



CALFED
BAY-DELTA
PROGRAM

Affected Environment and Environmental Impacts

Recreation

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DRAFT TECHNICAL REPORT
Environmental Setting - Affected Environment
CALFED Bay Delta Program
Recreation

August 25, 1997

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Environmental Setting - Affected Environment CALFED Bay Delta Program Recreation

1. SUMMARY

2. INTRODUCTION

This technical appendix describes characteristics of recreation areas that could be affected by implementation of the CALFED Bay-Delta Program (CALFED). Those recreation areas are as follows:

- The Sacramento-San Joaquin River Delta (Delta);
- Lakes and reservoirs
- Rivers and streams located both upstream and downstream of identified lakes and reservoirs;
- Coastal sport fisheries;
- National wildlife refuges (NWRs) or State wildlife management areas (WMAs); and
- Other facilities that provide limited recreation, such as aqueducts, canals, and private hunting clubs

Recreation characteristics are identified for potentially affected recreation areas in the Delta, Sacramento River, San Francisco Bay, San Joaquin River, SWP and CVP service area regions. Information presented for these recreation areas includes summaries of the following:

- Type of recreation facilities and activities,
- Annual recreation use;
- Seasonality of recreation use,
- Recreation quality conditions associated with lake levels or riverflows, and
- Origin of visitors.

Most of the activity at recreation areas in the Delta, Sacramento River, and San Joaquin River, regions is water-dependent or water-enhanced. Water-dependent activities include boating, fishing, rafting, and swimming; water-enhanced activities include camping, picnicking, hunting, and wildlife observation.

The description of recreation activities in the San Francisco Bay region focuses on fishing activity for anadromous fish species. The description of activities in the SWP and CVP Service Area region is limited to recreation occurring at terminal storage reservoirs, because they are the only recreation resource potentially affected by CALFED actions.

3. Study Period

In each of the following regional discussions, the "Historical Perspective" section describes recreation use, activities and facilities between 1940 and 1985. The existing conditions section for each region addresses the same aspects of recreation but during the more recent time period of between 1986 and 1995.

4. Sources of Information

Information for this technical report was compiled primarily from existing information discussed in numerous reports generated by various state, regional and local agencies. These reports include the Delta Protection Commission Recreation Access Study and various recreation use survey reports prepared by the California Department of Water Resources (DWR). This information was supplemented with information gathered from resource management agencies such as the California Department of Boating and Waterways (CDBW), California Department of Parks and Recreation (DPR), California Department of Fish and Game (DFG), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), Reclamation, U.S. Army Corps of Engineers (Corps), East Bay Municipal Utility District (EBMUD), Yuba County Water Agency (YCWA), Modesto Irrigation District, and South

Sutter Water District (SSWD), and other public and private operators of recreation facilities. All sources are cited in the "Historical Perspective" and "Existing Conditions" sections for each region and listed in full in the References section of this report.

V. Environmental Setting

4.1 Study Area

The study area for this document includes both the "problem area" and the "solution area" as defined by the CALFED project. The "problem area" is the geographical area containing the problems and issues CALFED actions are intended to address. This area includes the legally defined Delta, Suisun Bay to Carquinez Strait, and Suisun Marsh and is defined by CALFED as the Delta Region.

The CALFED solution area, which includes areas in California that may affect or be affected by potential CALFED actions, includes the Delta Region and the four additional regions. These five regions include:

- Delta Region
- Bay Region
- Sacramento River Region
- San Joaquin River Region
- SWP and CVP Service Areas Outside Central Valley

4.2 Delta Region

The study area in the Delta region encompasses the legal Delta and the Suisun Bay and Suisun Marsh areas. Recreation facilities in the study area include both public and commercial recreation facilities such as State recreation areas (SRAs), WMAs, private hunting clubs, and commercial marinas.

HISTORICAL PERSPECTIVE

Recreation use in the Delta has increased substantially over the past 45 years. In 1958 and again in 1963, recreation use was estimated at approximately 2.5 million user-days, with a user-day representing one person spending a day or portion of a day in one particular type of activity (California Department of Water Resources 1958, 1963). By 1978, recreation use in the Delta was estimated at 7 million visitor-days (Wade et al. 1987). Hunting; sport fishing; and water-dependent activities, such as boating, have continued to be important recreation activities in the region.

The following section briefly describes the development of each recreational activity from 1940 to 1985. A more detailed description of each facility, together with a discussion of available use information, is provided in the "Recreation Use and Facilities" section below.

Boating and Nonconsumptive-Use Activities. Prior to 1960, the majority of facilities available to boaters and other nonconsumptive-use recreationists centered on the use of commercial marinas and a very

limited number of city or county public-access areas. Delta yacht or ski clubs were popular at this time and became instrumental in organizing and promoting waterborne recreation in the Delta. Some of these early clubs, including the Sacramento Yacht Club; the Stockton Yacht Club; and the Sportsmen, Inc. Yacht Club, were formed in the late 1920s and early 1930s. By the late 1950s, the number of available Delta recreation facilities had grown to approximately 127 different facilities, including 110 privately owned commercial resorts, four publicly owned parks, and 13 private clubs. (California Department of Water Resources 1966.)

The increasing demand for more Delta recreation opportunities spurred the State to establish Brannan Island SRA in 1965 and Franks Tract SRA in 1966. Development of these State recreation areas enabled the State to collect fees for use of the areas and greatly enhance the level of recreational opportunities to include additional boating berths, campgrounds, picnic areas, and swim beaches. (Nelson pers. comm.)

Since the 1970s, as the demand for boating and nonconsumptive recreational opportunities continued to increase. Various commercial marinas and boating clubs continued to be developed, including the Tower Park Yacht Club and the Discovery Bay Yacht Club.

Waterfowl Hunting. Prior to World War II, the majority of waterfowl and pheasant hunting occurred on private farmland. After the war, the popularity of this sport brought an increasing number of hunters to private farmland. As Delta marshlands were drained and converted to agricultural use, land use conflicts with farmers spurred the

development of alternative hunting areas, including Grizzly Island WMA, Joice Island WMA, and Sherman Island WMA, in addition to a variety of State cooperative hunting areas. Although private duck clubs and WMAs have remained popular hunting areas, the State cooperative hunting areas decreased in popularity during the 1960s. (California Department of Water Resources 1966.)

The Suisun Bay and Suisun Marsh portions of the Delta have historically been popular areas for waterfowl hunters. Past estimates of total annual waterfowl hunter-days in the marsh, including use of public hunting areas, range from approximately 48,000 to 62,000 per hunting season (California Department of Water Resources 1984, San Francisco Bay Conservation and Development Commission 1976).

Sport Fishing. Recreational sport fishing historically has been a major activity in the Delta area, occurring throughout the year from shore locations, piers, and boats. Important sportfishing species include striped bass, shad, black bass, catfish, and steelhead. Although sturgeon and chinook salmon occur in the Delta area, these species are primarily caught in the San Pablo Bay and San Francisco Bay areas. Sport fishing for striped bass, American shad, and sturgeon is discussed below. Historical information on the sport fishing harvest of salmon caught within the Delta is unavailable.

Although commercial fishing for striped bass was abolished in 1935, a sport fishery was allowed to continue (Skinner 1962). By the early 1960s, a majority of the bass angling effort was concentrated in the Delta. Angling success for striped bass in the entire Bay-Delta region is shown in Table 1.

Sport-catch records indicate a declining trend, with an average annual catch ranging from a high of 750,000 fish during the 1960s to a low of approximately 150,000 during the early 1980s.

American shad has continually been a popular sport fish; however, a sport fishery for this species did not become well established until 1957 (Skinner 1962). Although historical statistics on the shad sport fishery in the Delta have not been estimated, fishing for American shad has been described as being very good during this period (California Department of Fish and Game 1979). One operator in the Delta estimated a catch of 30,000 fish by 2,500 anglers in 1954 (Skinner 1962).

In 1954, following a 35-year moratorium on both commercial and sport fishing for sturgeon, a sport fishery in the Bay-Delta was reestablished (Skinner 1962). A majority of the fishery is concentrated in the San Pablo Bay (Leet et al. 1992). Although exact sport-catch data are not available, the catch rate for sturgeon is estimated to have increased by 40% over the last 2 decades (Leet et al. 1992). This increase suggests that fishing for sturgeon has become more popular as stocks of other game fish, such as striped bass, have declined.

CURRENT RESOURCE CONDITIONS

RECREATION USE

The Delta is a popular recreation area, supporting an estimated 7 million visitor-days in 1985 (Wade et al. 1987). Water-dependent activities dominate annual recreational use in the Delta. Table 2 presents Delta recreation by activity showing its percentage of total use. Fishing and boating are the most populated activities in the Delta, accounting for approximately 70%

of total use.

Over 75% of the recreationists using the Delta live within Contra Costa, San Joaquin, Sacramento, Alameda, and Solano Counties. The majority of the remaining visitors live within a 100 mile radius of the Delta. (California Department of Water Resources 1993).

Delta use patterns indicate that a majority of the visitors stayed one day or less in the Delta (Cajucom et al. 1980). Use varies from season to season. The peak recreation period occurs from May through September. Spring and summer (March-September) account for an estimated 75% of total annual use (California Department of Water Resources 1993)

BOATING AND NONCONSUMPTIVE ACTIVITIES

Delta recreation facilities tend to be within close proximity of each other and concentrated near major roadways. Popular access points for boating, waterskiing, and jet skiing include Windmill Cove near State Route 4; King Island, Paradise Point, and Herman & Helens near Eight Mile Road; Tower Park near State Route 12; and Dels Boat Harbor near the City of Tracy. Houseboating is also concentrated along Eight Mile Road (Moyer pers. comm.). Wind surfing, a fast-growing sport in the Delta, typically occurs along State Route 160 between Sherman Island and Rio Vista and at Windy Cove. Windy Cove is a new facility constructed at Brannan Island SRA and is the only formal wind surfing site in the study area (Brady & Associates 1994). The limited number of boating access points across the Delta and the lack of readily available rentals for ski boats and personal watercraft continue to be issues for recreationists (Moyer pers. comm.).

WATERFOWL HUNTING

During the past 10 years, hunting has continued to occur on private lands, as well as in public areas, in the waterways, and on various small Delta islands (Jones & Stokes Associates 1995). Popular areas include Sherman Island WMA, Twitchell Island, Franks Tract SRA, and Clifton Court Forebay. In addition, the State owns 15,000 acres in Suisun Marsh at the western edge of the Delta, including approximately 6,000 acres of public hunting areas that compose the Grizzly Island and Joice Island WMAs.

Also during the last 10 years, existing regulations have closed the Joice Island WMA to hunting and set aside the area as a waterfowl sanctuary. However, beginning with the 1994-1995 hunting season, selected areas of the WMA were opened to a maximum of 35 hunters per season. (Becker pers. comm.)

SPORT FISHING

Today, fishing access in the Delta primarily occurs from four designated access areas and from a variety of roadside locations and levee banks. Table 3 presents current catch and angler effort trends for selected species in the Delta. Of all Delta species surveyed by DFG, striped bass was the most popular, with an average annual sport catch of 18,900, followed by American shad, salmon, and sturgeon (Table 3).

RECREATION FACILITIES IN THE LEGAL DELTA

Delta recreation facilities have been categorized as two types: public and commercial. Recreation facilities within

Suisun Bay and Suisun Marsh are described separately.

