



2020 WATER RESILIENCE PORTFOLIO

In Response to the Executive Order N-10-19

WATER RESILIENCE PORTFOLIO

Governor's Executive Order N-10-19



California Water Resilience Portfolio

JULY 2020

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Executive Summary

Water is central to nearly everything we value in California. Healthy communities, economies, farms, ecosystems and cultural traditions depend on steady supplies of safe and affordable water.

Those values are increasingly at risk as California confronts more extreme droughts and floods, rising temperatures, overdrafted groundwater basins, aging infrastructure and other challenges magnified by climate change. For some of California's most vulnerable populations, the risks are particularly acute.

Recognizing the need for action, Governor Gavin Newsom issued an Executive Order in April 2019 directing state agencies to develop recommendations to meet these challenges and enable water security for all Californians.

The Governor emphasized the need to harness the best of science, engineering, and innovation to prepare for what's ahead and support long-term water resilience and ecosystem health.

To that end, state agencies have developed this water resilience portfolio to improve California's capacity to prepare for disruptions, withstand and recover from climate-related shocks, and adapt into the future.

Building on state and local initiatives already underway and months of public input, the portfolio helps empower local and regional entities to meet their unique challenges, while delivering on the state's responsibility to provide tools and leadership, advance projects of statewide scale and importance, and help address challenges that are beyond the scope of any region.

Because no single solution can fully address the state's water challenges, the portfolio embraces a broad, diversified approach. Goals and actions are organized into four categories:

1. **Maintain and diversify water supplies:** State government will continue to help regions reduce reliance on any one water source and diversify supplies to enable flexibility as conditions change. Diversification will look different in each region based on available water resources, but it will strengthen water security and reduce pressure on river systems across the state.
2. **Protect and enhance natural ecosystems:** State leadership is essential to restore the environmental health of many of our river systems in order to sustain fish and wildlife. This entails

effective standard setting, continued investments, and more adaptive, holistic environmental management.

3. **Build connections:** The state aims to improve physical infrastructure to store, move, and share water more flexibly and integrate water management through shared use of science, data, and technology.
4. **Be prepared:** Each region must prepare for new threats, including flashier floods, deeper droughts, and hotter temperatures. State guidance will enable preparation, protective actions, and adaptive management to weather these stresses.

It will require time, effort, and funding to carry out this portfolio. The pace of implementation will depend upon the feasibility and availability of resources and competing priorities. But this portfolio sets a direction and creates a collective recognition of the ways we can manage water to build climate adaptability in California that works for people, the environment, and the economy.

Water resilience will be achieved region by region based on the unique challenges and opportunities in each area. Local, regional, and tribal leadership is therefore critical. Moving forward, separate agencies and groups must better integrate their water planning and management to steward shared watersheds and aquifers as threats evolve.

State government must focus on enabling regional resilience while continuing to set statewide standards, enable projects of statewide scale and importance, and help address challenges beyond the scope of any region. This portfolio will improve tools to local and regional entities building resilience, encourage collaboration, and support a cohesive, resilient "water system of systems" across California.

Carrying out this portfolio will require a new emphasis on cooperation across state agencies and with regional groups and leaders. Likewise, this portfolio will advance Newsom Administration priorities to build climate resilience across all sectors and make possible opportunity and prosperity for all Californians. This water resilience portfolio will serve as an important step toward achieving these ambitious goals.



Introduction

Water is our lifeblood in California. It has supported Native American cultures for time immemorial and today grows our food, underpins our health and well-being, fuels our economy, and sustains our natural places.

New and unprecedented challenges put that at risk. Our climate is warming and becoming more variable, which reduces mountain snowpack, intensifies drought and wildfire, raises sea level, and drives shorter, more intense wet seasons that worsen flooding. California's growing population--expected to increase to 45 million by 2050--puts greater pressure on the health of our rivers and aging water infrastructure.

To enable water security for all Californians, we must adapt and retool our water management system to meet these challenges. As Governor Newsom has explained:

"California's water challenges are daunting, from severely depleted groundwater basins to vulnerable infrastructure to unsafe drinking water in far too many communities. Climate change magnifies the risks. To meet these challenges, we need to harness the best in science, engineering and innovation to prepare for what's ahead and ensure long-term water resilience and ecosystem health. We'll need an all-of-the-above approach to get there."

Our imperative is to consider future generations and pursue actions to adapt to a changing climate in a way that supports people, the economy, and the environment.

Water Resilience

In April 2019, Governor Newsom directed state agencies through Executive Order N-10-19 to develop a "water resilience portfolio," described as a set of actions to meet California's water needs through the 21st century. The order identified seven principles on which to base this portfolio:

- » Prioritize multi-benefit approaches that meet several needs at once
- » Utilize natural infrastructure such as forests and floodplains
- » Embrace innovation and new technologies
- » Encourage regional approaches among water users sharing watersheds
- » Incorporate successful approaches from other parts of the world

- » Integrate investments, policies, and programs across state government
- » Strengthen partnerships with local, federal and tribal governments, water agencies and irrigation districts, and other stakeholders.

In response, state agencies developed an inventory and assessment of key aspects of California water, soliciting broad input from tribes, agencies, individuals, groups, and leaders across the state. An interagency working group considered this assessment and public input and developed a portfolio, which can be defined as the integrated use of a broad range of actions. It is intended to strengthen the resilience of water systems, thereby helping communities prepare for disruptions, to withstand and recover from shocks, and to adapt and grow from these experiences. Many actions involve tradeoffs. Recycling the discharge from wastewater treatment plants, for example, may reduce flows to rivers. And the pace at which we can carry out this diverse but connected set of actions will depend upon available resources. But taken together, these actions should allow us to thrive into an uncertain future.

Building on Recent Progress

This water resilience portfolio builds on a strong foundation. Governor Jerry Brown’s Water Action Plan, issued in 2014 and updated in 2016, established a comprehensive water strategy for state government. It underscored that no single solution exists to solve our water challenges and prioritized a broad array of state actions.

State policy makers have taken bold action in recent years while managing severe drought and flood emergencies: requiring sustainable use of groundwater; strengthening water efficiency standards for cities, towns and farms; accelerating habitat restoration; planning to modernize conveyance of a critical portion of the state’s water supply through the Sacramento-San Joaquin Delta; partnering with tribes and local leaders to remove four dams on the Klamath River; and continuing work on dust suppression and habitat projects at the Salton Sea.

Since Governor Newsom took office, he has partnered with the Legislature to tackle California’s drinking water crisis, supported development of voluntary agreements to improve environmental conditions in the Sacramento and San Joaquin river systems, and called for smaller capacity conveyance through the Delta. These existing efforts complement actions called for in this water resilience portfolio.

This Portfolio

We must prepare our water systems to support our growing state in a warmer, more variable climate. Four broad approaches are identified: 1) Maintain and diversify water supplies; 2) protect and enhance natural systems; 3) build connections; and 4) be prepared.

This water portfolio fails if it suggests a one-size-fits all approach to water resilience across our large state. Instead, water resilience will be achieved region by region based on the unique challenges and opportunities in each area. Leadership at the local, regional and tribal levels is essential. This water portfolio is shaped to provide important tools to local and regional entities building resilience and to encourage collaboration within and across these regions.

This portfolio includes more than 100 separate detailed actions to ensure California water systems work for our communities, our economy, and our environment. The Administration will work with the Legislature and stakeholders to make progress on the actions. These actions will be implemented to the extent resources are available.

No quick or singular fix will safeguard our communities in coming decades and preserve access to water for all Californians. Rather, advanced planning, thoughtful investments, integrated management, and unprecedented collaboration will prepare us for the future.

California Water Today

Governor Newsom’s Executive Order on water resilience directed state agencies to inventory and assess several key components of California’s water system and work already underway in state government to improve our water systems. This section summarizes this inventory and assessment, which is presented in the Appendix.

The inventory and assessment are based on available information from state agencies on water supply, demand, quality, climate, instream flows, and water rights. The inventory aggregates information from across the state and characterizes distinct regional conditions using several indicators. California can be subdivided in myriad ways for purposes of analyzing water resources; this inventory uses 10 commonly recognized hydrologic regions. Regional profiles that are developed in this inventory underscore the distinct challenges that different areas of the state face.

California’s water sector is truly a “system of systems.” Hundreds of distinct rivers and groundwater basins flow across our state and connect in complex ways. Thousands of separate entities manage water in California depending upon precipitation and

ever-changing human and environmental needs. Developing an understandable statewide inventory therefore requires some amount of generalization. Nonetheless, it highlights important needs that can shape state government actions for the benefit of Californians and our economy.

Existing Water Supply and Demand

California’s statewide annual precipitation is highly variable, from 100 million acre-feet in a dry year to more than 250 million acre-feet during a wet year. Droughts and floods are natural to California’s hydrology. Most precipitation comes in the winter from November through March and precipitation greatly varies between regions, resulting in 26 million acre-feet of average annual run-off along the North Coast to just 200,000 acre-feet of average annual runoff in the Mojave Desert.

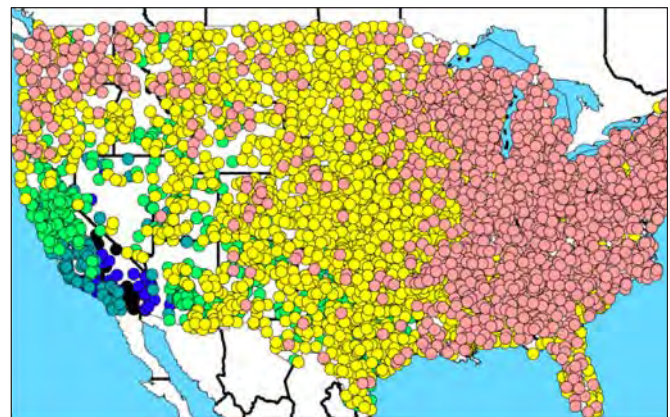
Not all rain and snow can be used as water supply for human use. Approximately 60 percent of precipitation is naturally lost to evaporation or used by vegetation in places like forested watersheds. Of the remaining water, about 50 percent naturally remains in rivers and streams, where it supports fish and wildlife and protects water quality. Most of this water flows through large rivers on the North Coast that are legally designated as Wild and Scenic Rivers, which limits new dams and diversions on these rivers.

Figure 1 California Hydroregions



Figure 2 Comparative Variability of California Precipitation

California experiences high annual variability in precipitation. Much of this variability stems from the role of a relatively small number of storms in making up the state’s water budget.



Coefficient of Variation, Water Year 1951-2008
0.1 0.2 0.3 0.4 0.5 0.6 0.7

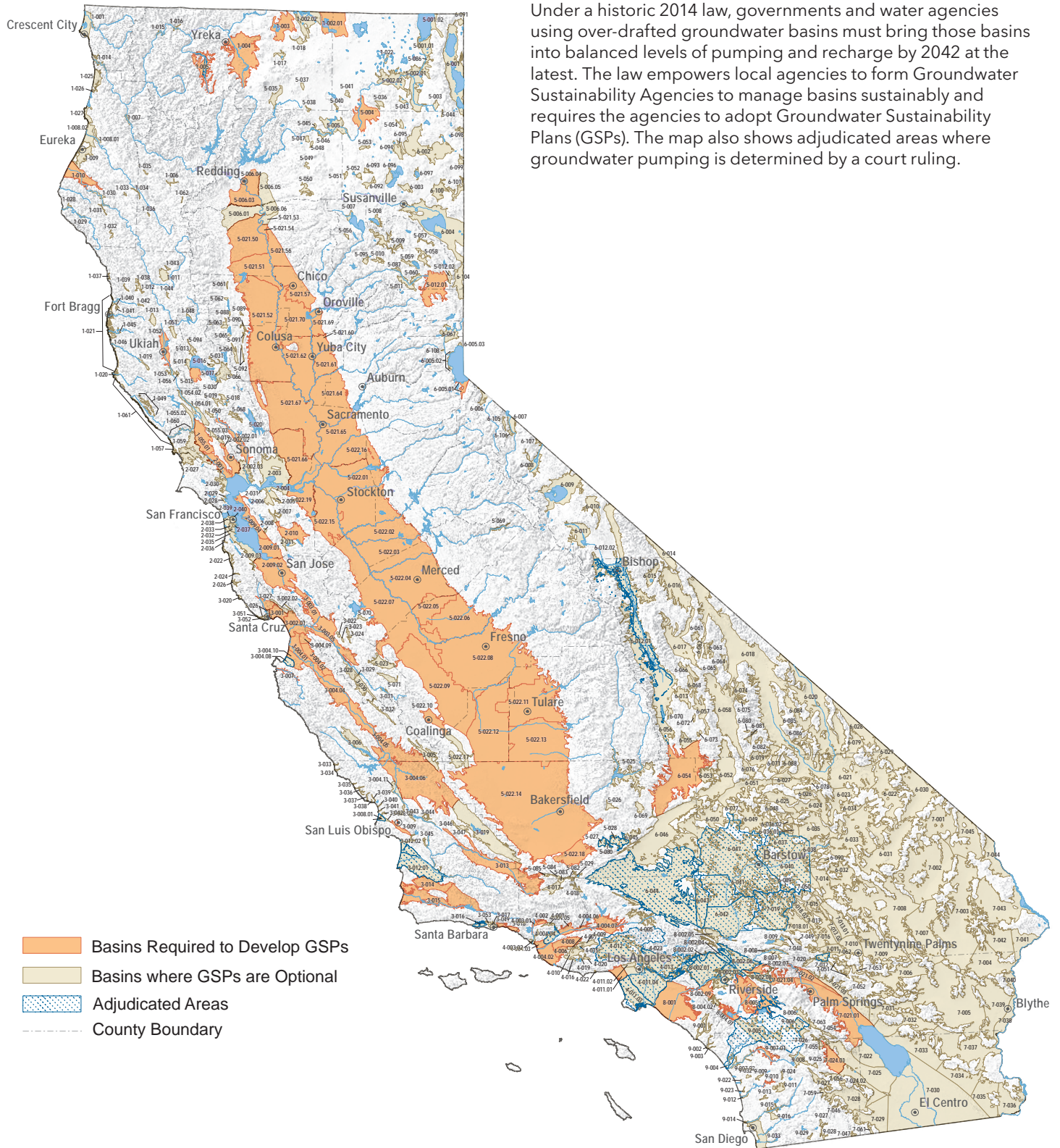
Figure credit: Mike Dettinger, U.S. Geological Survey

Figure 3 California Major Reservoirs and Conveyance Facilities

Federal, state, and local governments have built separate systems of dams, reservoirs, and conveyance facilities to move water to cities and farms and provide flood protection. This map shows the largest such facilities. The map does not include reservoirs owned by private electric utility companies.



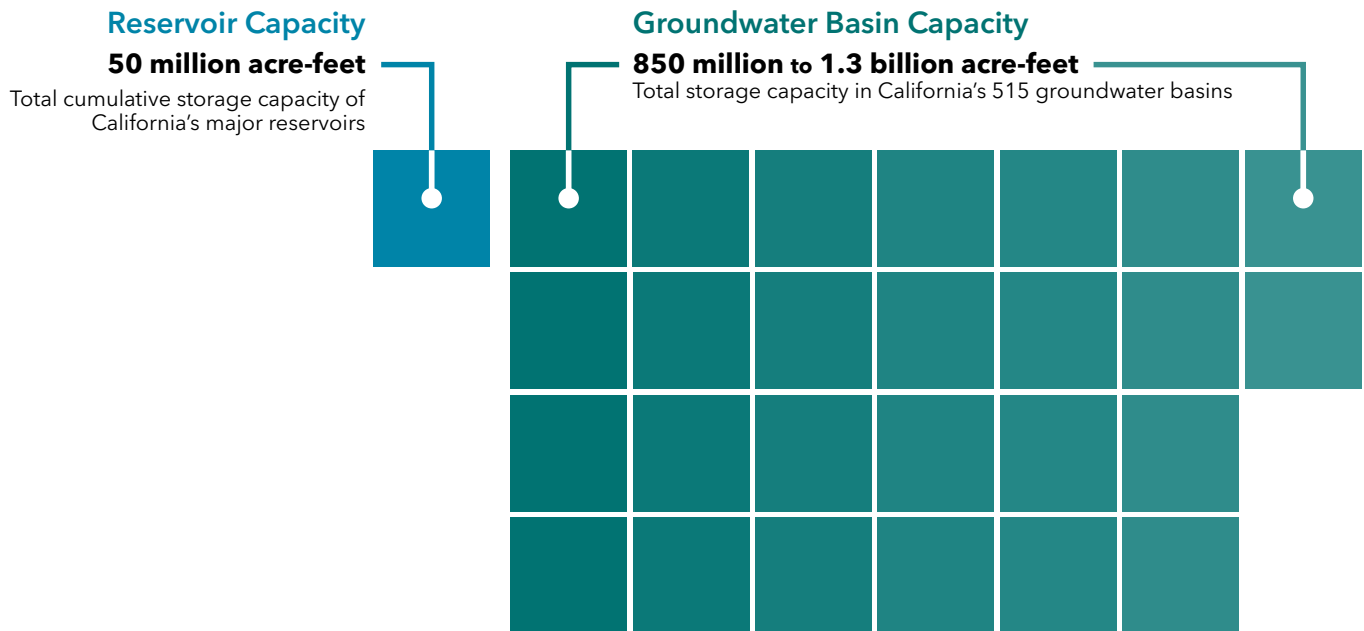
Figure 4 California Groundwater Basins and Subbasins



Under a historic 2014 law, governments and water agencies using over-drafted groundwater basins must bring those basins into balanced levels of pumping and recharge by 2042 at the latest. The law empowers local agencies to form Groundwater Sustainability Agencies to manage basins sustainably and requires the agencies to adopt Groundwater Sustainability Plans (GSPs). The map also shows adjudicated areas where groundwater pumping is determined by a court ruling.

Figure 5 Reservoir Capacity vs. Groundwater Basin Capacity

California's 515 groundwater basins can store far more water than the state's reservoirs combined. Overall groundwater storage outstrips surface storage even after taking into account that less than half the groundwater is available for use by people because it is either too deep to be pumped economically or of poor quality.



Water that Californians use comes primarily from collecting precipitation in reservoirs and diverting water from rivers—called surface water supply—or pumping groundwater from aquifers. Roughly two-thirds of water supply for human use across the state comes from surface supplies and one-third is pumped from underground aquifers, with some regions almost wholly dependent on groundwater.

Use of surface water is limited by how much rain and snow falls each year and how much water can be diverted from rivers based on environmental, water quality, and other legal limitations. While using water from our rivers has fueled our state's growth and prosperity, taking too much water from river systems degrades ecosystems and water quality, affecting the state's long-term health and economic viability. As a result, some surface water supplies from rivers are limited by standards to protect all beneficial uses of those rivers, including economic activity, tribal tradition and culture, subsistence fishing, commercial and sport fishing, environmental protection, drinking water, endangered species, and recreation.

More than 1,300 reservoirs have been built across the state to manage variable precipitation. The state's largest reservoirs were built decades ago to collect snowmelt from the Cascade and Sierra mountain ranges and convey water to cities and farms. Since most Californians live in the southern portion of the state and along the coast, long conveyance systems

were built to bring water from reservoirs to communities and businesses. These systems include the federal Central Valley Project, the State Water Project, and projects built by Los Angeles, San Francisco, and East Bay Area cities. While surface reservoirs are a critical part of California's water system, storing water across seasons and years and protecting communities from flood, they often alter the natural functions of rivers and limit habitat corridors for fish.

There are 515 groundwater basins across the state. Decades of over-pumping groundwater has caused subsidence and infrastructure damage in many areas. The Sustainable Groundwater Management Act (SGMA) requires that groundwater use in important groundwater basins be sustainable by 2040-42 to protect this water supply for the future. Implementation of the law will curb overdraft, reducing the amount of groundwater available compared to historical levels. To bring groundwater use in these basins to sustainable levels may require following of farmland, though there are opportunities to minimize total acreage followed.

Of the total water supply used directly by people, roughly 80 percent is used to grow food and fiber. Approximately 30 million acre-feet of water are used by farmers and ranchers each year, which enables the largest and most diverse agricultural sector in the nation. While irrigated acreage and the overall amount of water used by farmers has changed little over the last 50 years, the value of California farm output has

doubled, thanks to increased productivity and higher-value crops. A shift in recent years toward permanent orchards and vineyards has hardened demand for reliable water supplies, because growers cannot forgo irrigating these crops during drought.

Water supply reliability varies greatly within California's agricultural sector. Some growers depend entirely upon either surface water or groundwater, while others have access to both. Growers with senior water rights for surface water rarely face shortages while those with more junior water rights face cutbacks both during drought and during non-drought conditions to protect water quality and imperiled fish and wildlife. In the recent drought between 2012-16, growers halted production on about 500,000 acres—or 5 percent of the state's irrigated lands—due to lack of water supply.

The remaining 20 percent of water used by people in California supports residential and business use in our communities. This equates to about 7 million acre-feet in a given year, and approximately half of this water use goes to irrigating landscapes. Most metropolitan areas meet water demand through importing water from other parts of the state, besides using and reusing local supplies. Over time, local and state investments and changes to building codes produced increasingly efficient use of water in homes, allowing cities to grow while keeping water use level. During the last drought, average urban water consumption fell nearly 25 percent in response to state and local calls for conservation.

While most communities have benefited from reliable water supplies, water shortages are a persistent problem in many rural areas of the state. Many small water systems that rely on groundwater and homes with private wells lost their water supply during the recent drought. In some places, shortages were caused by intensified groundwater pumping that dropped aquifer levels. This water insecurity continues to plague rural communities.

Key insights from assessing California's current water supply and demand:

- » Different areas of the state have different water supplies and demand profiles. This requires regionally-tailored approaches to providing water supply to address demands.
- » More efficient use of water by communities and agriculture has stretched water supplies to meet demands, especially on urban landscapes.
- » Diverse water supply sources and reuse and recycling of water have helped many communities effectively weather drought.

- » Rural communities are particularly vulnerable to water shortages, given their isolation and lack of capacity to develop water supplies.
- » California's variable precipitation makes water storage crucial. Aquifers and off-stream reservoirs are the most feasible places to store additional water in the future, given the costs and environmental consequences of building new dams across streams.
- » Replenishing aquifers can help the state transition to sustainable groundwater usage but requires capacity to redirect and store water underground when it becomes available.

Current Health of Natural Systems

California's world-renowned biodiversity relies on healthy water-dependent habitats, from desert washes to seasonal pools to perennial streams. Our rivers naturally provide habitat for abundant fish and wildlife and have sustained human populations for thousands of years. Over the last 200 years, human engineering to capture and divert flows has altered the natural functions of most major rivers and water-dependent habitat in the state. Reclamation has eliminated most of the state's historical wetlands. These changes have impaired our overall resilience as a state and impacted fish and wildlife, threatening the existence of several native fish species including distinct runs of salmon and steelhead that support tribal communities, a commercial and sport-fishing industry, and marine species.

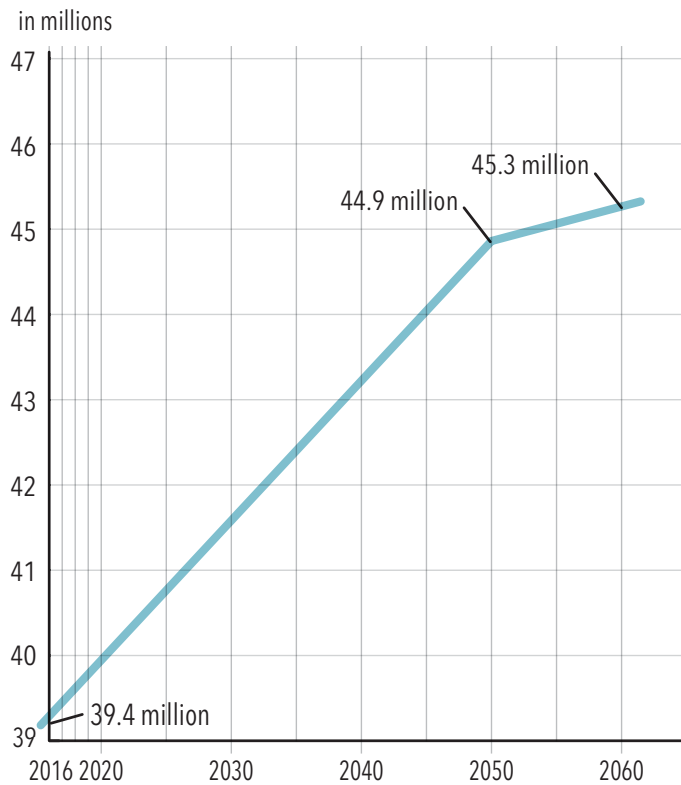
Reduced stream flows, increased temperatures, lack of habitat, and proliferation of invasive species have impacted many fish species across the state. Native fish and wildlife evolved to cope with drought, but dry periods are increasingly stressful given reduced habitat and river flow in recent decades. During extended drought, many streams already diminished by diversions warm, lessen, or dry up completely. Pollution compounds the stress. Many species are declining, and the number of fish species considered highly vulnerable to extinction rose from nine in 1975 to 31 species today.

State and federal laws enacted to protect against reduced river flows and loss of habitat have been unevenly applied and only partially successful. Instream flow requirements, for example, have been set on a limited number of rivers in the state. Many environmental regulatory laws focus on protecting single species rather than the ecological functions that allow many species to thrive. While endangered species laws provide a crucial layer of protection, more comprehensive and adaptable ecosystem management approaches to protecting our state's celebrated biodiversity are needed as ecological stressors mount.

Figure 6 California's Population Since 2016 and into The Future

State demographers expect California's population to add 5 million more residents over the next three decades.

Source: California Department of Finance



State and federal natural areas, refuges, and hatcheries play an important role in the resilience of native species. Maintenance of these wildlife-oriented assets is important to preserving the state's biodiversity and will become crucial as climate-driven changes further stress fish and wildlife.

More than 60 percent of California's developed water supplies originate in the Southern Cascade-Sierra Nevada regions. Overcrowded forests, degraded meadows, and an increasing risk of destructive wildfire threaten communities, ecosystems, and water quantity and quality. Less dense forests allow deeper snowpack to develop, while healthy meadows soak up snowmelt, filter it, and release it slowly, extending runoff. Fire-prone forests also heighten the risk of damage to reservoirs and pumping plants as fires can lead to flooding, siltation, and landslides.

Key insights from assessing the current health of California's natural systems:

- » Improved understanding is needed about the amount

of water that must stay in rivers and streams to protect fish, wildlife, habitat, and water quality, and further actions are needed to support the availability of water for these needs.

- » Drastic loss of fish and wildlife habitat makes it important to restore and connect habitat where feasible.
- » Hatcheries may be necessary to maintain viability of some fish species and the industries that depend on them.
- » Approaches to protecting fish and wildlife that focus on developing a static management plan for a single species are increasingly outdated as ecosystem-wide threats mount.
- » Restoration of forest health can help protect water supplies, quality, and infrastructure.

Water Quality

The quality of water in our state varies greatly by region. While the vast majority of Californians are fortunate enough to take clean drinking water for granted, upwards of one million residents lack access to safe drinking water. Many types of pollution from diffuse sources, such as contaminants of emerging concern, legacy and current use pesticides, sediment, and pathogens, are the cause of regional-scale water quality issues and difficult to address through a single regulatory action.

Surface water quality in rivers and at beaches ranges from pristine to heavily polluted. In urban areas, stormwater and urban runoff in dry weather pick up contaminants from city streets before discharging to lakes, rivers, or the ocean--leading to beach postings up and down the state. Surface water quality also is affected by sediment, pesticides, temperature, nutrients, metals, pathogens, and more, from municipal and industrial wastewater and agricultural runoff discharging into rivers, streams, and the ocean. A warmer climate provides optimal conditions for worsening harmful algal blooms, which can force the closure of beaches, rivers, and lakes due to health risks for people and pets.

Groundwater quality is affected by both naturally-occurring and man-made chemicals. Arsenic and uranium affect groundwater quality in aquifers where those elements are abundant due to the native geology. In urban areas, industrial compounds such as volatile organic compounds and metals have impacted large portions of basins and can take decades of treatment to remediate. In more rural areas, compounds such as nitrate from synthetic fertilizers, manure, and septic

systems can pose water quality risks to both public water systems and private domestic well users. These threats are particularly acute across the San Joaquin Valley and portions of the Central Coast.

In some regions of California, salinity from natural and manmade sources presents a long-term risk to water supply. Salinity can damage crops, corrode infrastructure, raise treatment costs, and pose an ecological threat. California and several other states work with the federal government, for example, to limit salt concentration on the lower Colorado River through farm irrigation improvements.

Key insights from assessing California's water quality:

- » Many Californians who depend upon small water systems or private wells are vulnerable to groundwater contamination. Larger suppliers must balance the potential threat of contaminants of emerging concern against the ability to supply water.
- » California's major water pollution problems are from diffuse, difficult-to-control sources, such as urban and farm runoff, fertilizers, pesticides, soil erosion, and legacy sources from past industrial activities.
- » Waterways are becoming increasingly prone to harmful algal blooms and low dissolved oxygen levels, which are exacerbated by climate change.
- » Salinity management is a crucial component of water resilience in some parts of the state.

Flood Risk

Flooding is a natural occurrence in California. It takes many forms, from slow-rise riverine flooding to explosive mud slides. Each of the state's 58 counties have experienced at least one significant flood event in the last 25 years, and over one quarter of the state's population and a half-trillion dollars in assets are exposed to flood risk.

California gets most of its annual precipitation from a handful of major winter storms. Levees and reservoirs help limit flood risk from these storms. Intensifying winter storms increase pressure on levees and complicate reservoir operations, which must balance flood risk with the need to store water supply.

Federal agencies play an important role in flood management. They set levee standards, ensure capacity in reservoirs during storm season, and manage a national flood insurance program. They also help to fund disaster preparedness, response, and recovery.

Investments in recent decades have reduced flood risks to protect the safety of California families and prevent disruptions to our economy, but flood systems require regular maintenance and as intensified storms heighten risk, additional projects are needed.

Flood protection has traditionally relied on strengthening and maintaining levees, and such work must continue, especially in urbanized areas and small communities. Some rural communities have reduced flood risk significantly by widening channels and allowing rivers to spread out across natural floodplains. This approach also helps recharge groundwater and creates wildlife habitat and recreational opportunities.

Key insights from assessing flood risks:

- » Given the number of Californians exposed to flood, public awareness and preparedness are crucial to minimizing risk.
- » Federal coordination is important to successful flood management in California.
- » Better forecasting of weather and more robust monitoring of snowpack and river conditions would allow reservoir operators to assess risks more carefully.
- » Avoiding floodplain development and allowing rivers to regain access to floodplains can help manage floods while benefiting water supplies and fish and wildlife habitat.

Climate Change Impacts

Global climate change, already altering our water resources in alarming ways, likely will escalate over time. California's climate is warming and becoming even more variable, which reduces winter snowpack, intensifies drought and wildfire, and drives more intense storms that worsen flooding. Exactly how these impacts play out across regions in coming decades depends on countless factors, including global efforts to reduce carbon emissions.

Each region of California will be affected differently. Rising winter temperatures will reduce mountain snowpack in the Sierra Nevada and Cascade ranges by 65 percent on average by the end of the century, increasing flashy winter runoff and flood risks while reducing spring and summer stream flow. Increasingly warm temperatures will mean higher risk of wildfire to fire-prone areas. Warming temperatures increase the severity of the natural drought cycle, which most greatly impacts areas that depend on surface water flows. Coastal communities are vulnerable to flooding with rising sea levels and storm surges, while agricultural

communities will have to adjust to new growing conditions driven by changing temperatures. Native species will migrate, seeking optimal conditions. Estuaries face degraded water quality during droughts. San Francisco Bay and the Sacramento-San Joaquin Delta will face salinity intrusion as sea level rises.

Historical hydrological patterns can no longer serve water managers as a trustworthy guide around which to plan, so climate science and projections have become increasingly important. Future conditions will continue to change and require ongoing adjustment and adaptation by water managers.

Key insights from assessing likely climate change impacts include:

- » Climate change will impact each area of our state in distinct ways, so building climate resilience must be customized by region.
- » Water infrastructure and management must be updated to allow capture of water when it is available in increasingly intense bursts and to provide water supplies and protect the environment during prolonged dry periods.
- » Water managers must address how a heightened risk of catastrophic wildfire will affect water supply and quality.
- » It will become increasingly important to enable habitat connections and corridors to allow native species to migrate based on changing climate conditions such as rising temperatures.
- » Improved physical connections between water users and more groundwater storage would help managers redirect and store water when it is available.
- » In many circumstances, forests, meadows, soils, wetlands, floodplains, and other natural assets can help California water systems adapt to climate change in beneficial and durable ways by filtering and storing water, attenuating peak flows, buffering sea-level rise, and recharging aquifers, while harboring fish and wildlife and sequestering carbon.

Future Water Needs

In coming decades, as our state confronts climate-driven impacts to our water systems, demand for water will likely rise alongside population and economic growth.

California is projected to add another five million residents by 2050. This growth could increase water demand in communities in that period by one to six million acre-feet, according to state estimates.

Residential water use will become increasingly efficient, given new state standards and local investments to recycle water, capture stormwater, and desalt ocean and brackish water.

Agricultural water demand will likely continue to outpace available water supplies into the future. Simply put, California agricultural production will be shaped by limits on available water supply. The amount of groundwater available for use will be determined by the annual sustainable yield that each groundwater basin can provide under the Sustainable Groundwater Management Act (SGMA), and it will be lower than historical pumping levels that overdrafted aquifers. Groundwater recharge is important to maximize the amount of groundwater that can be pumped on a sustainable basis.

Surface water supplies will be limited by the timing and volume of flows that must stay in rivers for other beneficial uses. Over time, as understanding of environmental needs improves, more reliable projections can be made about surface water supplies available for agriculture.

The projected statewide water needs of California fish, wildlife, and natural ecosystems have not been quantified, given the diversity of the state's river systems and evolving understanding of both the biological needs of species and future climate-driven conditions. However, it is clear that each river system requires adequate season-by-season water flow to protect the natural functions fish and wildlife need. Such flows also support healthy water quality and temperatures and should be complemented by adequate habitat and removal of invasive species to enable fish and wildlife to thrive.

Key insights from assessing future water needs:

- » Given natural limits on precipitation and the need to provide water for a broad range of beneficial uses, water efficiency, conservation, and reuse should be prioritized to stretch existing water supplies to meet increased future demands.
- » Capturing precipitation when it comes in increasingly short and intense periods is crucial. This requires finding ways to redirect and store flood flows into aquifers.
- » Water districts must prepare to serve additional customers at the same time climate change affects the reliability of surface supplies imported from long distances.
- » Many users of groundwater must reduce their demand, recharge aquifers, or both in order to bring

groundwater basins into sustainable conditions, even as climate change affects the reliability of local and imported surface supplies.

State Government's Current Role in Water

While most water is managed locally in California, several state agencies lead important water-related functions:

- » The Department of Water Resources (DWR) manages the State Water Project, oversees implementation of SGMA, leads statewide water resource planning, and serves as the statewide flood control agency.
- » The State Water Resources Control Board regulates public drinking water supply systems and allocation of water rights and, along with nine regional water quality control boards, permits discharges of waste to groundwater and surface water to protect water quality.
- » The California Department of Fish and Wildlife protects fish and wildlife resources affected by water management.
- » The California Department of Food and Agriculture supports the ongoing vitality of the state's agricultural industry.
- » The California Public Utilities Commission regulates investor-owned water sellers.
- » The Delta Stewardship Council oversees and implements with local, state, and federal partners a long-range management plan for the Sacramento-San Joaquin Delta.
- » The Central Valley Flood Protection Board serves as a partner to the U.S. Army Corps of Engineers and oversees the flood management system for the Sacramento and San Joaquin rivers.
- » State conservancies provide support for water-related ecosystem restoration and watershed management.
- » The California Department of Forestry and Fire Protection oversees forest health programs that provide watershed benefits.

Dozens of water-related programs, policies and investments are implemented across these agencies. These programs involve a wide range of functions, including funding, regulation, analysis and planning, local assistance, data gathering and dissemination, infrastructure maintenance, and emergency response.

A detailed breakdown of these state programs is contained in the Appendix.

The Governor and Legislature lead water policy in the state and enable state funding for water improvements. Since 1970, a total of \$34 billion in water-related bond funding has been approved through 23 separate measures; two other measures were rejected. Many state programs involve the disbursement of these bond funds to local agencies, tribes, and non-profit groups.

An assessment of state government's role in water finds:

- » The state's water management duties are dispersed across many agencies and programs and often siloed from one another in ways that limit overall effectiveness.
- » State agencies collect vast amounts of information that could support improved local and regional resilience but do not always synthesize and disseminate it in helpful, actionable ways.

Current Water Priorities

The Newsom Administration has actively advanced several water priorities, which complement those of this water portfolio.

To support access to **clean and safe drinking** water for all Californians, the Governor and Legislature partnered to establish an ongoing, stable funding source to help enable delivery of safe and affordable drinking water. The Safe and Affordable Drinking Water Fund (SB 200) provides up to \$130 million annually until 2030 to address the drinking water crisis.

The Water Board has adopted a plan to rapidly deploy this ongoing funding in a way that complements and leverages existing work using federal State Revolving Fund dollars and one-time bond funds. During this first year of implementation, most of the funding will be used to address immediate drinking water and public health needs, while planning gets underway for long-term solutions in hundreds of communities around the state.

Governor Newsom also directed state agencies to work with a broad range of water agencies and environmental conservation groups to develop **voluntary agreements** to implement the State Water Resources Control Board's Bay-Delta Water Quality Control Plan. The Water Board is legally required to update this plan to protect fish and wildlife, water quality, and other beneficial uses of water in the Delta and its key watersheds.

Successful voluntary agreements hold the promise to adaptively manage enhanced flows and habitat to improve conditions for fish and wildlife. Voluntary agreements must be adequate to meet the Water Board's standards. These agreements must undergo scientific peer review and environmental review under the California Environmental Quality Act.

Voluntary agreements reflect a collaborative approach to water resources management and native fish and wildlife protection.

At the same time, California's main system of **water conveyance**, which moves a large portion of the state's surface water supply, continues to be under threat from flood, subsidence, earthquake, and climate change. Our state-led water system that captures precipitation from the Sierra Nevada-Cascade mountains and the Sacramento and San Joaquin rivers to provide drinking water to 27 million Californians faces major vulnerabilities as it travels through the Sacramento-San Joaquin Delta.

Most notably, the U.S. Geological Survey indicates that there is a 66 percent probability in the next 30 years that a major northern California earthquake will occur that can disable the current levee-supported conveyance infrastructure in the Delta, threatening the drinking water for over half of all Californians. Besides protecting statewide water supplies, modernized Delta conveyance for these water projects will facilitate water transfers and groundwater recharge in overdrawn basins.

The Administration is advancing a single-tunnel conveyance project under the Delta to protect this statewide source from levee collapse caused by flood or earthquake risk and saltwater intrusion as sea level rises. This project will be funded by water agencies that will benefit from improved supply reliability. The project is undergoing environmental review and includes significant public engagement to design a project to limit Delta impacts and provide local benefits.

Moving Forward: Regional Networks, State Support

Water resources vary greatly across California. Different areas have unique water supplies, environmental conditions, user needs, and vulnerabilities. Given these differences, a one-size-fits-all approach to building water resilience does not work in California. Rather, effective water management and preparing for the future are best achieved at a regional scale.

Local and regional water agencies are well positioned to deliver needed improvements to water systems. Already, these thousands of local and regional entities account for approximately 85 percent of water system investments. They work together to secure water, steward natural river systems, reduce flood, drought, and fire risks, and prepare for the future. Effectively managing water resources requires collaboration beyond water agencies, including tribes, local

governments, and industries. Every Californian has an opportunity to help make California more water resilient.

At the same time, state government plays an important role in water management. Many areas of the state depend on water captured and moved hundreds of miles by state and federal infrastructure. Policymakers establish important water laws, policies, and standards. State agencies allocate billions of dollars for water supply, safe drinking water, flood protection, environmental restoration, and pollution control.

State government must focus on enabling regional resilience while continuing to set statewide standards, invest in projects of statewide scale and importance, and address challenges beyond the scope of any region.

While a regionalized approach will build our water resilience, regional approaches cannot cause further fragmentation. Local actions must be coordinated with neighboring entities that share common water resources, often in the same watershed or aquifer. In some areas, the state's Integrated Regional Water Management Program has advanced this coordination. In other places, flood control, groundwater management, stormwater management, forest health, and other issues provide an impetus for coordination.

Partnerships between state agencies and regional and local entities have evolved in recent years. State funding programs, for example, have encouraged watershed-scale collaboration and state agencies have worked to support large multi-benefit projects such as floodplain restoration combined with flood risk reduction. Moving forward, state-regional partnerships that advance broad, multi-benefit projects are critical to achieving water resilience.

A broad range of state government actions are needed to advance these partnerships. These partnerships may already exist in some regions and others may require new alignments.

The sections that follow detail the actions that the Newsom Administration will take, at a pace dictated by the availability of resources, to help California move toward regional water resilience.

Maintain and Diversify Water Supplies

California's people and economy depend upon reliable supplies of water. Reliability is challenged by population and economic growth and climate-driven variability. We must prioritize securing adequate water supplies for an uncertain future—and start fulfilling the human right to water for the more than one million Californians who currently lack safe drinking water supplies.

To cope with a future of reduced snowpack and more punishing droughts, local and regional entities must reduce reliance on any one source and diversify supplies to enable flexibility as conditions change. Supply diversification will look different in each region, depending upon available resources.

The state should prioritize regional supply diversification that achieves multiple benefits, such as increased water supply, restored habitat, improved public health, reduced energy consumption, and cleaner drinking water. Diversification takes many forms. The most cost-effective, environmentally beneficial way to stretch water supplies is through better water use efficiency and eliminating water waste. Many California communities have made great progress in reducing per capita water use in recent decades. More can be done, especially to reduce water used on ornamental turf and landscaping. In some cases, supply augmentation may be needed, too. Recycled water is a sustainable, nearly drought-proof supply when used efficiently, and the total volume of water California recycles today could triple in the next decade. Captured rain and storm runoff can be used to recharge aquifers, refill reservoirs, reduce urban heat island effects, provide landscape irrigation, and reduce the pollution that flows to rivers and beaches. Depending upon local circumstances, desalination can be a viable supply source, and desalting brackish groundwater can provide a safe supply and capacity for additional groundwater storage.

As average water temperatures warm, more precipitation will fall as rain and less as snow, and we will need more places to store peak runoff for dry times. California's groundwater aquifers have many times the total storage capacity of existing surface water reservoirs combined. Managed well, California's groundwater basins can provide a crucial buffer against drought and climate change. Another way to safeguard water supplies is to protect it from contamination and to clean up past contamination, which benefits people and the environment.

The following proposals detail how state agencies can support supply diversification:

1. Help local water agencies achieve reliable access to safe and affordable water.

- 1.1** Implement the Safe and Affordable Drinking Water Act of 2019, with provision of interim water to 75 drinking water systems or schools, planning assistance for 100 systems, and permanent solutions for 100 systems by the end of 2020. Map drinking water-source aquifers at high

risk of contamination and shortages and identify water systems and private wells that consistently fail to provide safe drinking water.

- 1.2** Increase financial capacity to support drinking water projects through the Drinking Water State Revolving Fund and other state and local funding mechanisms.
- 1.3** Work with the Legislature and stakeholders to explore feasible low-income water rate assistance options.
- 1.4** Evaluate the feasibility of requiring a water quality test at the point of sale when selling a property supplied by a private well and disclosure of the test results to prospective buyers.

2. Drive greater efficiency of water use in all sectors.

- 2.1** Implement existing "Make Conservation A Way of Life" laws (SB 606 and AB 1668, 2018), which create new efficiency standards for residential use and reporting requirements for agricultural use.
- 2.2** Simplify the Model Water Efficient Landscape Ordinance, which sets efficiency standards for landscaping of new and retrofitted developments. Support training for local government planners to ensure compliance with this law.
- 2.3** Fund the State Water Efficiency and Enhancement Program and prioritize grants for water-saving irrigation system improvements to socially disadvantaged farmers and ranchers in basins considered high priority under the Sustainable Groundwater Management Act (SGMA).
- 2.4** With public and stakeholder input, update the assumptions and methodologies of the Water Energy Cost Effectiveness Calculator, which helps investor-owned utilities determine the energy savings associated with water conservation.
- 2.5** Promote consistent and effective conservation messaging in partnership with local water districts.
- 2.6** Evaluate proposals for an exemption from state income tax any rebates, vouchers, or other financial incentives issued by a local water agency for participation in water efficiency or stormwater runoff improvement programs.

3. Help regions secure groundwater supplies by supporting the transition to sustainable use.

- 3.1** Continue implementation of SGMA, including reviewing Groundwater Sustainability Plans submitted in January 2020 and 2022 and assuring basin-wide alignment across the state's more than 250 new groundwater sustainability agencies. Support local implementation however possible, and where basin managers are unable or unwilling to implement the law, exercise appropriate enforcement.
- 3.2** Create a state interagency team to work with stakeholders to identify tools and strategies to address the economic, environmental, and social effects of changing land use and agricultural production as local water managers implement sustainable groundwater management.
- 3.3** Provide targeted support to local planning efforts to address potential land-use changes in regions implementing SGMA.
- 3.4** Explore ways to further streamline groundwater recharge and banking efforts that do not exacerbate water quality issues, and provide technical assistance to facilitate the redirection of water during periods of extended high flows to allow water to sink into aquifers, including on agricultural land. Ensure diversions are protective of native fish and wildlife.
- 3.5** Make funding available for groundwater recharge and storage projects with multiple benefits.
- 3.6** Create flexibility for groundwater sustainability agencies to trade water within basins by enabling and incentivizing transactional approaches, including groundwater markets, with rules that safeguard natural resources, small- and medium-size farms, and water supply and quality for disadvantaged communities.
- 3.7** Support use of aerial electromagnetic surveys, groundwater quality conditions, and well completion reports to identify optimal areas for enhanced recharge and critical connections in aquifer systems so that local governments may protect those lands from development and utilize for managed aquifer recharge.

3.8 Explore streamlined permitting for low-hazard dams that are not across a stream channel or watercourse and are used principally for agricultural and groundwater recharge purposes.

3.9 Help regions prevent contamination of groundwater basins, including through seawater intrusion, and remediate contaminated groundwater basins that will enable large-scale water recycling and conjunctive use.

4. Support local and regional agencies to recycle or reuse at least 2.5 million acre-feet a year in the next decade.

4.1 Increase financial capacity to support recycling, reuse, and wastewater projects through the Clean Water State Revolving Fund and other state and local funding mechanisms.

4.2 Continue work on raw water augmentation regulations and treated drinking water augmentation regulations to allow purified recycled water to be moved directly into drinking water distribution systems. Following the steps outlined in AB 574 of 2017, continue research underway that is identified in the direct potable reuse criteria feasibility report to the Legislature and convene an expert panel to review the proposed criteria to assure they are adequately protective of public health.

4.3 Implement 2018 legislation (SB 966) that requires creation of risk-based water quality standards for onsite collection and non-potable reuse of water in apartment, commercial, and mixed-use buildings.

4.4 Update 20-year-old "purple pipe" regulations to eliminate outdated and overly prescriptive requirements in order to expand use of non-potable recycled water while protecting food safety and the environment.

5. Support cities and counties to make stormwater capture a growing share of their supply.

5.1 To address inconsistent approaches in how municipalities estimate the cost of stormwater programs, develop a framework to identify cost of compliance with stormwater permit requirements.

- 5.2** Pilot stormwater capture and use projects through the Drinking Water State Revolving Fund to identify impediments to address and to provide a framework for additional future projects.
 - 5.3** Develop best management practices and standards for the design and construction of recharge wells used to capture urban stormwater.
 - 5.4** Provide statewide authority for wastewater facilities to accept stormwater and incentivize stormwater permittees to divert their captured stormwater at times when wastewater facilities have the capacity to accept such diversions.
- 6. Consider use of desalination technology where it is cost effective and environmentally appropriate.**
- 6.1** Consider new desalination projects according to existing state criteria including the Water Board’s Ocean Plan and the Coastal Act.
 - 6.2** Team with federal and academic partners to develop desalination technologies that treat a variety of water types for various uses, with a goal of enabling manufacturing of energy-efficient desalination technologies in the U.S. at a lower cost, same or better quality, and reduced environmental impact than non-traditional water sources.
- 7. Expand smart surface water storage where it can benefit water supply and the environment.**
- 7.1** Accelerate state permitting of projects that protect and enhance fish and wildlife and water supply reliability—such as Sites, Pacheco Reservoir Expansion, and the Chino Basin Conjunctive Use Environmental Water Storage/Exchange Program—that were selected under the Water Storage Investment Program (Proposition 1).
 - 7.2** Acquire through contract a portion of storage, dedicated for environmental purposes, for the life of the water storage projects the Water Commission selected under the Water Storage Investment Program funded by Proposition 1.
- 8. Protect and restore water quality by driving pollution reduction from a range of sources.**
- 8.1** Implement AB 834, the 2019 legislation that requires the Water Board to establish and maintain a comprehensive harmful algal bloom program that includes incident response, monitoring, and website postings.
 - 8.2** Support statewide source control programs that use incentives, innovation, public education, and, where necessary, enforcement to reduce nutrient, pesticide, erosion, and sediment discharge.
 - 8.3** Support statewide source control programs for emerging contaminants of concern that are hardest to treat.
 - 8.4** Explore ways to expand the scope and capacity of existing multi-agency post-fire assessment teams to evaluate anticipated impacts to aquatic life and drinking water sources.
 - 8.5** Support mercury control programs to reduce human and wildlife exposure to mercury-contaminated fish.
 - 8.6** Develop and implement statewide water quality objectives for aquatic toxicity to enhance protections for aquatic life. Assess biological communities to determine stream health and condition future projects to protect high-quality, high-functioning systems.
 - 8.7** Support research, technical assistance, and grower training within the Fertilizer Research and Education Program to better manage nutrient application and irrigation practices to protect water quality.
 - 8.8** Enhance dairy and livestock manure management programs to protect water quality, including activities that improve nutrient use efficiency and enable development of manure-based products, including bioenergy.
 - 8.9** Support regionally-based salinity and brine management programs to improve water quality and supply reliability.
 - 8.10** Support efforts to address transboundary flows of contaminated water, trash, and sediment at our border with Mexico.

Protect and Enhance Natural Systems

Many river systems across California have been highly altered by water development and these changes have impacted natural ecosystems on which fish and wildlife depend. Climate change further threatens these ecosystems as air and water temperatures increase and dry periods become more punishing.

Environmental conditions cannot be treated as something that simply needs to be “mitigated” as a result of water development. Fuller, more dynamic integration of environmental protection and enhancement into water management requires assessment of fish and wildlife needs. Understanding the level of flow needed to support aquatic and riparian habitat on major streams would enable local agencies to better balance competing demands for water and encourage water users to voluntarily improve environmental conditions in diverse ways under durable, legal agreements.

As average temperatures warm, salmon, steelhead, and other native species need access to cooler habitat. Removal or modification of obsolete or malfunctioning dams and culverts can help fish endure drought while replenishing sediment-starved beaches and wetlands in ways that help people and wildlife. The green infrastructure of wetlands, forests, soils, and floodplains support prodigious biodiversity, dampen floods, filter water, and recharge groundwater, among other valuable services. These natural assets lend themselves to multi-benefit water projects and large-scale habitat restoration that can build community and economic resilience. Such broad-benefit projects should be less difficult to plan, permit, and pay for than is the case now.

State agencies can protect and enhance natural ecosystems in several important ways:

9. Help regions better protect fish and wildlife by quantifying the timing, quality, and volume of flows they need.

- 9.1 Develop rapid methodologies to establish regional instream flow metrics through the multi-partner California Environmental Flow Framework. Provide regional training on the environmental flow methods and tools to support local and statewide resource managers. Develop a series of case studies around the state to refine the tools.
- 9.2 Conduct and utilize instream flow analyses to further develop instream flow recommendations for ecologically important streams to protect public trust values.

- 9.3 Bring together regulators, tribes, water users, public water agencies, non-governmental organizations, and other stakeholders to develop innovative, voluntary solutions to water supply, water quality, and ecosystem protection.

- 9.4 Work with universities, tribes, public water agencies, and non-governmental organizations to develop new tools for identifying functional ecosystem flows.

- 9.5 Develop analytical modeling tools that can be used to rapidly assess streamflow depletion tied to groundwater pumping.

10. Reconnect aquatic habitat to help fish and wildlife endure drought and adapt to climate change.

- 10.1 Support the revival of salmon, steelhead, lamprey, and other native fisheries and ecosystems central to several Native American tribes on California’s second-largest river through the bi-state effort to remove four Klamath River hydroelectric dams and related river restoration activities.

- 10.2 Support a comprehensive culvert and fish passage improvement program, including along transportation corridors, using the strategy generated by the public-private California Fish Passage Forum and by piloting new approaches with state and federal agencies in coordination with the six regional California Fish Passage Advisory Committees.

- 10.3 Develop priorities and a process for removal or reconfiguration of aging or obsolete dams with collaborative partners.

- 10.4 Evaluate, plan for, and respond to environmental stressors due to climate change, including development of regional contingency plans for fish and wildlife and ecosystems and promotion of climate change adaptation projects to prevent species decline.

- 10.5 Support urban stream restoration projects, including but not limited to multi-benefit erosion and flood management improvements that provide community access to clean water, daylight streams to create shaded corridors, remediate river-adjacent brownfields, and restore natural infrastructure.

