4. PROBLEMS, NEEDS, AND OPPORTUNITIES

Problems and Needs

- Water supply reliability
- Water supply
- Water management flexibility
- Anadromous fish survival
- Water quality
- Environmental

Opportunities

- Recreation
- Hydropower generation
- Flood control

The most significant elements of any water resources investigation are identifying the scope and magnitude of problems to be solved and discovering and articulating the needs and opportunities to be addressed for all affected resources. This requires the concise and accurate identification of existing resource conditions (provided in Section 3.0) and associated trends or changes to these conditions in the future. The identification of problems, needs, and opportunities provides a foundation for formulating alternative plans to solve the problems and needs and realize opportunities. This section presents the discovery and significance of existing resource conditions associated with the NODOS Investigation.

While the problems and needs presented in this section are described as water system problems, inherent to these are some of the problems and needs of other areas, discussed in this section as "opportunities."

4.1 WATER SUPPLY RELIABILITY

According to the California Water Plan 2005 Update (DWR, 2006), the biggest challenge facing California water resources management remains making sure that water is in the right places at the right times. As expected, this challenge is at its greatest during dry years when surface water available for all beneficial uses is greatly decreased. Those water users with access to alternate supplies, such as groundwater, utilize them, often at higher costs. Water users already incorporating water-use efficiency measures may find it more challenging to achieve additional water-use reductions. Water flows for instream uses, such as fisheries and water quality, generally are reduced in accordance with dry-year step-down provisions contained in the requirements or standards requiring the flows.

As competition grows among water users, management of the highly constrained and regulated water system becomes more challenging, complex, and, at times, contentious. During long or extreme droughts, water supplies are less reliable, heightening competition and sometimes leading to conflict among water users. Water quality is degraded, making it difficult and costly to bring water up to drinking water quality standards. Business and irrigated agriculture are adversely affected, jeopardizing California's economy. Ecosystems are strained, risking sensitive and endangered plants, animals, and habitats. Groundwater levels decline, and many rural residents who are dependent on small water systems or wells run short of water. Local, regional, state, and federal governments and water suppliers all have a role in assuring water resource sustainability and improving water supply reliability for the existing and future population and the environment.

The Upper Sacramento River and Northern Sacramento Valley suffer from a water supply reliability problem associated with the consistent and expedited delivery of water to downstream environmental, agricultural, and urban users. Present conditions along the Upper Sacramento River at times delay the delivery of water to specified locations at designated times.

Reliability is defined as delivering water to a particular location, for a beneficial purpose, with a desired quality, at a particular time. For example, the Ecosystem Restoration Program may require a certain quantity and quality of water to be delivered to a particular point at a particular time to meet a specified environmental need (e.g., to provide spawning habitat for Delta smelt or longfin smelt). Reliable delivery of water to meet this need requires that the water be available and that California's water system be able to deliver it where it is needed at the appropriate time. CALFED couples this requirement with the need for environmental restoration in the Bay-Delta system.

Water supply reliability is one of four primary interrelated objectives of the CALFED Program. Water supply reliability integrates the water supply elements of storage, conveyance, and quality. The CALFED ROD specifically addressed the linkage of storage to successful implementation of all other CALFED program elements:

> *Expanding water storage capacity is critical to the successful implementation of all aspects of the CALFED Program. Not only is additional storage needed to meet the needs of a growing population, but, if strategically located, it will provide much needed flexibility in the system to improve water quality and support fish restoration efforts. Water supply reliability depends upon capturing water during peak flows and during wet years, as well as more efficient water use through conservation and recycling.*

Therefore, the basic need being investigated by the NODOS Study Team is improvement of the water supply systems in the Sacramento Valley Region and California to more reliably serve all the beneficial uses that rely upon it. This would reduce the competition and conflict over how water resources are used and allocated.

4.2 WATER SUPPLY

The CALFED PPA identified a need for up to 6 MAF of new storage in California, including up to 3 MAF of storage north-of-the-Bay/Delta. The Bay-Delta drainage produces an average annual runoff of approximately 22 MAF. Total reservoir capacity in this drainage area is approximately 15 MAF, including 2.4 MAF of capacity in Trinity Lake, which captures runoff from a 692-square-mile drainage area outside of the Bay-Delta watershed.

