

# WATER FOR AGRICULTURE – TODAY AND TOMORROW

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## ABSTRACT

California is a state of diversity in terms of cultures, ecosystems, geography, and hydrology, bringing distinct challenges to the management of groundwater and surface water resources. Three recent years show marked variation in the amount and relative proportion of the water delivered to urban and agricultural sectors and water dedicated to the environment. During dry years, water dedicated to the environment is curtailed sharply and less water is available for agriculture. In the future, water management challenges will be more complex as population increases, demand patterns shift, environmental needs are better understood, and global climate change and other effects on the state's water resources and systems become more evident. As a strategic planning document, the California Water Plan Update provides California's water communities with a vision, mission, and goals for meeting challenges of sustainable water use through 2030 in the face of uncertainty.

**Key Words: irrigation, agriculture, water planning**

## INTRODUCTION

California is a state of diversity in terms of cultures, ecosystems, geography, and hydrology. This diversity brings distinct challenges to the management of groundwater and surface water resources. Most of the snow and rain fall in the mountains; most of the water is used in the valleys and coastal plains. Precipitation totals vary from year to year and from place to place. Wet years can bring the threat of floods; drought years put pressure on available water supplies.

California's diversity brings distinct challenges to the management of our water resources. Over the past 50 years, we have been able to meet our water demands primarily through an extensive network of water storage and conveyance facilities, groundwater development, and, more recently, by improving water use efficiency. In most years, California meets most of its agricultural, municipal, and industrial water management objectives through an extensive network of water storage and conveyance facilities, groundwater development, and, more recently, by improving water use efficiency.

A big challenge now and for the future is to make sure water is in the right places at the right times. Challenges will be greatest during dry years, when water dedicated to the environment is curtailed sharply and less water is available for agriculture. Greater reliance on groundwater during dry years results in higher costs for many users. At the same time, water users who have already increased efficiency may find it more challenging to achieve additional water use

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reductions during droughts. As competition grows among water users, water management during dry years will become more complex and, at times, contentious.

### WATER TODAY

California’s water balance can vary significantly from year to year. Three recent years show marked variation in the amount and relative proportion of the following: water delivered to urban and agricultural sectors and water dedicated to the environment (applied water use); where the water came from (water source); and how much water was reused among sectors. Each year, applied water is only a portion of California’s total precipitation and inflows. The rest—about 120 million acre-feet in an average year—either evaporates, is used by native vegetation, provides rainfall for agriculture and managed wetlands, or flows out of state or to salt sinks.