PUBLIC FACILITIES. There are approximately 23 public recreation facilities in the legal Delta (Appendix A). Three State agencies (DPR, DWR, and DFG) maintain five recreation areas in the Delta. The remaining recreation areas are operated by county and city agencies.

Recreation areas managed by DPR include Brannan Island SRA, Franks Tract SRA, and Delta Meadows River Park. Since 1986, annual attendance at all DPR facilities has averaged approximately 213,000 total visitors. Annual attendance for 1994 at DPR facilities was approximately 198,000 visitors.

Overall, use at the SRAs has been declining since the early 1990s. Annual attendance at all DPR recreation areas has dropped since 1989. Possible factors contributing to this decline include drought conditions in the Delta area, a higher overnight-camping fee, and a ban on alcohol consumption at the SRAs (Nelson pers. comm.). However, 1995 estimates of attendance at DPR recreation areas indicate that overall attendance has again increased well above 1994 numbers (Nelson pers. comm.). It should be noted that use at the other SRAs is only an estimate of total use. Currently, onsite visitor counts are not made to accurately estimate total visits at these recreation facilities.

Sherman Island WMA is located in Sacramento County and managed by DWR and DFG. Hunting-use information is limited; however, approximately 870 hunters were selected to participate in the 1995 hunting season on these Delta islands. (California Department of Fish and Game 1996.)

Clifton Court Forebay, managed by DWR and DFG, has a maximum capacity of 30 hunters and approximately 15 boats. Available use records indicate sporadic but increasing attendance at the forebay from 1971 to 1980. Implementation of a self-registration system at the forebay made use records after 1980 unreliable. Records after 1985 are unavailable because of repeated acts of vandalism, which forced the elimination of the self-registration system. (Gifford pers. comm.)

The majority of the other public facilities are relatively underdeveloped, providing only a launch ramp and water access for fishing.

COMMERCIAL FACILITIES. Marinas account for most recreation facility types in the Delta, totaling approximately 120. Marinas provide many services in addition to boat berthing and boat fuel. The many services provided at the marinas include ski boat and houseboat rentals; boat services, such as boat launching and marine supplies; camping and picnicking facilities; guest docks and fuel stations; and food and beverage services.

Marinas are not equally distributed throughout the Delta, but are concentrated in a handful of locations. The most heavily used areas include Bethel Island in Contra Costa County and Lower Andrus Island in Sacramento County. Bethel Island is very congested, with resorts and 33 marinas providing 1,185 berths. In addition to marina berths, the private facilities at Bethel Island include a large number of support and service facilities. Andrus Island, by comparison, is more rural but provides nearly 1,700 berths. Roberts Island and Empire Track King Island in San Joaquin

County provide 998 and 719 berths, respectively. (Brady & Associates 1994.)

PRIVATE HUNTING CLUBS. There are approximately 32 private waterfowl hunting clubs in the Delta region, totaling approximately 81,700 acres. Most of the private clubs are small, accommodating between eight and 16 hunters on a typical shoot day. Landowners manage private hunting clubs on Delta islands that, in some cases, are no longer in agricultural production. In 1995, approximately 200 people had memberships to private clubs. (Jones & Stokes Associates 1995.)

RECREATIONAL FACILITIES IN SUISUN BAY AND SUISUN MARSH.

Suisun Bay and Suisun Marsh recreation facilities are primarily centered around the recreational activities occurring at Grizzly Island WMA and numerous private hunting clubs in the area. There are fewer facilities in this geographic region of the Delta compared to those identified above. Information presented in this section is organized around a description of the recreational activities occurring at Suisun Bay and Suisun Marsh. General descriptions of the facilities are provided under each activity topic.

WATERFOWL HUNTING. By far the greatest single use of the marsh devoted to a recreational activity, measured in recreation user-days and acreage, is waterfowl and upland game hunting at approximately 158 private hunting clubs. Approximately 43,610 acres, or nearly 90% of the total 50,000 acres of marshland area, are devoted to managing private waterfowl hunting clubs. Most of the clubs are managed mainly to maximize waterfowl habitat. Most of the private clubs are operated primarily during 59 days of the waterfowl hunting season

from October 24 to November 14 and from December 5 to January 10. Some clubs are also used

for upland game hunting and as a meeting place for spring and summer recreation activities.

Waterfowl hunting at the all Suisun Bay and Suisun Marsh facilities averaged approximately 13,700 hunter-days from 1986 through 1995.

FISHING. The marsh's complex system of sloughs and bays provides substantial opportunities for fishing. Major sportfish species in the marsh consist of striped bass, black bass, and catfish. Opportunities for fishing include both boat and shore fishing, with most slough fishing done from the shore and bay fishing from boats. Public access to shore fishing is available at several facilities including fishing areas at Hill Slough, the Belden recreational site on Grizzly Island Road, Chadbourne Road bridge on Chadbourne Slough, sites located in the Grizzly Island WMA, and a fishing pier at the Montezuma Slough control structure. Recreational use for all fishing activities within the marsh, excluding bay fishing, is estimated at approximately 44,000 user-days per year (California Department of Water Resources 1984). Estimates of fishing activities at the Grizzly Island and Joice Island WMAs indicate that between 1987 and 1992, fishing use at these wildlife areas (combined) averaged approximately 17,500 user-days (California Department of Fish and Game 1993). Approximately 90% of this use occurred at the Grizzly Island Wildlife Area.

BOATING AND NONCONSUMPTIVE ACTIVITIES. Recreational boating takes place primarily on larger sloughs including Suisun Slough, Hill Slough, Montezumas

Slough, and the northern end of Goodyear Slough. The distribution and annual numbers of boaters on marsh sloughs are unknown. Public boat access to marsh sloughs is available at several marinas near Suisun City, at Pierce Harbor on Goodyear Slough, the Montezuma Slough boat ramp, and from smaller public and private boat docks scattered on sloughs throughout the marsh. Types of boats found in the marsh include small outboard recreational and fishing boats, large inboard cabin cruisers, and small sailboats en route to Suisun Bay.

Passive recreational activities, such as picnicking, nature study, trail use, sightseeing, and dog training, are featured at State WMAs and Rush Ranch in Solano County. Rush Ranch is a 2,070-acre property on Grizzly Island Road administered by the Solano County Farmlands and Open Space Foundation, featuring an interpretive program, approximately 7 miles of trails, and scheduled public nature tours.

Annual use of the total marsh for these passive recreational activities is unknown; however, nonconsumptive uses, including nature study, sightseeing, dog training, and miscellaneous activities at DFG wildlife areas, totaled approximately 9,000 user-days during the 1995-96 season.

Other active recreational activities, such as waterskiing, jet skiing, and other water sports, also take place on waterways throughout the marsh. Use of sloughs for these types of activities appears to be increasing. (Takacs pers. comm.)

4.3 SAN FRANCISCO BAY REGION

The San Francisco Bay region extends east from the Golden Gate Bridge and includes San Pablo Bay and San Francisco Bay.

Although numerous recreation activities occur in San Francisco and San Pablo Bays, this report focuses on sport fishing for salmon, steelhead, striped bass, and sturgeon.

Use and Visitor Characteristics

Lakes and reservoirs operated by EBMUD and MMWD are popular day-use destination sites for local residents. They and surrounding parks accommodate recreation activities year-round because of their proximity to major metropolitan areas. Those operated by SFWD do not substantially contribute to recreation use in the San Francisco Bay region because of access restrictions. Most of the visitation at Anderson Reservoir occurs between May and September (John pers. comm.).

RECREATION QUALITY CONDITIONS

As elsewhere in California, the quality of recreation at lakes and reservoirs in the San Francisco Bay region depends largely on surface-water levels. During severe drawdown conditions, access to boat ramps and swimming areas is substantially reduced or eliminated. Water-enhanced activities, such as picnicking and hiking, can also be affected as water levels fall.

Sport fishing in the San Francisco and San Pablo Bays and water-dependant recreation at reservoirs are the primary focuses of this section. Other recreation activities are not addressed in detail because they are not expected to be substantially affected by CALFED actions.

HISTORICAL PERSPECTIVE

This section focuses on the historical aspect of sport fisheries in the San Francisco Bay region and recreation occurring at reservoirs

operated by Bay area water agencies which could be affected by CALFED. Other recreation activities are not addressed in detail because they are not expected to be substantially affected by CALFED actions. The discussion of the trends in the region's sport fishery is based on historical data primarily gathered by California Department of Fish and Game. Whenever possible, the discussion is based on fishing effort data; however, when effort data are not available, catch information has been substituted as an indicator of overall fishing success.

SAN FRANCISCO AND SAN PABLO BAYS

Popular sport fish harvested in the San Francisco Bay region include striped bass, white sturgeon, and salmon. Although commercial fishing for striped bass was abolished in 1935, a sport fishery was allowed to continue (Skinner 1962). By the early 1960s, most of the south San Francisco Bay was no longer producing striped bass and much of the bass angling effort shifted to San Pablo Bay and the Delta region (Skinner 1962).

White Sturgeon. In 1954, following a 35-year moratorium on commercial and sport fishing for sturgeon, a sport fishery in the San Francisco Bay region was reestablished (Skinner 1962). Most of this fishery was centered in San Pablo Bay (Leet et al. 1992). Between 1954 and the mid-1960s, most sturgeon were taken incidentally by striped bass anglers. By the mid-1960s, the sport harvest of sturgeon began to increase dramatically as the minimum size limit was reduced to 40 inches and grass shrimp was discovered to be an effective bait (Leet et al. 1992).

Although exact sport-catch data for white sturgeon are not available, the catch rate for

sturgeon is estimated to have increased by 40% over the last two decades (Leet et al. 1992). This increase suggests that fishing for sturgeon has become more popular as stocks of other gamefish, such as striped bass, have declined. In response to increased angler success, catch regulations were modified by increasing the minimum size limit to 42 inches and establishing a maximum limit of 72 inches (California Department of Water Resources 1990).

Angling success for sturgeon was considered high from the mid-1960s through 1969. Total white sturgeon catch aboard commercial passenger-carrying fishing vessels (CPFVs) ranged from a low of approximately 830 fish in 1964 to a high of 2,300 fish in 1967 (Leet et al. 1992). Sturgeon fishing aboard CPFVs was not as successful in the 1970s, when total catch ranged from a high of approximately 1,170 fish in 1970 to 340 fish in 1977. In 1984 and 1985, total catch of white sturgeon was estimated at approximately 8,500 and 12,000 fish, respectively, based on abundance estimates (California Department of Water Resources 1990).

Salmon. The sport fishery for chinook salmon in the San Francisco Bay region is located primarily in San Francisco Bay near the Golden Gate Bridge. The salmon sport fishery in California did not become important until after World War II, long after the commercial salmon fishery was established. Historically, the sport fishery has harvested approximately 14% of the salmon landed within the subregion (Leet et al. 1992), with commercial fishing accounting for 86%.

Commercial sport fishing vessels have played an important role in the history of ocean sport fishery, accounting for an estimated

65% of the total sport harvest of salmon in the subregion (Leet et al. 1992). Most of these vessels originated from the San Francisco Bay area; relatively few of them were private vessels because of the strong currents near the Golden Gate Bridge (Leet et al. 1992).

Salmon landings data between 1940 and 1985 show that salmon fishing activity reached major peaks in 1955, 1968, and 1972, with annual landings of approximately 129,000, 128,000, and 152,000, respectively. These data also indicate that fishing activity reached lows in 1957, 1960, and 1978, with annual landings of approximately 44,700, 37,900, and 45,600, respectively. (Leet et al. 1992.)