The California Water Plan Update 2005 (DWR, 2006) presents three plausible demand scenarios for 2030. The water demand associated with year 2000 and the three 2030 water demand scenarios for average water years are shown in Table 4-1. For all three scenarios, 2 MAF per year of water will be needed by 2030 to eliminate groundwater overdraft statewide.

As shown in Table 4-1, for the three baseline scenarios, statewide water demand ranges from a reduction of about 0.4 MAF per year to an increase of 4.0 MAF per year. Additionally, to meet the need of eliminating statewide groundwater overdraft, demands for the three scenarios increase from 1.6 to 6.0 MAF. These demands cannot be used as direct indicators of future shortages. Some areas of the state have existing or planned resources to provide for these projected needs; many areas do not. New urban demand, driven by projected population increases, makes up a majority of future demand increases. Agricultural demand decreases significantly in each scenario.

There is additional information in the Water Plan Update related to describing the state's water resources needs. For example, an additional 1 MAF of currently unmet environmental demand has been identified, including flows recommended by CALFED's Ecosystem Restoration Program and CVPIA's Anadromous Fish Restoration Program and refuge water supply. In the demand summary above, 50% of that amount is

Table 4-1

Water Demand Under Three Future Scenarios (MAF)

Water Demand	2000	Year 2030 by Scenario		
		Current Trends	Less Resource Intensive	More Resource Intensive
Urban	8.9	11.9	10.3	14.7
Agricultural	34.2	30.8	31.4	32.4
Environmental	39.4	39.9	40.4	39.4
Total	**82.5**	**82.6**	**82.1**	**86.5**
Demand Change (2000-2030)		**-0.1**	**-0.4**	**4.0**
Eliminate Groundwater Overdraft		2.0	2.0	2.0
Demand Change (including overdraft)		**1.9**	**1.6**	**6.0**

shown in the Current Trends scenario, 100% is shown in the Less Resource Intensive scenario, and no additional environmental demand is shown for the More Resource Intensive scenario. Water supplies for these additional environmental demands have not been identified.

Shortages can occur within the Sacramento River basin under normal conditions, and the demand for water is rising. The Sacramento Region's CVP contractors and settlement contractors are subject to dry-year deficiencies. These contractors seek a greater degree of water supply reliability. Direct diversions to contractors often conflict with the needs of sensitive species, thereby shortening the available diversion period. CVP operations within the basin are especially vulnerable to droughts. According to several CALFED CALSIM simulations, full contract deliveries to CVP agricultural water service contractors north of the Delta can only be made in 75% of the years, based on recent conditions.

Because the Bay-Delta diversions supply approximately 75% of the water used in California, regional water shortages affect the entire state. CVP water supply conditions south of the Delta are even more problematic. By the year 2020, full contract deliveries to agricultural water service contractors will occur in approximately 50% of the years, based on recent conditions, while full contract deliveries for south of Delta municipal contractors will occur in 70% of the years. These forecasts indicate the need to augment water supplies for Delta exporters.

Water supply reliability simulations indicate that the SWP also lacks long-term reliability. Maximum contractual obligations for the SWP from Delta pumping stations are approximately 4.1 MAF. Of this maximum contract amount, the SWP has delivered a maximum contract amount of 3.2 MAF in 2000, or approximately 78%. According to reliability simulations, 3.0 to 4.1 MAF will be requested in 2021, depending on weather and associated hydrologic conditions. Average water delivery using historic hydrology and 2021 level demands is 3.1 MAF, approximately 75% of the maximum contract amount. The lowest SWP delivery during this simulation is 800 thousand acre-feet (TAF), only 19% of the maximum contract amount. This again illustrates the conclusion from the Water Plan Update that drought conditions present the most significant challenge to water managers.