11. Support the expansion of wetlands, including mountain meadows, to create habitat, filter runoff, buffer floods, and recharge groundwater.

- 11.1** Work with federal agencies to meet the water needs of wildlife refuges, which function together as a vital network for migratory shorebirds and waterfowl, including expediting transfer of water supplies to Central Valley Project Improvement Act refuges.
- 11.2** Implement the newly adopted State Wetlands Policy to make regulation of wetlands more protective, predictable, and consistent, and provide training to state and local water managers on those regulations.
- 11.3** Support expansion of multi-benefit floodplain projects across the Central Valley and coastal regions, including projects that reduce flood risk and restore or mimic historical river and floodplain processes, such as the Yolo Bypass and Cache Slough Partnership program.

12. Curb invasive species altering California waterways.

- 12.1** Work to eradicate nutria, large rodents introduced to the Central Valley from South America, which jeopardize wetlands and levees by eating aquatic plants and burrowing.
- 12.2** Support programs that prevent, detect, and manage invasive species and pests; develop California-specific invasive species risk assessments; and evaluate and improve weed management efforts.

13. Align and improve permitting to help launch and incentivize more restoration, multi-benefit, and multi-partner projects.

- 13.1** Coordinate grant and loan programs across state agencies to make funding for multi-benefit projects, including restoration, easier to arrange and leverage.
- 13.2** Support the development of expedited and cost-effective permitting mechanisms for common types of restoration and enhancement projects.
- 13.3** Expand use of the Regional Conservation Investment Strategies approach established in 2017 under AB 2087 to guide mitigation needs for water-related projects.

13.4 Incorporate strategically designed conservation planning (e.g., Natural Community Conservation Planning, Habitat Conservation Plans, Regional Conservation Investment Strategies) and other resource protection and recovery plans into mitigation approaches for levee modifications, operations, and maintenance.

13.5 Support the alignment of state permitting fees with level needed to properly fund state permitting agencies to deliver timely projects.

13.6 Pilot a project to evaluate the effectiveness of simplified environmental permitting processes and monitor whether such processes are achieving desired environmental outcomes.

13.7 Identify opportunities to meet legal standards in creative, collaborative ways, such as through voluntary agreements that enhance flows and habitat.

14. Upgrade and maintain state wildlife refuges, hatcheries, and restoration areas.

- 14.1** Support research, monitoring, maintenance, and management of state habitat restoration projects, hatcheries, and wildlife refuges.
- 14.2** Upgrade water and energy delivery systems on state-owned and managed land and in state hatcheries.
- 14.3** Develop and implement scientifically sound hatchery and genetic management plans in coordination with tribal governments to reduce risks to listed fish species.

15. Encourage investment in upper watersheds to protect water quality and supply.

- 15.1** Encourage enhancement of both forest and water management through watershed coordinator programs, resource conservation districts, and other groups coordinating regionally.
- 15.2** Work toward accomplishing the goals of the California Forest Carbon Plan, which recommends actions to achieve healthy and resilient forests that help the state meet greenhouse gas reduction goals.
- 15.3** Encourage landscape-scale management efforts, modeled after approaches such as the Sierra Nevada Conservancy's Watershed Improvement Program and the Tahoe-Central Sierra Initiative, to restore the health of watersheds and improve community resilience.

- 15.4** Complete plans for watershed restoration investments in the drainages that supply the Oroville, Shasta, and Trinity reservoirs, consistent with 2018 legislation (AB 2551).

16. Improve soil health and conservation practices on California farms and ranches.

- 16.1** Fund the Healthy Soils program, which supports on-farm practices that enhance water retention and provide other environmental benefits, through incentives, demonstrations, and technical assistance.
- 16.2** Enhance agricultural lands for biodiversity, resilience, and habitat benefits through incentives for on-farm conservation practices and innovative partnerships, such as the Healthy Soils Initiative, a collaboration of state agencies working to align policies and programs to promote the development of healthy soils.
- 16.3** Support research and technical assistance, such as through the UC Cooperative Extension Climate Smart Agriculture Advisors program and resource conservation districts, to support farmers and ranchers with education about healthy soils, manure management, water and nutrient efficiency practices, on-farm recharge, drought adaptation, and land management changes.

17. Minimize air pollution and restore habitat at the Salton Sea.

- 17.1** Support achievement of milestones within the 10-year Salton Sea Management Plan to minimize air pollution and preserve fish and wildlife habitat.
- 17.2** Develop criteria and a monitoring plan to evaluate Salton Sea improvements to local air quality and environmental habitat.
- 17.3** Building upon previous work, complete an independent feasibility analysis of water importation options for the Salton Sea.

18. Help protect the economic and ecological vitality of the Sacramento-San Joaquin Delta.

- 18.1** Continue to support local levee operations and maintenance in the Delta.
- 18.2** Complete the update to the Bay-Delta Water Quality Control Plan for San Francisco Bay and the Delta, as required by law, and implement the Plan, potentially through voluntary agreements.

- 18.3** Complete a climate change vulnerability assessment and adaptation strategy for the Delta to protect people, with a particular focus on disadvantaged communities, habitat, water quality, and supply.

- 18.4** Add an element to water management plans, which urban and agricultural suppliers submit to the state every five years, to ensure that districts that receive water from Delta-based projects demonstrate how they are reducing reliance on those supplies.

- 18.5** Provide incentives and technical advice to Delta landowners for creating managed wetlands or cultivating rice to reverse land subsidence and reduce carbon emissions. Eliminate subsidence-inducing practices on state-owned lands and pursue alternative sources of revenue to support long-term land management.

Build Connections

Our decentralized water management system, with thousands of entities managing water in California, can hinder our ability to steward shared water resources. Lack of coordination among water agencies in the same watershed, for example, limits preparedness for floods and droughts and the ability to quickly adapt when crises come. Overlap and gaps in jurisdictional boundaries can leave Californians out of the discussion and underserved. Connectivity must begin with identifying those most vulnerable around us, building their capacity to engage, and assuring that their needs are prioritized. A region, after all, is only as strong as its most vulnerable communities.

Our water systems are also challenged with aging, damaged, or increasingly risk-prone infrastructure that transports water between different areas of the state. Regions need physical connections—new pipelines and aqueducts and storage places to help move water from places of surplus to places of scarcity. We need other kinds of connections, too. A common, readily available set of facts about water supply and use can make balancing competing needs less contentious and more efficient. Integrated use of science and monitoring, data, and technology, coupled with human coordination, can help water managers match assets to challenges and share costs and benefits. Finally, state government must integrate itself to minimize regulatory and reporting burdens on local water managers and track outcomes toward regional resilience.

State agencies can help regions build connections in several important ways:

19. Modernize inter-regional conveyance to help regions capture, store, and move water.

- 19.1** Plan, permit, and build new diversion and conveyance facilities (such as a tunnel) in the Sacramento-San Joaquin Delta to safeguard State Water Project, and, potentially, Central Valley Project deliveries drawn from the Sacramento and San Joaquin river systems. New conveyance should complement existing and improved through-Delta conveyance to promote operational flexibility, protect water quality, and improve aquatic habitat conditions while limiting local impacts.
- 19.2** Continue studies of subsidence effects on water infrastructure, including state flood facilities, and support strategies to minimize damage from ongoing subsidence, halt subsidence, and rehabilitate infrastructure.
- 19.3** Conduct a feasibility analysis for improved and expanded capacity of federal, state, and local conveyance facilities to enhance water transfers and water markets. The analysis must incorporate climate change projections of hydrologic conditions.
- 19.4** Assess a state role in financing conveyance projects that could help meet needs in a changing climate.
- 19.5** Ensure effective long-term State Water Project management by completing risk-informed asset management plans for critical infrastructure that account for seismic, flood, and aging risks, among others.

20. Support groups and leaders in each of the state's regions to develop and execute integrated water resilience strategies.

- 20.1** Build on the Integrated Regional Water Management Program and other regional efforts to align climate scenarios and expand watershed-scale coordination and investments that contribute to water resilience. Emphasize integrated, multi-sector, and outcome-based planning, action, and monitoring.
- 20.2** Structure funding sources to reduce the hurdles for water projects that reflect integrated solutions, produce multiple benefits, and improve watershed function.

- 20.3** Support the capacity, participation, and full integration of tribal governments and under-represented communities in regional planning processes.

21. Ease movement of water across the state by simplifying water transfers.

- 21.1** Substantially reduce approval time for transfers while providing protections for the environment and communities.
- 21.2** Develop an open and transparent ledger system to allow for improved local and regional participation in the water transfer market.
- 21.3** Develop best practices for inter- and intra-basin groundwater trading programs that protect communities, economies, and the environment, including standards for measuring, reporting, accounting, and monitoring groundwater use and trading.
- 21.4** Explore an expedited process to facilitate transfers between Central Valley Project and State Water Project contractors.

22. Modernize water data systems to inform real-time water management decisions and long-term planning.

- 22.1** Develop data management training for state agencies that aligns protocols for water data access and management under the Open and Transparent Water Data Act of 2016 (AB 1755).
- 22.2** Support state water data compliance with AB 1755.
- 22.3** Streamline data submission and reporting to the state to avoid duplication and improve accuracy and consistency.
- 22.4** Align water diversion reporting by water users to a single date to simplify reporting.
- 22.5** Assess and integrate state and federal surface and groundwater models. Using an agreed-upon approach, establish the assumptions, data inputs, modeling parameters, and other requirements to develop water mass balances that may be used by regions.
- 22.6** Build upon implementation of SB 19 of 2019, which requires an assessment of the state's stream gage network. Convene state, local, and federal agencies and assess and prioritize the monitoring instrumentation needed (flow meters, remote sensing, weather stations, data logging, wireless transmission, etc.) to support regional resilience.

22.7 Explore ways to make water rights information easily available to the public by rebuilding the state’s water right data base to include digital place of use, diversion, and case history information, made available on an easy-to-use geospatial platform.

22.8 Evaluate existing requirements for telemetered diversion data (real-time water use), including potential streamlining opportunities with existing monitoring and reporting requirements. Analyze the costs and benefits of phasing in requirements for telemetered diversion data to diversions of 500 acre-feet or more per year, down from diversions of 10,000 acre-feet a year, to evaluate the potential to help water users coordinate projects, transfers, environmental protection, and other management activities.

22.9 In support of sustainable water management and conservation innovation, enable the use of OpenET—a transparent, credible, and open-source web platform for quantifying field-scale evapotranspiration (a measure of consumptive water use) using publicly available satellite and weather data.

23. Coordinate science crucial to water management.

23.1 Using the Delta Science Action Agenda and work of the Delta Science Program as a model, establish an inter-agency and public-private task force that includes diverse stakeholders and scientists with relevant expertise to prioritize key scientific questions statewide that must be answered to better inform water managers about how to best manage water supplies, water quality, and flood risk.

23.2 Improve Delta monitoring efforts based upon Delta Independent Science Board recommendations.

24. Foster innovation and technology adoption across all water sectors.

24.1 Promote broadband deployment in unserved and underserved areas of the state to enable farmers and irrigation districts to use the latest water management technologies, including irrigation control.

24.2 In order to enable application of promising new technologies, where needed, consider amending laws and regulations that restrict programs to certain technologies.

24.3 Establish a state-managed “water innovators” clearinghouse where new approaches and technologies can be posted online.

24.4 Establish Secretaries’ Awards for early, ambitious, or successful adoption of innovation, given by the Secretaries for the Natural Resources Agency, California Environmental Protection Agency, and Department of Food and Agriculture.

Be Prepared

Water management is essentially risk management. As the concentration of greenhouse gases in the atmosphere increases and the planet warms, the risks water managers face evolve. The future threatens flashier floods, deeper droughts, and hotter temperatures. At the same time, major water infrastructure components age. The average age of a state-regulated dam is 70 years. Some should be upgraded to handle changing precipitation patterns. Most Central Valley levees have not been maintained to meet federal standards.

Given that we will experience changes in the future that we cannot anticipate now, we must also adapt our institutions to be able to modify policies, investments and programs as conditions change. Science and monitoring can help us anticipate these changes as they occur. Better understanding and tracking of snowpack, storms, stream flow, and potential climate effects at a fine-grain, local level would help all water managers.

State agencies can support regional preparedness in several important ways:

25. Help regions prepare for new flood patterns.

25.1 Support implementation of the Central Valley Flood Protection Plan and its “state systemwide investment approach” to protect urban areas, small communities, and rural areas; improve operations and maintenance of the flood system; better coordinate reservoir operations; improve flood emergency response system; and integrate natural systems into flood risk reduction projects.

- 25.2** Review state, federal, and local permitting processes for flood risk reduction projects and operations and maintenance and recommend ways to improve permitting processes.
- 25.3** Research and explore ways to provide flood insurance beyond the national program.
- 25.4** Update and refine the regional flood management strategy in the Central Valley Flood Protection Plan to account for the projected impacts of climate change in order to protect vulnerable communities and infrastructure and restore floodplains along the San Joaquin River and its tributaries.
- 25.5** Facilitate inter-agency annual dam, flood, debris flow, and wildfire emergency tabletop exercises with emergency responders and local communities, focusing on testing emergency notification protocols, sirens and warning systems, and evacuation route planning.
- 25.6** Augment financial assistance and expand state technical assistance for communities to update their local hazard mitigation plans and general plans to meet state adaptation requirements at least once every five years by prioritizing disadvantaged and flood-vulnerable communities. Updates should account for climate change and forecasted population growth.
- 25.7** Provide hydraulic and economic modeling assistance to update the flood hazards within the California State Hazard Mitigation Plan, review the floodplain management elements of local hazard mitigation plans, and support flood loss avoidance studies following federally-declared disasters. These actions will maximize eligibility for federal financial assistance before and after disasters.
- 25.8** Partner with urban communities to improve existing and identify new flood risk reduction projects to meet or exceed state and federal requirements.
- 25.9** Partner with federal, tribal, and local agencies to support small community flood risk-reduction projects in vulnerable communities in the Central Valley and elsewhere.
- 25.10** Make available to the public bathymetric analyses of channels in the Delta to help local flood control agencies, landowners, and habitat managers better understand levee condition, habitat types, and channel siltation.

26. Help regions prepare for inevitable drought.

- 26.1** Submit recommendations to the Governor and Legislature on how to improve drought planning for small suppliers and rural communities identified as vulnerable to drought, as required by AB 1668, the 2018 legislation.
- 26.2** Review state actions during the 2012-16 drought and use the lessons learned to inform responses for future droughts.
- 26.3** Develop strategies to protect communities and fish and wildlife in the event of drought lasting at least six years.
- 26.4** Provide financial and technical assistance and training to reduce drought risk to tribal and under-represented communities with small water systems and households on private wells.

27. Improve the ability of regions to anticipate weather and climate changes.

- 27.1** Support regional decision making with watershed-scale climate vulnerability and adaptation assessments that include strategies to address risks to water supply, ecosystems, and water quality.
- 27.2** Support California Water Plan planning-area scale analysis of future flood risk, water demand, supply reliability, and water for the environment for a range of climate and growth scenarios. Incorporate climate change forecasts into permitting processes.
- 27.3** In cooperation with the U.S. Army Corps of Engineers and reservoir owners, evaluate the potential for implementing forecast-informed reservoir operations in watersheds where improved weather forecasting capabilities would allow reservoir operators to improve flood control and surface and ground water supply storage.
- 27.4** Support utilization of emerging technologies and partnerships to improve forecasts of precipitation, seasonal snowpack, and runoff at all time scales to support more efficient water management now and to help estimate the impacts of climate change on future flood and drought conditions.

Executing This Portfolio

Carrying out the actions of this water portfolio will require sustained leadership, oversight, funding, and cooperation. Given limited resources, not all actions can be implemented with equal urgency, but taken together, this suite of actions outlines a vision.

State agencies must serve as a crucial hub of collaboration across regions and all levels of government. This will require both focus and new emphasis on cooperation across state agencies and with regional groups and leaders.

Our work moving forward must also enable a faster pace of adaptation and coordination. Addressing new challenges as climate change advances requires stronger capacity to reflect, innovate, communicate, and coordinate. This cannot take place in silos but must be integrated within and across regions. State agencies can help facilitate this shared learning and innovation.

This water resilience portfolio is part of a broader state government effort to adapt to climate change. Currently, all state agencies are aligning investments, programs, and policies to protect communities and natural places from a wide range of climate-driven impacts. Water resilience actions must be integrated with other climate adaptation efforts, such as improving forest health and protecting coastal communities.

This water resilience portfolio is also part of enabling opportunity for all Californians, which is a critical priority for the Newsom Administration. Actions within this portfolio have been tailored to strengthen the economic and environmental vitality of all regions.

Finally, state agencies need to hold themselves accountable for achieving actions in this water resilience portfolio. This includes monitoring progress toward achieving these actions and modifying actions and strategies over time as needs and opportunities change.

To implement this resilience portfolio, state agencies will:

28. Institutionalize better coordination across state agencies.

- 28.1** Regularly convene the leaders of state agencies with water-related responsibilities to implement the portfolio actions and coordinate programs and expenditures.
- 28.2** Broaden the impact of the California Water Plan, required every five years by law, by increasing alignment and coordination between contributing state agencies. Assess progress toward regional water resilience

in Water Plan updates. Inventory recurring state-published water-related plans and assess whether each should be continued, modified, consolidated, or discontinued.

29. Partner with key non-state partners to improve coordination and alignment.

- 29.1** Establish regular dialogue with local and regional water stakeholders to improve how the state and regions work together to improve water resilience.
- 29.2** Work with local and regional stakeholders to explore organizing specific water resilience portfolios in each region and pilot innovations.
- 29.3** Consult and coordinate with California Native American tribes as directed under Executive Orders B-10-11 and N-15-19, which establish government-to-government consultation between the Administration and tribes.
- 29.4** Engage tribes to share traditional ecological knowledge with state agencies and stakeholders.
- 29.5** Work with local, regional, national, and binational partners to promote cross-border cooperation to explore and implement opportunities to improve water resilience.

30. Unify to pursue federal funding and cooperation.

- 30.1** Coordinate water resources priorities across state agencies and with local agencies and communities, as appropriate, to strengthen Congressional and federal agency support for California's water future.
- 30.2** Pursue federal funding for priority single-purpose and multi-benefit projects that may include flood risk reduction and ecosystem benefits and that are of inter-regional value.
- 30.3** Advocate to secure federal research that advances or improves California water management—for example, to meet California-specific forecasting needs.
- 30.4** Pursue reforms of federal hazard-related programs to ensure adequate federal funding for California water infrastructure repair, maintenance, and improvements.
- 30.5** Coordinate with federal land management agencies to improve forest resilience and watershed function on federal lands.

31. Actively integrate water resilience portfolio actions into other Administration efforts to build climate resilience.

- 31.1** Integrate the water resilience portfolio into the State Climate Action Plan that must be produced every three years.
- 31.2** Include water actions that build economic resilience into the Administration’s Regions Rise Together Initiative.

32. Track and report publicly on progress toward implementing this water resilience portfolio.

- 32.1** Issue an annual status report regarding implementation of this water resilience portfolio.
- 32.2** Gather stakeholders from across the state each year to discuss progress implementing this portfolio and more broadly achieving water resilience across the state.

What can our water future look like if we succeed? All Californians have safe and clean drinking water. Our native fish populations recover. Reliable water helps tribal governments, rural communities and agriculture thrive. Cities and towns grow while using water efficiently. We capture, use, and share water supplies to weather droughts. Our communities are safe from flood risks. And we adapt together to changes through collaborative, science-based management and strong partnerships.

With shared commitment and resources, this future is within reach.

APPENDICES



Appendix 1

Governor's Executive Order N-10-19

EXECUTIVE DEPARTMENT
STATE OF CALIFORNIA

Executive Order N-10-19

WHEREAS, water is a human right, and is central to California’s strength and vitality; and

WHEREAS, we face a range of existing water challenges, including unsafe drinking water across the state, major flood risks that threaten public safety, severely depleted groundwater aquifers, agricultural communities coping with uncertain water supplies, and native fish populations threatened with extinction; and

WHEREAS, climate change is having a profound impact on water and other resources, making the climate warmer and more variable, which reduces mountain snowpack, intensifies drought and wildfires, and drives shorter, more intense wet seasons that worsen flooding; and

WHEREAS, California continues to grow, with our population projected to grow to 50 million over the next several decades and our economic activities expanding as the world’s fifth largest economy; and

WHEREAS, the future prosperity of our communities and the health of our environment depend on tackling pressing current water challenges while positioning California to meet broad water needs through the 21st century; and

WHEREAS, many state programs, policies and investments are being implemented, such as the Sustainable Groundwater Management Act and new urban water efficiency standards, that can be built upon to meet these evolving challenges; and

WHEREAS, providing clean, dependable water supplies to communities, agriculture, and industry while restoring and maintaining the health of our watersheds is both necessary and possible; and

WHEREAS, achieving this goal requires a broad portfolio of collaborative strategies between government, sovereign tribes, local communities, water agencies, irrigation districts, environmental conservationists, academia, business and labor leaders, and other stakeholders.

NOW, THEREFORE, I, GAVIN NEWSOM, Governor of the State of California, by virtue of the power and authority vested in me by the Constitution and the statutes of the State of California, do hereby issue this Order to become effectively immediately.

IT IS HEREBY ORDERED THAT:

1. The California Natural Resources Agency, the California Environmental Protection Agency, the California Department of Food and Agriculture, in consultation with the Department of Finance, shall together prepare a water resilience portfolio that meets the needs of California’s communities, economy, and environment through the 21st century.

These agencies will reassess priorities contained within the 2016 California Water Action Plan, update projected climate change impacts to our water systems, identify key priorities for the administration's water portfolio moving forward, and identify how to improve integration across state agencies to implement these priorities.

2. These agencies shall first inventory and assess:

- a. Existing demand for water on a statewide and regional basis and available water supply to address this demand.
- b. Existing water quality of our aquifers, rivers, lakes and beaches.
- c. Projected water needs in coming decades for communities, economy and environment.
- d. Anticipated impacts of climate change to our water systems, including growing drought and flood risks, and other challenges to water supply reliability.
- e. Work underway to complete voluntary agreements for the Sacramento and San Joaquin river systems regarding flows and habitat.
- f. Current planning to modernize conveyance through the Bay Delta with a new single tunnel project.
- g. Expansion of the state's drinking water program to ensure all communities have access to clean, safe and affordable drinking water.
- h. Existing water policies, programs, and investments within state government.

3. This water resilience portfolio established by these agencies shall embody the following principles:

- a. Prioritize multi-benefit approaches that meet multiple needs at once.
- b. Utilize natural infrastructure such as forests and floodplains.
- c. Embrace innovation and new technologies.
- d. Encourage regional approaches among water users sharing watersheds.
- e. Incorporate successful approaches from other parts of the world.
- f. Integrate investments, policies and programs across state government.
- g. Strengthen partnerships with local, federal and tribal governments, water agencies and irrigation districts, and other stakeholders.

4. These agencies shall conduct extensive outreach to inform this process, including to other state agencies, sovereign tribes, federal and local government, local water agencies, agricultural groups, environmental justice and environmental conservation organizations, local and statewide business leaders, academic experts and other stakeholders.

IT IS FURTHER ORDERED that as soon as hereafter possible, this Order shall be filed with the Office of the Secretary of State and that widespread publicity and notice shall be given to this Order.

This Order is not intended to, and does not, create any rights or benefits, substantive or procedural, enforceable at law or in equity, against the State of California, its departments, agencies, or other entities, its officers or employees, or any other person.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 29th day of April 2019.



GAVIN NEWSOM

Governor of California

ATTEST:



Secretary of State



Appendix 2

Portfolio Actions by Responsible Agencies

Portfolio Actions by Responsible Agencies

Color Key

- Multiple Agencies
- State Water Resources Control Board
- Administration
- Department of Water Resources
- California Department of Fish and Wildlife
- California Department of Food and Agriculture
- California Natural Resources Agency
- Delta Stewardship Council
- California Public Utilities Commission

Agency Acronyms Explained

California Department of Fish and Wildlife	CDFW
California Environmental Protection Agency	CalEPA
California Department of Food and Agriculture	CDFA
California Natural Resources Agency	CNRA
California Office of Emergency Services	Cal OES
Department of Water Resources	DWR
Central Valley Flood Protection Board	Flood Board
Regional Water Quality Control Boards	Water Boards
State Water Resources Control Board	Water Board

MULTIPLE AGENCIES

- 2.1 Implement existing “Make Conservation A Way of Life” laws (SB 606 and AB 1668, 2018), which create new efficiency standards for residential use and reporting requirements for agricultural use. (DWR, Water Board)
- 2.6 Evaluate proposals for an exemption from state income tax any rebates, vouchers, or other financial incentives issued by a local water agency for participation in water efficiency or stormwater runoff improvement programs. (CNRA, CalEPA)
- 3.1 Continue implementation of SGMA, including reviewing Groundwater Sustainability Plans submitted in January 2020 and 2022 and assuring basin-wide alignment across the state’s more than 250 new groundwater sustainability agencies. Support local implementation however possible, and where basin managers are unable or unwilling to implement the law, exercise appropriate enforcement. (DWR, Water Board, CDFW)
- 3.4 Explore ways to further streamline groundwater recharge and banking efforts that do not exacerbate water quality issues, and provide technical assistance to facilitate the redirection of water during periods of extended high flows to allow water to sink into aquifers, including on agricultural land. Ensure diversions are protective of native fish and wildlife. (Water Board, DWR, CDFW, CDFA)
- 3.5 Make funding available for groundwater recharge projects with multiple benefits. (DWR, Water Board)
- 3.6 Create flexibility for groundwater sustainability agencies to trade water within basins by enabling and incentivizing transactional approaches, including groundwater markets, with rules that safeguard natural resources, small- and medium-size farms, and water supply and quality for disadvantaged communities. (DWR, Water Board, CDFW, CDFA)
- 3.7 Support use of aerial electromagnetic surveys, groundwater quality conditions, and well completion reports to identify optimal areas for enhanced recharge and critical connections in aquifer systems so that local governments may protect those lands from development and utilize for managed aquifer recharge. (DWR, Water Board, CDFA)
- 3.9 Help regions prevent contamination of groundwater basins, including through seawater intrusion, and remediate contaminated groundwater basins that will enable large-scale water recycling and conjunctive use. (Water Boards, DWR)
- 6.2 Team with federal and academic partners to develop desalination technologies that treat a variety of water types for various uses, with a goal of enabling manufacturing of energy-efficient

- desalination technologies in the U.S. at a lower cost, same or better quality, and reduced environmental impact than non-traditional water sources. (DWR, Water Board, California Energy Commission, CDFA, Ocean Protection Council)
- 7.1 Accelerate state permitting of projects that protect and enhance fish and wildlife and water supply reliability—such as Sites, Pacheco Reservoir Expansion, and the Chino Basin Conjunctive Use Environmental Water Storage/Exchange Program—that were selected under the Water Storage Investment Program (Proposition 1). (CNRA, CalEPA)
 - 8.1 Implement AB 834, the 2019 legislation that requires the Water Board to establish and maintain a comprehensive harmful algal bloom program that includes incident response, monitoring, and website postings. (CalEPA, CNRA, Department of Public Health)
 - 8.4 Explore ways to expand the scope and capacity of existing multi-agency post-fire assessment teams to evaluate anticipated impacts to aquatic life and drinking water sources. (CAL FIRE, Water Board)
 - 8.9 Support regionally-based salinity and brine management programs to improve water quality and supply reliability. (Water Board, DWR)
 - 8.10 Support efforts to address transboundary flows of contaminated water, trash, and sediment at our border with Mexico. (CalEPA, CNRA)
 - 9.1 Develop rapid methodologies to establish regional instream flow metrics through the multi-partner California Environmental Flow Framework. Provide regional training on the environmental flow methods and tools to support local and statewide resource managers. Develop a series of case studies around the state to refine the tools. (Water Board, CDFW, DWR)
 - 9.2 Conduct and utilize instream flow analyses to further develop instream flow recommendations for ecologically important streams to protect public trust values. (Water Board, CDFW)
 - 9.3 Bring together regulators, tribes, water users, public water agencies, non-governmental organizations, and other stakeholders to develop innovative, voluntary solutions to water supply, water quality, and ecosystem protection. (CNRA, CalEPA, CDFA)
 - 9.4 Work with universities, tribes, public water agencies, and non-governmental organizations to develop new tools for identifying functional ecosystem flows. (CDFW, Water Board)
 - 9.5 Develop analytical modeling tools that can be used to rapidly assess streamflow depletion tied to groundwater pumping. (CDFW, DWR, Water Board)
 - 10.2 Support a comprehensive culvert and fish passage improvement program, including along transportation corridors, using the strategy generated by the public-private California Fish Passage Forum and by piloting new approaches with state and federal agencies in coordination with the six regional California Fish Passage Advisory Committees. (CDFW, Caltrans, California Transportation Commission, California Fish and Game Commission)
 - 10.5 Support urban stream restoration projects, including but not limited to multi-benefit erosion and flood management improvements that provide community access to clean water, daylight streams to create shaded corridors, remediate river-adjacent brownfields, and restore natural infrastructure. (CNRA, CalEPA)
 - 11.3 Support expansion of multi-benefit floodplain projects across the Central Valley and coastal regions, including projects that reduce flood risk and restore or mimic historical river and floodplain processes, such as the Yolo Bypass and Cache Slough Partnership program. (DWR, CDFW, CDFA, Flood Board)
 - 12.1 Work to eradicate nutria, large rodents introduced to the Central Valley from South America, which jeopardize wetlands and levees by eating aquatic plants and burrowing. (CDFW, CDFA, Delta Conservancy)
 - 12.2 Support programs that prevent, detect, and manage invasive species and pests; develop California-specific invasive species risk assessments; and evaluate and improve weed management efforts. (CNRA, CalEPA, CDFA)
 - 13.1 Coordinate grant and loan programs across state agencies to make funding for multi-benefit projects, including restoration, easier to arrange and leverage. (CalEPA, CNRA, CDFA)
 - 13.2 Support the development of expedited and cost-effective permitting mechanisms for common types of restoration and enhancement projects. (CNRA, CalEPA)
 - 13.3 Expand use of the Regional Conservation Investment Strategies approach established in 2017 under AB 2087 to guide mitigation needs for water-related projects. (CDFW, CNRA)

- 13.4 Incorporate strategically designed conservation planning (e.g., Natural Community Conservation Planning, Habitat Conservation Plans, Regional Conservation Investment Strategies) and other resource protection and recovery plans into mitigation approaches for levee modifications, operations, and maintenance. (CNRA, CalEPA, CDFWA)
- 13.5 Support the alignment of state permitting fees with level needed to properly fund state permitting agencies to deliver timely projects. (CalEPA, CNRA)
- 13.7 Identify opportunities to meet legal standards in creative, collaborative ways, such as through voluntary agreements that enhance flows and habitat. (CNRA, CalEPA)
- 14.1 Support research, monitoring, maintenance, and management of state habitat restoration projects, hatcheries, and wildlife refuges. (CNRA, CDFW)
- 14.2 Upgrade water and energy delivery systems on state-owned and managed land and in state hatcheries. (CNRA, CDFW)
- 15.1 Encourage enhancement of both forest and water management through watershed coordinator programs, resource conservation districts, and other groups coordinating regionally. (Department of Conservation, CNRA, CalEPA)
- 15.2 Work toward accomplishing the goals of the California Forest Carbon Plan, which recommends actions to achieve healthy and resilient forests that help the state meet greenhouse gas reduction goals. (CNRA, CalEPA)
- 15.3 Encourage landscape-scale management efforts, modeled after approaches such as the Sierra Nevada Conservancy's Watershed Improvement Program and the Tahoe-Central Sierra Initiative, to restore the health of watersheds and improve community resilience. (State Conservancies, CNRA, CalEPA)
- 15.4 Complete plans for watershed restoration investments in the drainages that supply the Oroville, Shasta, and Trinity reservoirs, consistent with 2018 legislation (AB 2551). (CNRA, CalEPA)
- 16.2 Enhance agricultural lands for biodiversity, resilience, and habitat benefits through incentives for on-farm conservation practices and innovative partnerships, such as the Healthy Soils Initiative, a collaboration of state agencies working to align policies and programs to promote the development of healthy soils. (CDFA, CDFW, Wildlife Conservation Board)
- 18.2 Complete the update to the Bay-Delta Water Quality Control Plan for San Francisco Bay and the Delta, as required by law, and implement the Plan, potentially through voluntary agreements. (Water Board, CalEPA, CNRA)
- 18.3 Complete a climate change vulnerability assessment and adaptation strategy for the Delta to protect people, with a particular focus on disadvantaged communities, habitat, water quality, and supply. (DWR, Delta Stewardship Council)
- 18.4 Add an element to water management plans, which urban and agricultural suppliers submit to the state every five years, to ensure that districts that receive water from Delta-based projects demonstrate how they are reducing reliance on those supplies. (Delta Stewardship Council, DWR, CDFWA)
- 18.5 Provide incentives and technical advice to Delta landowners for creating managed wetlands or cultivating rice to reverse land subsidence and reduce carbon emissions. Eliminate subsidence-inducing practices on state-owned lands and pursue alternative sources of revenue to support long-term land management. (Delta Conservancy, DWR, CDFWA)
- 19.4 Assess a state role in financing conveyance projects that could help meet needs in a changing climate. (Water Commission, DWR)
- 20.1 Build on the Integrated Regional Water Management Program and other regional efforts to align climate scenarios and expand watershed-scale coordination and investments that contribute to water resilience. Emphasize integrated, multi-sector, and outcome-based planning, action, and monitoring. (CNRA, CalEPA)
- 20.2 Structure funding sources to reduce the hurdles for water projects that reflect integrated solutions, produce multiple benefits, and improve watershed function. (CNRA, CalEPA, CDFWA)
- 20.3 Support the capacity, participation, and full integration of tribal governments and under-represented communities in regional planning processes. (CNRA, CalEPA, CDFWA)
- 21.1 Substantially reduce approval time for transfers while providing protections for the environment and communities. (CNRA, Water Board)
- 21.3 Develop best practices for inter- and intra-basin groundwater trading programs that protect communities, economies, and the environment, including standards for measuring, reporting, accounting, and monitoring groundwater use and trading. (DWR, Water Board, CDFW, CDFWA)

- 21.4 Explore an expedited process to facilitate transfers between the Central Valley Project and State Water Project. (CNRA, Water Board)
- 22.1 Develop data management training for state agencies that aligns protocols for water data access and management under the Open and Transparent Water Data Act of 2016 (AB 1755). (DWR, Water Board, CDFW)
- 22.5 Assess and integrate state and federal surface and groundwater models. Using an agreed-upon approach, establish the assumptions, data inputs, modeling parameters, and other requirements to develop water mass balances that may be used by regions. (Water Board, DWR)
- 22.6 Build upon implementation of SB 19 of 2019, which requires an assessment of the state's stream gage network. Convene state, local, and federal agencies and assess and prioritize the monitoring instrumentation needed (flow meters, remote sensing, weather stations, data logging, wireless transmission, etc.) to support regional resilience. (DWR, Department of Conservation, Water Board, CDFW, Flood Board)
- 22.9 In support of sustainable water management and conservation innovation, enable the use of OpenET—a transparent, credible, and open-source web platform for quantifying field-scale evapotranspiration (a measure of consumptive water use) using publicly available satellite and weather data. (DWR, CDFA, Water Board)
- 23.1 Using the Delta Science Action Agenda and work of the Delta Science Program as a model, establish an inter-agency and public-private task force that includes diverse stakeholders and scientists with relevant expertise to prioritize key scientific questions statewide that must be answered to better inform water managers about how to best manage water supplies, water quality, and flood risk. (CNRA, CalEPA, CDFA, Delta Stewardship Council)
- 24.2 In order to enable application of promising new technologies, where needed, consider amending laws and regulations that restrict programs to certain technologies. (Water Board, DWR)
- 24.3 Establish a state-managed “water innovators” clearinghouse where new approaches and technologies can be posted online. (CNRA, CalEPA, CDFA, Office of Planning and Research)
- 24.4 Establish Secretaries’ Awards for early, ambitious, or successful adoption of innovation, given by the Secretaries for the Natural Resources Agency, California Environmental Protection Agency, and Department of Food and Agriculture. (CNRA, CalEPA, CDFA)
- 25.1 Support implementation of the Central Valley Flood Protection Plan and its “state systemwide investment approach” to protect urban areas, small communities, and rural areas; improve operations and maintenance of the flood system; better coordinate reservoir operations; improve flood emergency response system; and integrate natural systems into flood risk reduction projects. (DWR, Flood Board)
- 25.2 Review state, federal, and local permitting processes for flood risk reduction projects and operations and maintenance and recommend ways to improve permitting processes. (DWR, Flood Board)
- 25.3 Research and explore ways to provide flood insurance beyond the national program. (DWR, Flood Board)
- 25.4 Update and refine the regional flood management strategy in the Central Valley Flood Protection Plan to account for the projected impacts of climate change in order to protect vulnerable communities and infrastructure and restore floodplains along the San Joaquin River and its tributaries. (DWR, Flood Board)
- 25.5 Facilitate inter-agency annual dam, flood, debris flow, and wildfire emergency table-top exercises with emergency responders and local communities, focusing on testing emergency notification protocols, sirens and warning systems, and evacuation route planning. (DWR, CAL FIRE, California Highway Patrol, CDFW, CDFA, Cal OES, Water Board)
- 25.6 Augment financial assistance and expand state technical assistance for communities to update their local hazard mitigation plans and general plans to meet state adaptation requirements at least once every five years by prioritizing disadvantaged and flood-vulnerable communities. Updates should account for climate change and forecasted population growth. (DWR, Cal OES, Office of Planning and Research)
- 25.8 Partner with urban communities to improve existing and identify new flood risk reduction projects to meet or exceed state and federal requirements. (DWR, Flood Board)

- 26.1 Submit recommendations to the Governor and Legislature on how to improve drought planning for small suppliers and rural communities identified as vulnerable to drought, as required by AB 1668, the 2018 legislation. (DWR, Water Board, CDFWA)
- 26.2 Review state actions during the 2012-16 drought and use the lessons learned to inform responses for future droughts. (CNRA, CalEPA, CDFWA, CAL FIRE)
- 26.3 Develop strategies to protect communities and fish and wildlife in the event of drought lasting at least six years. (CNRA, CalEPA)
- 26.4 Provide financial and technical assistance and training to reduce drought risk to tribal and under-represented communities with small water systems and households on private wells. (DWR, Water Board)
- 27.1 Support regional decision making with watershed-scale climate vulnerability and adaptation assessments that include strategies to address risks to water supply, ecosystems, and water quality. (DWR, Water Boards)
- 27.2 Support California Water Plan planning-area scale analysis of future flood risk, water demand, supply reliability, and water for the environment for a range of climate and growth scenarios. Incorporate climate change forecasts into permitting processes. (DWR, Water Board, Office of Planning and Research, CDFWA)
- 28.2 Broaden the impact of the California Water Plan, required every five years by law, by increasing alignment and coordination between contributing state agencies. Assess progress toward regional water resilience in Water Plan updates. Inventory recurring state-published water-related plans and assess whether each should be continued, modified, consolidated, or discontinued. (DWR, Water Board, CDFW, CDFWA, Flood Board, Delta Stewardship Council)
- 29.1 Establish regular dialogue with local and regional water leaders to improve how state and regions work together to improve water resilience. (CNRA, CalEPA, CDFWA)
- 29.2 Work with local and regional stakeholders to explore organizing specific water resilience portfolios in each region and pilot innovations. (CNRA, CalEPA, CDFWA)
- 29.4 Engage tribes to share traditional ecological knowledge with state agencies and stakeholders. (CNRA, CalEPA, CDFWA)

- 29.5 Work with local, regional, national, and binational partners to promote cross-border cooperation to explore and implement opportunities to improve water resilience. (CNRA, CalEPA)

STATE WATER RESOURCES CONTROL BOARD

- 1.1 Implement the Safe and Affordable Drinking Water Act of 2019, with provision of interim water to 75 drinking water systems or schools, planning assistance for 100 systems, and permanent solutions for 100 systems by the end of 2020. Map drinking water-source aquifers at high risk of contamination and shortages and identify water systems and private wells that consistently fail to provide safe drinking water.
- 1.2 Increase financial capacity to support drinking water projects through the Drinking Water State Revolving Fund and other state and local funding mechanisms.
- 1.3 Work with the Legislature and stakeholders to explore feasible low-income water rate assistance options.
- 4.1 Increase financial capacity to support recycling, reuse, and wastewater projects through the Clean Water State Revolving Fund and other state and local funding mechanisms.
- 4.2 Continue work on raw water augmentation regulations and treated drinking water augmentation regulations to allow purified recycled water to be moved directly into drinking water distribution systems. Following the steps outlined in AB 574 of 2017, continue research underway that is identified in the direct potable reuse criteria feasibility report to the Legislature and convene an expert panel to review the proposed criteria to assure they are adequately protective of public health.
- 4.3 Implement 2018 legislation (SB 966) that requires creation of risk-based water quality standards for onsite collection and non-potable reuse of water in apartment, commercial, and mixed-use buildings.
- 4.4 Update 20-year-old "purple pipe" regulations to eliminate outdated and overly prescriptive requirements in order to expand use of non-potable recycled water while protecting food safety and the environment.
- 5.1 To address inconsistent approaches in how municipalities estimate the cost of stormwater programs, develop a framework to identify cost of compliance with stormwater permit requirements.

- 5.2 Pilot stormwater capture and use projects through the Drinking Water State Revolving Fund to identify impediments to address and to provide a framework for additional future projects.
- 5.4 Provide statewide authority for wastewater facilities to accept stormwater and incentivize stormwater permittees to divert their captured stormwater at times when wastewater facilities have the capacity to accept such diversions.
- 8.2 Support statewide source control programs that use incentives, innovation, public education, and, where necessary, enforcement to reduce nutrient, pesticide, erosion, and sediment discharge.
- 8.3 Support statewide source control programs for emerging contaminants of concern that are hardest to treat.
- 8.5 Support mercury control programs to reduce human and wildlife exposure to mercury-contaminated fish.
- 8.6 Develop and implement statewide water quality objectives for aquatic toxicity to enhance protections for aquatic life. Assess biological communities to determine stream health and condition future projects to protect high-quality, high-functioning systems.
- 11.2 Implement the newly adopted State Wetlands Policy to make regulation of wetlands more protective, predictable, and consistent, and provide training to state and local water managers on those regulations.
- 22.7 Explore ways to make water rights information easily available to the public by rebuilding the state's water right data base to include digital place of use, diversion, and case history information, made available on an easy-to-use geospatial platform.
- 22.8 Evaluate existing requirements for telemetered diversion data (real-time water use), including potential streamlining opportunities with existing monitoring and reporting requirements. Analyze the costs and benefits of phasing in requirements for telemetered diversion data to diversions of 500 acre-feet or more per year, down from diversions of 10,000 acre-feet a year, to evaluate the potential to help water users coordinate projects, transfers, environmental protection, and other management activities.

ADMINISTRATION

- 1.4 Evaluate the feasibility of requiring a water quality test at the point of sale when selling a property supplied by a private well and disclosure of the test results to prospective buyers.
- 2.5 Promote consistent and effective conservation messaging in partnership with local water districts.
- 3.2 Create a state interagency team to work with stakeholders to identify tools and strategies to address the economic, environmental, and social effects of changing land use and agricultural production as local water managers implement sustainable groundwater management.
- 3.3 Provide targeted support to local planning efforts to address potential land-use changes in regions implementing SGMA.
- 6.1 Consider new desalination projects according to existing state criteria including the Water Board's Ocean Plan and the Coastal Act.
- 22.2 Support state water data compliance with AB 1755.
- 22.3 Streamline data submission and reporting to the state to avoid duplication and improve accuracy and consistency.
- 22.4 Align water diversion reporting by water users to a single date to simplify reporting.
- 24.1 Promote broadband deployment in unserved and underserved areas of the state to enable farmers and irrigation districts to use the latest water management technologies, including irrigation control.
- 28.1 Regularly convene the leaders of state agencies with water-related responsibilities to implement the portfolio actions and coordinate programs and expenditures.
- 29.3 Consult and coordinate with California Native American tribes as directed under Executive Orders B-10-11 and N-15-19, which establish government-to-government consultation between the Administration and tribes.
- 30.1 Coordinate water resources priorities across state agencies and with local agencies and communities, as appropriate, to strengthen Congressional and federal agency support for California's water future.
- 30.2 Pursue federal funding for priority single-purpose and multi-benefit projects that may include flood risk reduction and ecosystem benefits and that are of inter-regional value.

- 30.3 Advocate to secure federal research that advances or improves California water management—for example, to meet California-specific forecasting needs.
- 30.4 Pursue reforms of federal hazard-related programs to ensure adequate federal funding for California water infrastructure repair, maintenance, and improvements.
- 31.2 Include water actions that build economic resilience into the Administration’s Regions Rise Together Initiative.
- 32.1 Issue an annual status report regarding implementation of this Water Resilience Portfolio.
- 32.2 Gather stakeholders from across the state each year to discuss progress implementing this portfolio and more broadly achieving water resilience across the state.
- 19.3 Conduct a feasibility analysis for improved and expanded capacity of federal, state, and local conveyance facilities to enhance water transfers and water markets. The analysis must incorporate climate change projections of hydrologic conditions.
- 19.5 Ensure effective long-term State Water Project management by completing risk-informed asset management plans for critical infrastructure that account for seismic, flood, and aging risks, among others.
- 21.2 Develop an open and transparent ledger system to allow for improved local and regional participation in the water transfer market.
- 25.7 Provide hydraulic and economic modeling assistance to update the flood hazards within the California State Hazard Mitigation Plan, review the floodplain management elements of local hazard mitigation plans, and support flood loss avoidance studies following federally-declared disasters. These actions will maximize eligibility for federal financial assistance before and after disasters.

DEPARTMENT OF WATER RESOURCES

- 2.2 Simplify the Model Water Efficient Landscape Ordinance, which sets efficiency standards for landscaping of new and retrofitted developments. Support training for local government planners to ensure compliance with this law.
- 3.8 Explore streamlined permitting for low-hazard dams that are not across a stream channel or watercourse and are used principally for agricultural and groundwater recharge purposes.
- 5.3 Develop best management practices and standards for the design and construction of recharge wells used to capture urban stormwater.
- 18.1 Continue to support local levee operations and maintenance in the Delta.
- 19.1 Plan, permit, and build new diversion and conveyance facilities (such as a tunnel) in the Sacramento-San Joaquin Delta to safeguard State Water Project, and, potentially, Central Valley Project deliveries drawn from the Sacramento and San Joaquin river systems. New conveyance should complement existing and improved through-Delta conveyance to promote operational flexibility, protect water quality, and improve aquatic habitat conditions while limiting local impacts.
- 19.2 Continue studies of subsidence effects on water infrastructure, including state flood facilities, and support strategies to minimize damage from ongoing subsidence, halt subsidence, and rehabilitate infrastructure.
- 25.9 Partner with federal, tribal, and local agencies to support small community flood risk-reduction projects in vulnerable communities in the Central Valley and elsewhere.
- 25.10 Make available to the public bathymetric analyses of channels in the Delta to help local flood control agencies, landowners, and habitat managers better understand levee condition, habitat types, and channel siltation.
- 27.3 In cooperation with the U.S. Army Corps of Engineers and reservoir owners, evaluate the potential for implementing forecast-informed reservoir operations in watersheds where improved weather forecasting capabilities would allow reservoir operators to improve flood control and surface and ground water supply storage.
- 27.4 Support utilization of emerging technologies and partnerships to improve forecasts of precipitation, seasonal snowpack, and runoff at all time scales to support more efficient water management now and to help estimate the impacts of climate change on future flood and drought conditions.

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

- 7.2 Acquire through contract a portion of storage, dedicated for environmental purposes, for the life of the water storage projects the Water Commission selected under the Water Storage Investment Program funded by Proposition 1.
 - 10.3 Develop priorities and a process for removal or reconfiguration of aging or obsolete dams with collaborative partners.
 - 10.4 Evaluate, plan for, and respond to environmental stressors due to climate change, including development of regional contingency plans for fish and wildlife and ecosystems and promotion of climate change adaptation projects to prevent species decline.
 - 11.1 Work with federal agencies to meet the water needs of wildlife refuges, which function together as a vital network for migratory shorebirds and waterfowl, including expediting transfer of water supplies to Central Valley Project Improvement Act refuges.
 - 13.6 Pilot a project to evaluate the effectiveness of simplified environmental permitting processes and monitor whether such processes are achieving desired environmental outcomes.
 - 14.3 Develop and implement scientifically sound hatchery and genetic management plans in coordination with tribal governments to reduce risks to listed fish species.
- 16.1 Fund the Healthy Soils program, which supports on-farm practices that enhance water retention and provide other environmental benefits, through incentives, demonstrations, and technical assistance.
 - 16.3 Support research and technical assistance, such as through the UC Cooperative Extension Climate Smart Agriculture Advisors program and resource conservation districts, to support farmers and ranchers with education about healthy soils, manure management, water and nutrient efficiency practices, on-farm recharge, drought adaptation, and land management changes.

CALIFORNIA NATURAL RESOURCES AGENCY (CNRA)

- 10.1 Support the revival of salmon, steelhead, lamprey, and other native fisheries and ecosystems central to several Native American tribes on California's second-largest river through the bi-state effort to remove four Klamath River hydroelectric dams and related river restoration activities.
- 17.1 Support achievement of milestones within the 10-year Salton Sea Management Plan to minimize air pollution and preserve fish and wildlife habitat.
- 17.2 Develop criteria and a monitoring plan to evaluate Salton Sea improvements to local air quality and environmental habitat.
- 17.3 Building upon previous work, complete an independent feasibility analysis of water importation options for the Salton Sea.
- 30.5 Coordinate with federal land management agencies to improve forest resilience and watershed function on federal lands.
- 31.1 Integrate the water resilience portfolio into the State Climate Action Plan that must be produced every three years.

DELTA STEWARDSHIP COUNCIL

- 23.2 Improve Delta monitoring efforts based upon Delta Independent Science Board recommendations.

CALIFORNIA PUBLIC UTILITIES COMMISSION

- 2.4 With public and stakeholder input, update the assumptions and methodologies of the Water Energy Cost Effectiveness Calculator, which helps investor-owned utilities determine the energy savings associated with water conservation.

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

- 2.3 Fund the State Water Efficiency and Enhancement Program and prioritize grants for water-saving irrigation system improvements to disadvantaged farmers and ranchers in basins considered high priority under the Sustainable Groundwater Management Act (SGMA).
- 8.7 Support research, technical assistance, and grower training within the Fertilizer Research and Education Program to better manage nutrient application and irrigation practices to protect water quality.
- 8.8 Enhance dairy and livestock manure management programs to protect water quality, including activities that improve nutrient use efficiency and enable development of manure-based products, including bioenergy.



Appendix 3 | Section 1

Inventory and Assessment of California Water

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Inventory and Assessment of California Water

In calling for a water resilience portfolio, Governor Newsom directed state agencies to first inventory and assess key aspects of California water. This appendix comprises the results of that effort which, along with input received from hundreds of individuals and stakeholder groups, guided the development of this water resilience portfolio.

Much of the information in this appendix is presented through a division of California into 10 hydrologic regions, each covering a large watershed. A separate section covers the Sacramento-San Joaquin Delta, a central hub through which much of California's water supply moves.

This appendix opens with a brief look at how California has managed its water resources since statehood and a broad summary describing where its water comes from and where it goes. A more detailed examination of water supply and demand follows, broken down by water year types, since the source and use of supplies varies greatly depending upon how much it rains and snows in any given year.

This appendix then attempts to inventory projected water needs in coming decades. Projections of water demand depend upon assumptions of climate change, population growth, development patterns, and the degree to which new development displaces agriculture. This section illustrates forecasted changes in agricultural and urban water use under different scenarios by 2050.

A high-level look at water quality is offered through a statewide map showing contaminants of concern by region. A ranking of beach water quality shows that runoff is the major polluter of state beaches; beach water quality is generally good when it is not raining, but deteriorates with wet weather.

This Appendix also includes a series of 10 "regional summaries." These summaries round up information about the most likely climate effects and most common pollutants in each region. They also include information about environmental safeguards by showing those streams where regulators have set minimum flows to protect fish and wildlife. The summaries also identify the total number of water rights in each region and the volume of water associated with those water rights. Together, this information gives some shape to the water resource assets and challenges of each region.

To probe those regional challenges more deeply, state agencies assessed the vulnerability of each region against 12 different factors, including drinking water threats, water scarcity, flood risk, and threats to ecosystem vitality. Regional vulnerability to each factor was ranked on a scale of "1" to "4," with "4" most vulnerable. The vulnerability rankings are included in each regional summary and also aggregated. The aggregation demonstrates the importance of taking a regional approach to water resilience, given the variance in assets and challenges in different parts of California. A description of methodology and sources used to conduct the assessments is included at the end of the regional summaries.

The regional summaries are followed by an overview of the Sacramento-San Joaquin Delta. The Delta's unique geography, history, and role as the collection point for water supplies used by large parts of California make it an important consideration in statewide water resources. The Delta overview in this section focuses on climate risks to the low-lying estuary, as they are particularly acute, with far-reaching implications.

The final component of this inventory looks inward, tallying the dozens of water-related programs managed by state agencies and sorting those programs by major functions. This compendium helps describe how state government approaches management of a critical natural resource. It reflects a wide reach, varied roles, and the priorities and investments over time of the Legislature and governors. It also reveals great potential for coordination and strategic deployment of resources, and it served to inform this water resilience portfolio.

