California Issues

A Briefing on California Water Issues

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Editor's Note: California and water. The two always have been and always will be inextricably linked. No resource is more vital to the state's prosperity or steeped in more controversy.

This briefing issue is produced by the Water Education Foundation to provide the public with a short overview of the current key issues in California water. There is a need for a fair and balanced portrait of these critical topics because decisions on these controversial issues affect everyone in the state.

It is important for Californians to know the views of the three main interest groups -- agricultural, urban and

environmental -- who have a stake in management of our water resources. It also is necessary to learn about the issues facing governmental officials who oversee water management. The mission of the Foundation is to provide impartial coverage of water issues to lead to a broader understanding and resolution of water problems. California water issues can appear overwhelmingly complex and controversial. Through the Foundation, we try to open the door to understanding these issues so that Californians will be able to best manage and protect this precious resource.

We believe that learning about water will help you determine what decisions should be made regarding these important issues.

People interested in more in-depth information on these current water issues and other topics are encouraged to subscribe to Western Water magazine, published bi-monthly by the Foundation, or refer to the Foundation's Layperson's Guide series. The publications can be ordered through our online store.

– Rita Schmidt Sudman, executive director, Water Education Foundation

A Briefing on California Issues

Updated March 2002 Gary Pitzer

As the nation's most populous state, California faces many complicated and compelling problems. Although polls have shown the public's top concerns are education, job security, crime and immigration, water fuels the economy. Proper management of the quality and quantity of the state's "liquid gold" is critical to California's well being.

Since the days of Mark Twain -- who is said to have coined the phrase "Whiskey's for drinking; water's for fighting over" -- cities, farmers and environmentalists have battled over who will control California's water. the three powerful political factions have effectively turned the water issue into a stalemate by blocking one another's agenda.

Yet the critical question of how -- or if -- the state's limited water supply can be stretched to meet future needs remains. The fundamental controversy surrounding California's water supply is one of distribution. The decades-long conflicts between competing interests over the use of available supplies has been exacerbated by the

state's swelling population and periods of drought.

According to the state Department of Water Resource's (DWR) Bulletin 160-98, California's population was more than 32 million in 1995 and is expected to increase an additional 15.5 million by 2020. The gap between water supply and demand is projected to total 2.4 million acre-feet during normal years and up to 6.2 million acre-feet in drought years by 2020. (An acre-foot of water is about 326,000 gallons -- enough to cover an acre of land, about the size of a football field, 1 foot deep and meet the average needs of between one and two residential households.)

In addition to satisfying the basic needs of residential customers, demands for more reliable and higher quality water supplies continue to come from the state's agricultural industry, businesses, manufacturers and developers. At the same time, protecting water quality, which may impact water allocation, is of fundamental importance to people, fisheries, wildlife, and recreational interests.

Within California, there are two major arteries serving as the sources of surface water for urban and agricultural areas: The Colorado River and the Sacramento-San Joaquin Delta (Bay-Delta).

The Delta serves as a major water source for approximately two-thirds of the state – over 22 million people. The region is fed by two major rivers: the Sacramento from the north and the San Joaquin from the south. The mixture of fresh water from these two waterways and numerous tributaries combine with salty ocean water from San Francisco Bay to create the largest estuary on the West Coast of North America. Massive pumps at the southern end of this marsh pull approximately 5.5 million acre-feet annually of fresh water from the entanglement of waterways and sloughs southward to Central Valley farmland via the Central Valley Project and ultimately, to the southern California region via the State Water Project.

The massive Colorado River winds its way through the southwestern United States before terminating in the Gulf of California in Mexico. Along the way, the river provides water to seven states including California, with each state's water use determined by the Colorado River Compact of 1922. According to the compact, California is permitted to use 4.4 million acre-feet of the Colorado annually. But, for several years, California has been using well beyond that. As water conditions have tightened in several of the other states, the secretary of the Interior has demanded that California reduce its use of the Colorado River - a major challenge to river water users.

Adding to the increased emphasis on water conservation, water management in the northern part of the state has, for the past several years, been driven by the struggle to balance water needs and environmental protection in the Bay-Delta.

The Sacramento River endangered winter-run and

spring-run chinook salmon are anadromous fish that travel down river, through the Delta to the Pacific Ocean and back to complete their life cycle. The federal Endangered Species Act (ESA) requires modification of water project operations and restriction of water exports to protect the salmon. Further pumping constraints were imposed to protect the tiny Delta smelt, a threatened fish found only in the Delta, thus adding more fuel to the water distribution controversy among farmers, environmentalists and cities.

California's capricious climate fluctuates between flood and drought, which significantly impacts supplies. A series of storms that began in December 2001 left the state with a snowpack water content 111 percent of average. Eureka, Redding and Sacramento have rainfall totals more than 100 percent of average, followed closely by San Jose, Fresno and Bakersfield. Precipitation in Los Angeles and San Diego stands at 53 percent and 32 percent of average, respectively. Forecasters predict above normal rainfall in February, followed by a drier than normal March. April and May are expected to be wetter than average.

Drought can wreak havoc on the state. The 1987-1993 drought served as a wake up call to many. It highlighted the fact that if available supplies are not used more efficiently and/or expanded, overdrafted groundwater basins, water rationing for urban users, fallowed farmland and lost jobs loom on the horizon. In addition to the hydrologic drought, some water interests complain about the imposition of a "regulatory" drought. A number of contractors' water deliveries have been cut back during average rainfall years to meet the requirements of federal laws that aim to preserve the state's dwindling native fresh water fisheries and riparian dependent species.

Parts of the state are -- at times – inundated by floods, most recently in January 1997. The 1997 New Year's storm was the second most devastating flood to hit the state this century. By the end of January, 48 of the state's 58 counties were declared disaster areas.

In order to resolve the stalemate over the limited water supply and ever-increasing demand, a coalition of federal and state agencies with management and regulatory responsibilities in the Bay-Delta -- a critical link in the water supply system – was formed in 1995. This coalition, known as CALFED, made significant progress in the first year of its Bay-Delta Program. Noteworthy accomplishments were made in areas supported by state bond funds, such as groundwater storage, environmental water account, ecosystem restoration and conveyance and water recycling. In fiscal year 2001-02, the governor and Legislature have committed $508 million to the program, including $62.6 million from the state’s general fund.