Chinook has been the most important salmon species caught in the California Coast Subregion, accounting for 79% of the total salmon sport catch. San Francisco has been the most important subarea, yielding 67% of total sport landings between 1979 and 1985. (Pacific Fishery Management Council 1993b.)

CURRENT RESOURCE CONDITIONS SPORT FISHING

Sportfishing activity in the San Francisco Bay region is associated with abundance, migration patterns, and fishing regulations. Striped bass, white sturgeon, and chinook salmon are important sport fish. Sport fishing in the region occurs year-round.

Sport fishing occurs from private vessels, from CPFVs, and along the shore. The popularity of shore and boat fishing is associated with the type of sport fish being sought. Most fishing occurs aboard private vessels because CPFVs have become less popular. CPFV operators indicate a sustained decline in the popularity of fishing

aboard these vessels, probably a result of the decline in the abundance of salmon and striped bass (Boydston pers. comm.). Although the exact number of CPFVs operating in the San Francisco Bay region is not known, an estimated 8 to 12 CPFVs currently operate in San Francisco Bay (a substantial decline from the 30 to 40 CPFVs that operated in the 1970s) (Fraser pers. comm.). During this period, fishing from private vessels in the San Francisco Bay region has grown in popularity, probably because of growth in the local population (Fraser pers. comm.).

Striped Bass. Striped bass is the most important sport fish caught in San Francisco Bay (San Francisco Estuary Project 1992). Fishing for striped bass occurs aboard private vessels and CPFVs, or from shore. An estimated 65% of total catch is made aboard private vessels, 21% from shore, and 14% from CPFVs (Leet et al. 1992).

Fishing for striped bass in the Bay-Delta region occurs year-round and closely follows the migration patterns of the fish (Leet et al. 1992). Generally, striped bass are found in greater numbers in San Pablo and San Francisco Bays during summer and return to the Delta in fall. In spring, mature bass move upstream to spawn in the Sacramento and San Joaquin Rivers (State Water Contractors 1987).

Most of the catch of striped bass in California occurs in the Bay-Delta region, including San Francisco Bay (35%), San Pablo Bay and Carquinez Strait (21%), Suisun Bay (6%), and the Sacramento-San Joaquin River Delta (20%) (California Department of Fish and Game 1989). An estimated 15% of total catch occurs in the Sacramento River upstream from Courtland, the remaining 3% in the ocean just outside

the Golden Gate Bridge and in the San Joaquin River.

Recent DFG surveys show that approximately 23,358 striped bass were caught from July 1, 1992, to June 30, 1993, in the portion of the Bay-Delta region between Carquinez Bridge and Sacramento (Table 4). Striped bass was the most popular fish caught during this period, accounting for approximately 697,000 angler hours. Data for striped bass harvest in the entire Bay-Delta region indicate that an estimated 61,800 fish were harvested in 1990 (Interagency Ecological Studies Program 1993).

The quality of striped bass angling in the Bay-Delta region depends on location, abundance, and regulations. During winter, striped bass are relatively inactive and fishing success is relatively low (Dumas et al. 1993). Fishing increases in spring as the fish begin to move up the Delta to spawn (Leet et al. 1992). The abundance of striped bass in the region is probably associated with Delta water diversions, Delta outflows, and water quality (California Department of Fish and Game 1989). Although not directly affecting fishing success, size and possession limits can restrict total angling efforts for striped bass.

White Sturgeon. White sturgeon is one of the popular game fish sought in the Bay-Delta region. Although both green and white sturgeon are found, white sturgeon are more abundant because green sturgeon spend a greater portion of their lives in the ocean (San Francisco Estuary Project 1992).

Sturgeon are popular game fish because of their large size; however, they have one of the lowest catch rates per hour of angler effort for sport fish in the region. This catch

rate is approximately one fish per 19 hours of fishing (Wixom pers. comm.).

Fishing trips for sturgeon are taken aboard both private vessels and CPFVs. A comparison of total sport catch of white sturgeon with catch reported by CPFVs for 1984, 1985, and 1987 indicates that approximately 8% of all white sturgeon are landed by private vessel operators (Leet et al. 1992; California Department of Water Resources 1990). The remaining 92% are caught aboard private vessels.

Sturgeon fishing continues year-round in San Pablo Bay, Suisun Bay, and the Delta. Fishing success in each area is probably associated with the movement of the fish in response to changing salinity conditions in the Bay-Delta region.

According to recent DFG surveys, approximately 1,915 sturgeon were caught from July 1, 1992, to June 30, 1993, between Carquinez Bridge and Sacramento (Table 4). Of this total, an estimated 87% were released (Wixom pers. comm.). Angling effort for sturgeon during this period totaled approximately 412,400 angler hours.

The distribution of sturgeon in the Bay-Delta region is influenced by riverflows into the Delta. Sturgeon are more likely to be found in the Suisun Bay area during dry years and in San Pablo Bay during wet years.

Salmon. Although salmon support a large sport fishery in the ocean, the salmon sport fishery in the San Francisco Bay region is small (San Francisco Estuary Project 1993). Salmon are typically caught in the area around the Golden Gate Bridge and upstream of Carquinez Strait. (Salmon landed in the San Francisco Bay sport fishery

are included in the discussion of the Pacific Coast region.) Salmon in the Bay-Delta region are caught aboard CPFVs and private vessels; a% breakdown of the total catch aboard these vessels is not available.

4.4 Sacramento River Region

Major reservoirs in this region include Shasta Lake, Whiskeytown Lake, Lake Oroville, Folsom Lake, New Bullards Bar Reservoir, and Englebright Lake (Table 6). Major rivers and streams in the region include the Sacramento, Feather, Yuba, American, and Bear Rivers, and Clear Creek. Other potentially affected lakes and reservoirs include Keswick Reservoir, Lake Red Bluff, Camp Far West Reservoir, Thermalito Forebay and Afterbay, Lake Natoma, and reservoirs located upstream of major reservoirs.

The Sacramento River region includes federal wildlife refuges, State WMAs, and private hunting clubs (Table 6). These refuges and WMAs are treated as important recreation areas.

In addition to the lakes, rivers, and wildlife refuges listed above, the following tributaries to the Sacramento River could be affected by CALFED actions through implementation of stream restoration measures: Cottonwood, Cow, Deer, Bear, Battle, Mill, Paynes, Antelope, Butte, Big Chico, Thomes, and Elder Creeks; and Colusa Basin Drain. Recreation use along these streams was not addressed because data concerning potential impacts of CALFED actions on flows and fisheries are not available.

Historical Perspective

Lakes and Reservoirs. Recreation opportunities in the Sacramento River region

have been shaped by the construction of large reservoirs and the alteration of major rivers. Construction of Shasta Lake, Whiskeytown Lake, Lake Oroville, Folsom Lake, New Bullards Bar Reservoir, and Englebright Lake provided extensive flatwater recreation opportunities. At the same time, historical recreation activities on the Sacramento, Feather, Yuba, and American Rivers were affected as flows, water temperatures, and fisheries were altered by operation of the reservoirs.

Important reservoirs in the Sacramento River region were completed between 1941 and 1970. Shasta Lake, which Reclamation completed in 1945, was the CVP's first major multipurpose facility. Initial recreation use did not occur until 1948, when the reservoir was filled (U.S. Bureau of Reclamation 1976). USFS began developing and managing flatwater and shoreline recreation resources at Shasta Lake once the Whiskeytown-Shasta-Trinity National Recreation Area (NRA) was established. Historically, Shasta Lake has been the most popular Reclamation lake or reservoir, with use ranging from 1.8 million to 4 million recreation days annually between 1970 and 1985. (Petrinovich pers. comm.)

Whiskeytown Lake, which was constructed by Reclamation in 1963, also falls within the NRA, with recreation facilities managed by NPS. Between 1970 and 1985, annual recreation use at Whiskeytown Lake ranged from a low of 804,000 recreation days in 1974 to a high of 1.6 million recreation days in 1976 and then declined through the early 1980s. (Petrinovich pers. comm.)

Folsom Lake, completed in 1955, was the second major lake or reservoir constructed by Reclamation in the region. DPR manages the lake's recreation facilities. Visitation is not well documented between 1955 and

1970. After 1970, visitation declined from approximately 2 million to less than 1 million recreation days in 1977 and increased to nearly 2.8 million recreation days in 1985. (Petrinovich pers. comm.)

Lake Oroville, a part of SWP, was completed in 1968, with recreation facilities operated by DPR. Since 1968, visitor use has fluctuated substantially, ranging from 288,000 visitors in 1968 to 939,000 visitors in 1981. Visitation declined substantially in 1985 to 771,000 visitors. (California Department of Water Resources 1989.)

Other major lakes or reservoirs in the region include Englebright Lake (constructed by the Corps in 1941) and New Bullards Bar Reservoir (constructed by YCWA in 1970). Visitation at both has increased steadily from 1941 to 1985. Because Englebright Lake was constructed to control mining debris, recreation use did not begin until new techniques for controlling debris were developed in the early 1960s. From 1970 to 1985, annual visitation at Englebright Lake increased from 66,000 to nearly 116,000 visits. Recreation use at New Bullards Bar Reservoir increased steadily from 1970 to 1985, although historical records appear to understate the total amount of recreation known to have occurred at this facility.

Rivers. Recreation activities along rivers in the Sacramento River region were modified with the construction of dams on the Sacramento and Feather Rivers. Before major dams were constructed, flows and water temperatures fluctuated seasonally. Low flows and relatively high water temperatures occurred in summer and high flows and low water temperature in winter. In some instances, modification to riverflows resulted in substantial changes to sport fisheries.

Before Shasta Lake was built, summer flows in the Sacramento River were low, water temperatures rose above optimum ranges for salmonids, and only warmwater species were present below the dam site during summer periods (U.S. Fish and Wildlife Service 1950). The most common summer gamefish in the river before construction of the lake were striped bass and catfish.

After Shasta Lake was constructed, water temperatures and flows in the river were altered to such a degree that a year-round salmonid sport fishery was created. Chinook salmon, steelhead trout, and rainbow trout made the greatest contribution to the fishery (U.S. Fish and Wildlife Service 1950). Its popularity is indicated by the growth in the number of recreation-related support services. On the reach of the river between Orland and Redding, the number of boat landings to serve the growing sport fishery increased from zero in 1945 to 11 in 1949. An estimated 46 establishments (e.g., resorts and bait shops) serving the sport fishery were in operation along the river in 1949 (U.S. Fish and Wildlife Service 1950).

Between May 1948 and February 1949, an estimated 8,000 salmon and 3,800 rainbow trout and steelhead were caught on the reach of the river between Orland and Redding with angler efforts of 171,300 and 43,200 hours, respectively (U.S. Fish and Wildlife Service 1950). Between 1968 and 1975, an estimated annual average of 17,900 steelhead were landed by 31,900 anglers and 17,500 salmon were landed by 24,300 anglers in the entire river (California Department of Fish and Game 1980).

The Feather River below Lake Oroville and the Yuba River below Englebright Lake continued to support an important anadromous fishery, although not as extensive as that on the Sacramento River.

Changes in water flow and temperature in the Feather River after completion of Lake Oroville did not substantially alter the number of fish species present in the lower portion of the river (California Department of Fish and Game 1975). Averages based on angler surveys conducted from 1968 to 1974 indicate that 2,700 anglers caught 530 striped bass annually, 4,800 anglers caught 1,800 steelhead annually, and 4,500 anglers caught 644 chinook salmon each year (California Department of Fish and Game 1980).