A Timeline of California Water

For at least 10,000 years before European settlers reach California, an estimated 300,000 Native Americans depended upon the streams, springs, and lakes of what is now California. Gold seekers who descended on the land starting in 1848 kicked off an era of water development that grew steadily in scale and ambition through the 1960s, resulting in projects of dams, pumping plants, and canals that move water across hundreds of miles and over mountains. The construction heyday was followed by an environmental movement that led to foundational laws protecting clean water, endangered species, and wild and scenic rivers. Since the 1970s, Californians have grappled in Congress, courts, and the statehouse to balance the needs of agriculture, cities, and fish and wildlife, with a growing trend toward regional collaboration on projects that benefit more than one sector. Water districts increasingly turn to conservation and reuse to satisfy a growing population. Many Californians who depend upon small water systems or household wells still suffer water shortages and contamination. Farmers and irrigations districts that once used groundwater excessively now face a historic law to bring basins into sustainable conditions. As climate change promises record-breaking periods of drought and precipitation, the infrastructure of the last era is aging.

The Construction Era

1850: California admitted to the Union.

1860: The Legislature authorizes the formation of levee and reclamation districts.

1862: What is still the largest flood in California's recorded history fills the Central Valley, ruins one-third of the state's taxable land.

1878: State Engineer's Office created and investigates drainage, navigation, and flood control projects on Sacramento Valley rivers.

1884: In a lawsuit filed by Marysville flood victims, a federal judge prohibits discharge of debris in the Sierra Nevada mountains, essentially halting hydraulic mining there.

1887: The Legislature allows farmers to form districts to collectively capture and convey water for irrigation.

1899: Tulare Lake, a vast lake that once harbored one of the state's highest populations of Native Americans, is effectively dried by diversions from rivers that feed it.

1902: Congress passes the Reclamation Act to fund construction and maintenance of irrigation projects in western states.

1913: The city of Los Angeles finishes an aqueduct to deliver water from the Owens Valley, a diversion that eventually desiccates Owens Lake.

1924: The newly formed East Bay Municipal Utility District acquires water rights on the Mokelumne River.

1928: State constitution amended to forbid waste or unreasonable use of water.

1928: The Metropolitan Water District of Southern California is created to

bring Colorado River water to Southern California cities.

1929: East Bay Municipal Utility District completes Pardee Dam, highest in the world at the time, and an aqueduct to tap Sierra Nevada runoff.

1931: The County of Origin Act is passed in response to ensure that areas where water originates have an adequate supply for present and future needs.

1931: State Engineer Edward Hyatt completes the "State Water Plan" detailing the infrastructure needed to move water north to south across the state.

1933: The Legislature passes the Central Valley Act to authorize the State Water Plan. Voters subsequently pass a \$170 million bond to build it.

1934: San Francisco completes construction of the Hetch Hetchy Aqueduct, which carries water from a newly dammed glacial valley in Yosemite National Park.

1935: The U.S. Bureau of Reclamation (Reclamation) finishes Hoover Dam, then the tallest in the world, on the Colorado River between Nevada and Arizona.

1935: Reclamation takes over the Central Valley Act project California voters approved in 1933, because the state bonds are unmarketable in the Great Depression.

1938: Reclamation finishes the 80-mile-long All-American Canal to bring Colorado River water to Imperial Valley farms.

1942: Friant Dam begins operation. The Reclamation dam eventually dries up entire stretches of the San Joaquin River, destroying one of the state's biggest salmon runs.



1862: Largest flood in California's recorded history



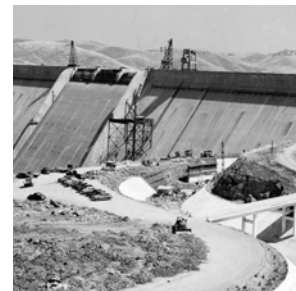
1884: Judicial ruling halts hydraulic mining



1913: Los Angeles Aqueduct begins deliveries



1934: Hetch Hetchy aqueduct completed



1942: Friant Dam begins operation

1944: Reclamation finishes Shasta Dam, centerpiece of the 20-dam Central Valley Project providing water to nearly a third of California's irrigated farm acreage.

1955-56: Christmas Eve flooding across the state kills 64 people, most in Yuba City and Sutter County, where a broken Feather River levee unleashes a wall of water.

1959: The Delta Protection Act requires water projects operators to control salinity in the Sacramento-San Joaquin Delta.

1960: Voters narrowly approve a \$1.75 billion bond to build the State Water Project.

1962: Reclamation completes Trinity Dam and reroutes the Trinity River to generate electricity and capture more water for the Central Valley Project.

1967: The Legislature merges two separate water quality and water rights boards to create the State Water Resources Control Board.

1968: The state Department of Water Resources completes Oroville Dam on the Feather River, cornerstone of the State Water Project, which moves water 600 miles to cities and farms.

Growing Environmental Awareness

1968: Congress passes the National Wild and Scenic Rivers Act.

1969: Through the Porter-Cologne Water Quality Act, the Legislature strengthens the pollution control authority of the State Water Resources Control Board.

1970: The first "Earth Day" is observed nationwide.

1972: California designates its own "Wild and Scenic Rivers."

1972: Congress passes the Clean Water Act.

1973: Congress passes the Endangered Species Act.

1977: The driest year in recorded California history, based on statewide runoff.

1979: Reclamation completes New Melones Dam on the Stanislaus River despite protests by environmentalists.

1981: North Coast rivers are protected as Wild and Scenic.

1983: In a lawsuit to protect Mono Lake from water diversions, the state Supreme Court declares that the public trust doctrine can invalidate water diversions that harm waterways.

1984: The State Water Resources Control Board orders the Imperial Irrigation District to stop wasting water.

1987: The first year of a six-year drought.

1988: Metropolitan Water District of Southern California and Imperial Irrigation District sign agreement under which IID conserves water and transfers it.

Balancing Interests as the Climate Shifts

1993: The California Water Plan describes climate change as a potential threat to the state's water resources.

1994: The "Bay-Delta Accord" launches a federal-state-stakeholder partnership to improve environmental conditions in the Delta and improve water supply reliability.

1997: New Year's Day flooding across the state sets new records, breaks Feather River and Sutter Bypass levees, causing nearly \$2 billion in damage.

2003: California water agencies further quantified rights to use of Colorado River water within California, building on the original agreement executed in 1931.

2009: The Legislature passes the Delta Reform Act and creates the Delta Stewardship Council.

2012: A five-year drought ensues, including the driest four consecutive years in California based on statewide precipitation.

2014: The state enacts the Sustainable Groundwater Management Act, requiring the users of overdrawn groundwater basins to achieve sustainable conditions by 2042 at the latest.

2014: CVP agricultural water contractors have first ever zero water allocations.

2015: Sierra snowpack is an unprecedented five percent of historical average. The year breaks records for warmest average temperatures.

2016: The water year from October 2016 to September 2017 ends the five-year drought with the second-highest statewide runoff on record.

2018: California legislature passes landmark water conservation bills.

2019: The Legislature establishes the Safe and Affordable Drinking Water Fund, to provide financial support for disadvantaged communities lacking access to safe drinking water.



1960-68: State Water Project approved and developed



1970: First nationwide Earth Day



1983: Mono Lake ruling



2014: First allocations of zero water for SWP and CWP



2014: Sustainable Groundwater Management Act



Existing California Water Supply and Demand

Precipitation is the primary source of water supply and natural groundwater recharge in California. It varies region by region, year by year, season by season.

Figure 1 illustrates the variation in average annual precipitation across the state, from the Mojave Desert to the redwood forest. Only some of the water that falls on the state can be used by people; much of it is used by vegetation or stays in protected rivers. Figure 2 shows how the sources and uses of California water vary depending on whether a year is wet, dry, or somewhere in between. It illustrates, for example, that the amount of water communities and farmers use changes much less year by year than the amount of water left for environmental purposes. While agricultural use, for example, ranges roughly between 32 million acre-feet and 35 million acre-feet, environmental water fluctuated between roughly 25 million acre-feet in a dry year to 53 million acre-feet in a wet year. Where the water comes from changes, too, depending upon precipitation. Groundwater extraction falls in wet years but rises in dry years, when rivers and streams run low. Figure 3 shows average water sources and uses over several years from a statewide perspective and by region. Comparing statewide and regional water uses and supplies underscores the diversity among the state's regions. California's hydrologic regions are the size of some states and characteristics such as precipitation, runoff, developed water supplies, and water use can vary greatly from year to year, even within the same region. Figure 3 makes clear which regions—such as the Central Coast and San Joaquin Valley—depend most heavily upon groundwater. It also shows that where urban use dominates, such as in the San Francisco and South Coast regions, the sources of supply are most diverse.

Figures 4 and 5 break down water sources and uses by region for a wet and dry year. The difference in the two types of years is reflected dramatically in the total volume of water discharged by rivers protected as wild and scenic across the state, especially along the North Coast. The higher precipitation of 2011 also allowed for greater reuse of water, especially in the Sacramento Valley, where surface supplies are relatively abundant. The two figures illustrate that the federal and state water projects, which move supplies into delivery canals in the Sacramento-San Joaquin Delta, delivered far more water to farms and cities south of the Delta in a wet year compared to a dry year.

In the figures, "applied water use" refers to the volume of water that was applied and used by urban and agricultural sectors and was dedicated to the environment.

Figure 1 California's Surface Water

Although it swings between roughly 100 million and 300 million acre-feet (MAF) a year, on average about 200 million acre-feet of rain and snow fall on California. Most falls in the north. Only some is available to meet human demands.

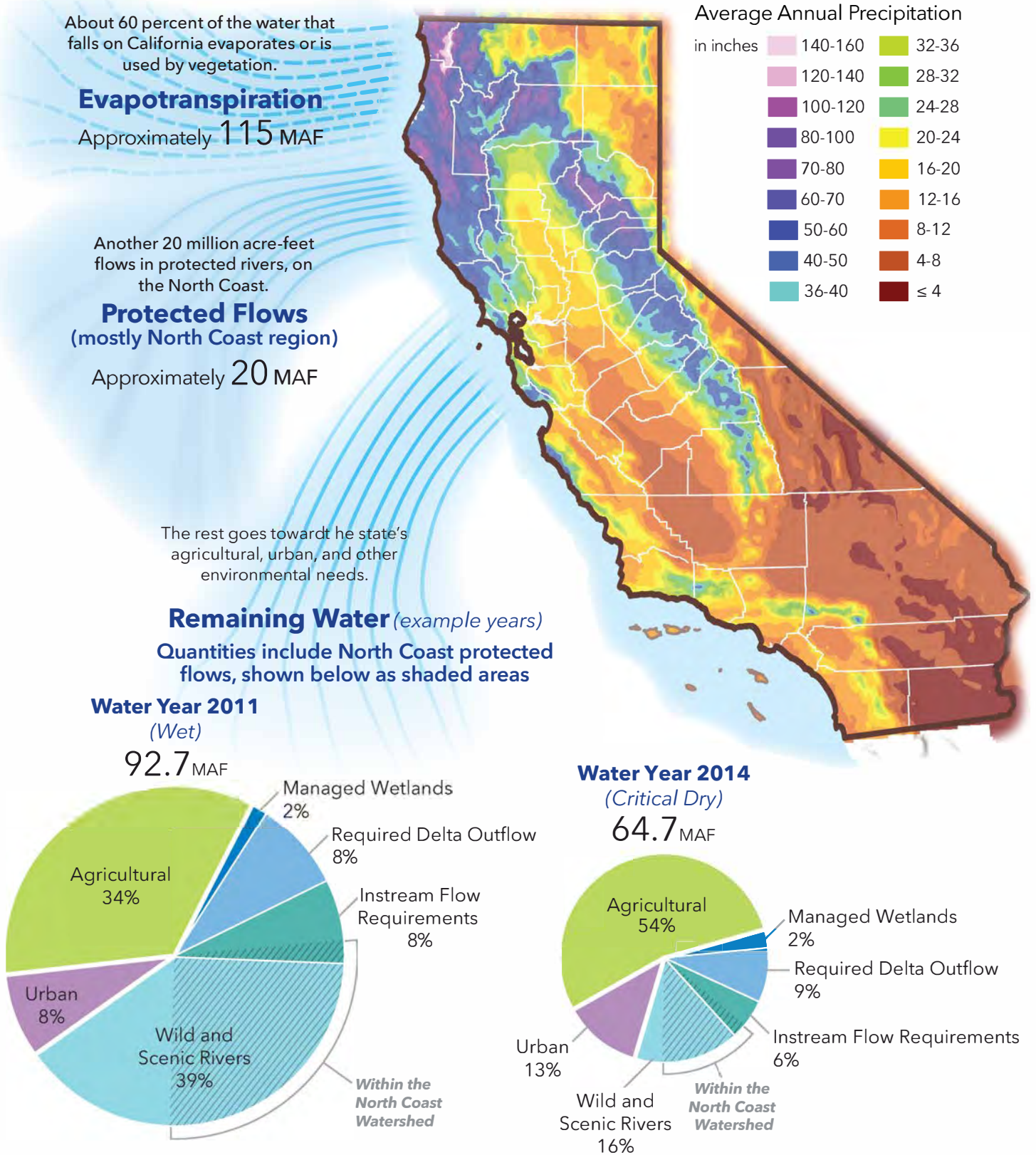


Figure 2 California Water - How It Was Used and Where It Came From, 2011-2015

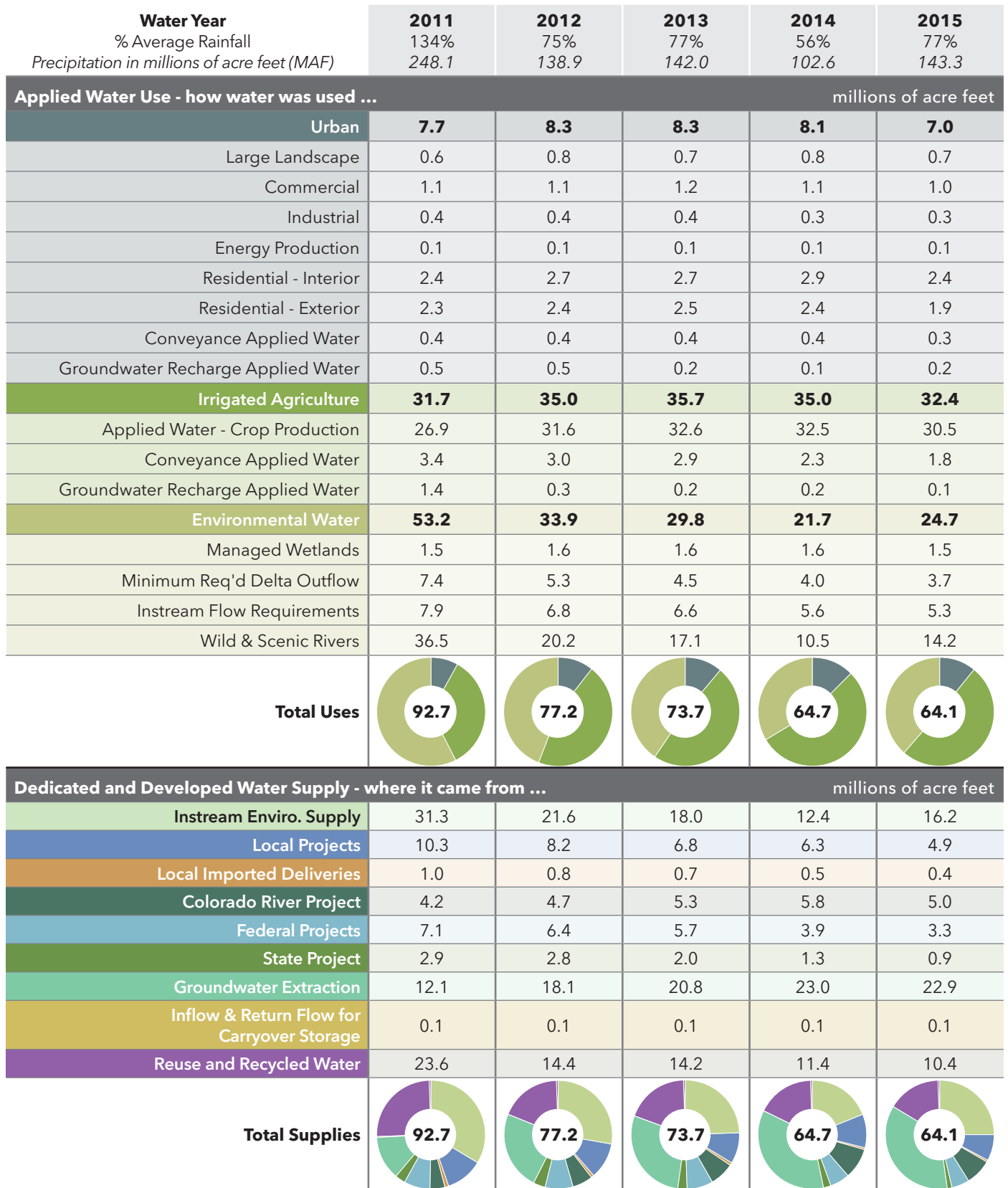


Figure 3 Statewide and Regional Water Uses and Supplies, 1998-2015

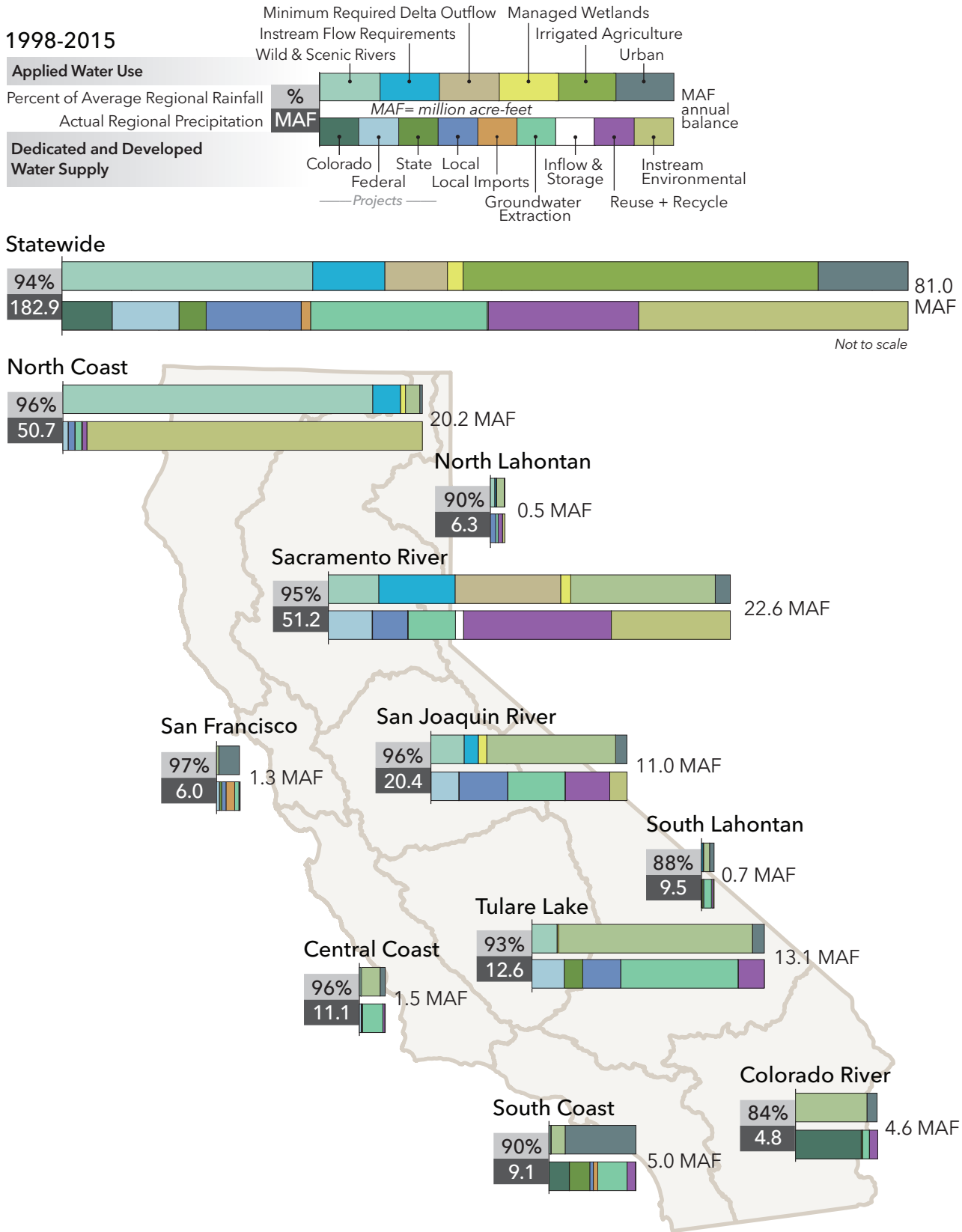


Figure 4 Regional Water Uses and Supplies in Water Year 2011 (Wet Year)

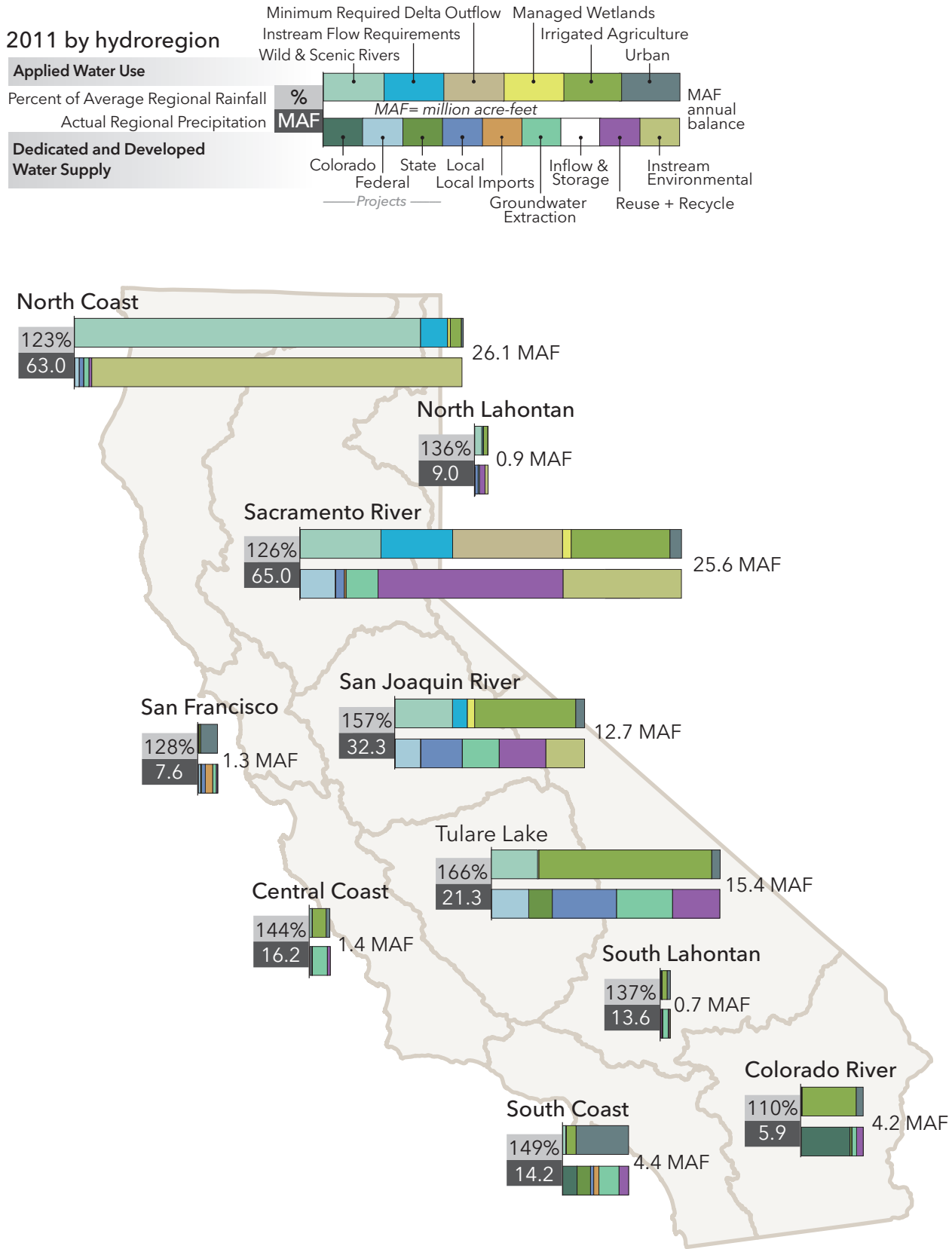
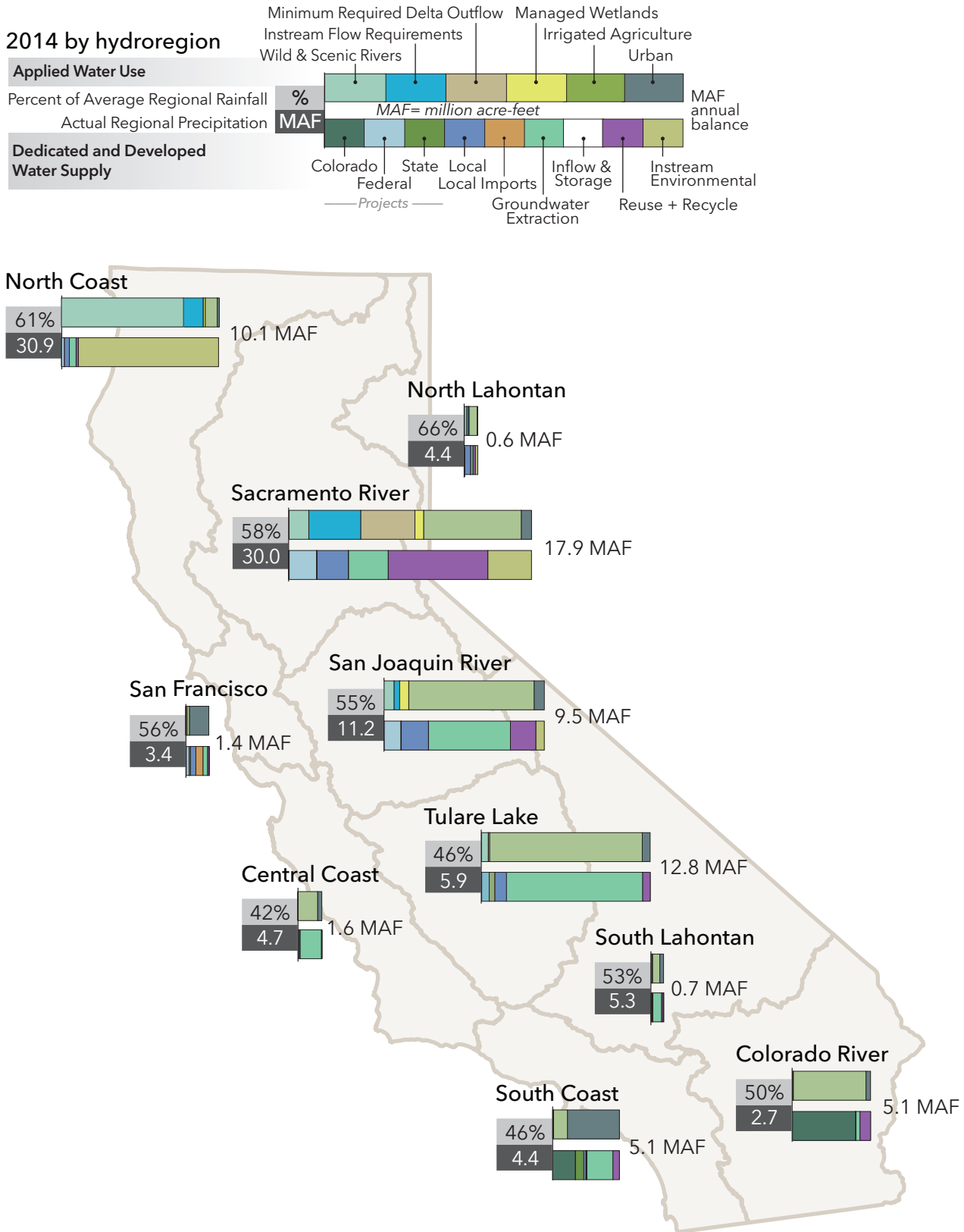


Figure 5 Regional Water Uses and Supplies in Water Year 2014 (Critically Dry Year)





Projected California Water Supply and Demand to 2050

To encourage water managers and the public to think holistically about water management, in 2014 the Department of Water Resources applied future scenarios of population growth, housing densities, land use patterns and climate to project future water demand in California's 10 hydrologic regions. The following two charts, Figure 6 and Figure 7, reflect that projection of future water demand. Overall, the first figure shows that statewide, the amount of water used by agriculture is expected to decline while urban use rises. The second figure shows regional variation in these projections, with urban water use expected to increase most in the South Coast region, while agricultural water use is expected to decline most in the San Joaquin and Tulare Lake regions.

After taking into account the fact that residential and business development often displaces farmland, the projections find a wide range in the potential overall demand for water in California in 2050. Assuming population growth is relatively low and high-density development dominates, net demand for water could fall between 600,000 acre-feet to 3.3 million acre-feet. Under a scenario of rapid population growth and low-density development, net water demand could increase from 300,000 acre-feet to nearly 3 million acre-feet.

These projections do not take into account the Sustainable Groundwater Management Act. That set of laws will require local governments to bring overdrawn groundwater basins into sustainable conditions no later than 2042, which may require restrictions on pumping. The projections assume only that groundwater use will continue with current trends. The use projections also assume that water is allocated for environmental needs based on existing requirements and that people continue to conserve water at 2014 levels of efficiency. In light of the 2014 enactment of the Sustainable Groundwater Management Act, agricultural water use may decline even more than projected.

In Figure 6, the change in water demand is the difference between the historical average for 1998 to 2005 and future average for 2043 to 2050. Urban demand is the sum of indoor and outdoor water demand, where indoor demand is assumed to not be affected by climate. Outdoor demand, however, depends upon such climate factors as the amount of precipitation falling and the average air temperature. The chart reflects nine growth scenarios and 13 climate scenarios. The net change in urban and agricultural water demand is shown at the top of

the Figure 6. Urban demand increased under all nine growth scenarios, consistent with population growth. On average, urban demand increased by 1.3 million acre-feet under the three low-population scenarios, 2.9 million acre-feet under the three current-trend population scenarios, and about 6.1 million acre-feet under the three high-population scenarios, when compared with the historical average of 8.2 million acre-feet. In contrast, agricultural use decreased under all nine growth scenarios, with the greatest decreases coming with the largest population increases.

The projections indicate that change in future urban water demands is less sensitive to housing density assumptions or climate change than to assumptions about future population growth.

Figure 6 Modelled Changes in Statewide Agricultural and Urban Water Demand

Change in Statewide Agricultural and Urban Water Demands for 117 Scenarios from 2006-2050 (million acre-feet per year)

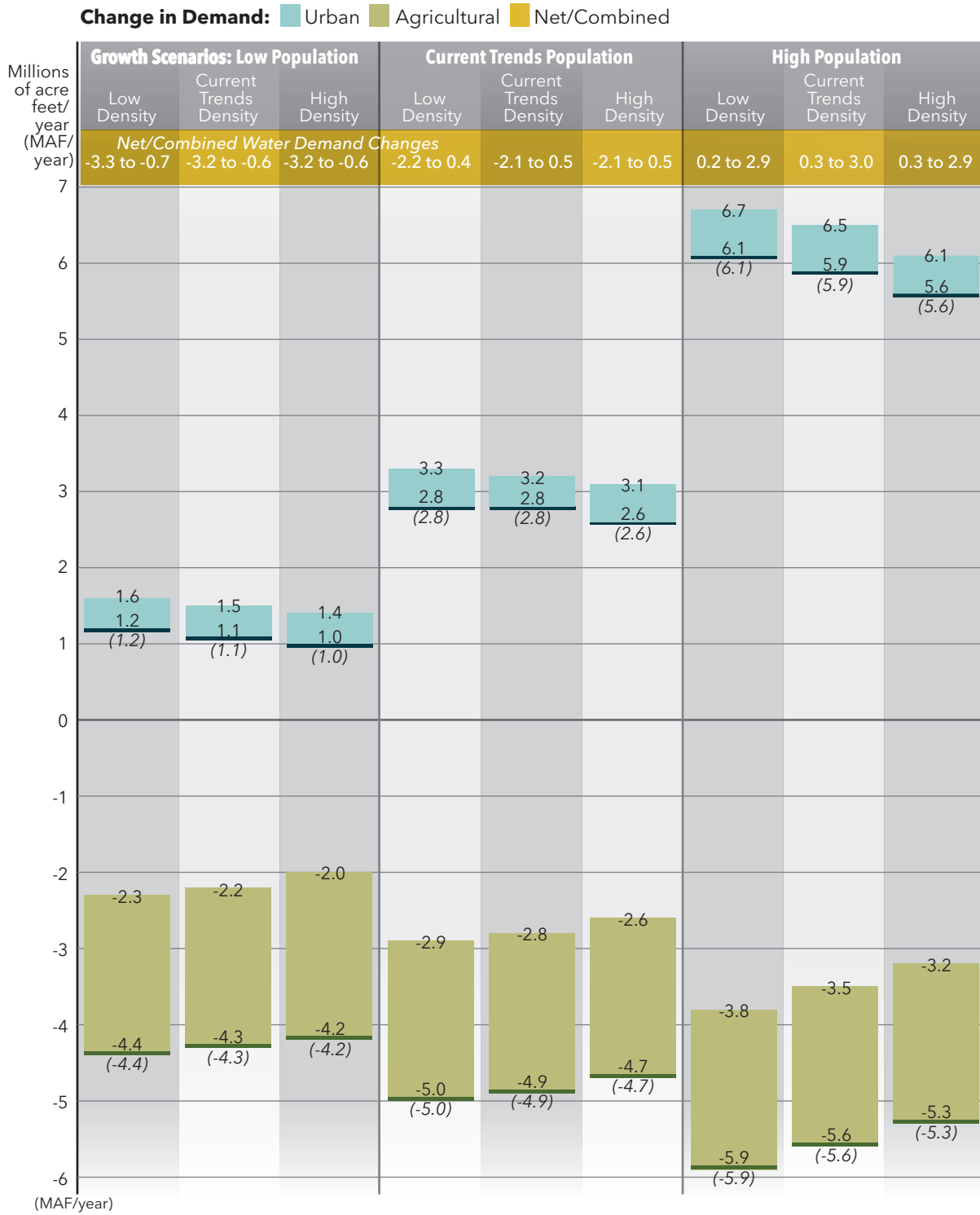


Figure 7 Modelled Changes in Regional Agricultural and Urban Water Demand

Change in Regional Agricultural and Urban Water Demands for 117 Scenarios from 2006-2050 (million acre-feet per year)

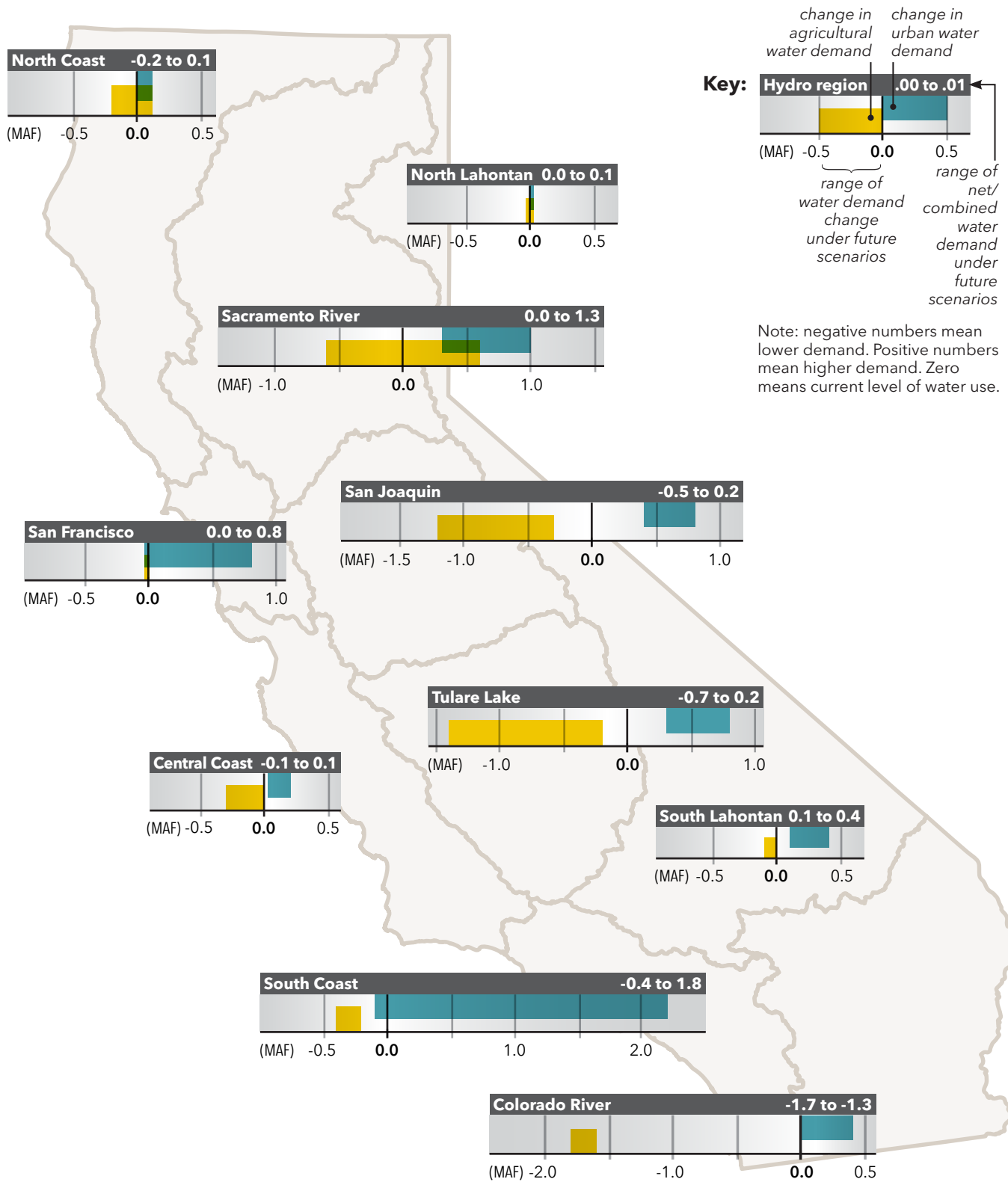


Figure 8 California Water Quality Issues

California faces numerous water quality problems.



Source: State Water Resources Control Board

Note: The map highlights only major regional problems, including those for which total maximum daily loads (TMDLs) have been set by water quality regulators.

TMDL: The initials used for 'Total Maximum Daily Load.' The initials 'TMDL' are used to denote the quantity of a pollutant that can be assimilated by a waterbody and still meet water quality objectives. TMDLs are also referred to as the loading capacity or assimilative capacity of the waterbody. TMDLs are

not always identified as daily loads, but rather monthly or annual loads, but the term TMDL is commonly still used for familiarity. Similarly, TMDLs are commonly, but not always, expressed as "loads." They can also be expressed as concentrations or other appropriate measure.

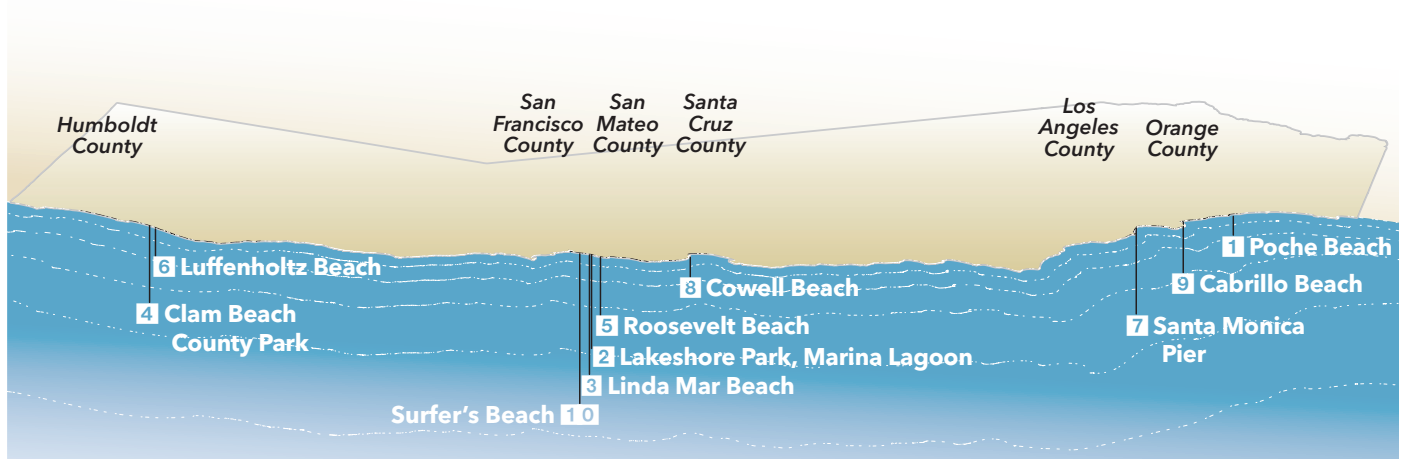
Figure 9 California Beach Water Quality

In the summer, water quality at the state’s approximately 500 beaches is generally excellent, with some exceptions, the worst of which are listed below as “beach bummers.” During wet weather, runoff washes pollutants and contaminants into the ocean and degrades the water quality at most beaches. The chart below, prepared by

the Santa Monica-based nonprofit group Heal the Bay, shows those beaches with the poorest summer grades. To generate its beach water quality reports, Heal the Bay collects shoreline monitoring data from local and state government agencies. The better the grade a beach receives, the lower the risk of illness to beachgoers.

2017-18 Beach Bummers	2017-18			2016-17			2015-16			2014-15			2013-14		
	2017-18 Summer Dry	2017-18 Winter Dry	2017-18 Wet Weather	2017-18 Summer Dry	2017-18 Winter Dry	2017-18 Wet Weather	2015-16 Summer Dry	2015-16 Winter Dry	2015-16 Wet Weather	2014-15 Summer Dry	2014-15 Winter Dry	2014-15 Wet Weather	2013-14 Summer Dry	2013-14 Winter Dry	2013-14 Wet Weather
1 Poche Beach @ Creek, San Clemente, Orange County	F	F	F	A	A	F	A	B	n/a	A	A	F	B	A	B
2 Lakeshore Park, Marina Lagoon, San Mateo County	F	n/a	F	F	B	F	C	B	F	F	C	F	F	F	F
3 Linda Mar Beach, Pacifica, San Mateo County	F	F	F	C	A	F	A	C	F	B	C	F	A	A+	D
4 Clam Beach County Park, Humboldt County	F	n/a	C	F	n/a	F	F	n/a	F	F	n/a	n/a	D	n/a	n/a
5 Roosevelt Beach, Half Moon Bay, San Mateo County	F	F	F	A	A	D	A	A+	D	A+	A+	C	A+	A	A
6 Luffenholtz Beach, Humboldt County	F	n/a	D	D	n/a	C	C	n/a	D	A	n/a	n/a	A	n/a	n/a
7 Santa Monica Pier, Los Angeles County	D	F	F	D	F	F	F	F	F	F	F	F	D	F	F
8 Cowell Beach, Santa Cruz, Santa Cruz County	D	B	B	F	A	F	F	A+	D	F	F	C	F	n/a	A+
9 Cabrillo Beach (@ restrooms), Los Angeles County	D	F	F	B	B	F	A	A	D	D	B	F	F	D	F
10 Surfer’s Beach, Half Moon Bay, San Mateo County	D	F	C	A	A	C	A	n/a	A+	A	A+	B	A	A+	B

PLEASE NOTE: Starting in 2015, the SWRCB required all coastal counties receiving state funds to monitor their beaches at point zero - where the discharge meets the ocean. Prior to monitoring year 2015-16, only Los Angeles County (and portions of Orange, San Diego, and Humboldt counties) sampled directly at the outfall, which gives the most accurate picture of water quality.





Appendix 3 | Section 2

Regional Assessment



Regional Summaries

The following section explores water management assets and challenges within each of 10 major hydrologic regions in California. The summaries provide a regional look at water sources and uses, likely climate change effects, major contaminants of surface and groundwater, regulated flows to protect fish and wildlife, and water rights. Each regional summary also includes a high-level analysis of the capacity of each region to address flood, drought, sea level rise, groundwater sustainability, water scarcity, water quality, and other issues.

This section concludes with a closer look at the Sacramento-San Joaquin Delta. Parts of the Delta fall within the Sacramento River and San Joaquin River hydrologic regions. It is the West Coast's largest estuary and lies at the center of a complex statewide water system. The Delta is addressed separately because of its unique geography, history, role in major water project deliveries, combination of climate risks, and the state and local leadership necessary to address a range of interconnected Delta challenges.

Figure 10 California Hydrologic Regions



North Coast

The North Coast region encompasses approximately 19,000 square miles, including 340 miles of scenic coastline and remote wilderness areas. About half of the region is protected as open space. It is the wettest region in California, with a mean annual runoff (29 million acre feet) that amounts to 40 percent of the state's total natural runoff. The population totaled about 690,000 in 2017, less than two percent of the state's population, with the highest percentage of tribal members. Groundwater accounts for about one-third of the region's water supply.



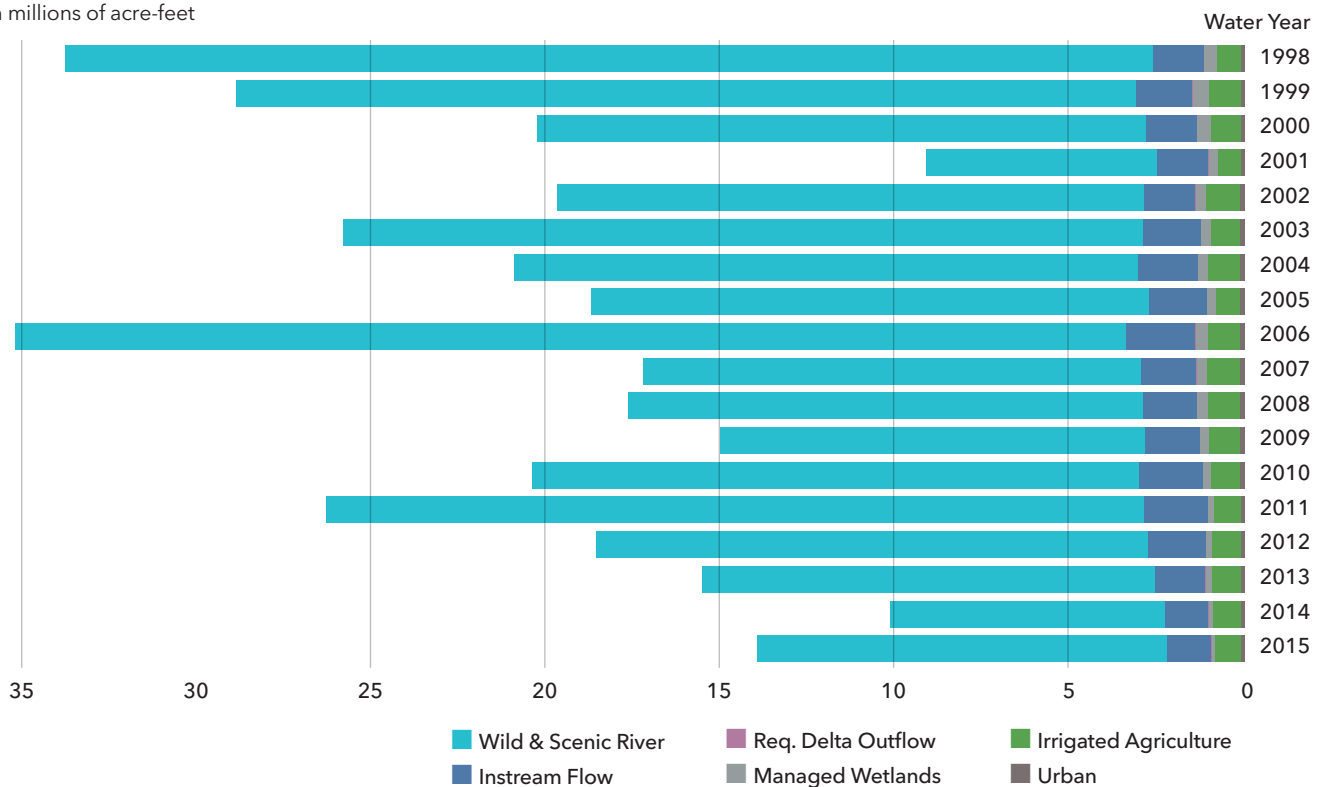
North Coast Region Water Use and Supply

California's water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came

from each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.

...in millions of acre-feet

Applied Water Use



North Coast Region Likely Climate Effects

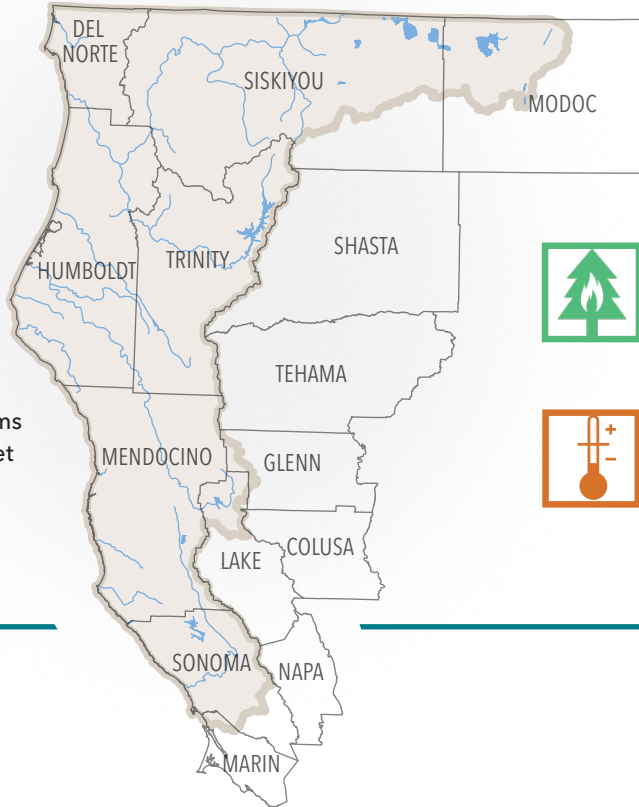
Population: 690,000
... in 2100: 1 million



Increased frequency of flooding in low-lying areas, especially along the coast



More intense storms within a shorter wet season



Higher likelihood of extreme wet and dry years

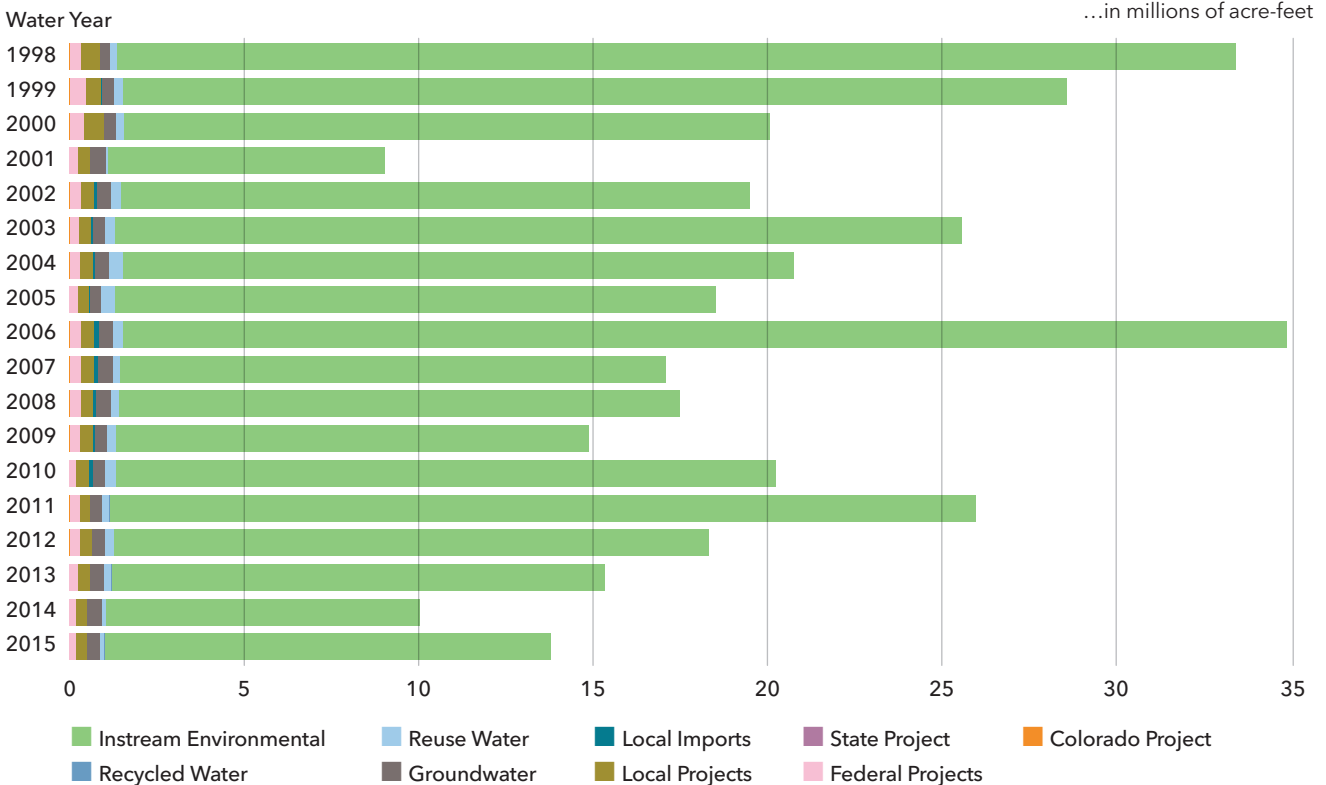


Longer fire season, increase in wildfire frequency, expansion in fire-prone areas



Average annual maximum temperatures likely to increase 5 to 9 degrees F by 2100

Dedicated and Developed Water Supply



North Coast Region Water Quality

Most of the North Coast region's rivers and streams are affected by failing septic tanks, gravel mining, and agriculture. Groundwater quality issues include seawater intrusion and elevated nutrients in shallow coastal areas. Other concerns are total dissolved solids and elevated mineral and heavy metal concentrations.

