CHAPTER IV
WATER AND RELATED RESOURCES PROBLEMS AND NEEDS

ANADROMOUS FISH SURVIVAL

The population of Chinook salmon has significantly declined over the past 30 years. There are numerous factors contributing to the decline including: water diversions from the Sacramento River; drought conditions; reduction in suitable spawning gravels; fluctuations in river flows; toxic acid mine drainage; unnatural rates of predation; and fish harvests. However, one of the most significant environmental factor is unstable water temperatures.

Water temperatures that are too high or in some cases too low can be detrimental to salmon. Elevated water temperatures can negatively impact spawning adults, egg maturation and viability, and pre-emergent fry, significantly diminishing the resulting ocean population and next generation of spawners. Additionally, stress caused by high water temperatures may reduce fish resistance to parasites, disease, and pollutants. Cold water is detrimental to the rapid growth of some juveniles. Since construction of Shasta Dam, water released in the spring was unusually too cold for this rapid growth of fall and late fall-run juvenile salmon. This was detrimental to the salmon because they must attain a length of about 70 millimeters and migrate downstream before temperatures in the lower Sacramento River and the Delta reach about 73 degrees.

Each of the above contributing factors are being addressed by various Federal, State, and local projects. They range from changing the timing and amount of reservoir releases to changing the temperature of released water. One of the operating parameters at Shasta was directed by the SWRCB and in the 1993 NMFS Biological Opinion (BO) for the Winter-run Salmon. This BO established surrogate flows in the river downstream from Keswick Dam primarily to effect water temperatures. Another important minimum flow assumption being used in operational studies for the surface water storage projects in the CALFED ROD includes implementing CVPIA (b)(2) based fish actions.

In addition to flow requirements, structural changes at Shasta Dam have been made to help better manage temperature needs to benefit anadromous fish populations in the upper Sacramento River. As mentioned, this consists of the Shasta Dam TCD that was completed in 1997. The TCD can draw water from the different levels of the lake, including the deepest, to help maintain a better temperature for salmon as well as running the water through the penstocks to produce power. The TCD is effective in helping to reduce Winter-run salmon mortality in some critically dry years and for Fall and Spring-run salmon in below normal years.

Likely conflicting with water temperature improvements made by the TCD at Shasta, is implementation of requirements contained in the Trinity River December 2000 ROD. As mentioned, one of the major features of the ROD is to reduce the average annual export of Trinity River water from 74 percent of the flow to 52 percent. This would result in a reduction of flows from the Trinity River Basin into Keswick Reservoir and then into the Sacramento River. Water diverted from the Trinity River is generally cooler than flows released from Shasta Dam. Accordingly, should the elements of the Trinity ROD be implemented, some of the benefits derived from the TCD will be offset by the reduction of the cooler water from the Trinity River.

Findings in the 2000-2001 Biennial Report of a California Department of Fish and Game Commission on the Sacramento River Winter-run Chinook Salmon indicate that the total number of fish are tending to be increasing. This is likely primarily due to minimum release requirements at Shasta Dam and to the TCD. However, there is still a residual need for generally cooler water in the Sacramento River especially in dry and critically dry years. This need for management of cooler water will increase should the Trinity River Decision be implemented.

WATER SUPPLY NEEDS

Demands for water in California exceed available supplies. As indicated in **Tables 10 and 11**, this need for additional supplies also exists in the Central Valley and is expected to continue. As the population of the Central Valley continues to grow, along with the needs to maintain a healthy and vibrant industrial and agricultural economy, the demand for adequate and reliable water supplies will become more acute. **Table 12** is a summary comparison of existing and expected future water use (2020 level demands) versus available supplies in the Sacramento River, San Joaquin River, and Tulare Lake Basins under drought year conditions from Bulletin 160-98. As shown, it is estimated that the demand for water in the future (2020 level demands) will exceeded available supplies in the Central Valley by at least 10 percent. In addition, based on the results of recent system modeling (CALSIM II), it is highly likely that the expected shortages will be greater than that shown in the table.

It is believed that the competition for available water supplies will intensify as water demands to support municipal, industrial, and related urban growth increase relative to agricultural uses. **Table 12** also shows the expected trend in the distribution of water supplies and water sources under drought year conditions from Bulletin 160-98 in the three basins. The data not only illustrates that although the current and projected shortages are significant, just as important is the understanding that much of the water required for new urban growth is projected to come from redirected agricultural uses.