**Figure 1: California water balance, 1998, 2000, and 2001.**

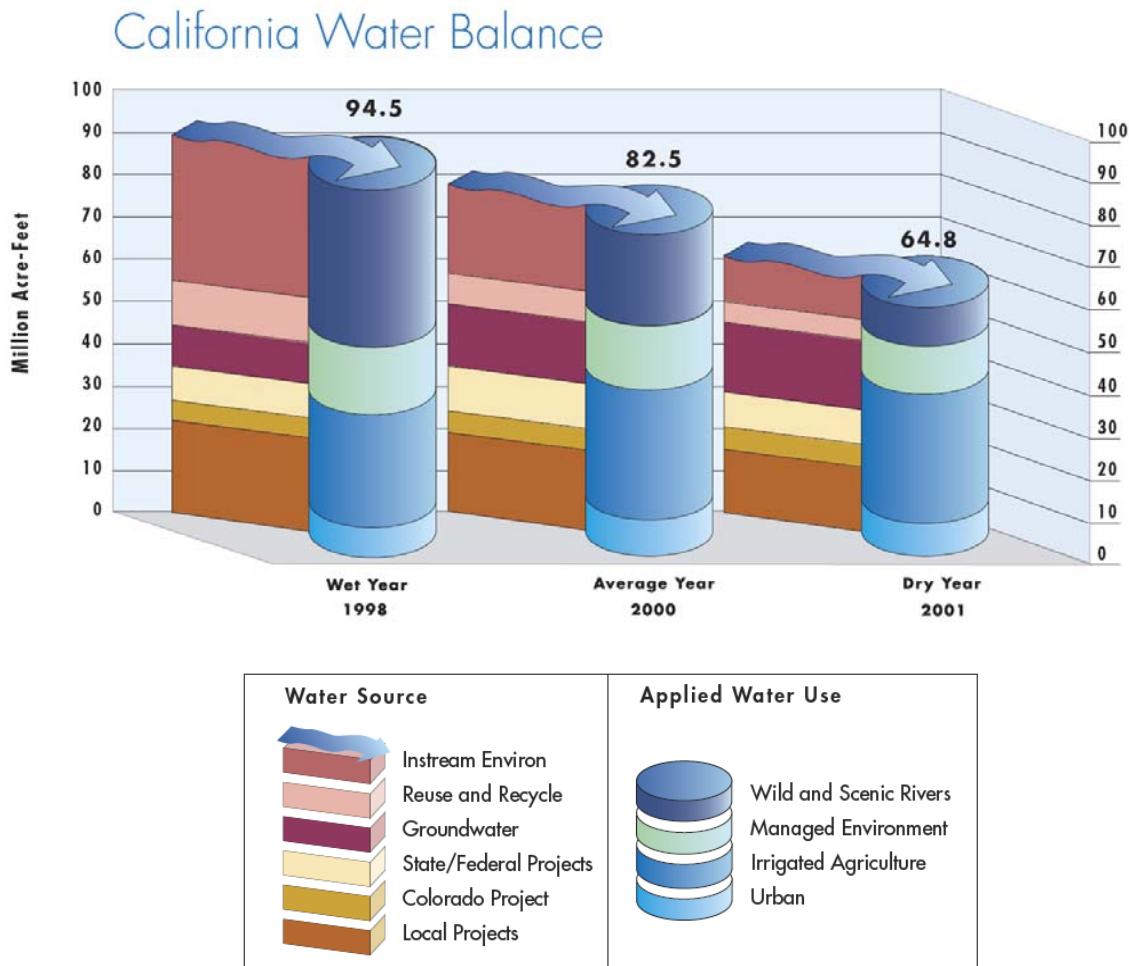
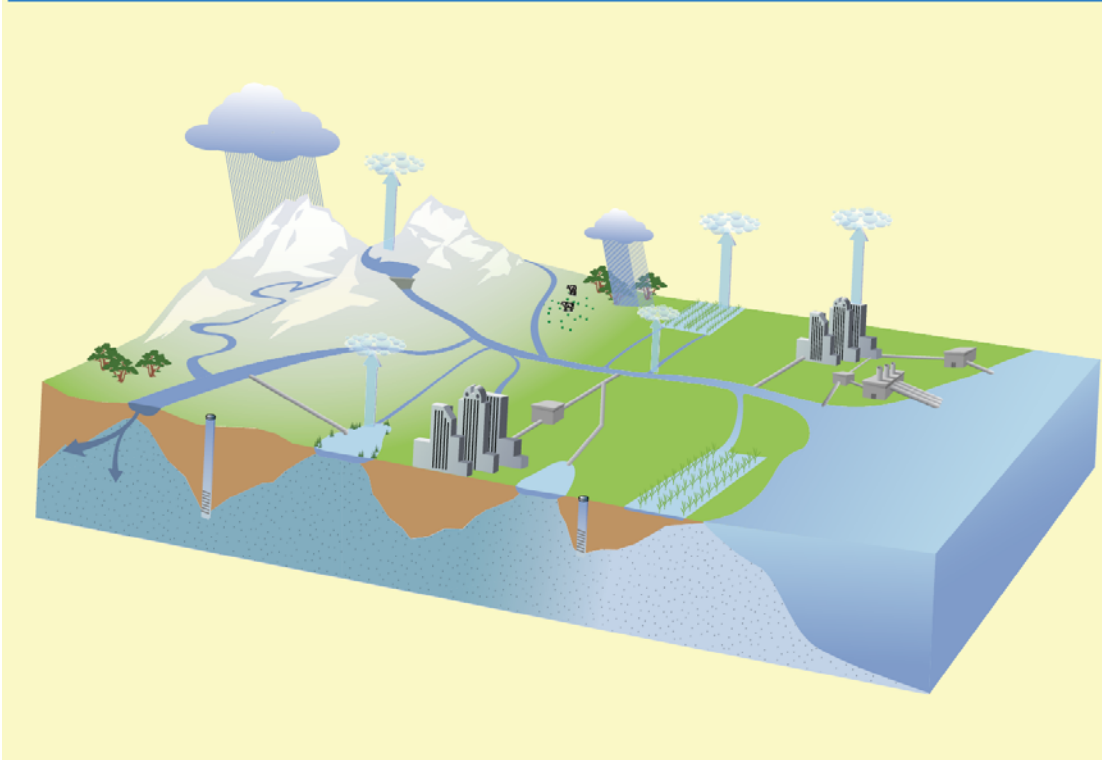


Table 1 summarizes the total supply and distribution of the dedicated supply to various uses within California for the three years evaluated. As indicated for wet (1998) and dry (2001) years,

the total supply and the distribution of the dedicated supply to various uses do change significantly, compared to the average year 2000 values.

