STATE OF THE BASIN REPORT

A Guide to the Colorado River Crisis

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ACKNOWLEDGEMENTS

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AT A GLANCE: THE 2026 COLORADO RIVER INFLECTION POINT

With the Colorado River's flow severely reduced, and reservoirs at record lows, the Colorado River Basin—which supports 40 million people across 7 US states and Mexico, and $1.4 trillion in GDP—must pivot from crisis management to building long-term solutions for this lifeline of the American West.

THE WATERMARKS OF A CRISIS

A century-old overestimation about water flow is colliding with a 26-year "mega-drought" in the summer of 2026, pushing the basin's water systems to the brink of collapse. The 1922 Compact that allocated the river among Upper Basin and Lower Basin states was based on over-optimistic expectations for water supply. This over-allocation, compounded by heat-driven aridification, has depleted Lake Mead and Lake Powell to around one-third capacity.

- **Critical Thresholds:** By the fall of 2026, the US Bureau of Reclamation has warned that Hoover Dam may generate 40% less hydropower. The giant reservoirs that store water and generate electricity face the risk of reaching "minimum power pool" (losing hydropower) or "dead pool," where water can no longer flow downstream, devastating ecosystems and the $1.4 trillion regional economy.
- **Invisible Losses:** Groundwater—the basin's "savings account"—is being drained faster than surface water.
- **Water Quality:** As water flows decrease, pollutants and salinity are increasing concerns. Higher salinity risks violating an amendment to the 1944 treaty that governs how the US and Mexico share the river.
- **Economic & Societal Stakes:** Companies often fail to price in water risk, city budgets are under pressure from efforts to diversify water sources, and consumers will be impacted via their food and electricity bills.

THE SHARED CHALLENGES

The Colorado River Basin's water problems have massive economic and societal stakes, affecting national security, food stability, and corporate supply chains.

- **Governance & Politics:** Interim guidelines to govern the river expire this year, and the federal government is expected to announce a new framework.
- **Food & Water Security for All:** The basin is America's "salad bowl," providing an estimated 90% of the US's leafy greens in winter. It's also an important source of milk, beef and eggs.
- **Tribal Rights:** While 30 Tribal Nations hold rights to 25% of the river, other Tribes have unsettled claims. Many Tribes also lack the infrastructure to use their share; their inclusion in a post-2026 framework is imperative.
- **Industry at Risk:** Semiconductor manufacturing, data centers, defense companies, mining operations and other companies depend on the river's dwindling flow.
- **Aridification:** "Drought" conditions are actually a permanent or semi-permanent shift to a hotter, drier landscape, with the river's flow expected to drop another 20% by 2050 and 35% by 2100.
- **Water Banking:** A system of banking water has included injecting water into aquifers for later withdrawal, and "interstate water banking" – creating concerns about false security in reservoir levels.

A "SILVER BUCKSHOT" APPROACH

There is no silver bullet, only silver buckshot, as a Western saying goes. A multi-pronged approach is being taken to move beyond short term crisis management and build long-term resilience for the basin.

- **Urban Efficiency:** Water re-use and programs to replace ornamental turf with xeriscaping are highly effective, and could be more widely implemented. Cities like Las Vegas have decoupled growth from water use, recycling water and reducing per-capita consumption.
- **Alternative Frameworks:** Tribal partnerships, corporate partnerships, and new ways to approach river governance are emerging.
- **Agricultural Innovation:** Agriculture is estimated to account for around half of all water uses. Moving to more efficient irrigation equipment, lining canals, and experiments with less thirsty crops and "agrivoltaics" (solar panels over crops) all show promise but have yet to be scaled.
- **Technological Scaling:** Wastewater recycling and desalination programs are expanding, but come with challenges around transportation and water quality.
- **Nature-Based Infrastructure:** Restoring wetlands offers long-term dividends for the microclimate and beyond, helping to improve water quality and recharge aquifers. Forest thinning is being undertaken, but with controversy around results. Low-cost solutions like Beaver Dam Analogs (BDAs) can help do this for as little as $1,000 per structure, compared to $1 million per mile for traditional engineering.

CONCLUSION: FROM AWARENESS TO ACTION

The tools to solve the crisis exist, and many are already being deployed by conservation groups, Tribes, and with support from government funding or corporate partnerships. The missing ingredients are speed and scale. The 2026 deadline for a new water-sharing framework for the river has created a narrow window for new approaches, and the severity of the drought leaves little time to debate. It's time to end the zero-sum game of fighting over water allocations, and build a collaborative approach that sets all stakeholders in the Colorado River Basin up for nature's future dividends.

INTRODUCTION

> ***The resourcefulness that built the American West is far from running dry.***

The river that built the American West has run out of time.

Over 100 years ago, an unusually wet period created optimism about the Colorado River's flow. Seven states agreed to share its waters on a wealth that rarely materialized. The cost of that overestimation has been compounding over the decades, and after a 26-year "mega-drought" in the region, the year of reckoning has arrived.

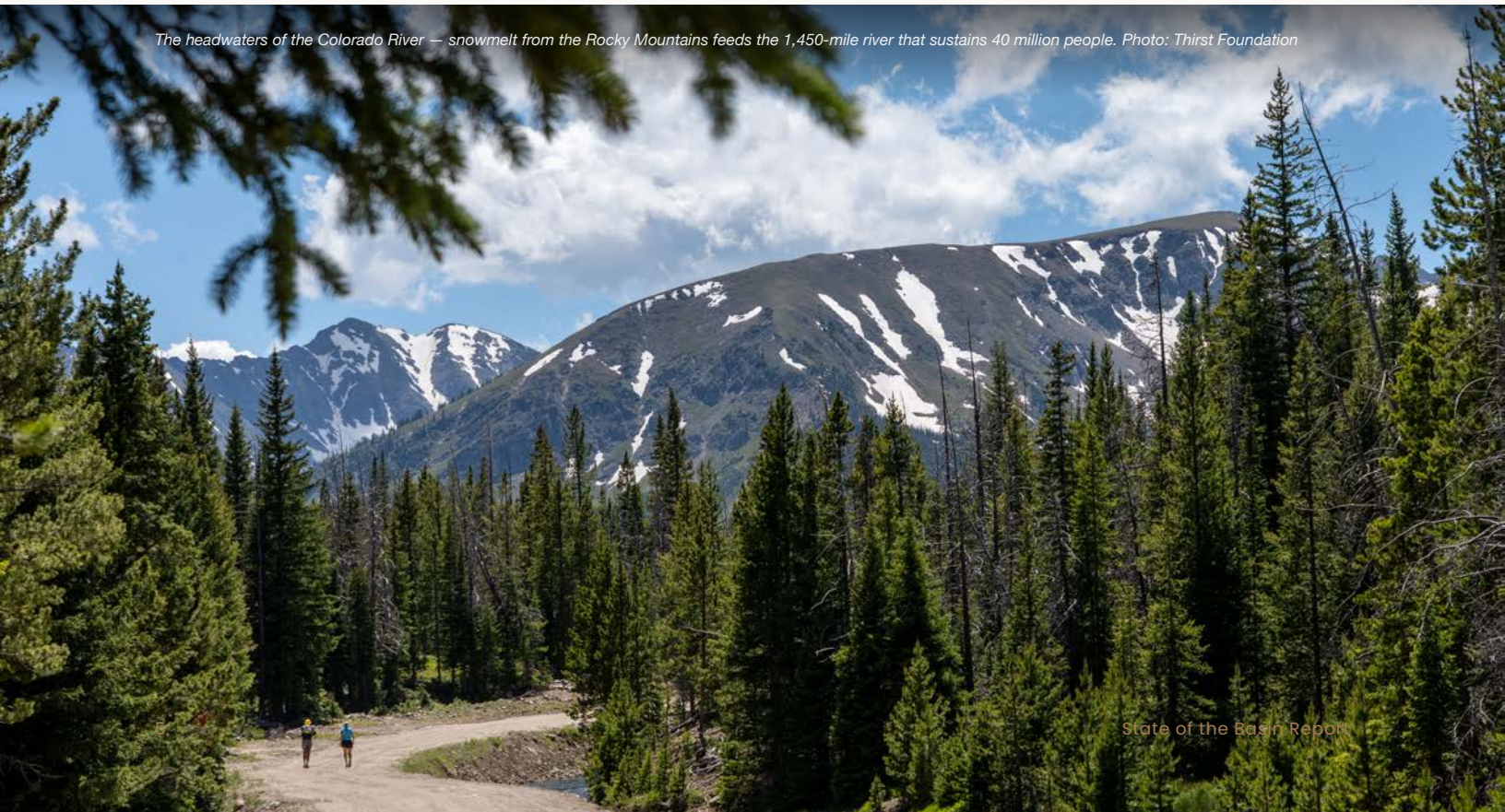
In the spring of 2026, reservoirs along the Colorado River Basin have become severely depleted. Aquifers are being drained. Agriculture is struggling. Dams are at risk of falling below the threshold required to generate power, or even more importantly, of reaching "deadpool," when water can no longer flow through the dam – a turning point that could damage the dam's equipment, the river's ecology and industries and communities across 7 U.S. states. The economic and societal implications of the Colorado River crisis are staggering: an estimated $1.4 trillion in annual GDP for the US economy is at risk, along with 16 million jobs and a way of life for 40 million people who depend on water from the river and its tributaries.

But the resourcefulness that built the American West is far from running dry.

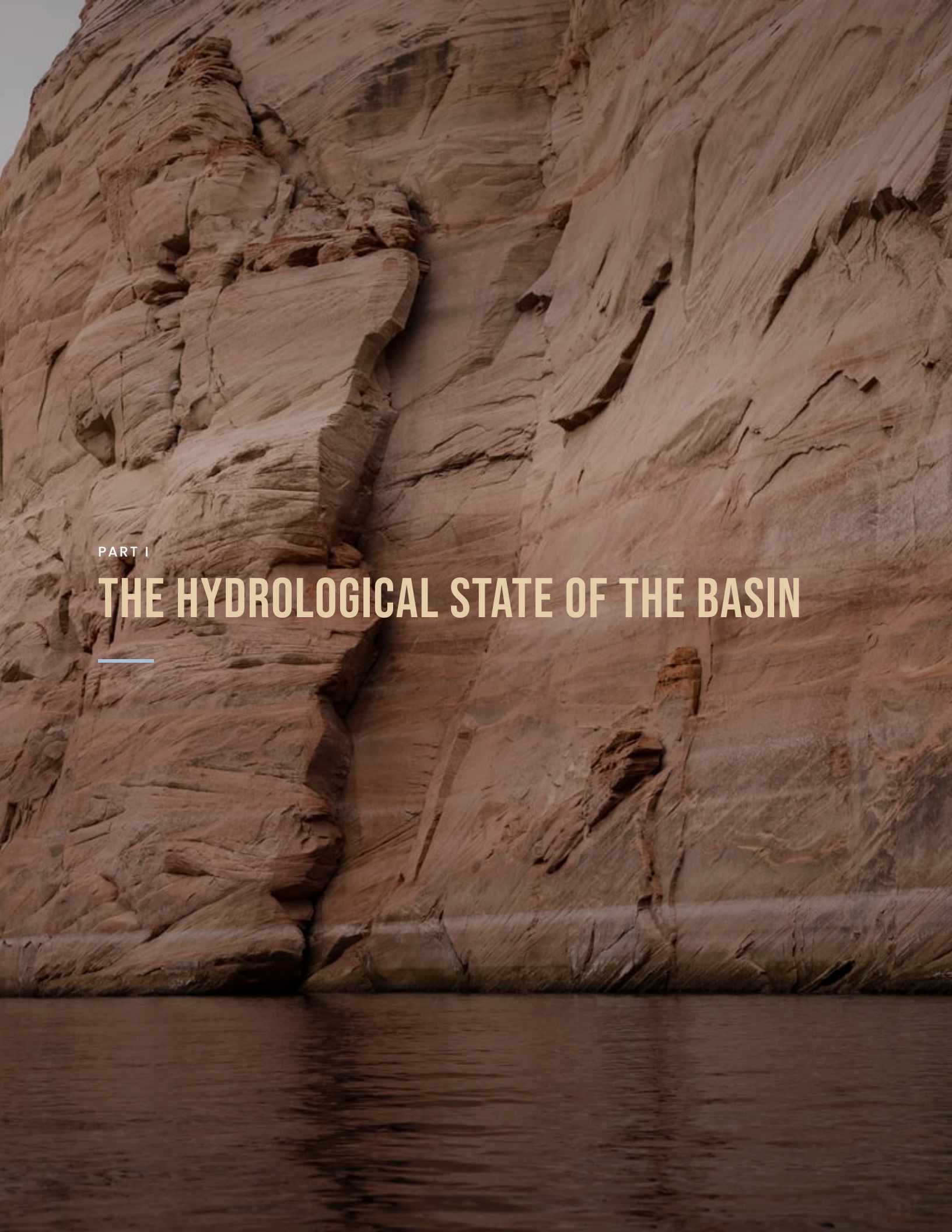
Some states have agreed to voluntary water cuts; Native American Tribes are reducing their water use to help stave off system collapse; cities are recycling, companies are investing in new water-saving technologies, and conservation groups are driving nature-based solutions. There are promising ways to mitigate the crisis, even as logistical and political challenges remain to be addressed.

This report examines the biggest challenges to the Colorado River Basin, based on interviews with subject matter experts, reviews of scientific and news articles, and data provided by the Water Resilience Coalition. It also addresses the most promising strategies to mitigate them.

Drawing on recent research and insights about ecology, water management and technology, it looks past the zero-sum game of fighting over water allocations, and zeroes in on the emerging methods to keep the river running, together.



The headwaters of the Colorado River — snowmelt from the Rocky Mountains feeds the 1,450-mile river that sustains 40 million people. Photo: Thirst Foundation



PART I

THE HYDROLOGICAL STATE OF THE BASIN

WATERMARKS OF A CRISIS

> ***The river's entire infrastructure, and the agriculture, cities and industries that depend on its water are all at stake.***

Around six million years ago, an ancient inland lake spilled over in a mega-flood, surging water and debris all the way out to the Pacific Ocean.

The Colorado River was born. For millions of years, it continued to flow from source to sea, winding through alpine meadows, high-desert plateaus, and carving out the Grand Canyon. Even when glaciers retreated 14,000 years ago, the deep snowpack of the Rocky Mountains continued to feed out into a wide delta roamed by megafauna. And for thousands of years after, the delta's sediment sustained the rich marine ecosystems in the Gulf of California, while the river itself sustained Indigenous people and drew Spanish explorers, ultimately fueling the explosive 20th century growth of the American West.

But for more than a half-century now, the river's delta has been a dry, salty desert, its water rarely flowing to the sea. And the river upstream is showing even more signs of stress.

Since 2000, the river's flows have shrunk by 20 percent compared with 20th-century averages. Groundwater, which is supposed to be the "savings account" for emergencies, is also being drained – even faster than surface water. As of May 2026, the Rocky Mountain snowpack that replenishes it was at just 17% of normal, a historic, record low.