TABLE 12
COMPARISON OF EXISTING AND FUTURE WATER USE VERSUS SUPPLIES IN THE CENTRAL VALLEY - DROUGHT YEAR CONDITIONS
(1,000 ACRE-FEET)

Water Condition	1995 Acre-Feet	2020 Acre-Feet	Comparison	
			Acre-Feet	Percent
Applied Water				
Urban	2,103	3,305	1,202	57
Agricultural	26,324	25,073	-1,251	-5
Environmental	6,936	6,957	21	0
Total	35,363	35,335	-28	0
Water Supply				
Surface Water	19,758	19,591	-167	-1
Groundwater	12,088	12,192	104	1
Recycled/Desalted	0	0	0	0
Total	31,846	31,783	-63	0
Shortage	***3,517***	***3,552***	***35***	***1***

Source: The California Water Plan, Bulletin 160-98, Appendix 6A, Regional Water Budgets with Existing Facilities and Programs, November 199, Sacramento River, San Joaquin River, and Tulare Lake Basins.

Various potential options are identified in Bulletin 160-98 to help meet expected future water shortages in the Central Valley. These options include construction of new dams and reservoirs consisting of new on-stream storage at the Parks Bar site on the Yuba River, Auburn Dam on the American River; and enlargements to Friant Dam on the Upper San Joaquin River, Pine Flat on the Kings River, and Lake Kaweah on the Kaweah River. It also identifies construction of offstream storage at the Waldo Reservoir Site near the Yuba River. Other measures expected to help meet future needs include ground water overdrafting, drought water marketing, and implementation of various CALFED programs. To date, however, with exception of possible new water storage on the Upper San Joaquin River, none of the new on-stream or offstream surface water storage projects appear likely to be implemented. Upper San Joaquin River (Friant Dam) is the only existing facility where a feasibility study is on-going. Significant additional efforts are underway in development of the 2003 Water Plan to identify potential reliable future water sources to help meet future needs.

Even with major efforts by multiple agencies to address the complex water resources issues in the State along with aggressive water conservation and increased water recycling and other water management measures, it is expected that demands will significantly exceed supplies. To avoid major impacts to the economy and overall environment of the State, it is believed that development of additional reliable water supplies is needed to meet future demands.

OTHER ENVIRONMENTAL OPPORTUNITIES

The health of the Sacramento River ecosystem as well as elsewhere in the Central Valley has been severely impacted in the last century by conflicts in the use of limited resources, particularly water resources. The result has been a decline in habitat and native species populations and a growing number of endangered and threatened species.

Construction of Shasta Dam has had both negative and positive effects on environmental resources in the region. Negative impacts of Shasta Dam include the blocking of historic fish migration into the upper watersheds of the Sacramento River, modification of seasonal flow patterns and the natural riverine processes that they support, and inundation of fish and wildlife habitat. However, the water resources within the reservoir also support a variety of environmental values and objectives throughout the Central Valley and Bay-Delta, playing a central role in environmental flow regulation and water quality. While construction of the dam displaced valuable riverine and upland habitat, it also created shoreline and shallow-water habitat for aquatic, terrestrial, and avian species. For example, Shasta Lake is home to the largest concentration of nesting bald eagles in California, with 18 pairs nesting within 0.5 miles of the shoreline in any given year.

Shasta Lake Area

Upstream from Shasta Dam within the lake, on adjacent lands, and in and near tributary streams natural resources have been impacted by various of activities. Probably the greatest impact has come from historic mining, ore processing practices, and acid mine drainage.

To guide the management of the Shasta-Trinity National Forest, the FS has prepared the Shasta-Trinity National Forest Land Resource Management Plan (STNFLRMP). Primary goals are to integrate a mix of management activities that allow use and protection of forest resources; meet

the needs of guiding legislation; and address local, regional, and national issues. The STNFLRMP includes actions to implement management practices for increasing the amount of cover available for spawning and nursery habitat for warm-water fish in Shasta Lake and on its tributary streams. The STNFLRMP is also to guide implementation of the Aquatic Conservation Strategy of the Northwest Forest Plan for protection and management of riparian and aquatic habitats adjacent to Shasta Lake. The DFG has stocked Shasta Lake with Chinook salmon and rainbow trout to support the lakes cold water fisheries. Opportunities exist to further support the ongoing programs of the FS. These opportunities include improvement and restortion of environmental conditions by developing self–sustaining natural habitat in the Shasta Lake and tributaries area to benefit fish and wildlife resources.

Downstream From Shasta Dam

Land and water resources development has caused major resource problems and challenges. In addition to reduction in anadromous fish populations highlighted above, several others include reduction in riparian, wetland, floodplain, and shaded riverine habitat. This has resulted in reduced populations of many individual plant and animal species.