**Table 1: California water summary (maf)**

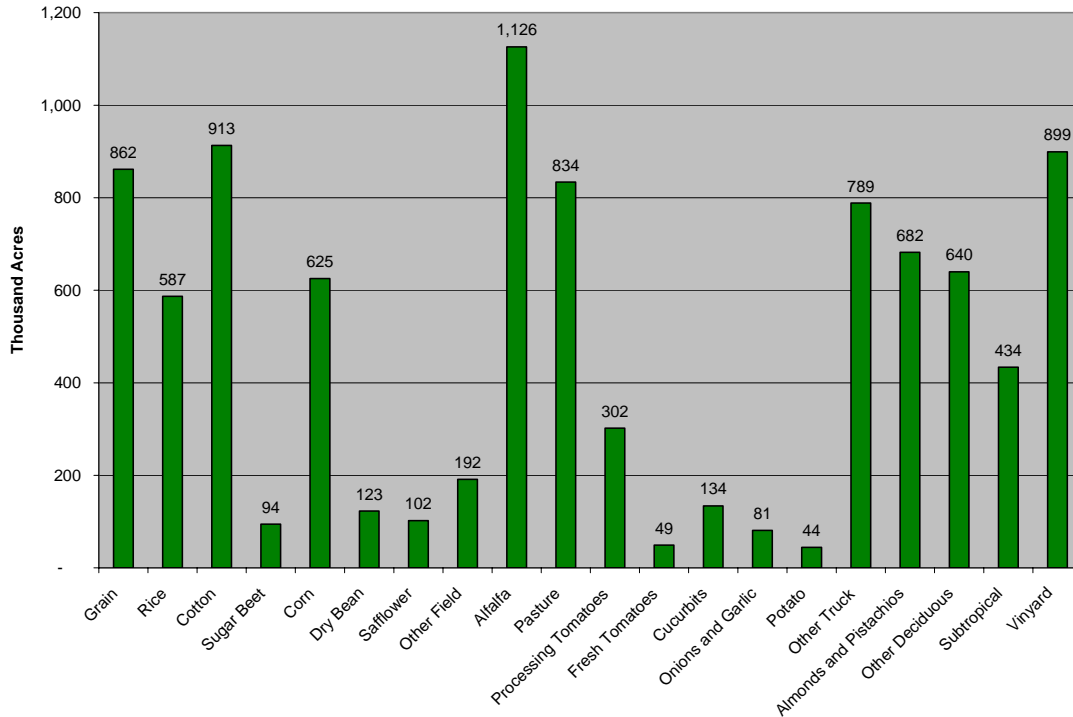
	1998 (171% of normal) <sup>a</sup>	2000 (97% of normal) <sup>a</sup>	2001 (72% of normal) <sup>a</sup>
Total supply (precipitation & imports)	336.9	194.7	145.5
Total uses, outflows, & evaporation	331.5	200.4	159.9
Net storage changes in state	5.5	-5.7	-14.3
<b>Distribution of dedicated supply (includes reuse) to various applied water uses</b>			
Urban uses	7.8 (8%)	8.9 (11%)	8.6 (13%)
Agricultural uses	27.3 (29%)	34.2 (41%)	33.7 (52%)
Environmental water <sup>b</sup>	59.4 (63%)	39.4 (48%)	22.5 (35%)
<b>Total dedicated supply</b>	<b>94.5</b>	<b>82.5</b>	<b>64.8</b>
maf = million acre-feet			
a. Percent of normal precipitation. Water year 1998 represents a wet year; 2000, average water year; 2001, drier water year.			
b. Environmental water includes instream flows, wild and scenic flows, required Delta outflow, and managed wetlands water use. Some environmental water is reused by agricultural and urban water users.			



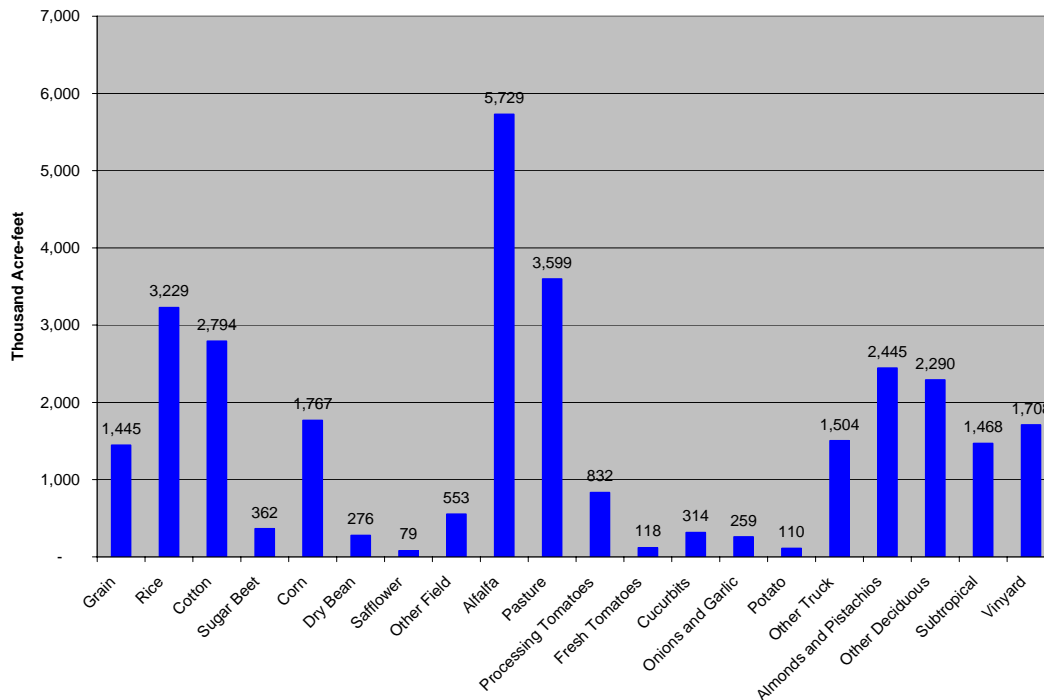
***Focus on Agriculture Today.*** California's geography and Mediterranean climate have allowed the state to become one of the most productive agricultural regions in the world. California produces over 250 different crops and leads the nation in production of 75 commodities. In an average hydrologic year, agriculture uses about 34 million acre-feet of irrigation water on about 9.5 million acres of irrigated land. Alfalfa tops the list of irrigated crops in terms of irrigated

area and applied irrigation water. Figure 2 shows the irrigated crop area by crop group for 2000, a recent average hydrologic year. Figure 3 shows the amount of irrigation water applied to each crop group.