The Colorado River's reservoirs are the largest in the US, and can store about four times the river's average annual flow – a system designed as a buffer against drought. At the start of the century, Lake Powell and Lake Mead were almost full. And over the last 20 years, their vast holdings have enabled water deliveries to continue at near-normal rates, buying time for negotiations and water-use reductions, even as the river's flow winnowed. But this year, they've fallen to less than a quarter and less than a third of their capacity, respectively. As the current operating rules on how to share the river's dwindling water expire, the basin is approaching a crisis, where reductions in flow and restrictions on use will devastate water users across sectors – in ways that few are adequately prepared for.

The river's entire infrastructure, and the agriculture, cities and industries that depend on its water are all at stake.

Dams are monumental, highly engineered structures, but dropping water levels open them up to structural vulnerabilities. Pressure changes can quickly cause "cavitation erosion," as bubbles form and burst rapidly, sending shockwaves through the dam's outlet works, damaging them over the course of months, or even hours. There's also a risk of "minimum power pool" – when water levels are so low they are unable to generate hydroelectricity. Even more severe declines risk "dead pool," the level at which water cannot pass through the dam and travel downstream.

From there follow risks of lower hydropower. The Hoover Dam may produce 40% less electricity in the fall of 2026, the US Bureau of Reclamation has cautioned. As of June 2026, the lake formed by the Hoover Dam, Lake Mead, was at roughly 29% of its capacity. Lake Powell, a larger reservoir upriver, was at around 24% capacity, and predicted to get just 13% of its average supply flowing into it this summer – the lowest in the reservoir's history.

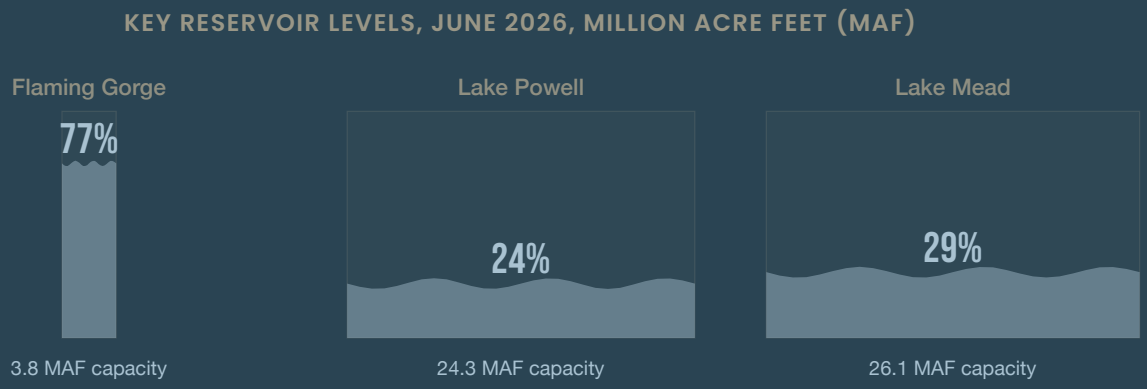
THE COLORADO RIVER BASIN

246,000 square miles across seven states, 30 Tribes, and Mexico

Sources: Natural Earth, USGS, USBR, NRCS SNOTEL, Census, Lincoln Institute of Land Policy

A DRYING RIVER BASIN

> *Lake Powell is predicted to get just 13% of its average spring and summer runoff — the lowest in the reservoir's history.*



Source: USBR

The situation has triggered emergency measures. In April 2026, the government said it would help raise Lake Powell's levels by releasing more water upstream from Flaming Gorge reservoir, which straddles Wyoming and Utah – and by reducing Lake Powell's outflows to Lake Mead. The measure was taken to try and avoid the risk that Lake Powell falls below minimum power pool this year.

In a May statement, Reclamation predicted that at a minimum, Lake Powell will be 3,507.35 feet on December 31, 2026 – above its minimum power pool level of 3,490 feet. The effect is only temporary, and reduced outflows to Lake Mead will potentially reduce Hoover Dam's hydropower generating capacity. In a June update, Reclamation announced that under its most probable 24-month projections, Lake Powell would approach its minimum power pool by February of 2027.

Further downstream, Lake Mead's minimum level by the end of the year is projected to be 1,035.26 feet, above its minimum power pool of 950 feet.

The challenges within the Colorado River Basin have already resulted in millions of federal disbursements, many of them through a $4 billion package under the Inflation Reduction Act, which in 2022 designated funds for Reclamation to combat drought in Western states.

Other parties taking action include California, Arizona and Nevada, which together proposed a three year water-saving plan. A basin-wide group representing water providers, agricultural producers, conservation organizations, and Tribal interests has also asked Congress to provide at least $2 billion in new federal funding – just for a "near-term" drought mitigation. The group has said it's aligned in seeking a broad range of tools: including conservation, efficiency, and the development of new water supply sources.

But more cooperation and funding are needed. The "Upper Basin" states of Colorado, New Mexico, Utah and Wyoming, and the "Lower Basin" states of Arizona, California and Nevada are still at odds over how cutbacks should be shared, stalling progress towards a resolution. Federal guidelines on managing Lake Powell and Lake Mead that expire in 2026 have yet to be reworked as a result. Reclamation is expected to announce a new 10-year framework by late summer of this year – which may trigger lawsuits if states aren't happy with its terms.

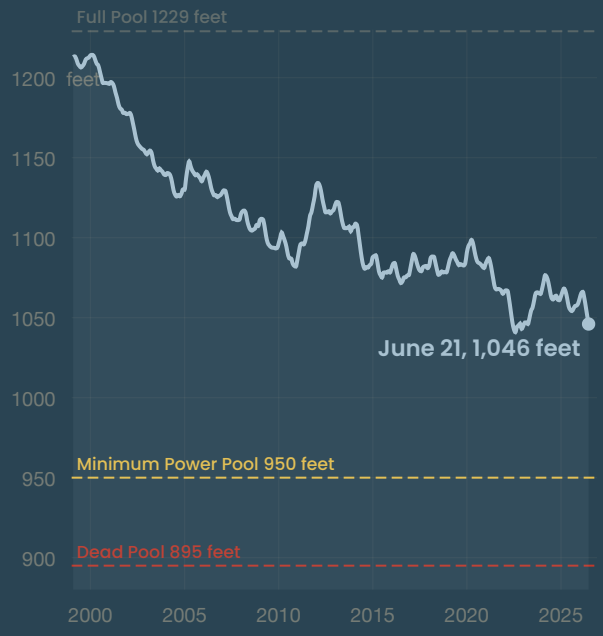
River flow and reservoir challenges aren't the only problems. Groundwater, which hydrologists and policymakers compare to a "savings account" reserved for emergencies, is also in trouble.

RESERVOIR STORAGE & RIVER FLOW

Storage has plummeted since 2000 at Mead and Powell

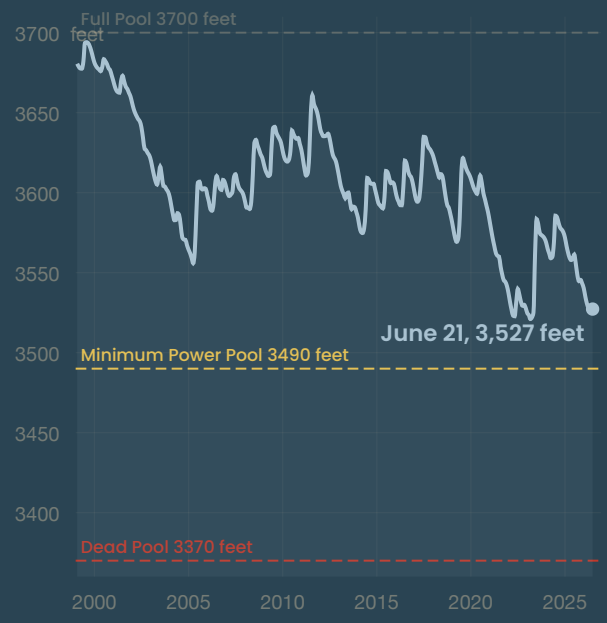
LAKE MEAD

Elevation in feet, 1999–2026



LAKE POWELL

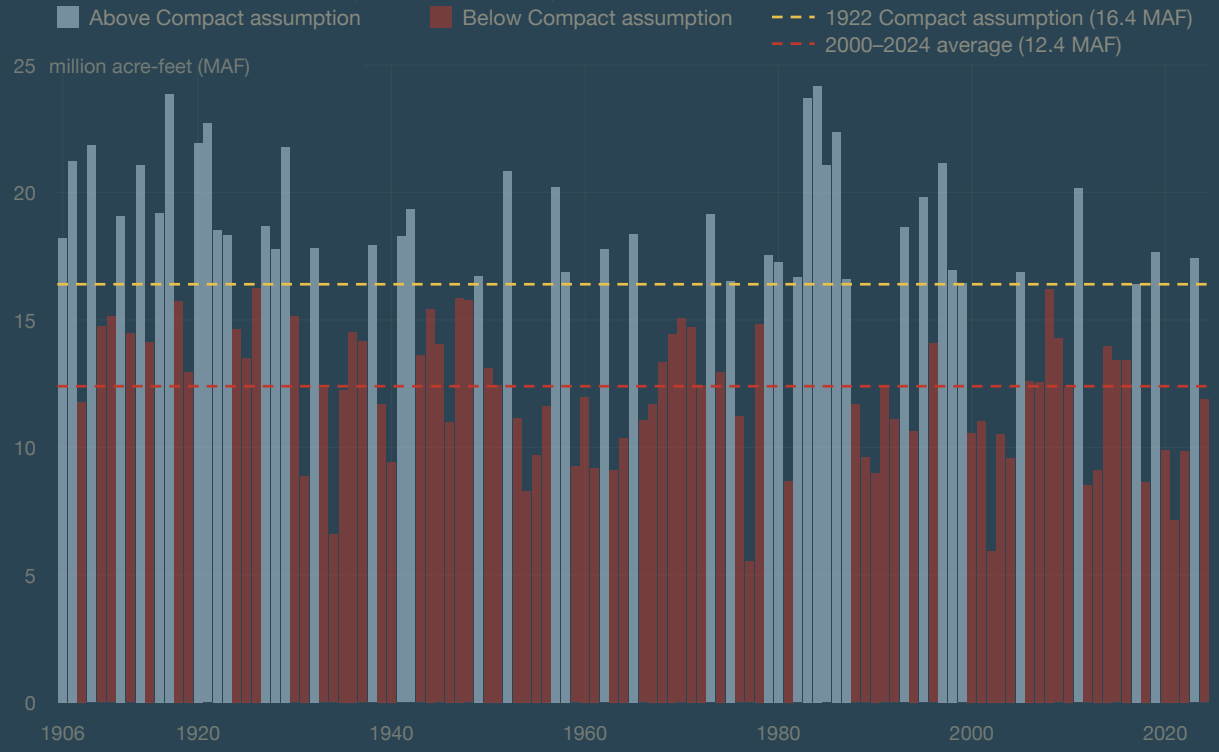
Elevation in feet, 1999–2026



Most years, the river's flow is below the 16.4 MAF assumed by the 1922 Compact

COLORADO RIVER NATURAL FLOW AS IT PASSES THROUGH LEES FERRY

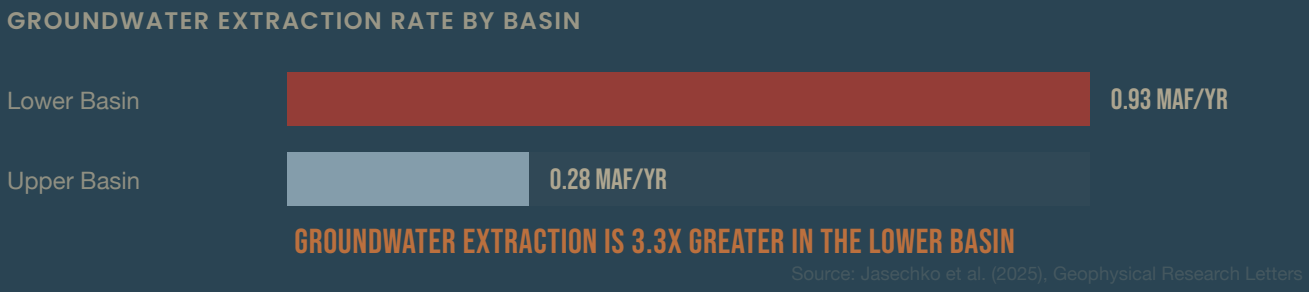
Annual flow in million acre-feet, 1906-2024 (USBR reconstructed)



Sources: USBR RISE API (reservoir elevations, monthly 1935-2026); USBR Natural Flow Dataset 1906-2024

AQUIFERS, A DWINDLING SAVINGS ACCOUNT

> *Reservoirs and aquifers in the Colorado River Basin have together lost a combined 42 million acre-feet of water since 2002.*



Source: Jasechko et al. (2025), Geophysical Research Letters

Basin-wide groundwater storage has fallen significantly, indicating that aquifers are being drained even faster than surface water, according to research using NASA satellite data. Together, the data show that reservoirs and aquifers in the Colorado River Basin have together lost a combined 52 cubic kilometers (or 42 million acre-feet) of water since 2002. The reduction of groundwater was 65% of that total, or about 34 cubic kilometers (28 MAF).

As surface water supplies decline, water users, especially in Arizona, have shifted to groundwater extraction. In the Lower Basin, groundwater supplies about 40% of total water use. It's being extracted at a much higher rate than in the Upper Basin – 0.93 MAF/y versus 0.28 MAF/y, respectively.

Aquifer depletion doesn't just lead to increased water costs and decreased availability for small pumpers, it can also lead to irreversible damage. When too much water is pumped from aquifers, their underground structures can collapse, destroying their ability to hold water again. "Land subsidence" can also occur, damaging nearby infrastructure.

Declining water quality is another challenge. Agricultural irrigation, industrial uses and a combination of climate factors are increasing the salinity of the river's water. For farmers, that means smaller crop yields. For homeowners and municipalities, it means faster corroding pipes that can get clogged with salt. Estimates of the cost of rising salinity in the United States portion of the Colorado River Basin range from hundreds of millions to over a billion dollars a year, and damages occur in Mexico as well. As river flows continue to fall, and the water gets saltier as a result, the U.S. faces the risk of violating an amendment to the 1944 treaty that governs how the US and Mexico share the river.

Salt isn't the only water quality concern. Abandoned mines across Colorado have leaked heavy metals into headwater tributaries, and other chemicals including pesticides and pharmaceuticals all become more concentrated in drought conditions. Cleanups of abandoned mines can cost hundreds of millions of dollars.

THE HUMAN AND ECONOMIC STAKES

> ***Water-intense industries face vulnerabilities in their supply chains.***

The Colorado River ceased its continuous rush to the ocean soon after the gates of Glen Canyon Dam closed in 1963, choking off a flow that had already been constrained by the Hoover Dam in 1935. Over the decades since, its wide, lush delta began to dry, and by the late 1980s, flows to the ocean had largely dried up.

