighbors continue their unrelenting sprawl — Arizona's population has more than tripled in the past 50 years, from 1.8 million in 1970 to 7.2 million today — the state has often been regarded as the poster child for unsustainable development. Now that Colorado River water appears to be drying up, critics are voicing their “I told you so's.”

That's a bad rap though, at least for Phoenix, according to Sorensen. The city is prepared to carry on with business as usual even if the last of the Colorado River water evaporates into the desert sky, depriving Phoenix of 40 percent of its water supply. City officials have been busy planning for this eventuality, and much of the responsibility for that has fallen to Sorensen.

As she stands behind her large desk on the 9th floor of the municipal building in the heart of downtown Phoenix, surrounded by windows that look out on glass office towers gleaming in the desert sun, Sorensen deftly handles questions about the city's water future. On her desk sits a crystal ball, a joke gift that she says she wishes was real. She's proud of the work she has done since she was appointed in 2013 — before that she served four years as head of Mesa, Arizona's water department — although she admits it has been a challenge.

The Phoenix Water Services Department is one of the nation's largest, with 1.5 million customers spread out across 540 square miles. It maintains 7,000 miles of water lines and 5,000 miles of sewer lines.

The Salt River is the single biggest source of water for metro Phoenix, and provides about 60 percent of its needs. It is a large desert river, some 200 miles long, that begins at the confluence of the snow-fed White and Black rivers, is joined by a series of perennial, spring-fed streams, and then meets the Verde River east of Phoenix.

Just after the turn of the 20th century, the first of four dams was constructed on the Salt for a growing Phoenix, and today those reservoirs are Phoenix's main water supply. However, Phoenix's north side gets only Colorado River water, and should that source dry up one day, constructing infrastructure to connect north Phoenix to new sources of water would cost a half-billion dollars. Funding for such a project would hardly be a *fait accompli*; in late December, the Phoenix City Council rejected a water rate increase to pay for the infrastructure expansion. The Salt and Gila rivers also may someday be severely impacted by climate change. "They could be affected by a mega-drought," said Andrew Ross, a sociology professor at New York University and author of *Bird on Fire: Lessons from the World's Least Sustainable City*.

“They are in the bullseye of global warming, too.” Perennial streams could dry up and snowfall in Arizona’s White Mountains could dwindle, as it has done in the Rockies, further depriving the rivers of a steady supply of water.

“We’ve decoupled growth from water,” says a city official. “We use the same amount of water we did 20 years ago.”

Beyond the Salt River, Phoenix has undertaken some innovative water strategies. Among the first of these was the Arizona Water Bank. California is entitled to 4.4 million acre-feet of water a year from the Colorado, but because Arizona was not using its full allotment of 2.8 million acre-feet, its excess water was being slurped up by a perpetually thirsty California. So the water bank, a unique system of underground storage, was created in 1996 as a way to store Colorado River water that the state couldn’t use, rather than letting it flow through to California. It turned out to be a prescient move, but not for the reason it was created. In that era, few people foresaw the crash of the Colorado River system.

Arizona has since created seven water banks, largely in empty underground aquifers. A series of large pools has been built above the aquifers and, as water is pumped into them, it slowly leaches through a layer of gravel and rock and fills the aquifer. So far the water banks have cost the state \$330 million, storing 3.6 million acre-feet in 28 sites across three counties — more than a year’s worth of Colorado River water.

One of the largest water banks is 40 miles west of Phoenix near the tiny town of Tonopah, Arizona. The nearly \$20 million facility has 19 infiltration basins covering more than 200 acres. It was constructed alongside the Central Arizona Project canal, and a pipe delivers 300 cubic-feet-per-second of Colorado River water a day to fill the basins.

In addition, other aquifers underneath Phoenix are brimming with 90 million acre-feet of water, some natural and some pumped in — enough to last the city for years. One problem is that much of it is contaminated, both from natural sources of arsenic and chromium and from the city’s many Superfund sites, which include manufacturing sites polluted by industrial solvents and unlined landfills that contain hazardous waste. But Sorensen dismisses the cleanup challenges as surmountable. “As long as the contamination isn’t nuclear, we can fix it,” she says. “What matters here is that the water is wet.”

Phoenix also recycles almost every bit of wastewater that journeys through its system. The vast majority of it — more than 20 billion gallons of recycled water a year — goes to cool the Palo Verde Nuclear Power Plant. Another 30,000 acre-feet is traded to an irrigation district as gray water to use on agricultural fields and the district, in turn, sends potable water from the Salt River to the city.