**Figure 2: Irrigated crop area (thousand acres) for twenty crop groups, 2000.**



**Figure 3: Applied irrigation water use (thousand acre-feet) for twenty crop groups, 2000.**



## WATER TOMORROW

In the future, water management challenges will be more complex as population increases, demand patterns shift, environmental needs are better understood, and global climate change and other effects on the state's water resources and systems become more evident. Because we don't know with certainty what will happen in the future, the latest California Water Plan Update includes three plausible yet very different baseline scenarios for 2030, rather than a single "likely future." These are not predictions and do not include new water agency-sponsored conservation programs or climate change effects. They are possible pictures of the future that depend on many assumptions and offer three water demand conditions for 2030. Each of these scenarios describes a different baseline for 2030, to which the water community would need to respond by implementing a mix of the management strategies:

***Current Trends.*** Recent trends continue for the following: population growth and development patterns, agricultural and industrial production, environmental water dedication, and naturally occurring conservation (like plumbing code changes, natural replacement, actions water users implement on their own, etc.).

***Less Resource Intensive.*** Recent trends for population growth, higher agricultural and industrial production, more environmental water dedication, and higher naturally occurring conservation than Current Trends (but less than full implementation of all cost-effective conservation measures currently available).

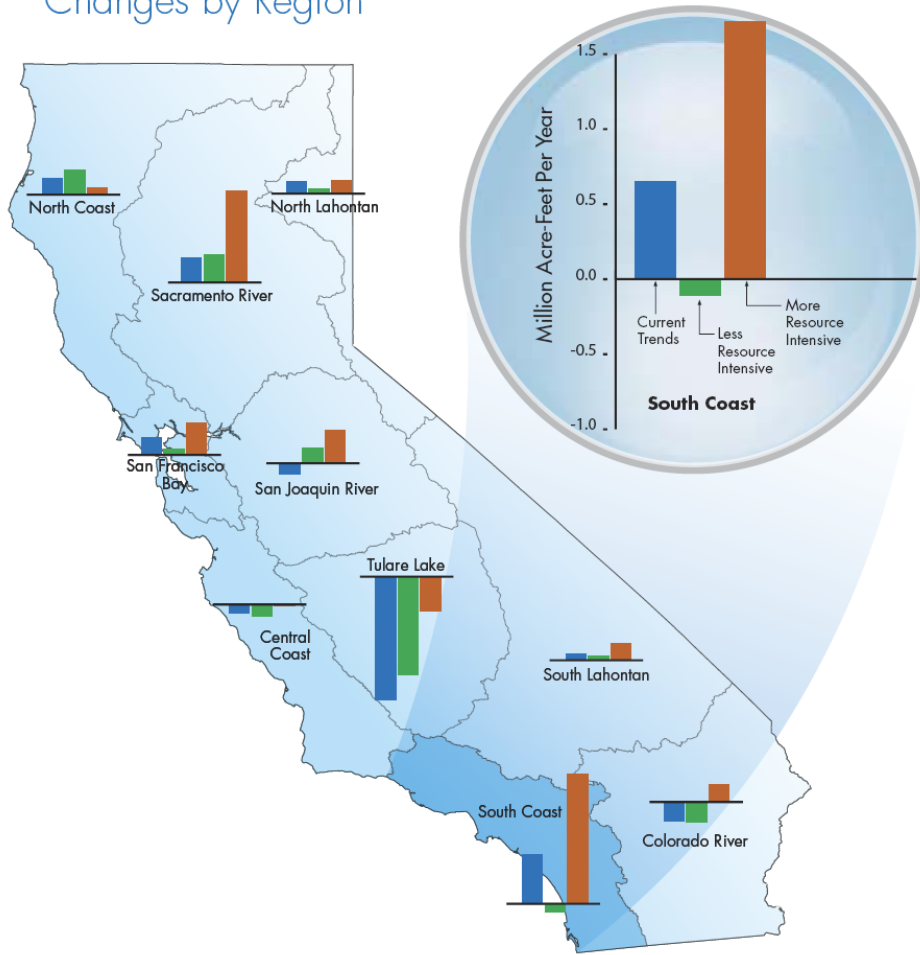
***More Resource Intensive.*** Higher population growth rate, higher agricultural and industrial production, no additional environmental water dedication (year 2000 level), and lower naturally occurring conservation than Current Trends.

These three scenarios include two kinds of water use efficiency actions: those that water users take on their own (called naturally occurring conservation), and those encouraged by water agency programs. Only naturally occurring conservation was varied among the scenarios, and all scenarios include the same continued implementation of cost-effective actions by water suppliers.

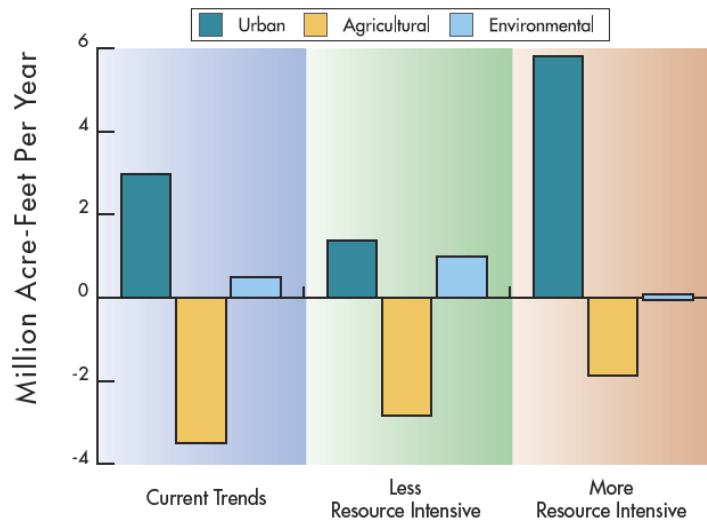
Figure 4 shows how water demands could change in average water years between 2000 and 2030 for three scenarios by hydrologic region. Figure 5 shows the changes statewide by water using sector. Figure 6 gives the net change statewide, plus groundwater overdraft.