The only other times the water has run to the sea were in "pulse flows" made in an effort to restore the river channel under historic agreements between the U.S. and Mexico, or driven by heavy precipitation or snow melt related to El Niño weather patterns.

With the river's flow diverted into canals or stored in massive reservoirs for human needs, there has been little water set aside for so-called "environmental flows" that help maintain the river's ecosystem. The binational agreement called for occasional releases of water with the aim of regenerating native cottonwood and willow habitats – the kinds of places that can support wildlife and mitigate extreme temperatures. The largest pulse flow, in 2014, released enough water to fill about 52,000 Olympic sized swimming pools, successfully reconnecting the river with the Gulf of California. It recharged aquifers, and visibly greened the delta. But its effects were deemed short-lived, and subsequent flows have been smaller, and spread out over longer periods of time. They've also been adapted in an effort to prevent water loss through absorption in the driest parts of the river channel, with water routed through canals directly to restoration and recreation areas.

The damming of the Colorado River may have helped parch its delta, but there was massive upside. Lake Mead, created by the Hoover Dam, and Lake Powell, created by Glen Canyon Dam, have together been a wellspring for some of the world's most dynamic economies. Phoenix and its booming tech industry, Las Vegas and its casinos, aerospace and manufacturing, and the country's vegetable supply in winter wouldn't exist as we know them today. Even Los Angeles and Hollywood, which rely only partly on the river's water, wouldn't have grown to their size without its massive reservoirs and system of aqueducts.

By that same token, these dynamic economies can't remain the same if the basin's water supply continues to deteriorate. They face an increasing pressure to balance the needs of urban and industrial water use with the ecology and farmland that support their long-term existence.

It's often estimated that the Colorado River Basin is responsible for $1.4 trillion in gross domestic product, and helps support an estimated 35 to 40 million people and 16 million jobs. In reality, many of these people get their water from the Colorado River and a variety of other sources, including aquifers. But linked supply chains mean even those with other water sources, or living far from the river's banks are still affected by its decreasing flows.

The $1.4 trillion figure stems from a 2015 report that calculated what the economic impact would be if the river's water wasn't available for a year, and no substitute was found. Given how much the Southwest's economy has grown in the last decade, the number is likely bigger today. A more recent, but narrower study in 2025 found that water use in the basin generates $20.6 billion in annual direct economic benefits: $18.3 billion from urban use, $1.4 billion from agriculture, and $874 million from hydropower.

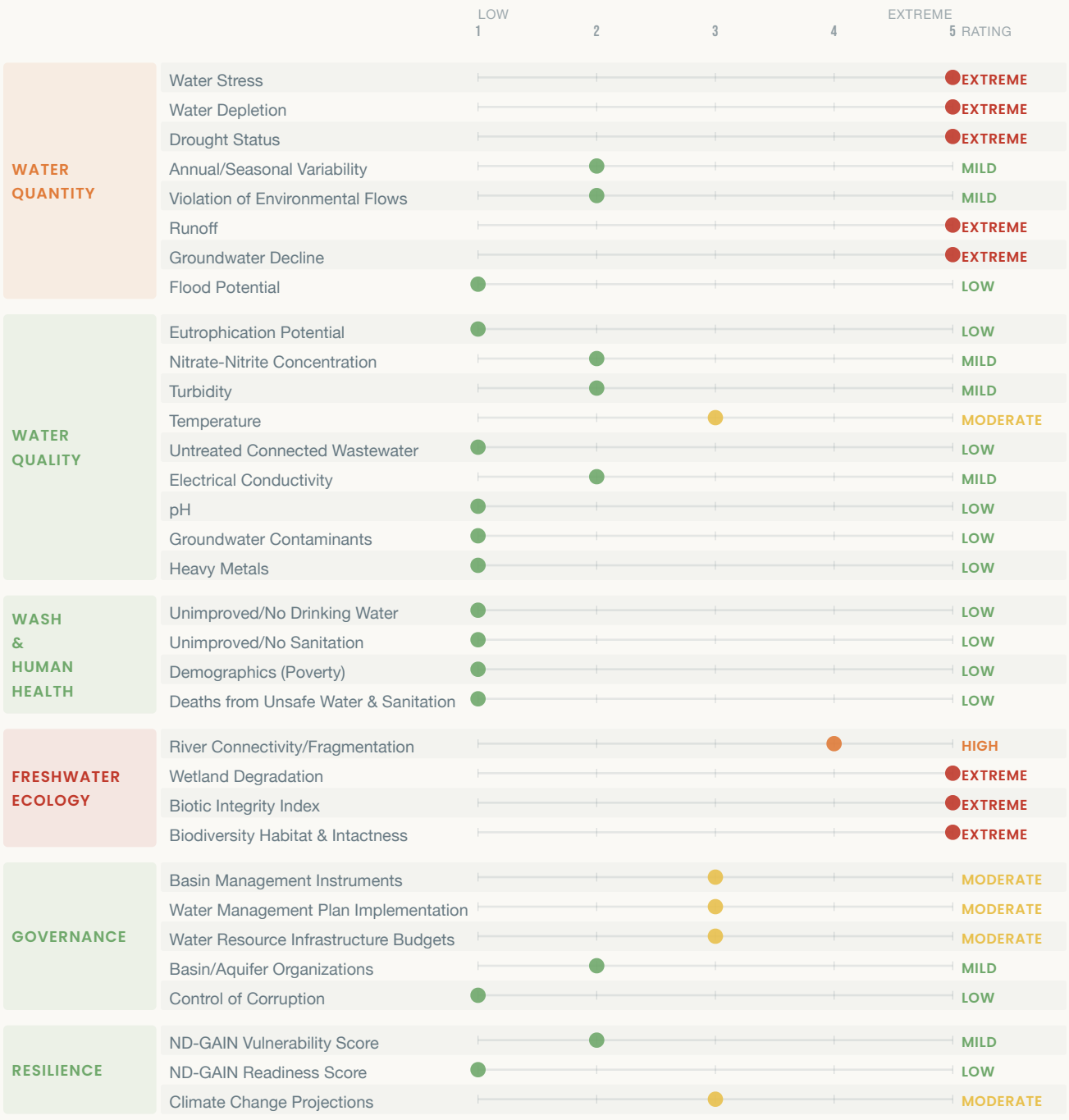
These are significant sums, but they pale next to the real-world impact the river's struggles are having on all parts of the economy – from corporate profits to city budgets and consumer wallets.

Many companies that depend on the river's water are critical to food security, national security, and energy. The basin grows most of the United States' winter vegetables, as well as wheat, cotton, livestock, and food for livestock, all of which require substantial irrigation. In the tech industry, semiconductor manufacturing and data centers, particularly in Arizona, are water-intense uses. Extensive coal, copper, molybdenum, gold, and silver mining have high water demands and quality impacts.

Rising costs are already here. Global companies are increasingly aware of the concerns in the basin. The Pacific Institute undertook a recent study for the Water Resilience Coalition, finding the basin's drought, groundwater decline, wetlands degradation and biodiversity disturbance were all category 5, its most severe rating. Its study also raised concerns about salinity increases, pollution and the loss of native fish and aquatic species.

A STRESSED BASIN

> *The basin's drought, groundwater decline, wetlands degradation and biodiversity disturbance were all category 5, its most severe rating.*



Source: Cohen, M. (2026). Colorado River Basin Diagnostic. Pacific Institute. Water Action Hub. Reviewed June 12, 2026.

THE ECONOMIC STAKES

> *Real estate, municipal bonds, and infrastructure investments in water-stressed cities carry long-term risk that current valuations may not fully price in.*

Much of the economic risk of water scarcity isn't priced into financial markets, however. CDP, a non-profit that runs an environmental disclosure system for clients, says few companies track their water risk accurately, and the risks are intensifying. If companies don't assign a financial value to water beyond the price they pay water utilities, or discuss the issue with their suppliers, they leave huge vulnerabilities in their value chains – especially in water-intensive industries such as food & beverage, agriculture, textiles, and semiconductors.

The wider economic impact of water scarcity is difficult to gauge because many companies don't incorporate water risk into their accounting. From over 8,500 companies disclosing on water in 2024, just 426 (5%) reported having an internal water price, CDP estimates. For the companies that do disclose their risks, CDP suggests their costs can be mitigated with a six-to-one return on investment.

Big corporations aren't the only ones economically impacted by the basin's drought. Real estate, municipal bonds, and infrastructure investments in water-stressed cities carry long-term risk that current valuations may not fully price in.

City budgets are already under pressure from efforts to diversify away from river water and upgrade infrastructure – often passing those costs on to consumers through utility bills.

Consumers will be hit from multiple angles. Given the Colorado River Basin supplies the majority of the US's vegetables in winter, almost a third of its milk, and almost 16% of its beef, dwindling crop yields are already playing into higher grocery bills. Electricity prices could also rise, given the hydroelectricity generated by dams, as well as thermoelectric plants along the river which also depend on large volumes of water.

Lost tourism revenue is another economic blow. Water from the Colorado River Basin supports National Parks and wildlife refuges, with estimates that at Grand Canyon National Park alone, tourism contributed $1 billion in economic output in 2022.

On a societal level, declining river flows have already affected some farmers, and some of the 30 federally recognized Tribal Nations in the basin.

In 2025, farmers, ranchers and other water users in Lower Basin and Upper Basin states had to cut back on water use because of low flows. In such cases, farms not only have to stop growing crops, and struggle to bring back fallow land, they can be forced to lay off farm workers. Not knowing how much water they'll get year-to-year creates uncertainties that are hard to build their operation around.

But water is more than just something on a budget line or an ingredient in global supply chains. For fisherman, boaters, hikers and campers and everyone who enjoys the outdoors, it's a way of life. For those asked to make cutbacks to use, or pay more for essentials like food and utility bills, water scarcity means needing to worry about something one once took for granted – and a significant impact on quality of life.

PART II

CHALLENGES

THE GOVERNANCE CHALLENGE: A CENTURY OLD OVERESTIMATION

> ***If the river hadn't been overcommitted in the first place, the situation would be more manageable.***

The crisis isn't just one of changing water quantity and quality – it's one of addressing water governance.

The famous last line of the 1974 movie *Chinatown* – "Forget it, Jake. It's Chinatown" – is still conversational shorthand for the region's long history of competing over water. But those fights date to decades before the release of the movie, which was loosely based on real-life water conflicts.

Many of the water-related institutions of the West are artifacts of an earlier time, when decisions on water were based on the precedence of the claim rather than on principles of efficiency, equity, or environmental impacts. A complex body of rules, legislation, interstate agreements, court decisions, and international treaties known as the Law of the River emerged to address water conflicts. Infrastructure followed: reservoirs were designed to maximize hydroelectric power production and minimize flood damage, and canals and other diversions created to transport the water. Those old priorities are thus ingrained today, visible in the permanently altered flow of the river, the changed uses of the land around it, and the local extirpation of native species.

The "doctrine of prior appropriation" from the western settlement era meant that the first person to put the water to use had a priority right to keep using it. Known as "first-in-time, first-in-right," the rule created a tension, with upstream states fearing that faster-developing downstream states would establish senior rights that might limit their own future use. Many of today's rules and water diversions are the result of this legacy, which has fostered a "use it or lose it" mentality that creates a disincentive to water conservation.

In 1922, the Colorado River Compact was drawn up to try and resolve the "wild west" of water allocations. It divides the region at Lees Ferry, Arizona, and gave the Upper Basin and the Lower Basin each 7.5 million acre-feet of water per year. The actual wording of the compact says Upper Basin states "will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet for any period of ten consecutive years."

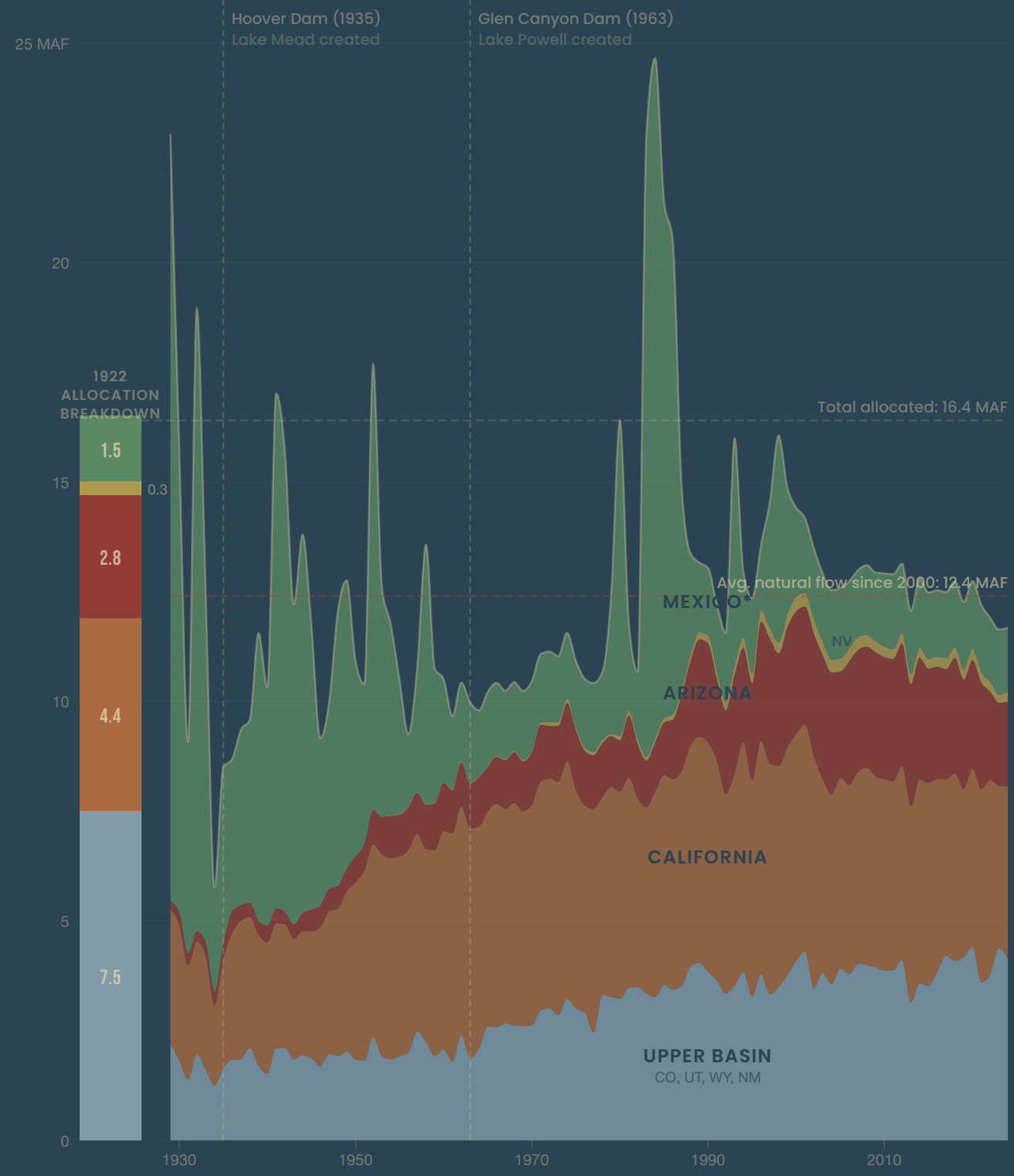
The 1922 compact also introduced a fatal flaw. Drawn up after an unusually wet period, it assumed that river flows would average 16.4 MAF (million acre feet) per year. But actual annual flows from 1906 to 2024 were only about 13.5 MAF, and since 2000 the average has been even less – around 12.4 MAF. Reclamation has said in slides about its draft environmental impact statement that there's a key tradeoff between reservoir storage and delivery reductions, and that the tradeoff becomes more extreme in drier years. Under its category of "critically dry long-term hydrology," even large planned reductions cannot prevent dead pool-related reductions due to low releases from Lake Powell.