4.3 WATER MANAGEMENT FLEXIBILITY

Because of highly seasonal precipitation and the fact that annual runoff can vary greatly from year to year, California has developed an elaborate network of storage and delivery systems to supply cities, farms, businesses, and the environment with adequate water year-round. A need exists to improve California's water management (operational) flexibility to provide improved statewide water supply reliability and improved access to affordable water supplies. As both urban and agricultural water use and recognition of environmental water needs have increased, so have conflicting demands for limited water supplies in a highly constrained and regulated system. Water management flexibility can create significant benefits for the system including, but not limited to, more rapid response to meeting all urban, agricultural, and environmental water quality regulatory standards; rapid response to unexpected and unpredicted incidents, such as Delta levee breaks that can shut down the SWP, CVP, and Bay Area export operations in the Delta; and means to meet aquatic flow standards and provide aquatic restoration benefits in the valley rivers and in the Delta (while maintaining supply reliability to other urban, agricultural, and environmental beneficial water uses).

As noted previously, there is growing concern amongst scientists and water managers associated with potential impacts of global warming on California's water resources. One of the more significant impacts identified is related to the state's reliance on Sierra and Trinity snowpack storage. Estimates of a 3-degree Celsius rise in temperature in California would raise snow levels up to 1,500 feet, with a corresponding loss of up to 5 MAF of April 1 snowpack storage. The system flexibility afforded by additional reservoir storage could mitigate the loss of snowpack storage resulting from global climate change.

The Bay-Delta system diversion point provides the water supply for a wide range of in-stream, riparian, and other beneficial uses, including drinking water for millions of Californians and irrigation water for agricultural land. As both water use and the recognition of environmental water needs have increased during the past several decades, conflicts have increased among users of Bay-Delta water. In response to declining fish and wildlife populations, water flow and timing requirements have been established for certain fish and wildlife species. Over the past decade, several protective actions, including the CVPIA and the 1995 Bay-Delta Water Quality Control Plan, have reduced the ability of the SWP and CVP to contribute to statewide water supply reliability. These protective actions have restricted SWP and CVP operational flexibility, affecting the quantity, quality, and timing of deliveries from the projects. CALFED has estimated that these two protective actions have reduced water contract deliveries by over 1,000,000 AF annually during dry periods.

There are water shortage losses that demand-management measures cannot prevent, such as compromised water quality, loss of crop yield from delayed or inadequate irrigation, or loss of fish because of reduced stream flow or increased water temperature. These issues highlight the need for system flexibility, allowing water to be available at the proper time and place, and for the duration it is needed. This flexibility is essential to capitalize on the ability to carry water over from one year to the next.

4.4 CVP, CALFED, AND RELATED ENVIRONMENTAL CONCERNS

The need and opportunity for Sacramento River and Bay-Delta ecosystem restoration are well documented by the CALFED program and others. Providing storage north of the Delta would allow water to be diverted from the Sacramento River during periods when outflows and water quality are less problematic for endangered, threatened, or sensitive species.

The CVPIA redefined the purposes of the CVP to include protection, restoration, and enhancement of fish, wildlife, and associated habitats and protection of the Bay-Delta Estuary as having equal priority with other purposes. The CVPIA required the dedication of an additional 800,000 AF of CVP yield to the restoration of fish, wildlife, and habitat purposes and redirected between 368,000 to 815,000 AF of water normally diverted into the Central Valley to remain as instream flows on the Trinity River (DOI, 1999). The average (weighted by water-year class probability) annual water volume required for the Trinity River is estimated at approximately 594,500 AF. The CVPIA also directed Reclamation to provide full Level 4 supplies from willing sellers to wildlife refuges identified in the Refuge Water Supply Plan and the San Joaquin Basin Action Plan, amounting to approximately 129,000 AF of additional refuge water supply. CVPIA also includes dedicating a portion of the CVP yield to the Anadromous Fish Restoration Program, which includes a goal of doubling anadromous fish in the Central Valley and streams. These operational mandates for environmental purposes reduced Sacramento River and Bay-Delta CVP supplies.