***Resource Management Strategies.*** No single water resource management strategy is sufficient to meet future regional demands with so much variation possible from region to region and sector to sector. The state must ensure that each region can tailor responses to local conditions. We can achieve this most effectively by implementing integrated regional water management supported by strong statewide water management systems. Figure 7 lists the resource management strategies considered in the latest California Water Plan Update.

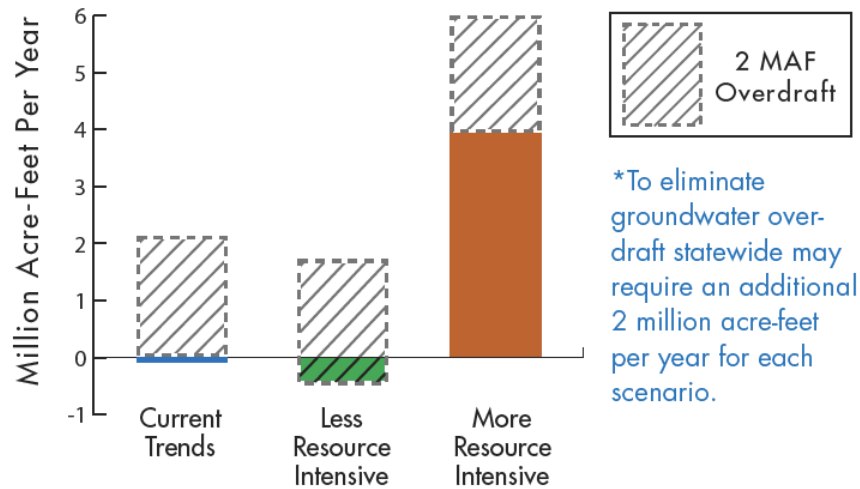
**Figure 4: Change in water use from 2000 by hydrologic region for three 2030 scenarios.**  
 Changes by Region



**Figure 5. Change in water use from 2000 by water use sector for three 2030 scenarios**



**Figure 6: Change in water use from 2000 statewide, plus groundwater overdraft.**



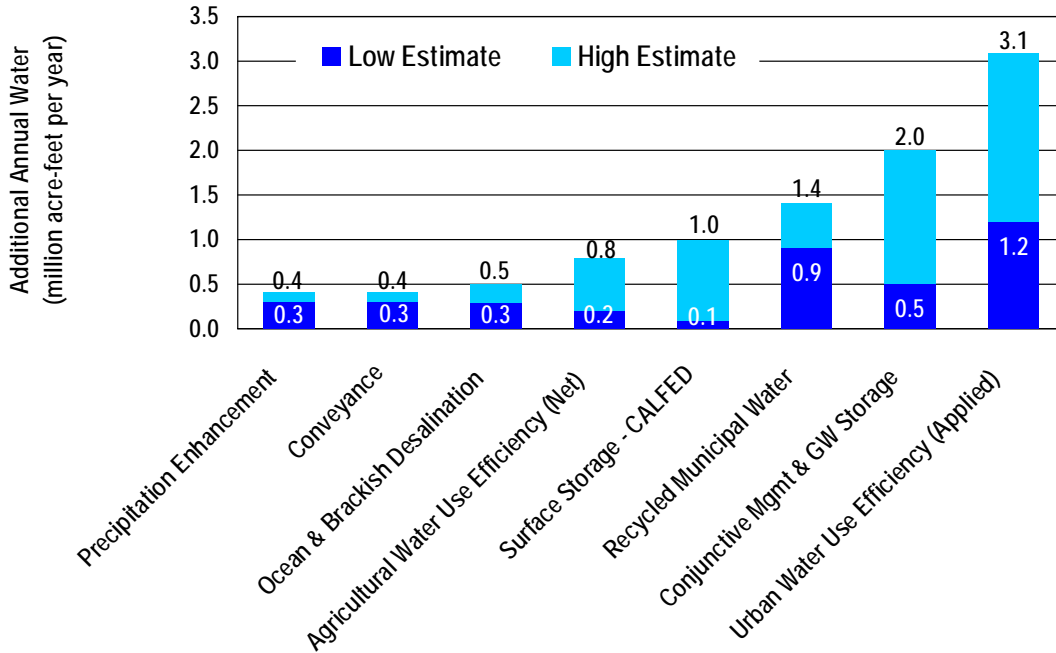
**Figure 7: Resource management strategies**