Demand has exceeded these amounts in most years in the 21st Century, creating a supply-demand imbalance that has led to many of the current problems, including tensions between the Upper and Lower Basin. There are significant hydrologic and institutional differences between the two basins, which contribute to the challenges. The Lower Basin argues that it's already implemented significant conservation measures, while the Upper Basin cites hydrological variability as a barrier to committing to fixed reductions. Yes, the river's flow is dwindling due to lower snowpack, warmer temperatures and more evaporation from reservoirs, and higher evapotranspiration from plants, but if the river hadn't been overcommitted in the first place, the situation would be more manageable.

ALLOCATION VS. REALITY

The Law of the River allocated the river's flow at a time when 16.4 MAF were expected

Mix of consumptive water uses in US states and deliveries to Mexico, 1929–2024 (Million Acre-Feet/Year)

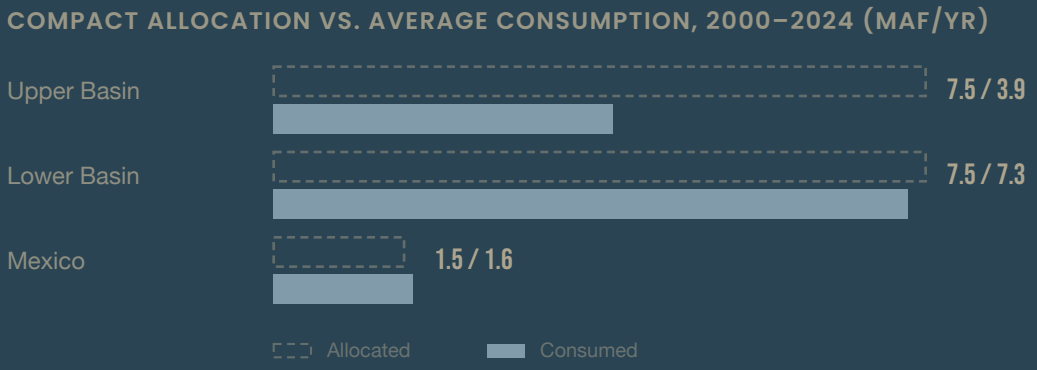


*Mexico values represent total flow to Mexico, including natural and surplus releases — not consumption alone.

Source: U.S. Bureau of Reclamation

THE GOVERNANCE CHALLENGE

> *How do we find a system for valuing water amid increasing scarcity – one that doesn't commodify it?*



The compact was negotiated by the seven basin state representatives and the federal government, but two significant parties that depend on the Colorado River were not included in those negotiations – Mexico, and the 30 federally recognized Tribes in the basin. Nor did the Compact acknowledge environmental needs.

Mexico was later allocated more water from the over-committed river to try and make amends. The 1944 U.S.-Mexico Water Treaty pledges 1.5 MAF per year to Mexico — on top of the 15 MAF promised to Upper Basin and Lower Basin states (except in times of extraordinary drought when flows to Mexico can be reduced or in times of surplus when the flows can be increased to Mexico.)

A number of Native American Tribes are still working through their water rights settlements. A 1908 decision in *Winters v. United States* had already decreed that when the federal government creates an Indian reservation, it reserves enough water to make that land livable – but the 1922 compact didn't allocate the water to do that. Today, after decades of grueling lawsuits by some Tribes, some of the basin's 30 federally recognized Tribes have rights to 20% to 25% of current river flows. But some still have unresolved claims that could increase total Tribal water rights to a third or more of total river flows, according to a paper by the Getches-Wilkinson Center at the University of Colorado. That creates a significant unknown as the basin works through its current shortfalls.

Despite its pitfalls, states haven't given up on the 1922 compact. If anything, the last quarter century of drought has intensified debates over it. In 2005, federal officials and the seven basin states and other stakeholders began building a framework to better respond to the region's growing drought. The result was the interim guidelines, which set the rules for reservoir operations and establish lower basin shortage triggers and volumes from 2007 until 2026. They expire in 2026, bringing an age-old dispute to a head.

As the clock ticks down towards that deadline, the federal government is working with stakeholders to finalize a new plan. Reclamation has held public meetings, and received thousands of submissions from the public, Tribes, states, federal agencies and other stakeholders about how to best govern the river. Some states have signalled they're ready to challenge an outcome they don't agree with. A legal battle over the dwindling river would cost the basin states millions of dollars, and end up in the Supreme Court, drawing money and resources away from efforts to deal with the physical reality of water scarcity which is already on the West's doorstep.

With a collaborative approach possibly coming together in the summer of 2026, the basin's drawn-out legacy of fighting over water rights begs the question – not just to court systems, but to societies at large. How do we find a system for valuing water amid increasing scarcity – one that doesn't commodify it?

Other countries have gone through droughts around vital river basins before, and come up with their own solutions, such as Australia with its Murray-Darling Basin Plan in 2012 (see below).

FOOD AND WATER SECURITY FOR ALL

> ***When looking at the total picture, including evaporation from the region's giant reservoirs, agriculture is just 52% of overall water consumption.***

It's often said agriculture accounts for 74% of the Colorado River's uses, and suggested that it's therefore the first place to make major changes to address drought challenges.

The full picture is more complex. When looking at the total picture, including evaporation from the region's giant reservoirs and environmental uses, water is just 52% of overall water consumption, according to a study of its flows published in Nature in 2024.

Globally, food security is a growing concern due to more extreme weather and rising temperatures. The amount of farmland is also shrinking even as the population grows. Overall, since 1996, farmland in the US has declined around 8%, or 75 million acres. In Colorado, the losses are said to be even steeper over a similar period – around a 32.2% decrease in irrigated acreage.

The Imperial Valley in southern California is one of the largest and most productive agricultural areas in the US, estimated to produce around two-thirds of US winter vegetables. According to its 2024 report, its top commodities were cattle, alfalfa, broccoli, lettuce, and Bermuda grass hay. The Yuma Valley, in southwestern Arizona, is also an important food source, and says its exports go to over 70 countries. Together, it's estimated these areas produce 90% of the US's leafy greens in winter.

Food insecurity may seem like a distant problem in the well-stocked grocery isles of the American West, but it's been predicted that in order to maintain US agricultural productivity through 2050, $6.1 billion to $7.9 billion annually in public R&D spending may be required. When it comes to the Colorado River Basin, farmers have already faced huge challenges trying to adapt to uncertain water allocations and long-term climate change.

Switching to less water-intensive crops is often suggested as a solution. But the plants that best survive long droughts aren't always the ones that suck up the least water on a regular basis. Alfalfa, used as cattle feed, is the most controversial crop in the basin, and a prime example: its ability to send down deep roots and go into dormancy makes it incredibly drought-hardy, yet, it's also become one of the region's most water-intensive crops because heavy irrigation increases yield. Alfalfa for export is even more controversial. The Farm Bureau, an agricultural advocacy and grassroots organization, estimates that among western states, around 31% is exported. Alfalfa serves as one example of many on the role of commodity exports on water consumption in the basin.

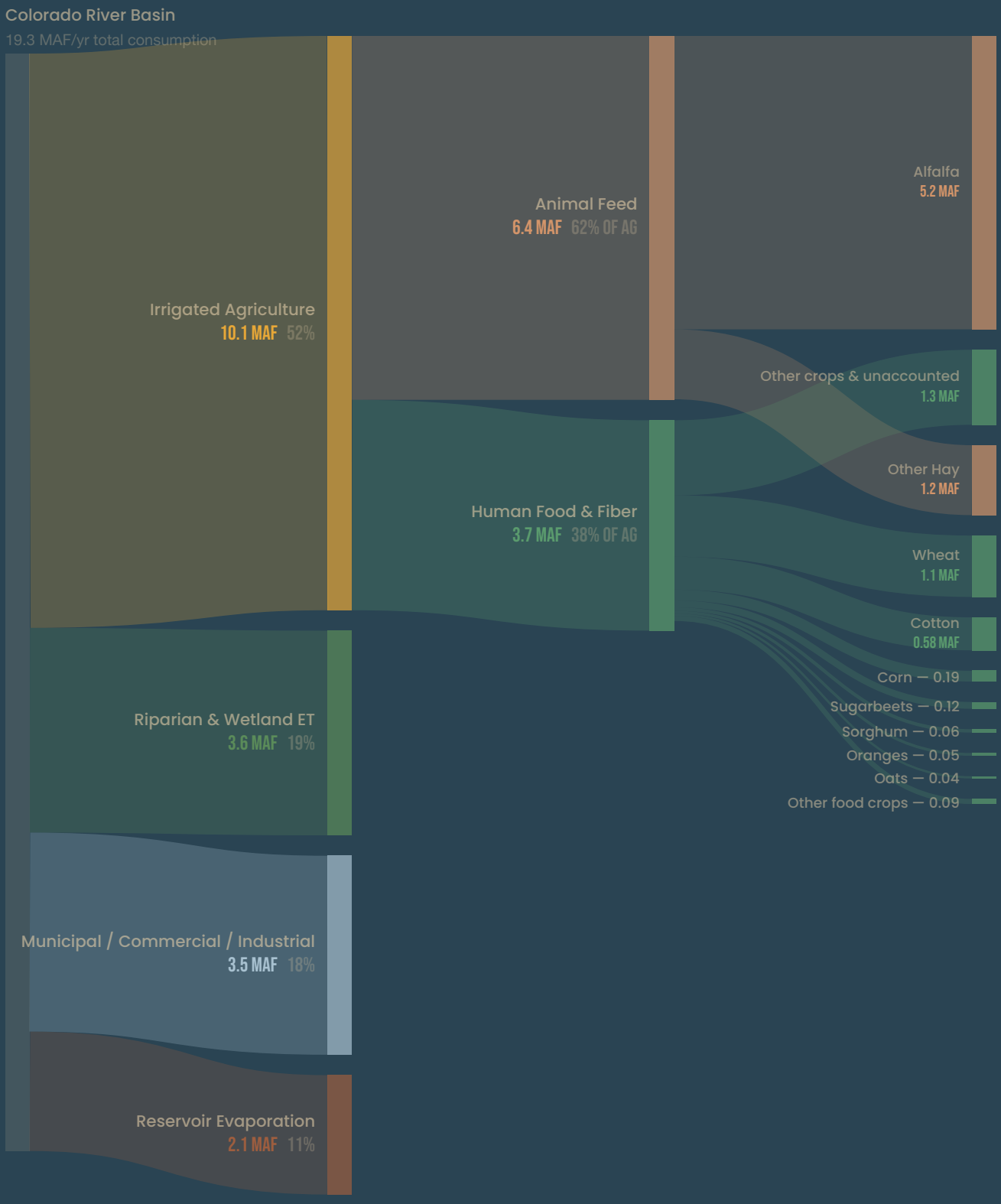
When it comes to establishing better water security in the basin, clearly agriculture can become more efficient – but there are also other places to look.

GLOBAL CASE STUDY: AUSTRALIA'S "BIG DRY"

The Murray-Darling Basin (MDB) is the largest interconnected system of rivers in Australia. It ran into an exceptionally severe, decade-long drought in Australia that lasted from 1997 to 2010, often called the Millennium Drought or "the Big Dry." In response, the Murray-Darling Basin Authority (MDBA) devised one of the world's most ambitious reallocations of water from agriculture back to the environment. Signed into law in 2012, it set "Sustainable Diversion Limits (SDLs)" that came into effect in 2019, and limited the amount of water taken from the Murray-Darling Basin for irrigation supply, town use, industrial uses, drinking water supply, and any other future use. In hindsight, some of the plan's measures are considered a success, such as its investment in more productive irrigation systems. But it has also been criticized for failing to anticipate accelerating climate change, and not putting aside enough water to restore the environment. Water theft and a lack of enforcement thwarted some of the plan's goals, as did changes to the plans wrought by powerful stakeholders. There are ongoing concerns that the basic human right to access adequate, safe drinking water is not being met in some towns, including communities that are predominantly Indigenous.

WHERE THE WATER GOES

Over half the basin's water goes to agriculture according to a study of 2000–2019 averages



Sources: Richter et al. (2024) Nature Comms. Earth & Environ., Tables 1 & 2; Pacific Institute, Bureau of Reclamation

INDUSTRIAL AND TECHNOLOGICAL STAKES

Data centers, like alfalfa, have become a focal point of the water crisis. Community opposition to their vast facilities has been growing on social media and at hearings and public meetings, along with complaints about related operations like semiconductor manufacturing. One of the biggest concerns is the large amounts of water such operations consume.

In fact, data centers vary widely in terms of their water use. It's been estimated that a large data center can use an estimated 5 million gallons of water each day – as much as a town of up to 50,000 residents. And that for every 10-50 medium-length responses from some AI queries, a 500ml bottle of water is used, according to a 2025 study in Communications of the ACM.

But there are vast differences in the technologies used by different companies. While some data centers use "close-loop" systems that continuously recirculate the same fluid, others are "evaporative" – leaving the facility entirely and requiring the data center to bring in a constant stream of new water.

There is still not robust data or consistent methodology for reporting and disclosing water use, even as new data centers are coming online rapidly in the region. The industry itself provides most of the data on water use, creating skepticism about its reliability. While some cities may require disclosure of water use, open questions remain about the water that goes into generating the electricity for data centers.

A 2024 report from the Lawrence Berkeley National Laboratory estimated direct water consumption for U.S. data centers at 66 billion liters (or 17 billion gallons) nationally in 2023. But water consumed to generate the electricity that powers the facilities has received far less attention, and it could be much higher: nearly 800 billion liters.

The report predicts that by 2028, hyperscale data centers could consume up to 124 billion liters of water. That's about 0.1 MAF per year – smaller than the amount of water to produce animal feed, which has been estimated to use 6.4 MAF per year, and less than combined municipal, commercial and industrial use, which is around 3.5 MAF – but still on par with the amount of water used by a city about the size of Tucson, or a year's worth of some crops.

With new technology, improvements in data center water efficiency can be made. But even as locations become more efficient, they're likely to produce the same kind of efficiency paradox that exists in agriculture: the more water you have, the more water you use.