Current water supply storage on the Sacramento River limits the amount of water available for environmental purposes. The CALFED ERP seeks to acquire new sources of water to improve conditions for spawning, rearing, and migration of myriad fish species in the Sacramento River and the Delta. New storage supplies could provide the means to meet CVPIA Refuge Water Supply and other in-Delta environmental objectives. Accordingly, a need exists to provide water supplies for the environment and provide the flexibility in the system necessary to improve environmental conditions in the Sacramento River and the Delta. Further needs exist to reduce the impacts of water diverted from the Sacramento River and to provide cooler water for fish spawning habitat.

4.5 ANADROMOUS FISH SURVIVAL

Today, less than 5% of the approximately 500,000 acres of riparian forest that historically fringed the Sacramento River remains. Most of the land adjacent to the river is protected by levees, such as the river section from the Chico Landing to the Delta. In addition to levees, upstream development has changed the landscape of the Sacramento River. Dams have blocked access to over 80% of spawning and rearing habitat historically available to Chinook salmon and steelhead.

In addition to blocking the spawning migrations of Chinook salmon and steelhead, the operations of upstream dams and in-Delta pumping facilities and diversions have altered natural flow regimes by changing the frequency, magnitude, timing, and direction of flow. These changes could affect all fish species in the rivers, Delta, and Bay. Salmon and steelhead are particularly susceptible to poor water conditions.

There are many other issues that affect the survival of anadromous fish. Reservoirs created by dams act as settling basins for coarse sediment and organic material, diminishing sediment movement and degrading downstream spawning and rearing habitat. Inactive and abandoned mine drainage have created conditions that are toxic to aquatic species, as well have discharges from urban and M&I areas. Agricultural areas can discharge potentially harmful herbicides and pesticides. Discharges from any source can also increase turbidity. Water temperature conditions that adversely affect downstream species have been created by removal of riparian vegetation, reservoir operations, agricultural drainage, and channel modification (CALFED, 2000).

Turbidity, temperature, dissolved oxygen, bromide, chloride, and nitrogen affect these species in each aspect of their reproductive cycle. For example, temperatures in the upper Sacramento River spawning beds must be kept near 56 degrees Fahrenheit (°F) to allow salmon and steelhead incubation and smolt survival.* These requirements are further complicated by the number of different species inhabiting the spawning area and the life stage of each of these species. For instance, Central Valley steelhead have different fresh water incubation and rearing requirements than do several salmon species because they require longer periods in fresh water. Thus, juvenile steelhead may be present in the Sacramento River spawning grounds when fall-run Chinook salmon are beginning to spawn, and each may have independent water supply and water quality needs.

These requirements have altered water management operations in the Sacramento River and the Bay-Delta. For a period after the large dams were constructed, reservoirs were kept relatively full, and the cold water released from the hypolimnion provided cooler summer temperatures in the downstream reaches. Since the early 1980s, however, reservoirs have been drawn down farther because of increased water demands, resulting in warmer water releases and higher egg mortality rates. The warmer water temperatures have especially harmed winter-run Chinook salmon, which spawn in spring and summer. To address this problem, special modifications were made to Shasta Dam to allow for the release of cooler water from the hypolimnion even when water levels in the reservoir are drawn down.

At present, a need exists within the NODOS Investigation area for the ability to change system-wide operations to improve the adequacy of anadromous fish migration flows. Four seasonal runs of Chinook salmon occur in the Central Valley system or, more accurately, in the Sacramento River drainage area, with each run being defined by a combination of adult migration timing, spawning period, juvenile residency, and smolt migration periods. Fish losses have been the prominent indicator of Bay-Delta environmental decline. Facilities constructed to support water diversions cause straying or direct losses of fish and can increase exposure of juvenile fish to predation.