Wildlife Refuges. Wildlife refuges in the Sacramento River region provide consumptive and nonconsumptive recreation opportunities. Opportunities for nonconsumptive recreation, which includes wildlife viewing, are provided at Sacramento and Colusa NWRs and Gray Lodge WMA. Opportunities for consumptive recreation, which include fishing and waterfowl hunting, are provided at all wildlife refuges in the region.

Gray Lodge WMA, the first wildlife refuge in the Sacramento River region, was established in 1931 (U.S. Bureau of Reclamation 1989). Historically, Gray Lodge WMA has been the most popular of the five refuges in the region, accounting for approximately 61% of total use at all refuges in the region between 1973 and 1985. During this period, annual use averaged approximately 61,000 visitors per year, of which an estimated 24% were hunters (California Department of Fish and Game 1993). Use at the refuge increased by approximately 95% between 1973 and 1985.

Sacramento NWR, established in 1937, has historically been the second most popular refuge in the Sacramento River region, with

an annual average of 29,200 visitors between 1973 and 1985 (Forrest pers. comm.). Nonconsumptive uses accounted for approximately 73% of total use during this period.

Colusa NWR, established in 1944, has been the third most popular refuge in the region, with an annual average of 8,000 visitors between 1973 and 1985 (Forrest pers. comm.). Nonconsumptive and consumptive uses have historically been equally popular at the refuge, each accounting for 50% of total use.

Sutter and Delevan NWRs, established in 1944 and 1963, respectively, have been used almost exclusively for hunting. Between 1973 and 1985, annual hunting activity averaged approximately 2,500 visitors at Sutter NWR and 5,500 visitors at Delevan NWR. (Forrest per. comm.)

Current resource conditions

Major recreation sites in the Sacramento River region are the major lakes and reservoirs (Shasta Lake, Whiskeytown Lake, Lake Oroville Complex, Folsom Lake, New Bullards Reservoir Bar, and Englebright Lake), and important rivers and streams (the Sacramento, Feather, American, and Yuba Rivers and Clear Creek), and major federal wildlife refuges and State WMAs (the Sacramento NWR Complex and Gray Lodge WMA). Waterfowl hunting on private lands is also a leading form of recreation in the region. Other areas potentially affected by CALFED actions include Keswick Reservoir, Lake Red Bluff, Camp Far West Reservoir, and the Bear River below Camp Far West Reservoir, along with other reservoirs and rivers upstream of important reservoirs.

Rivers. The Sacramento, Feather, and Yuba Rivers and Clear Creek are important rivers and streams in the Sacramento River region. Although complete data are not available to quantify trends in recreation use along each river, it can be assumed that most water-dependent and water-enhanced recreation activities along the rivers have increased with the population in the region. Where available, the most current data are used to provide an overview of recreation use in a particular area.

The recreation characteristics of these sites and the use and activities at each are listed in Tables 6 and 7, respectively.

4.5 San Joaquin River Region

Historical Perspective

Major lakes and reservoirs in this region are San Luis Reservoir, Millerton Lake, New Melones Reservoir, Lake McClure, and New Don Pedro Reservoir (Table 8). Major rivers include the San Joaquin, Merced, Tuolumne, and Calaveras. Other potentially affected lakes and reservoirs in the region include Bethany Reservoir, O'Neill Forebay, New Hogan Lake, Camanche Reservoir, and other reservoirs located upstream of major reservoirs.

The San Joaquin River region includes federal and State wildlife refuges and private hunting clubs (Table 8).

The State Water Project's (SWP's) California Aqueduct and U.S. Bureau of Reclamation's (Reclamation's) Delta-Mendota Canal (Table 10) provide limited recreation opportunities in the region.

Lakes and Reservoirs

Recreation opportunities in the San Joaquin River region have been substantially shaped by the construction of large lakes and reservoirs on the San Joaquin River and all its major tributaries. Construction of San Luis Reservoir, Millerton Lake, New Melones Reservoir, New Hogan Lake, New Don Pedro Reservoir, and Lake McClure provided extensive flatwater recreation opportunities. Recreation opportunities on the San Joaquin, Mokelumne, Calaveras, Stanislaus, Tuolumne, and Merced Rivers were affected as flows, water temperatures, and fisheries were altered by operation of the lakes and reservoirs.

Most of the major lakes and reservoirs in the San Joaquin River region were completed in the 1960s and 1970s. Table 8 lists the major recreation areas, the owner/manager and the year the area was constructed.

Recreation activities associated with rivers in the San Joaquin River region were modified as dams were constructed on the San Joaquin, Stanislaus, Tuolumne, Merced, and Calaveras Rivers.

Millerton Lake on the San Joaquin River modified the flows and temperature of the river. Mean monthly riverflows before construction of the dam ranged from 1,000 cubic feet per second (cfs) in October to more than 5,000 cfs in April and May (Jones & Stokes Associates 1976). During the irrigation season, however, the river was diverted substantially, creating hazards for chinook salmon, steelhead trout, striped bass, American shad, and sturgeon (Jones & Stokes Associates 1976).

The Stanislaus River downstream of Goodwin Dam historically supported resident populations of warmwater game species, including largemouth and smallmouth bass, channel and white catfish,

black crappie, bluegill, and green sunfish. Historical anadromous fish populations below Goodwin Dam included chinook salmon, steelhead, striped bass, American shad, and sturgeon. Salmon production in the Stanislaus River contributed to sport and commercial catches in the ocean and lower San Francisco Bay (Jones & Stokes Associates 1976). In 1962, DFG estimated that the Stanislaus River chinook salmon run supported an average annual use of 10,000 angler days of sport fishing. The river also most likely supported other nonconsumptive recreation pursuits such as swimming, boating, camping, and picnicking.

The Tuolumne River historically supported a significant trout fishery in the upper coldwater reaches of the river. Rainbow, brown, brook, and golden trout ranged as far downstream as the present location of New Don Pedro Reservoir. Largemouth and smallmouth bass, bluegill, white catfish, and other warmwater fish species were common in the lower foothill and valley reaches of the river (Jones & Stokes Associates 1976). Before impoundment of the lower reach, the Tuolumne River supported steelhead and annual chinook salmon runs of up to 100,000 fish (Jones & Stokes Associates 1976). No information or use data on angling or nonconsumptive recreation before the construction of New Don Pedro Reservoir have been located.

The Merced River historically supported populations of spring- and fall-run chinook salmon that averaged 12,000 fish per year. The salmon run on the Merced River declined and was in poor condition for at least 20 years before the construction of Lake McClure. Operation of the dam has improved the preproject flow conditions, and salmon habitat improvement projects have effectively maintained chinook salmon populations (Jones & Stokes Associates

1976). As with other San Joaquin rivers, the Merced River also supported an unknown number of dispersed water-dependent and water-enhanced recreation pursuits such as swimming, boating, camping, and picnicking.

No recreation or fisheries data for the Calaveras River before the construction of New Hogan Lake have been located. Recreation activities are assumed to be similar to those of other rivers in the region, including some fishing, swimming, boating, camping, and picnicking.

Wildlife Refuges. Wildlife refuges in the San Joaquin River region provide both consumptive and nonconsumptive recreation opportunities. Nonconsumptive recreation opportunities, which include wildlife viewing, are provided at San Luis, Merced, and Kern NWRs, and Volta and Los Banos WMAs. Consumptive recreation opportunities, which include fishing and waterfowl hunting, are provided at Volta and Los Banos WMAs and Kern NWR. Use data for these refuges is shown on Table 9.

Current Resource Conditions

Major recreation areas in the San Joaquin River region are Millerton Lake; San Luis Reservoir; New Melones Reservoir; Lake McClure; New Don Pedro Reservoir; and the San Joaquin, Merced, Tuolumne, and Stanislaus Rivers. Major federal and State wildlife refuges are the San Luis, Merced, and Kern NWRs and the Volta and Los Banos WMAs. Waterfowl hunting on private lands is also described in this section. Other potentially affected recreation areas include Bethany Reservoir, O'Neill Forebay, New Hogan Lake, Camanche Reservoir, and reservoirs located upstream of major reservoirs; the Mokelumne and Calaveras Rivers; and the California Aqueduct and Delta-Mendota Canal.

The recreation characteristics of these sites and the use and activities at each are listed in Tables 10 and 11, respectively.

CVP and SWP Service Area Region

Historical Perspective

In 1951, the State Legislature authorized what is now the State Water Project (SWP) and appropriated funds for detailed studies. The funds were contingent on voter approval which was given in 1960. The SWP is a water conveyance system that includes 29 storage facilities, 18 pumping plants, four pumping-generating plants, five hydro-electric power plants and approximately 660 miles of canals and pipelines. Water from the Feather River watershed and the Sacramento-San Joaquin Delta is captured and conveyed to areas of need in the San Francisco Bay area, the San Joaquin Valley, Southern California and the Central Coast. Parts of the project have been serving California since 1962. The SWP's principal purpose is to store and water and distribute it statewide. However, since its inception, an additional purpose of the SWP has been to provide recreational opportunities through the system, along the aqueducts and at the several terminal reservoirs located throughout the state.

Central Valley Project (CVP) facilities include several dams and reservoirs built between the 1930s and 1960s by a combination of state and federal agencies. The major purposes of the facilities included, navigation, regulation and flood control of the Sacramento and San Joaquin Rivers, supplying water for irrigation and domestic use and power generation. Recreation was never explicitly defined as a purpose within funding authorization for the CVP.

Current Resource Conditions

Within the service area of the SWP and outside of the Central Valley, there are several reservoirs, lakes and aqueducts which provide facilities for anglers, boaters, picnicker, campers and cyclists. These facilities are in both northern and southern California.

In northern California, Lake Davis, Frenchman Lake, and Antelope Lake were constructed principally for recreation and fish and wildlife enhancement. All three lakes are stocked with trout. Lake Oroville and Thermalito Forebay and Afterbay have facilities for water sports, camping, and picnicking. Limited hunting is allowed at the Afterbay. In Alameda County, near Livermore, Lake Del Valle offers boating, swimming, fishing, camping, and picnicking.

In Southern California, Castaic and Pyramid lakes offer boating, fishing, picnic sites and water skiing. At Lake Perris, in addition to water sports, visitors can hike, rock climb and scuba dive. Silverwood Lake in the San Bernardino Mountains also offers a variety of recreational opportunities.

Additionally, fishing is allowed along many miles of the California Aqueduct.

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Table 1. Historical Average Annual Sport Catch of Striped Bass in the Bay-Delta, 1960-1990

| Period | CPFV¹ Catch | Total Catch |
|---------------|-------------------------------|--------------------|
| 1960-1969 | 33,400 | 750,000 |
| 1970-1979 | 17,000 | 403,000 |
| 1980-1985 | 8,700 | 150,000 |

Note: Historical striped bass catch data is for the entire Bay-Delta region.

¹ CPFV = commercial passenger-carrying fishing vessels.

Sources: California Department of Fish and Game 1989, and Leet et al. 1992.