Surface Water Quality

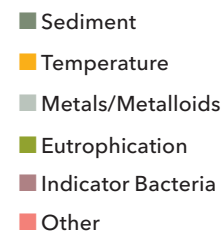


Within the jurisdiction of the North Coast Regional Water Quality Control Board there are 185 impairments. An impairment is a waterbody-pollutant

combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. Sediment is the most frequent reason for such impairments in this region, followed by temperature and metals, which include mercury and aluminum. Excessive nutrients that support dense algae growth and lead to low dissolved oxygen levels are also a problem on some streams and lakes.

Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

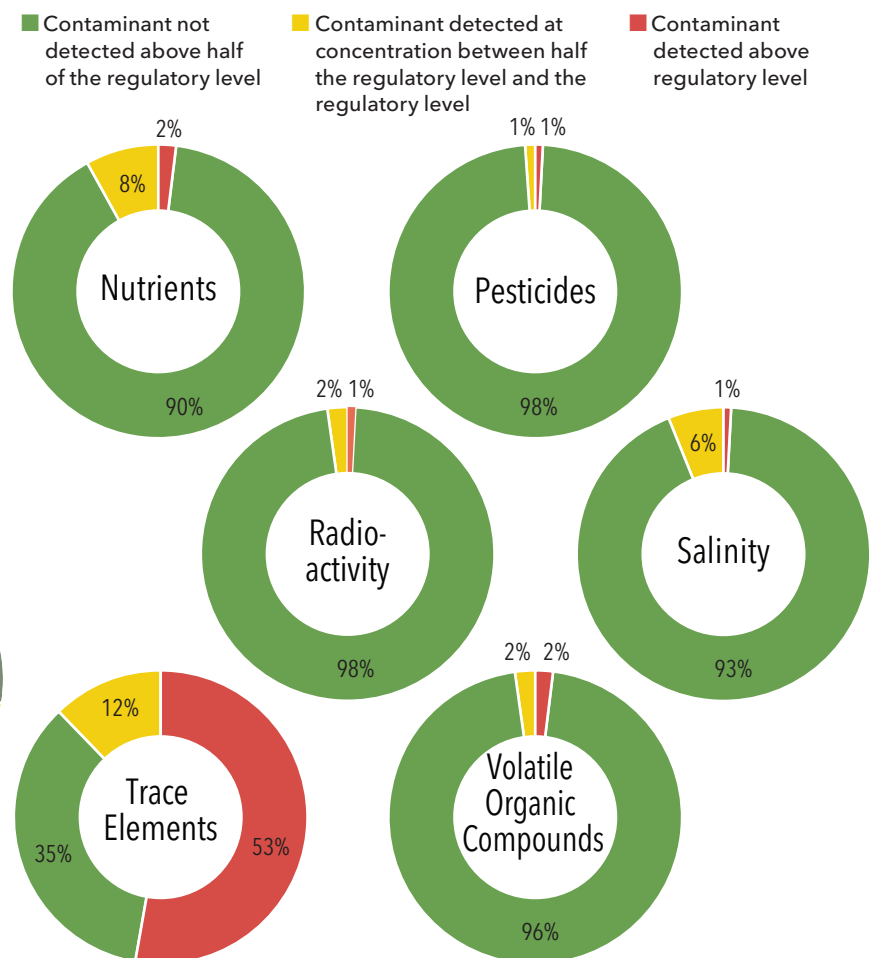


Groundwater Quality

Groundwater accounts for approximately a third of the public water supply in the North Coast region. There are about 1,000 active public supply wells. Generally, groundwater in the North Coast region is the least degraded in the state. The most common kinds of groundwater contaminants (before treatment) are naturally occurring manganese, iron, and arsenic. Nitrate occurs, too, but far less frequently. Approximately 38,000 domestic wells supply individual homes and are not regulated by the state.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in North Coast region groundwater, by percentage of public water system wells sampled.



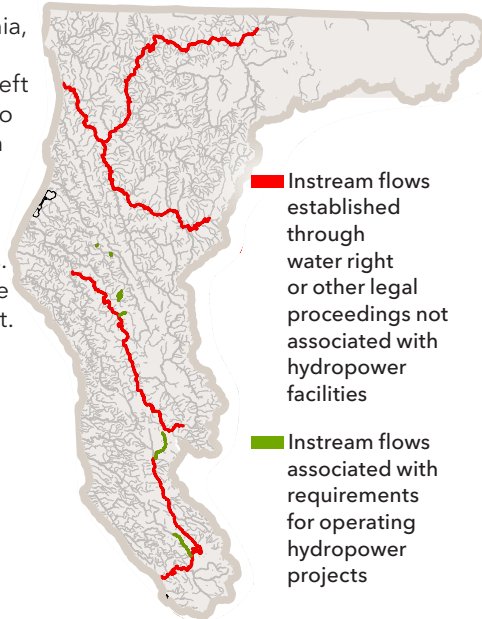
Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

North Coast Region Instream Flow* Requirements

On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. The list and map show where instream flows have been set.

*Does not include federal or state Wild and Scenic River protections.



Baker Creek	FERC License
Bluford Creek	FERC License
Collins Creek	Water Rights Decision
Dry Creek	FERC License; Water Rights Decision
East Fork Russian River	FERC License; Water Rights Decision
Eel River	Biological Opinion
Kekawaka Creek.....	FERC License
Klamath River.....	Biological Opinion
Mill Creek.....	FERC License
Mud Creek.....	FERC License
Powerhouse Canal	FERC License
Russian River.....	Water Rights Decision
Sulphur Creek	FERC License
Trinity River	Biological Opinion

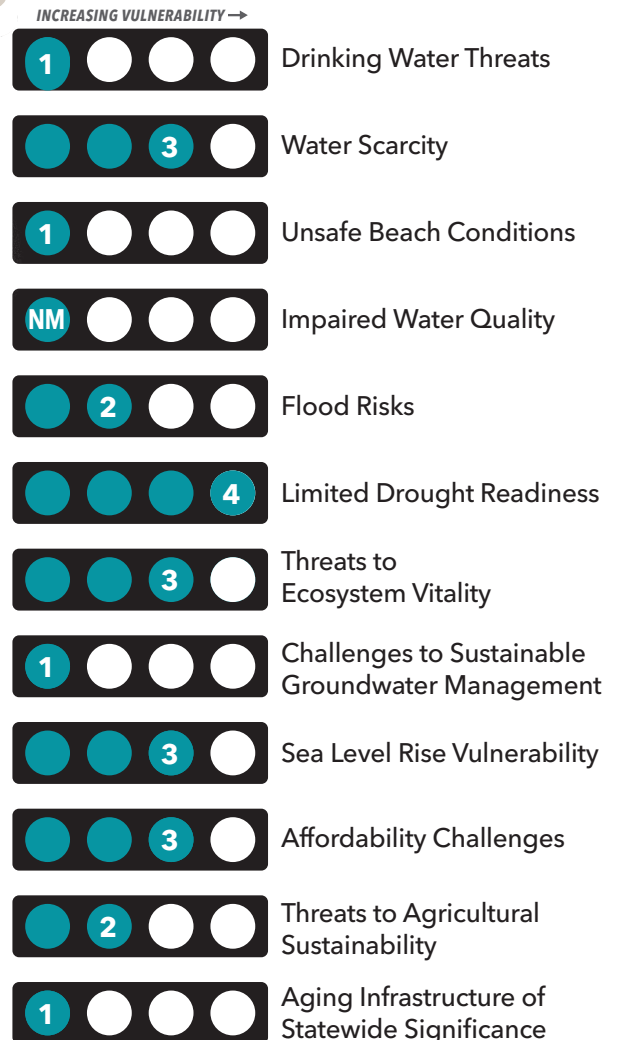
North Coast Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the North Coast region, the number of individual rights of each kind, and the total volume of water associated with those rights.

North Coast	total 8,106
Appropriative	2,577
Federal Claims	111
Federal Stockponds	77
Registration Cannabis	233
Registration Domestic	208
Registration Irrigation	10
Registration Livestock	81
Statement of Diversion and Use	4,665
Stockpond	144
Associated volume of water (in acre-feet):	1,680,577

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

North Coast Region Vulnerability Indicators



For methodology and sources see page 108.

Sacramento River

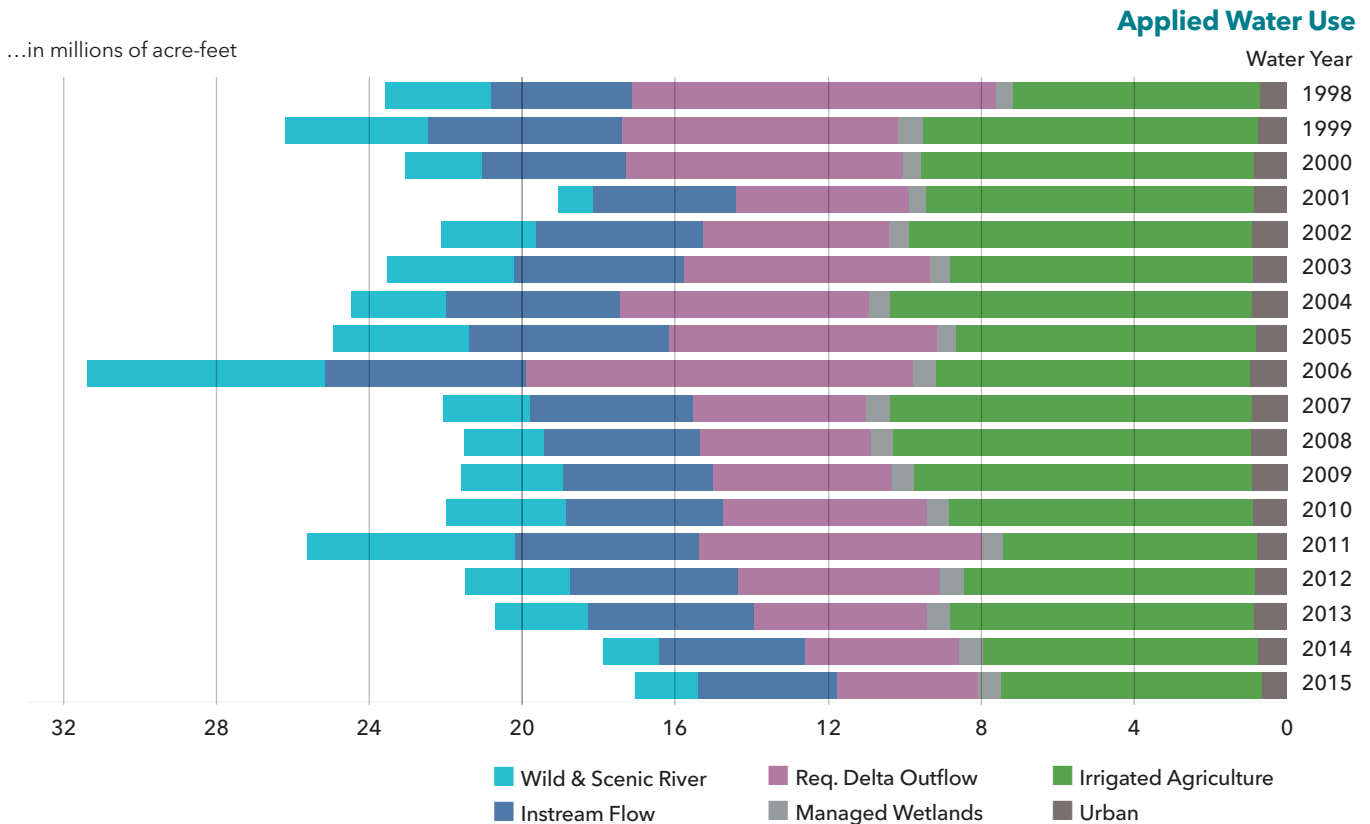
The Sacramento River hydrologic region includes the entire drainage of the state's largest river, from Modoc County to Solano County, where the Sacramento River flows into San Francisco Bay. The region covers approximately 27,200 square miles. In 2017, its population was estimated at nearly 3.2 million people. Climates in the region range from high desert with annual precipitation of 10 to 20 inches to the valley, where precipitation varies from about 35 inches annually in Redding to 18 inches in Sacramento. The region supports nearly 2 million acres of irrigated farmland. Groundwater supplies about a third of the water used in the region.



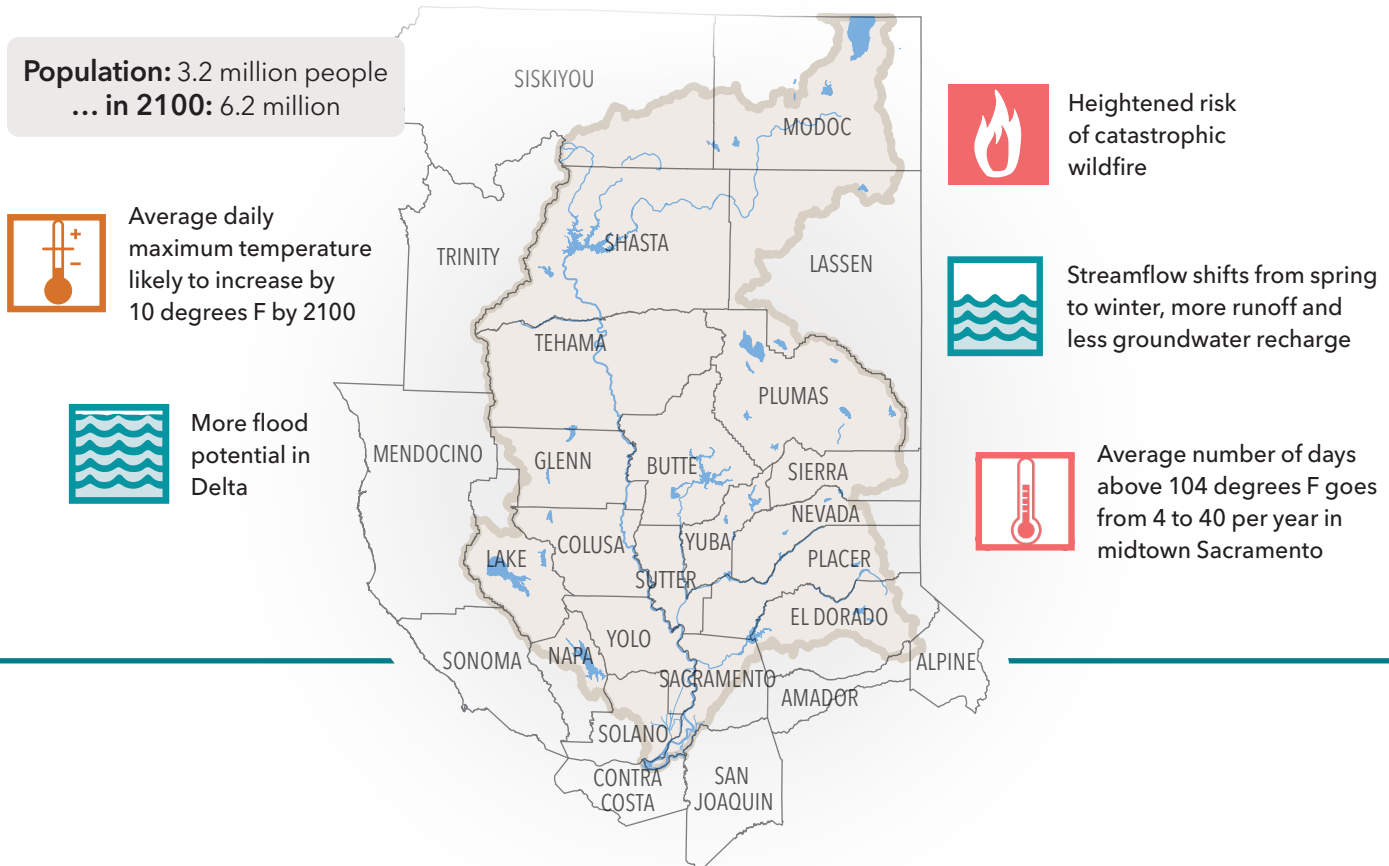
Sacramento River Region Water Demand and Supply

California's water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came

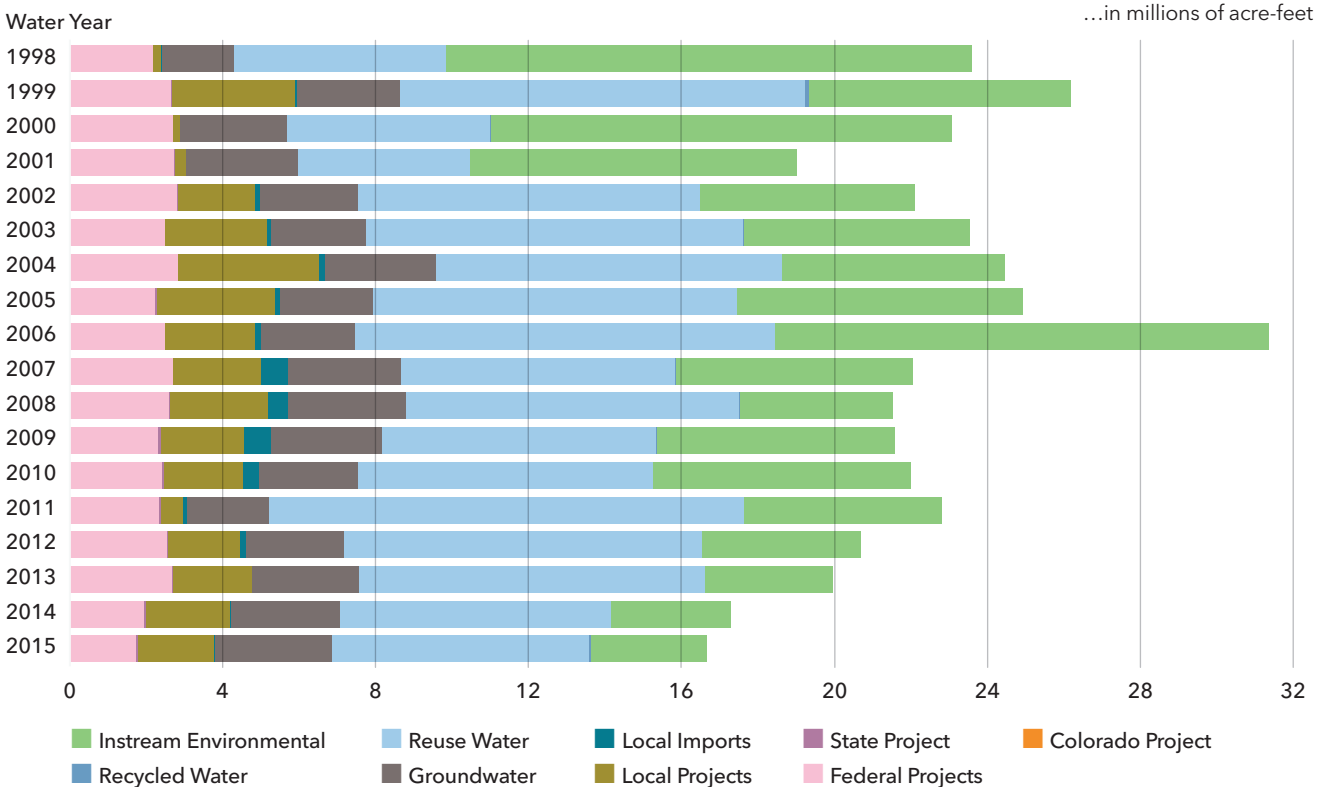
from each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.



Sacramento River Region Likely Climate Effects



Dedicated and Developed Water Supply



Sacramento River Region Water Quality

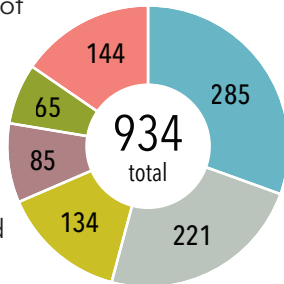
Generally, water quality is high in the Sacramento Valley for both groundwater and surface water. Copper, cadmium, zinc, and lead from past mining are problems in some upper Feather River tributaries. Quicksilver, a liquid form of mercury used by miners during the Gold Rush, can be converted in water to methylmercury, a potent neurotoxin that can build up in fish-eating wildlife. Many streams—especially Cache Creek—contain fish with elevated levels of methylmercury.

Surface Water Quality



The Sacramento River region falls within the jurisdiction of the Central Valley Regional Water Quality Control Board. Within the regional

board's area, there are 934 impairments. An impairment is a waterbody-pollutant combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. The most common contaminants are pesticides, affecting 30 percent of the streams listed as impaired. Metals and metalloids including mercury are the second-most common reason for impairment, followed by toxicity.



Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

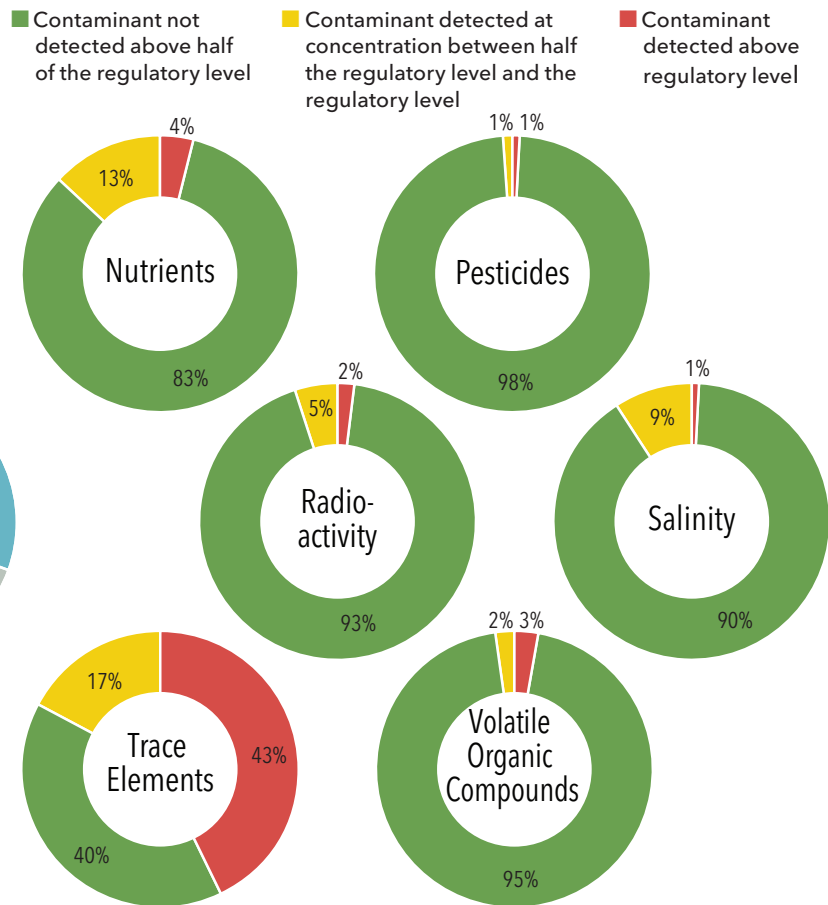
- Pesticides
- Metals/Metalloids
- Toxicity
- Indicator Bacteria
- Eutrophication
- Other

Groundwater Quality

Groundwater accounts for approximately 30 percent of the public water supply in the Sacramento River region. There are about 2,280 active public supply wells. The most common kinds of groundwater contaminants (before treatment) are naturally occurring manganese, iron, and arsenic. Nitrate and pesticide-related chemicals occur far less frequently in sampling. More than 115,000 domestic wells supply individual homes and are not regulated by the state.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in Sacramento River region groundwater, by percentage of public water system wells sampled.



Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

Sacramento River Region Instream Flow* Requirements

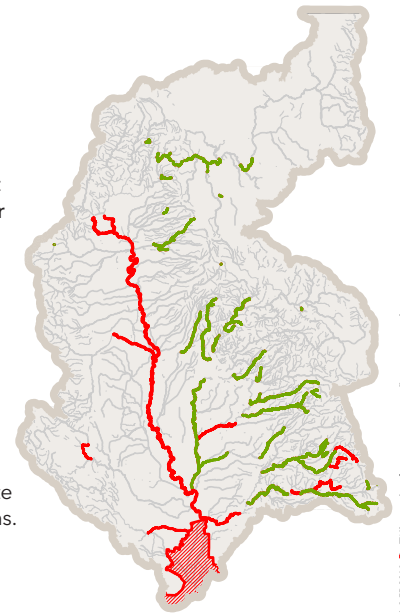
On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. The list and map at right show where instream flows have been set.

Sacramento River.....	Biological Opinion
North Fork Feather River.....	FERC License
Camp Creek.....	FERC License
South Fork American River.....	FERC License
Deadwood River.....	FERC License
South Fork American River.....	FERC License
Ward Creek.....	FERC License
Nelson Creek.....	FERC License
Hat Creek.....	FERC License
Hatchet Creek.....	FERC License
Sucker Run Creek.....	FERC License
Lost Creek.....	FERC License
Lower American River.....	Water Right Decision
American River.....	Water Right Decision
McCloud River.....	FERC License
Middle Fork American River.....	FERC License
Pit River.....	FERC License
Slab Creek.....	FERC License
Old Cow Creek.....	FERC License
Feather River.....	FERC License
Middle Fork Cottonwood Creek.....	FERC License
Perry Creek.....	FERC License
Pit River.....	FERC License
Pit River.....	FERC License
North Fork Feather River.....	FERC License
Bailey Creek.....	FERC License
Putah Creek.....	Settlement Agreement
Little Roaring Creek.....	FERC License
Rock Creek.....	Water Right Order
South Fork Feather River.....	FERC License

Information on additional instream flow requirements in this region available at https://www.waterboards.ca.gov/water_issues/programs/cannabis/existing_flow_requirements.html.

- Instream flows established through water right or other legal proceedings not associated with hydropower facilities
- Instream flows associated with requirements for operating hydropower projects

*Does not include federal or state Wild and Scenic River protections.



Sacramento River Region Water Rights

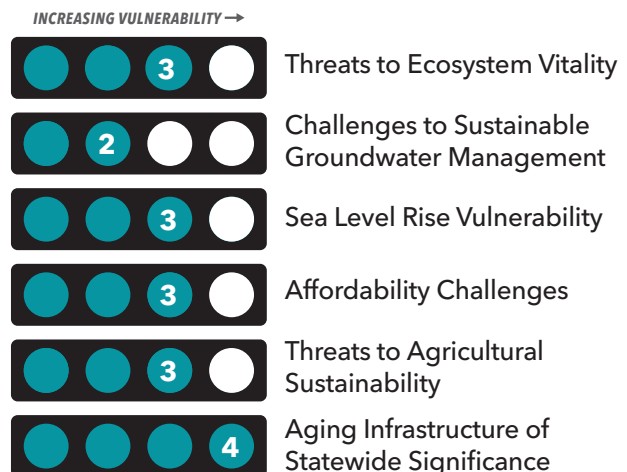
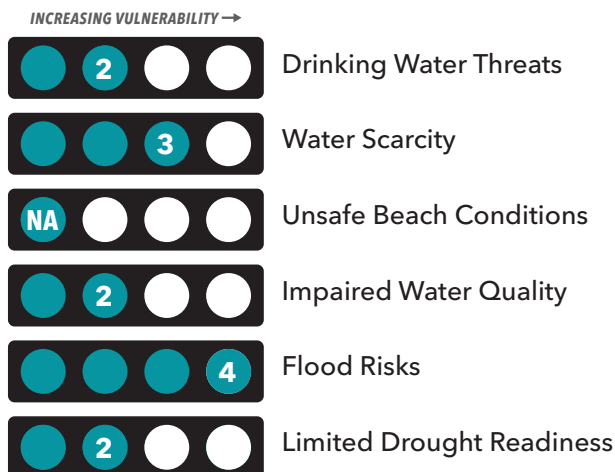
A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the Sacramento River region, the number of individual rights of each kind, and the total volume of water associated with those rights.

Sacramento River	total 9,535
Appropriative.....	3,787
Federal Claims.....	260
Federal Stockponds.....	218
Registration Domestic.....	16
Registration Livestock.....	71
Statement of Diversion and Use.....	4,215
Stockpond.....	968
Associated volume of water (in acre-feet):	23,316,342

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

Sacramento River Region Vulnerability Indicators

For methodology and sources see page 108.



North Lahontan

The North Lahontan hydrologic region covers approximately 6,100 square miles in far northeastern California. Average annual precipitation is 23 inches, and all runoff drains east to Nevada. Roughly 93,000 people lived in the region in 2017, but visitors to the Tahoe basin often outnumber local residents. Most of the land is federal, with many ski and vacation resorts. Cattle ranching is the principal agricultural activity. Groundwater accounts for about 30 percent of the annual supply.



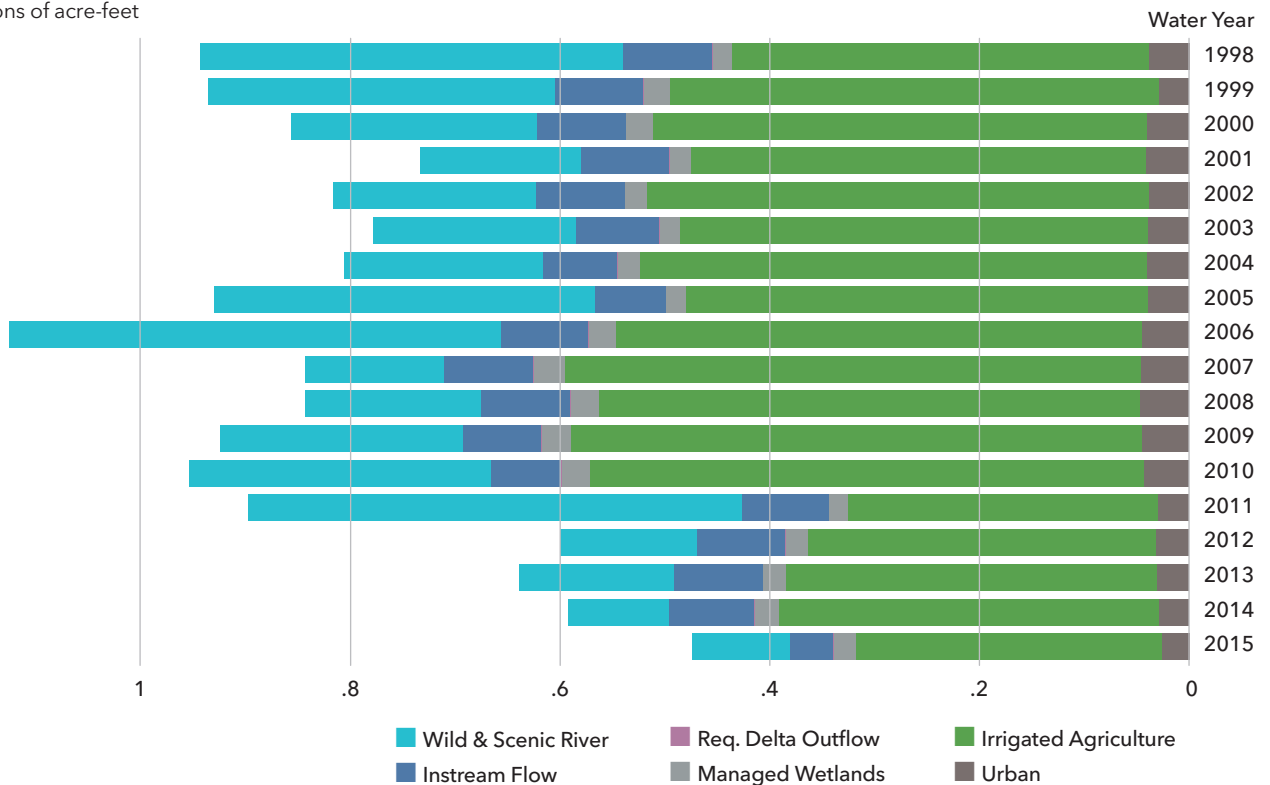
North Lahontan Region Water Demand and Supply

California's water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came

from each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.

...in millions of acre-feet

Applied Water Use



North Lahontan Region Likely Climate Effects

Population: 93,000 people
... in 2100: 150,000



Northern Sierra snowpack to disappear by 2100



Probability of flash floods increases as the wettest day of the year predicted to increase as much as 30% by 2100



Increased streamflow in winter, reduction in summer flows

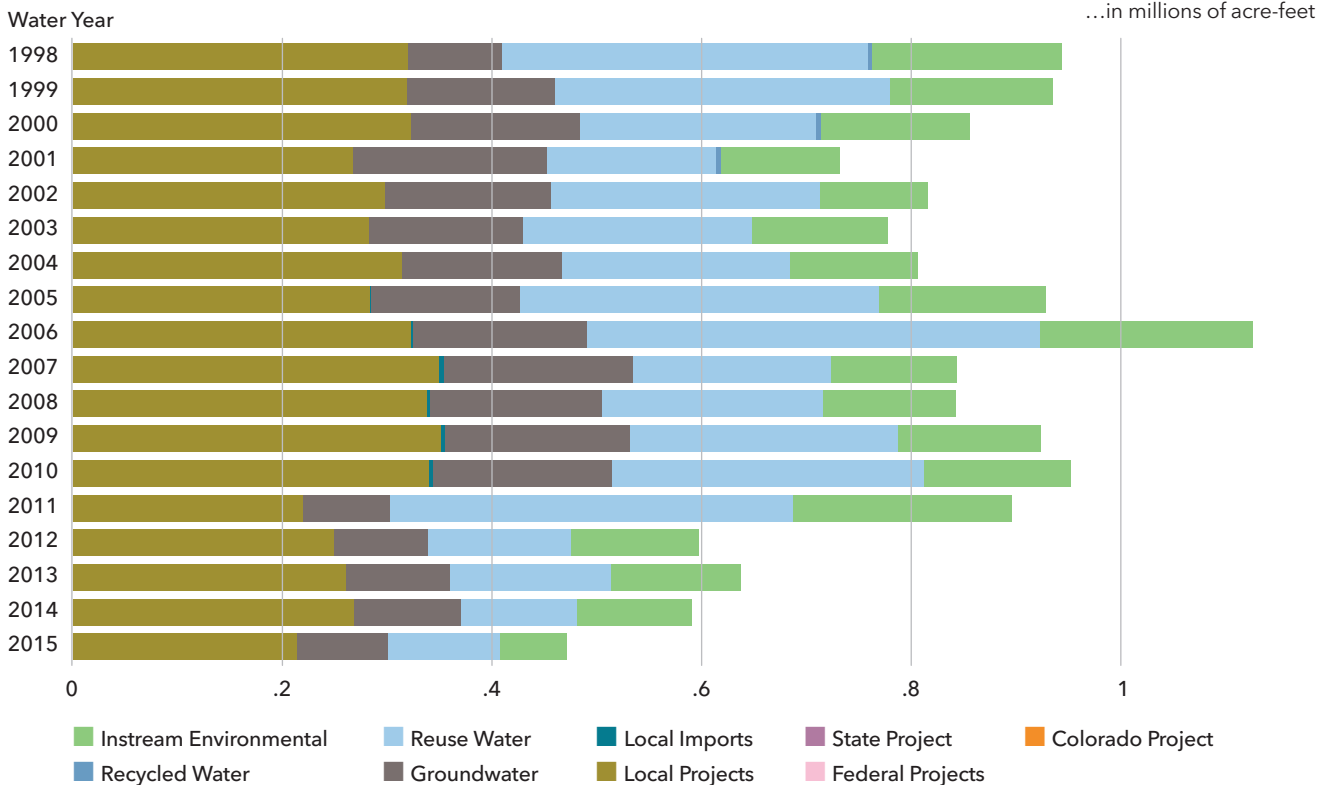


Longer fire season, increase in wildfire frequency, expansion in fire-prone areas



Total precipitation may not change, but extremes—deluge and drought—increase

Dedicated and Developed Water Supply



North Lahontan Region Water Quality

Compared to other regions, water quality problems in the sparsely-populated North Lahontan region are minor, given the alpine source of supplies. In some areas, groundwater has been contaminated by MTBE and nitrate. Fine sediment and urban runoff can compromise the clarity of Lake Tahoe. Some rivers and streams are degraded by mining and grazing.

Surface Water Quality



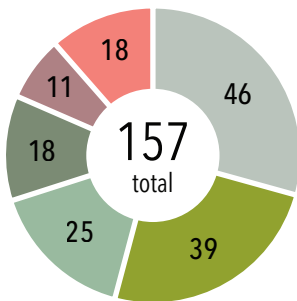
The North Lahontan region falls within the jurisdiction of the Lahontan Regional Water Quality Control Board. Within the regional board's

area, there are 157 impairments. An impairment is a waterbody-pollutant combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. Metals including mercury are the most common cause of impairment, followed by excess nutrients and low dissolved oxygen.

Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

- Metals/Metalloids
- Eutrophication
- Salinity
- Sediment
- Indicator Bacteria
- Other

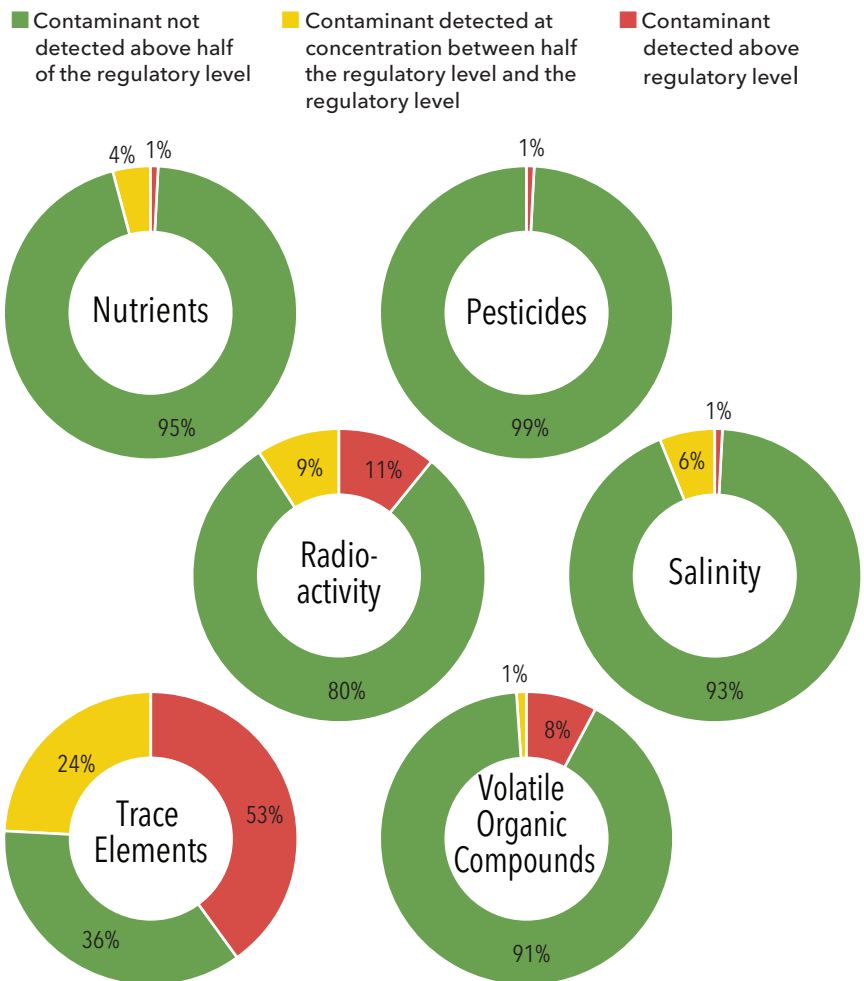


Groundwater Quality

Groundwater accounts for approximately 32 percent of the public water supply in the North Lahontan region. There are roughly 350 active public supply wells. The most common groundwater contaminants (before treatment) are naturally occurring arsenic, manganese, and iron. Manmade compounds such as PCE occur less frequently in sampling.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in North Lahontan region groundwater, by percentage of public water system wells sampled.

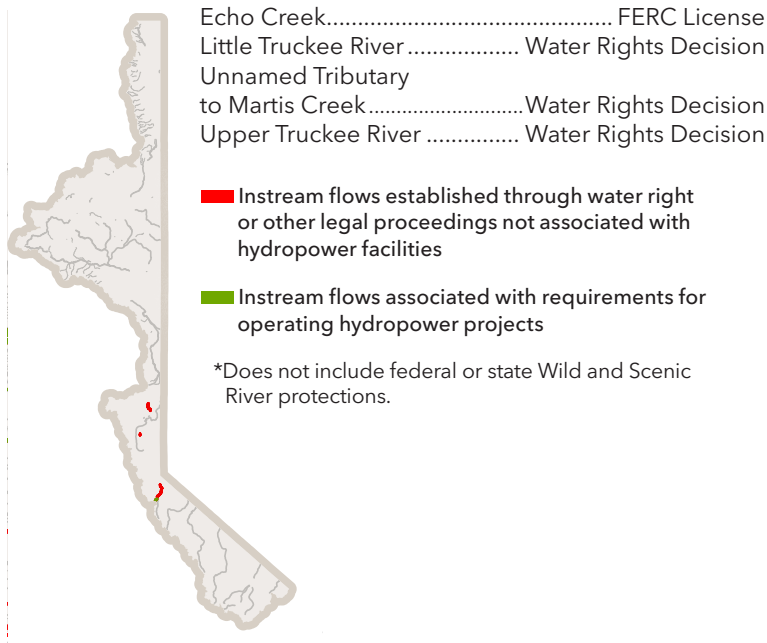


Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

North Lahontan Region Instream Flow* Requirements

On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. The list and map below show where instream flows have been set.



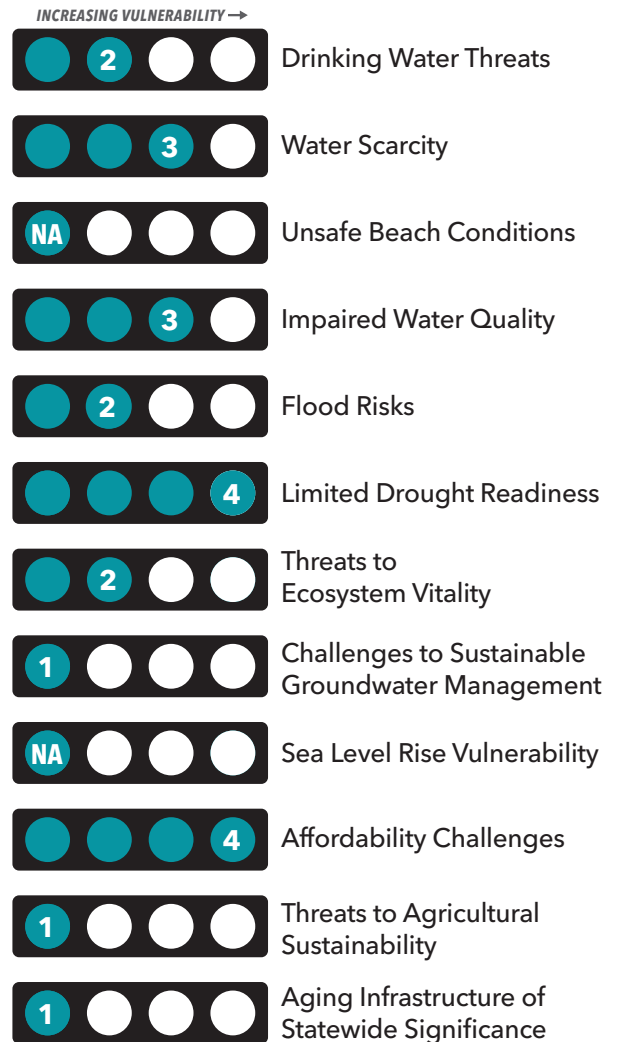
North Lahontan Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the North Lahontan region, the number of individual rights of each kind, and the total volume of water associated with those rights.

North Lahontan	total 1,672
Appropriative	516
Federal Claims	140
Federal Stockponds	11
Registration Domestic	1
Registration Livestock	6
Statement of Diversion and Use	779
Stockpond	219
Associated volume of water (in acre-feet):	290,408

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

North Lahontan Region Vulnerability Indicators



For methodology and sources see page 108.

San Francisco Bay



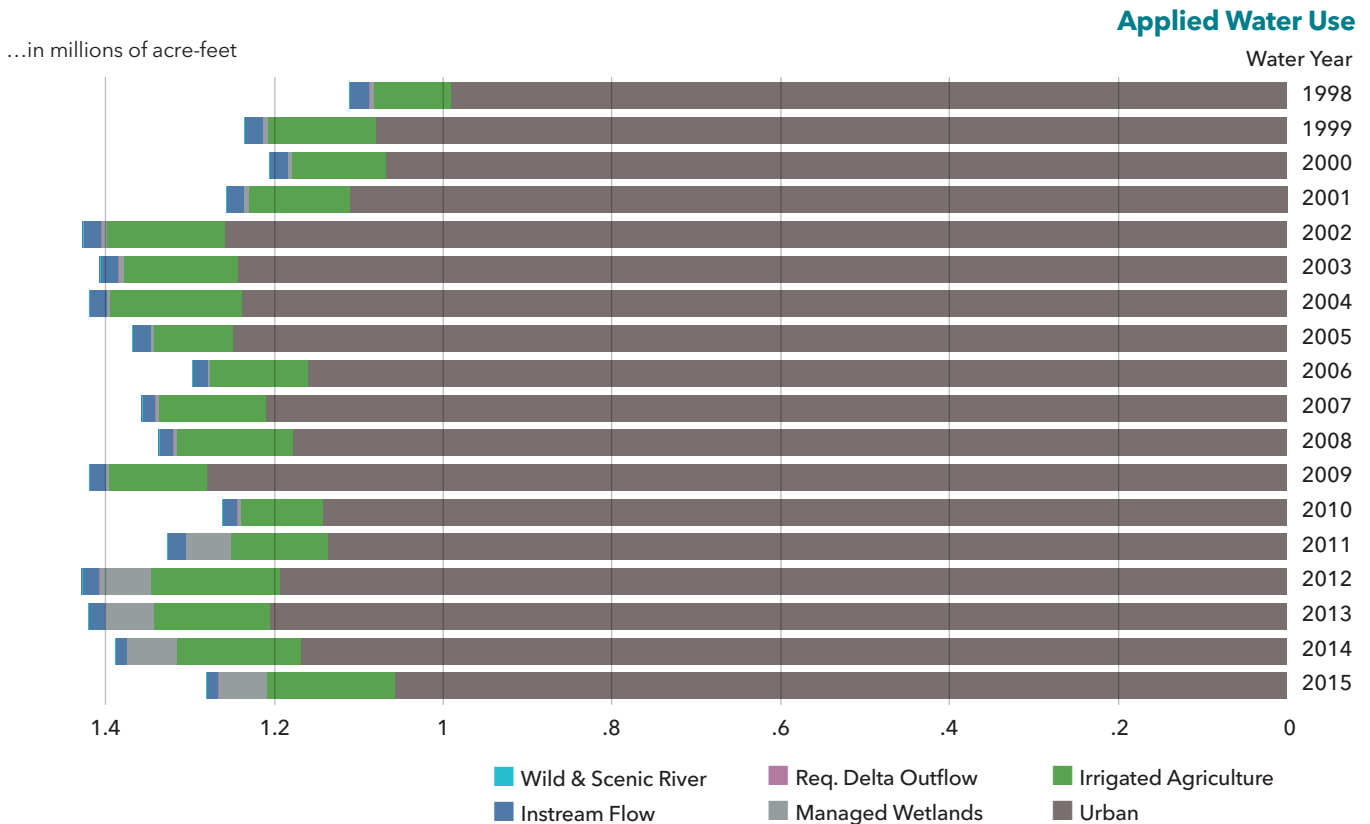
San Francisco Bay hydrologic region covers approximately 4,500 square miles. Average precipitation ranges from 15 inches to 20 inches, depending upon location. It is the second smallest of the state's 10 hydrologic regions but home to the second largest population at 6.9 million people in 2017. Land use ranges from Napa and Sonoma valley vineyards to the technological production of Silicon Valley. About 70 percent of the urban supply is imported into the region, much of it from the Sierra Nevada mountains and the Sacramento-San Joaquin Delta. Local groundwater and streams meet about a third of the region's water demand.



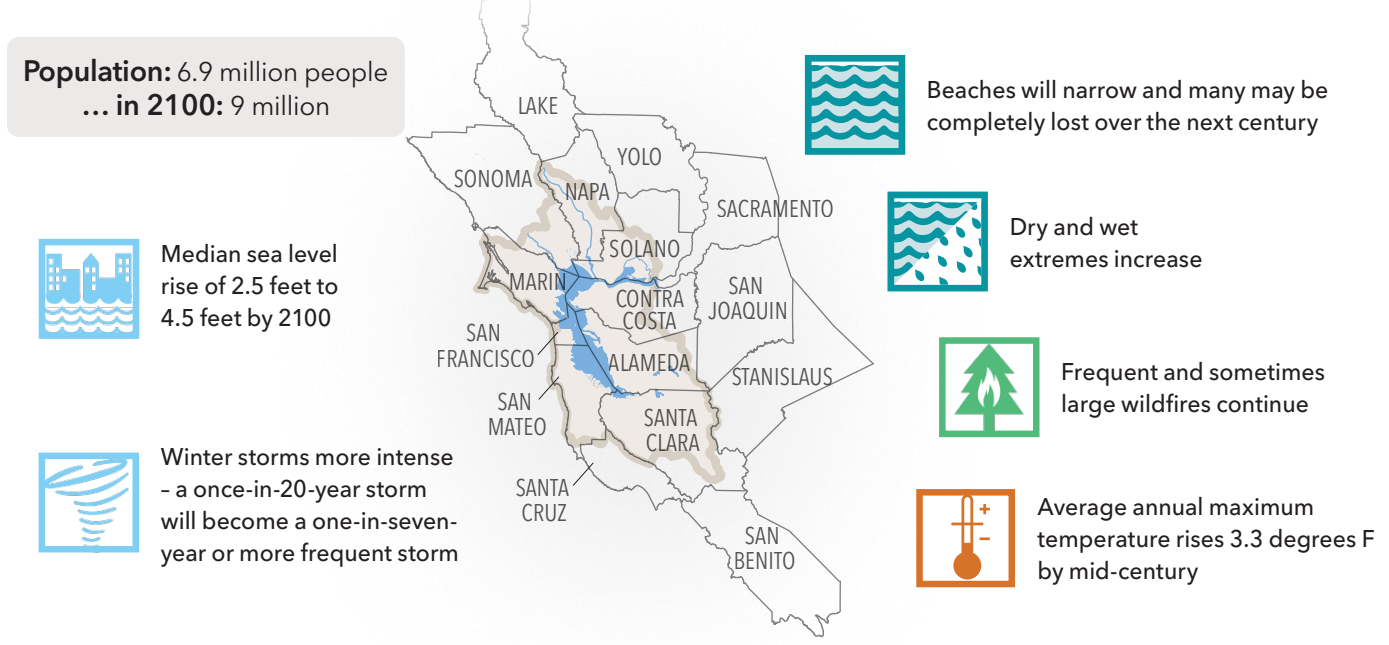
San Francisco Region Water Demand and Supply

California's water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came

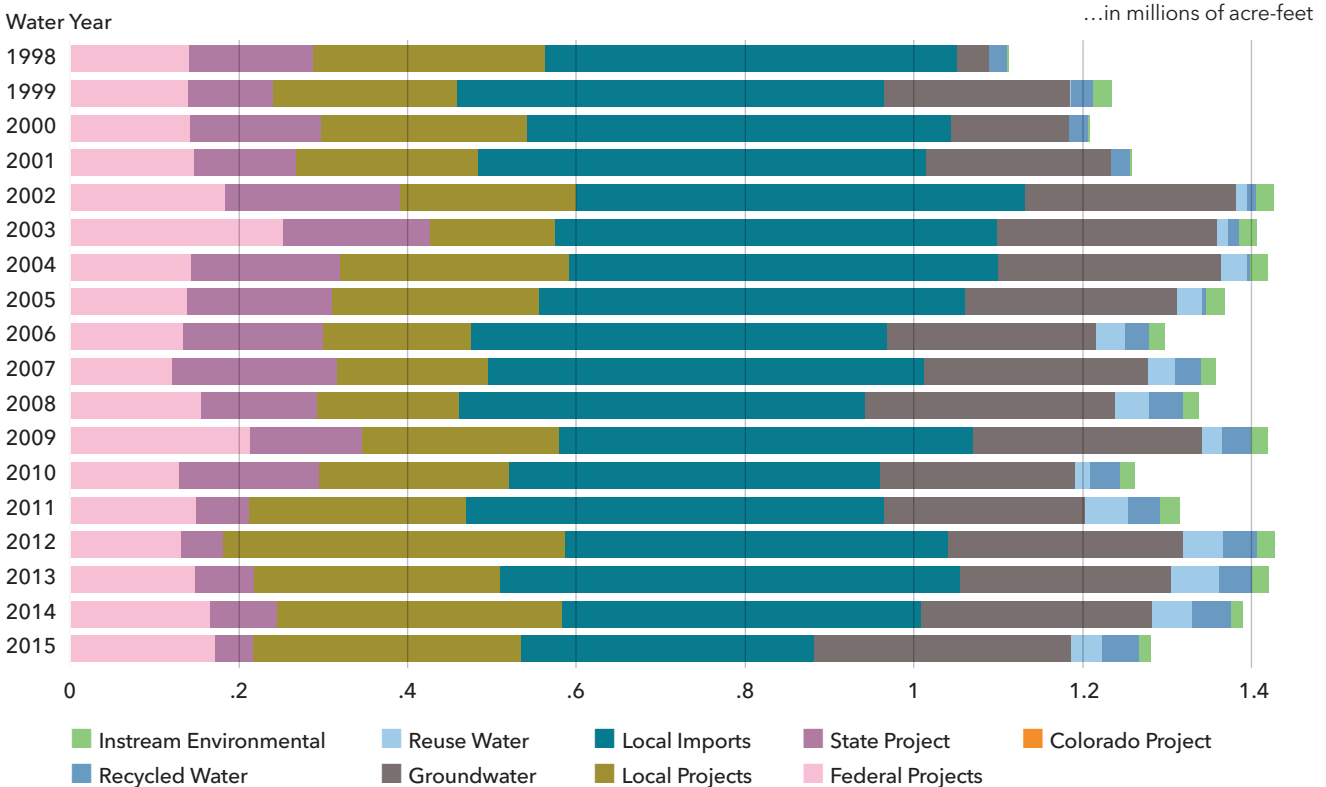
from each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.