The quantity, quality, diversity, and connectivity of riparian, wetland, floodplain, and shaded riverine habitat along the Sacramento River has been severely limited by the confinement of the river system by levees, reclamation of adjacent lands for farming, bank protection, channel stabilization, and land development. The modification of seasonal flow patterns by dams and water diversions has also inhibited the natural channel-forming processes that drive riparian habitat succession. It is estimated that less than five percent of the historic acreage of riparian habitat within the Sacramento River Basin remains today.

Reduced quality and quantity of habitat has resulted in reduced population of many fish and wildlife species. Due to low populations and questionable sustainability of many species, listings under State and Federal endangered species acts have increased in recent years. Introduction of non-native species has also contributed to the decline in native animal and plant species. Lack of linear continuity of riparian habitats impact the movement of wildlife species among habitat patches, adversely affecting dispersal, migration, emigration and immigration. For many species, this has resulted in reduced wildlife numbers and population viability.

Ecosystem restoration along the Sacramento River has been the focus of several ongoing programs, including the CALFED Bay-Delta Program, SB 1086 Program, CVPIA, and the Central Valley Habitat Joint Venture. These and numerous local programs have been established in an effort to address the ongoing conflicts over the use of limited resources within the Central Valley. Much effort has been directed in the upper Sacramento River region toward restoring or improving anadromous fisheries, which provide recreational and commercial values in addition to their environmental value. Despite these efforts, there remains a significant need to restore and preserve ecosystem resources along the Sacramento River.

FLOOD PROBLEMS

Large and small communities, as well as agricultural lands, are under threat from flooding and the flood control issues are very complex. The Corps is conducting a comprehensive basin-wide study of flood management issues and options in the Sacramento River Basin, and continues to

develop the Sacramento River Bank Protection Project and assist in local flood control projects along the Sacramento River.

Flooding poses risks to human life, health, and safety. Development in flood prone areas has exposed the public to the risk of flooding. While the existing flood management system has reduced the frequency that flooding occurs, large storms can result in river flows that exceed the capacity of the system or cause failures in the system. The January 1997 flood revealed flood management system problems including levee instability, insufficient conveyance capacity of many channels, and inefficiencies in flood management and warning programs and procedures. The threat to the public is caused by many factors. In particular, overtopping or sudden failures of levees can cause deep and rapid flooding with little warning, threatening lives and public safety.

Physical impacts from flooding occur to residential, agricultural, commercial, industrial, institutional, and public property. Damages occur to buildings, contents, automobiles, and outside property including agricultural crops, equipment, and landscaping. Physical damages include cleanup costs and costs to repair roads, bridges, sewers, power lines, and other infrastructure components. Nonphysical flood losses include income losses and cost of emergency services such as flood fighting and disaster relief.

Even though the Shasta Dam project has the potential to significantly control flood flows in the upper Sacramento River, there are influencing factors than can conflict with flood operation. Flood control operations at Shasta Dam, even with explicit rules provided in the flood control manual, are difficult to manage during a flood event. This is primarily due to the extreme inflow volumes to Shasta that can occur over long periods, numerous points of inflow along the river downstream from Shasta, and the multiple points of operational interest downstream. The primary downstream control point along the Sacramento River that determines reservoir releases under real-time operation is Bend Bridge. However, there are other un-official points of operation that are considered, such as peak flows at Hamilton City or other rural communities that are at risk of flooding.

These factors, combined with uncertainty of storm forecasting, can lead to staff exhaustion and, worse, loss of efficient control at Shasta Dam. Once this occurs, it could cause a domino effect on flood problems downstream to the Sacramento-San Joaquin Delta. Accordingly, there is recognized need for improved flood protection along the Sacramento River.

HYDROPOWER NEEDS

Were California a nation, it would be the 12th largest consumer of electricity, using roughly the same as South Korea and Italy. Among the 50 states, California is the second largest consumer of electricity. Although California has 12 percent of the nations' population, it only uses 7 percent of the electricity. This makes California the most energy efficient state per capita in the nation. Even so, the demands for electricity are growing at a rapid pace. As an example, over the next 10 years California's peak demand for electricity is expected to increase 30 percent from about 50,000 Mega-Watts (MW) to about 65,000 MW. There is, and will continue to be, increasing demands for new electrical energy supplies, including clean energy sources such as hydropower.

RECREATION NEEDS

As the population of the State continues to grow, there will be significant growing demands for water oriented recreation at and near the lakes, reservoirs, streams, and rivers of the Central Valley. This increase in demand will be especially pronounced at Shasta Lake. Any increase in the water surface area at the lake will likely provide opportunities to help meet future recreation demands.