Table 2. Delta Recreation Use by Activity. 1985

| Activity | Number of Visitor Days | % of Total |
|---------------------------------|------------------------|------------|
| Boating ^a | 2,224,000 | 32% |
| Boat and Shoreline fishing | 2,710,500 | 38% |
| Nonconsumptive use ^b | 2,015,500 | 28% |
| Waterfowl hunting | 120,200 | 2% |
| Total | 7,070,200 | 100% |

^aBoating includes cruising, waterskiing, jet skiing, and sailing.

^bNonconsumptive uses include sightseeing, relaxing, camping, picnicking, swimming, and photography.

Sources: California Department of Water Resources 1984, 1993.

Table 3. Average Annual Angler Effort and Catch for Selected Species in the Sacramento River between the City of Sacramento and the Carquinez Bridge, 1991-1994

| Species | Angler Effort* | Sport Catch |
|-----------------|----------------|-------------|
| Salmon | 93,200 | 4,130 |
| Steelhead trout | 960 | 31 |
| American shad | 32,200 | 16,320 |
| Striped bass | 628,500 | 18,900 |
| Catfish | 64,200 | 12,000 |
| Black bass | 7,300 | 970 |
| Sturgeon | 249,400 | 1,500 |

Notes: * Angler effort is measured in the number of hours fishing for each species.

Source: California Department of Fish and Game 1995.

Table 4. Catch of Selected Fish Species in the Bay-Delta Region

| Species (1) | Catch (2) | Effort | |
|---------------|-----------|--------------|-----|
| | | Angler Hours | % |
| Striped bass | 23,358 | 696,723 | 57 |
| Sturgeon | 1,915 | 412,437 | 34 |
| Salmon | 2,730 | 79,541 | 6 |
| American shad | 26,535 | 38,297 | 3 |
| Total | 54,538 | 1,226,998 | 100 |

NOTES:

- (1) No steelhead were landed in the region during this period.
- (2) Catch data are from July 1, 1992, to June 30, 1993.

SOURCE:

- (a) Wixom pers. comm.

**Table 5. Potentially Affected Recreation Areas
in the Sacramento River Region**

| | Recreation Area | Owner/Recreation Manager | Year Constructed/ Established |
|----|-----------------------------|--|----------------------------------|
| | Reservoirs and Lakes | | |
| 1 | Shasta | Reclamation/USFS | 1945 |
| 2 | Whiskeytown | Reclamation/NPS | 1963 |
| 3 | Keswick | Reclamation/Shasta County | 1945 |
| 4 | Lake Red Bluff | Reclamation/Reclamation | 1966 |
| 5 | Lake Oroville | DWR/DPR | 1968 |
| 6 | Thermalito Forebay | DWR/DPR | 1968 |
| 7 | Thermalito Afterbay | DWR/DFG | 1968 |
| 8 | Folsom | Reclamation/DPR | 1955 |
| 9 | Natoma | Reclamation/DPR | 1955 |
| 10 | Englebright | Corps/Corps | 1941 |
| 11 | New Bullards Bar | YCWA/USFS | 1970 |
| 12 | Camp Far West | SSWD/Private concessionaire | 1963 |
| | Rivers | | |
| 13 | Sacramento | NA/BLM, Reclamation, DPR, Counties, Private | NA |
| 14 | American | NA/DPR; Sacramento County | NA |
| 15 | Feather | NA/private | NA |
| 16 | Yuba | NA/private | NA |
| 17 | Clear Creek | NA/NPS, private | NA |
| 18 | Bear | NA/private | NA |
| | Wildlife Refuges | | |
| 19 | Sacramento NWR | USFWS/USFWS | 1937 |
| 20 | Delevan NWR | USFWS/USFWS | 1962 |
| 21 | Sutter NWR | USFWS/USFWS | 1944 |
| 22 | Colusa NWR | USFWS/USFWS | 1944 |
| 23 | Gray Lodge WMA | DFG/DFG | 1931 |

NOTE:

SOURCES:

California Department of Finance 1991; U.S. Bureau of Reclamation 1989, 1993a.

LEGEND:

BLM = U.S. Bureau of Land Management
 Corps = U.S. Army Corps of Engineers
 DFG = California Department of Fish and Game
 DPR = California Department of Parks and Recreation
 DWR = California Department of Water Resources
 NA = not applicable
 NPS = National Park Service
 NWR = National Wildlife Refuge
 Reclamation = Bureau of Reclamation
 USFWS = U.S. Fish and Wildlife Service
 SSWD = South Sutter Water District
 USFS = U.S. Forest Service
 WMA = Wildlife Management Area
 YCWA = Yuba County Water Agency

Table 6. Recreation Characteristics of Major and Other Potentially Affected Recreation Areas in the Sacramento River Region

| Recreation Areas | Surface Area or Length (acres or miles) | Number of Major Facilities | | | | | Activity Restrictions | Primary Game Fish |
|---|---|----------------------------|------------------|-----------------|------------------|-------------------|--|----------------------|
| | | Marinas | Boat Launches | Picnic Areas | Camp- grounds | Swimming Areas | | |
| Key Areas | | | | | | | | |
| Reservoirs and Lakes | | | | | | | | |
| Shasta | 29,500 | 13 | 6 | 1 | 22 | 0 | Swimming/boat speed restrictions | C/RT/SB |
| Whiskeytown | 3,250 | 1 | 3 | 0 | 3 | 2 | Boat speed restrictions in coves | KS/RT |
| Oroville | 15,800 | 2 | 3 | 3 | 9 | 1 | None | BT/CF/KS/LB/RT/SB |
| Folsom | 11,450 | 1 | 8 | 5 | 4 | 1 | None | C/CF/RT/SB |
| New Bullards Bar | 4,810 | 1 | 2 | 1 | 4 | 0 | No skiing along shore | KS/LB/RT/SB |
| Englebright | 760 | 2 | 4 | 1 | 17 | 0 | No skiing in upper portion of lake | KS/LB/RT/SB |
| Rivers and Creeks | | | | | | | | |
| Sacramento | | | | | | | | |
| Upper Reach | 60 | 6 | 8 | 8 | 1 | 0 | None | CS/RT/SH |
| Middle Reach | 160 | 19 | 19 | 11 | 21 | 0 | None | AS/CS/RT/S/SH/STB |
| Lower Reach | 80 | 24 | 13 | 7 | 4 | 1 | None | AS/CF/CS/S/SH/STB |
| Feather | 40 | 0 | 3 | 0 | 0 | 0 | None | AS/CS/ST/STB |
| American | 23 | 1 | 16 | 12 | 0 | 0 | None | AS/CS/RT/SH/STB |
| Yuba | 20 | 0 | 0 | 0 | 0 | 0 | Activity restricted on private lands | AS/CS/SH |
| Clear Creek | 17 | 0 | 0 | 0 | 0 | 0 | Activity restricted on private lands | CS/RT |
| Wildlife Refuges (1) | 25,580 | 0 | 0 | 0 | 0 | 0 | Limited access during waterfowl season | CF/LB |
| Private Hunting Clubs (2) | 227,027 | 0 | 0 | 0 | 0 | 0 | None | NA |
| Other Potentially Affected Areas | | | | | | | | |
| Reservoirs | | | | | | | | |
| Keswick | 640 | 0 | 1 | 0 | 0 | 0 | None | C/RT/SB |
| Lake Red Bluff | 530 | 0 | 1 | 1 | 1 | 0 | Reservoir drained in winter | CS |
| Camp Far West | 2,680 | 1 | 2 | 2 | 2 | 2 | None | BB/C/SB |
| Rivers | | | | | | | | |
| Bear | 20 | 0 | 0 | 0 | 0 | 0 | Dewatered in summer | CF/SB |

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NOTES:

- (1) Wildlife refuges include Sacramento NWR (10,800 acres), Delevan NWR (5,600 acres), Sutter NWR (2,600 acres), Colusa NWR (4,040 acres), and Gray Lodge WMA (2,540 acres). Fishing at wildlife refuges is allowed only at Delevan NWR and Gray Lodge WMA.
- (2) Private hunting clubs number approximately 516 throughout the Sacramento Valley region.

SOURCES:**Reservoirs and Lakes:**

Shasta: U.S. Forest Service 1990; U.S. Bureau of Reclamation 1992a.
 Keswick: U.S. Bureau of Reclamation 1986 1992a.
 Whiskeytown: U.S. Bureau of Reclamation 1992a.
 Red Bluff: U.S. Bureau of Reclamation 1992b.
 Oroville: California Department of Parks and Recreation 1988.
 Folsom: U.S. Army Corps of Engineers 1991; California Department of Parks and Recreation 1989a.
 New Bullards Bar: Yuba County Water Agency 1993.
 Englebright: U.S. Army Corps of Engineers 1992a.
 Camp Far West: Yuba County Water Agency 1993, Melton pers. comm.

Rivers:

Sacramento: U.S. Bureau of Reclamation 1990; California Department of Water Resources 1982; Wixom pers. comm.
 Feather: Wixom pers. comm.
 American: U.S. Army Corps of Engineers 1991; U.S. Bureau of Land Management 1990.
 Yuba: California Department of Fish and Game 1991a.
 Clear Creek: California Department of Water Resources 1986.
 Bear: Melton pers. comm.
 Wildlife refuges: U.S. Bureau of Reclamation 1993a; U.S. Fish and Wildlife Service 1992a.
 Private hunting clubs: California Department of Fish and Game 1994.

LEGEND:**Fish code letters:**

| | | | |
|--------------------|----------------------|----------------------|----------------------|
| AS = American shad | CF = catfish | NA = not applicable | SH = steelhead trout |
| BB = black bass | CS = chinook salmon | RT = rainbow trout | STB = striped bass |
| BT = brown trout | KS = kokanee salmon | S = sturgeon | |
| C = crappie | LB = largemouth bass | SB = smallmouth bass | |

Table 7. Recreation Use and Activities at Major and Other Potentially Affected Recreation Areas in the Sacramento River Region

| Recreation Areas | Use (1,000) (1) | Water-Dependent Activities (%) | | | | | Water-Enhanced Activities (%) | | | | | Total |
|---|--------------------|-----------------------------------|------------------|---------|-------------|---------------------------|----------------------------------|------------|-------------|---------|-------|-------|
| | | Power Boating | Other Boating | Fishing | Waterskiing | Swimming and Beach Use | Camping | Picnicking | Sightseeing | Resorts | Other | |
| Key Areas | | | | | | | | | | | | |
| Reservoirs and Lakes | | | | | | | | | | | | |
| Shasta | 2,422 | 31 | 3 | 12 | 10 | -- | 9 | -- | 3 | 16 | 16 | 100 |
| Whiskeytown | 279 | 23 | -- | 6 | 7 | 24 | 20 | 3 | 15 | -- | 2 | 100 |
| Oroville | 418 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | |
| Folsom | 362 | 29 | 5 | 20 | -- | 27 | 4 | 9 | -- | -- | 6 | 100 |
| New Bullards Bar | 52 | 29 | -- | -- | -- | -- | 70 | 1 | -- | -- | -- | 100 |
| Englebright | 92 | 33 | -- | 21 | 14 | 15 | 11 | 6 | -- | -- | -- | 100 |
| Rivers (2) | | | | | | | | | | | | |
| Sacramento | | | | | | | | | | | | |
| Upper Reach | 35 | 3 | 9 | 26 | -- | 6 | 11 | 11 | 26 | -- | 8 | 100 |
| Middle Reach | 42 | 7 | 10 | 49 | 2 | 12 | 8 | 2 | 7 | -- | 5 | 100 |
| Lower Reach | 84 | 16 | -- | 43 | -- | 10 | 5 | 6 | 17 | -- | 1 | 100 |
| Feather | 89 | -- | -- | 100 | -- | -- | -- | -- | -- | -- | -- | 100 |
| American | 27 | -- | 12 | 10 | -- | 10 | -- | -- | 53 | -- | 15 | 100 |
| Yuba | 2 | -- | -- | 100 | -- | -- | -- | -- | -- | -- | -- | 100 |
| Clear Creek | 1 | -- | -- | -- | -- | 49 | -- | -- | 42 | -- | 9 | 100 |
| Wildlife Refuges (3) | 103 | -- | -- | 4 | -- | -- | -- | -- | 73 | -- | 23 | 100 |
| Private Hunting Clubs (4) | 935 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 100 | 100 |
| Other Potentially Affected Areas | | | | | | | | | | | | |
| Reservoirs and Lakes | | | | | | | | | | | | |
| Keswick | 0.5 | -- | -- | 70 | -- | -- | -- | -- | 20 | -- | 10 | 100 |
| Red Bluff | 86 | 2 | -- | 7 | 3 | 1 | 42 | 2 | 25 | -- | 18 | 100 |
| Camp Far West (6) | 72 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |

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| Recreation Areas | Water-Dependent Activities (%) | | | | | | Water-Enhanced Activities (%) | | | | | Total |
|------------------|--------------------------------|---------------|---------------|---------|-------------|------------------------|-------------------------------|------------|-------------|---------|-------|-------|
| | Use (1,000) (1) | Power Boating | Other Boating | Fishing | Waterskiing | Swimming and Beach Use | Camping | Picnicking | Sightseeing | Resorts | Other | |
| Rivers | | | | | | | | | | | | |
| Bear | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |

NOTES:

- (1) Use at all reservoirs is reported in 12-hour Recreation Visitor Days (RVDs), at rivers is reported in 6-hour RVDs, at wildlife refuges is reported in 6-hour RVDs, and at private hunting clubs is reported in visits. Use data for rivers include fishing only.
- (2) All use figures are 1992 data except for Clear Creek (1980).
- (3) Wildlife refuges are Sacramento NWR, Delevan NWR, Sutter NWR, Colusa NWR and Gray Lodge WMA.
- (4) Includes approximately 516 clubs throughout the Sacramento River Region.

SOURCES:

Reservoirs and Lakes:
 Shasta: use (U.S. Bureau of Reclamation 1992b), activity (U.S. Forest Service 1993b).
 Whiskeytown: use (U.S. Bureau of Reclamation 1992b), activity (U.S. Bureau of Reclamation 1981).
 Oroville: use (Goswick pers. comm.).
 Folsom: use (Erba pers. comm.), activity (California Department of Parks and Recreation 1989a).
 New Bullards Bar: use (U.S. Bureau of Reclamation 1992b), activity (Yuba County Water Agency 1993).
 Englebright: use (U.S. Army Corps of Engineers 1992a), activity (U.S. Army Corps of Engineers 1992a).
 Keswick: use (U.S. Bureau of Reclamation 1992b), activity (U.S. Bureau of Reclamation 1981).
 Red Bluff: use (U.S. Bureau of Reclamation 1992b), activity (U.S. Bureau of Reclamation 1979).
 Camp Far West: use (Higley pers. comm.), activity (Yuba County Water Agency 1993).

Rivers:
 Sacramento: use and activity (California Department of Water Resources 1982).
 Feather: use (Wixom pers. comm.).
 American: use and activity (U.S. Army Corps of Engineers 1991).
 Yuba: use (Wixom pers. comm.).
 Clear Creek: use and activity (California Department of Water Resources 1986).
 Bear: use and activity (Melton pers. comm.).
 Wildlife refuges: use (California Department of Fish and Game n.d., Forrest pers. comm., U.S. Bureau of Reclamation 1993a), activity (Forrest pers. comm.).
 Private hunting clubs: Use (California Department of Fish and Game 1992).

LEGEND:
 -- = no use reported in these categories.
 NA = no information currently available.

**Table 8. Major and Other Potentially Affected Recreation Areas
in the San Joaquin River Region**

| | Recreation Area | Owner/Recreation Manager | Year Constructed/ Established |
|----|-----------------------------|---|-------------------------------------|
| | Reservoirs and Lakes | | |
| 1 | Bethany | DWR/DPR | 1967 |
| 2 | San Luis | Reclamation, DWR/DPR | 1967 |
| 3 | O'Neill Forebay | Reclamation, DWR/DPR | 1967 |
| 4 | Millerton | Reclamation/DPR | 1942 |
| 5 | New Melones | Reclamation/Reclamation | 1979 |
| 6 | Camanche | EBMUD/EBMUD | 1963 |
| 7 | New Hogan | Corps/Corps | 1963 |
| 8 | New Don Pedro | TMID/LDPRA | 1971 |
| 9 | Lake McClure | MID/MID | 1967 |
| | Rivers and Canals | | |
| 10 | San Joaquin | NA/Private | NA |
| 11 | Stanislaus | NA/Private | NA |
| 12 | Tuolumne | NA/Private | NA |
| 13 | Calaveras | NA/Private | NA |
| 14 | Merced | NA/Private | NA |
| 15 | Mokelumne | NA/Private | NA |
| 16 | California Aqueduct | DWR/DWR | 1968 |
| 17 | Delta-Mendota Canal | Reclamation/Fresno and Stanislaus County Parks and Recreation Department | |
| | Wildlife Refuges | | |
| 18 | San Luis NWR | USFWS/USFWS | 1966 |
| 19 | Merced NWR | USFWS/USFWS | 1951 |
| 20 | Volta WMA | Reclamation/DFG | 1952 |
| 21 | Los Banos WMA | DFG/DFG | 1929 |

| Recreation Area | Owner/Recreation Manager | Year Constructed/ Established |
|--|--------------------------|-------------------------------------|
| SOURCES: | | |
| California Department of Finance 1991; U.S. Bureau of Reclamation 1989, 1993a. | | |
| LEGEND: | | |
| Corps = U.S. Army Corps of Engineers | | |
| DFG = California Department of Fish and Game | | |
| DPR = California Department of Parks and Recreation | | |
| DWR = California Department of Water Resources | | |
| EBMUD = East Bay Municipal Utility District | | |
| LDPRA = Lake Don Pedro Recreation Agency | | |
| MID = Merced Irrigation District | | |
| NA = not applicable | | |
| NWR = National Wildlife Refuge | | |
| Reclamation = Bureau of Reclamation | | |
| USFWS = U.S. Fish and Wildlife Service | | |
| TMID = Turlock-Modesto Irrigation District | | |
| WMA = Wildlife Management Area | | |

Table 9 . Use at Major Wildlife Refuges in the San Joaquin River Region

| Use Type (1) | 1986 | 1987 | 1988 | 1989 | 1990 | Average Annual Use |
|----------------|--------|--------|--------|--------|--------|--------------------|
| Nonconsumptive | 22,325 | 26,456 | 32,537 | 30,293 | 35,695 | 33,413 |
| Consumptive | | | | | | |
| Hunting | 11,810 | 13,535 | 11,511 | 9,890 | 11,132 | 11,536 |
| Fishing | 3,408 | 4,380 | 4,064 | 3,686 | 4,246 | 4,291 |
| Subtotal | 15,218 | 17,915 | 15,575 | 13,576 | 15,378 | 15,826 |
| Total | 37,543 | 44,371 | 48,112 | 43,869 | 51,073 | 49,239 |

NOTES:

- (1) Use is reported in number of visits.
- (2) Because no data are available for San Luis and Merced NWRs in 1983 and San Luis NWR in 1984, average annual use is based on 1985 through 1990 data.

SOURCES:

Cortese and Miller pers. comms.

Table 10. Recreation Characteristics of Potentially Affected Recreation Areas in the San Joaquin River Region

| Recreation Areas | Surface Area (acres or miles) | Number of Key Facilities | | | | | Activity Restrictions | Primary Game Fish |
|---|----------------------------------|--------------------------|------------------|-----------------|------------------|-------------------|--|----------------------|
| | | Marinas | Boat Launches | Picnic Areas | Camp- grounds | Swimming Areas | | |
| Key Areas | | | | | | | | |
| Reservoirs and Lakes | | | | | | | | |
| San Luis | 12,700 | 0 | 2 | 0 | 1 | 0 | Waterskiing limited | BB/CF/SB |
| Millerton | 4,920 | 1 | 6 | 6 | 1 | 2 | Boat speed restrictions | C/RT/SB/STB |
| New Melones | 3,580 | 1 | 10 | 2 | 2 | 1 | None | NA |
| McClure | 7,100 | 3 | 6 | 3 | 2 | 3 | None | BB/BG/LB |
| New Don Pedro | 13,000 | 2 | 3 | 1 | 3 | 1 | None | BG/C/CF/RT/SB |
| Rivers | | | | | | | | |
| San Joaquin | 100 | 1 | 0 | 3 | 0 | 0 | Activity restricted on private lands | CF/SB |
| Merced | 50 | 0 | 0 | 4 | 2 | 0 | Activity restricted on private lands | CF/SB |
| Tuolumne | 50 | 0 | 0 | 3 | 0 | 0 | Activity restricted on private lands | CS |
| Stanislaus | 60 | 0 | 1 | 10 | 1 | 0 | Activity restricted on private lands | C/CF/LB/SB |
| Wildlife Refuges (1) | 18,600 | 0 | 0 | 0 | 0 | 0 | Limited access during waterfowl season | CF/SB |
| Private Hunting Clubs (2) | 96,842 | 0 | 0 | 0 | 0 | 0 | None | N/A |
| Other Potentially Affected Areas | | | | | | | | |
| Reservoirs and Lakes | | | | | | | | |
| Bethany | 160 | 0 | 1 | 2 | 0 | 0 | Boat speed restrictions | CF/STB |
| O'Neill Forebay | 2,700 | 0 | 2 | 2 | 1 | 1 | None | BB/CF/STB |
| New Hogan | 4,400 | 1 | 4 | 2 | 4 | 2 | Boat speed restrictions | BB/BG/C/CF/GS/STB |
| Camanche | 7,700 | 2 | 3 | 0 | 2 | 0 | Waterskiing limited | BT/C/CF/LB/RT/S/SB |
| Rivers, Aqueducts, and Canals | | | | | | | | |
| Mokelumne | 40 | 0 | 0 | 1 | 0 | 1 | Activity restricted on private lands | AS/CS/SH/ST |
| Calaveras | 45 | 1 | 1 | 1 | 0 | 0 | Activity restricted on private lands | AS/CS/SH/ST |
| California Aqueduct (3) | 340 | 0 | 0 | 0 | 0 | 0 | No water contact | BG/C/CF/GS/LB/SF/STB |
| Delta-Mendota Canal (4) | 200 | 0 | 0 | 0 | 0 | 0 | No water contact | STB/CF |

NOTES:

- (1) Wildlife refuges are San Luis NWR (7,400 acres), Merced NWR (2,600 acres), Volta WMA (3,000 acres), and Los Banos WMA (5,600 acres). Fishing at refuges is allowed only on the San Luis NWR.
- (2) These are approximately 176 private hunting clubs throughout the San Joaquin River region.
- (3) California Aqueduct has 12 fishing access sites.
- (4) Delta-Mendota Canal has two fishing access sites.