Various public interest and environmental groups, urban water agencies and irrigation districts are working to find solutions to California's water problems. Innovation is a key component in this solution and practices such as water recycling and water marketing are becoming the water

jargon of the future. But as with every proposal, there are glitches. A stumbling block for water recycling thus far has been the lack of public trust over science's ability to clean wastewater to the point of potability. Likewise, water marketing has met with obstacles due to a lack of a defined market.

Eyes are turning towards to the Bush administration to see what positions it will take and what role it will play in the effort to yield solutions to some of the state's most intricate and delicate water problems. It is unknown at this point in time the extent to which Interior Secretary Gale Norton will play in supporting not only the CALFED effort, but other California issues including the Colorado River. Though it is too early to tell, discussion will undoubtedly continue in the areas of growth, expanding urban supplies, water conservation, the Bay-Delta, water marketing, agricultural drainage and water needs for fish and wildlife.

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ALLOCATING MORE WATER FOR FISH AND WILDLIFE

A critical challenge for the water world has been to provide more water to protect and restore fish and wildlife. Societal values have evolved over the last century from an ethic of conquering nature to one of coexisting with it. This fundamental change in values, combined with the passage of strict state and federal laws protecting endangered species and their habitat, and lawsuits by environmental groups to enforce these laws, has impeded most conventional water development for the last two decades.

Since the Gold Rush, California and the American West have been transformed from vast, sparsely populated open spaces into one of the world’s leading regions for food production and manufacturing. Much of that development was made possible by tapping the region’s abundant natural resources, especially water, and putting them in the service of human needs.

That rapid and intensive development has made significant changes in the natural environment. Fish populations have been depleted, wetlands drained and rivers forced into artificial channels. Dams and levees have altered natural water flow patterns. Native species of many plants and animals have declined, and in some cases become extinct. Water quality has been impaired by pollutants from mining, urban sources and agricultural activities.

Widespread interest in environmental restoration is a relatively recent phenomenon. Its roots date back to the 1960s and 1970s with enactment of federal legislation such as the Wild and Scenic Rivers Act in 1968 and the Endangered Species Act (ESA) in 1973. Together with companion laws enacted in California, these measures helped create the legal apparatus for protecting endangered native populations of wildlife, fish and plants that has since expanded to encompass broader restoration objectives.

The ESA prohibits actions that harm listed species or disrupts its normal pattern of behavior. Many threatened and endangered species live in riparian areas and the ESA mandates have led to the alteration of dam operations, water diversions and pumping facilities.

CALFED's Ecosystem Restoration Program (ERP) is intended to address a variety of issues related to reduced numbers of native fish, wildlife and plants as a result of water diversions and land use. The ERP, along with the water management strategy, also is designed to assist with the recovery of endangered species found in the Bay-Delta.

A key component of the ERP is its focus on adaptive management. Adaptive management can help bridge the gap between scientific theory and actual results by allowing for scientific research, test programs and monitoring of pilot restoration projects. For example, scientists would identify a goal; such as increasing Delta smelt populations, and a range of options to achieve that goal. These actions would then be monitored to determine if they are meeting the goal. If not, they would be modified.

Some of the typical ERP actions identified by CALFED include acquiring water from sources throughout the Bay-Delta's watershed to provide flows and habitat conditions for fishery protection and recovery, improving Delta outflow during key periods, constructing setback levees, developing assessment, prevention and control programs for invasive species, and modifying or eliminating fish passage barriers, including the removal of some dams, and construction of fish ladders and fish screens at other dams.

The ERP proposes that 138,000 to 191,000 acres of land within the Delta be converted to wildlife habitat or other uses, including 98,000 acres to 115,000 acres of farmland (some of which – 40,000 to 70,000 – would be "wildlife friendly" and would not require a total cessation of farming). Specific Delta islands on which CALFED is restoring fish and wildlife habitat include Staten, Prospect, Twitchell and Sherman islands, and McCormick-Williamson Tract. Stage 1 funding is estimated at $1.3 billion, including $200,000 for the Environmental Water Account. An additional $300,000 has been identified for the Science Program.

Other actions identified in the ERP include, but are not limited to, proposals to:

- Implement large-scale restoration projects on selected streams and rivers, including Clear Creek, Deer Creek, Cosumnes River, San Joaquin River and Tuolumne River, in cooperation with local participants.
- Improve fish passage through modifications or removal of the following locally owned dams: small diversion dams on Butte Creek; eight Pacific Gas & Electric Company diversion dams on Battle Creek; McCormick-Saeltzer Dam on Clear Creek; Woodbridge Dam on Mokelumne River; and Clough Dam on Mill Creek.
- Restore habitat in San Pablo Bay, Suisun Bay and

Suisun Marsh and the Yolo Bypass including tidal wetlands and riparian habitat.

- Improve salmon spawning and juvenile survival in upstream tributaries by purchasing up to 100,000 acre-feet of water per year by the end of Stage 1. Some of these flows may be contributed to the Environmental Water Account (EWA).
- Complete protection and restoration of the Sacramento River meander corridor as part of the Sacramento River Conservation Area/SB 1086 program.
- Implement an invasive species program, including prevention, control and eradication.
- Improve dissolved oxygen conditions in the San Joaquin River near Stockton. The dissolved oxygen in the San Joaquin River, in the vicinity of Stockton, dips below state environmental criteria, causing a migratory block for salmon and threatening other fish.

Since efforts to restore the winter-run salmon were initiated in the late 1980s, an increase in their numbers has been recorded. Many attribute the boost in numbers to above average precipitation, instream flow increases and non-flow measures to aid the salmon.

Recovery, however, is far from complete and some fish populations continue to decline. Another chinook population - the spring-run - has dropped from around 1 million to a few thousand. Spring-run chinooks are listed as threatened under the ESA. The National Marine Fisheries Service lists the central California coho salmon and coho stocks in northern California as threatened. Steelhead trout populations are listed as endangered in southern California and threatened in the south-central California coast, central coast, the Central Valley and in northern California. The fall and late-fall runs of chinook salmon on the Sacramento and San Joaquin rivers are presently candidates for listing.