The following fish species are among those affected by water operations in the Sacramento River and Bay-Delta: the federally and state endangered winter-run Chinook salmon, the federally and state threatened Delta smelt, the federally threatened Central Valley steelhead evolutionary significant units (ESU), the federally and state threatened Central Valley spring-run Chinook salmon, the green sturgeon listed as a California Species of Special Concern, and the federally threatened Sacramento splittail. Biological opinions for these species affect current water supply operations. Non-listed fish species that also may be affected by water operations include striped bass, Pacific lamprey, river lamprey, white sturgeon, and American shad. Further, several non-fish species have the potential to be impacted by system-wide water operations, such as the western pond turtle and the valley elderberry longhorn beetle, both federally and state endangered species that depend on riparian habitat in the Delta and Sacramento River.

As illustrated in this section, historical water management practices have greatly affected anadromous fish survival, but in turn, species water requirements affect current water operations. The listing of several fish species in the Sacramento River and Delta under state and federal species protection laws has greatly influenced system-wide water supply operations. Each listed species has specific water supply requirements that mandate state and federal projects manage releases to meet species' needs. Timing reservoir releases to meet critical needs is difficult because Lake Shasta and Lake Oroville are many miles away from targeted reaches further downstream or in the Delta.

In 1966, the gates on the Red Bluff Diversion Dam (RBDD) remained in place all year. In 1986, the gates were raised from early December to late March to accommodate federally endangered winter-run Chinook salmon. By 1996, the current pattern of eight months of gates-out operation was in force. Water

* Experts disagree on the range of temperatures that various evolutionarily significant units (ESUs) of salmon need for survival in different life stages.

cannot be diverted into the Tehama-Colusa Canal when the gates are raised; thus, when irrigation demands begin in earnest in late March and April, operational constraints reduce the Tehama-Colusa Canal Authority's (TCCA's) ability to meet demand for irrigation water.

In the Delta, water management also has been impacted by fishery requirements. Delta pumps must cease pumping when threats to salmon and Delta smelt livelihood exist. Adjustments of pumping operations in the Delta to meet broad environmental objectives have further constrained water supplies. In 1978, the SWRCB adopted Decision 1485 (D-1485), setting water quality standards, export limitations, and minimum flow rates for both the SWP and CVP. These conditions sought to simultaneously protect all beneficial uses in the Bay-Delta. Later SWRCB decisions, such as D-1641 and the Bay-Delta Water Quality Control Plan (D-95-06), further constrained pumping operations in pursuit of the same objectives. All of these conditions continue to affect supply reliability for all uses in the Sacramento River and Bay-Delta, including environmental uses.

4.6 WATER QUALITY

Nonpoint-source pollution, including urban and agricultural runoff, is the largest contributor of human-induced contamination of surface water and groundwater in the state. Regarding surface water, about 13% of the total miles of California's rivers and streams and about 15% of its lake acreage are listed as impaired. Regarding groundwater, samples analyzed from all 10 hydrologic regions showed that 5 to 42% of public water supply wells exceeded one or more drinking water standards, depending on the region. The exceedance was usually for inorganic chemicals or radioactivity and, in particular, nitrate, which presents a known health risk. Largely agricultural or industrial regions had high percentages of exceedances for pesticides and volatile organic chemicals, respectively. Seawater intrusion in the Delta and in coastal aquifers, agricultural drainage, and imported Colorado River water can increase salinity in all types of water supplies, adversely affecting many beneficial uses. The quality of California water is of particular and growing concern. Degraded water quality can limit, or make very expensive, some water supply uses or options because the water must be pretreated.

The NODOS Investigation study area currently has a need for improved water quality. Improved water quality in the Bay-Delta is needed for drinking water, agriculture, and environmental restoration. Water quality is a function of the physical and chemical composition of a source of water supply. The composition requirements of each end use vary, but the guiding elements of a Bay-Delta water quality "needs assessment" are salinity, toxins, and drainage.

Water of a specific quality and temperature is also required to ensure species survival and sustain habitat in the Bay-Delta system to support a diversity of fish and wildlife populations. All Delta fisheries are sensitive to a variety of water quality constituents. For example, Delta smelt require a water source with an electrical conductivity measurement (ECw) of less than 12,000 ECw in order to reproduce. The survival of Delta smelt increases as the Delta's "X2" line (the line in the Delta connecting points with a salinity concentration of 2 parts per million) moves downstream toward San Francisco Bay. In addition, the ideal temperature of Delta water for Delta smelt is 71.6°F, but they cannot survive at all if water temperatures exceed 77°F. Accordingly, there is a need to provide water of sufficient quality to meet biological needs, such as those of the Delta smelt. This requirement manifests as the need for a supply of fresh water at a certain temperature and the ability to deliver that supply when it is needed.