SOURCES:**Reservoirs and Lakes**

San Luis: California Department of Water Resources 1989.
 Millerton: California Department of Parks and Recreation 1989a.
 New Melones: Butterbaugh pers. comm.
 McClure: Merced Irrigation District 1993.
 New Don Pedro: Don Pedro Recreation Agency, n.d.
 Bethany: California Department of Water Resources 1989.
 O'Neil Forebay: California Department of Water Resources 1989.
 New Hogan: U.S. Army Corps of Engineers 1992b.
 Camanche: Yuba County Water Agency 1993; BioSystems Analysis 1992.

Rivers, Aqueducts, and Canals

San Joaquin: California Department of Parks and Recreation 1990; Jones & Stokes Associates 1976.
 Merced: Rodriguez pers. comm.
 Tuolumne: California Department of Parks and Recreation 1990.
 Stanislaus: Jones & Stokes Associates 1976.
 Mokelumne: Moranton pers. comm.; California Department of Fish and Game 1991b.
 Calaveras: Jones & Stokes Associates 1988.
 California Aqueduct: California Department of Fish and Game 1984.
 Delta-Mendota Canal: U.S. Bureau of Reclamation 1993a.
 Wildlife refuges: U.S. Fish and Wildlife Service 1983; 1991a; 1992b; Kie pers. comm.
 Private hunting clubs: California Department of Fish and Game 1994.

LEGEND:**Fish species code letters are:**

| | |
|---------------------------|--|
| AS = American shad | GS = green sunfish |
| BB = black bass | LB = largemouth bass |
| BG = bluegill | NA = no information currently available |
| BT = brown trout | RT = rainbow trout |
| C = crappie | S = sturgeon |
| CF = catfish | SB = smallmouth bass |

Table 11. Recreation Use and Activities Potentially Affected Recreation Areas in the San Joaquin River Region

| Recreation Areas | Water-Dependent Activities (%) | | | | | | Water-Enhanced Activities (%) | | | | | Total |
|---|-----------------------------------|---------------|---------------|---------|--------------|------------------------|----------------------------------|------------|----------------------|---------|-------|-------|
| | Use (1, 2) (1,000) | Power Boating | Other Boating | Fishing | Water-skiing | Swimming and Beach Use | Camping | Picnicking | Relaxing/Sightseeing | Resorts | Other | |
| Key Areas | | | | | | | | | | | | |
| Reservoirs and Lakes | | | | | | | | | | | | |
| San Luis | 210 | 4 | -- | 34 | -- | 3 | 14 | 11 | 20 | -- | 14 | 100 |
| Millerton | 316 | 7 | -- | 2 | 6 | 6 | 5 | -- | 74 | -- | -- | 100 |
| New Melones | 498 | 64 | -- | -- | -- | -- | 36 | -- | -- | -- | -- | 100 |
| Lake McClure | 606 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |
| New Don Pedro (3) | 280 | -- | -- | -- | -- | -- | 28 | -- | -- | -- | 72 | 100 |
| Rivers(4) | | | | | | | | | | | | |
| San Joaquin (5) | 157 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |
| Merced (6) | 109 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |
| Tuolumne (7) | 150 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |
| Stanislaus | 122 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |
| Wildlife Refuges (8) | 56 | -- | -- | 7 | -- | -- | -- | -- | 71 | -- | 22 | 100 |
| Private Hunting Clubs (9) | 241 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 100 | 100 |
| Other Potentially Affected Areas | | | | | | | | | | | | |
| Reservoirs and Lakes | | | | | | | | | | | | |
| Bethany | 30 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |
| O'Neill Forebay | 417 | 7 | -- | 17 | -- | 22 | 6 | 15 | 22 | -- | 11 | 100 |
| New Hogan | 185 | 24 | -- | 11 | 15 | 17 | 12 | 8 | 8 | -- | 5 | 100 |
| Camanche | 258 | -- | -- | -- | -- | -- | 40 | -- | -- | -- | 60 | 100 |
| Rivers, Aqueducts, and Canals | | | | | | | | | | | | |
| Mokelumne (10) | 18 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |
| Calaveras | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0 |
| California Aqueduct | 61 | -- | -- | 100 | -- | -- | -- | -- | -- | -- | -- | 100 |
| Delta-Mendota Canal (11) | 23 | -- | -- | 100 | -- | -- | -- | -- | -- | -- | -- | 100 |

NOTES:

- (1) Use at all reservoirs is reported in 12-hour RVDs, at all rivers is reported in 6-hour RVDs, and at all wildlife refuges and private hunting clubs is reported in 5-hour RVDs.
- (2) Annual use is for 1992, except Bethany Reservoir (1991) and California Aqueduct (1991).
- (3) Water-dependent activities at New Don Pedro Reservoir account for 72% of use.
- (4) Reported use is for boating, fishing, swimming, and wildlife viewing activities only.
- (5) San Joaquin River use estimates are for Fremont Ford SRA, Las Palmas Fishing Access Site, Mossdale Landing County Park, and Don Reis County Park.
- (6) Merced River use data are for McConnell and George J. Hatfield SRAs, Hageman County Park, and Henderson County Park.
- (7) Tuolumne River use estimates are based on a 1980 survey adjusted using 1992 population levels.
- (8) Wildlife refuges are San Luis NWR, Merced NWR, Volta WMA, and Los Banos WMA.
- (9) There are approximately 176 private hunting clubs throughout the San Joaquin River Region.
- (10) Mokelumne River use data are for the Mokelumne River Day Use Area.
- (11) Access to the Delta-Mendota Canal is limited to access sites Nos. 2A and 5.

SOURCES:**Reservoirs and Lakes**

- San Luis: use (U.S. Bureau of Reclamation 1992a), activity (California Department of Water Resources 1987).
Millerton: use (U.S. Bureau of Reclamation 1992a), activity (U.S. Bureau of Reclamation 1986).
New Melones: use (U.S. Bureau of Reclamation 1992a), activity (Davis pers. comm.).
McClure: use (Ardohain pers. comm.).
New Don Pedro: use and activity (Cornell pers. comm.).
Bethany: use (Erba pers. comm.).
O'Neill Forebay: use (U.S. Bureau of Reclamation 1992a), activity (California Department of Water Resources 1987).
New Hogan: use and activity (Lykins pers. comm.).
Camanche: use and activity (Hill pers. comm.).

Private Hunting Clubs: (California Department of Fish and Game 1992).

Rivers and Canals

San Joaquin: use (California Department of Parks and Recreation 1990).

Merced: use (California Department of Parks and Recreation 1990).

Tuolumne: use (California Department of Parks and Recreation 1990).

Stanislaus: use (California Department of Parks and Recreation 1990).

Mokelumne: use (Moranton pers. comm.).

California Aqueduct: use (Higley pers. comm.), activity (California Department of Water Resources 1989).

Delta-Mendota Canal: use (U.S. Bureau of Reclamation 1992a), activity (U.S. Bureau of Reclamation 1993b).

Wildlife Refuges: use (Murczek pers. comm., California Department of Fish and Game n.d.), activities (U.S. Fish and Wildlife Service 1990).

LEGEND:

-- = no use reported in these categories.

NA = no information currently available.

U.S. Army Corps of Engineers

DRAFT REPORT

**Environmental Impacts/Consequences
Draft Technical Report
Recreation**

August 25, 1997

1. INTRODUCTION

The purpose of this report is to analyze and describe changes that could result from implementing each of the three CALFED alternatives. This report will be used with other information to develop the impact portion of the CALFED Programmatic Environmental Impact Report/Environmental Impact Statement (EIR/EIS).

In general, because CALFED is intended to improve natural conditions in the Delta, the overall impact of CALFED on recreation is expected to be a beneficial one. However, construction of CALFED projects, redirection of recreation use and recreation facilities, and increase in recreation could lead to significant adverse impacts to existing recreation use and opportunities. The potential impacts discussed are described for five separate regions including the Delta Region, the Bay Region, the Sacramento River Region, the San Joaquin River Region and the State Water Project and Central Valley Project Service Areas Outside the Central Valley.

2. EXECUTIVE SUMMARY

2.1 Summary of Potentially Significant Impacts

Table 1 summarizes all potentially significant impacts to recreation facilities, opportunities and use in each of the five regions for each of the alternatives.

2.2 Summary of Mitigation Strategies

Mitigation measures to minimize impacts to existing recreation use include the following:

Construction required for ecosystem restoration projects and levee system integrity which could affect nearby recreation should be conducted in non-recreation peak-season, to the extent possible

Provide new and equitable facilities when temporarily or permanently eliminating existing facilities.

Minimize fluctuation of reservoir levels for existing and new reservoirs.

2.3 Summary of Potential Significant

Unavoidable Impacts

No potentially significant unavoidable impacts were identified. All potentially significant impacts can and should be mitigated with a combination of measures including timing of construction and provision of temporary or new equitable facilities.

3. ASSESSMENT METHODS

Both qualitative and quantitative methods can be used to assess the changes in recreation opportunities. Where recreation opportunity thresholds (e.g., the reservoir level at which boat ramps become unusable, streamflows where rafting becomes infeasible) and necessary input data exist, they will be used to assess the effects of CALFED actions on recreation opportunities. In other areas, and for other activities, qualitative methods based on historical use data; availability and accessibility of recreation sites; and the abundance of fish, waterfowl and support facilities (e.g. boat launches and marinas) will be used.

4. SIGNIFICANCE CRITERIA

Determination of significance of impacts is based on the application of significance criteria described in Section 4, below. Based on the information available (see References) Alternatives are reviewed and compared to the significance criteria. If the actions included in the alternative appear to trigger one or more of the criteria, then the potential impact is described to the extent possible.

At the programmatic level, in many instances, it is not possible to make an accurate determination of the significance of an impact. In these cases, potential impacts are described to the extent possible and it is noted that further analysis will be required in subsequent environmental review at the project level. For recreation, this is particularly the case for the construction and operation of storage and conveyance projects.

Changes to the both recreation opportunities, and recreation use will be evaluated to assess the impacts of the CALFED alternatives on recreation resources.

There are several different criteria used to determine if each of the proposed alternatives could have a potentially significant impact on existing recreation activities in the project area at the programmatic level. The significance criteria used for a qualitative evaluation are substantially broader than those used for a quantitative or project level analysis. Those used for this study are as follows:

- Potential for fluctuation in lake or reservoir water levels which could result in:
 - Changes in recreation opportunities

- Potential for significant propeller damage to boats from exposed hazards as water level drops
- Exacerbation of conflicts between recreational user groups
- Potential to expose boat launches and limiting or prohibiting use of boat facilities
- Reduction in recreation visitor-days
- Changes in fresh-water flows in rivers and the Delta during the recreational season
- Changes in recreation opportunities reduced average flows in rivers used by boaters (rafters, kayakers)
- Changes of river temperature which reduce recreational swimming, tubing, canoeing, kayaking, and rafting
- Change in the quality of the recreational boating experience in Delta channels
- Temporary closing of channels and rerouting due to construction
- Temporary restriction of recreation activities due to construction
- Conversion of recreation facilities to other uses
- Reduction of opportunities for one activity resulting in increase in recreation use-days for other recreational uses in the Delta (shifting activities)
- Increase in recreation use-days for hunting in the Delta
- Change in regional duck hunter success within both the solution area and the problem area
- Changes to nature walk or sightseeing activities associated with fishery changes
- Changes to vegetation species that reduce existing recreation
- Change to fishing opportunities
- Change in regulations related to boating

5. ENVIRONMENTAL IMPACTS

5.1 Impact Analysis

Within this section the impacts of the No-Action Alternative and Alternatives 1,2 and 3 are described. Each of the alternatives have many aspects in common, including the four common programs and several of the storage and conveyance components. To avoid repetition, impacts associated with the common programs and storage and conveyance components are described within the first alternative in which they appear. Thereafter, if they appear in an alternative, the reader is referred to the previous section wherein the impacts are described.