The Central Valley Project Improvement Act (CVPIA), passed in 1992, provides assistance to the environment. The law reallocated 800,000 acre-feet annually (600,000 acre-feet in dry years) of CVP yield to restore valley fisheries. Additionally, the act ensured annual instream flows for the Trinity River and Central Valley wildlife refuges (in December 2000, former Interior Secretary Bruce Babbitt signed a Record of Decision to increase flows in the Trinity River from about 340,000 acre-feet annually – about 25 percent of its historic flow – to 369,000 acre-feet in a dry year to 815,000 acre-feet in a wet year); established an anadromous fish restoration program to boost native fish population levels by 2002; and an annual $50 million environmental restoration fund financed by surcharges on CVP water and power. An adaptive management plan to increase flows is currently being implemented.

Another species of fish, the Sacramento splittail, has been the center of controversy since being listed as threatened under the federal ESA in February 1999. That action

prompted a lawsuit by state water contractors and in 2000 a federal district court judge invalidated the listing. The decision stated that the USFWS failed to consider the opposition to the listing by state Department of Fish and Game scientists and data showing record or near record high abundance of splittail in 1998. The ruling also stated that USFWS failed to adequately explain how it reached the conclusion that the splittail is threatened with extinction. Instead of removing the fish from threatened status, however, the judge gave the USFWS six months to reconsider the listing. Officials requested and were granted an additional six months. A final decision on the listing will be made by Oct. 15, 2002, according to USFWS.

Habitat management plans to protect biodiversity – the variety of plant and animals species and their interaction -- are vying with the controversial ESA single- species approach. The biodiversity approach, adopted by Interior, allows landowners who have endangered species on their property and agree to a habitat conservation plan to avoid having to take additional steps to protect a listed species. The plans are seen as a way to provide landowners with more economic certainty. However, critics say habitat plans are being used as a means to get around the ESA protections.

A state-initiated habitat conservation plan was developed in southern California after the gnatcatcher, a song bird that lives in coastal sage scrub, was listed as threatened under the federal ESA. Real estate developers vigorously opposed the bird's listing. Under the Natural Communities Conservation Planning (NCCP) program, parcels of sage scrub will be conserved but development of other parcels will be allowed.

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GROWTH

By 2002, California's population swelled to more than 35 million people, reflecting the tremendous overall growth experienced during the past decade. A buzzword emanating from state and federal levels is so-called "smart growth" or, the idea of allowing growth while protecting and ensuring resources. Areas such as the Central Valley have experienced population booms over the past decade, leading communities and governments to protect against the possibility of over-population, including impacts to the state's finite water supply. Although the state's growth has been closely tied to water development, it was not until recently that local land use agencies and water districts were required to communicate about the impacts of proposed development projects on water supply.

Responding to the demand of continued growth on the state’s limited water resources, policy makers authored legislation to ensure surface and groundwater supplies are adequate to meet budding development. SB 672 (Machado) requires the State Water Plan to incorporate greater emphasis on regional and local solutions to meet community

water needs. SB 221 (Kuehl) requires officials to make the determination, prior to issuance of a final subdivision map, that adequate water supplies exist to meet the needs of new, large housing developments. Finally, SB 610 (Costa) expands the requirements that public water purveyors prepare water supply assessments early in the land use planning process. All of the bills were signed by Gov. Gray Davis and became law on Jan. 1, 2002.

Some people contend that, in addition to more efficient water use, the state's economic future depends on constructing new water storage and transfer facilities and adding to the State Water Project (SWP). The SWP is one of two major state water delivery systems and has not been completed as planned. The cost and regulatory process involved in new projects, however, are formidable.

Water shortage is just one of many problems stemming from rapid population growth. Urban sprawl -- including into vulnerable floodplains, traffic congestion, air pollution, environmental degradation and declining services also result.

Continuing to develop in the state's floodplain is a significant concern because of risks to lives and property. Many of the alluvial valley areas of California are extensively developed and flooding in these areas has caused billions of dollars in damage. Building in these high risk areas continues because development pressures supersede flood safety concerns.

California is the most urbanized state in the nation and most of the projected growth will occur in the Central Valley and south coast region. The 18-county Central Valley population is projected to reach 13.8 million by 2040 - a 64 percent increase from today's population of 9 million. Some estimates put the loss of farmland over this 40-year period to be upwards of 1 million acres. Already acreage losses are becoming apparent. Between 1994 -1996, the state Department of Conservation reported that nearly 18,000 acres of irrigated farmland statewide were converted to urban use, 8,100 acres in the San Joaquin Valley. California farmland is disappearing at a rate of about 100,000 acres a year, according to the American Farmland Trust. Some consider the conversion of land to urban development a threat to agricultural production and the region's air quality. However, recent attempts to produce legislation that would limit growth based on the ability to provide an ample water supply for new development have yet to make it into or through the legislative process.

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ENHANCING AND PROTECTING URBAN SUPPLIES

Many urban water managers worry about California's water supply reliability during an extended drought. For this arid region of the United States, it is not a matter of if a drought will occur, but when. Keeping water in the state's elaborate network of canals, reservoirs and aquifers is of the highest importance for a state so dependent on water for its

economic stability.

Though California has not faced a drought in several years, fears remain over the devastating impacts a prolonged shortage of water could have on the state. Drought-proofing the state has become a serious priority on every level of the water hierarchy. The need for a solution when an extended drought occurs was emphasized by the 1987-1993 drought which highlighted the vulnerability of many regions in the state, particularly southern California and the central coast.

About 20 million Californians get some portion of their water from the SWP -- the state's major distribution system for urban water supplies. The 29 water agencies that buy SWP water have contracted for long-term deliveries of about 4 million acre-feet of water. The existing facilities, however, allow the SWP to deliver between 2.5 million and 3 million acre-feet in a normal water year and 1.1 million acre-feet in dry years.

Metropolitan Water District of Southern California (MWD), the state's largest water purveyor for nearly 16 million people, has built a new off-stream reservoir in Riverside County to nearly double the wholesaler's surface water storage capacity. The Diamond Valley Lake will store 800,000 acre-feet of water at a cost of more than $2 billion. The lake held 625,000 acre-feet of water in February 2002.

Contra Costa Water District has completed construction of a new off-stream reservoir at a cost of $450 million. The Los Vaqueros Reservoir holds 100,000 acre-feet of water. Most of the water is for emergency supplies and to improve the quality of Delta water exported to Contra Costa County that can become salty during summer months and droughts.