The Bay-Delta system is the diversion point of drinking water for millions of Californians and is critical to the state's agricultural sector. Drinking water standards are dynamic. The potential for increasingly stringent drinking water requirements that require new treatment technologies is spurring water providers to seek higher-quality source waters and to address pollution in source waters. The salts entering the Bay-

Delta system from the ocean and from return flows upstream and within the Delta decrease the utility of Bay-Delta system waters for many purposes, including the ecosystem, agriculture, and drinking water. Accordingly, there is a need to improve source water and system-wide operations to meet drinking water quality standards.

Typically, the months of April through July are most favorable with respect to the Delta as a source of drinking water. Outflow from natural runoff is usually high enough during this period to push seawater out of the Delta. This period is also outside the peak loading time related to agricultural drainage. Because water supply needs are greatest in these months, given direct demand requirements, the need for enhanced water quality in the NODOS Investigation study area becomes crucial. However, fishery concerns have resulted in a shift in exports from these higher-quality spring months to lower-quality fall months, with a corresponding degradation in delivered water quality. In particular, May and June have proven to be sensitive Delta smelt months, with elevated take at the export pumps.

Increasing Delta outflow in fall months through reservoir releases would reduce other chemical concentrations in Delta drinking water diversions. For example, preliminary modeling studies conducted by CALFED suggest that, depending on the amount of outflow enhancement and assuming some Delta conveyance improvements, peak reduction of bromide in the south Delta in fall months could be in the range of 20% to 30%. With additional storage facilities north of the Delta, peak fall bromide concentrations could be lowered by as much as 30% to 50% in many years, including the driest ones. Export management strategies also could be implemented to reduce organic carbon loads in drinking water diversions. Export reductions during periods of peak organic carbon loading, in February and March, also would benefit Delta fisheries. Accordingly, there is a need to reduce toxin accumulation in Delta drinking water through better upstream water management and water supply augmentation.

Drainage is another aspect of Delta water quality. Urban and agricultural runoff can carry toxins into the Delta that can infiltrate drinking water, be introduced into the aquatic food chain, or remain latent on the bed or banks of a water body. Preventing toxins from entering water sources is a key priority of CALFED. CALFED also acknowledges that removing or diluting toxins with increased non-toxic fresh water flows or flushing them from the Bay-Delta system into the ocean is beneficial. Therefore, there is a need for enhanced water quality to increase flows into the Delta when toxins are most likely to affect fisheries, drinking water quality, or the environment.

4.7 OTHER OPPORTUNITIES

CALFED documents recommend that opportunities to address other regional water resources needs be considered in the evaluation of all potential projects. This investigation will consider opportunities for power generation and recreation, to the extent possible.

4.7.1 Hydropower Generation

According to the California Energy Commission, California's electric peak demand is almost completely caused by summertime air conditioning loads that create sharp peaks in demand. Traditionally, loads are served by generating facilities but responsiveness programs may also be effective in balancing supply and demand. Recent trends in electricity use are driven by economics and population growth. As population increases in the Sacramento Valley and throughout California, demands for electricity will continue to grow rapidly. This demand for electricity drives the need for new electrical supplies, such as hydropower, or demand responsiveness programs, such as off-peak pumping at power generating facilities. While offsetting the power needs of offstream storage pumping, the NODOS Investigation will explore the ancillary benefits that hydropower generation can offer to the statewide grid.

4.7.2 Recreation

Recreational activities within watersheds of the streams flowing through the study area include hiking, fishing, camping, boating, mountain biking, and off-road vehicle use. Recreational use and opportunity are currently very limited within the study area, and demands for water-oriented recreational opportunities in the Sacramento River Basin are high. Some of these demands are served by reservoirs on the western slope of the Sierra Nevada Mountains. However, as population increases in the Sacramento Valley, demands for flat water, river, and land-based recreation are expected to increase.