San Francisco Region Likely Climate Effects



Dedicated and Developed Water Supply



San Francisco Region Water Quality

In the counties surrounding San Francisco Bay, urban runoff contaminants include pathogens, nutrients, sediment, and toxic residue from past mining, industrial production, and pesticides. Emerging pollutants in the region include flame retardants, perflourinated compounds, and pharmaceuticals. The Bay itself and many streams that feed it have elevated mercury levels, much of it from local mercury mining and mining activities in the Sierra Nevada and coastal mountains.

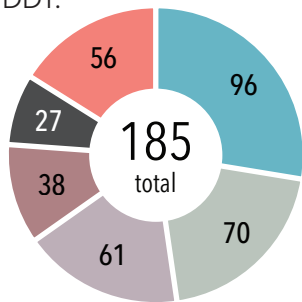
Surface Water Quality



Within the jurisdiction of the North Coast Regional Water Quality Control Board there are 185 impairments. An impairment is a waterbody-pollutant combination

where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. Pesticides are the most common contaminant in the region, including banned but persistent chemicals such as DDT.

Metals including mercury are the second most common type of impairment. Bacteria that indicate fecal contamination and trash are also problems.



Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

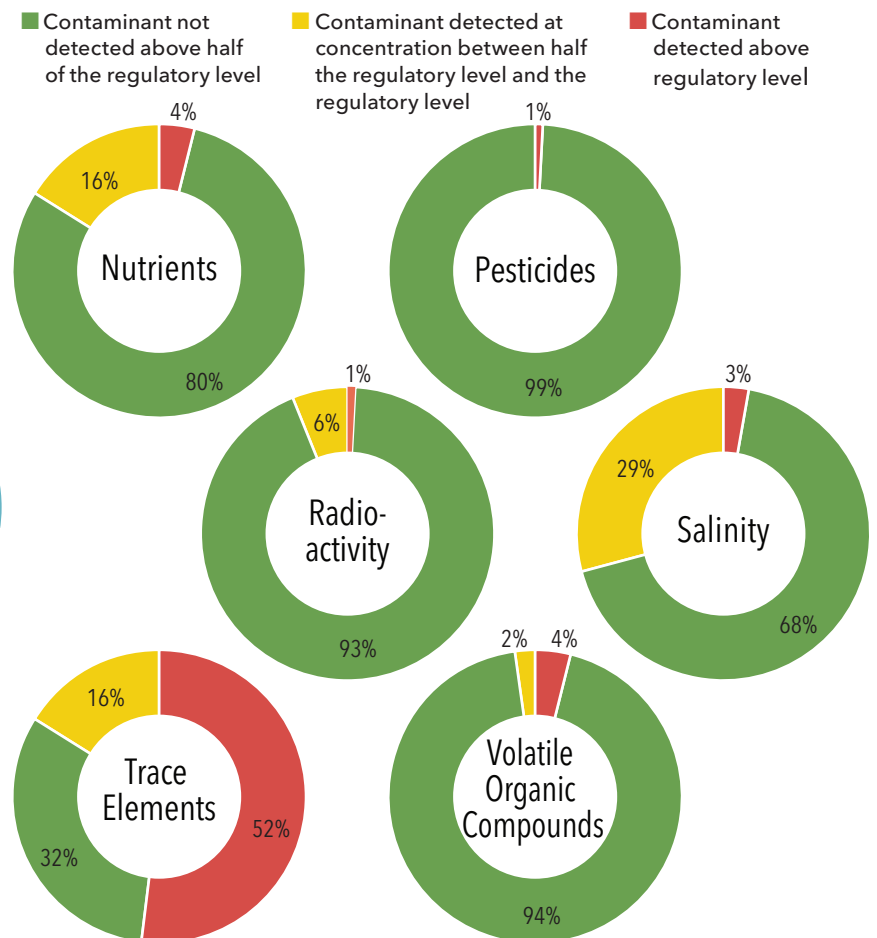
- Pesticides
- Metals/Metalloids
- Other Toxic Organics
- Indicator Bacteria
- Trash
- Other

Groundwater Quality

Groundwater accounts for approximately 21 percent of the public water supply in the San Francisco Bay region. There are about 880 active public supply wells. The most common contaminants of groundwater (prior to treatment) are naturally occurring manganese, iron, and arsenic. Nitrate and total dissolved solids are also encountered at less frequency. The roughly 17,000 domestic wells that supply individual homes in the region are not regulated by the state.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in San Francisco region groundwater, by percentage of public water system wells sampled.



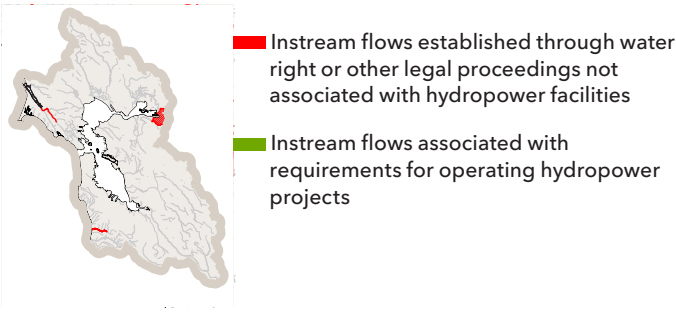
Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

San Francisco Region Instream Flow Requirements

On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. The list and map below show where instream flows have been set.

Lagunitas Creek Water Rights Order
San Gregorio Creek..... Water Rights Order



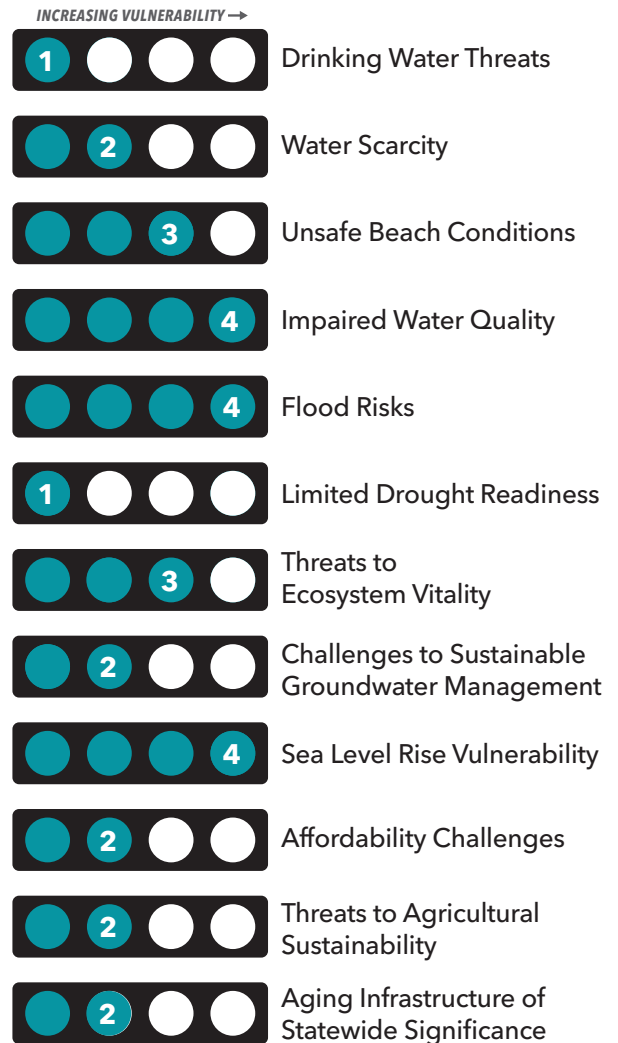
San Francisco Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the San Francisco region, the number of individual rights of each kind, and the total volume of water associated with those rights.

San Francisco Bay	total 2,622
Appropriative	1,106
Registration Domestic	29
Registration Irrigation	3
Registration Livestock	80
Statement of Diversion and Use	951
Stockpond	453
Associated volume of water (in acre-feet):	374,907

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

San Francisco Region Vulnerability Indicators



For methodology and sources see page 108.

San Joaquin River



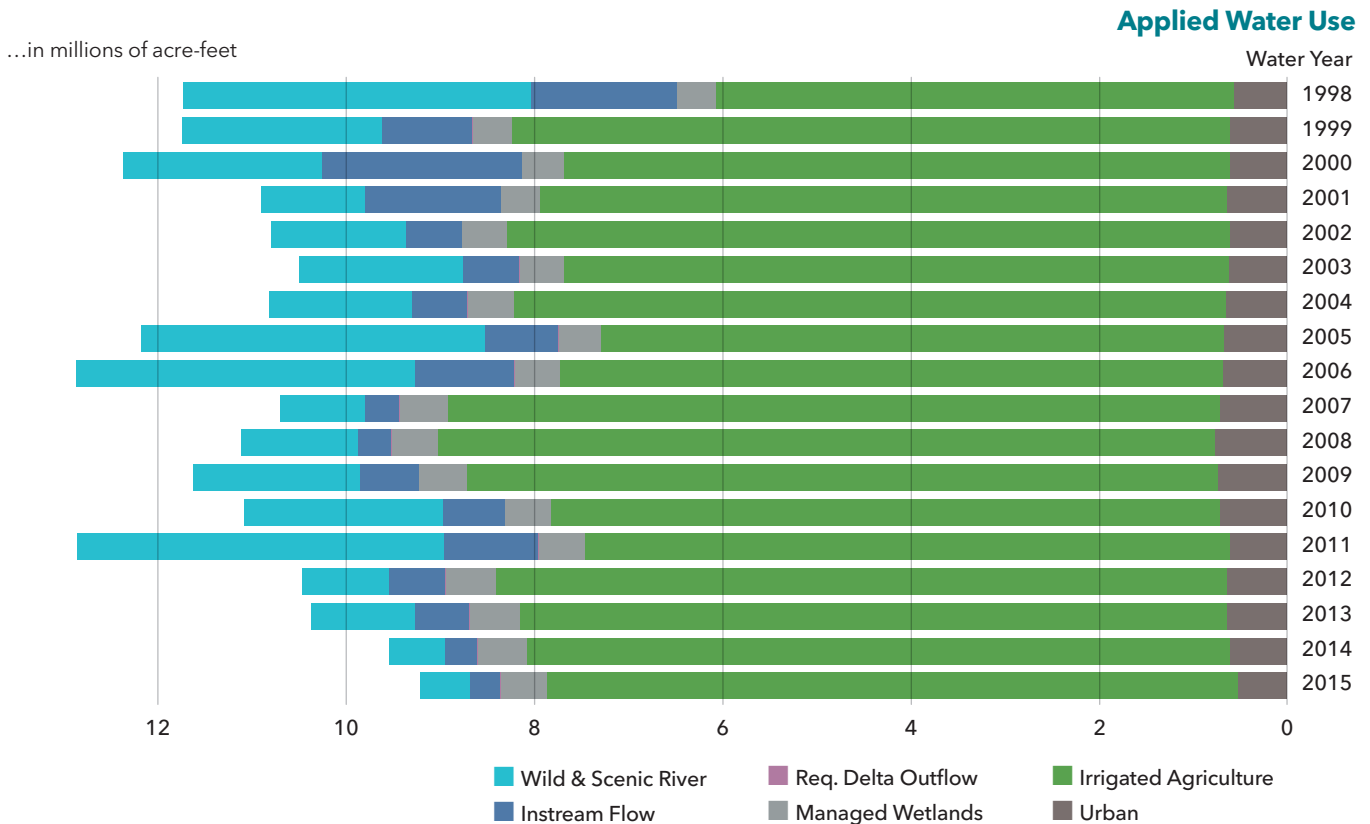
The San Joaquin River hydrologic region covers about 15,200 square miles in the northern part of the San Joaquin Valley, the southern part of the Sacramento-San Joaquin Delta, and parts of the Sierra Nevada and Diablo mountain ranges. It includes the entire drainage of the 300-mile-long San Joaquin River. Annual precipitation in the Sierra can be 35 inches, while on the heavily farmed valley floor, annual precipitation ranges from about 22 inches near Stockton to 6.5 inches in the southwest. About 2.3 million people lived in the region in 2017. Most natural flows from the upper San Joaquin river are diverted to irrigate crops outside the region. Most of the region’s surface water is delivered by the federal Central Valley Project. Groundwater accounts for about two-fifths of the region’s supply.



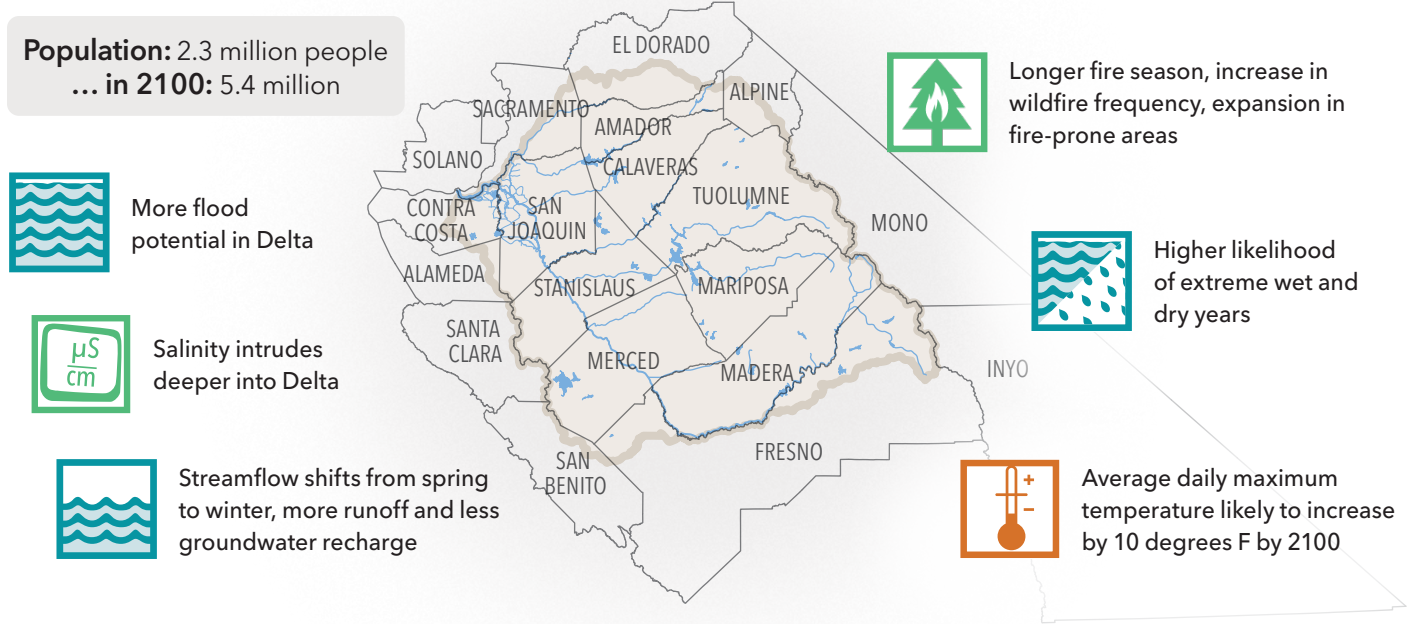
San Joaquin Region Water Demand and Supply

California’s water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came from

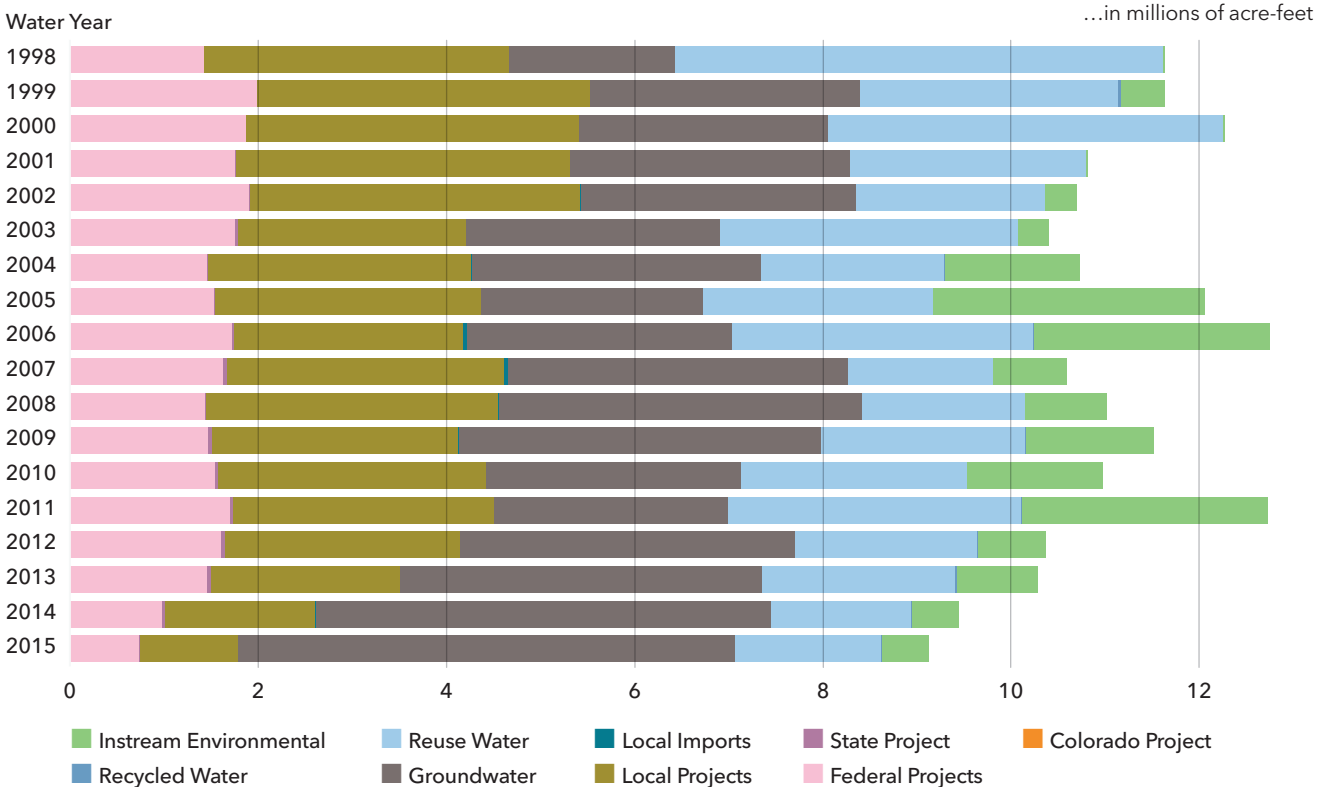
each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.



San Joaquin Region Likely Climate Effects



Dedicated and Developed Water Supply



San Joaquin Region Water Quality

Salt management is the most serious water quality concern in the San Joaquin River region. Since the 1940s, mean average salt concentrations in the lower San Joaquin River have doubled as a result of water diversions and farm runoff. Soils on the west side of the region are naturally high in selenium and salts, and when farmers drain the shallow groundwater from the root zone to protect crops, the drainage water can reach toxic levels.

Surface Water Quality

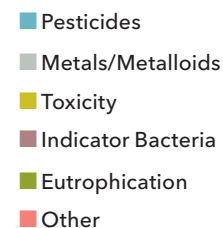


The San Joaquin River region falls within the jurisdiction of the Central Valley Regional Water Quality Control Board where there are 934

impairments. An impairment is a waterbody-pollutant combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. The most common contaminants in the region are pesticides, affecting 30 percent of the streams listed as impaired. Metals and metalloids including mercury are the second-most common reason for impairment, followed by toxicity.

Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

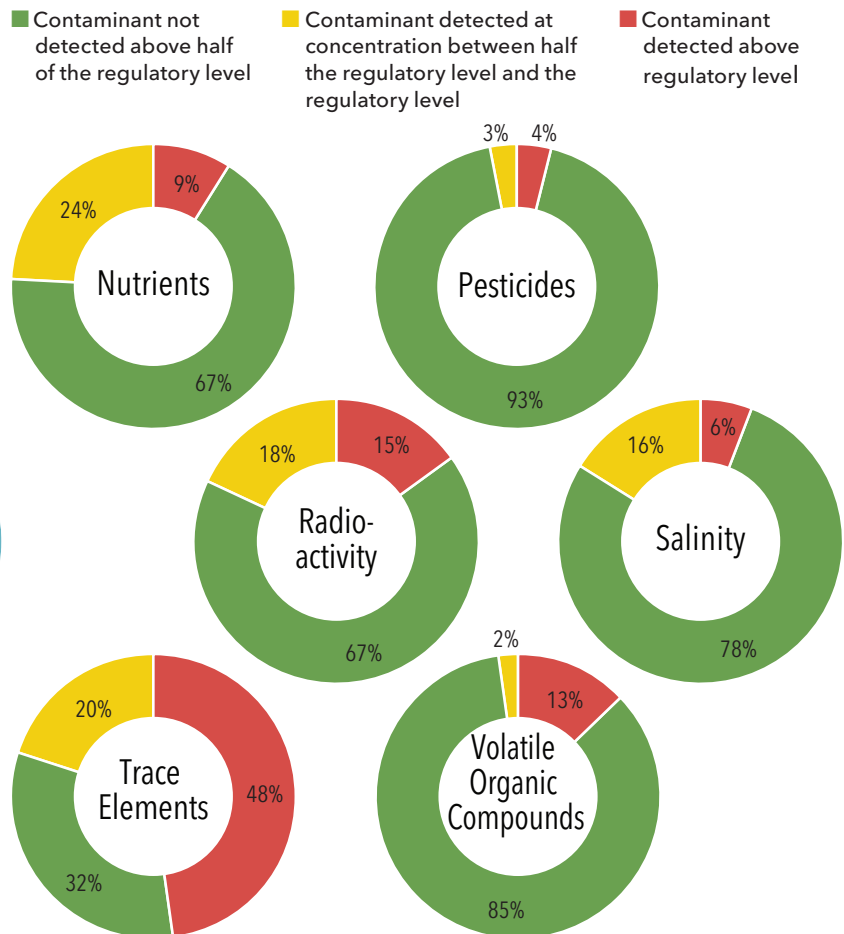


Groundwater Quality

Groundwater accounts for nearly 40 percent of the public water supply in the San Joaquin River region, with approximately 2,300 active public supply wells. The most common contaminants (prior to treatment) are naturally occurring manganese, iron, and nitrate. Samples also detect manmade chemicals common to pesticides, fertilizers, and soil fumigants including 1, 2, 3 TCP, nitrate, and DBCP. An estimated 74,000 domestic wells supply individual homes in the region and are not regulated by the state.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in San Joaquin region groundwater, by percentage of public water system wells sampled.

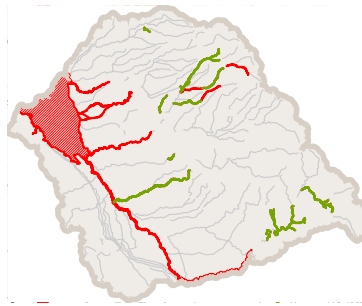


Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

San Joaquin Region Instream Flow* Requirements

On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. The list and map show where instream flows have been set.



- █ Instream flows established through water right or other legal proceedings not associated with hydropower facilities
- █ Instream flows associated with requirements for operating hydropower projects

*Does not include federal or state Wild and Scenic River protections.

Angels Creek	FERC License
Bear Creek	FERC License
Beaver Creek	FERC License
Big Creek	FERC License
Bolsillo Creek	FERC License
Camp 62 Creek	FERC License
Chinquapin Creek	FERC License
Highland Creek	FERC License
Kellogg Creek	Water Rights Decision
Merced River	FERC License
Middle Fork Stanislaus River	FERC License; Water Rights Order
Mill Creek	FERC License
Mokelumne River	Water Rights Decision; Water Rights Order
Mono Creek	FERC License
North Fork Stanislaus River	FERC License
North Fork Willow Creek	FERC License
Perry Creek	FERC License
Pitman Creek	FERC License
San Joaquin River	FERC License; Water Rights Decision
Silver Creek	FERC License
South Fork San Joaquin River	FERC License
South Fork Stanislaus River	Water Rights Order; FERC License
South Fork Willow Creek	FERC License
Stanislaus River	Biological Opinion
Stevenson Creek	FERC License
Summit Creek	Water Rights Order
Tuolumne River	FERC License
Willow Creek	FERC License

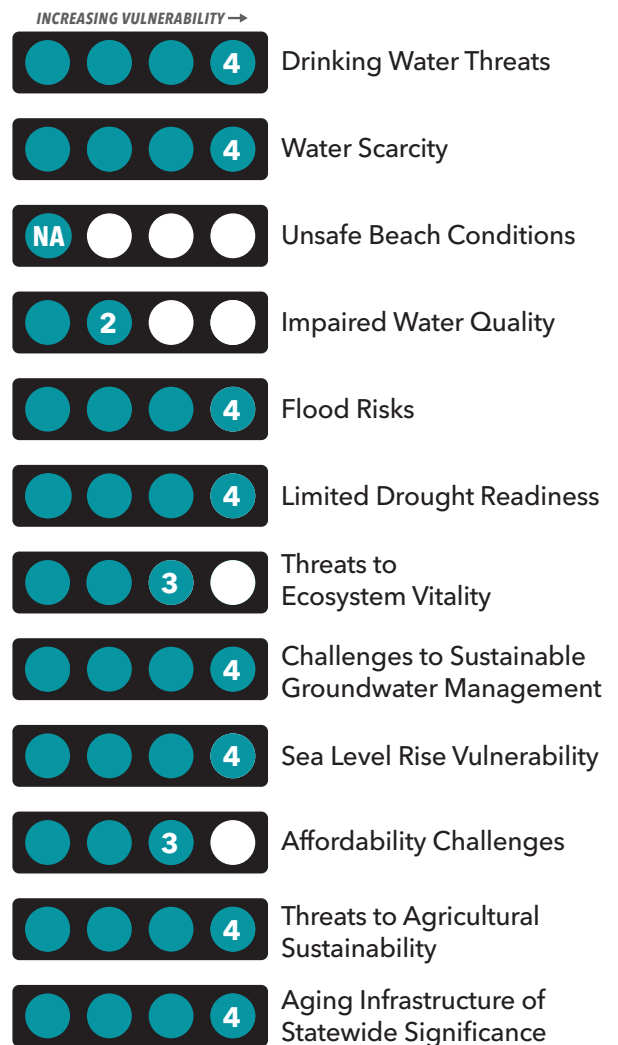
San Joaquin Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the San Joaquin region, the number of individual rights of each kind, and the total volume of water associated with those rights.

San Joaquin River	<i>total</i> 5,565
Appropriative	1,842
Federal Claims	137
Federal Stockponds	24
Registration Domestic	4
Registration Livestock	37
Statement of Diversion and Use	2,769
Stockpond	752
Associated volume of water (in acre-feet):	22,533,703

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

San Joaquin Region Vulnerability Indicators



For methodology and sources see page 108.

South Lahontan

The South Lahontan hydrologic region covers approximately 27,000 square miles in eastern California. It includes the lowest and highest points in the state (Mount Whitney and Death Valley) and in 2017 was home to an estimated 980,000 people. Annual rainfall averages 10 inches or less for most of the region. Groundwater accounts for roughly two-thirds of the agricultural and urban supply. The city of Los Angeles controls rights to much of the region's largest river, the Owens. Some water districts in the region import Northern California water from the State Water Project.



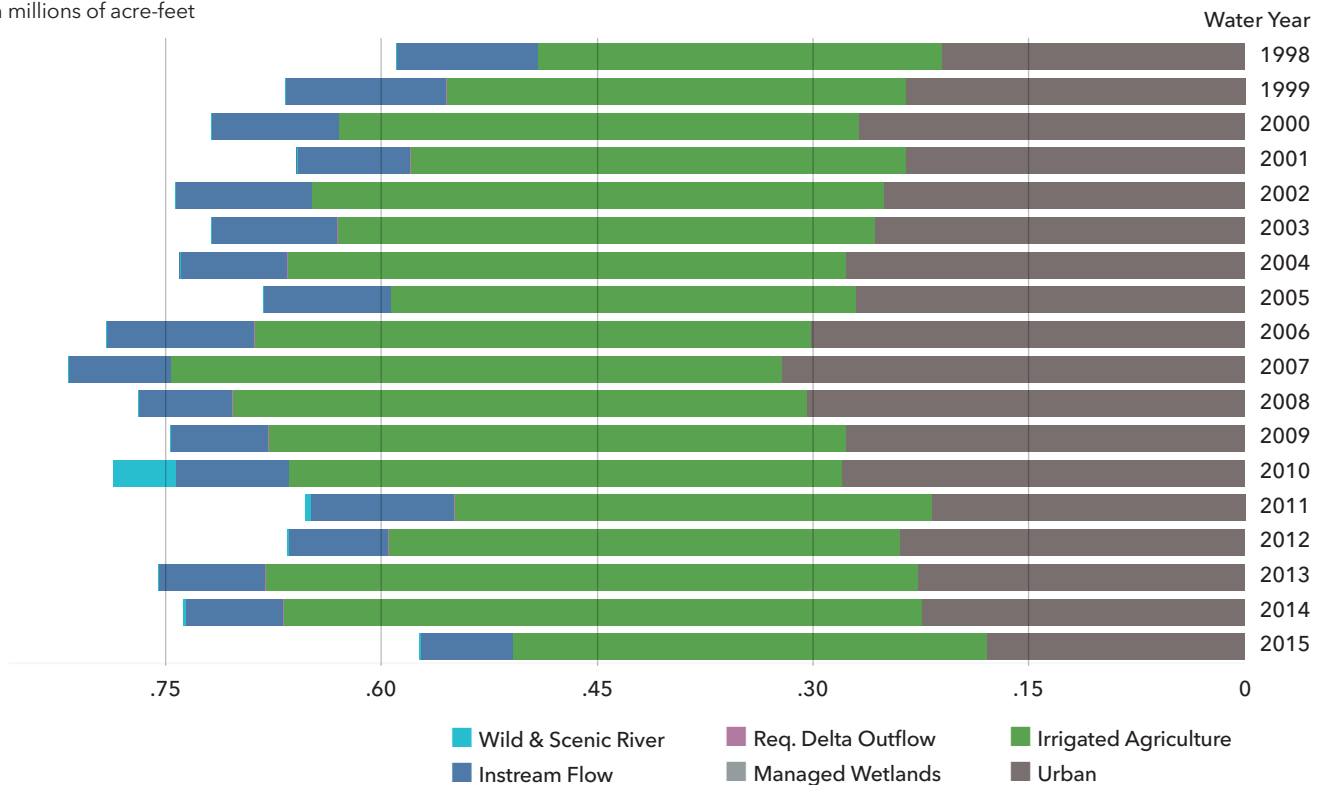
South Lahontan Region Water Demand and Supply

California's water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came

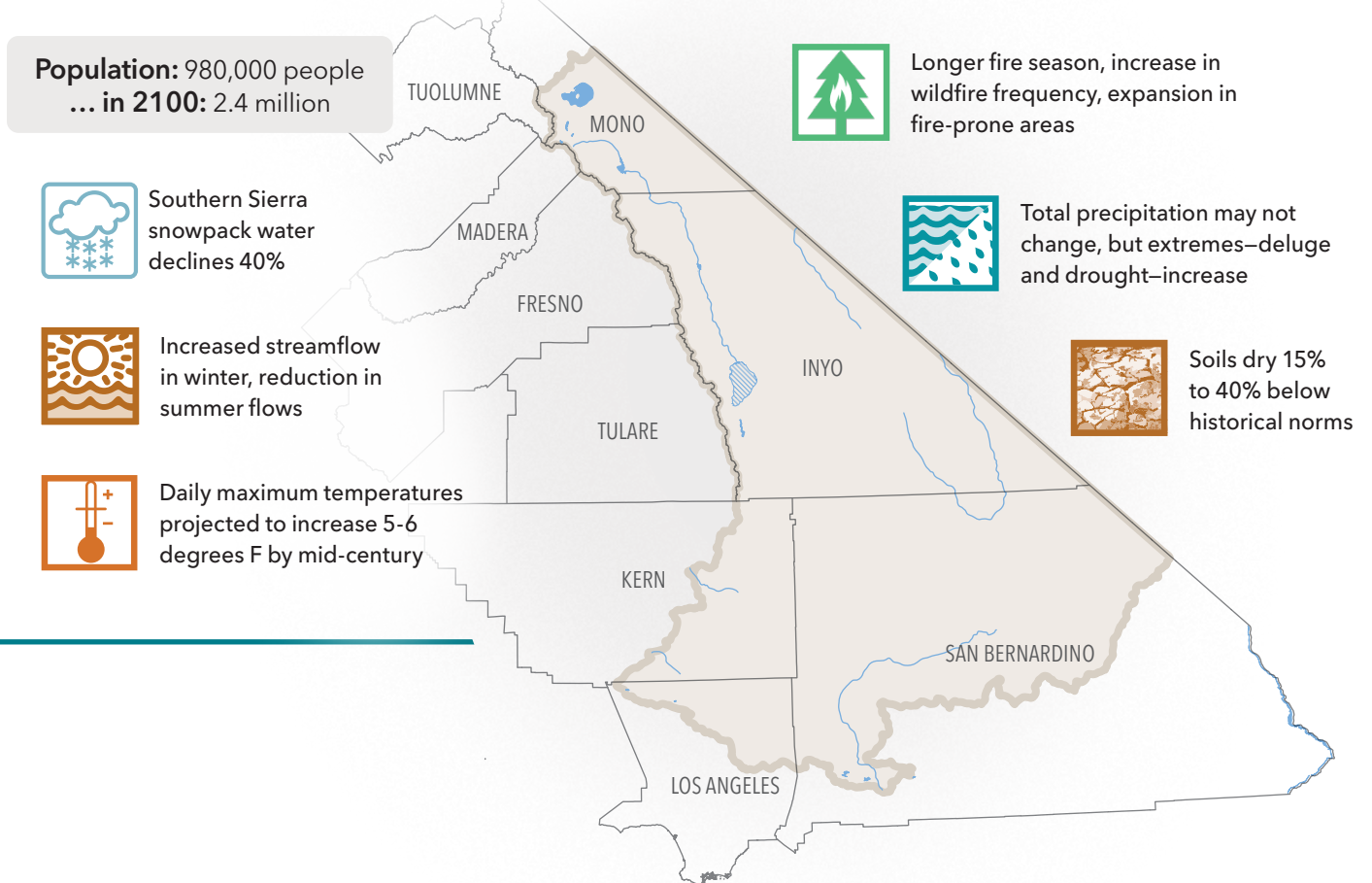
from each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.

...in millions of acre-feet

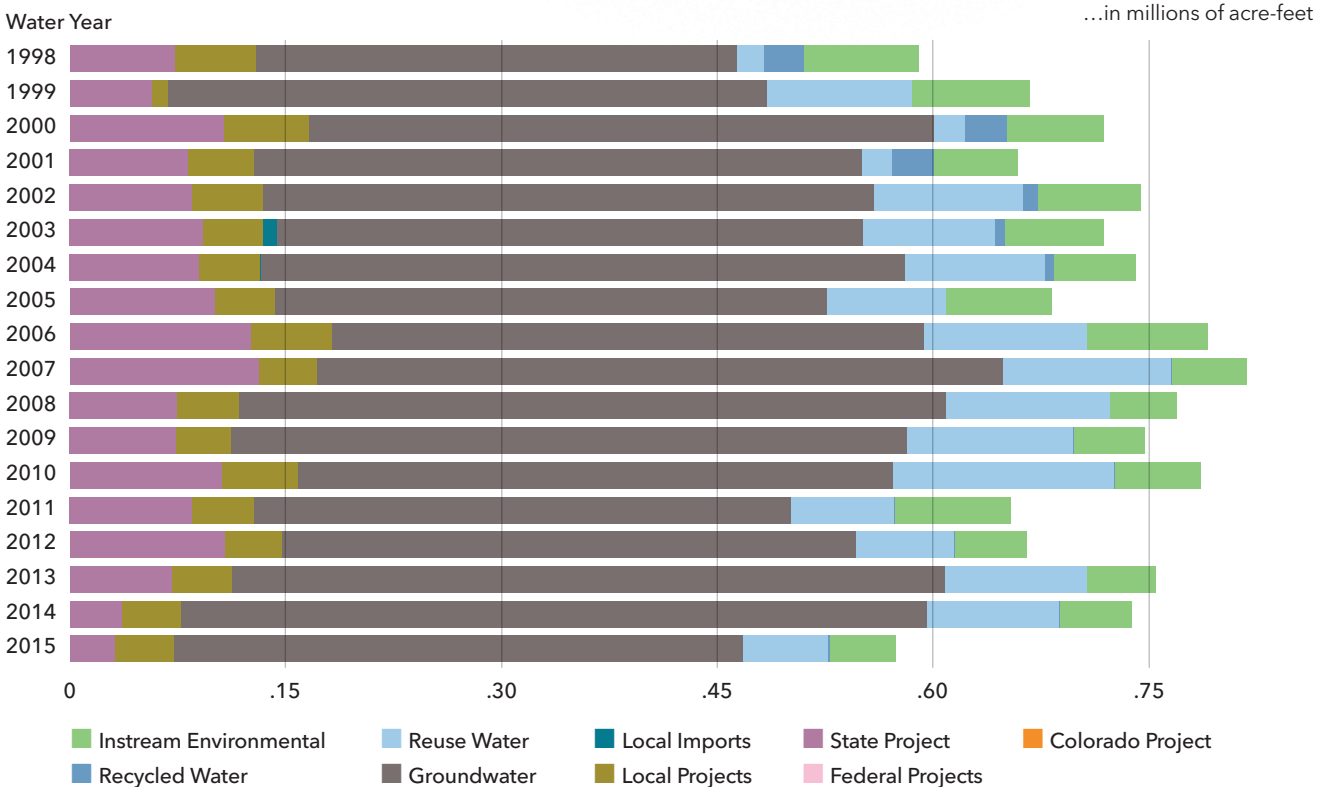
Applied Water Use



South Lahontan Region Likely Climate Effects



Dedicated and Developed Water Supply



South Lahontan Region Water Quality

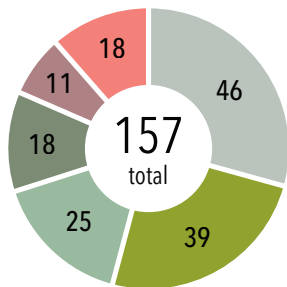
The mountain runoff that makes up most of the region's surface and groundwater is of excellent quality. There is some localized degradation of water by nitrates, total dissolved solids, and minerals from geothermal activity, farms, treated municipal sewage disposal, and industrial waste disposal.

Surface Water Quality



The South Lahontan region falls within the jurisdiction of the Lahontan Regional Water Quality Control Board. Within the board's area there

are 157 impairments. An impairment is a waterbody-pollutant combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. The largest number of impairments in the region are due to metals including mercury, followed by excess nutrients linked to a condition called eutrophication, which can harm animal life with low dissolved oxygen levels. Other common contaminants include salinity and sediment.



Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

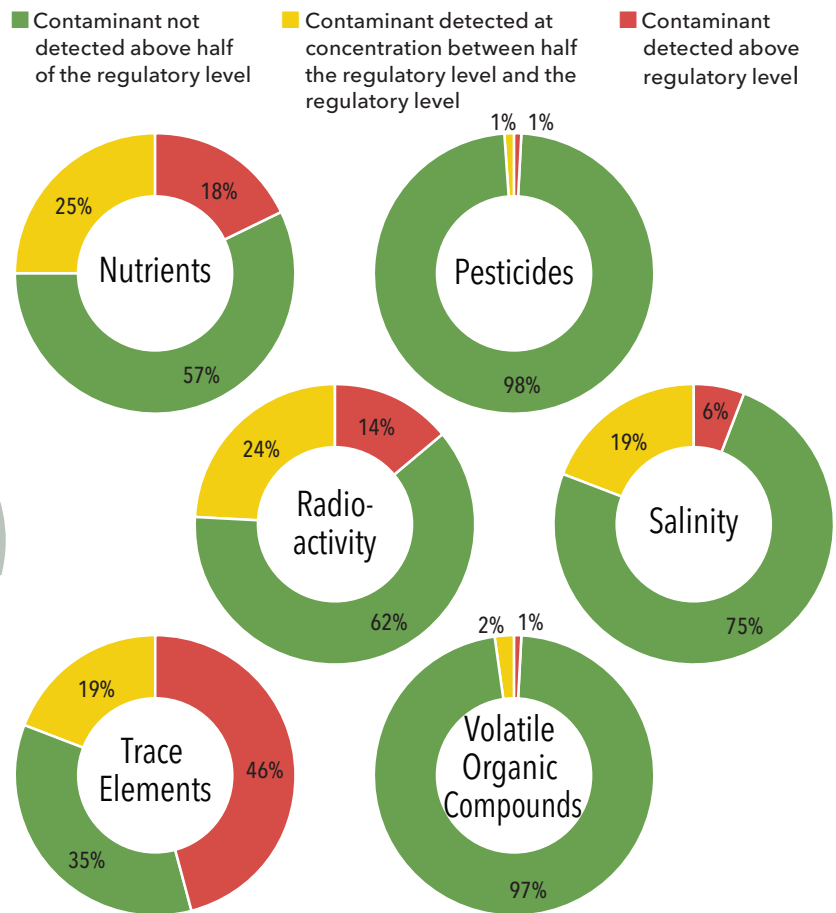
- Metals/Metalloids
- Eutrophication
- Salinity
- Sediment
- Indicator Bacteria
- Other

Groundwater Quality

Groundwater accounts for approximately 66 percent of the public water supply in the South Lahontan region. There are about 970 active public supply wells. The most common contaminants found prior to treatment in sampling of these wells are naturally occurring arsenic, iron, and radioactive constituents including gross alpha and uranium. The roughly 10,000 domestic wells that supply individual homes in the region are not regulated by the state.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in South Lahontan region groundwater, by percentage of public water system wells sampled.



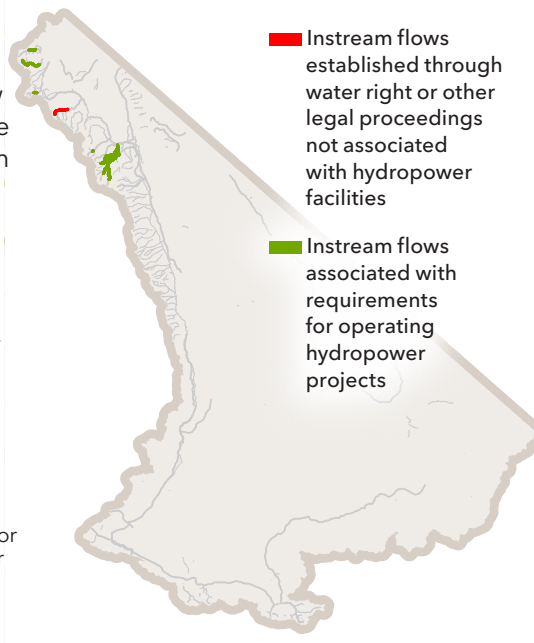
Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

South Lahontan Region Instream Flow* Requirements

On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. The list and map at right show where instream flows have been set.

*Does not include federal or state Wild and Scenic River protections.



Birch Creek	FERC License
Bishop Creek	FERC License
Lee Vining Creek	FERC License
Mammoth Creek	Water Rights Order
McGee Creek	FERC License
Middle Fork Bishop Creek	FERC License
Mill Creek	FERC License
Rush Creek	FERC License
South Fork Bishop Creek	FERC License

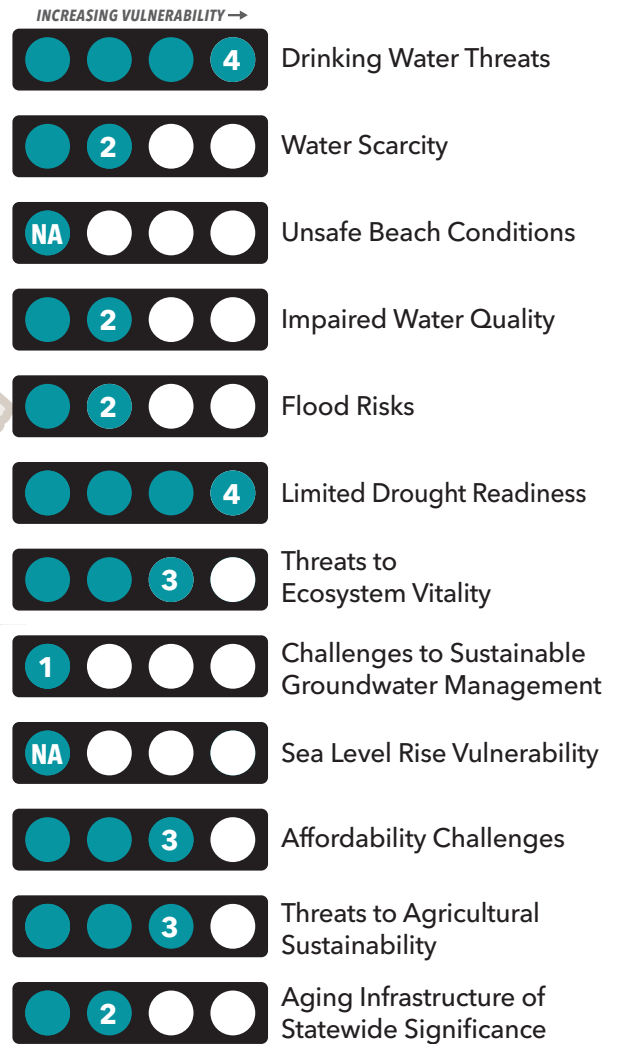
South Lahontan Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the South Lahontan region, the number of individual rights of each kind, and the total volume of water associated with those rights.

South Lahontan	total 1,362
Appropriative	424
Federal Claims	48
Groundwater Recordation	384
Statement of Diversion and Use	503
Stockpond	3
Associated volume of water (in acre-feet):	1,466,980

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

South Lahontan Region Vulnerability Indicators

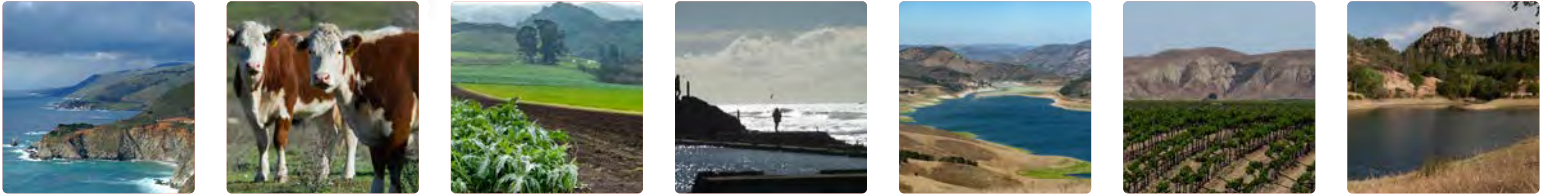


For methodology and sources see page 108.

Central Coast



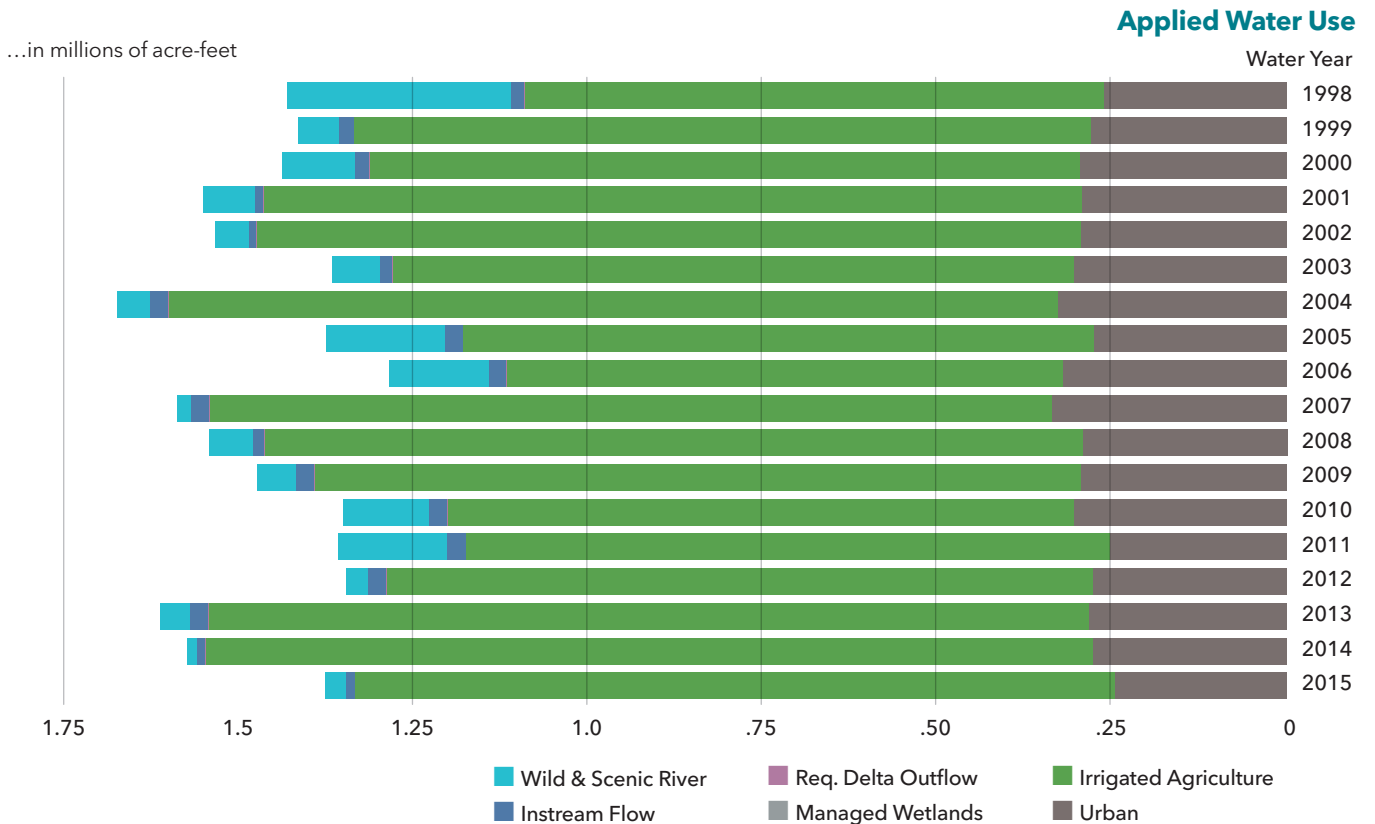
The Central Coast hydrologic region covers approximately 11,300 square miles in central California. The average annual precipitation is 18.7 inches. An estimated 1.6 million people lived in the region in 2017. Average annual precipitation ranges from 11 inches to 36 inches. Groundwater accounts for more than three-quarters of the supply, making the Central Coast the state's most groundwater-dependent region. The frost-free coastal valleys grow crops including strawberries and artichokes. Citrus and avocados are grown in the southern part of the region near Santa Barbara.