New reservoirs are expected to be used in conjunction with alternative sources, such as wastewater recycling, water conservation, water transfers, groundwater banking and, for some coastal communities, sea water desalination. California has some 200 water reclamation facilities that recycle about 450,000 acre-feet a year. The treated wastewater is used in a variety of ways, ranging from irrigation to groundwater recharge. It is anticipated that another 162 recycling plants will be on line by the first decade. These projects, which are mostly in southern California, are expected to produce up to 1 million acre-feet of recycled water annually by 2020.

There have been some problems associated with gaining public acceptance of water recycling projects. The so-called "yuck factor" has in several instances, killed entire water recycling projects. In 1998, San Diego dropped a recycling proposal because of public resistance. Similarly, the Dublin San Ramon Service District in the Bay Area has been debating the possibility of using recycled water for direct injection in order to meet growing demands for water.

Developing alternative sources of supply --from increasing storage capacity to expanding reuse of recycled wastewater – is not a panacea for meeting all the anticipated demand but helps close the gap between supply and demand. Most

recently, the Orange County Water District has received support for its plan to expand its water recycling program as has a plan to generate power using recycled water on natural steam vents in Santa Rosa. In addition to rising water demand, urban water agencies face water quality issues. Surface water and groundwater supplies have been contaminated by both manmade and natural substances. The most significant threat to water quality is nonpoint source pollution, which includes runoff from city streets, construction sites and agricultural fields; leaking underground storage tanks; accidental spills; and abandoned mines. Controlling nonpoint pollution is very difficult because it does not come from a single source.

The federal Clean Water Act (CWA) regulates both surface water and groundwater quality and is enforced by the U.S. Environmental Protection Agency (EPA). The CWA was amended in 1987 to include a requirement that states develop a nonpoint source pollution assessment and management program.

Meanwhile, to help combat non-point source pollution, total maximum daily loads (TMDLs) are becoming an integral part of both federal and state regulations of pollutants in waterways. According to the EPA, TMDLs are "a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards." After a previous TMDL implementation rule was criticized as too stringent, EPA Administrator Christine Whitman signed an order extending the effective date of the rule until April 2003.

However, in *Pronsolino v. EP*A, a recent court case over TMDLs, owners of timber land challenged EPA's authority to establish TMDLs for rivers impacted by sediment and temperature. The case has been appealed to the U.S. Ninth Circuit Court of Appeals because the farm and timber lobby wants a definitive statement that the state can determine its own controls without losing federal funding.

Federal and state laws regulate drinking water in the United States, which is generally the best in the world. The U.S. Environmental Protection Agency (EPA) oversees drinking water quality for the nation, while in California, the Division of Drinking Water and Environmental Management in the Department of Health Services oversees state drinking water laws. After spending two decades focused on the long-term health effects of chemical contaminants and removal of such pollutants, public water officials increasingly have turned their attention to microbial concerns. Officials with the federal Centers for Disease Control and Prevention are conducting studies to determine the percentage of gastrointestinal illness cases that are due to drinking water consumption.

Both arsenic and chromium 6 have been pressed to the forefront of water quality and drinking water standards in recent months. Chromium, a naturally occurring element found in the earth’s crust, also is formed by some industrial processes chrome plating and paint coloring. The California’s

Department of Health Services (DHS) regulates chromium 6 in drinking water at a maximum contaminant level of 50 parts-per-billion (ppb). California officials withdrew a non-regulatory public health goal of 2.5 ppb for chromium 6 in November 2000 because of insufficient data to justify the number.

In a similar vein, arsenic has generated interest and concern from the water community. Also a naturally occurring element, industry, mining and agriculture all have increased the amount of arsenic released into California's water supply. On Oct. 31, 2001, Whitman of the EPA announced a new arsenic drinking water standard of 10 ppb. Drinking water purveyors have until 2006 to be in full compliance with the rule.

Although California Gov. Gray Davis has vowed to phase out the fuel additive MTBE (methyl tertiary butyl ether) by the end of 2002, that deadline could likely be extended because of the difficulty in finding a suitable replacement. MTBE was targeted because it is a groundwater contaminant once it leaks from storage tanks.

In March 2000, the federal EPA announced it would significantly reduce or eliminate the use of MTBE and boost the use of alternatives, such as ethanol. A draft regulation was adopted in October 2000 but nothing final came to fruition before the end of the Clinton Administration. It is unknown what steps will be taken, if any, by the Bush Administration to phase out MTBE.

MTBE, a clean air additive, is not regulated by the SDWA and has been detected in some lakes due to inefficient two-stroke engine motor boats and watercraft. MTBE also has been discovered in groundwater supplies because of leaking underground fuel tanks and many communities have had to shut down wells because of MTBE contamination. Some gas stations, including many in the South Lake Tahoe region, have already begun to sell MTBE-free gasoline. In addition, both Lake Tahoe and Donner Lake enacted bans on two-stroke engines in 1999.

The health impacts of MTBE are not yet known. It can be detected at very low levels because it tastes and smells like turpentine. Some suspect it is a potential carcinogen and the state Department of Health Services (DHS) has issued advisory heath limits of 35 parts per billion (ppb), which is equivalent to 1 microgram per liter or 1 inch in 16,000 miles. A 1998 study conducted by the state Office of Environmental Health Hazard Assessment concluded that MTBE did not meet the definition of a human carcinogen under Proposition 65 despite findings by the EPA and others that the chemical has caused cancer in laboratory test animals. Additionally, a 1998 state auditor's report called for tightening the regulatory process used to access MTBE contamination and chastised DHS for allegedly being slow in reporting MTBE contamination. DHS has said the report jumps to the conclusion that MTBE is a carcinogen.

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WATER CONSERVATION

For hydrologists, an important tool is a “water balance,” a comparison of water supply to use. A water balance published by DWR in its 1998 update of the California Water Plan (Bulletin 160-98) forecasts a statewide total net demand of 80.1 million acre-feet in an average water year met by a supply of 79.9 million acre-feet in 2020, a deficit of 200,000 acre-feet. Under drought conditions, the projected imbalance increases to 2.7 million acre-feet.

In the past, the traditional way of closing the gap between supply and demand has been to increase supplies -- either by building new facilities such as dams or by tapping underground aquifers. But building new facilities is costly and such projects face strict environmental review before they can be approved. Groundwater resources, although abundant in many areas of California, are overdrafted in others and take time to replenish. And overpumping groundwater can lead to subsidence, an often irreversible collapse of the earth’s surface overlying an aquifer, or saltwater intrusion into coastal aquifers. Conservation is an option that can cost-effectively stretch uses of available_water and help preserve groundwater resources.State officials estimate that a combination of urban and agricultural demand-management programs, land fallowing, water banking and voluntary rationing during droughts, and permanent land retirement in areas with poor drainage could reduce net water demand by a total of 3 million acre-feet by 2020.