The problem isn't just how much water each data center uses, but how the data centers cluster in certain regions. Arizona and Nevada in particular have emerged as huge hubs, and Phoenix is one of the fastest-growing data center markets in the U.S. Growth has exploded since 2019, powered by a move away from rising California real estate prices, and more cloud-computing needs. Even more recently, AI has hyper-accelerated the growth of data centers – including hundreds across the basin states.

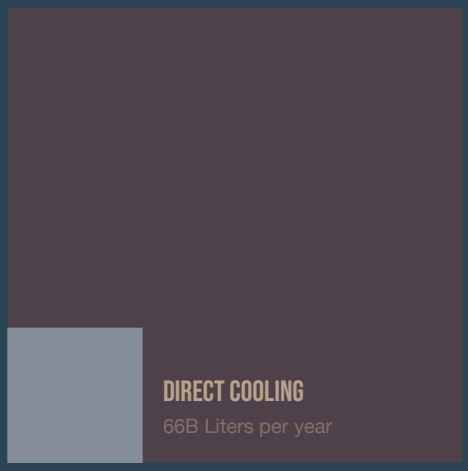
Power transmission lines crisscross the canyon below Hoover Dam — the river's hydroelectric capacity is declining with water levels. Photo: Thirst Foundation

DATA CENTERS ACROSS THE BASIN

Sources: Data Center Map; Lincoln Institute of Land Policy

A THIRST FOR KNOWLEDGE

U.S. DATA CENTER WATER USE, 2023



Source: Lawrence Berkeley National Laboratory (2024)

The growth of data centers seems unlikely to decelerate, and new technology is constantly evolving to try and make them more water-efficient. But there are questions around whether a drought-stricken, water-stressed region is the best location to support the growth of this industry. Even with closed-loop systems, warmer, polluted fluid can re-enter the water system, having a negative impact on water quality. Data centers routinely need to release small amounts of water to keep salts, metals and chemicals from building up – a process sometimes referred to as "blowdown."

Given international rivalry to win the "AI race," national security is often invoked to give data centers leniency. But there's also a national interest in coordinating their strategic infrastructure beyond the local level, and considering other national priorities like water security.

Data centers are just the newest and most visible water-intensive industry. Agriculture, energy production and textiles have been heavy water users for decades. More broadly, activities in the Colorado River Basin serve as base for multiple supply chains with significant water impacts.

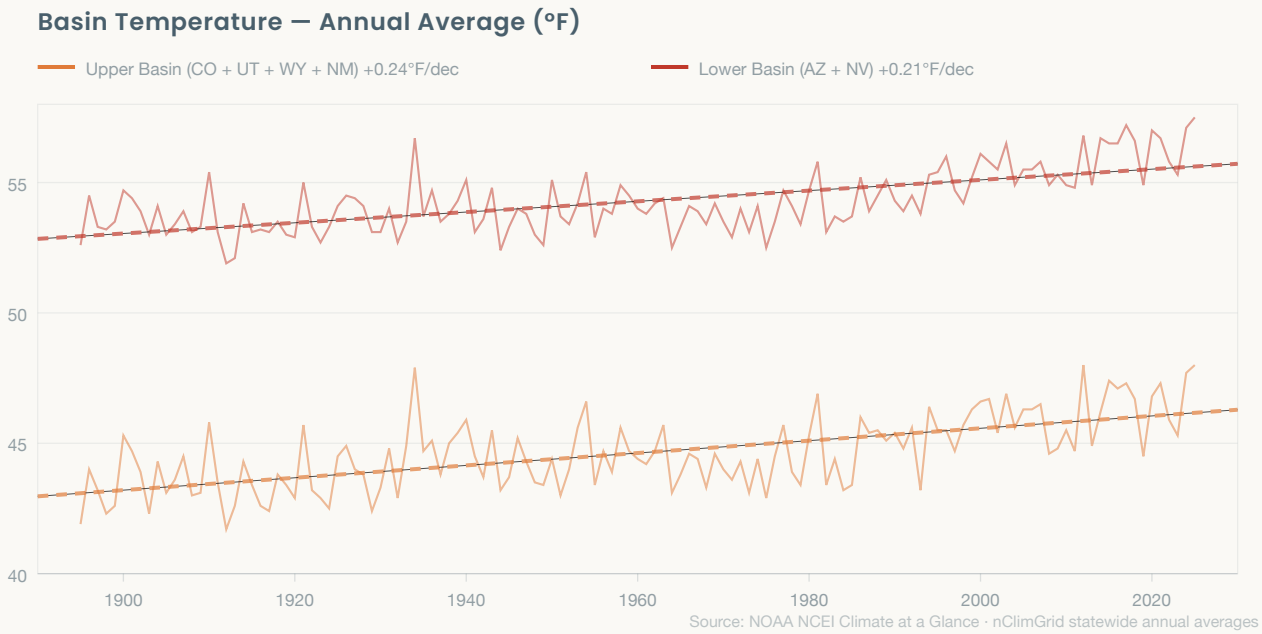
Data centers aren't the only water intensive industry; the basin is also home to major semiconductor manufacturers. Other businesses that depend on water systems fed by the river include significant operations in defense, mining, oil and gas, and energy. Aside from several large dams that generate hydroelectric power, thermoelectric plants also depend on large volumes of water for cooling and operations – whether they use coal, natural gas, or nuclear fuel.

In Mexicali, Baja California, extensive manufacturing activity in foreign-owned factories known as "maquiladoras" is deeply integrated into both the economies of Mexico and the United States.

Arguments about balancing water security against food security and national security are already arising in response to federal proposals on post-2026 frameworks. While stakeholders and policymakers need to be realistic about the finite amount of fresh water supply available, they also need to move past a zero-sum mentality, and talk about where overlapping interests can help build long-term solutions.

"MEGA-DROUGHT" OR ARIDIFICATION: THE CLIMATE OUTLOOK

> *Planning for a drought assumes the water comes back — but planning for aridification means designing for a smaller flow of water on a long-term time scale.*



Underlying all of these pressures is a more fundamental challenge: a changing climate

Parched conditions and rising temperatures that have gripped the region since 2000 are sometimes called a "megadrought." Scientifically, it's more nuanced. The region is experiencing heat-driven aridification – defined as a semi-permanent or permanent shift towards a drier environment. Dryness in the area is the worst since record-keeping began. And based on tree rings, it is also the worst in the southwestern United States in 1,200 years.

Planning for a drought assumes the water comes back – but planning for aridification means designing for a smaller flow of water on a long-term time scale.

The majority of the Basin already has an arid or semiarid climate, and 87 percent of the precipitation returns to the atmosphere through evaporation. There are signs the dryness will deepen. Climate models predict an additional 20% drop in Colorado River water flow by 2050, and 35% by 2100.

And temperatures are expected to keep rising. The climate of the Colorado River Basin has warmed by over 2°F (1.1°C) since 1980. Studies predict air temperatures will warm 3.6°F to 10.8°F (2–6°C) by 2100, from a 1990 baseline.

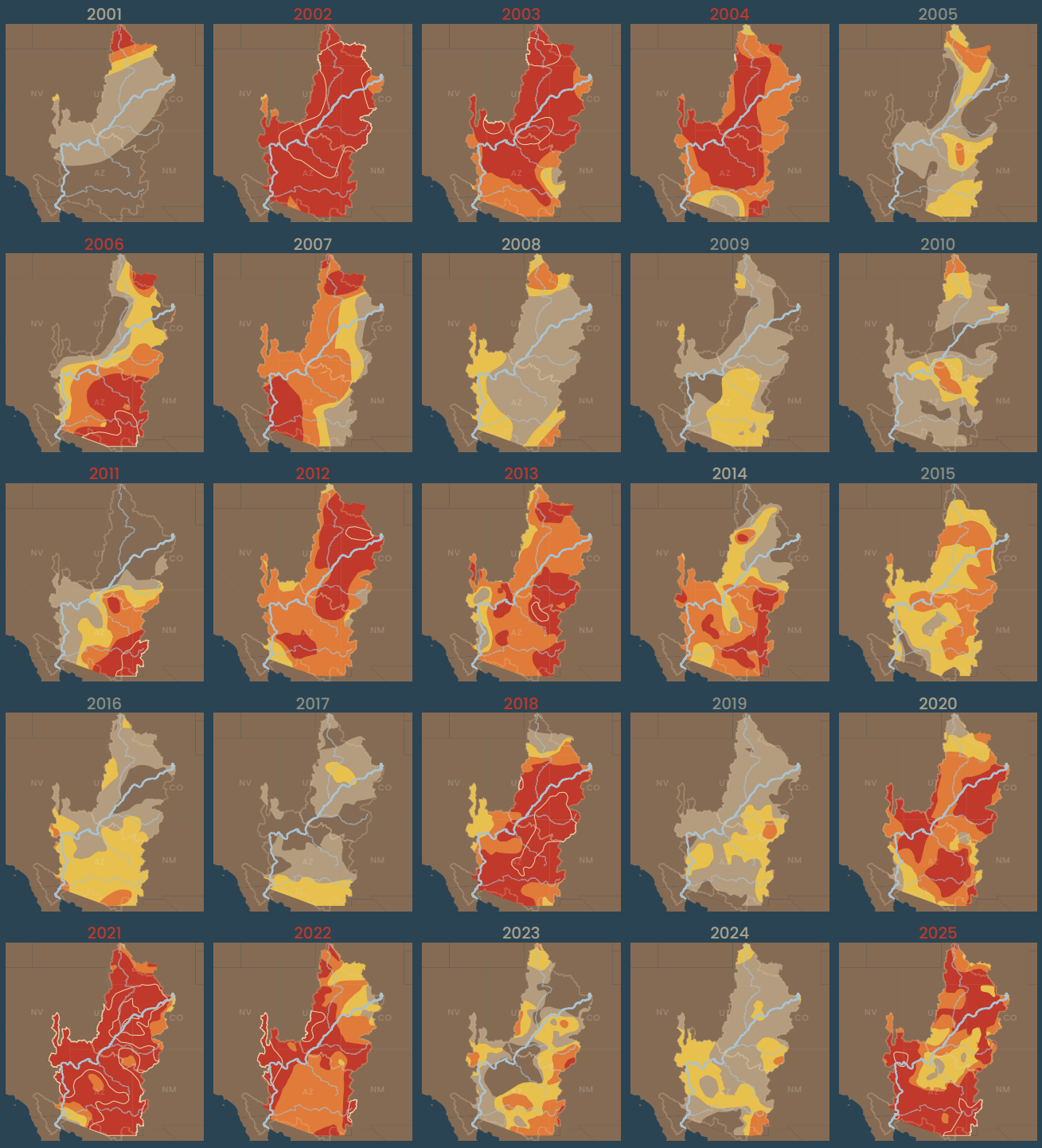
DROUGHT YEAR BY YEAR

Peak drought severity across the Colorado River Basin each year, 2001–2025

US DROUGHT MONITOR

Peak drought level · May–Sep composite · 2001–2025

D0: Abnormally Dry D1: Moderate D2: Severe D3: Extreme D4: Exceptional



Source: US Drought Monitor

A HOTTER, DRIER WEST

> *Changing weather patterns force a reckoning with the limits of engineering: how much can infrastructure and technology compensate for a fundamentally altered water cycle, and how much do consumption patterns simply need to adapt?*

While the climate is changing globally, the unique geology of the Colorado River Basin has left it more vulnerable. Its fragile desert surface soils, stirred up by agriculture and other human activities, generate dust that reduces the snowpack's reflectivity, causing it to absorb more heat and melt earlier. Its canyon topography has led to the creation of huge open-air reservoirs that evaporate an astonishing 860,000 acre-feet of water annually – essentially acting as open-air evaporation pans. Its porous bedrock layers also act like a sponge in some places, trapping and leaking precious water supplies. Rising temperatures and increasing dryness have also brought more intense wildfires, which result in erosion that threatens rivers and water supplies.

The Salton Sea in Southern California's desert region of Imperial and Riverside County is an example of some of the area's unique challenges. Formed in 1905 when the Colorado River broke through an irrigation canal and flooded the Salton Sink, the sea is now rapidly drying up again. This is creating a drier, warmer microclimate in the vicinity that's more prone to windstorms. As the water recedes, it also leaves behind acres of exposed sediments laden with decades-worth of agricultural pesticides, fertilizers, and heavy metals that become airborne in those winds. California has created a "Salton Sea Management Program" to control dust on the exposed lakebed, to be partially funded by a tax on lithium extracted from geothermal brine beneath the Salton Sea region. Meanwhile, human health impacts have already arrived; children living near the Salton Sea were found to experience poorer lung function than children exposed to less wind-blown dust.

Changing weather patterns force a reckoning with the limits of engineering: how much can infrastructure and technology compensate for a fundamentally altered water cycle, and how much do consumption patterns simply need to adapt?

In the American West, declining Colorado River flows have made that question urgent — and set in motion efforts on both fronts.

WATER BANKING

> *If the river stops running, whoever is last to try and call in their credit could lose out.*

When the Colorado River's flows fall below allocated levels, cutbacks for some users are automatic — the water simply isn't there to deliver. There have been attempts to build more flexibility into how water is "banked" and shared among different stakeholders.

Tools being used include Aquifer Storage and Recovery (ASR), or injecting surplus surface water into underground aquifers during wet years, then pumping it back out during droughts. Unlike surface reservoirs, underground storage doesn't lose as much water through evaporation, and the natural underground storage chamber is already there. Such projects have been going on since 1987, when The Las Vegas Valley Water District (LVVWD) started injecting river water into aquifers.

Interstate Water Banking is when one state stores another's unused allocation in its aquifers and earns credits. For example, when Nevada stores water in Arizona's aquifers, the Arizona Water Banking Authority accrues long-term storage credits. When Arizona needs the water, it gets pumped out of the aquifer – which releases an equal portion of Arizona's Colorado River entitlement, which can then go to Nevada instead.

Such deals are widespread. Through water banking efforts in Nevada, Arizona, California and in Lake Mead, the Southern Nevada Water Authority has stored more than 2.2 million acre-feet of water — 11 times Nevada's 2024 consumptive Colorado River water use. ICS or "intentionally created surplus" credits were created in 2007 for Arizona, California and Nevada, and expanded in 2019. It allows reductions in use to be exchanged for credits in Lake Mead in an effort to create incentives for conservation and new contributions to Lake Mead.

As of the end of calendar year 2024, about one-third of all water stored in Lake Mead — 3.33 million acre-feet — was classified as ICS – previously conserved water held in individual accounts for future withdrawals – raising concerns about false security in reservoir levels and the potential for a rapid, catastrophic drop in water availability.

Mechanisms for transferring water rights have been around for decades – such as permanent fallowing, and the "water ranches" of the mid-1980s, when city governments of Phoenix and Mesa bought rural farmland intending to pump and transport groundwater to supplement their municipal supplies. Rural property purchases have long been seen as insurance policies for urban centers.