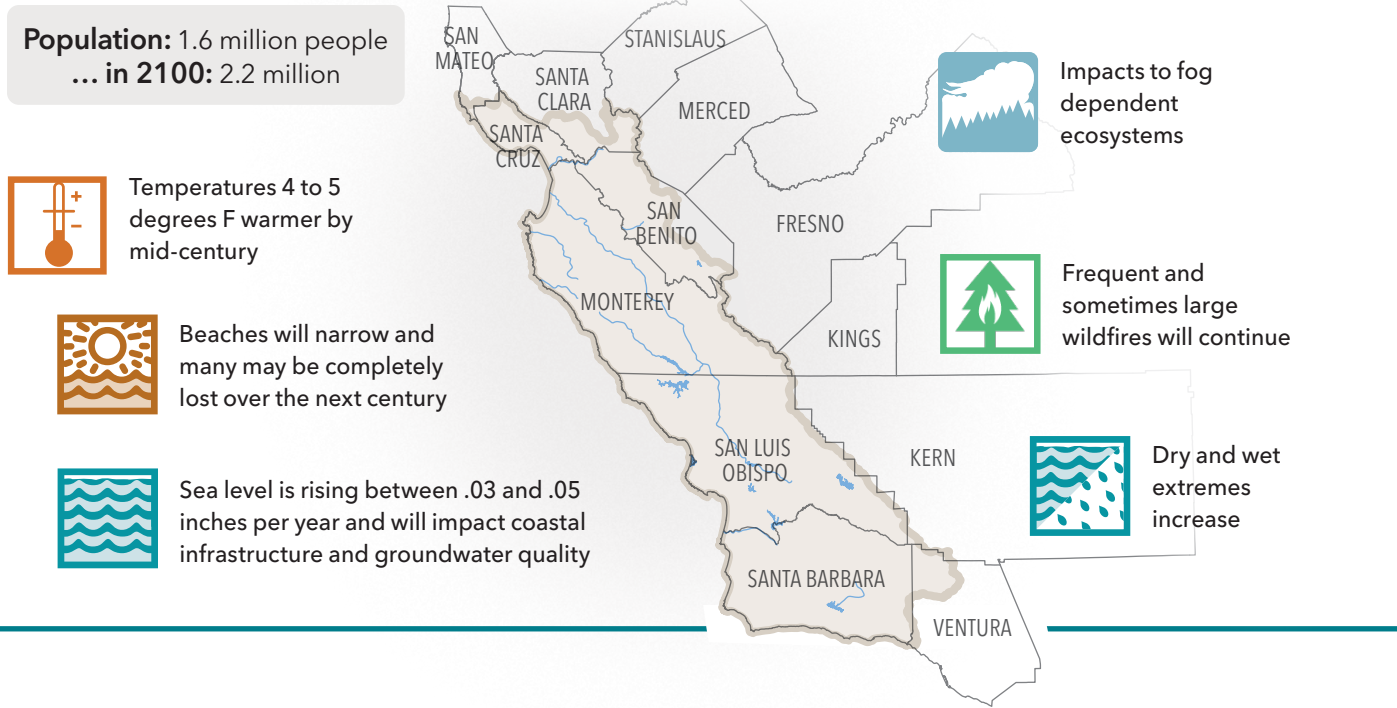
Central Coast Region Water Demand and Supply

California's water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came from

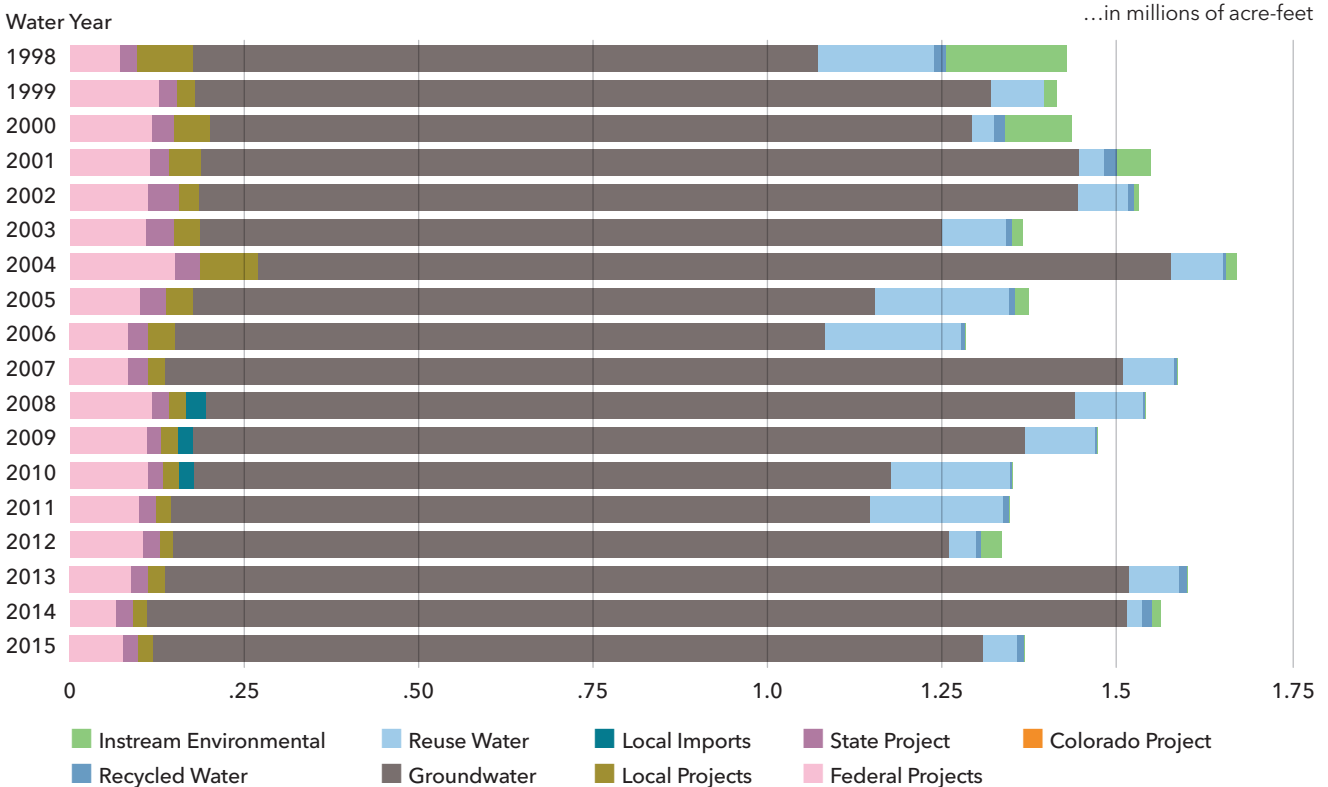
each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.



Central Coast Region Likely Climate Effects



Dedicated and Developed Water Supply



Central Coast Region Water Quality

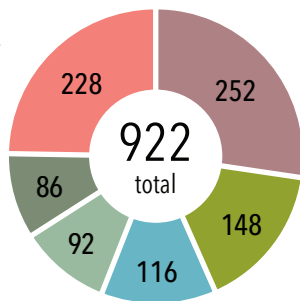
The Central Coast region suffers from both groundwater and surface water contamination, including nitrates, pesticides, and sediment that exceeds toxic thresholds. Major sources include dairies, farms, sewage treatment plants, and septic systems. Many coastal groundwater basins are threatened by seawater intrusion.

Surface Water Quality



The Central Coast region falls within the jurisdiction of the Central Coast Regional Water Quality Control Board. Within the board's area there

are 922 impairments. An impairment is a waterbody-pollutant combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. The largest number of such water body impairments are tied to the types of bacteria used to detect and estimate the level of fecal contamination of water. Excess nutrients and low dissolved oxygen also occur frequently. Pesticides, salinity, and sediment are other concerns.



Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

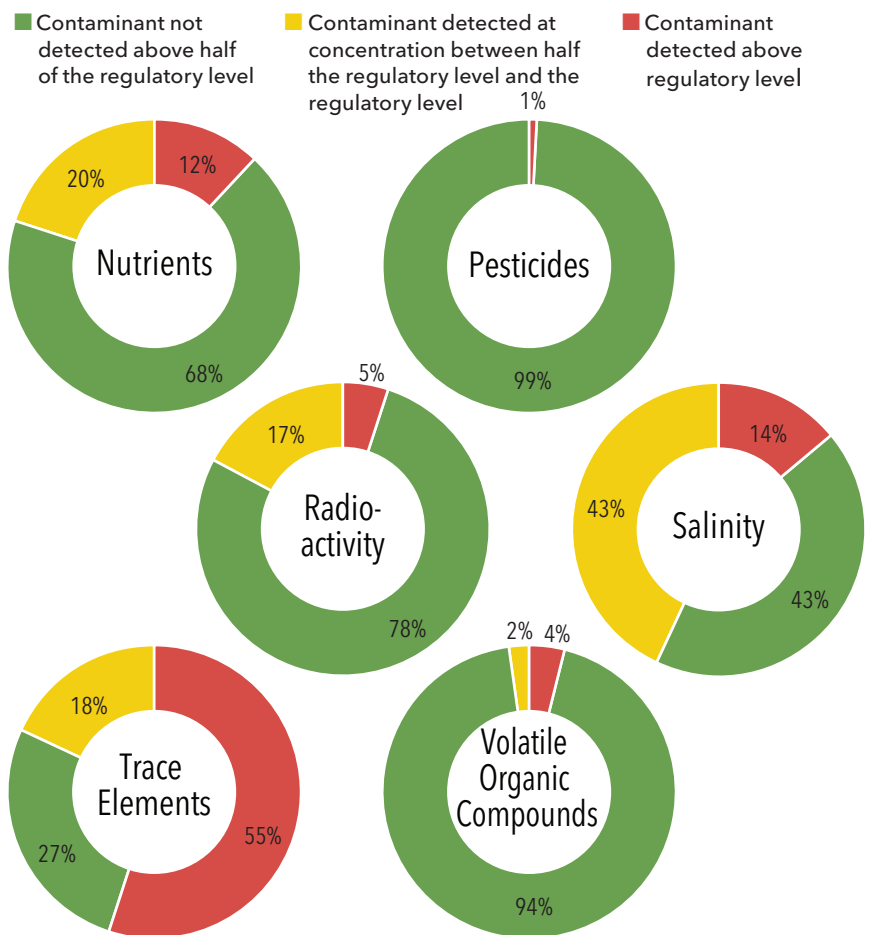
- Indicator Bacteria
- Eutrophication
- Pesticides
- Salinity
- Sediment
- Other

Groundwater Quality

Groundwater accounts for approximately 86 percent of the public water supply in the Central Coast region. There are about 1,500 active public supply wells. Naturally occurring iron, manganese, arsenic, and other metals are the most common groundwater contaminants (before treatment), followed by nitrate. The approximately 18,000 domestic wells supplying individual homes in the region are not regulated by the state.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in Central Coast region groundwater, by percentage of public water system wells sampled.

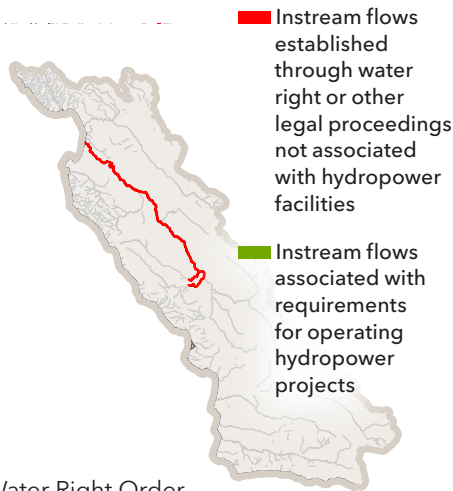


Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

Central Coast Region Instream Flow* Requirements

On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. The list and map show where instream flows have been set.



Salinas River..... Water Right Order

*Does not include federal or state Wild and Scenic River protections.

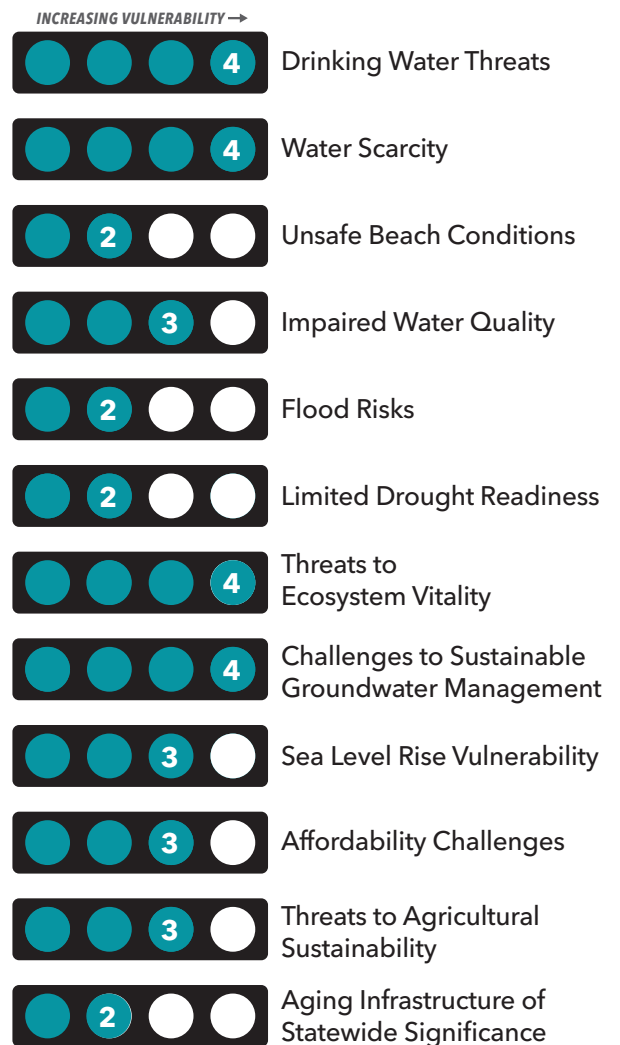
Central Coast Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the Central Coast region, the number of individual rights of each kind, and the total volume of water associated with those rights.

Central Coast	total 2,517
Appropriative	752
Groundwater Recordation	9
Registration Cannabis	1
Registration Domestic	10
Registration Livestock	20
Statement of Diversion and Use	1,103
Stockpond	622
Associated volume of water (in acre-feet):	375,998

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

Central Coast Region Vulnerability Indicators



For methodology and sources see page 108.

Tulare Lake



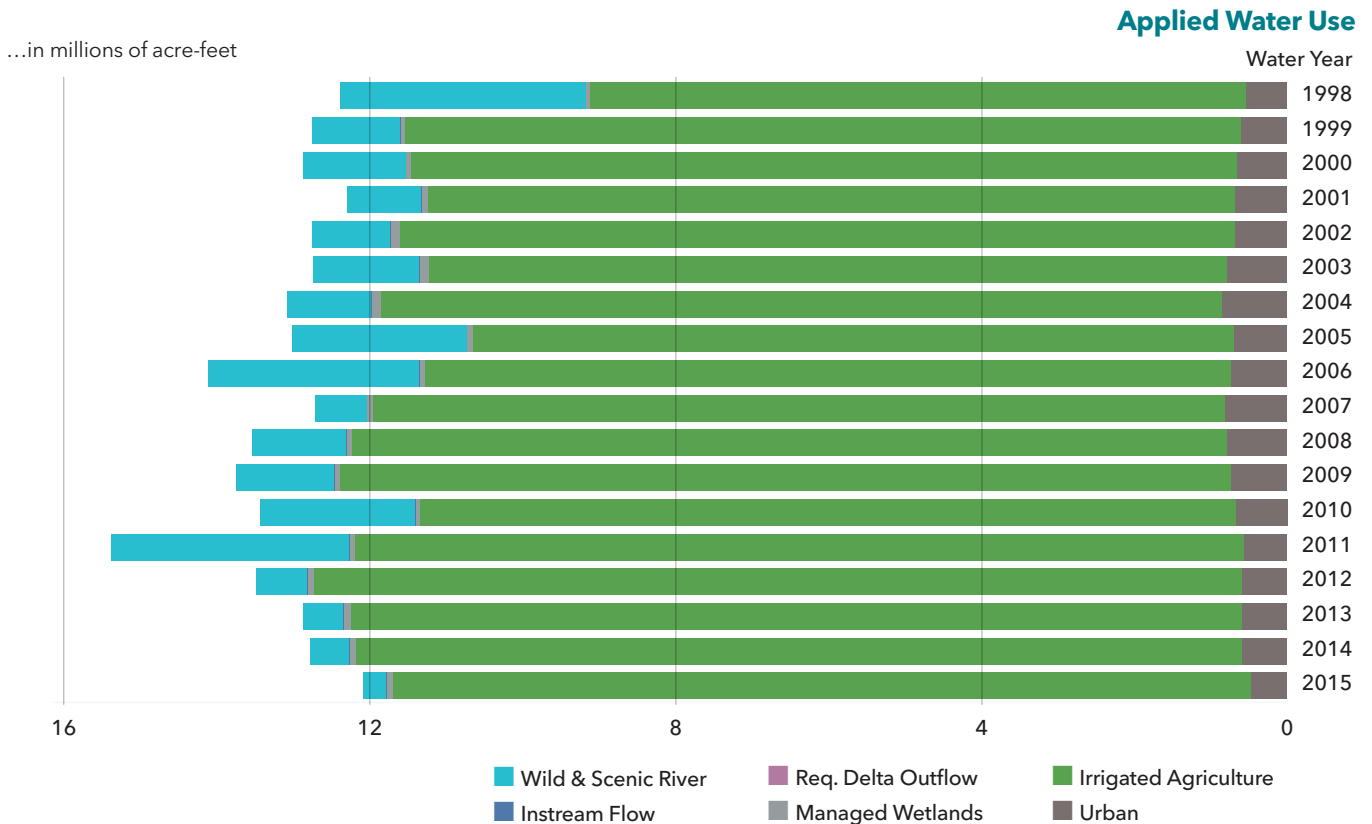
The Tulare Lake hydrologic region encompasses roughly 17,000 square miles in the southern San Joaquin Valley that once contained a vast freshwater lake. The dramatically altered landscape now includes three million irrigated acres. Top crops are almonds and pistachios. Average annual rainfall on the valley floor ranges from about six to 11 inches. An estimated 2.4 million people lived in the region in 2017, with most residents in Fresno, Bakersfield, and Visalia. In normal years, surface water (primarily river water delivered through projects) supplies 70 percent of the demand by farms for water in the region. In dry years, farmers turn to groundwater for as much as 70 percent of supplies.



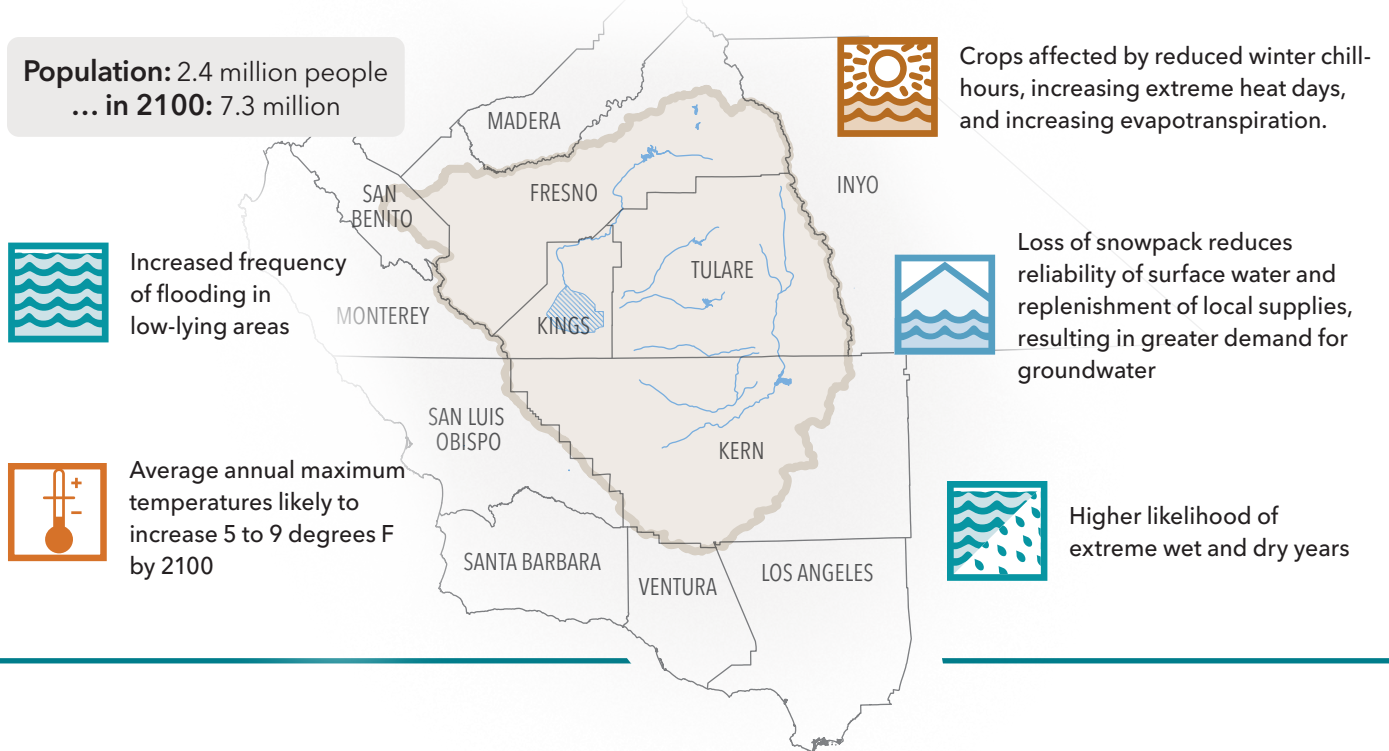
Tulare Lake Region Water Demand and Supply

California’s water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came

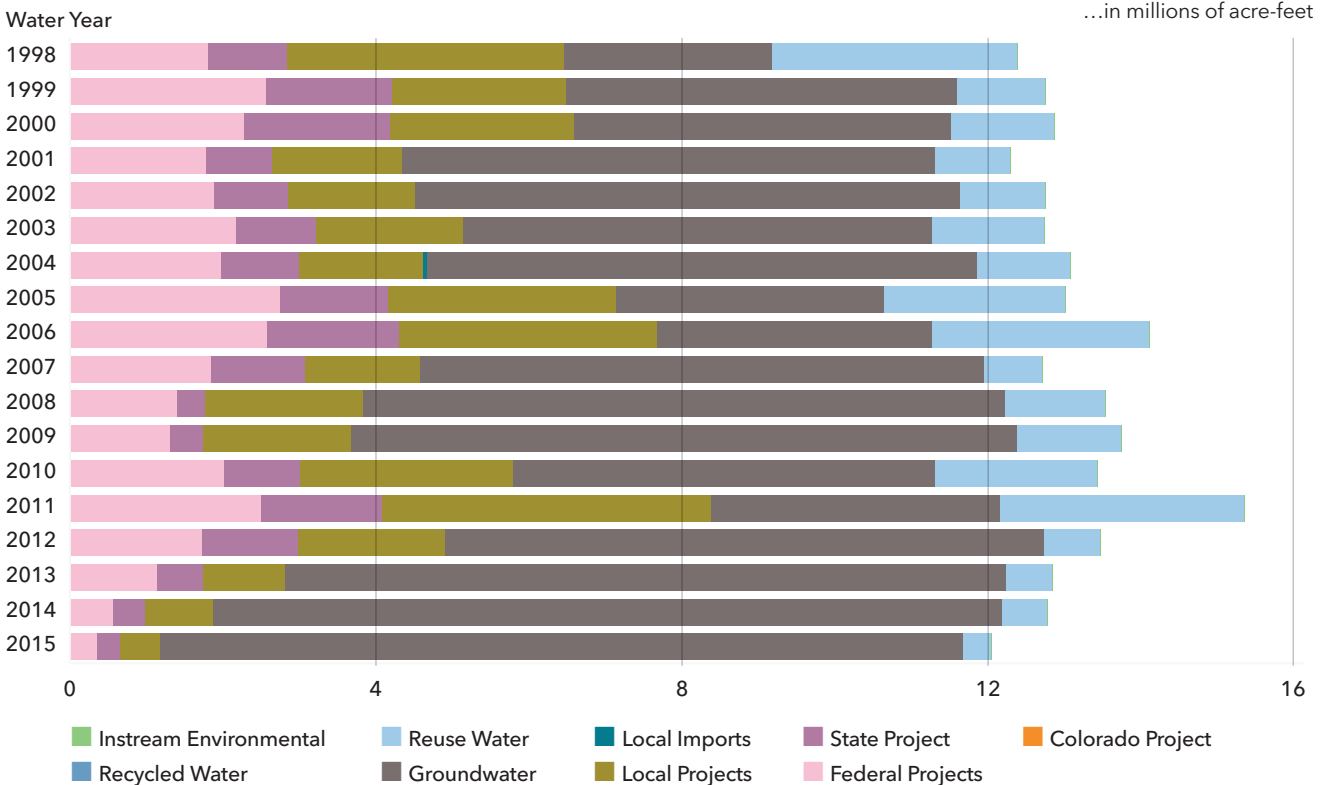
from each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.



Tulare Lake Region Likely Climate Effects



Dedicated and Developed Water Supply



Tulare Lake Region Water Quality

The biggest water quality problem in the Tulare Lake region is accumulation of salts, including nitrates. The problem is compounded by overdraft of groundwater and importation of water from outside the basin, which concentrates salts within the remaining groundwater. Thousands of acres in the basin can no longer be farmed due to high salinity in the soils.

Surface Water Quality

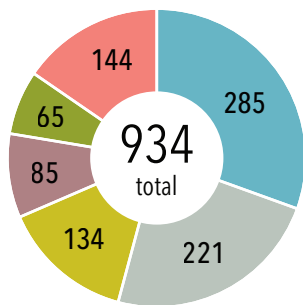


The Tulare Lake region falls within the jurisdiction of the Central Valley Regional Water Quality Control Board. Within the board's area there

are 934 impairments. An impairment is a waterbody-pollutant combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. The most common contaminants are pesticides, affecting 30 percent of the streams listed as impaired. Metals and metalloids including mercury are the second-most common reason for impairment, followed by toxicity (defined as the effects of pollutants and pollutant combinations on aquatic biota).

Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:



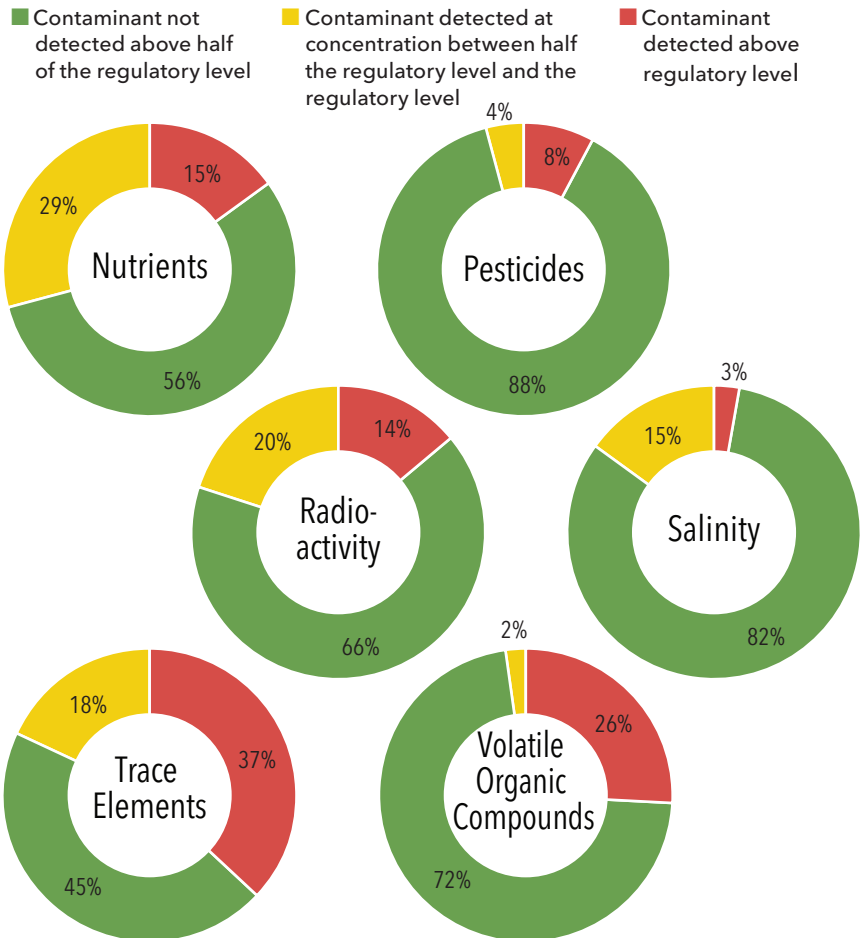
- Pesticides
- Metals/Metalloids
- Toxicity
- Indicator Bacteria
- Eutrophication
- Other

Groundwater Quality

Groundwater accounts for approximately 53 percent of the public water supply in the Tulare region, the third highest such dependence in the state. There are about 2,300 active public supply wells. Unlike the rest of California, where most common groundwater contaminants occur naturally, the most common contaminants of Tulare Lake region groundwater are derived from human activities. These include the industrial solvent and pesticide ingredient 1,2,3 TCP and nitrates, which generally come from fertilizers, manure, and septic systems.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in Tulare Lake region groundwater, by percentage of public water system wells sampled.



Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

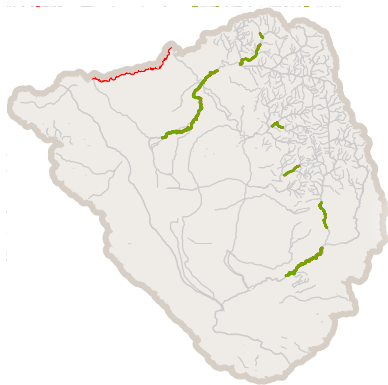
Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

Tulare Lake Region Instream Flow* Requirements

On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. Often, such "instream flows" are required by the Federal Energy Regulatory Commission (FERC) as part of a license to operate a hydroelectric dam and powerhouse. The list and map below show where instream flows have been set.

East Fork Kaweah River	FERC License
Helms Creek	FERC License
Kaweah River	FERC License
Kern River.....	FERC License
Kings River	FERC License
Middle Fork Tule River.....	FERC License
North Fork Kings River	FERC License

North Fork Middle Fork Tule River FERC License*Does not include federal or state Wild and Scenic River protections.



- Instream flows established through water right or other legal proceedings not associated with hydropower facilities
- Instream flows associated with requirements for operating hydropower projects

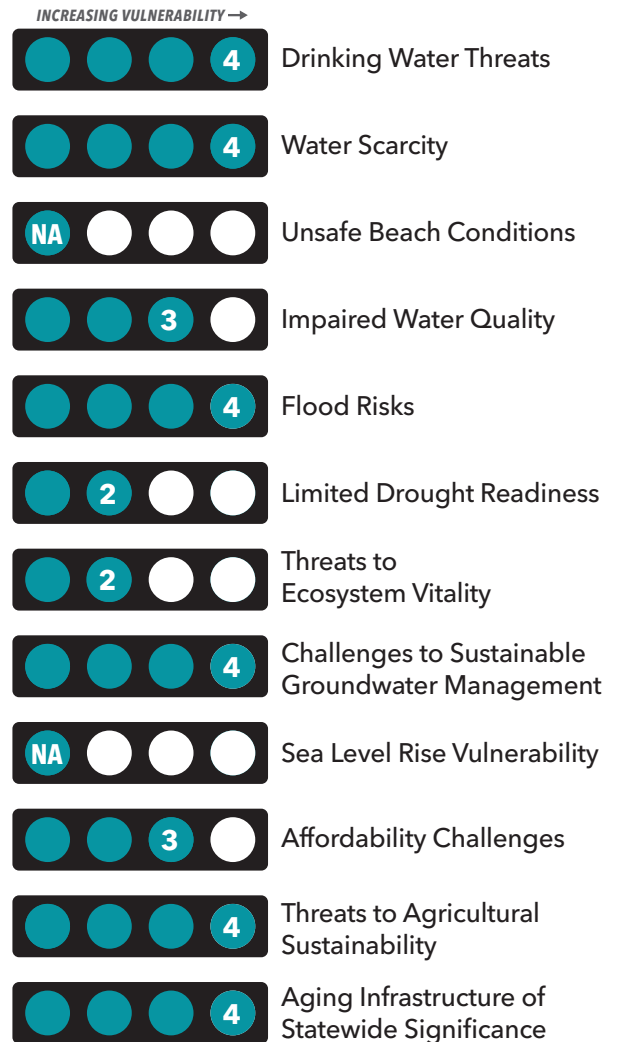
Tulare Lake Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the Tulare Lake region, the number of individual rights of each kind, and the total volume of water associated with those rights.

Tulare Lake Region	<i>total</i> 2,132
Appropriative	325
Federal Claims	184
Federal Stockponds	26
Statement of Diversion and Use	1,393
Stockpond	204
Associated volume of water (in acre-feet):	3,161,803

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

Tulare Lake Region Vulnerability Indicators



For methodology and sources see page 108.

South Coast



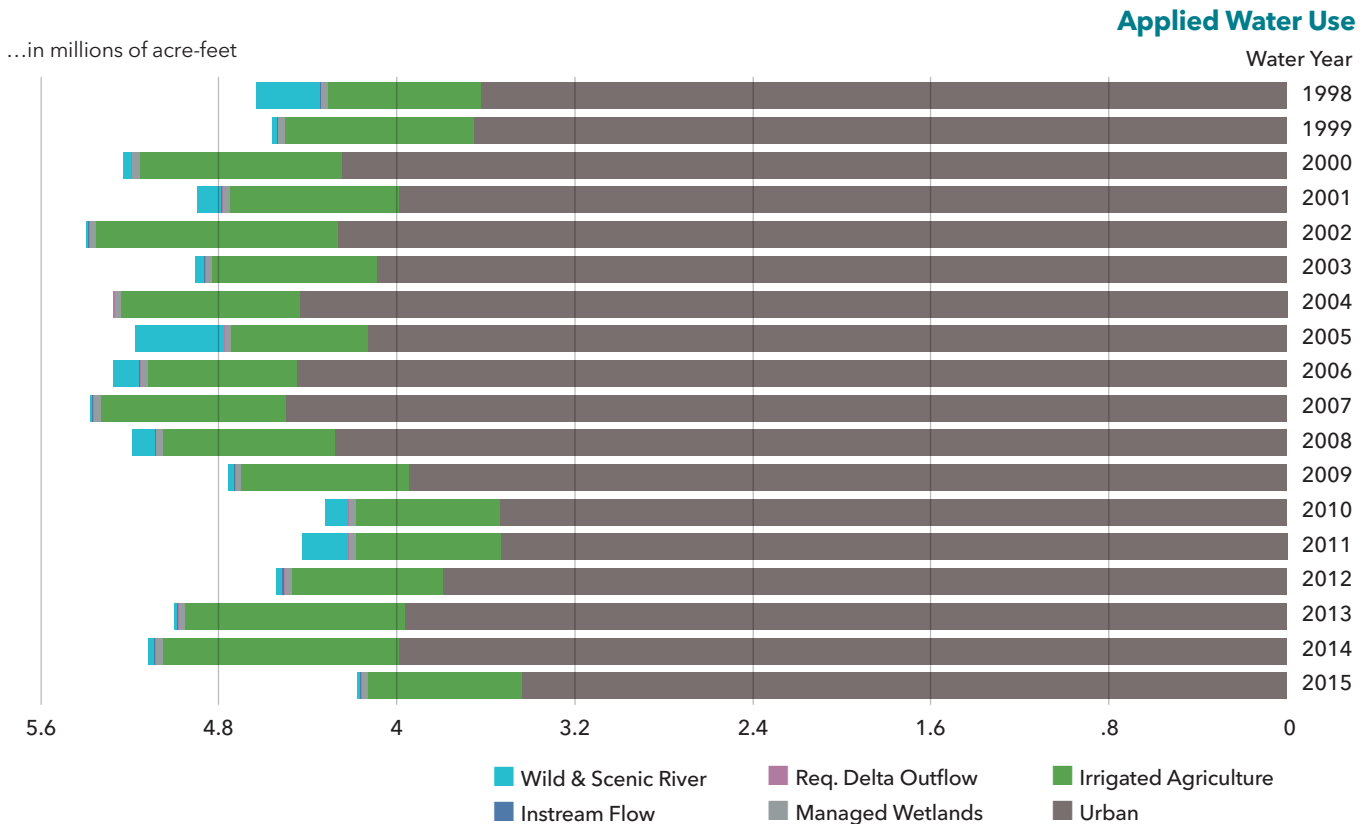
The South Coast hydrologic region covers 11,000 square miles, just seven percent of the state’s total area, but in 2017 was home to more than half the state’s population, 20.7 million people. The region extends from the Pacific Ocean to Riverside County and from Ventura south to San Diego. Major crops include citrus, avocado, and nursery production. Water supplies are diverse, ranging from local rivers and the Sacramento, San Joaquin, Colorado, and Owens rivers to transfers, recycling, and desalination. Groundwater comprises on average 34 percent of the water used in the region.



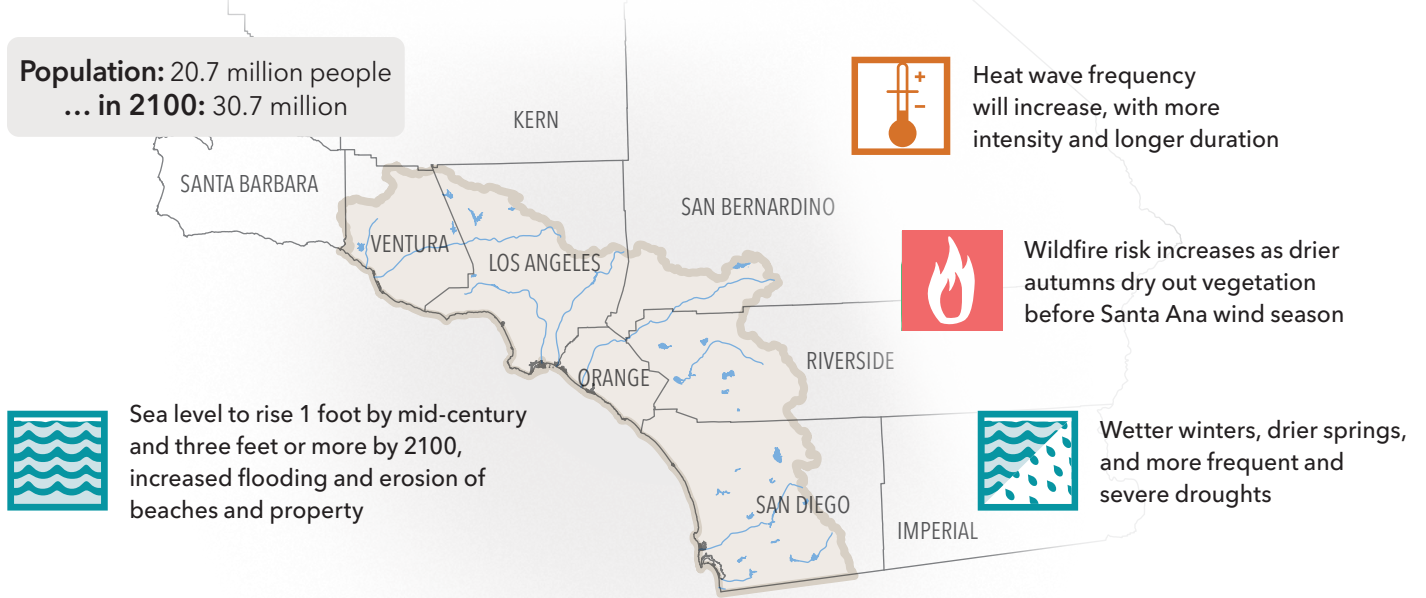
South Coast Region Water Demand and Supply

California’s water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came from

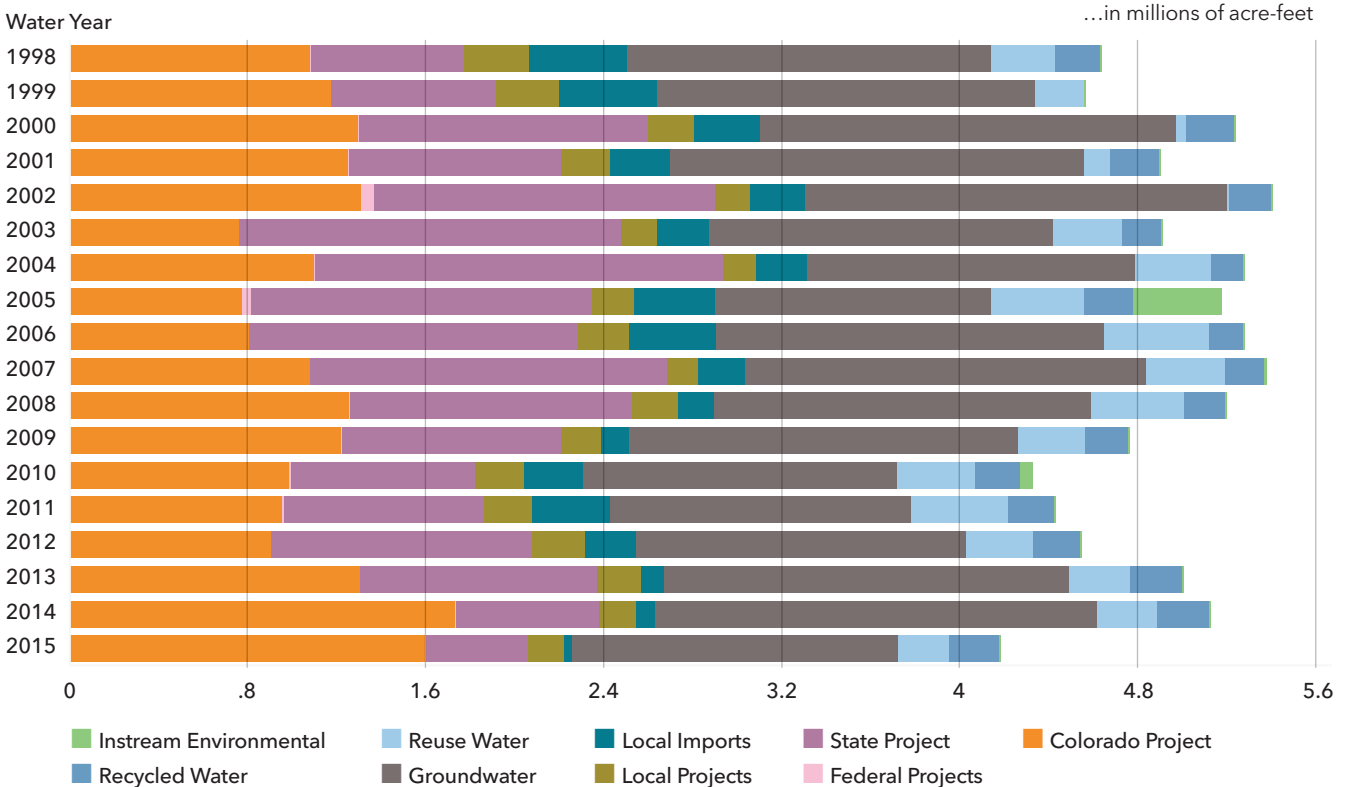
each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.



South Coast Region Likely Climate Effects



Dedicated and Developed Water Supply



South Coast Region Water Quality

Pollution from urban runoff, wastewater and industrial discharges, farm chemicals, livestock operations, and seawater intrusion compromise water quality in the South Coast region. Groundwater has been degraded by fertilizers, pesticides, failing septic systems, and perchlorate, chromium-6, volatile organic compounds, and other chemicals from industrial activity.

Surface Water Quality

Within the Los Angeles Regional Water Quality Control Board area, there are 880 impairments. The South Coast region falls within the jurisdiction of three separate regional water quality control boards.

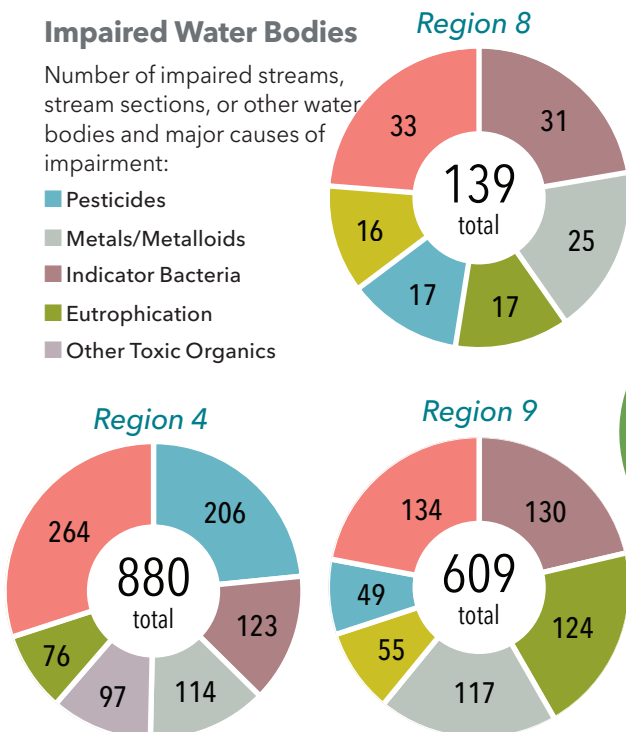


- There are within the Los Angeles Regional Water Quality Control Board area, 880 impairments. An impairment is a waterbody-pollutant combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. Legacy pesticides, including DDT, are a common contaminant, as are bacteria and metals that include copper, lead, and mercury.
- Within the areas covered by the Santa Ana and San Diego regional water quality control boards, there are 748 impairments. The most frequent reasons for impairment are contamination by bacteria, metals, and excessive nutrients and dissolved oxygen.

Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

- Pesticides
- Metals/Metalloids
- Indicator Bacteria
- Eutrophication
- Other Toxic Organics



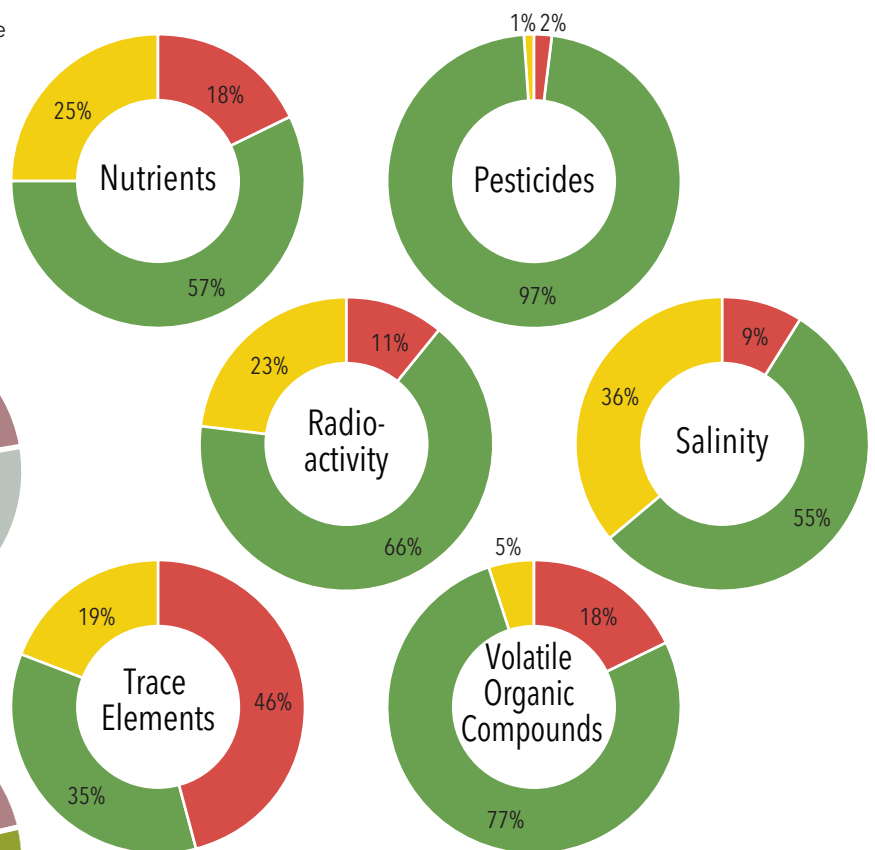
Groundwater Quality

Groundwater accounts for about a third of the public water supply in the South Coast region, with approximately 2,600 active public supply wells. Compared to other parts of California, the region has the highest frequency of detection of manmade chemicals among the groundwater wells sampled. The most common contaminants (prior to treatment) are manganese, iron, and nitrate. An estimated 25,000 to 26,000 domestic wells supply individual homes in the region and are not regulated by the state.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in South Coast region groundwater, by percentage of public water system wells sampled.

- Contaminant not detected above half of the regulatory level
- Contaminant detected at concentration between half the regulatory level and the regulatory level
- Contaminant detected above regulatory level



Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

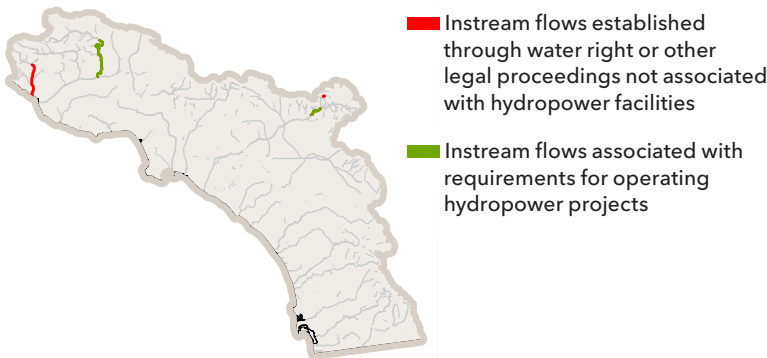
Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

South Coast Region Instream Flow* Requirements

On some streams in California, regulators have set rules for how much water should be left in a natural stream channel to support aquatic and riparian wildlife and habitat. The amounts vary according to season and different species' needs. Often, such "instream flows" are required by the Federal Energy Regulatory Commission (FERC) as part of a license to operate a hydroelectric dam and powerhouse. The list and map below show where instream flows have been set.

Bear Creek	Water Rights Order
Piru Creek	FERC License
Santa Ana River	FERC License
Ventura River	Biological Opinion

*Does not include federal or state Wild and Scenic River protections.



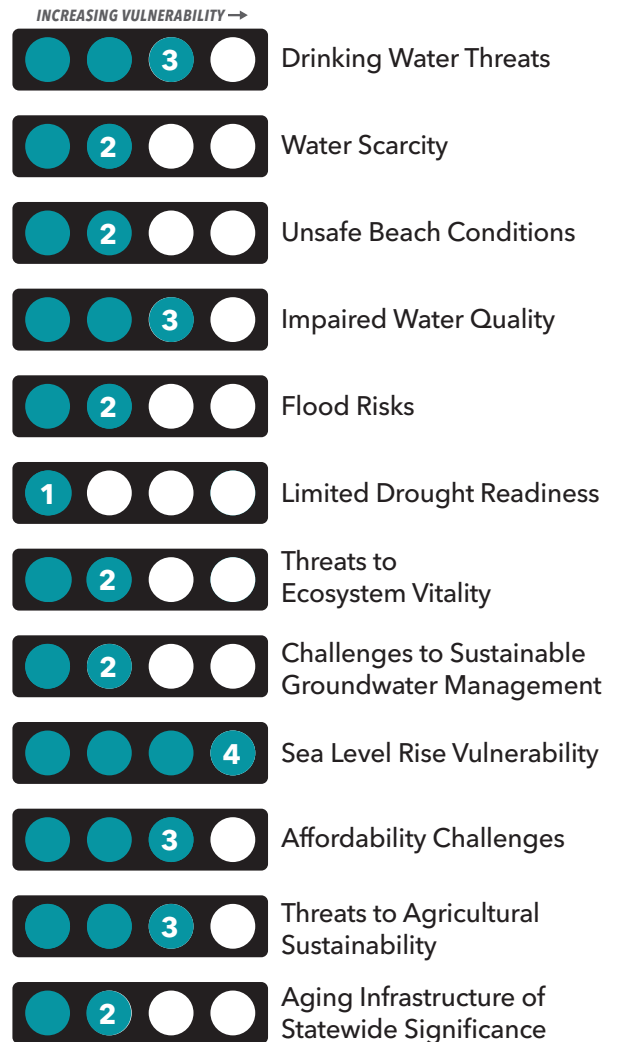
South Coast Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the South Coast region, the number of individual rights of each kind, and the total volume of water associated with those rights.

South Coast	total 1,291
Appropriative	484
Federal Claims	68
Federal Stockponds	2
Groundwater Recordation	369
Registration Domestic	1
Statement of Diversion and Use	309
Stockpond	58
Associated volume of water (in acre-feet):	282,458

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

South Coast Region Vulnerability Indicators



For methodology and sources see page 108.

Colorado River



The Colorado River hydrologic region covers approximately 20,000 square miles in southeastern California. The average annual precipitation is about six inches, making it the most arid region of California. An estimated 800,000 people lived in the region in 2017. It is known for year-round agricultural production, with alfalfa the leading crop. The largest body of water in the region is the Salton Sea, a hyper-saline inland lake fed largely by agricultural runoff. About 75 percent of the region’s urban and agricultural water supply comes from the Colorado River. Groundwater provides about eight percent of the supply in normal years.