Agriculture uses about 75 percent of the state's developed water and environmentalists have long contended a 10 percent reduction in irrigation water use could free up enough water to permit decades of urban population growth. Since the 1980s, state agricultural water consumption has remained relatively stable at around 9 million irrigated acres. At the same time, improved farming techniques have led to an increase in per-acre production.

The Agricultural Efficient Water Management Practices Act resulted in the development of a memorandum of understanding (MOU) by which signatory irrigation districts and water agencies committed to adopt a number of mandatory and conditional efficient water management practices (EWMPs). The MOU, which to date has been signed by 50 agricultural water representing 4.7 million acres, requires signatory water suppliers to submit water management plans to the Agricultural Water Management Council comprised of one member from each signatory agency. In addition to the six “universally applicable” EWMPs, there are a dozen “conditionally applicable” EWMPs

that may be adopted by signatory agencies on an as-needed basis, subject to cost/benefit analysis. These measures include construction and operation of tailwater reuse systems, automation of canal structures, and installation of water meters to measure the volume of water delivered to individual water users. Accurate water use data are considered critical to the design and operation of effective water management plans.

Water demand has also has been effected by the CVP Improvement Act (CVPIA), which fundamentally changed CVP operations by putting the protection of fish and wildlife on equal footing with irrigation and flood control. The federal CVP, built in the 1940s, is the largest water storage and transfer system in the state. It stores up to 12 million acre-feet and delivers 7.3 million acre-feet annually, 90-percent of which is used to irrigate about 3 million acres of farmlands south of the Delta, with the remaining 10 percent of CVP water used for wildlife refuges.

The full impact of the CVPIA, however, is just now being felt. A management plan for the dedicated yield was released in late 1997 but did not require the total 800,000 acre-feet of project yield to be allocated annually. The plan became the subject of a lawsuit and was eventually thrown out by a judge. In July 1999, a trial was held on the use of the 800,000 acre-feet of water and Interior developed a new accounting plan. The plan contains several methods of accounting for upstream reservoir releases and Delta outflow. The plan was ultimately approved by the court and farmers on the west side of the San Joaquin Valley could see water supply cutbacks as high as 50 percent.

DWR concluded that by 2020, irrigation efficiencies and increased conservation could reduce net demand by about 300,000 acre-feet. An additional 200,000 acre-feet of water could be conserved by retiring some farmland with serious drainage problems on the west side of the San Joaquin Valley. A bill passed by the state Legislature in 1998 will pay $200 million to finish lining the All-American and Coachella canals (which transport Colorado River water to the Coachella and Imperial valleys) and help by increasing irrigation efficiency and water conservation.

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THE BAY-DELTA

The Sacramento-San Joaquin Delta is a 1,153-square-mile region located where California's two greatest rivers – the Sacramento and San Joaquin -- converge and flow into San Francisco Bay. The Delta is a vital link for the state's water supply. Forty-two percent of the state's annual runoff flows through this maze of islands, marshes and sloughs. State and federal water facilities located in the south Delta pump water to supply farms and cities in central and southern California, providing water to about two-thirds of the state's population. These projects and local facilities also provide

about 60 percent of the water used in the San Francisco Bay Area.

The Delta is a highly productive agricultural region because of its flat topography, mild climate and abundant water. Its waters support 28 native and 28 non-native fish populations, in addition to the salmon and steelhead populations that migrate through the estuary.

Battles over the Delta's water and health of its ecosystem have been fought for decades, but it was not until the end of 1994 that the three key water interests agreed to protect the Bay-Delta. Stakeholders and state and federal agencies finally signed onto a set of interim water quality standards after years of lawsuits, unsuccessful administrative efforts by the State Board to develop viable water quality standards and intervention by the EPA.

The water quality standards require water exports to be reduced by about 400,000 acre-feet in average rainfall years and up to 1.1 million acre-feet in drought years. The accord provides cities and farmers with more water supply certainty because it assumes the outflow will adequately protect ESA-listed and other declining Delta fish species. If additional water is needed to protect ailing species, the federal government will provide any water presumably purchased from willing sellers above and beyond the amount set forth in the plan.

For more than five years, the CALFED Bay-Delta Program searched for equilibrium among the Delta's complex problems and its contentious stakeholders. The pieces of the political puzzle fell into place in 2000 when top state and federal officials reached agreement on a vision for balancing the Bay-Delta's competing interests, releasing "A Framework for Action" and the programmatic the Record of Decision (ROD).

The Framework Agreement provided an overview of a seven-year, $8.7 billion program designed to give each of the major stakeholder groups – urban, agricultural and environmental – something. The agreement offered ideas for how to increase water storage and water conservation, improve water quality and restore ecosystem functions through a broad array of projects. But none of the interests got everything it wanted.

The 54-page Framework Agreement essentially covers the first seven years, Stage 1, of the ultimate 30-year CALFED Bay-Delta program. It includes timelines and targets, which are spelled-out in greater detail in CALFED's 6,500-page

programmatic environmental documents released July 21, 2000. Additional studies and analysis on hundreds of individual actions and proposals still need to be completed, however.

The 1,199-page federal ROD was released in August 2000.

The CALFED plan itself is extremely comprehensive; the solution will not be implemented overnight, and it will take time to see results. The Ecosystem Restoration Program alone calls for over 600 different actions in all the regions of the Bay-Delta watershed. Other elements are equally complex. How to ensure the plan is implemented over the next 30 years given the cycle of political administrations in California and Washington, D.C., remains a major issue.

Increased water recycling, water conservation, water transfers, millions of dollars in additional habitat restoration projects, and improvements in Delta levees also are included in the 30-year, $10 billion package.

Another major Delta issue is drinking water quality. About 20 million Californians receive at least a portion of their drinking water supplies from the Delta. Because the region was once a swamp, it has rich, organic soils containing compounds that are the building blocks for suspected human carcinogens called trihalomethanes, or THMs. THMs are disinfectant byproducts formed when chlorine is used to treat drinking water. Water utilities are struggling to find ways to reduce THMs without increasing the risk of microbial agents in drinking water.