But as the understanding of the region's long-term aridification has grown, water transfers begin to look more and more risky. The most severe risk is with fallowing – the expansion of fallowed lands in California from 2008 to 2022 was found in a 2025 study to be associated with increasing dust. But there are other ways to fallow. Colorado recently passed a bill that would require cities or speculators who buy farm water to revegetate dried-up land —creating a situation where revegetation of formerly irrigated lands is a fundamental requirement for any water transfer.

Even when it comes to storage and credit systems, the potential for deepening drought or severe water shortages creates the risk of a literal liquidity crisis, involving water. For example, if California goes to get its water from Lake Mead, but Lake Mead is at dead pool, California wouldn't be able to draw water. It would still technically own the water, but the water would be inaccessible. As of June 2026, Lake Mead was getting closer to the 1,000-foot cutoff level where ICS drop to zero. In other words, if the river stops running, water banking arrangements may mean that whoever is last to try and call in their credit could lose out.

PART III

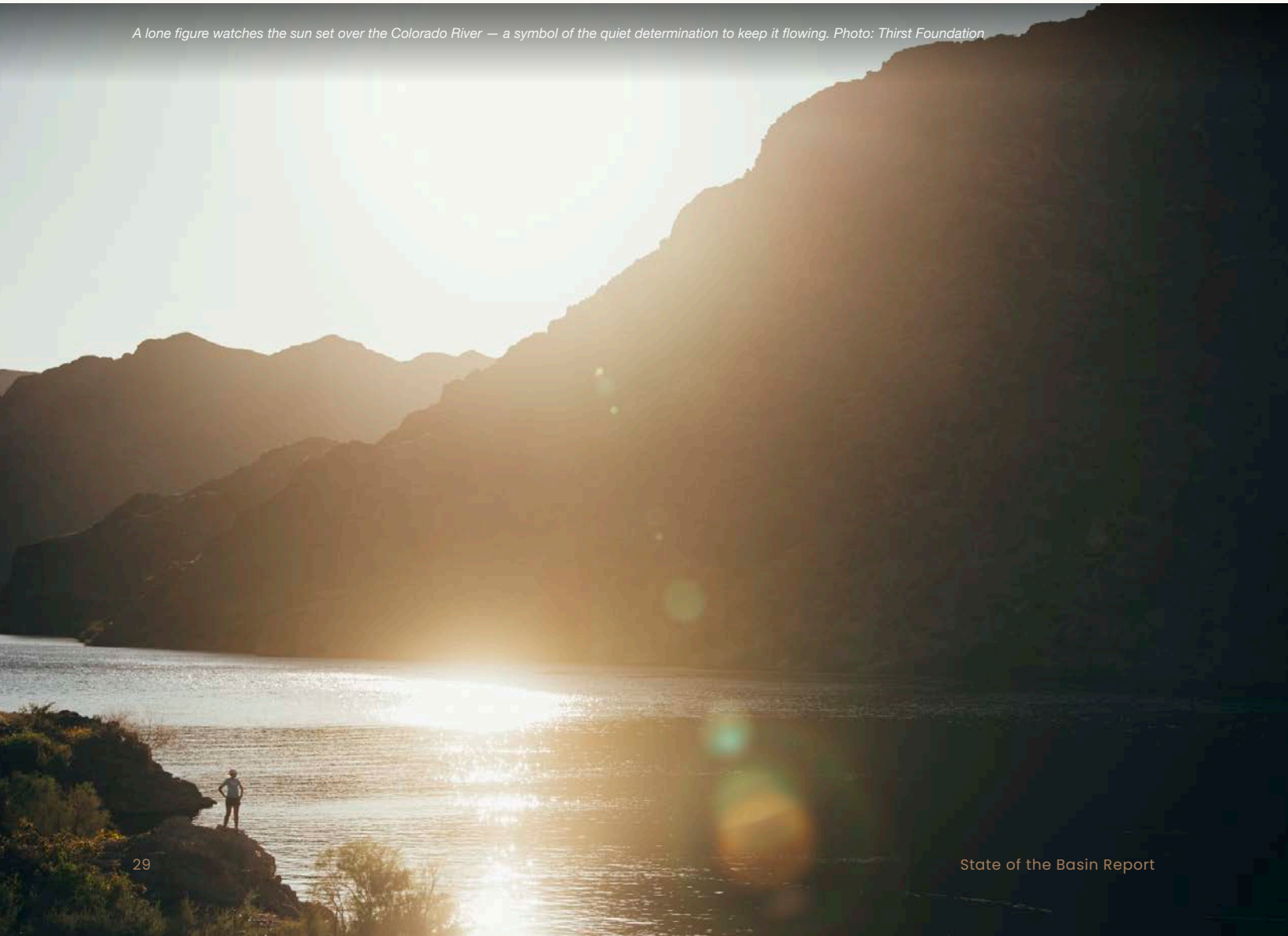
APPROACHES

APPROACHES

"There is no silver bullet – only silver buckshot" is a common saying in Western water circles. The conversation around how to deal with the Colorado River Basin's growing water crisis is still evolving. But as governance deadlines and declining water supplies converge in 2026, the "silver buckshot" or "all of the above" approach is one thing stakeholders agree on.

A variety of proven and innovative approaches to building long-term resilience in the basin are already underway. They include ramping up agricultural and municipal water conservation, restoring habitat, managing salinity, and meeting tribal water needs.

Many approaches are helpful, but have drawbacks. Large-scale desalination creates more water, but is expensive, energy-intensive, and can take a significant environmental toll, adding to greenhouse gas emissions and creating toxic discharges and saltier waters that harm marine life. Adaptation measures that try to do more with less – like getting rid of lawns and large swimming pools – face limits as populations grow. Even as cities, companies and individuals use less water or recycle more, a lack of policy guardrails to guide where the conserved water goes could mean the "efficiency paradox" would mean the water gets used elsewhere. There are tough conversations ahead, about whether some of the most water-stressed areas in the basin may face limits on future growth or require significant reductions in current water. And the broader challenge of climate change means that without reducing greenhouse gas emissions, rising temperatures are likely to keep exacerbating the region's problems.



A lone figure watches the sun set over the Colorado River — a symbol of the quiet determination to keep it flowing. Photo: Thirst Foundation

WATER CONSERVATION: HOW CITIES ARE DOING MORE WITH LESS

Demand reduction is one of the simplest ways to save water. While efficiency gains in agriculture and industry have been more uneven, some cities offer a clear success story.

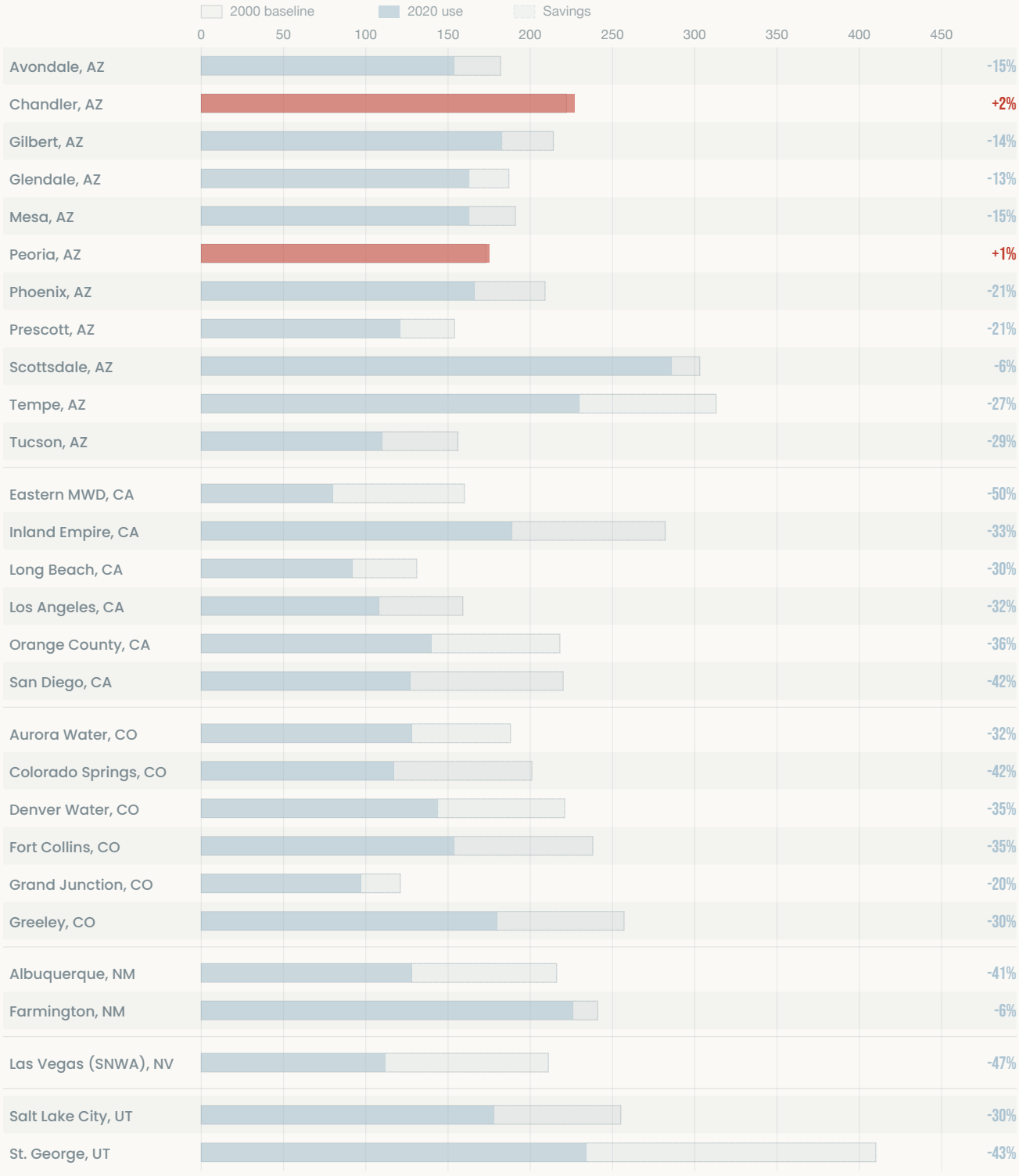
Overall, cities in the region have reduced water use by 18% since 2000, despite a 24% population increase, through measures like outdoor water use reduction, efficient plumbing fixtures, leak detection and tiered pricing, according to The Environmental and Energy Study Institute (EESI). A 2014 study found that such measures enabled water providers to avoid even higher rate increases associated with acquiring additional water supplies, saving ratepayers money in addition to reducing total water demand.

Some of the improvements in water efficiency are due to long-term incentives created at the federal level; the EPA WaterSense guidelines, launched in 2006, encouraged more water-efficient products, driving down nationwide water use over the years. But municipal efforts in some cities have driven remarkable efficiency, setting an example for others. One 2023 study found that, based on data obtained from 28 water utilities in the Colorado River Basin, changes in total per capita water use ranged from +2% (in Chandler, Arizona) to -50% (in the Eastern Metropolitan Water District of California).

An irrigation canal flows across Arizona farmland Photo: Adobe/mdurson

MANY BASIN UTILITIES CUT WATER USE, EVEN AS POPULATIONS GREW

From 2000 to 2020, only two of 28 utilities saw water use per capita rise.



Source: Richter (2023), Decoupling Urban Water Use from Population Growth in the Colorado River Basin, J. Water Resources Planning and Management

GOODBYE, GRASS

The variation reflects differences in starting points, local policy choices, and the mix of tools deployed.

Among the most cost-effective near-term measures are bans on ornamental ("non-functional") turf. California recently enacted a new law, phasing in prohibitions on irrigating grass in areas such as road medians and parking lots and commercial landscapes, potentially saving hundreds of thousands of acre-feet of water each year. Smart water meters (known as AMI for Advanced Metering Infrastructure) can help identify leaks, flag overwatering, and reduce overconsumption. Adoption among the basin's largest urban water utilities has been widespread, but smaller municipalities and rural districts can be slower to implement the technology due to upfront costs.

Las Vegas, Nevada offers one of the most successful examples of reducing urban demand. Since 1999, the Southern Nevada Water Authority has run incentive programs — variously called 'turf roll-ups' or 'cash-for-grass' — that encourage residents to replace lawns with xeriscaping, or drought-tolerant plants. It's estimated such measures save nearly 13 billion gallons of water annually — 55 gallons for every square foot of grass removed. The water authority, which encompasses Las Vegas, has also restricted the size of residential pools and has moved for a moratorium on evaporative cooling mechanisms– which it estimates to be the second largest consumptive water use, accounting for nearly 10 percent of Southern Nevada's annual Colorado River allocation.

Its Water Efficient Technologies (WET) program offers incentives to commercial and multi-family property owners who install water-efficient devices such as high-efficiency showerheads, toilet and urinal retrofits, and retrofits of cooling towers for industrial use with qualifying technology.

Overall, between 2002 and 2023, Southern Nevada's per capita water use decreased by about 58% percent and its use of Colorado River water declined about 42%. Meanwhile, the population increased by about 52%. The water authority notes that worldwide, few —if any— communities have done as much as fast to improve water efficiency and reduce water waste.

Aurora, Colorado, has also taken strong steps to reduce water demand. In 2022, it adopted an ordinance that applies to all new developments, prohibiting ornamental turf in front and side yards and limiting turf in backyards. It also has a strong reuse program, supplying non-potable reclaimed water for irrigation at parks and golf courses.

Photo: Thirst Foundation

GOVERNANCE: THE RACE FOR A NEW FRAMEWORK

> ***The Nature Conservancy reports that over the past five years, projects spanning seven irrigation districts have saved nearly 50,000 acre-feet of water.***

Given the governance challenges that have hamstrung solutions to the Colorado River Basin's growing water shortages, there are also proposals to devise new frameworks. They range widely from vague ideas yet to be hashed out in theory, to Tribal-corporate partnerships that are already making a difference in the real world.

TRIBAL PARTNERSHIPS

In 2022, a partnership between the Jicarilla Apache Nation, The Nature Conservancy (TNC) and the New Mexico Interstate Stream Commission (ISC) created an innovative arrangement that allowed the ISC to lease up to 20,000-acre feet of water per year (for 10 years) from the Nation to benefit threatened and endangered fish and increase water security for New Mexico. The Nation had previously leased water to coal-fired power plants that faced closure, making the new partnership an opportunity for better ecological use, restoring habitats that support both fish and local communities.

In 2024, the Gila River Indian Community (GRIC) received funding from the Bureau of Reclamation for three separate critical water infrastructure projects totaling nearly $107 million. As part of the agreement, GRIC agreed to leave 47,020 acre-feet of its Colorado River water entitlement in Lake Mead over 10 years. By replacing old concrete pipes will both improve water efficiency, the project gave the community the ability to bring agricultural fields back into production after fallowing.

The $2.2 billion Navajo-Gallup Water Supply Project was part of a settlement enacted by Congress, designed to make water accessible, delivering clean municipal and industrial water from the San Juan River Basin to the eastern Navajo Nation, the southwestern Jicarilla Apache Nation, and the city of Gallup. The contract was funded through a combination of the State of New Mexico, Navajo Nation Sihasin, and Reclamation funds. When complete, it will include pipeline, water treatment plants, and serve an estimated 250,000 people.