<p><b>Reduce Water Demand</b></p> <ul style="list-style-type: none"> <li>➤ Agricultural Water Use Efficiency</li> <li>➤ Urban Water Use Efficiency</li> </ul>	<p><b>Improve Operational Efficiency &amp; Transfers</b></p> <ul style="list-style-type: none"> <li>➤ Conveyance</li> <li>➤ System Reoperation</li> <li>➤ Water Transfers</li> </ul>
<p><b>Improve Water Quality</b></p> <ul style="list-style-type: none"> <li>➤ Drinking Water Treatment &amp; Distribution</li> <li>➤ Groundwater/Aquifer Remediation</li> <li>➤ Matching Quality to Use</li> <li>➤ Pollution Prevention</li> <li>➤ Urban Runoff Management</li> </ul>	<p><b>Increase Water Supply</b></p> <ul style="list-style-type: none"> <li>➤ Conjunctive Management &amp; Groundwater Storage</li> <li>➤ Desalination – Brackish &amp; Seawater</li> <li>➤ Precipitation Enhancement</li> <li>➤ Recycled Municipal Water</li> <li>➤ Surface Storage – CALFED</li> <li>➤ Surface Storage - Regional/Local</li> </ul>
<p><b>Practice Resource Stewardship</b></p> <ul style="list-style-type: none"> <li>➤ Agricultural Lands Stewardship</li> <li>➤ Economic Incentives (Loans, Grants, and Water Pricing)</li> <li>➤ Ecosystem Restoration</li> <li>➤ Floodplain Management</li> <li>➤ Recharge Areas Protection</li> <li>➤ Urban Land Use Management</li> <li>➤ Water-dependent Recreation</li> <li>➤ Watershed Management</li> </ul>	

**Range of Additional Water for Eight Resource Management Strategies.** Figure 8 shows the potential range of water demand reduction and supply augmentation for eight resource management strategies by 2030. Low estimates are shown in the lower section of each bar.

Estimates are from studies described in the Water Plan Update. The water benefits of these strategies are not always additive.

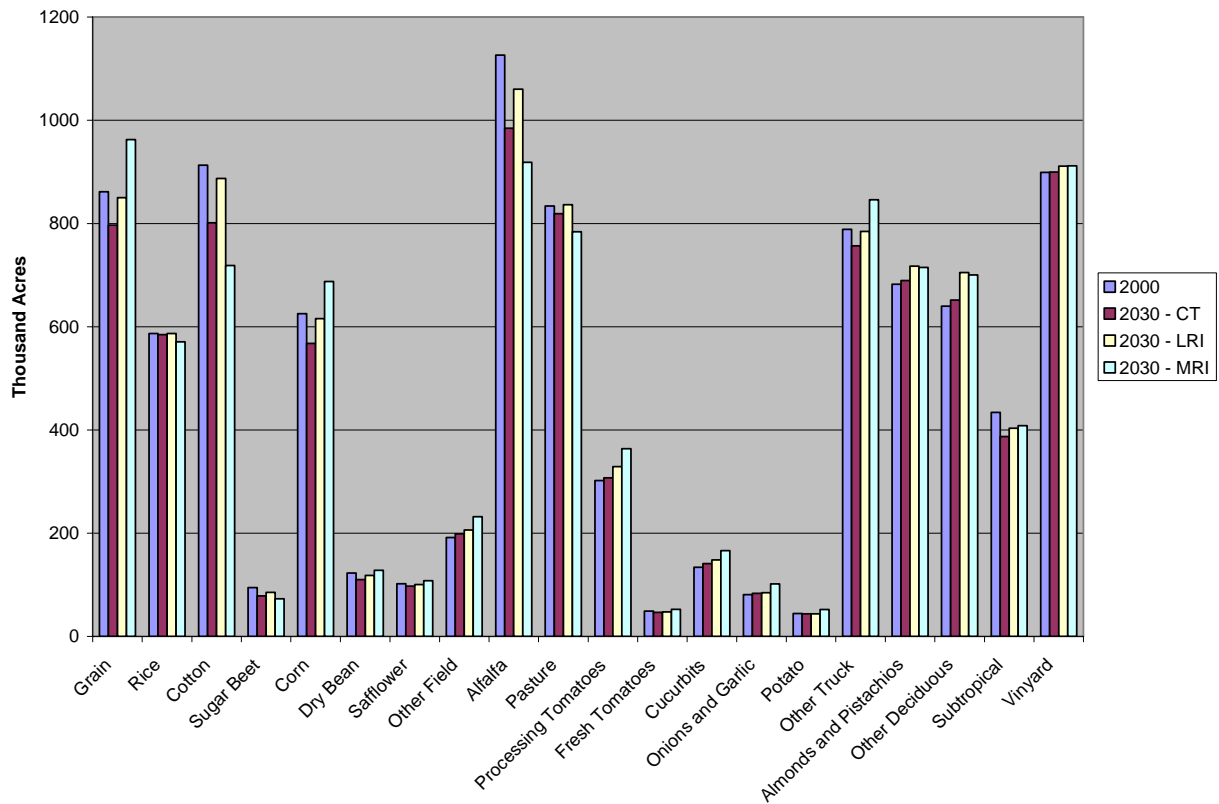
**Figure 8: Range of additional water for eight resource management strategies.**



**Focus on Agriculture Tomorrow.** Following the 2005 Water Plan’s narrative description of the Current Trends scenario, irrigated crop area is specified to decrease according to DWR forecasts based on historical rates of land conversion from agriculture to urban development, tempered by increases in multi-cropping and some new lands coming into production. The Water Plan specifies that in the Less Resource Intensive scenario, irrigated crop area levels out at the current area. It was assumed that irrigated land area decreases at half the rate as in the Current Trends scenario (5.6% total reduction from 2000-2030 instead of 10.0%), and the percentage of multi-cropped area increases to 11.6% in 2030. These two adjustments lead to a constant total irrigated crop area. In the More Resource Intensive scenario, irrigated crop area also levels out at the current area as in the Less Resource Intensive scenario. Irrigated crop area is assumed the same for the Low Water Demand scenario as for the Current Trends scenarios, but with a small reduction in irrigated land area (compensated for by lesser increase in multi-cropping). Figure 9 shows irrigated crop area by crop group in 2000 and the assumed irrigated crop area for each of the three 2030 scenarios.