Concerns were further raised by two Department of Health Services studies released in 1998. The studies suggested a link between pregnant women in their first trimester who drank tap water with high levels of THMs and an increased risk of miscarriage. Special attention was paid in the studies to bromodichloromethane, a THM which forms when chlorine combines with bromides -- such as those found in the Delta -- during the chlorination at the treatment plant.

Water agency representatives point out that the limitations of the water quality database in the study mean that its conclusions are subject to a large degree of uncertainty. Federal rules limit THMs in drinking water to 100 ppb.

Environmental groups say the byproducts are more of a threat than what is suggested by existing studies, pointing to their analysis of water quality and health data that reveals a link between high rates of birth defects and miscarriages and regions with high amounts of chlorination byproducts. Such high chlorination would not be necessary if drinking water sources were cleaner, the groups say.

Environmental health experts believe the link between the byproducts and the possible harm to unborn children is suggestive, not conclusive. High levels of byproducts are nonetheless of concern, according to researchers. EPA in 2002 instituted stricter standards for seven byproducts: five haloacetic acids, bromate and chlorite. Also required is a

one-fifth reduction in allowable THM levels.

In addition to these complex water quality issues, the 1,100 miles of levees that protect Delta islands and channel water through the maze of Delta sloughs are unstable. Levees are highly erodible and susceptible to failure by erosion, seepage, earthquakes and land subsidence. If massive failure occurred, salt water would flood many Delta islands, forcing Delta water users throughout the state to rely on stored supplies. Water deliveries to southern and central California would be seriously disrupted.

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COLORADO RIVER

Southern California is facing a decrease in the water supply provided by the Colorado River -- one of the most controversial and heavily regulated rivers in the world. Allocation of the lower Colorado has been fought over for decades and involved interstate compacts, a U.S. Supreme Court decision, a treaty with Mexico and federal and state legislation. The lower Colorado's flow is divided between Arizona, California, Nevada, several American Indian tribes and Mexico.

The six California water agencies that receive Colorado River water have continually used about 800,000 acre-feet more than their combined annual 4.4. million acre-feet share of Colorado River water. The water districts are the Imperial Irrigation District (IID), Palo Verde Irrigation District, MWD, which built the 242-mile long Colorado River Aqueduct that transports up to 1.2 million acre-feet of flow to its users, Los Angeles Department of Water and Power, San Diego County Water Authority (SDCWA) and Coachella Valley Water District (CVWD).

Former Interior Secretary Bruce Babbitt warned California in 1996 that it can no longer rely on receiving more than its yearly entitlement because of growing demand in Arizona and Nevada. In response to Babbitt's request, California has drafted the California's Water Use Plan for the Colorado River (know colloquially as the 4.4 Plan) to reduce its consumption of the Colorado River back to its 4.4 million acre-feet apportionment, primarily through water conservation in the agricultural sector and water transfers to the urban sector. Under the proposed plan, up to 800,000 acre-feet of water would be conserved via dry-year fallowing agreements, canal seepage recovery, groundwater banking, conjunctive use and desalinization of drainage water, as well as meet an American Indian water settlement within the state (16,000 acre-feet to the San Luis Rey Indian tribe located near San Diego).

Before the end of his term in early 2001, Babbitt signed the Record of Decision for the Interim Surplus Criteria. The criteria, an integral part of California's water use plan, will allow California to use surplus flows from the river -- as it weans itself from overuse of the Colorado River – until 2016. While the seven basin states were able to arrive at consensus over the criteria, environmental groups contend that greater diversions of river surplus will choke the Colorado River Delta, a large wetland area south of the border in Mexico. The groups contend the delta is reliant on the surplus flows of the Colorado River to remain healthy.

Another important element of the 4.4 Plan is the proposed water transfer between IID and San Diego of up to 200,000 acre-feet annually (possibly 300,000 after the tenth year) of conserved Colorado River water. The 40 year-agreement (with an option to renew for 35 more years if both parties agree) was signed by both parties in April 1998. In August 1998, MWD signed an MOU with San Diego; allowing use of its aqueduct to transport water between IID and San Diego. At the end of the 1998 legislative session, a bill was passed to provide $235 for the lining of the Coachella and All American canals. In essence, the money will alleviate the disagreement over the wheeling rates between MWD and San Diego. Instead what will happen is a water "swap" in which IID will transfer water to MWD and MWD, in turn, will transfer water to San Diego. The plan is intended to expedite the proposed transfer. Plans also have been announced by San Diego and DWR to speed $3 million to study the feasibility of building a new pipeline connecting San Diego directly with the Colorado River.

On October 14, 1999, the three major southern California water users of the Colorado River -- IID, Coachella and MWD -- agreed to quantification terms on the Colorado River (though no final agreements have been signed). The step was an important one in the quest to get California back to its ascribed apportionment of 4.4 million acre-feet, in part because it opens up the availability of water for transfer between IID and San Diego. However, several components still need to be resolved including interim surplus criteria. Such criteria would allow the major southern California water users entities – in particular MWD – to use more than their allocation of the river during certain prescribed conditions while California weans itself from the river.

Another component of the transfer still to be addressed is the environmental compliance at both the state and federal levels. Of concern is the Salton Sea, a 40-mile-long body of saline water (25% saltier than the Pacific Ocean) that serves as an important stopover for birds along the Pacific Flyway. The Sea receives all of its water from the agricultural runoff of surrounding Imperial and Coachella valley farmlands. It is unknown what could happen to the Sea if these agricultural areas begin to conserve the field drainage flowing to the Sea.

Because the water that runs off the land is so important to the Salton Sea, Bureau and Salton Sea Authority officials developed an alternative proposal in which farmers would be

paid to fallow a portion of their acreage to make water available for transfer to San Diego. The reduction of inflows to the Salton Sea would be less under a fallowing program than conventional conservation techniques, reducing the transfer's effect on the sea.

Even without the transfer, if nothing is done to offset the sea's increasing salinity, scientists estimate the sea will reach the 50,000-ppm to 60,000-ppm threshold in 12 to 20 years. The sea now receives about 1.3 million acre-feet of inflow. Agricultural drainage from IID farms provides most of that water, about 1 million acre-feet. If both the IID-SDCWA and the IID-CVWD transfers go through, inflow from IID farms could drop to 700,000 acre-feet. A draft environmental study released in January 2002 states that the water transfer would reduce inflow to the sea, which in turn would worsen water quality and threaten sport fishing.