CORPORATE PARTNERSHIPS

As federal spending on water infrastructure and environmental concerns has gone down sharply, big companies have begun to make targeted investments. The nonprofit Bonneville Environmental Foundation, which channels corporate money to water-saving efforts through its "Business for Water Stewardship" program, has contracted more than $27 million from major companies for such projects since 2020. Companies including Procter & Gamble and Google helped pay for projects on the Gila River Indian Community reservation in Arizona.

Companies including Boeing, Coca-Cola, Meta, Microsoft, Google, and Intel have also partnered with groups such as The Nature Conservancy and the National Forest Foundation to support dozens of resilience projects over the past decade in the Verde River, a tributary of Arizona's Salt River, which eventually flows into the Colorado River. The Nature Conservancy (TNC) reports that over the past five years, projects spanning seven irrigation districts have saved nearly 50,000 acre-feet of water.

ALTERNATIVE FRAMEWORKS

While water banking and the swaps and credits systems described above have already created a de facto market method of dealing with shortages, there are proposals to move to a more formally structured market methodology. The problem is many are highly theoretical, and have been subject to endless debates.

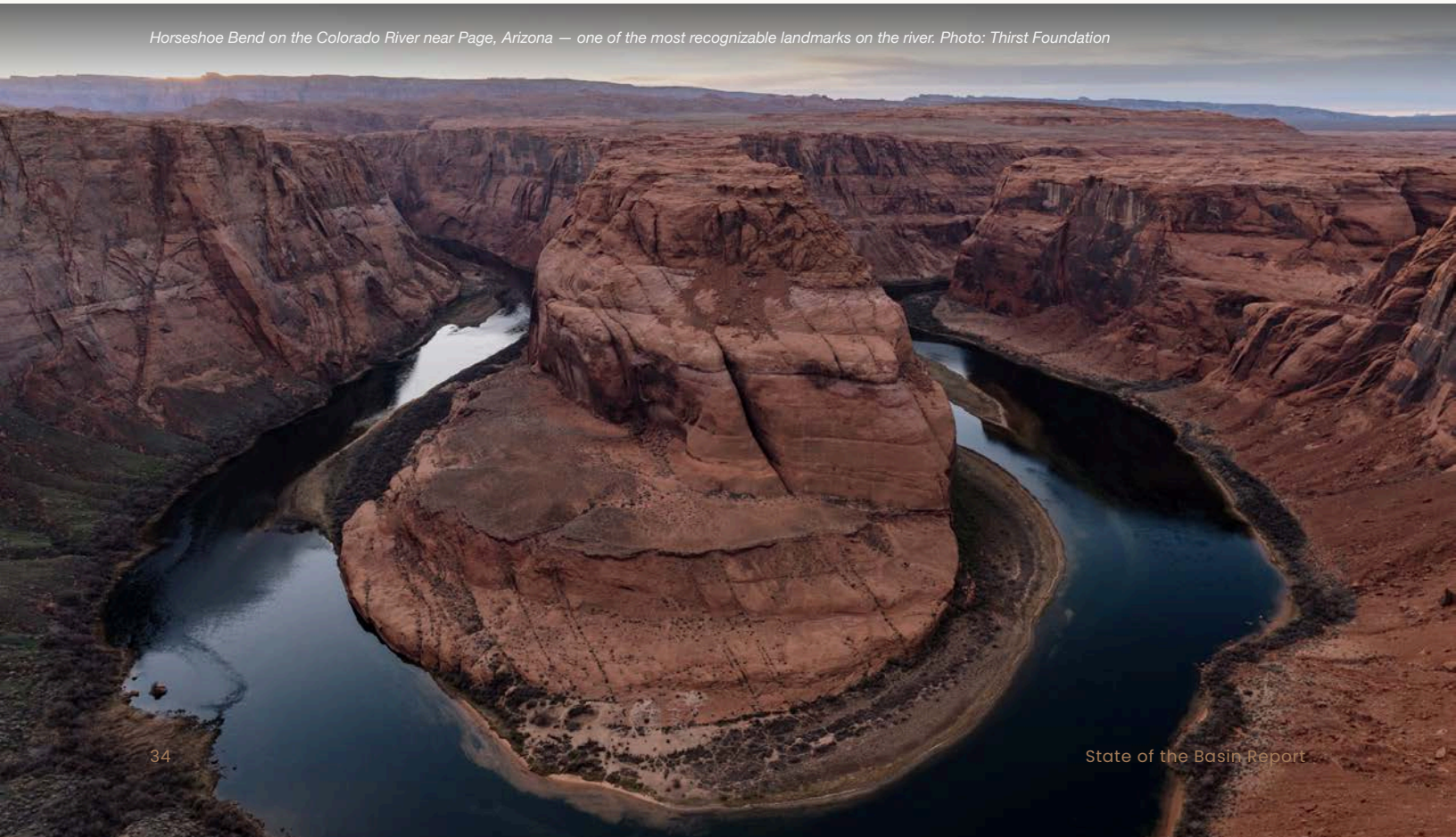
Water bankruptcy is one school of thought that tries to create a framework for scarcity. It encourages societies to accept that they have not only overspent their "income" from rivers, soils, and snowpack — but have depleted long-term "savings" in aquifers, glaciers, wetlands, and other natural reservoirs. It draws helpful analogies to corporate bankruptcies: just as a bankrupt company's liabilities exceed its assets, a bankrupt river's extraction surpasses its inflows. But unlike a corporate bankruptcy, in which senior creditors have rights over junior creditors according to statutory law, and a judge presides over disputes, water bankruptcy methodology has yet to settle on priority rules, and debates over how to do so have gotten caught up in ethical and societal issues around something as exceptional as water – a resource necessary not just for well-being, but for life itself.

As of the time of the writing of this report, Upper Basin and Lower Basin states were waiting to see what the federal government will impose, after five potential alternatives were outlined in a Post-2026 Operational Guidelines and Strategies for Lake Powell and Lake Mead, which could sideline many efforts to make overarching new frameworks.

Still, ideas and initiatives are emerging as various groups try to make sure environmental, Tribal and local government needs are met.

The Water & Tribes Initiative was launched in 2017 to enhance the capacity of Native American Tribes to manage their water resources and ensure they have a stronger voice in basin-wide management discussions, particularly within the Colorado River Basin. But it isn't a decision-making group, and does not speak on behalf of Tribes.

One approach that's sprung up is Climate Mayors, a group that approaches river governance from the perspective of cities.



Horseshoe Bend on the Colorado River near Page, Arizona — one of the most recognizable landmarks on the river. Photo: Thirst Foundation

GLOBAL CASE STUDY: SOUTH AFRICA'S DAY ZERO

In Cape Town's famous water crisis of 2017, a city of 4 million narrowly averted having its water shut off after a third consecutive year of drought. Running dangerously low on potable water, local officials raced against time to avert what they called "day zero"— a doomsday scenario where 6 reservoirs would fall to 13.5% of their combined capacity, and drinking water would need to be shut off for most businesses and homes. The government made hard and fast decisions, launching an information campaign that rallied citizens and private companies, urging them to take short showers, stop watering gardens with potable water, and limit their daily water use to specific targets. It created a slogan for tourists to "save like a local" and gamified the race to avert crisis, communicating a moving forecast of whether "day zero" was being pushed off by successful water-saving. The drought had lasting consequences. Less water for agriculture had a massive ripple effect on employment, household food security, regional GDP, and export capacity. It's been estimated that major crop production fell 20.4% from the 2017 to 2018 harvesting season, resulting in a R5.9 billion ($415 million) loss in industry, and over 30,000 lost jobs – which led to more social unrest in agricultural areas. Other studies estimate that the longer-term cost, factoring in things like livestock diseases, has been in the billions of dollars over the years. But there was a huge silver lining in how drastically Cape Town's residents made their cutbacks, and in the city's lasting legacy of water efficiency. By the time the drought eased in 2018, Capetonians had reduced their water usage by nearly 60% from 2015 levels. With each resident using little more than 50 liters (about 13 gallons) per day, Cape Town achieved one of the lowest per capita water consumption rates of any major city in the world, showing that the fastest and most cost-effective way to handle a water crisis is to cut consumption, swiftly and aggressively.

NATIONAL CASE STUDY: CLIMATE MAYORS

Local solutions to global problems are an emerging success story. The cities, towns and Tribes along the Colorado River feel the most immediate impact from increasing shortfalls in river water, and many share the same challenges: supply-demand imbalances, reliance on threatened hydropower, and the need for new water efficiency initiatives and information campaigns – why not cooperate? Climate Mayors, founded in 2014, is a bipartisan peer-to-peer network of over 350 United States mayors representing millions of Americans across 48 states. It has mostly focused on reducing greenhouse gas emissions, building local climate resilience, and advocating for federal and global climate action. It has also tackled issues like taxes on electric vehicles, mercury emissions from coal plants, and utility costs. The group is also enhancing its regional focuses – including work with Western mayors in the Colorado River Basin states on water security.

AGRICULTURAL EFFORTS

> ***Farmers warn the West risks creating a new dust bowl like that in the 1930s. Some consider fallowing the "F-word" of farming.***

Agriculture accounts for the largest share of the river's water use, and a range of initiatives aim to reduce that consumption, both by shifting to less water-intense crops, and through better infrastructure.

The Imperial Irrigation District in California, which delivers water to a half-million acres of farmland in one of the most productive agricultural areas in the US, has a conservation program that involves water transfers among farm units, a fallowing program, and water efficiency improvement. It recently agreed to take measures such as compensating growers for reduced yields on some forage crops caused by reduced irrigation during peak summer water use – freeing up an additional 100,000 acre-feet of conserved river water in 2026. In 2025, "IID's conservation programs generated 726,000 acre-feet of savings, more than 23% of its entitlement, with some of that going to build elevation in Lake Mead.

Farms are also finding that by improving forecasting, informed decisions can be made as far ahead as possible about whether to plant extra fields – or different crops entirely.

Research on water-efficient crops is ongoing, but there's been progress. The Intermountain West Alternative Forages Research Project is a rancher-led project that brings together scientific and advocacy partners to determine whether different crops could produce healthy yields with less water. It's currently focused on research into new hay varieties, specifically Kernza, sainfoin and silflower, in different areas and different elevations across the Basin.

"Small grain forage" – such as a three-way mix of wheat, barley, and oats, can also be a more water-efficient alternative to alfalfa and corn, and can be harvested earlier in the season – meaning that if farmers run out of water in July, they can still harvest a marketable crop.

But trying new crops is a significant risk for farmers, who can face capital and cash-flow constraints. It requires new harvesting equipment, the development of new supply chains – and there's no guarantee a new product will sell. Farmers in Colorado who've tried to shift away from alfalfa to other forage grains have found challenges when they go to sell them, according to an article in the Colorado Sun.

One promising development is "agrivoltaics," the practice of adding solar panels to agricultural fields. The partial shade from solar panels keeps plants cooler and saves water, while evaporated moisture from the plants helps prevent the solar panels from overheating, helping them produce more energy. The win-win combination has been proposed as a way to mitigate the trend in solar panels simply replacing agricultural land. "Animal agrivoltaics" are also being used in some places to shade livestock. The data shows real benefits – a French study showed that agrivoltaic systems improve water use efficiency by 20–47%, lower air and soil temperatures by 1–4°C, and enhance crop resilience in water-scarce regions, according to a 2025 article. It has yet to be proven at scale, however.

More efficient irrigation systems offer another avenue for reduction, though adoption has been slower than expected, and "gravity" irrigation methods like flooding fields and irrigating with ditches still made up around a third of irrigation methods in Western states as of 2023.

The most modern, efficient systems for irrigating crops – subsurface or drip irrigation still aren't widely used because they're more expensive than traditional methods and don't fit with some crop mixes. A study of Western states that includes the basin states has shown that farmland has been steadily adopting "pressurized" irrigation like sprinklers or drip irrigation, which now makes up the majority of most irrigation systems in those states, according to the US Department of Agriculture. But within that category, there's a vast difference as drip irrigation is much more efficient than sprinkler irrigation.

Another emerging practice is "deficit irrigation" in which farmers do not provide the crops' total water needs, and instead ration irrigation water. Deficit irrigation research is still emerging, and farmers are looking for strategies that will help them maintain economically viable yields.

More efficient irrigation methods are a proven way to reduce water in some locations, but there's also been an "irrigation efficiency paradox" that leads to farmers using those savings to expand production rather than reducing overall water consumption, according to the Environmental & Energy Study Institute.

Lining canals to prevent seepage is another practice that helps save water in agriculture. By lining a 49-mile section of a major canal in California that irrigates farmland, the Coachella Valley Water District said it saves 132,000 acre-feet per year, with a further 35-mile section saving an additional 26,000 acre-feet.

While there are emerging methods that hold great promise to save water, some practices have become more controversial over the years, such as fallowing fields. Some programs pay farmers to temporarily reduce diversion of the river's water and instead leave it in the system to prop up reservoir levels. A program called the System Conservation Pilot Program (SCPP), which pays farmers and ranchers in the Upper Colorado River Basin to voluntarily leave fields dry to save water, stalled after agriculture and irrigation boards and other parties complained that the system has negative impacts.

Though transferring or leasing water rights can help create a cushion for extremely dry spells, it also has drawbacks: for groundwater transfers, there can be seepage from aquifers, energy costs associated with pumping, and high infrastructure costs, like building injection wells and recovery pumps. Diverting streamflow can also harm local fish and wildlife habitats. The risk of pumping out too much from aquifers can cause land subsidence, or sinking, and compromise the aquifer's future ability to store water.

"Buy and dry" deals, in which farmland is bought up and then fallowed – sometimes permanently – to gain their water allocations, have been around for some time, but are raising new concerns for how under certain conditions, they can degrade soil, increase local aridification, and reduce the land's future agricultural productivity – sometimes making it hard to ever cultivate it again.

Fallowing may resolve a short-term demand issue, but can also raise long-term food security concerns, and raise food prices, farmers say. They are well aware of how fallowing can change the landscape, and warn the West risks creating a new dust bowl like that in the 1930s. With that, and the headaches of weed control and dust control that accompany such projects – often coming at the farmer's own cost – some consider it the "F-word" of farming.