**Figure 9: Irrigated crop area (thousand acres) for twenty crop groups, 2000 and 2030 by scenario.**



CT = Current Trends  
 LRI = Less Resource Intensive  
 MRI = More Resource Intensive

## THE CALIFORNIA WATER PLAN UPDATE

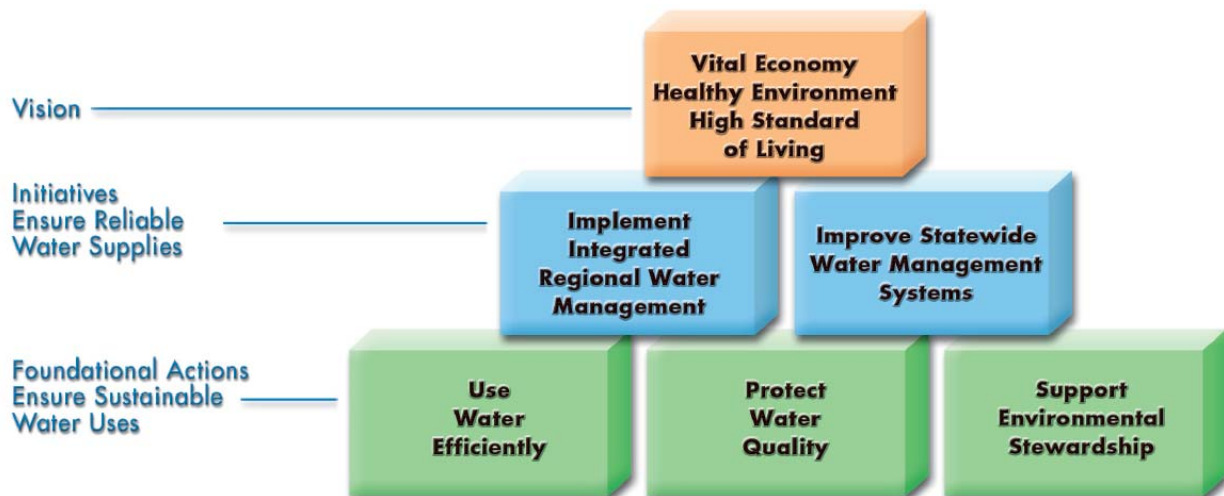
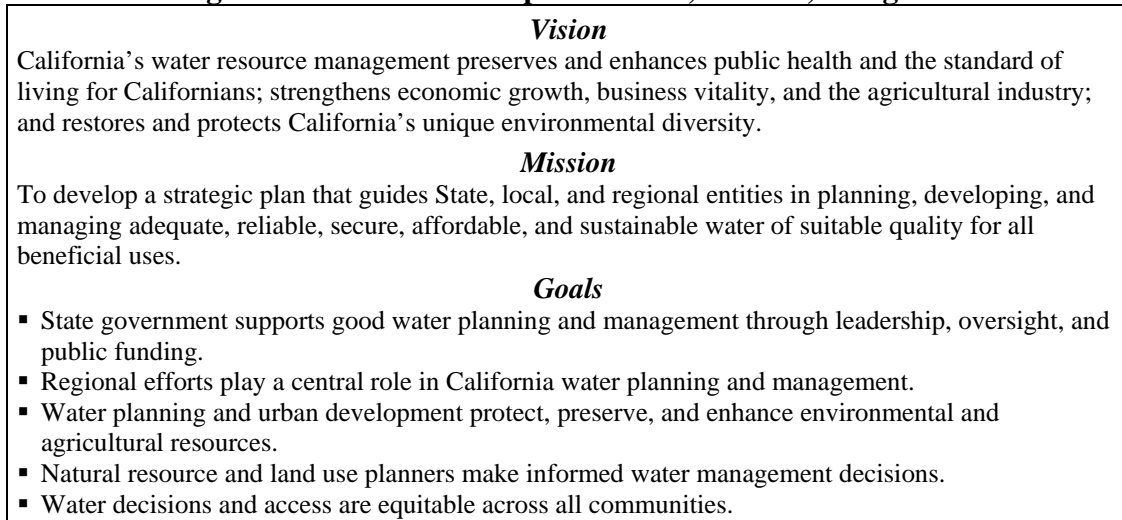
The Department of Water Resources (DWR) has changed the process for preparing the California Water Plan Update and the information it contains. The Water Plan has become a strategic document that describes the role of State government and the growing role of California's regions in managing the state's water resources.