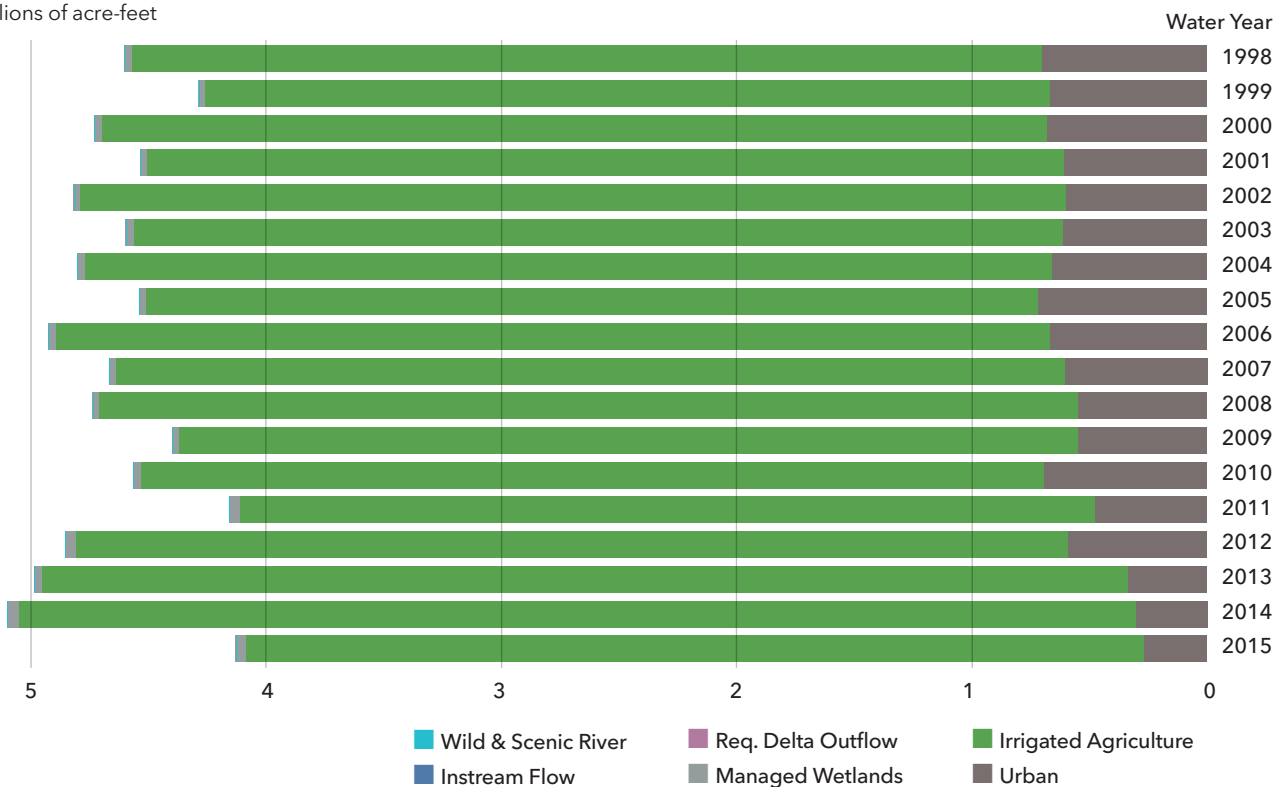
Colorado River Region Water Demand and Supply

California’s water resources vary significantly from year to year. Eighteen recent years show this variability. **The Applied Water Use** chart below shows how water is applied to urban and agricultural sectors and dedicated to the environment. The **Dedicated and Developed Water Supply** chart shows where the water came from

each year to meet those uses. The chart does not include the approximately 125 million acre-feet in an average year that either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of the state to salt sinks like saline aquifers.

...in millions of acre-feet

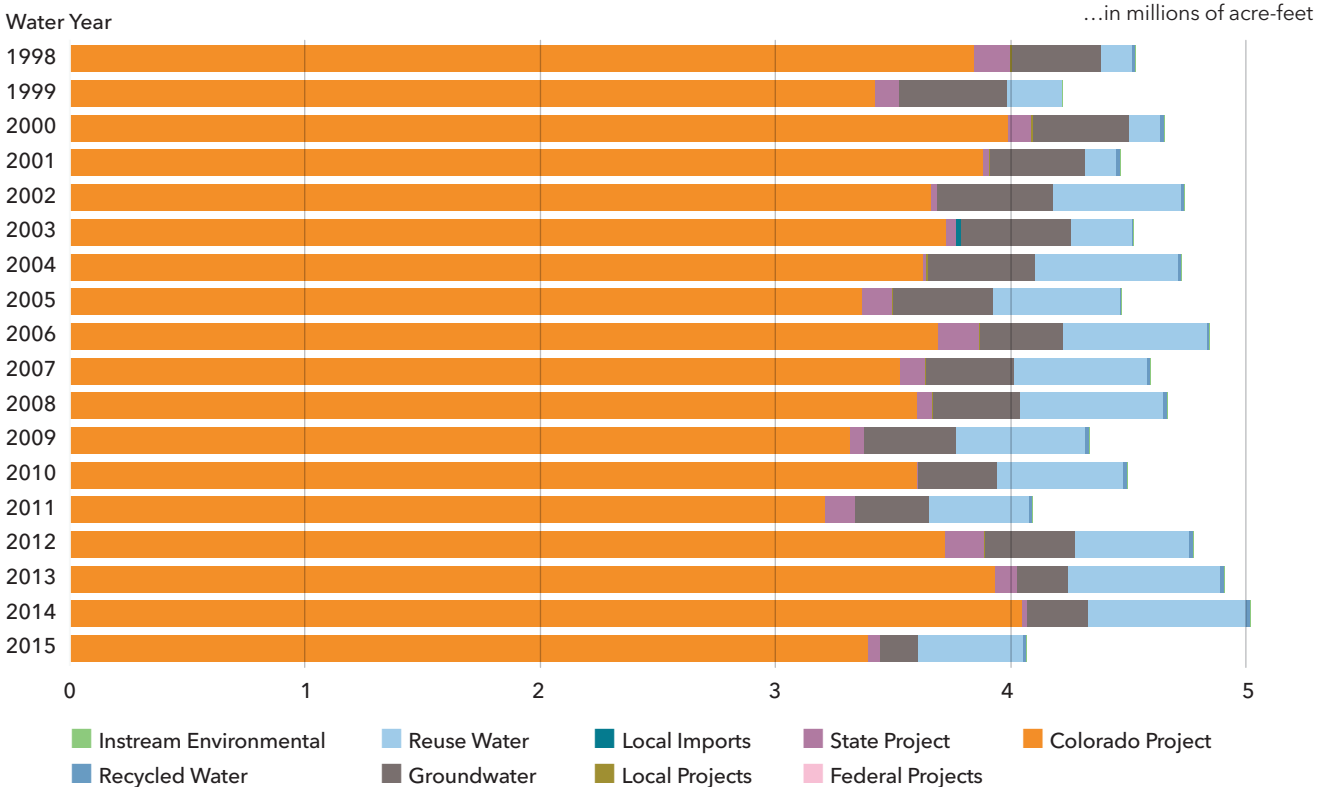
Applied Water Use



Colorado River Region Likely Climate Effects



Dedicated and Developed Water Supply



Colorado River Region Water Quality

Water quality concerns exist in all 28 of the Colorado River region's watersheds. The New River is severely polluted by waste discharges in Mexico and contributes to water quality problems at the Salton Sea. Other sources of contamination include leaking underground storage tanks and animal feed and dairy operations.

Surface Water Quality



The Colorado River regional falls within the jurisdiction of the Colorado River Basin Regional Water Quality Control Board. Within the regional board's area

there are 68 impairments. An impairment is a waterbody-pollutant combination where pollutant levels have been found to exceed water quality standards. A waterbody is a stream, section of stream, lake, coastal beach or other waterway and can range in size from an entire watershed to a small reach of river. There may be more than one impairment per water body. Pesticides account for the largest number of such listings in the region. Bacteria that indicate fecal contamination, toxic organic compounds such as PCBs, and metals are also concerns.

Impaired Water Bodies

Number of impaired streams, stream sections, or other water bodies and major causes of impairment:

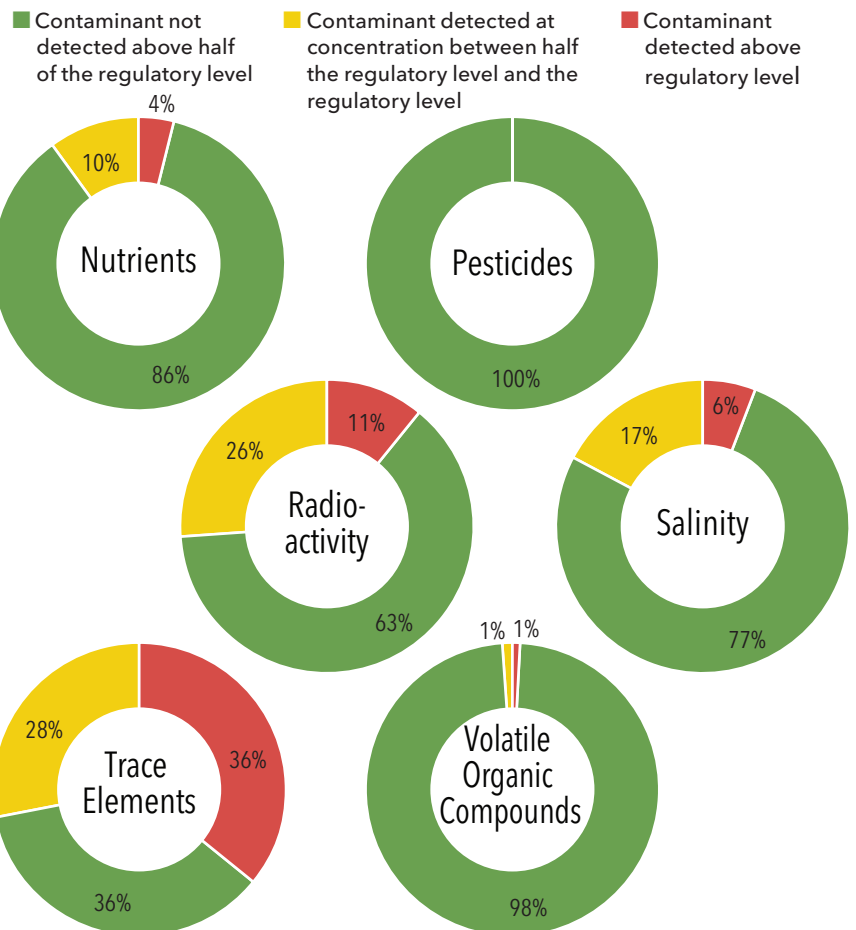


Groundwater Quality

Groundwater accounts for approximately nine percent of the public water supply in the Colorado River region of California. There are approximately 530 active public supply wells. The most common groundwater contaminants (before treatment) are naturally occurring iron, arsenic, fluoride, and manganese. Elevated levels of total dissolved solids and nitrate occur less frequently in sampling. There are approximately 7,000 domestic wells serving individual homes that are not regulated by the state.

Classes of Groundwater Contaminants, by Percentage of Public Supply Wells

These charts show the types of contaminants found in Colorado River region groundwater, by percentage of public water system wells sampled.



Nutrients consist of nitrogen (nitrate and nitrite) most commonly connected to human-caused sources such as fertilizer application and discharge of animal waste.

Trace elements include iron, manganese, and arsenic occurring in groundwater mostly from natural sources. Some are tied to human activity including, mining, urban runoff, and industrial processes.

Colorado River Region Instream Flow Requirements

-None
- Instream flows established through water right or other legal proceedings not associated with hydropower facilities
- Instream flows associated with requirements for operating hydropower projects



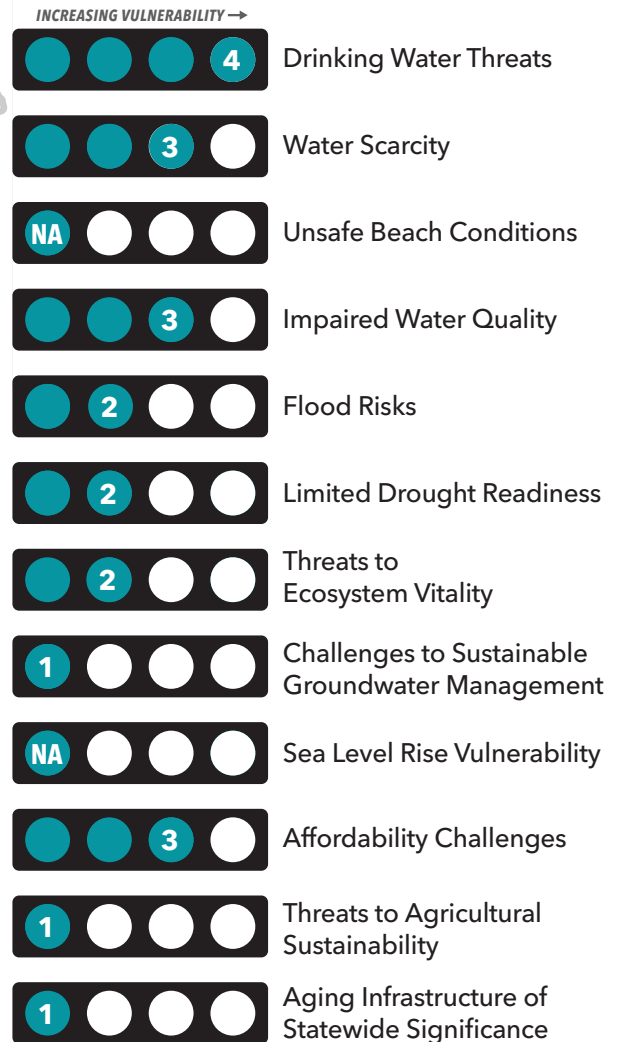
Colorado River Region Water Rights

A water right is a legal entitlement authorizing water to be diverted from a specified source and put to beneficial, non-wasteful use. Below is a list of the main kinds of water rights in the Colorado River region, the number of individual rights of each kind, and the total volume of water associated with those rights.

Colorado River	<i>total</i> 604
Appropriative	85
Federal Claims	31
Groundwater Recordation	431
Statement of Diversion and Use	57
Associated volume of water (in acre-feet):	4,667,305

What is a Statement of Diversion and Use? Diversions that are not covered by permits, licenses, registrations or certifications issued by the State Water Board, including diversions under claim of riparian, pre-1914 appropriative or other right. A statement does not constitute proof of a water right.

Colorado River Region Vulnerability Indicators

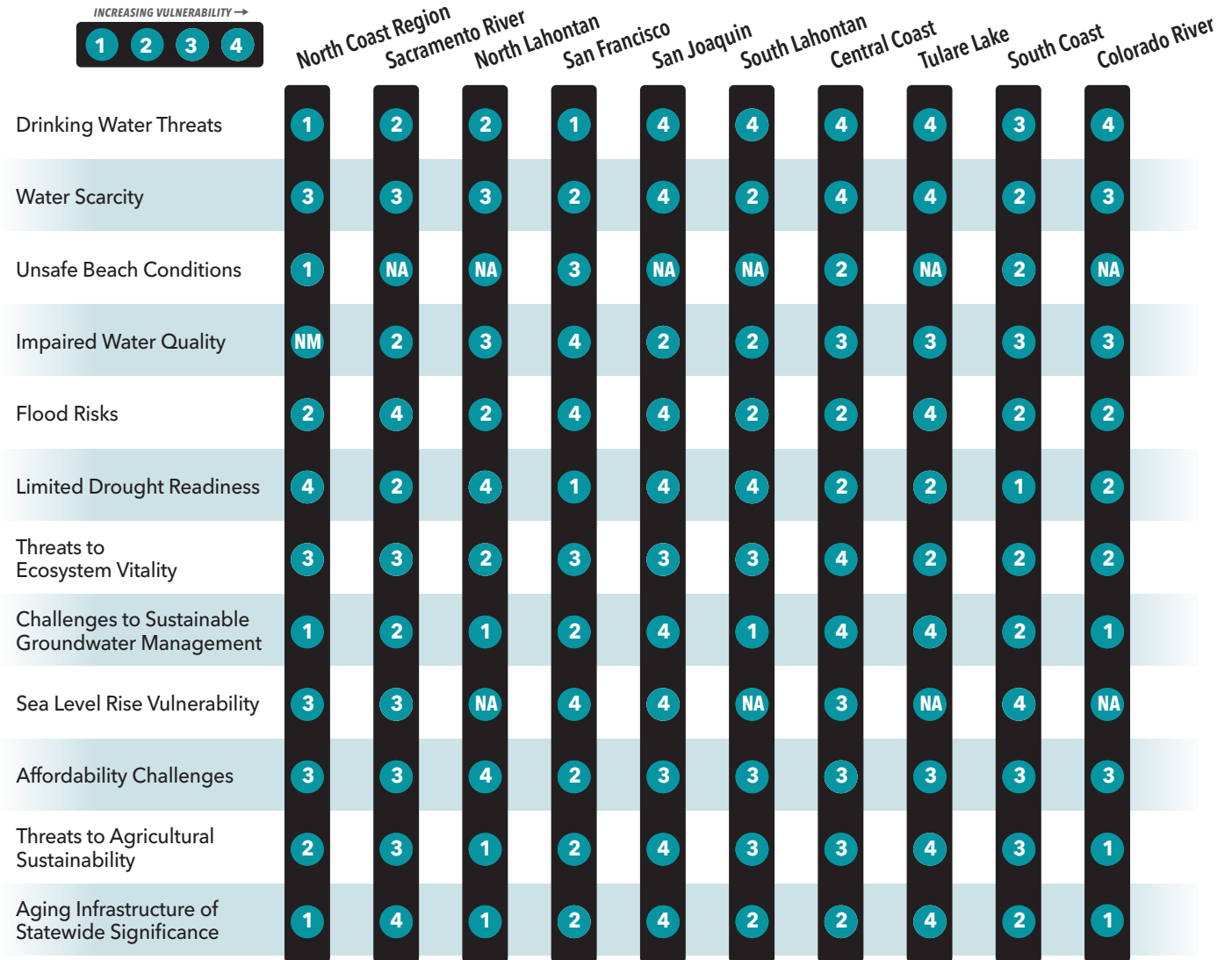


For methodology and sources see page 108.

Comparing Regional Vulnerability Indicators

The chart below is a broad snapshot of regional water challenges, presented solely to differentiate water needs across the state. The sources of information used in these assessments are listed on the following page. These regional summaries are presented not to suggest a governance structure or to guide state funding, but rather as a method to differentiate water needs across

the state. Projects and initiatives to strengthen water resilience may be achieved best in smaller geographies or even across these regions. These summaries are offered to stimulate a deeper conversation about defining and achieving water resilience on a regional scale. Climate change will impact the severity of these vulnerabilities.



Vulnerability Indicator Descriptions and Methodology

Data Behind the Regional Vulnerability Indicators

Drinking Water Threats - considers the proportion of people in each hydrologic region served by public water systems with at least 15 service connections, which are not in compliance with federal and state primary drinking water standards.

Water Scarcity - considers the percentage of the population in each hydrologic region not covered by Urban Water Management Plans, the percentage of water in each region that is imported, and the condition of the region's groundwater basins.

Unsafe Beach Conditions - considers the levels of fecal-indicator bacteria in the four coastal hydrologic regions.

Impaired Water Quality - considers both the proportion of water bodies found by regulators to be impaired, as well as the proportion of public water systems in each hydrologic region that were not in compliance with drinking water standards.

Flood Risks - considers the percentage of the population in each hydrologic region at risk from flooding in a given year, as well as the potential level of urban and agricultural asset damage in each region.

Limited Drought Readiness - considers the proportion of people in each hydrologic region that are covered by water shortage contingency plans.

Threats to Ecosystem Vitality - considers river flow volumes and patterns, land cover naturalness, presence of species of concern and water quality for each hydrologic region.

Challenges to Sustainable Groundwater Management - considers the proportion of groundwater basins in each hydrologic region that have documented declining groundwater levels, the proportion of basins determined by DWR to be of high- or medium-priority, and the proportion of basins that are managed under a groundwater basin adjudication.

Sea Level Rise Vulnerability - considers percentage of land area in each hydrologic region impacted by extreme storm events (100-year) and sea level rise (55 inches), the total population potentially impacted, and the percentage of the population in a region below the poverty estimate.

Affordability Challenges - considers the ratio of water bills to income for each hydrologic region.

Threats to Agricultural Sustainability - considers the relationship between agriculture and groundwater by calculating the proportion of irrigated acreage in each hydrologic region that is either in a critically overdrafted groundwater basin and/or a basin with declining groundwater levels.

Aging Infrastructure of Statewide Significance - considers both the percentage of conveyances in a hydrologic region that are significantly impacted by land subsidence, as well as the potential impacts to life and property due to dam failure.

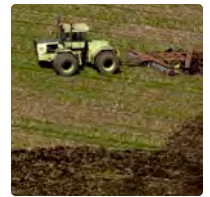
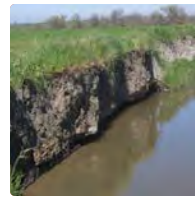
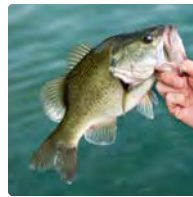
Sources

- Human Right to Water Portal (SWRCB)
- Urban Water Management Plans
- United States Census Bureau
- SGMA Basin Prioritization data
- California Water Plan
- Heal the Bay Beach Report Card (2018-2019)
- USEPA 303(d) List
- USGS National Hydrography Dataset
- State Plan of Flood Control (DWR 2010)
- California's Flood Future (DWR 2013)
- Water Use Efficiency data
- California Data Exchange Center
- National Landcover data
- Biogeographic Information and Observation System
- Social Vulnerability Index (the Centers for Disease Control and Prevention)
- Dams Within Jurisdiction of the State of California (DWR 2018)
- Interferometric Synthetic Aperture Radar (InSAR) data

The Delta



The Sacramento-San Joaquin Delta is home to small historic communities, a mosaic of farms, a “switching yard” for north-to-south water delivery projects, and the largest West Coast estuary. Its maze of channels and wetlands are an important stop for waterfowl and shorebirds on the Pacific Flyway and a migration corridor for chinook salmon and steelhead. Millions of boaters, anglers, birdwatchers, and windsurfers visit each year. The region faces climate pressures like no other in California. Ever-higher tidal and storm surge from San Francisco Bay and increasingly warm storms draining through the Delta from much of northern and central California will test the region’s hundreds of miles of levees.



The Delta: Its Unique Role and Considerable Challenges

Although the Delta is not one of the state’s ten major hydrologic regions, it plays a complex role in the water resilience of California and faces particularly acute climate risks. More than 200 federal, state, regional, and local agencies are responsible for managing various components of the Delta, including water quality, levee maintenance, land ownership, habitat restoration, and emergency response.

The two biggest water delivery systems in California, the federal Central Valley Project and State Water Project, use pumping plants in the Delta to divert water from northern

ivers to millions of people and acres of farmland in the Bay Area, San Joaquin Valley, and Southern California. Natural gas storage and transmission facilities, highways, railroads, and electric transmission pathways criss-cross Delta islands.

In 2009, the Legislature and Governor recognized the statewide significance of the Delta and decades of conflict over its natural resources when they enacted the Delta Reform Act. The law created a new state agency, the Delta Stewardship Council, to advance co-equal goals—a more reliable statewide water supply and a healthy ecosystem, both achieved in a manner that protects and enhances the unique characteristics of the Delta as an evolving place. The law also created the Delta Conservancy to be a state partner in implementation of the Council’s Delta Plan.

The Delta as it currently exists depends upon levees. Built by farmers starting after the Gold Rush to drain marshland, the Delta now contains an estimated 1,000 miles of levees. The levees protect islands that are near or well below sea level and guide freshwater through the region. The Delta levees

protect assets from floods and also function as part of the state and federal water project systems. In the central and western Delta, levees essentially act as dams, holding water back from bowl-shaped islands that have subsided 20 feet or more. Such subsidence is tied to the peat soil, which decomposes and releases carbon dioxide as it is dried and tilled. Delta subsidence contributes one to two percent of the state’s total carbon emissions.

The Delta is no simple river system; it is tidally influenced, with huge amounts of fresh and saltwater ebbing back and forth across the Delta twice a day. About 80 percent of the inflow to the Delta comes from the Sacramento River. Freshwater inflow varies tremendously by season and year, and much river water that otherwise would flow into the Delta is diverted by water users upstream.

Construction of Delta levees began in the late 1800s, often with Chinese laborers.



Delta Region Likely Climate Effects

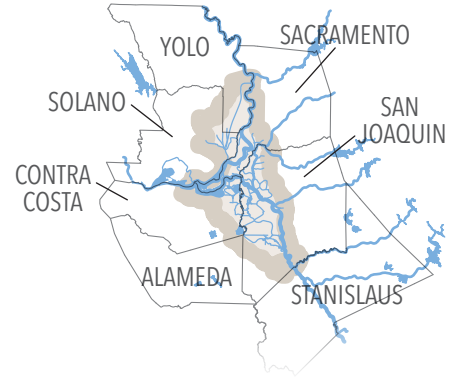
The Delta faces increasing flood risk and water quality challenges, with big implications for not just local communities but much of the state.

Most climate projections indicate the future will bring fewer days of precipitation but increases in the intensity of the largest storms. Warmer, higher storm runoff into the Delta—it drains nearly half of California—will test the strength of levees. High runoff that coincides with peak tides, storm surge, and strong winds from the Pacific Ocean will worsen the test. Should Delta levees fail, the damage could extend well beyond lives and property in the Delta itself. The rush of water onto flooded islands could draw ocean water deep into the Delta, forcing water diversions to cease

until enough fresh water could be released upstream to flush the salt water out.

More gradual changes could be cumulatively costly, too. Climate projections show that as winter storms warm and become rainier and snowpacks melt earlier, a greater fraction of runoff generated will pass through the Delta earlier in the year. As a result, summer salinity in the upper San Francisco Bay and Delta is projected to increase.

Even the most gradual expressions of sea level rise will eventually transport more ocean salinity into the Bay-Delta. This will affect brackish and freshwater habitats. The tradeoff to manage salinity could reduce the amount of water

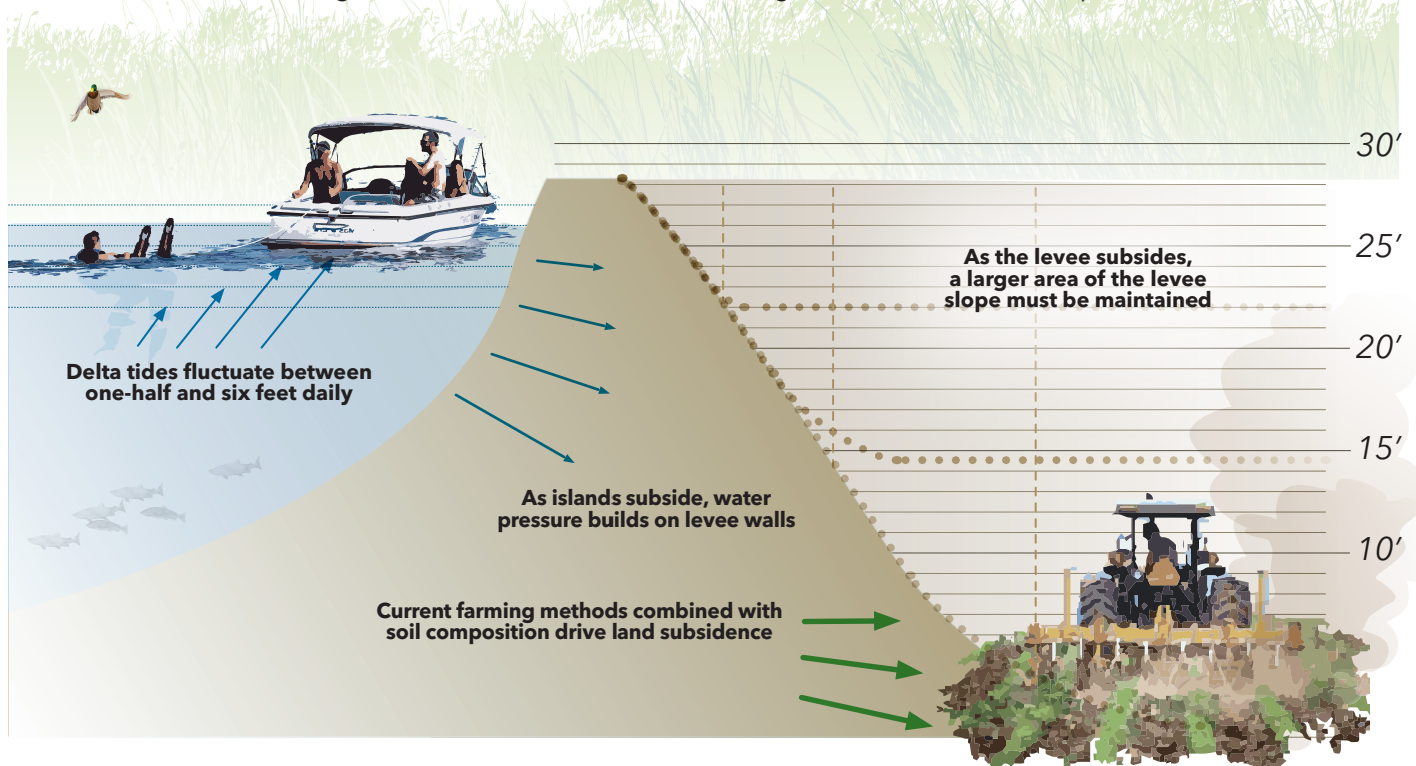


available to support an ecosystem already under stress and for export from the Delta. Exports could be naturally curtailed by about 10 percent under mid-century climate projections, and by about 25 percent by 2100. The actual effects will depend on future operating rules and future decisions, including responses to climate change itself.

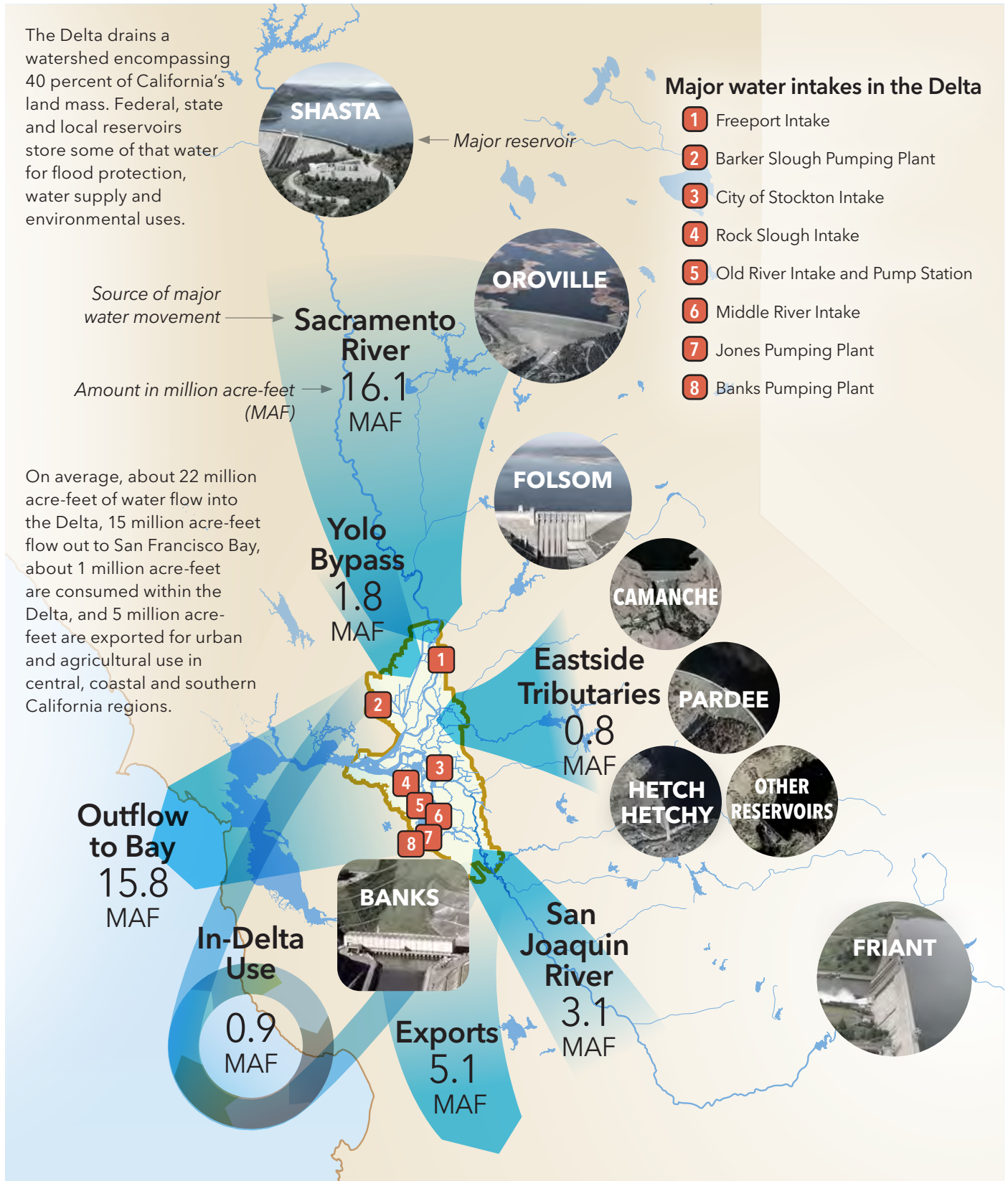
Levees, water pressure and subsidence

Delta levees hold water back from flooding dozens of islands, many of them deeply subsided. The potential for levee failure increases as the difference in elevation grows between the interior of an island and the adjacent channel water surface. The greater that elevation

difference, the greater the water pressure on levees, making it more likely that water will seep through or under levees. Nutria and other burrowing rodents create tunnels and gaps exploited by that pressure. Over time, rising sea levels also increase pressure on levees.

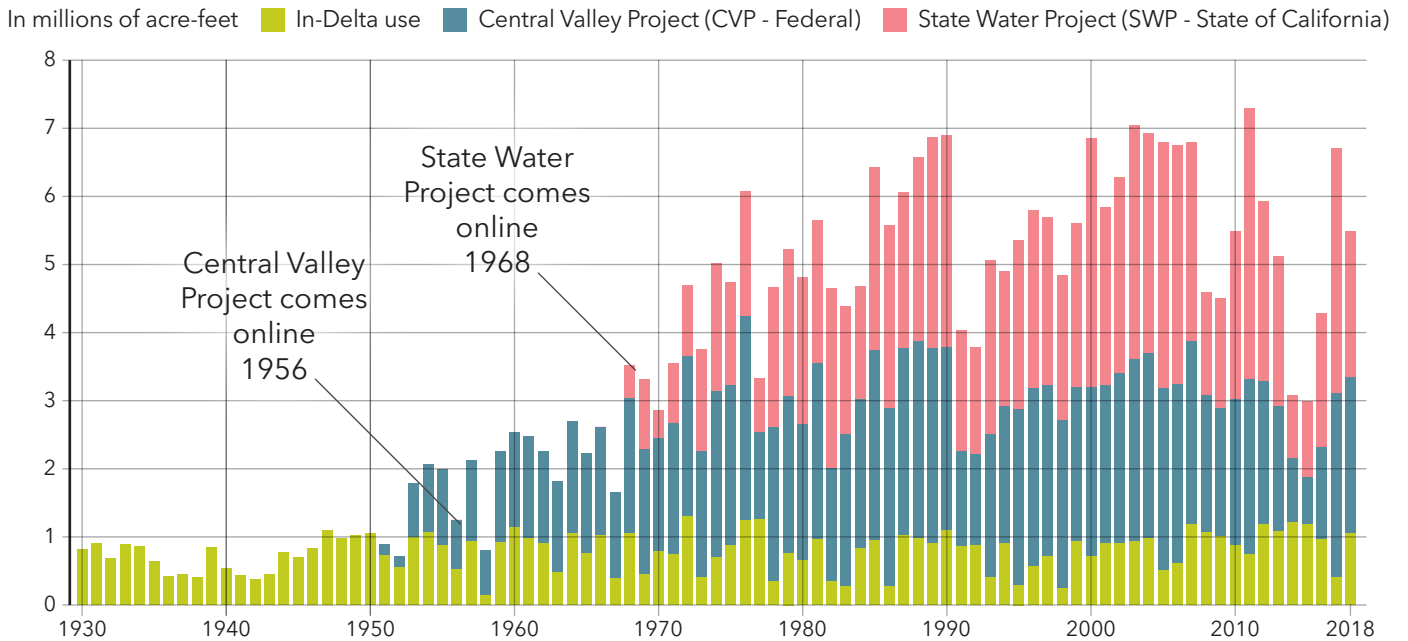


Delta Water: Inputs and Outputs



Delta Water Use

Major uses of water that flows to the Delta, from 1930-present



On average, water use within the Delta is about one million acre-feet a year. The Central Valley Project (CVP) began diverting water from south Delta channels in the 1950s. State Water Project (SWP) diversions from nearby channels began in the 1960s. The total volume of water moved by those projects increased through the 1970s. Operation of the projects is subject to many state and federal laws and agreements designed to protect water quality and endangered species. Over the past decade, the two projects combined have moved on average about 4 million acre-feet of water a year to water districts in the Bay Area, Southern California, and San Joaquin Valley.



Looking Ahead

Under 2009 law, water districts that depend upon delivery of water drawn from the Delta must reduce their reliance on the Delta for those supplies. Many Southern California water districts are building regional self-sufficiency but do not expect to be able to feasibly replace all water supply diverted from the Delta over the next couple of decades. Water drawn from the Delta remains critically important to San Joaquin Valley agriculture. To allow the state and federal water projects to adapt to a changing climate, the state is studying construction of new intakes on the Sacramento River, with a tunnel to carry water directly to the existing pumping plants. The Delta Stewardship Council has organized a multi-agency assessment of Delta climate vulnerability, the first step to a comprehensive adaptation strategy.

Land Subsidence and Sea Rise in the Delta

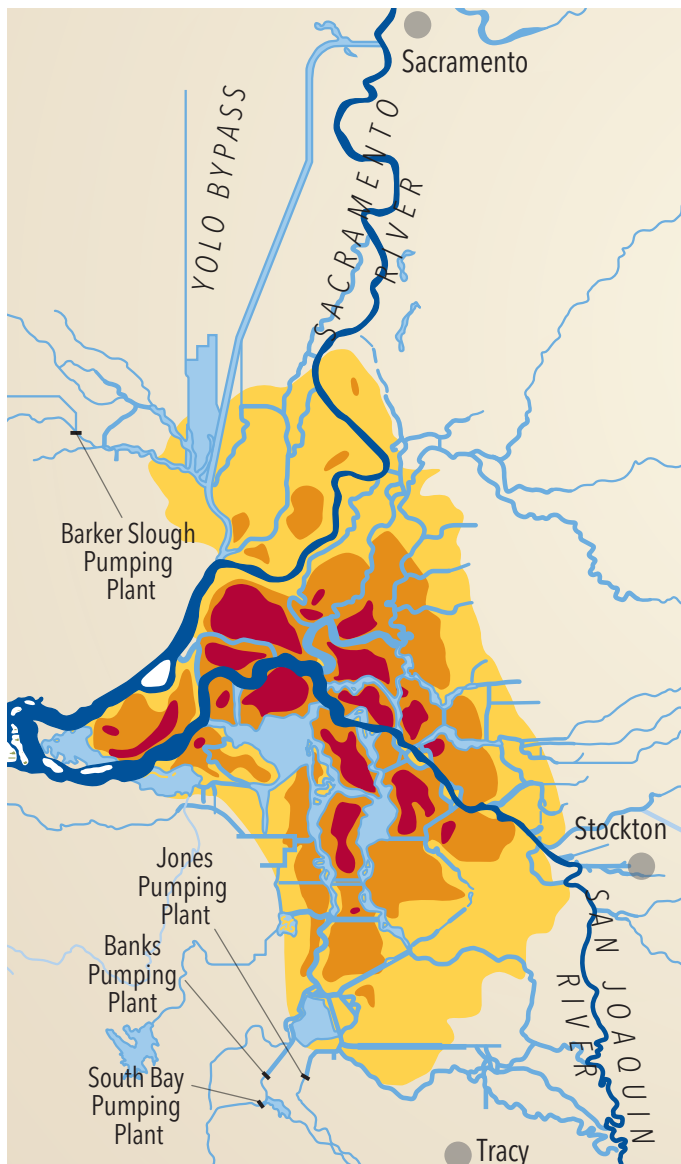
Many Delta islands are well below sea level, heightening vulnerability to floods, earthquake, and rising sea levels. The subsidence of Delta islands is connected to the conversion of freshwater tidal marsh into farmland during the late 1800s and early 1900s. People built levees, filled in tidal channels and sloughs,

and lowered the groundwater tables below crop root zones with drains. Exposed to oxygen, the Delta's peat soil is converted from organic carbon soils to carbon dioxide, contributing carbon emissions to the atmosphere. As sea levels rise and the center of Delta islands deepen, the water pressure on levees

increases. Should Delta levees fail, water—fresh or salty, depending upon tides—would rush to fill the bowl-like islands. This could inundate Delta communities and tens of thousands of acres and cause significant interruption of water supply deliveries.

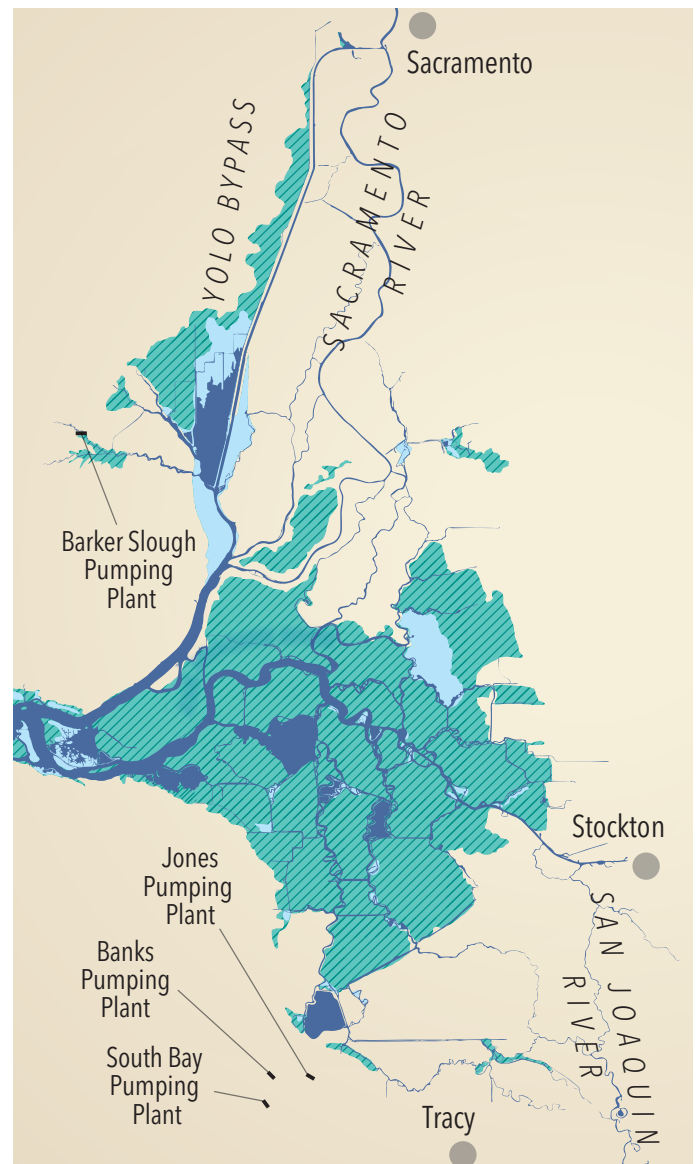
Current Subsidence Levels in the Delta

- Above sea level
- Sea level to 10 feet below sea level
- 10 to 15 feet below sea level
- 15 feet or more below sea level



Future Flooding Potential with Sea Level Rise

- Flood zone circa 2015
- Flood zone with 5 feet sea level rise (1.5 meters, estimated 2100)
- Open water



Delta Issues



Ecosystem Restoration

The Delta's natural ecosystem is in significant decline. Restoring the Delta to its historical, unaltered state is not feasible or desirable; however, integrated restoration actions must

accelerate and focus on creating conditions that favor a more diverse, highly functioning ecosystem. This means making more room for fish and wildlife in the Delta while balancing human land and water uses. It also means identifying and overcoming institutional and regulatory barriers to get restoration projects off the ground faster.



Development Pressures

The Delta landscape has been much altered by urban encroachment, often entailing higher flood risk. The Delta Protection Commission, created in 1992 and strengthened

by the Delta Reform Act of 2009, oversees development in the core area called the Primary Zone. The Delta Stewardship Council's Delta Plan further steers new development to the 26,000 acres in the Secondary Zone already earmarked for urbanization in local plans. Small housing developments that may occur outside these limits must meet high flood control standards.



Risk Reduction

Located at confluence of California's two largest rivers and tributaries, the Delta is home to a range of important communities, infrastructure and economic assets. Its complex labyrinth of islands and waterways is protected by

some 1,100 miles of mostly earthen levees. Although eliminating flood risks will be impossible, prudent planning, reasonable land development, and improved flood management can significantly reduce risk to people, property, and state interests, and is critical to achieving the state's coequal goals and protecting the Delta.



Delta as A Place

The Delta is a unique place characterized by and beloved for its rural landscape, cultural significance to native peoples and legacy communities, natural resources, recreational opportunities, and more. Protecting the Delta as an

evolving place means accepting inevitable change but also preserving the fundamental characteristics and values that contribute to the Delta's special qualities and that distinguish it from other places. The Delta region in 2019 was designated as California's first National Heritage Area.



Non-native (invasive) Species

Among the world's estuaries, the Delta is one of the most invaded by nonnative species such as the overbite clam, Asian clam, water hyacinth and Brazilian waterweed. Some have been in the Delta for more

than a century (largemouth and small mouth bass). They disrupt the food chain for native species and choke waterways. Because it is nearly impossible to eradicate nonnative species once they are established, many can be considered legacy stressors that can be managed but not eliminated.



Water Quality

Water quality in the Delta is influenced by many factors, including rainfall, snow runoff, tidal influences, and reservoir releases. It is central to the State's goals for the Delta – restoring the Delta ecosystem and providing for a more

reliable water supply, while protecting and enhancing the Delta as a unique and evolving place. Conditions that affect water quality – proper salinity for estuarine life, drinking water and agricultural irrigation – must be managed and balanced in ways that allow these goals to be met simultaneously.

References

- California Department of Water Resources. 2019. California Water Plan Update 2018. Sacramento (CA): California Department of Water Resources. California Natural Resources Agency. 80 pp.
- . 2019. The Sustainability Outlook: A Summary. Sacramento (CA): California Department of Water Resources. California Natural Resources Agency. 14 pp.
- . 2019. Sustainability Outlook Indicator Descriptions and Methodology. Sacramento (CA). Prepared by: Stantec Inc. 390 pp.
- . 2014. California Water Plan Update 2013 California Water Plan Update 2013 Volume 1 - The Strategic Plan. Sacramento (CA): California Department of Water Resources. California Natural Resources Agency. 420 pp.
- . 2014. California Water Plan Update 2013 California Water Plan Update 2013 Volume 2 - Regional Reports. Sacramento (CA): California Department of Water Resources. California Natural Resources Agency. [Website]. Viewed online at: <https://water.ca.gov/Programs/California-Water-Plan/Water-Plan-Updates#Volume-2---Regional-Reports>.
- California State Water Resources Control Board. 2019. "Electronic Water Rights Information Management System." Sacramento (CA): Californian State Water Resources Control Board. [Website]. Viewed online at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/ewrim/.
- . 2019. "Existing Flow Requirements." Sacramento (CA): Californian State Water Resources Control Board. [Website]. Viewed online at: https://www.waterboards.ca.gov/water_issues/programs/cannabis/existing_flow_requirements.html.
- . 2019. "Groundwater Ambient Monitoring and Assessment System (GAMA) - Groundwater Information System." Sacramento (CA): Californian State Water Resources Control Board. [Website]. Viewed online at: <https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/Default.asp>.
- . 2019. "Impaired Water Bodies - Final 2014/2016 California Integrated Report." Sacramento (CA): Californian State Water Resources Control Board. [Website]. Viewed online at: https://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2014_2016.shtml.
- Central Valley Flood Protection Plan Update 2017. Viewed online at: <https://http://cvfpcb.ca.gov/cvfpp/>.
- Delta Stewardship Council. 2013. The Delta Plan. Sacramento (CA): Delta Stewardship Council. 374 pp. [Website]. Viewed online at: <https://deltacouncil.ca.gov/delta-plan/>.
- Dettinger M, Anderson J, Anderson M, Brown L, Cayan D, and Maurer E. 2016. Climate Change and the Delta, San Francisco Estuary and Watershed Science. Scholar Commons. 28 pp. Viewed online at: <https://escholarship.org/uc/item/9k43h252>.
- Existing Flow Requirements. Viewed online at: https://www.waterboards.ca.gov/water_issues/programs/cannabis/existing_flow_requirements.html
- Heal the Bay. 2018. Heal the Bay 2017-2018 Beach Report Card. Santa Monica (CA). 77 pp. Viewed online at: https://healthebay.org/wp-content/uploads/2018/07/BRC_2017-2018_07-12-18.pdf.
- Louise J, Haden VR, Wheeler SM, Hollander AD, Perlman J, O'Geen T, Mehta VK, Clark V, Williams J, and Thrupp A. 2012. Vulnerability and Adaptation to Climate Change in California Agriculture. Sacramento (CA): University of California Davis. Prepared for: California Energy Commission. 113 pp. Viewed online at: <https://ww2.energy.ca.gov/2012publications/CEC-500-2012-031/CEC-500-2012-031.pdf>.
- Office of Environmental Health Hazard Assessment. 2019. Achieving the Human Right to Water in California - An Assessment of the State's Community Water Systems. [Public Review Draft]. Sacramento (CA): Office of Environmental Health Hazard Assessment. California Environmental Protection Agency. 152 pp.
- State of California. 2019. "California's Fourth Climate Change Assessment." Sacramento (CA): State of California. Governor's Office of Planning and Research. California Natural Resources Agency. California Energy Commission. [Website]. Viewed online at: <http://www.climateassessment.ca.gov/>.



Appendix 3 | Section 3

State Water-Related Programs



State Water-Related Programs

While most of the water Californians use is managed and funded locally, the state plays an important role as a regulator, policy and standard setter, funder, planner, partner, and provider of science, data, and information.

Several state agencies lead important water-related functions:

The **Department of Water Resources** manages the State Water Project, which includes Oroville Dam and the 444-mile-long California Aqueduct. The 50-year-old project delivers water to local agencies that reach 27 million Californians. The Department was created after deadly flooding in 1955 and tasked with planning, building, and overseeing the nation's largest state-built, multi-benefit water conveyance system. DWR also oversees implementation of the Sustainable Groundwater Management Act, leads statewide water resource planning, and serves as the statewide flood control agency.

The **State Water Resources Control Board** was created by the Legislature in 1967 out of recognition that water quantity and quality needed to be coordinated. The five-member board has authority and responsibility to protect water quality and balance competing demands among agricultural, municipal, industrial, and environmental uses. It allocates water rights, adjudicates water right disputes, develops statewide water protection plans, establishes water quality standards, and guides the nine Regional Water Quality Control Boards located in the major watersheds of the state.

The **California Department of Fish and Wildlife** dates to the Division of Fish and Game created by the Legislature in 1927. It became the Department of Fish and Game in 1951 and its name changed to the Department of Fish and Wildlife in 2013. Its mission--to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public--gives it a major role in water management as a regulator, planner, and manager of habitat and hatcheries.

The **California Department of Food and Agriculture** was formed by the Legislature in 1919 to promote and protect agriculture. The department is now organized into five divisions and six special programs. The mission of the Office of Environmental Farming & Innovation is to support agricultural production and incentivize practices resulting in a net benefit for the environment through innovation, efficient management, and science. This office includes the California Healthy Soils Initiative, a collaboration to promote the development of healthy soils on farmlands and ranchlands.

The **California Public Utilities Commission** is responsible for ensuring that California's investor-owned water utilities deliver clean, safe, and reliable water to their customers at reasonable rates. The Commission's Water Division regulates more than 100 investor-owned water and sewer utilities providing water service to about 16 percent of California's residents. Approximately 95 percent of that total is served by nine large water utilities, each serving more than 10,000 connections.

The **Delta Stewardship Council** was created by the Legislature in 2009 to write and enforce a management plan for the Sacramento-San Joaquin Delta, which funnels runoff from nearly half of California into San Francisco Bay. The seven-member Council's charge is to advance the state's coequal goals for the Delta - a more reliable statewide water supply and a healthy and protected ecosystem, both achieved in a manner that protects and enhances the unique characteristics of the Delta as an evolving place.

The **California Water Commission** provides a public forum for discussing water issues, advises the director of the Department of Water Resources on matters within the department's jurisdiction, approves rules and regulations, and monitors and reports on the construction and operation of the State Water Project. A water bond approved by voters in 2014 gave the Commission responsibility for the distribution of public funds set aside for the public benefits of water storage projects.

The **Central Valley Flood Protection Board** serves as a non-federal partner to the U.S. Army Corps of Engineers that oversees, manages, and ensures adequate operations and maintenance of the flood management system for the Sacramento and San Joaquin rivers.