RECENT WATER DEALS

YEAR	PURCHASED PROPERTIES	DEAL TERMS
2018/2023	Cibola Valley Irrigation and Drainage District in La Paz County (485 irrigated acres)	GSC Farm LLC, a private company, proposed selling 2,083 acre-feet of Colorado River water (678 million gallons) to the fast-growing Phoenix suburb Queen Creek for $21 million. The deal faced strong opposition, and the diversion was just approved in 2023.
2022/2023	Metropolitan Water District and the Quechan Tribe of the Fort Yuma Indian Reservation (45,000-acre Quechan tribal lands)	A two-year seasonal fallowing pilot that will pay interested farmers to not grow crops on a portion of their lands and make the conserved river water available for urban needs and to help California boost declining water levels in Lake Mead.
2023	Metropolitan Water District of Southern California (serving southern California from Ventura to San Diego counties) (26,000 acres of farmland)	Landowners in the Palo Verde Valley agreed to fallow the land for three years, funded by federal money to stabilize the Colorado River through 2026.
April 2024	Aurora, Colorado (4,806 acres of farmland irrigated by the Catlin Canal, within the Arkansas River Valley)	Aurora purchased the farmland along with associated water rights for $80 million, with the city permitted to access the water only three times in ten years under specific conditions — allowing a private partner to continue farming alfalfa in the intervening years. The terms are for rotation, rather than permanent fallowing.

CLOSING THE LOOP: WATER RECYCLING AND DESALINATION

> ***Water recycling has taken off across the Southwest — Las Vegas currently returns a large percent of its indoor water to Lake Mead.***

"Water recycling," which captures, treats and repurposes wastewater or stormwater, has taken off across the Southwest. Las Vegas currently returns a large percent of its indoor water to Lake Mead, something enabled by its geographic proximity to the reservoir.

Such practices have been in use since the 1960s, when cities started to irrigate green spaces using non-potable recycled water. Still, fear and criticism of water recycling programs continues to be an issue in city politics. Residents say they fear poor water quality, and elected officials counter that without recycling, there won't be enough water to drink.

There's an opportunity to adopt water recycling at a much wider scale.

Impediments to further adoptions include quality concerns, infrastructure costs, regulatory or permitting requirements, and potential injury to downstream water users. When it comes to agricultural use of partially treated wastewater, chemical pollution and microbial infections are a risk. Another challenge is the feasibility of reverse osmosis for inland communities, where brine disposal may present a challenge without direct access to the ocean.

Plenty of projects are in the works: Arizona regulators approved new rules in 2025 allowing treated wastewater to be directly converted into drinking water—compared to past systems where recycled water only went to "non-potable" uses like agriculture, or where it was diluted in an aquifer or river water first. The new rules could allow utilities to recycle the majority of its wastewater, helping offset declines in Colorado River supplies. The City of Phoenix plans to build a $1 billion facility by 2030.

WATER RECYCLING WORKS

Arizona's new rules to put recycled water directly into taps has a framework to ensure the water is safe. More research remains to be done on recycled water, with some studies showing that conventional municipal wastewater and water treatment plants are not specifically designed to filter out pharmaceuticals. Effective technologies exist, and calls are ongoing for more investments in scalable solutions.

Even in the manufacturing industry, there are challenges to meeting quality standards. Semiconductor manufacturing requires highly purified water, and TSMC is working on an Industrial Reclamation Water Plant in Phoenix with the aim of improving its current reuse rate, targeting 90% or better.

Desalination is another way to create alternate water supplies, reducing dependence on the river. The San Diego County Water Authority (SDCWA) signed a memorandum of understanding in 2026 to explore whether a plant in Southern California that turns ocean water into drinking water could help other states like Arizona and Nevada by giving them a portion of California's river supply – in an effort to help defray SDCWA's payment obligations for an expensive water supply it does not need because supply exceeds demand. A public lands access group has proposed an ambitious plan to build eight massive desalination plants off the California coastline, turning ocean water into freshwater.

The challenges of transporting a dense fluid like water, and the cost of infrastructure to desalinate it makes this method more expensive than conservation or water recycling, however. The estimated cost per acre-foot of water from wastewater recycling ranges from $2,000-$3,600, whereas seawater desalination costs somewhere between $3,100-3,400 per acre-foot. It is also more energy-intensive, and poses a threat to marine life.

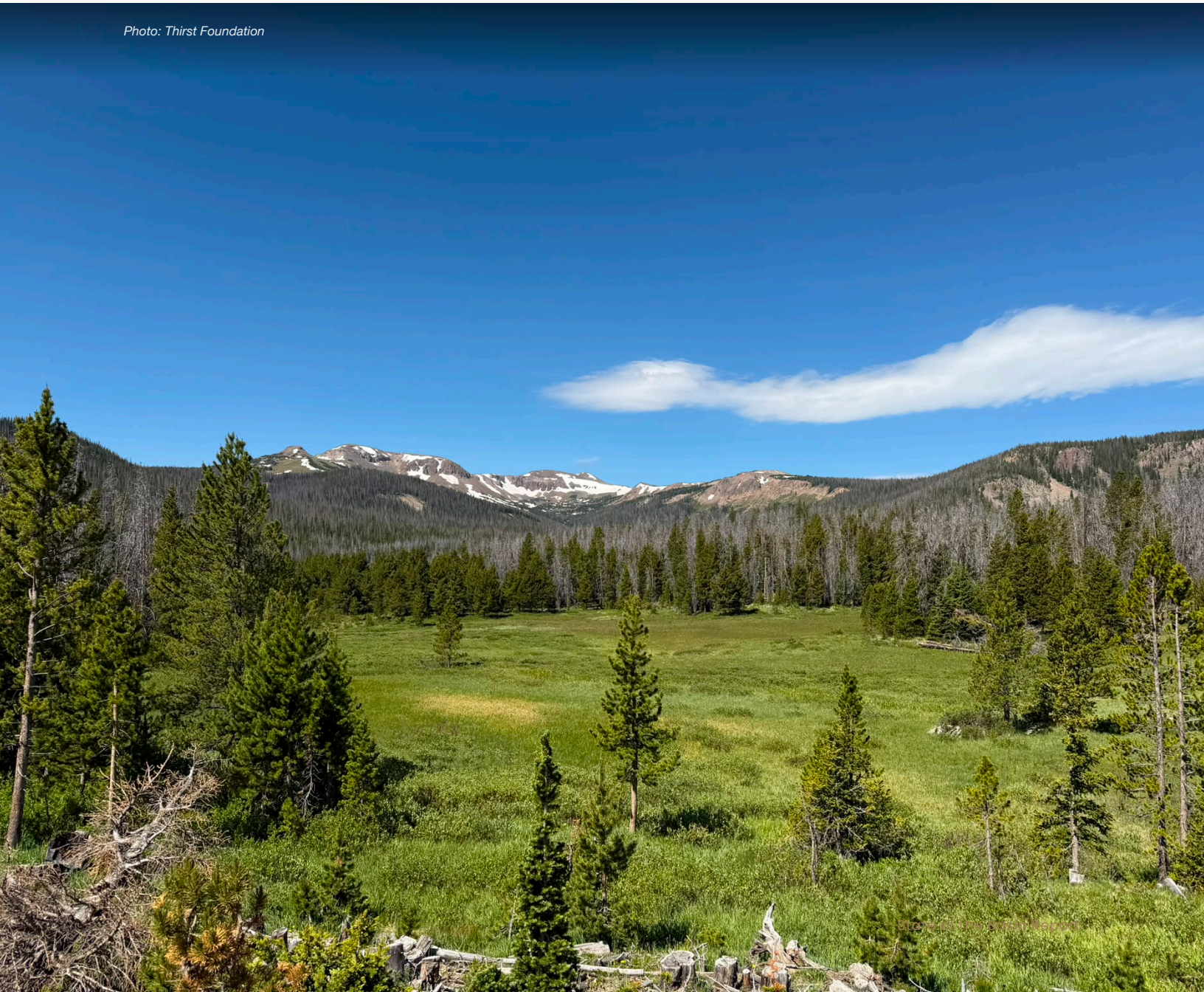
NATURE'S ENGINEERS: ENVIRONMENTAL-BASED SOLUTIONS

> ***There's a growing interest in nature-based solutions, which offer a double-dividend of saved costs and intrinsic environmental benefits.***

The “hard” or “grey” infrastructure solutions like recycling, efficiency and desalination show promise. But they all require significant cost outlays, have finite lifespans, and can fail. There’s a growing interest in nature-based solutions, which offer a double dividend of saved costs and intrinsic environmental benefits.

A growing range of techniques are cost-effective, offer longer-term benefits, and combine water quantity management with water quality improvements. Many involve restoring water rights to Tribes, which have been stewarding the lands and waters of the Colorado River Basin land since time immemorial. And many set the basin up for increasing dividends through the years, by fostering ecosystems that can grow and adapt.

Photo: Thirst Foundation



FLOODPLAIN RECONNECTION & WETLAND RESTORATION

By removing levees and other barriers along waterways and raising riverbeds, rivers are being allowed to flood again – something which modern engineering has mostly tried to prevent. This method of restoration, known as "floodplain reconnection" builds resilience against climate extremes by creating a natural sponge around rivers. Because water is slowed down, and spread across low-lying lands in floodplains, groundwater is naturally recharged. The stored groundwater then feeds slowly back into the river later in the year, meanwhile filtering out sediment and pollutants. Another benefit is that these floodplains slow riverbank erosion and provide wildlife corridors.

Significant funds have been allotted to ecosystem and habitat restoration under the Inflation Reduction Act (IRA); $388.3 million was allotted to fund the Upper Colorado River Basin Environmental Program, and $100 million was allotted to similar programs in the Lower Basin.

As recently as May 2026, the Bureau of Reclamation released $4.6 million for wetland restoration, floodplain improvements, and erosion control on conserved lands in western Colorado to build more resilience to drought. The projects approved so far are diverse, including projects like one in Navajo Nation to remove invasive species and replant native ones. Restoring stream habitats, stabilizing river banks, removing levees, restoring wetlands and reconnecting floodplains are all examples of other measures that have been approved.

Restoring wetlands doesn't just offer a local benefit, the newly greened areas can also store massive amounts of carbon – a boon to the broader climate.

LEAVE IT TO BEAVER

Manmade structures that use posts, willow branches and other materials to imitate the natural structure of a beaver dam are one of the most promising, low-tech, cost-effective options to restore the natural environment around rivers. By slowing streamflow, expanding wetlands, elevating groundwater tables and filtering pollutants they create a wide spectrum of ripple effects. They help with both water supply and water quality, and can help reduce wildfire risk. Beaver dam analogs (BDAs) are also biodiversity hotspots that serve as crucial feeding, nesting, and breeding grounds for amphibians, fish, waterfowl, and mammals. Because healthy forests and wetlands also absorb carbon dioxide from the atmosphere, they likewise offer future dividends.

Traditional engineering projects can cost more than $1 million per mile, but some BDAs are being installed for as little as $1,000 to $5,000 per structure, including the cost of design and permitting, according to a report by the US Department of Agriculture. By slowing stream flow, reconnecting floodplains, and raising groundwater tables, BDAs create wet, sponge-like zones that act as natural buffers against drought, and help slow down the natural process of "channel incision" through which rivers erode downward, taking the water table down with them.

Federal agencies, environmental advocacy groups and private ranchers have all been installing the structures, some with variations that can make them more or less permeable to water flow. In some cases, environmental groups are relocating real beavers to these human-made structures, reintroducing them in areas where they have not been seen for generations – and once again, setting up wetlands for nature's dividend.

FOREST THINNING & PRESCRIBED FIRES

Forest thinning is another nature-based solution with some traction, but it's also been a controversial topic. Proponents have long argued it's good for fire prevention – which is also considered a boon to river health, given how fires destroy vegetation and release ash that elevates water temperatures. The rationale is that by thinning out trees and brush, fires have less fuel to feed on, and buffer zones can be created to stop a fire's spread. Critics say it's just "logging in disguise," and can allow more sun to dry out forest floors, potentially accelerating the spread of fires.

Into that controversy come new arguments about forest thinning's ability to stoke river flows. The thinking is that with fewer tree roots sucking up water, there will be more water available in the system. The reality is more complex, however. Some studies have found that forest thinning didn't change water yield – or even decreased it. Results varied by landscape – places that were already drier, had higher solar radiation, or where other vegetation grew rapidly to replace the trees had decreased water yields after forests were thinned. The thinning was also found to have a longer-term detrimental effect related to snow: when forests are thinned, snow melts earlier and the forest floors dry out more quickly, making it harder for growth to regenerate.

Thinning is going ahead in many places regardless of ongoing research. Arizona State University and Salt River Project, a utility in Arizona that provides water and power, have said forest thinning on about 3,400 acres would generate a benefit of approximately 230 acre-feet, or nearly 75 million gallons, of water during the first year, and that one acre-foot of water can provide for three Arizona families for one year. SRP says it chooses forest thinning projects to fund based on factors including water benefits, reducing wildfire risk and protecting communities.

Meanwhile, other projects are focused on planting more trees. Planting willow and cottonwood is among the priorities of a $1.1 million Navajo Nation Riparian Restoration project.

Conservation groups like River Partners say self-sustaining forests in places like the Cibola National Wildlife Refuge can re-wild desert river landscapes and support dwindling wildlife populations. More than a decade of restoration work by the Raise the River coalition (including the Sonoran Institute and National Audubon Society) has been devoted to planting native trees in the river's delta.

More vegetation helps create cooler microclimates, as tree canopy cover is associated with a localized drop in ambient air temperatures. Overall, more trees can also help the climate – it's been estimated that by planting more than a half trillion trees, atmospheric carbon could be reduced by about 25 percent.

After more than a century of engineering the Colorado River to meet the needs of growing cities in the West, turning to nature-based solutions requires a radical reorientation in thinking. Such solutions operate at a different scale: individually, they seem modest, but collectively, they can add up to significant improvements in water quality, groundwater recharge, and ecosystem health — benefits that engineered solutions rarely provide.

RIVER AT A CROSSROADS

> ***What's needed is not more water — it is the solid, common ground on which to build solutions, together.***

The Colorado River Basin's path forward from 2026 will be a challenging one. A quarter-century drought is deepening, an old governance system is expiring, and the world outside the basin is also struggling with hotter temperatures and lack of coordination on climate threats.

A stark hydrological reality leaves little time to debate the best course: the river is carrying drastically less water; its two massive reservoirs are severely depleted; the snowpack that feeds them is at historic lows. Even the region's reserve – groundwater – is quickly disappearing.

But this report has found that strategies for an adaptive, resilient West exist – and many are already out there in action, just waiting to be harnessed. Cities have shown that with the right efficiency measures and incentives, they can drive down water consumption even as their populations grow. Farmers are upgrading to new equipment and researching new crops. Water recycling is moving from stigma to standard practice, and there's potential to adopt it in other locations. Nature-based solutions like beaver dam analogs are recharging aquifers for a fraction of the cost of a hard infrastructure, and creating ecosystems that can yield dividends for years. Tribal settlements have also returned water rights to the land's original stewards.

The problem is not that the tools do not exist, it is that they need to be scaled. As a century of misguided expectations over the river's flow evaporate in the summer of 2026, now is the time to act.

Every stakeholder in the Colorado River Basin faces the same shrinking river, the same expiring framework, and the same uncertainties around an unstable climate. As the river continues to dwindle, what's needed is not more water – it is the solid, common ground on which to build a path forward.

Sunset over Lake Mead — exposed islands reveal the reservoir's dramatic decline, but the basin's story is still being written. Photo: Thirst Foundation

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