In preparing Update 2005, DWR sought the participation of California's water communities, responded to new State laws, and, by working with an Advisory Committee, developed a new approach to planning California's water future. DWR significantly expanded the public forum for updating the California Water Plan by establishing the 65-member Advisory Committee and a 350-person Extended Review Forum and seeking input from 2,000 other interested members of the public.

As a strategic planning document, this water plan provides California's water communities with a vision, mission, and goals (Figure 10) for meeting challenges of sustainable water use through

2030 in the face of uncertainty. The plan provides a Framework for Action to stimulate progress now to ensure a sustainable and reliable water supply in 2030. This framework will focus and prioritize State government’s water planning, oversight, and technical and financial assistance on several foundational actions and initiatives, as illustrated in Figure 11.

**Figure 10: Water Plan Update vision, mission, and goals.**



**Figure 11: Water Plan Update vision, initiatives, and foundational actions.**

The Framework for Action also identifies a number of support activities that are essential to accomplishing its foundational actions and initiatives. These support activities include providing effective State leadership, assistance and oversight; clarifying roles and responsibilities; and developing funding strategies to help local agencies and governments meet the needs of Californians. The support activities also include investing in new water technologies, adapting for global climate change impacts, improving water data management and analysis, increasing scientific understanding, and making decisions equitable across all communities.

California Water Plan Update 2005 has recommendations for decision-makers, resource managers, water suppliers, and water-users. For each recommendation, the implementation plan includes specific near-term and comprehensive long-term actions, resources assumptions, implementation challenges, and performance measures.

**1. Diversify Regional Water Portfolios** - California must invest in reliable, high quality, sustainable, and affordable water conservation, efficient water management, and development of water supplies to protect public health, and to improve California's economy, environment, and standard of living.

**2. Promote and Practice Integrated Regional Water Management** - State government must provide incentives and assist regional and local agencies and governments and private utilities to prepare integrated resource and drought contingency plans on a watershed basis; to diversify their regional resource management strategies; and to empower them to implement their plans.

**3. Remediate Surface Water and Groundwater Contaminants** - State government must lead an effort with local agencies and governments to remediate the causes and effects of contaminants on surface water and groundwater quality.

**4. Improve Aging Water Infrastructure** - California must maintain, rehabilitate and improve its aging water infrastructure, especially drinking water and sewage treatment facilities, operated by State, federal, and local entities.

**5. Implement the CALFED Program** - State government must continue to provide leadership for the CALFED Bay-Delta Program to ensure continued and balanced progress on greater water supply reliability, water quality, ecosystem restoration, and levee system integrity.

**6. Provide Effective State Government Leadership, Assistance, and Oversight** - State government must lead in water planning and management activities that: (a) regions cannot accomplish on their own, (b) the State can do more efficiently, (c) involve inter-regional, inter-state, or international issues, or (d) have broad public benefits.

**7. Clarify State, Federal, and Local Roles and Responsibilities** - California must define and articulate the respective roles, authorities, and responsibilities of State, federal, and local agencies and governments responsible for water.

**8. Develop Funding Strategies and Clarify Role of Public Investments** - California must develop broad, realistic and sustainable funding strategies that define the role of public investments for water and other water-related resource needs over the next quarter century.

**9. Invest in New Water Technology** - State government must invest in research and development to help local agencies and governments implement promising water technologies more cost effectively.

**10. Adapt for Global Climate Change Impacts** - State government must help predict and prepare for the effects of global climate change on our water resources and water management systems.

**11. Improve Water Data Management and Scientific Understanding** - DWR and other State agencies must improve data, analytical tools, and information management and exchange needed to prepare, evaluate, and implement regional integrated resource plans and programs in cooperation with other federal, tribal, local, and research entities.

**12. Protect Public Trust Resources** - DWR and other State agencies must explicitly consider public trust values in the planning and allocation of water resources and protect public trust uses whenever feasible.

**13. Increase Tribal Participation and Access to Funding** - DWR and other State agencies must invite, encourage, and assist tribal government representatives to participate in statewide, regional, and local water planning processes and to access State funding for water projects.

**14. Ensure Environmental Justice across All Communities** - DWR and other State agencies must encourage and assist representatives from disadvantaged communities and vulnerable populations, and the local agencies and private utilities serving them, to participate in statewide, regional, and local water planning processes and to get equal access to State funding for water projects.

Update 2005 is presented in five volumes: (1) Strategic Plan, (2) Resource Management Strategies, (3) Regional Reports, (4) Reference Guide, and (5) Technical Guide. In April 2005, DWR distributed the Public Review Draft, and in June held public workshops to receive comments. Governor Schwarzenegger approved the final California Water Plan Update 2005 in January 2006, which is available online at:

[www.waterplan.water.ca.gov](http://www.waterplan.water.ca.gov)

## **CONCLUSION**

California faces big water management challenges in the future, especially during critically dry years. To ensure that water use is sustainable, California must base groundwater and surface water management on three foundational actions: use water efficiently and protect water quality to get maximum utility from existing supplies; and manage water in ways that protect and restore the environment. To ensure reliable water supplies, water management must pursue two initiatives: first, promote and practice integrated regional water management; and second, maintain and improve statewide water management systems.

The State can secure its water resources for the future by making the right choices and the necessary investments. Working together, we can secure our water future for the next generation so that our water resources can protect public health and improve the standard of living; strengthen economic growth, business vitality, and the agricultural industry; and protect and restore watersheds and unique ecosystems.

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