Because the sea's evaporation rate is now equal to present inflow, this reduction would accelerate the sea's rising salinity. With the transfers, scientists believe the Salton Sea would reach the 50,000-ppm to 60,000-ppm threshold at least 10 years earlier, maybe even sooner. The sea would also shrink in size, leaving many people who now have lakefront property several hundred yards from the shoreline.

Alternatives to reduce salt in the sea range in scope (and cost) from diking off a portion of the sea to create an evaporation pond to pumping salty water into the air to evaporate. Costs for the proposals range from $300 million to $542 million. Funding for the pilot program is being met through about $8.5 million in federal appropriations. Some immediate steps will also be taken to assist the sea including cleaning up fish carcasses; fish harvesting to reduce overpopulation; improving recreational opportunities; and more studies. Currently pilot programs including evaporation towers and solar evaporation ponds are being tested at the sea.

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WATER MARKETING

Water marketing -- the sale, exchange, or lease of water from one user to another -- has the potential for becoming a key tool for meeting rising water demand. Water transfers, however, can raise a host of issues because of the unique nature of water, the interdependence of many users, and the traditional use of the resource.

The 1987-1993 drought brought water transfers to the forefront. Out of necessity, water agencies in 1991 arranged many short-term transfers -- exchanges for one year or less. In 1991, California became a water broker with the creation of the state Drought Water Bank. Through the bank, the state bought mostly surplus surface water from agricultural users who fallowed fields or used groundwater, and sold it to critically water-short urban, agricultural and environmental users. The drought bank was reestablished on a more limited scale in 1992 and 1994.

The passage of the CVPIA also promoted water transfers by allowing CVP water designated for agricultural purposes to be voluntarily transferred to urban uses. Yet, transferring water -- in particular from farms to cities -- is an emotionally charged issue because whoever controls a region's water controls its destiny, as shown by the transfer of water out of Owens Valley to Los Angeles in the early 1990s. The Los Angeles Department of Water and Power purchased thousands of acres in Inyo County in the eastern Sierra Nevada solely for the purpose of exporting water. It built two aqueducts – one in 1913 and the other in 1970 -- to transport the valley water to the city of Los Angeles. The second aqueduct exported surface and groundwater and included diversions from streams feeding into Mono Lake, a basin north of Owens Valley.

One of the major concerns over water marketing is the potential for farmers to sell their surface water and pump groundwater in its place, depleting the resource. There also are risks of third party impacts to rural communities and agriculture-related industries if farmers sell their water and quit farming. Agricultural suppliers, farm workers and other related businesses can lose income, which can rock the rural community. Environmentalists are divided on the issue of water marketing. Some say that trades alleviate the need for new water projects and storage facilities and are part of he solution to meeting rising urban demands. However, there are concerns that transfers that alter water releases, cause temperature and flow fluctuations that can harm fish, particularly salmon eggs and young fry.

Because most of California's precipitation falls in the northern part of the state and the greatest water demand is in central and southern California, many transfers have to be transported through the Delta. Given the estuary's complex environmental and water quality problems, the State Board requires that all through-Delta transfers undergo an environmental assessment prior to approval.

Another issue is whether the source of water proposed for transfer actually augments supply. Transfers from conserved or recycled water, for example, can increase supply. Other types of transfers can reallocate or in fact decrease supply, such as where water that has been contracted for but never allocated -- known as "paper water" -- is traded.

Increasingly, private companies are starting to play a greater and greater role in the development of a water market. Companies such as Cadiz, U.S. Filter, Vidler and Western Water Co. have made a business out of purchasing land with water rights (primarily groundwater) on the premise the water will be sold to those willing to pay a premium to use it. Private companies are considered integral in establishing a viable water market in California and as the

market develops, it is possible that more and more private companies will offer their services to water users willing to pay.

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GROUNDWATER OVERDRAFT AND CONTAMINATION

In an average year, groundwater supplies about 30 percent of California's urban and agricultural water supplies, and up to 40 % in a drought year. This does not include the water required for environmental uses. More than 9 million Californians – nearly one in three – rely solely on groundwater to meet their needs, including the major cities of Fresno and Bakersfield. Some regions are even more dependent on groundwater. Along California's central coast, 90 percent of the drinking water comes from groundwater. Although groundwater and surface water are treated as separate resources they are intimately connected.

In average rainfall years, Californians use more groundwater than is replaced by precipitation, stream seepage or artificial recharge programs. Annual statewide overdraft -- taking out more than is replenished -- is estimated by DWR to be approximately 1.4 million acre-feet in a normal year. The long-term decline in groundwater storage can result in lowered water tables and increased energy costs for pumping. In some basins, overdraft leads to land subsidence and can cause sea water and other contaminants to invade the aquifer.

One method of increasing water supply reliability is the joint or "conjunctive" use of surface water and groundwater supplies. More than 65 water agencies in the state operate groundwater recharge programs. The success of many of these programs, however, depends on purchasing available surface water from other users.

At the core of any conjunctive use project is a concept that many in California have resisted – groundwater management. For a conjunctive use program to succeed, water must be measured and managed as it is extracted from and/or recharged into a groundwater aquifer. Yet managing a groundwater basin, to some, equals a state-dictated system for a resource that has, historically, been considered a property right of overlying landowners. And while the state's surface water system is devoted to the concept of moving water from areas of plenty to areas of need, proposals to transfer groundwater from one area of the state to another invite suspicion.

Each conjunctive use project, however, is different, with its own set of legal, political and technical challenges, and some question how much "new" water projects will ultimately yield. Where do you get the surface water to store in a groundwater aquifer? How do you determine a groundwater basin's safe yield? How long will it take to extract the groundwater? What about overlying landowners' rights to the native groundwater? How do you protect the quality of that native underground supply?

One significant groundwater recharge program is the Kern Water Bank in Kern county, which was transferred from DWR to the local water agencies in 1996. Under the program, available surface water from the SWP, CVP or Kern River is purchase by the six participating water agencies to recharge depleted aquifers and shallow ponds. By mid-1998, over 700,000 acre-feet of water had been recharged, and like a traditional savings account, water deposited into the water agency can be withdrawn as needed. Bank authorities believe there is sufficient room to store approximately 1 million acre-feet of water in the facility.