Funding State Water-Related Programs

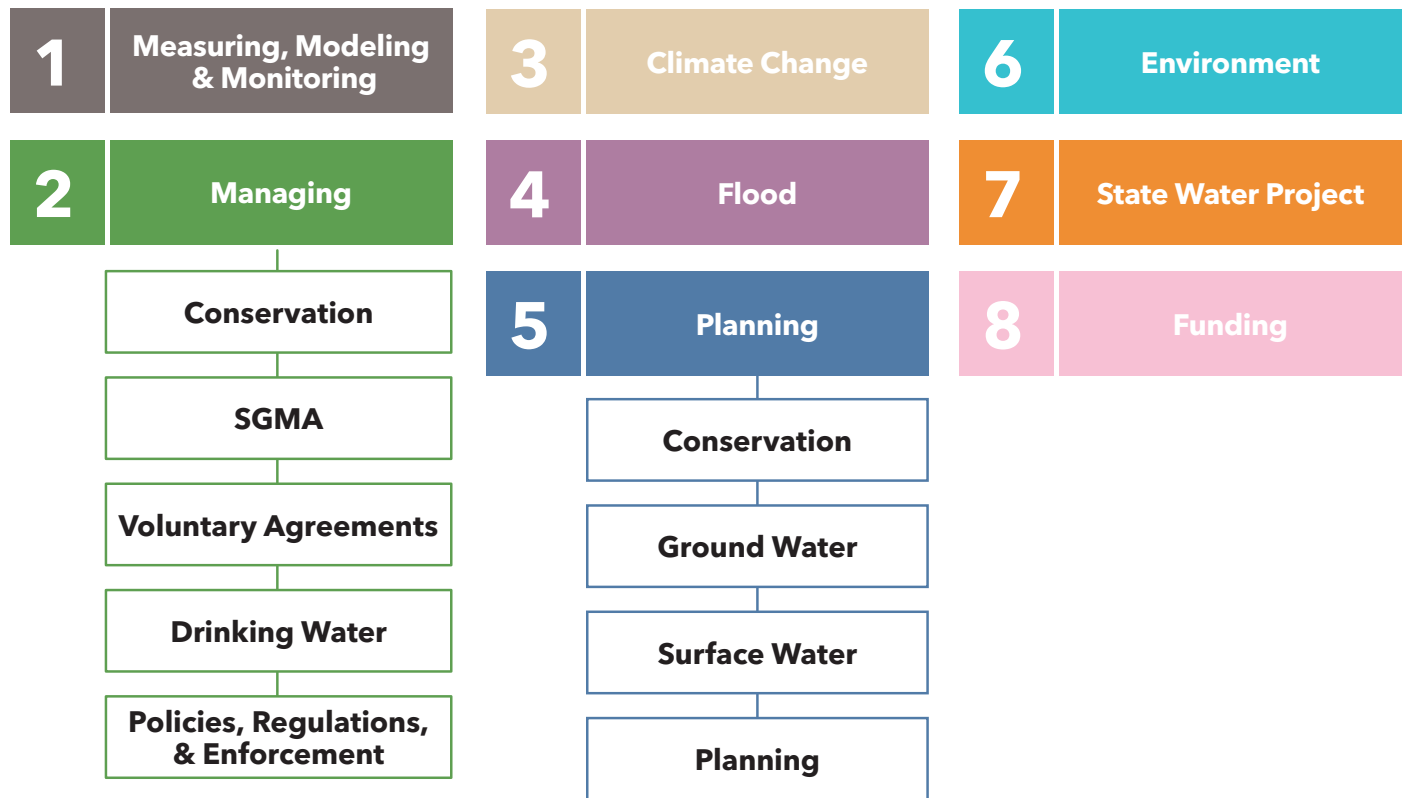
Local water, flood, stormwater, sewer, and other water-related districts provide an estimated 85 percent of the \$33 billion a year spent managing water resources in California. The state contributes approximately 12 percent of that overall expenditure.

The money to fund the dozens of state programs described in the following section comes from a variety of sources through the state's budget process. Three kinds of state funds typically account for nearly two-thirds of California's budget. First is the state General Fund, which accounts for revenues that are not designed for a specific purpose. Second are special funds, comprised of more than 500 separate special funds from taxes, fees, and licenses and which

are designated for a specific purpose, such as the administration of water rights or dam safety programs. The third are general obligation bond measures. Since 1970, California voters have approved 23 of 25 general obligation bond measures that included water-related funding to be administered by state agencies. Federal funds comprise approximately one-third of the state's overall budget, but only three percent of California's water-related funding.

State Water-Related Programs

The following section displays basic information on elements of major water-related programs within the California Natural Resources Agency, California Environmental Protection Agency, California Department of Food and Agriculture, California Public Utilities Commission, and the Delta Stewardship Council.



Acronyms Explained

California Department of Food and Agriculture	CDFA
California Department of Fish and Wildlife	CDFW
California Natural Resources Agency	CNRA
California Public Utilities Commission	CPUC
California Environmental Protection Agency	CalEPA
Delta Stewardship Council	DSC
Department of Water Resources	DWR
Regional Water Quality Control Boards	Water Boards
State Water Resources Control Board	Water Board

Agricultural and Urban Water Use Models

These models are used by DWR to estimate annual water use in the agricultural and urban sectors for each of DWR's 256 detailed analysis units, and are aggregated to provide county, hydrologic region, and statewide estimates. This information is utilized in updates to the California Water Plan.

AGENCY: DWR

Water Operations Modeling

DWR staff in the Bay-Delta Office and the State Water Project Operations Office use Calsim, DSM2, Particle Tracking, and Reclamation Temperature models to develop water supply forecasts and estimate water quality conditions to adjust upstream reservoir operations to meet regulatory requirements. These models can also be used as a forecast tool to conduct comparative water resource management scenarios.

AGENCY: DWR

Bay-Delta Hydrological and Operations Modeling

Water Board Bay-Delta staff and consultants have developed a model of the Sacramento River watershed, Delta, and tributaries to the Delta (SacWAM), and are developing a similar model for the Lower San Joaquin River tributaries (SJWAM). Both models are currently configured to use pre-processed inflow hydrologies based on historical observations. Both models can also simulate hydrology based on historical or modeled climate data, but require additional development and calibration to use this feature for planning studies. Additional input may include a range of climate change scenarios for future planning activities.

AGENCY: WATER BOARD

Integrated Modeling Steering Committee

Established in response to a recommendation by the Delta Independent Science Board, the Steering Committee will improve communication and coordination of modeling efforts in the Delta and improve the efficiency of limited habitat restoration resources.

AGENCY: DSC

AB 1755, 'Open and Transparent Water Data Act'

DWR operates a statewide integrated water data platform for publication of all state-held water and ecological data. These data allow for additional assessment of existing demands and available supply.

AGENCY: DWR

California Irrigation Management Information System (CIMIS)

Designed in 1982 by DWR and UC Davis, CIMIS provides daily estimates of evapotranspiration to support irrigation scheduling. It was designed to assist irrigators in managing their water resources more efficiently.

AGENCY: DWR

California Data Exchange Center (CDEC)

DWR manages a centralized database to store, process, and exchange real-time hydrologic information gathered by various cooperators throughout the state. CDEC data enable forecasters to prepare flood forecasts and water supply forecasts, reservoir and hydroelectric operators to schedule reservoir releases, and water suppliers to anticipate water availability. CDEC is available to other public and private agencies, news media, and the general public.

AGENCY: DWR

California Data Exchange Network

The California Environmental Data Exchange Network (CEDEN) is a database incorporating water quality information provided to the Water Board by a network of external data providers to support water quality management in California. The purpose is to provide a central location to find and share information about water bodies, including streams, lakes, rivers, and the coastal ocean.

AGENCY: WATER BOARD

Annual Water Diversion and Use Reporting: Electronic Water Rights Information System (eWRIMS)

Each year, the Water Board Division of Water Rights collects reports from approximately 45,000 water diversions. Water rights information can be downloaded using the Water Board's electronic water rights information system (eWRIMS).

AGENCY: WATER BOARD

Regional Water Atlas

The Division of Integrated Water Management is developing a GIS-based Regional Water Atlas to provide ready access to data that is developed by 48 regional groups. These groups have developed plans that address regional climate change impacts and other challenges to water supply reliability. This information will support future updates to the California Water Plan.

AGENCY: DWR

Water Data Library

DWR developed the Water Data Library to provide geographic-based data on groundwater and surface water conditions throughout California. These data are utilized by local agencies to monitor and evaluate quality data associated with minerals, metals, and nutrient data.

AGENCY: DWR

Safe Drinking Water Information System (SDWIS) and Water Quality Information Receiving System (WQIR)

SDWIS is a U.S. Environmental Protection Agency-designed database created to track water quality data that comes in electronically from public water systems via WQLR. The system primarily tracks and then runs these data against established rules to determine public water system compliance with the State and Federal Safe Drinking Water Acts. Access to SDWIS data is through the Water Board's DRINC portal or viewed on its Human Right to Water web portal.

AGENCY: WATER BOARDS

Electronic Annual Report (eAR) for Public Water Systems

The Division of Drinking Water collects water use and other general information from public water systems. The Electronic Annual Report includes information on water system vulnerabilities, sensitivity to climate change, water systems leakage data, and information regarding billing and costs of water to address reports requested by the Legislature.

AGENCY: WATER BOARDS

Aggregated Farm Gate Delivery Report

DWR collects information related to total farm gate deliveries submitted by water suppliers who provide water to agricultural land. Many of these farm gate delivery volumes are estimated. Suppliers for more than 25,000 acres are required to meter deliveries. This information is used to assist development of agriculture water management plans.

AGENCY: DWR

Bulletin 120-Water Supply Index Forecasting

The Hydrology Section of DWR participates in the California Cooperative Snow Survey program and develops a Water Supply Index and Snowmelt Runoff Forecast. These data are used in Bulletin 120 to forecast water supply.

AGENCY: DWR

Environmental Lab Accreditation Program (ELAP)

The Water Board Division of Drinking Water implements a lab accreditation program that ensures general environmental and public health data of known, consistent, and documented quality are reliable.

AGENCY: WATER BOARD

Water Quality and Biological Monitoring Program

In response to various laws, regulations, and permits, DWR monitors and collects water quality, nutrient, and phytoplankton data in the Sacramento-San Joaquin Delta, Suisun Bay, and San Pablo Bay each month. In addition, DWR established monitoring stations in the Delta and Suisun Bay to collect data related to salinity, temperature, stage/flow, dissolved oxygen, and other parameters every 15 minutes. These data can be accessed through California Data Exchange Network.

AGENCY: DWR

California Water Quality Monitoring Council

The California Water Quality Monitoring Council was formed in response to Senate Bill 1070 (2006) and is a joint action by both the California Environmental Protection Agency and the California Natural Resources Agency. Both agencies are required to integrate and coordinate water quality and ecosystem monitoring, assessment, and reporting. The Monitoring Council members represent a wide variety of water quality related interests including regulatory agencies, the regulated community, the public, and scientific community.

AGENCY: CALEPA, CNRA

Surface Water Ambient Monitoring Program

The Surface Water Ambient Monitoring Program (SWAMP) was created in 2000 in response to Assembly Bill 982 (1999). The SWAMP program conducts water quality monitoring at the statewide and regional level for use in assessing attainment of beneficial uses in streams, rivers, lakes, wetlands and estuaries, and some coastal regions. This program creates optimal interagency monitoring coordination, data sharing platforms, and supports collaborative science-based decision making. Data collected through SWAMP is available through the California Data Exchange Network as well as the CA Open Data Portal.

AGENCY: WATER BOARDS

The Clean Water Team

The Clean Water Team (CWT) is the citizen monitoring program of the Water Boards and is a part of the Surface Water Ambient Monitoring Program (SWAMP). The CWT Citizen Monitoring Coordinator works statewide to provide technical assistance and guidance documents, training, QA/QC support, and temporary loans of equipment.

AGENCY: WATER BOARDS

303d/305b Integrated Report

The Water Boards conduct assessments of readily available data collected internally or submitted by external entities to identify waters not meeting water quality standards. Waters not meeting standards are listed as impaired and prioritized for additional regulatory action to address the impairment through development of Total Maximum Daily Load.

AGENCY: WATER BOARDS

California Cooperative Snow Surveys Program

Established in 1929 by the Legislature, the program is a partnership of more than 50 state, federal, and private agencies coordinated through DWR. The program collects, analyzes and disseminates snow data from manually measured snow courses and telemetering snow sensors located throughout the Sierra Nevada and Shasta-Trinity mountains.

AGENCY: DWR

Groundwater Ambient Monitoring and Assessment Program

The Groundwater Ambient Monitoring and Assessment (GAMA) Program conducts comprehensive monitoring of groundwater quality, compiles and integrates groundwater quality data from several different sources and regulatory programs, and makes that data readily accessible to the public. GAMA also performs studies related to groundwater vulnerability, groundwater quality in domestic wells, and groundwater impacts associated with non-point sources of contamination. The GeoTracker GAMA online database compiles groundwater quality data from hundreds of thousands of wells, well construction information, and other useful information into an easy-to-use interface where the public can download and review groundwater quality data.

AGENCY: WATER BOARDS

MEASURING, MODELING & MONITORING

California Central Valley Groundwater Surface Water Simulation Model (C2VSim)

The Sustainable Groundwater Management Office utilizes the California Central Valley Groundwater Surface Water Simulation Model to assess groundwater supply and demand for previous years and also make projections into the future.

AGENCY: DWR

Urban Water Supplier Conservation and Water Use Tracking

The Water Board tracks potable water use, local water shortage stages, and conservation activities for each of the state's urban water suppliers. These data help staff evaluate water use responses to changing drought and hydrologic conditions. Data reporting was mandatory from 2014-2017 during the drought, but has been reported voluntarily since the end of 2017.

AGENCY: WATER BOARD

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MANAGING

CONSERVATION

Model Water Efficient Landscape Ordinance (MWELo)

The MWELo sets new landscape and retrofitted landscape water efficiency standards. All agencies must adopt, implement, and enforce the MWELo or a more stringent standard. DWR's Division of Regional Assistance established water budgets for landscapes on new properties and develops standards for irrigation systems.

AGENCY: DWR

Water Conservation

DWR monitors progress towards meeting new legislative goals for water conservation at state facilities. DWR also develops the Irrigable Landscape Area Measurement, which is used by about 400 urban retail water suppliers to calculate urban water use objectives.

AGENCY: DWR

Validated Water Loss Audit Reports

Assembly Bill 1668 and Senate Bill 606 (2018) require the Water Board to adopt regulations for efficient municipal urban water use. These regulations must be adopted by 2022 and will be based on technical recommendations provided by DWR. Additional legislation passed in 2015 requires the Water Board to also adopt standards for water distribution system loss by 2020.

AGENCY: DWR

Water Use Efficiency

Assembly Bill 1668 and Senate Bill 606 (2018) require the Water Board to adopt regulations for efficient municipal urban water use. These regulations must be adopted by 2022 and will be based on technical recommendations provided by DWR. Additional legislation passed in 2015 requires the Water Board to also adopt standards for water distribution system loss by 2020.

AGENCY: WATER BOARD

Sustainable Groundwater Management Act (SGMA)

SGMA establishes requirements for sustainable groundwater use in specific high-use basins. SGMA requires local governance groups (Groundwater Sustainability Agencies, or GSAs) to evaluate groundwater quantity and quality conditions in their basins and avoid causing undesirable results related to groundwater pumping. DWR has developed groundwater sustainability plan (GSP) regulations that serve as the regulatory requirements for groundwater management in these basins. The Water Board may take additional regulatory actions in SGMA basins where GSAs are not formed, do not develop a GSP, or where a GSP has been determined to be inadequate by DWR. Staff from the Water Board and DWR coordinate with locals, non-governmental organizations, and academia to provide guidance and policies on how best to develop and implement the requirements of SGMA.

AGENCY: DWR, WATER BOARD

Airborne Electromagnetic (AEM) Pilot Surveys To Characterize Aquifers

DWR is working with local partner agencies to conduct pilot studies associated with Airborne Electromagnetic (AEM) surveys to provide state-of-the-art technology and data to Groundwater Sustainability Agencies. AEM uses magnetic arrays suspended from aircraft to map subsurface texture, which can be used to infer critical information about subsurface lithology, aquifer characteristics, and potential management actions that will assist in managing groundwater. DWR will collaborate with Water Board staff to assist with utilizing this information to monitor groundwater.

AGENCY: DWR, WATER BOARD

Sustainable Groundwater Management Act (SGMA)

CDFW developed a Groundwater Program to ensure fish and wildlife resources reliant on groundwater are addressed in Groundwater Sustainability Plans (GSPs), and to support compliance on CDFW-owned lands that are subject to SGMA requirements.

AGENCY: CDFW

Voluntary Agreements and Habitat Benefits Assessment

As an alternative to the Water Board update to the Bay-Delta Plan, the California Natural Resources Agency has led a Voluntary Agreements (VAs) effort to improve habitat and flows in the Delta and key tributaries through negotiations with water interests to support ecosystem needs while protecting water supply reliability. The VAs seek to improve conditions for fish through specific river flows and habitat enhancement projects over a 15-year period. DWR is conducting hydrologic modeling and analysis to support discussions related to water supply reliability while CDFW has been engaged to secure VAs that meet environmental objectives.

Water Board staff and consultants are conducting hydrological and operations modeling developed for Bay-Delta planning activities. This modeling provides the basis for analysis of environmental impacts and benefits of VAs and will build upon the programmatic environmental analyses to assess impacts of the VAs pursuant to the California Environmental Quality Act.

Water Board, CNRA, DWR, CDFW, and other parties are assessing habitat benefits associated with potential agreements. Habitat analysis builds on hydrological and operations modeling of the VAs and other policy options, as well as prior habitat restoration planning by other agencies.

AGENCY: CNRA, DWR, CDFW, WATER BOARD

Drinking Water Field Operation Branches

The Water Board's Field Operation Branches are responsible for the enforcement of the federal and California Safe Drinking Water Acts and the regulatory oversight of approximately 7,500 public water systems to assure the delivery of safe drinking water to all Californians.

AGENCY: WATER BOARDS

Drinking Water Treatment Technology Unit

Water Board staff lead and support the development of technologies used by public water systems to treat drinking water sources to the standards of the Safe Drinking Water Act.

AGENCY: WATER BOARD

Source Water Protection Program

Water Board staff develop and implement a program to improve the protection of drinking water sources through the implementation of a Source Water Protection Plan.

AGENCY: WATER BOARD

Investor-Owned Utilities

The CPUC is responsible for ensuring that California's investor-owned water utilities deliver clean, safe, and reliable water to their customers at reasonable rates. The Water Division regulates over 100 investor-owned water and sewer utilities under the CPUC's jurisdiction.

AGENCY: CPUC

Division of Safety of Dams (DSOD)

There are currently 1,250 jurisdictional-sized dams regulated by DSOD. The DSOD conducts independent analyses of dam design, oversees construction, reviews and approves new dam construction, and oversees enlargement, repair, alteration, and removal of existing dams.

AGENCY: DWR

Annual Enforcement Program Reporting

Every year the Water Boards compile annual Enforcement Performance Reports concerning violations and enforcement across various program areas and track performance targets. The Office of Enforcement reviews these reports and assesses program performance.

AGENCY: WATER BOARDS

National Pollution Discharge Elimination System (NPDES) Facilities in Significant Noncompliance (SNC)

The U.S. Environmental Protection Agency compiles a list of National Pollution Discharge Elimination System permitted facilities with specific types of violations and identifies them as Significant Noncompliance. The Office of Enforcement is leading an effort at the state level, in coordination with the Division of Water Quality and the Office of Information Management and Analysis, to reduce the number of significantly non-compliant facilities in California.

AGENCY: WATER BOARD

Human Right to Water Enforcement Assessment

The Water Boards review legal authorities and enforcement tools related to securing safe drinking water sources in communities impacted by discharges of pollutants.

AGENCY: WATER BOARDS

Waste Discharge Requirement Program

Waste discharges that are otherwise exempt from Clean Water Act permitting requirements are regulated under the Waste Discharge Requirement (WDR) Program. WDRs are routinely required for agricultural and industrial waste discharges to land, small wastewater treatment systems, and landfills.

AGENCY: WATER BOARDS

Irrigated Lands Regulatory Program

The Irrigated Lands Regulatory Program, through Waste Discharge Requirements (WDRs) or conditional waivers (Orders), regulates discharges from irrigated agricultural lands to prevent agricultural discharges from impairing surface and groundwater. These WDRs and Orders contain conditions requiring water quality monitoring of receiving waters and corrective actions when impairments are found.

AGENCY: WATER BOARDS

Land Disposal

The Water Board Land Disposal Program implements regulations for compost and landfill facilities where waste is discharged to land. Requirements for siting, operation, and closure of waste disposal sites are enforced through issuance of Waste Discharge Requirements to ensure adequate protection of water quality.

AGENCY: WATER BOARD

Water Rights Enforcement

The Division of Water Rights ensures the fair and consistent use of water, in accordance with state law and the water rights priority system.

AGENCY: WATER BOARD

Statewide General Waste Discharge Requirements (WDR) for Sanitary Sewer Systems

The Water Board requires public agency Sewer System Operators to develop and implement sewer system management plans. These Sanitary Sewer System plans are submitted online. All public agencies that own or operate a sanitary sewer system that is comprised of more than one mile of pipes or sewer lines which conveys wastewater to a publicly-owned treatment facility must apply for coverage under the Sanitary Sewer Systems WDR.

AGENCY: WATER BOARD

Operator Certification and Licensing Programs

Operators of public water systems must meet specific experience and training requirements. The Water Board administers an Office of Operator Certification to ensure drinking and wastewater systems are appropriately managed and also administers a tank tester licensing program to effectively manage those who test underground storage tanks.

AGENCY: WATER BOARDS

Salt and Nutrient Management Planning

Salt and Nutrient Management Plans (SNMPs) are a requirement of the Water Board Recycled Water Policy. An appropriate SNMP identifies existing water quality, estimates the assimilative capacity of aquifers/groundwater basins to receive salts and nutrients, and establishes implementing programs to manage and minimize salt and nutrient loading.

AGENCY: WATER BOARD

Recycled Water Policy

The Water Board supports and encourages the sustainable use of recycled water to promote conservation of water resources. The Recycled Water Policy is an important element of the overall effort to encourage the safe use of recycled water in a manner that is protective of public health and the environment. The purpose of the Recycled Water Policy is to increase the use of recycled water from municipal wastewater sources.

AGENCY: WATER BOARD

Water Rights Permitting, Petitions, and Licensing

The Water Board Division of Water Rights is responsible for permitting new water rights, modifying existing rights, permitting discharges from wastewater treatment facilities, and licensing certain types of water rights that were obtained or applied for after 1914. The permitting and petition processes include an evaluation of water availability and an analysis of whether new or modified rights will affect senior right holders.

AGENCY: WATER BOARD

Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) Program

The CV-SALTS program synthesizes and assesses water quality data for salts and nitrates primarily for Central Valley groundwater basins. The information will support implementation of a valley-wide salt and nitrate management plan.

AGENCY: WATER BOARDS

Abandoned Mines Program

The Water Board participates in the California Abandoned Mine Lands Agency Group, a multi-agency group coordinated by the Department of Conservation to identify, assess, rank, and remediate abandoned mines.

AGENCY: WATER BOARD

Cyanobacteria Harmful Algal Blooms (CyanoHABs)

CyanoHABs are an indicator of ecosystem disfunction and represent a health risk to humans, domestic animals, and wildlife. Assembly Bill 834 (2019) requires the Water Board to establish a Freshwater and Estuarine Harmful Algal Bloom Program to monitor and respond to harmful algal blooms. Collaboration with local, state, academic institutions, and federal and international agencies furthers understanding of the cyanoHAB issue.

AGENCY: WATER BOARD

401 Water Quality Certification and Wetlands Program

The federal Clean Water Act Section 401 and the Porter-Cologne Water Quality Control Act regulate discharges of fill and dredged material. These regulations protect water quality and drinking water supply through issuance of dredge and fill permits for flood control projects, water supply projects, dam replacement and retrofit projects, hydroelectric power projects, housing, transportation, and water supply pipeline projects.

AGENCY: WATER BOARD, WATER BOARDS

Stormwater Planning and Permitting

Storm water discharges in California are regulated through National Pollutant Discharge Elimination System (NPDES) permits. Storm water can mobilize pollutants which can then flow directly to water bodies through sewer systems which then pollutes rivers, lakes, and the ocean. However, storm water can also be a resource and

recharge groundwater when properly managed. The Water Boards are involved in initiatives to manage storm water as a resource through the Strategy to Optimize Resources Management of Storm Water (STORMS).

AGENCY: WATER BOARDS

Dairies, Concentrated Animal Feeding Operations (CAFOs)

The nine Regional Water Boards oversee programs to regulate waste discharges from dairies and concentrated animal feeding operations.

AGENCY: WATER BOARDS

Water Quality Control Planning, Standards and Total Maximum Daily Loads

Water Quality Control Plans (Basin Plans) are foundational to every water quality program within the Water Board. These plans establish beneficial uses of waters, water quality objectives to protect the uses, and programs of implementation to achieve the objectives. Water quality objectives are used to set effluent limitations in National Pollutant Discharge Elimination System permits and Waste Discharge Requirements for non-point sources as well as establish total maximum daily loads. Water data is compared to water quality objectives to determine if there is risk to public health, aquatic life, or other beneficial uses, and to determine if a waterbody is impaired.

AGENCY: WATER BOARDS

Forestry Program

The Forest Activities Program regulates non-point source activities in forested headwaters. These activities include timber harvest and fuels management, post-fire impacts assessment and mitigation, rural roads construction and maintenance and off-highway vehicle use areas. The Water Boards work with CAL FIRE, CDFW, and the Department of Conservation in assessing, addressing, and regulating all of these non-point source activities. The Water Boards provide regulatory oversight of these activities by issuing waste discharge requirement or waivers.

AGENCY: WATER BOARDS

Oil and Gas Extraction Regulatory Program

The Oil and Gas Extraction Regulatory program assesses potential impacts to groundwater associated with well stimulation (hydraulic fracturing) activities. This program provides regulatory oversight of activities associated with oilfield produced water, underground injection control, and produced water ponds.

AGENCY: WATER BOARDS

Onsite Wastewater Treatment Systems (OWTS) Policy

The OWTS Policy authorizes subsurface disposal wastewater and establishes minimum requirements for the permitting, monitoring, and operation of OWTS to protect beneficial uses of waters.

AGENCY: WATER BOARDS

Drinking Water: Regulations (direct potable reuse, on-site reuse, residential treatment devices, other)

Direct Potable Reuse is recycled municipal wastewater that has been treated to a high level and used directly as drinking water. The Water Board is implementing the legislative mandates to develop uniform water recycling criteria for Direct Potable Reuse. This project allows for a potential new drinking water supply for water agencies that have the technical, managerial, and financial capacity necessary to undertake the project and comply with the regulations to protect public health.

AGENCY: WATER BOARD

Recycled Water Regulatory Development

This effort exercises general oversight over recycled water projects, including review of Water Board's permitting practices, and leads the effort to meet the recycled water use goals to ensure protection of public health.

AGENCY: WATER BOARDS

Hearings and Special Projects

Water right hearings are quasi-adjudicative proceedings that are conducted by the Water Board to gather information and develop a formal record so that a Decision or Order can be made on a matter within the Water Board jurisdiction. Hearings may be held for water right enforcement actions, denial or granting of a petition, adoption of a rule or regulation, or assessing facts related to Water Board programs.

AGENCY: WATER BOARDS

Delta Watermaster

The Delta Watermaster is an independent officer of the state, appointed to a four-year term by the Water Board. The Watermaster is responsible for monitoring and enforcing Water Board orders and licenses or permit terms and conditions within the legal boundaries of the Sacramento-San Joaquin Delta.

AGENCY: WATER BOARD

Delta Plan Certification of Consistency

The Delta Reform Act and its implementing regulations require that state and local agencies that propose to carry out, fund, or approve projects in the Delta must certify their projects' consistency with the Delta Plan's regulatory policies prior to implementation.

AGENCY: DSC

Cannabis Water Quality and Water Rights Oversight

CDFA ensures public safety and environmental protection by licensing, regulating commercial cannabis cultivators, and managing the state's track-and-trace system in California. The Water Board has developed a Cannabis Policy in collaboration with other state agency partners that establishes requirements for diversion and use of water to protect water quality from potential degradation resulting from cannabis cultivation. CDFW requires a Lake and Streambed Alteration Agreement when a project activity may substantially adversely affect fish and wildlife resources. Additionally, CDFW commenced a pilot evaluation of water needs for cannabis cultivation and the subsequent effects to aquatic habitat and wildlife.

AGENCY: CDFA, WATER BOARD, CDFW

Water Board Climate Change Program

Water Board staff provide data and input for the state's climate change assessments and coordinate agency efforts to incorporate climate change information into permitting and policy. The Water Board incorporates climate change into basin planning efforts, developing regional climate change strategies, and resolutions.

AGENCY: WATER BOARD, WATER BOARDS

Climate Vulnerability Assessment and Adaptation Strategy for the Delta

This initiative will assess climate-related risk to key sectors, assets and resources, and services, and evaluate potential responses. This work will help the state prioritize future adaptation investments in the Delta and provide a toolkit of information to support planning for long-term resilience.

AGENCY: DSC

Wetlands Restoration for Greenhouse Gas Reduction Program

CDFW coordinates with California Air Resources Board on approved methodologies to estimate and report on greenhouse gas benefits. Eligible projects include coastal tidal wetlands, Sacramento-San Joaquin Delta wetlands, mountain meadows, and seasonal inland wetlands.

AGENCY: CDFW

DWR Climate Change Program

DWR's climate change program implements climate mitigation and adaptation measures to ensure that Californians have an adequate water supply, reliable flood control, and healthy ecosystems, now and in the future. The following efforts support climate change adaptation:

The Atmospheric River (ARs) Research Program observes and forecasts ARs to help flood emergency response and manage volumes of water for use as snowpack vanishes.

DWR prepares annual hydroclimate reports which include a compilation of indicators and graphical visualization of data trends for hydrology and climate in California.

A climate change screening analysis protocol informs how best to address climate change in a project.

A climate change decision scaling approach supports watershed-scale climate change adaptation for future hydrologic conditions by providing risk assessment.

AGENCY: DWR

Climate Change Consortium

CDFA formed the Climate Change Consortium for Specialty Crops in 2012 and the Climate Change Consortium, Southern California region, in 2019. The Consortia bring together farmers and ranchers with academic experts and representatives of agricultural support services. The final report from 2013 and recent regional efforts summarize the potential impacts of climate change to California's specialty crop industry and outline the recommendations of the Consortium based on diverse expertise.

AGENCY: CDFA

Flood Management Programs

DWR is responsible for flood management activities at the state level and has developed several programs to prepare for and respond to flood events.

The Systemwide Flood Risk Reduction Program is responsible for implementation of systemwide multi-benefit flood management projects that accommodate higher flood flows due to climate change and create opportunities for habitat restoration.

The Flood Emergency Response Program helps prepare communities and water management entities to respond to flood emergencies through flood project inspections, river forecasting support, climatology and meteorology support, reservoir operations, and decision support systems.

The State Plan of Flood Control Maintenance Program, in coordination with the Central Valley Flood Protection Board, is responsible for operating and maintaining over 300 miles of federally constructed flood control features in the Central Valley.

DWR developed and the Flood Board adopted the Central Valley Flood Protection Plan, which inventories and assesses flood risk reduction actions needed to improve and modernize the flood system to address multiple benefits and also the effects of climate change.

DWR and the Flood Board developed the Central Valley Flood Protection Plan Conservation Strategy, which identifies and analyzes floodplain restoration opportunities to inform multi-benefit projects that help address anticipated climate change impacts in the Central Valley.

The Division of Multi-Benefit Initiatives prepared the California Flood Future Report that evaluates statewide flood management and flood risk reduction needs and provides recommendations for modernizing the flood system to address the effects of climate change.

AGENCY: DWR

Flood-MAR

Flood-MAR is an integrated and voluntary resource management strategy that uses flood water resulting from, or in anticipation of, rainfall or snow melt for managed aquifer recharge (MAR). DWR is collaborating with the Merced Irrigation District to evaluate how Flood-MAR could assist with future water needs. Likewise, the Tuolumne Study is investigating an approach to assess climate change impacts and adaptation strategies for reservoir operations.

AGENCY: DWR

California Water Plan

The California Water Plan is the state's strategic plan for sustainably managing and developing water resources for current and future generations. The California Water Plan is required by statute to be updated every five years and describes status and trends of California's water-dependent natural resources; water supplies; and agricultural, urban, and environmental water demands for a range of plausible future scenarios.

AGENCY: DWR

Urban Water Management Plans (UWMPs)

Every urban water supplier that either provides over 3,000 acre-feet of water annually or serves more than 3,000 urban connections is required to submit an UWMP to DWR. In all, 450 urban water suppliers report on existing urban demands. These plans cover more than 90 percent of the state's population and include 20-year projections of water supply and demand.

AGENCY: DWR

Agricultural Water Management Plans

The Water Conservation Act of 2009 requires agricultural water suppliers serving more than 25,000 irrigated acres to adopt and submit to DWR an Agricultural Water Management Plan. These plans must include reports on the implementation status of specific Efficient Water Management Practices. DWR provides annual agricultural water budget resources and technical assistance. These plans consider climate change impacts.

AGENCY: DWR

Small Suppliers and Rural Communities at Water Shortage Risk

Conservation legislation passed in 2018 requires DWR, in coordination with stakeholders and other state agencies, to identify small suppliers and rural communities at risk of drought and water shortage vulnerability.

DWR will prepare a legislative report by January 2020 on the development and implementation of countywide drought and water shortage contingency plans.

AGENCY: DWR

SGMA Portal and SGMA Data Viewer

The Sustainable Groundwater Management Office developed SGMA Portal and SGMA Data Viewer. These tools allow various SGMA-related regional datasets to be combined to perform assessments of groundwater supply and demand.

AGENCY: DWR

Bulletin 118 2020

DWR prepares Bulletin 118, an inventory and assessment of California's groundwater. This Bulletin informs decisions affecting the protection, use, and management of groundwater as well as supply and use statewide for each hydrologic region.

AGENCY: DWR

SGMA Technical Support Services Program

The Sustainable Groundwater Management Office provides guidance and support to local agencies enabling them to collect important baseline data, which allows for the continued improvement of models used to inform management and policy decisions.

AGENCY: DWR

Delta Ecosystem Enhancement Program

This DWR program helps maintain flood system-related natural infrastructure (restored wetlands) and contributes to supporting and maintaining Delta levee system integrity for water supply reliability.

AGENCY: DWR

Regional Flood Management Plans

Regional flood Management plans are developed with state support by the local stakeholders responsible for planning future flood system improvements and multi-benefit environmental projects consistent with the Central Valley Flood Protection Plan, as well as operations and maintenance of the existing State Plan of Flood Control, which involves 1,600 miles of levees.

AGENCY: DWR, FLOOD BOARD

Emergency Management Program

The Water Boards are tasked with protecting California’s surface and groundwater quality and drinking water supplies and wastewater functionalities during initial emergency response following disasters as well as long-term recovery efforts.

AGENCY: WATER BOARDS

Delta Levee Investment Strategy and Program Management Plan

The DSC and DWR, in cooperation with the Flood Board, are developing a project management plan for co-maintenance and implementation of the Delta Levee Investment Strategy. A Delta Plan amendment prioritizes discretionary, state investments for Delta levee improvements, based on an island’s flood probability and risks to life, property, water supply, habitat, and Delta as Place under several future time periods and scenarios.

AGENCY: DSC, DWR, FLOOD BOARD

Regional Office Tribal/Regional Technical Assistance Program

DWR and its Regional Offices work with tribes, disadvantaged communities, and other local entities to provide assistance for project design, coordinating studies, and assessing hydrology, geology, geomorphology, habitat conditions, and environmental compliance.

AGENCY: DWR

Consistency of Local and Regional Planning Documents with Delta Plan

The Delta Reform Act requires the Council to review and provide advice to local and regional planning agencies for their plans associated with sustainable communities strategies and alternative planning strategies.

AGENCY: DSC

Regional Conservation Investment Strategies (RCIS)

Assembly Bill 2087 (2016) established RCIS to create a tool for better infrastructure and conservation regional planning. DWR is currently involved in two RCIS—one in Yolo County and one in the mid- and upper-Sacramento River region. RCIS are high-level planning documents that describe both infrastructure needs and conservation opportunities in a region.

AGENCY: DWR

Delta Nutrient Research Plan

The Delta Nutrient Research Plan will identify research and modeling needs to determine whether water quality objectives for nutrients can address problems of harmful algal blooms, limited food supplies for native fish, invasive aquatic plants, and low dissolved oxygen in the Delta.

AGENCY: WATER BOARD

Integrated Regional Water Management (IRWM) Plans

The IRWM Planning Act of 2002 (SB 1672) and California Water Code require the development of an IRWM Plan in order to receive allocated grant funding from voter-approved bond measures (Propositions 50, 84, 1E and 1). DWR is legislatively tasked to approve the formation of IRWM plans for consistency with statutory and regulatory requirements. Since the passage of SB 1672, 48 IRWM regions have been formed that cover 87 percent of the state’s area and 99 percent of its population. The program provides a foundation for collaborative, integrated work to build regional resilience.

AGENCY: DWR, WATER BOARDS

Yolo Bypass Partnership

The Yolo Bypass-Cache Slough Partnership (Partnership) includes 16 state, federal, and local agencies signatory to a 2016 memorandum of understanding collaborating in implementation of multi-benefit projects in the region. The Partnership is proposing efforts to address common policy issues, such as programmatic permitting, so the more than 20 projects under development can efficiently move to construction.

AGENCY: DWR

Instream flow recommendations

CDFW develops instream flows to ensure that stream flows are maintained at levels that are adequate for long-term protection, maintenance, and stewardship of fish and wildlife resources.

AGENCY: CDFW

Regional Office Projects/ Implementation

The Division of Regional Assistance collaborates with other state and local agencies to develop projects related to water resource management, habitat enhancement, river restoration, and other ecosystem projects. Projects involve the Salton Sea, the San Joaquin River Restoration, and fish passage efforts.

AGENCY: DWR

Fish Passage Improvement Program (FPIP)

Staff from the Division of Multi-Benefit Initiatives plan and implement fish passage projects to modify or remove instream barriers which impede migration and spawning of anadromous fish. This program also maintains an inventory of migration barriers and salmonid habitats both upstream and downstream of on various rivers and streams throughout the state.

AGENCY: DWR

California Fish Passage Forum

In 2001, the Natural Resources Secretary created a forum of state and federal government, non-government, and private entities to address instream barriers and screens impacting salmon and steelhead migration. The group is the California Fish Passage Forum and is now a national fish habitat partnership.

AGENCY: CDFW

Salton Sea Program

The Salton Sea Management Program (SSMP) Phase I is a 10-year plan to provide dust-suppression and bird and fish habitat development in the Salton Sea. DWR staff are developing the Species Conservation Habitat Project that will encompass approximately 3,770 acres.

AGENCY: DWR

Salton Sea

The Water Board regularly monitors and assesses progress on the implementation of the Salton Sea Task Force Management Program. The Water Board holds annual workshops on the progress of remediation efforts underway at the Sea.

AGENCY: WATER BOARD

EcoRestore Initiative

This Natural Resources Agency initiative implemented a program to develop and restore at least 30,000 acres of habitat in the Sacramento-San Joaquin Delta. Staff from the Division of Multi-Benefit Initiatives are coordinating development of 30 restoration projects. Over 9,000 acres of tidal wetland restoration in the Delta will be realized by 2021.

AGENCY: DWR

Watershed Coordinator Program

The Watershed Coordinator Program builds capacity at resource conservation districts and other non-profit partners with grants for dedicated watershed coordinator positions to prioritize watershed needs and projects to meet state and local water, biodiversity, and forestry goals. Watershed coordinator positions are locally-based and integrated into state and local watershed planning processes.

AGENCY: DEPARTMENT OF CONSERVATION"

Integrated Watershed Management Program

DWR's Integrated Watershed Management Program is responsible for advancing policies, programs, and projects that integrate and provide multiple benefits including ecosystem restoration elements, flood management, and local water supply. The following programs work to achieve this direction:

The North Delta Program implements projects proposed under the North Delta Flood Control and Ecosystem Restoration Project to advance ecological restoration and reduce regional flood risk.

The West Delta Program addresses subsidence on DWR-owned land in the west Delta by constructing wetlands, growing rice, and studying greenhouse gas sequestration.

The San Joaquin Fish Population Enhancement Program implements projects that benefit native fish populations, with a focus on salmon and steelhead in the lower San Joaquin River watershed.

The Dutch Slough Restoration Project is a multi-benefit habitat restoration project that restores uplands and tidal marsh.

The Riverine Stewardship Program makes funding available for planning and implementation of projects that restore streams, creeks, and rivers to enhance the environment for fish, wildlife, and people.

The North Delta Flow Action study monitors pulse flow through the Yolo Bypass to identify increases in phytoplankton production which is a key measurement of Delta smelt food supply.

AGENCY: DWR

Refuge Water Supply/Wildlife Areas

CDFW manages water resources for more than 700 properties totaling more than 1.2 million acres. This involves a variety of water use purposes including wildlife habitat management on wildlife areas and ecological reserves and the production of salmon and trout at CDFW-managed fish hatcheries.

AGENCY: CDFW

Hatchery Water Supply and Quality

During the 2012-2016 statewide drought, CDFW upgraded equipment at state hatcheries to use less water and improve water quality and temperature for fish health. Five of 24 facilities have been upgraded.

AGENCY: CDFW

Nutrient Management Training Program

Through its Fertilizer Research and Education program, CDFA develops and deploys training for farmers, ranchers and crop consultants to improve management of agricultural nitrogen and to protect groundwater and surface water resources from excess nitrogen applied to cropland. Since 2014, the department has collaborated with the University of California and numerous farming organizations to provide specialized training to over 4,300 farmers and 1,000 Certified Crop Advisors.

AGENCY: CDFA, SWRCB

State Water Project

The California State Water Project (SWP) is a water storage and delivery system of reservoirs, aqueducts, power plants and pumping plants. Operated by DWR, the SWP is the nation's largest state-built, multi-purpose, user-financed water project. It supplies water to more than 27 million people in northern California, the Bay Area, the San Joaquin Valley, the Central Coast, and Southern California. The SWP also provides irrigation to about 750,000 acres of farmland. High-priority programs to ensure a continued reliable water supply include:

A Climate Action Plan-Vulnerability Assessment evaluates, describes, and quantifies the vulnerabilities of DWR's assets and business activities to climate change.

Water supply and water demand assessments are performed regularly as part of SWP operations to meet near- and long-term needs of SWP water users. These assessments include: monthly SWP water allocation studies; monthly SWP loads and resources studies; the annual Management of the SWP report (Bulletin 132); and the annual SWP maintenance schedule.

The California Aqueduct Subsidence Study is assessing the effects of subsidence and identifying options to ensure reliability of the California Aqueduct.

DWR adopted an asset management policy and risk framework to inform development of the SWP's long-term investment plan for aging infrastructure.

The SWP's dam safety policy, strategy, and program are reviewed and updated regularly to ensure the safety of the public and reliability of SWP dam-related infrastructure. An annual report is submitted to the Federal Energy Regulatory Commission.

The SWP Water Quality Program conducts water quality assessments regularly on water bodies of the SWP.

The Municipal Water Quality Program (MWQP) monitors, forecasts, and reports on Sacramento-San Joaquin Delta and SWP water quality constituents that affect drinking water quality. MWQP generated data are incorporated in models to provide information to the urban State Water Contractors on source water conditions.

Suisun Marsh Salinity Control Gates Reoperation Study is assessing various strategies to control salinity intrusion into the marsh during the summer.

The SWP hydropower facilities are operated under licenses issued by the Federal Energy Regulatory Commission (FERC). The FERC licenses were issued

with 50-year terms and are currently being renewed for Oroville, Warner/Castaic, and Devil Canyon facilities.

The SWP must operate in conformance with regulatory permit requirements including Water Right Decision 1641 and Biological Opinions issued by the U.S. Fish and Wildlife Service and National Marine Fisheries Service.

AGENCY: DWR

Delta Conveyance Project

The current administration supports a single tunnel Delta conveyance concept. DWR would need to lead the environmental planning for the project and coordinate with the Delta Conveyance Design and Construction Authority (DCA) on engineering activities. When appropriate, DWR would submit Change Petitions to the Water Board for processing to change any necessary points of diversion. Additionally, DWR would need to consult with the CDFW to obtain compliance with the California Endangered Species Act. DWR would also need to evaluate the project for consistency with the DSC Delta Plan.

AGENCY: DWR, WATER BOARD, CDFW, DSC

Bond Funding for Water Use Efficiency Projects

DWR's Water Use Efficiency (WUE) Program awards grants for both urban and agricultural water use efficiency projects throughout the state, including pilot and demonstration projects to improve irrigation practices; outreach, training, and technical assistance; rebate programs such as for turf and toilets; mobile irrigation lab assessments; and infrastructure improvements. Since 2004, the WUE Program has provided more than 260 grants ranging from \$10,000 to \$3 million to communities throughout California.

AGENCY: DWR

Integrated Regional Water Management (IRWM) Grant Programs

Since 2006, the IWRM Grant programs funded by voter-approved bonds (Propositions 50, 84, and 1) have provided over \$1.5 billion in grants to communities in 48 IRWM regions, matched by \$4 billion in local investments, to fund nearly 1,300 planning and implementation projects that provide multiple benefits throughout the state. Since 2016, nearly \$52 million has been awarded to incentivize engagement of traditionally underrepresented communities in the program. DWR has worked with the 48 IRWM regions to schedule award of an additional \$400 million in Proposition 1 funding in 2020-22.

AGENCY: DWR, WATER BOARD

Sustainable Groundwater Management Grant Programs

Since 2016, DWR has awarded over 100 grants and nearly \$93 million in Proposition 1 funding to help counties and Groundwater Sustainability Agencies (GSAs) comply with SGMA. DWR will award another \$150 million or more in Proposition 68 funding in 2020-22 to further help GSAs with development of plans and implementation of groundwater projects.

AGENCY: DWR

Water Energy Grant Program

In 2014-16, funded by the Greenhouse Gas Reduction Fund, the Water-Energy Grant Program provided \$46 million in grants to implement 39 projects designed to reduce greenhouse gas emissions, water use, and energy use. The program has benefitted nearly 90,000 households within disadvantaged communities, and has resulted in over 200 billion gallons of water saved and a reduction of over 337 metric tons of greenhouse gas emissions.

AGENCY: DWR

State Water Efficiency and Enhancement Program (SWEEP)

CDFA's SWEEP provides financial incentives for agricultural operations to invest in water irrigation and/or distribution systems that save water and reduce greenhouse gas emissions. Since 2014, the program has received \$87.1 million in greenhouse gas reduction fund and bond allocations and funded 725 projects. These projects have an estimated annual water savings of 110,000 acre-feet.

AGENCY: CDFA

Delta Levee System Integrity Program

The Delta Levee System Integrity Program provides local assistance grants and subventions to flood management agencies in the Delta for levee improvements.

AGENCY: DWR, FLOOD BOARD

Urban Streams Restoration Program (USRP)

DWR's USRP provides grants to local communities for projects to reduce flooding, erosion, and associated property damage; restore, enhance, or protect the natural ecological values of streams; and promote community involvement, education, and stewardship. Since 1985, the USRP has provided more than 270 grants ranging from \$1,000 to \$1 million to communities throughout California. The USRP is currently working to distribute an additional \$9.4 million to projects in 2020.

AGENCY: DWR

Water Storage Investment Program

Proposition 1 of 2014 dedicated \$2.7 billion for investments in water storage projects. In 2018, the California Water Commission (CWC) made conditional funding determinations to 8 projects. Project applicants are currently obtaining statutory requirements prior to receiving a final funding award. The CWC works with CDFW, Water Board, and DWR to achieve the program goals.

AGENCY: DWR, CDFW, WATER BOARD

Nonpoint Source Pollution (NSP) Control Program

The NPS Program administers grant money it receives from U.S. Environmental Protection Agency through the federal Clean Water Act and from the state Timber Regulation and Forest Restoration Fund. These grant funds can be used to implement projects or programs that will help to reduce NPS pollution.

AGENCY: WATER BOARDS

Safe and Affordable Drinking Water Implementation

The Water Board is charged with implementing key provisions of the California Safe Drinking Water Act. Governor Newsom signed Senate Bill 200 in July 2019, creating the Safe and Affordable Drinking Water Fund to help water systems provide an adequate and affordable supply of safe drinking water in both the near and long terms. The Fund provides \$130 million through 2030 for comprehensive and sustainable provision of safe drinking water to all Californians.

AGENCY: WATER BOARD

Funding Programs for Capital Projects and Urgent Drinking Water Needs

Since 2010, the state has provided over \$3 billion in assistance to address safe and affordable drinking water needs through capital projects to replace, repair, and improve aging infrastructure and create new treatment systems. The Water Board also has provided millions of dollars to address emergency drinking water needs. In addition, the Water Board has provided millions to assess and cleanup groundwater contamination that impairs drinking water aquifers. The Drinking Water State Revolving Fund, bond funds, Site Cleanup Subaccount,

general fund, and Cleanup and Abatement Account are the sources of funding for these various programs. The Water Board also funds a wide variety of capital projects to improve water quality through its Clean Water State Revolving Fund Program.

AGENCY: WATER BOARD

Beach Safety Program

The Water Boards distribute funds to 17 local agencies to conduct water quality monitoring of ocean beaches along the coast of California as part of the Safe to Swim Network. The funds provide public notification of swimming safety at ocean beaches through ambient bacteria sampling, reporting, and, if needed, posting warning signs or closing beaches. Beaches are sampled at least weekly between April 1 and October 31.

AGENCY: WATER BOARDS

USACE Flood Risk Reduction Projects

DWR partners with U.S. Army Corps of Engineers to implement an \$8.7 billion cost-share program that partners with local, state, and federal agencies to implement projects that reduce flood risk for people, infrastructure assets, and over 550,000 acres in urban areas within the Central Valley.

AGENCY: DWR, FLOOD BOARD

Small Community Flood Risk Reduction Program (SCFRR)

This is a cost-share program implemented by DWR to assist communities to achieve up to 100-year flood protection. The SCFRR Program addresses flood risk to Central Valley small communities with consideration for disadvantaged communities.

AGENCY: DWR, FLOOD BOARD

Restoration Grant Program - Proposition 1

CDFW administers two grant programs associated with restoration. The Watershed Restoration Grant Program focuses on restoration projects of statewide importance outside of the Sacramento-San Joaquin Delta and the Delta Water Quality and Ecosystem Restoration Grant Program focuses on projects that benefit the Delta.

AGENCY: CDFW

Restoration Grant Programs - Proposition 68

\$85 million of Proposition 68 has been allocated for projects statewide that support CDFW’s mission across three priorities, Rivers and Streams Grants, Southern Steelhead Grants, and Fish and Wildlife Improvement Grants.

AGENCY: CDFW

Delta Science Program: Critical Science Investigations

The statutorily-mandated mission of the Delta Science Program is to provide the best available, unbiased scientific information to inform decision-making in the Delta, which is required to be achieved, in part, through the funding of research. As part of the Delta Water Quality and Ecosystem Restoration Grant Program awarded by CDFW under Proposition 1, the Delta Science Program continues to collaborate with CDFW to fund projects that support pre-restoration monitoring, restoration design synthesis, and real-time decision support tool evaluation.

AGENCY: DSC, CDFW

Healthy Soils Program

The Healthy Soils Program stems from the California Healthy Soils Initiative, a collaboration of state agencies and departments to promote the development of healthy soils on California’s farmlands and ranchlands. CDFA’s healthy soils program incentivizes on-farm practices and demonstration projects for soil management practices that sequester carbon, reduce atmospheric greenhouse gas, and improve soil health. The program has received \$22.5 million from Greenhouse Gas Reduction Fund and bond allocations from 2016-19 and an additional \$28 million for 2019-20. The program has awarded 623 projects on over 57,000 acres.

AGENCY: CDFA

Technical Assistance Grant Program

Per Assembly Bill 2377 (2018), CDFA allocates five percent of the Healthy Soils, State Water Efficiency and Enhancement Program and Alternative Manure Management Grant dollars for technical assistance to implement those practices. To date, CDFA has funded \$1.582 million in technical assistance grants.

AGENCY: CDFA

Fertilizer Research and Education Grant Program

The Fertilizer Research and Education program collects yearly about \$3 million from fertilizer fees to administer the program and to fund research and education to minimize the environmental impacts of fertilizer use, including nitrate in groundwater and greenhouse gases. Funding has supported implementation of the Water Boards Irrigated Lands Regulatory Program.

AGENCY: CDFA

Watershed Improvement Program

Under the Sierra Nevada Watershed Improvement Program, the Sierra Nevada Conservancy issues grants to public agencies, non-profits, and eligible tribes for projects that support healthy watersheds and forests, strategic conservation, resilient Sierra Nevada communities, and vibrant recreation and tourism.

AGENCY: SIERRA NEVADA CONSERVANCY

Forest Health Grant Program

Through the California Climate Investments Forest Health Grant Program, CAL FIRE funds projects that proactively restore forest health to reduce greenhouse gases, protect upper watersheds where the state’s water supply originates, promote the long-term storage of carbon in forest trees and soils, minimize the loss of forest carbon from wildfire, and further the goals of the California Global Warming Solutions Act of 2006 (AB 32).

AGENCY: CAL FIRE