And the city is working on “toilet-to-tap” technology aimed at someday making sewage water so clean it will be drinkable. The technology for recycling wastewater into drinking water exists, but is only used in a few places, including San Diego. Arizona says it will play a role in its water supply some day — if, that is, the city can sell the idea to consumers.

Desalinization of seawater has long been floated as a possibility for Arizona, and much of the U.S. Southwest, and officials say it too will be part of Arizona’s water mix — someday. The process, which forces water through an extremely fine filter, is energy-intensive, extremely expensive, and a major environmental problem because of the waste it generates. Nonetheless, Arizona sits on top of 600 million acre-feet of brackish water, and officials have also considered treating water from the Gulf of California, nearly 200 miles to the southwest.

For now, though, Phoenix appears to have positioned itself well for a new era of drought. Sorensen credits the people of Phoenix for adapting to the desert by using far less water per capita. “We’ve decoupled growth from water,” she said. “We use the same amount of water that we did 20 years ago, but have added 400,000 more people.” In 2000, Some 80 percent of Phoenix had lush green lawns; now only 14 percent does. The city has done this by charging more for water in the summer. Per capita usage has declined 30 percent over the last 20 years. “That’s a huge culture change,” Sorensen says.

In fact, the decoupling of water from growth through conservation has taken place throughout the Lower Colorado Basin. “Actual municipal water use across the basin, with the exception of Utah, is declining, even as population rises,” said John Fleck, director of the University of New Mexico Water Resources Program. “Albuquerque has built its long-range plan around conserving more than its demand for decades to come, and Las Vegas’ demonstration of its ability to use less water is stunning.”

But while Phoenix and Las Vegas are pursuing conservation strategies as a partial solution to the withering of the Colorado River, others entities in the region aren’t. Much of conservative Arizona is in denial about what the potential drying of the West may mean, if they recognize it at all. “We’re just starting to acknowledge the volatile water reality,” said Kevin Moran, senior director of western water for the Environmental Defense Fund. “We’re just starting to ask the adaptation questions.” Ross, of New York University, argues that the biggest problem for Arizona is not climate change, but the denial of it, which keeps real solutions — such as reining in unsustainable growth or the widespread deployment of solar energy in this sun-drenched region — from being considered. “How you meet those challenges and how you anticipate and overcome them is not a techno-fix problem,” he said, “It’s a question of social and political will.”

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short of being able to cope with a full-blown climate crisis.

So, for now, Arizona's rampant growth continues. To the west of Phoenix a new tech city is emerging. Mt. Lemmon Holdings, a subsidiary of computer magnate Bill Gates's investment firm, Cascade Holdings, has plans to build a "smart city," for example, on the outskirts of Phoenix near the town of Buckeye. The new city, on 24,000 acres — about the same size as Paris — would have infrastructure for self-driving cars, hi-tech factories, and high-speed public wi-fi.

Meanwhile, the so-called Sun Corridor — 120 miles of Sonoran Desert between Phoenix and Tucson — is seen as the state's next burgeoning megalopolis. It's one of the fastest-growing regions in the country and its population of more than 5.5 million — anchored by Phoenix in the northwest and Tucson to the southeast — is expected to double by 2040.

And what about the water for this growth? Under state law, a developer must prove it has a 100-year supply for any new housing development. The primary solution for that has been for the Central Arizona Groundwater Replenishment District to fill or replenish aquifers where growth is planned — and the source for that is the precarious Colorado River water.

An aquifer storage and recovery well being drilled in the Desert Ridge neighborhood of North Phoenix.

The reality, though, is that all of these well-intentioned measures may fall far short of being able to cope with a full-blown climate crisis. Someday the desert may reclaim what has been built here — as it did with the Hohokam.

Whether that unfolds remains to be seen. By Ross's reckoning, the withering of Arizona will not be uniform, and those most affected will be the people least able to find alternatives, such as impoverished communities in South Phoenix.

“The well-resourced communities in the northeast are well set up,” for a drier future, said Ross. “And there are communities like South Phoenix that have been poisoned for decades that are not. It’s obvious who is going to suffer the most when the shortage really hits.”

“Here, we are all looking at Cape Town in shock,” said Taylor Hawes, of the Nature Conservancy’s Colorado River program, referring to the crisis last year when that South African city appeared on the brink of running out of water. “We’re not that far from that if things go south.”

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