4.7.3 Flood Protection

Improvements to the water management system may provide opportunities to increase flood protection by allowing better coordination of various Sacramento region reservoirs to provide for additional flood storage space at selected on stream reservoirs, including Folsom, Oroville, and Shasta.

4.8 SUMMARY

Table 4-2 summarizes the problems, needs, and opportunities and shows the relationship to the potential planning objectives.

Table 4-2

Problems, Needs, and Opportunities Relative to Planning Objectives

Problems and Needs	Planning Objectives
Water Supply Reliability – Reliably delivering water to meet urban, environmental, and agricultural requirements requires both the availability and timely delivery of water to where it is needed.	Increase water supply reliability for agricultural, M&I, and environmental purposes by enhancing water management flexibility for the Sacramento Valley.
Water Supply – Current and future demands for water in California exceed available supplies during many years. The Preferred Program Alternative in the CALFED Record of Decision identified a need for up to 6 million acre-feet of new storage in California, including up to 3 million acre-feet of storage north of the Bay-Delta.	Increase water supplies for agricultural, M&I, and environmental purposes to help meet California's current and future water demands.
Water Management Flexibility – As water use and recognition of environmental water needs have increased, so have conflicting demands for limited water supplies in a highly constrained and regulated system. Water management (operational) flexibility can create significant benefits for the system including, but not limited to more rapid response to meeting urban, agricultural and environmental water quality regulatory standards; rapid response to unexpected and unpredicted incidents such as Delta levee breaks that can shut down the SWP, CVP, and Bay Area export operations in the Delta; and more options and means to meet aquatic flow standards and provide aquatic restoration benefits in the valley rivers and in the Delta.	Enhance water management flexibility by providing additional diversion, storage, and delivery opportunities.
Anadromous Fish Recovery – Water resources facilities and operations including levees, dams, and diversions have affected the survivability of anadromous and other fish populations associated with the Sacramento River and Delta. Other negative effects are related to land use changes, habitat conversion, and water quality degradation due to introduced impurities. Four anadromous and two resident fish species have received state or federal designations as threatened, endangered, or of special concern.	Increase the survival of anadromous fish populations in the Sacramento River and improve the health and survivability of other aquatic species.
Water Quality – The Delta is a source of drinking water for over 20 million Californians and provides vital habitat for over 750 plant and animal species. The CALFED water quality program goal is to improve Delta water quality beyond current regulatory requirements for all beneficial uses, including urban, agricultural, and environmental uses.	Improve Delta water quality.

Table 4-2
(Continued)

Opportunities	Planning Objectives
Environmental – Water managers need more effective tools to strategically acquire, store, transfer, and release water in response to real-time ecosystem needs. Flexibility in the state's water delivery system is necessary for providing water at critical times to meet environmental needs.	Provide increased water supplies, water supply reliability, and management flexibility for environmental purposes, including CALFED programs such as Delta water quality, EWA, and ERP.
Hydropower Generation – While offsetting the power needs of offstream storage pumping, the NODOS Investigation will explore the ancillary benefits that hydropower generation can offer to the statewide energy grid.	Provide hydropower generation capacity for the Sacramento River basin to offset energy usage and pumping costs, potentially contributing ancillary benefits to the statewide grid.
Recreation – Recreational use and opportunity are currently very limited within the study area, and demands for water-oriented recreational opportunities in the Sacramento River basin are high. Some of these demands are served by reservoirs on the western slope of the Sierra Nevada mountains. However, as population increases in the Sacramento Valley, demands for flat water, river, and land-based recreation are expected to increase.	Develop additional recreational opportunities in the study area.
Flood Control Storage – Improvements to the water system may provide opportunities to increase flood protection by allowing better coordination of various Sacramento region reservoirs to provide additional flood storage space at selected on-stream reservoirs, including Folsom, Oroville, and Shasta.	Provide incremental flood control storage opportunities.