While California uses more groundwater than any other state, it along with Texas are the only remaining Western states lacking a comprehensive statewide groundwater management system. Regulation exists in some local districts or in basins that have been adjudicated by the courts, but generally there are no controls in California over extraction. Agricultural interests oppose statewide regulation for fear it would curtail pumping in drought years.

In 1999, DWR announced plans to update Bulletin 118 – a loose framework of groundwater management criteria that the state plans to modify. The three-year program includes a modeling study of 500 groundwater basins around the state. Once completed, the updated bulletin is intended to provide specific groundwater management guidelines for use by local entities. A final report is expected to completion in 2002.

All of the state's groundwater basins are contaminated to some degree. Contamination usually concentrates in small sections of the basin. A serious and immediate threat to potable water supplies is contamination from landfills, leaked toxins, solvents, microbial agents, acid mine drainage and agricultural chemicals. The huge cost, complexity and time required to clean up contaminated basins has forced some communities to abandon their wells and rely on imported surface water supplies.

Some of the most widely publicized groundwater problems in California involve contamination from manmade chemical compounds. Volatile organic compounds (VOCs) from industrial sources, which are known or suspected carcinogens, seriously polluted wells in the San Gabriel Valley in Los Angeles County. In the Central Valley, irrigation runoff containing fertilizers, pesticides and herbicides has significantly polluted some areas. The city of Santa Monica in mid-1997 was forced to close half of its drinking wells after the gas oxygenate MTBE was found at levels exceeding recommended safety levels.

In some overdrafted coastal aquifers, seawater has intruded and impaired groundwater quality.

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AGRICULTURAL DRAINAGE

The leaching of applied chemicals and naturally occurring

trace elements from agricultural soils poses problems throughout the West. It is especially acute in California. The state's nearly $27 billion agricultural industry produces half the nation's fruits, nuts and vegetables and directly and indirectly employs one out of six Californians. Yet the environmental impact of such intense irrigated agriculture cannot be overlooked.

Drainage water can be tainted not only with pesticides but also high concentrations of salts, selenium, arsenic, boron and/or other trace elements. Decades of surface irrigation has caused the leaching of selenium from soils in parts of the south and west sides of the San Joaquin Valley and the Imperial Valley. Selenium is a naturally occurring trace element toxic to wildlife when concentrated. In 1983, the discovery of thousands of dead or deformed waterfowl at the Kesterson National Wildlife Refuge alerted the public to the dangers of concentrated selenium levels. Kesterson, a western San Joaquin Valley wetlands area that was supplied with agricultural drainage water from the San Luis Drain, was closed in 1986. In 2000, the Ninth U.S. Circuit Court of Appeals ruled that the federal government had to do something to dispose of the drainage water but did not specifically endorse a drainage canal and discharge into the Delta.

In April 2001, the Bureau filed a plan that says it will evaluate “viable drainage alternatives” with a record of decision by 2005. Among those choices is completion of the San Luis Drain, which would cost an estimated $500 million to $13 billion.

Selenium levels in excess of those deemed safe also have been found in the Salton Sea and in agricultural evaporation ponds in the Tulare Basin. Attempts have been made to close the Tulare Lake Basin drainage ponds that have selenium levels exceeded those found at Kesterson to protect migratory waterfowl. Drainage water is the only source of water in many of these ponds, resulting in high concentration of selenium, other trace elements and salts. Under an agreement with the USFWS, alternative bird habitat was provided in 1995 by five of the 10 pond operators to reduce the exposure of waterfowl to the Tulare evaporation ponds. According to the USFWS, about 40 percent of the alternative habitat successfully mitigated the hazards to the birds.

Subsurface drainage systems are commonly used throughout the San Joaquin, Imperial and Coachella valleys to drain excess or saline water from the root zone, where dense soils prevent water from percolating into the subsurface. To alleviate problems wrought by irrigating the west side San Joaquin Valley's poorly drained saline soils, the Bureau began constructing the San Luis Drain in 1968 to carry drainage water to the Delta. The work on the drain was halted in 1975 when concerns arose over the cost and impact of the discharge on Delta water quality and wildlife. Following a lawsuit by Westlands Water District farmers, Westlands and the Bureau entered into a settlement whereby the Bureau agreed to cooperate with Westlands on

potential drainage solution studies. Eventually, an arrangement was reached whereby land shown by the studies to have drainage problems would be purchased by the Bureau and taken out of production. However, opposition by some landowners shelved the settlement.

The Bureau allowed some farmers served by the CVP San Luis Unit to use a 28-mile section of the San Luis Drain for a two-year trial period beginning in 1996 to protect the Grasslands wetlands. Negotiations with federal agencies and other stakeholders resulted in a use agreement that includes extensive monitoring, monthly and annual selenium load limits and fee assessments if those limits are exceeded. After completing the fourth year of the program in 2000, the farmers were 23 percent below their allowable discharges.

The west side of the San Joaquin Valley is served by the CVP, and the Bureau initiated a program to buy and retire selenium-laden land in the area under the CVPIA. The Bureau hopes to begin purchasing several thousands acres of land with the most serious drainage problems from willing sellers in 1998. CVPIA will provide the Bureau with approximately $17 million to purchase up to 15,000 acres of land from Westlands Water District (Westlands) in Fresno, Kings and Tulare counties. Westlands will retain water rights to approximately 40,000 acre-feet and in return, will contribute $2,000 towards the purchase of each acre of land by the Bureau. The land will be restored through a joint Bureau/USFWS/Bureau of Land Management CVPIA Expanded Land Retirement Demonstration Project to allow for native plant and animal populations to thrive, It is estimated that if current irrigation practices continue, salt and trace element-tainted, shallow groundwater will adversely affect 40 percent of the west side of the San Joaquin Valley's irrigable farmland and threaten its $7 billion a year agricultural industry, according to the 1990 San Joaquin Valley Drainage Program report. Thus far, about 2,000-acres have been retired by the Bureau as part of a demonstration project. An additional 15,000-acre demonstration project is currently undergoing NEPA review. In 2001, the lake is at 6,385 feet above sea level and is expected to meet the State Board mandated height of 6,292 feet above sea level in about 10 to 15 years.

SUMMARY

As difficult as it is for California's diverse water interests to agree on anything, most appear to realize that California will resolve its water problems only through compromise and innovative thinking. Increasingly, alternative methods of enhancing water supply will replace or augment environmentally sensitive water development projects. Using new strategies to satisfy the state's many competing demands is the challenge that the public and water managers will face into the next century.

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