5.1.1 Description of No-Action Resource Conditions

In this section, the effects of the No Action Alternative on recreation opportunities, use and facilities are described qualitatively.

Delta Region-Resource Conditions

Within the Delta Region, implementation of the No Action Alternative would result in potentially significant impacts to recreation.

The 2020 level of development will result in an increase in population throughout the State of CA including the Delta Region. The increase in population will place stress on existing Delta recreation resources, some of which are already stressed from overuse (waiting for reference from MWD's consultant on this issue.)

Continued implementation of the Sacramento-San Joaquin Delta Levees Subvention project would be a positive impact to recreation resources. Without monies to continually upgrade and maintain delta levees they are at risk of failure from

continual degradation and catastrophic events. Failure of levees in many locations would severely impact existing recreation resources.

Bay Region-Resource Conditions

Recreation resources in the Bay Region may experience significant impacts related to overuse from the increase in population expected from the 2020 Level of Development.

Sacramento River Region- Resource Conditions

Reoperation of the Folsom Reservoir could result in impacts to existing recreation activities at the reservoir. The extent and type of impacts would vary depending on the amount of flood storage required. Impacts would result from drawdown of the reservoir in late fall for flood protection. Similarly, benefits to recreation could be realized downstream of the reservoir if releases are greater than current conditions.

San Joaquin River Region- Resource Conditions

If agricultural lands are retired in the San Joaquin River Region, either from direct retirement or from elimination of subsidies, conversion of these lands to recreational uses would be positive impact in the region.

SWP and CVP Service Areas-Resource Conditions

No impacts to recreation are anticipated in the No Action Alternative.

5.1.2 Description of Alternative Resource Conditions

Delta Region

A summary of potential impacts to recreation facilities, opportunities and use in the Delta Region for each alternative is shown on Table 2.

Alternative 1

Alternative 1 consists of three sub-alternatives, 1a, 1b and 1c. For each of these subalternatives the impacts to recreation are the same for the common components: the ERPP, Water Quality, Water Use Efficiency and Levee System Integrity. The impacts to recreation vary from sub-alternative only with respect to the storage and conveyance components proposed.

Ecosystem Restoration Program Plan (ERPP)

This impact discussion addresses only those program actions which will impact recreation opportunities, recreation facilities and increase or decrease recreation use. These program actions and their potential impact on recreation opportunities and/or recreation use are described qualitatively below.

In general, those actions which may have direct impacts on recreation in the Delta Region include habitat restoration, species recovery activities, and actions designed to eliminate "stressors" on the ecosystem. In general, the overall impact of these actions are thought to be beneficial. As conditions in the Delta improve for fish and wildlife by improving habitat, recreation opportunities involving wildlife viewing and fishing will benefit.

Habitat. Many of the areas targeted for habitat restoration are currently used for recreation activities including boating, hunting, wildlife viewing and sportsfishing. Other areas are currently used for agriculture and will be converted to uses which will be more compatible to recreation. For example, the development of new deep water areas and tidally influenced channels will create new recreation opportunities for boaters and the restoration of freshwater marshes and tidal wetlands may create new opportunities for hunters.

Although the overall impact of habitat restoration will be positive, restoration activities may result in some adverse impacts to recreation. Impacts to recreation will primarily be felt during construction activities when specific areas may be temporarily closed to the public and some recreation facilities such as piers or marinas will be temporarily or permanently closed. If restoration actions require the permanent closure of a recreation facility, mitigation should include the relocation of a similar facility in a nearby location with the same or equitable amenities.

Species and Species Groups:

Implementation of the species and species groups elements in the Delta Region is intended to result in the recovery of numerous special status fish and bird species. Several of the actions designed to protect and recover fisheries are also planned for regions upstream of the Delta, however the effects of those efforts will benefit the Delta as well. In the long-term, by improving the sustainability of a species, particularly fish and hunted species, such as ducks, impacts to recreation will be positive as recreation opportunities for fishing and hunting will also be sustained.

Because restoration actions will result in increased visitation by birds and other wildlife, the impact to recreation would also likely include expanded opportunities for wildlife viewing, particularly birds, and the Delta could become a major destination for birders increasing visitors days, compared to the existing condition. There is also the potential for commercial enterprises to develop services for visitors such as guided tours to service visitors.

Stressors. Implementation of the elements of the ERPP designed to eliminate or reduce stressors may have an impact on existing recreation. The stressor element includes a requirement to reduce boat traffic and boat speeds in areas where levees or channel islands and their associated shallow water and riparian habitat are susceptible to wake damage. Reduction of boat traffic in some areas could result in an increase in traffic in other areas causing congestion during peak use days in the summer months.

Additionally, mandatory reduction in speed in some areas will create a change in recreation activities from the existing condition. Jet skis and boats using the Delta currently operate at speeds up to

Although the ERPP does not currently specify proposed speed requirements it could be assumed that the new regulations will alter jet ski and boat behavior and could potentially decrease the number of use-days for boating in the Delta.

Water Quality Program

The water quality program is intended to provide good water quality for all users of water from the Delta, including recreational beneficial uses. Improved water quality for the Delta will have several indirect beneficial impacts on recreation. Existing health hazards related to ingesting raw water from

the Delta during recreational activities will diminish, water clarity should improve resulting in an improved aesthetic experience, as part of improving the overall ecosystem, water quality is a critical element in making the Delta a thriving ecosystem which will have an overall positive impact on recreation. None of the actions required to implement the water quality program are expected to negatively impact recreation. However, the water quality program does include an action to improve management of boat discharges which could lead to more stringent regulation.

Water Use Efficiency Program

Water saved through these programs is anticipated to result in a beneficial impact to recreation resources. Water not used by the service areas will be both stored in recreation areas (reservoirs) and allowed to flow through recreation areas (rivers and the Delta).

The Water Use Efficiency Program may modify the timing of wetland dewatering or reduce the amount of applied water at wildlife refuges. There is a potential that these changes, depending on the extent and the timing, could affect wildlife use of the refuges, and therefore could have an impact on existing recreation at the wildlife refuges.

Levee System Integrity Program

Of the several long-term programmatic actions included in the Levee System Integrity Program the one which will have the greatest impact on recreation is the Levee Associated Recreation.

The development of beach slopes associated with levees should result in increased recreational opportunities and facilities and result in an overall positive impact on

recreation. The development of new beach areas may also result in an increase in recreation use.

The enhancement of current recreational opportunities and the creation of new areas for passive and active uses should also result in a positive impact on recreation. However, until specific enhancements are proposed and it is clear what current activities and facilities are proposed to be redirected, it is not possible to state what the impacts to recreation will be. Impacts could include elimination of an existing opportunity in a specific portion of the Delta such as boat ramps, piers or marinas.

The levee system integrity program is intended to reduce the risk to land uses from catastrophic breaching of Delta levees. Currently, many recreation areas within the Delta such as camping facilities, boat launches etc. are at risk of damage if a levee in the vicinity were to be breached. The Levee System Integrity Program will reduce this risk.

There is a potential that during construction of levee repairs and levee strengthening, some temporary impacts to recreation activities could occur. Additionally, there is a possibility that in some locations the repair or modification of a specific levee could encroach on an existing recreation facility resulting in a decrease in size, or function of the facility or an elimination of the facility completely. The types of mitigation measures which may be required to mitigate for the encroachment on or elimination of a specific facility could include, improvement of a nearby facility or development of a new facility with the same or similar services in the vicinity of the impact.

To the extent possible, the restoration and

redesign of existing levees and the design of new levees should accommodate vehicular access and parking for shoreline fishing, boat launching, swimming, hiking, bicycling, and wildlife viewing. Also, if levee projects are designed to provide access to waterfront parcels of useable land on island edges then opportunities for boat-in day use and camping can be created.

Operation and Storage Facilities

Development of a comprehensive recreation plan, which is part of the storage and conveyance component for all alternatives, would avoid potential impacts to recreation resulting from construction of storage and conveyance facilities.

There are no storage facilities proposed within the Delta Region for Alternative 1. However, Alternative 1c does include surface storage and groundwater storage upstream of the Delta. Depending on the operation of these upstream storage facilities, impacts to recreation in the Delta region could result from alteration of existing flows or changes in current water temperature.

Alternative 1a includes "Reoperation" of existing water supply facilities including storage facilities, pumps and conveyance facilities. The purpose of the reoperation is to provide flow events during the spring outmigration of fishery species using the tributaries to the Delta. It is anticipated that the water required for this reoperation will be provided from water otherwise delivered during the growing season to agricultural needs and will not impact the water supply required for recreation uses.

Conveyance Facilities

Sub-alternatives 1b and 1c include modifications in the South Delta. Sub-alternative 1b and 1c also include improvements to the CVP and SWP to provide additional operational flexibility:

Construction of these improvements may temporarily restrict recreation activities including boating, fishing, hunting and wildlife viewing in the vicinity of the construction area. To mitigate this potentially significant impact, construction should be scheduled to minimize conflict with the peak recreation season (May to September).

Operation of these improvements will result in improved fishery resources and therefore potentially increase the visitor use for fishing activities. Depending on the extent of the increase in visitor use, this result in a significant increase in recreation use which could put stress on existing limited recreation facilities.

Alternative 2

Common Programs

The impacts to recreation associated with implementation of the following four common programs in the Delta Region are the same for Alternative 2 as described above in Alternative 1, except as noted below.

Ecosystem Restoration Program Plan

Inundation of Bouldin Island in sub-alternative 2d should result in an increase in aquatic related recreation opportunities including fishing, wildlife viewing and boating.

- **Water Quality Program**
- **Water Use Efficiency Program**
- **Levee System Integrity Program**

Storage

Of 5 sub-alternatives to Alternative 2, only 2c includes storage within the Delta Region. This 50,000 to 100,000 AF of storage may provide additional recreation opportunities within the Delta Region. While providing new recreation opportunity, new storage in the Delta, depending on the exact location may also result in significant impacts to existing recreation due to inundation or other related construction impacts.

Depending on the operation of upstream storage facilities in Sub-alternatives 2b, 2d and 2e, impacts to recreation in the Delta region could result from alteration of existing flows or changes in current water temperature.

Conveyance Facilities

Construction and operation of the several conveyance facilities included in the various sub-Alternatives to Alternative 2 would result in the same impacts as those described for the same conveyance facilities included in Alternative 1.

In sub-alternative 2c, the construction of the three isolated conveyance channels and intakes may have significant impacts to recreation both during construction and operation. Construction impacts would include restrictions on uses such as boating, fishing, hiking and hunting in construction areas. Operations impacts would depend on the exact location of facilities such as pumps and maintenance structures required and may require relocation of existing recreation

resources. Additionally, the inundation of Holland Tract could require the relocation of the existing 33-berth Marina on Rock Slough. This would be a significant impact.

Construction of the Mokelumne River Floodway modifications and flooding of Bouldin Island to improve conveyance in sub-alternatives 2d and 2e may result in temporary recreation impacts during construction. Operation of these sub-alternatives would permanently displace any land-based recreation opportunities currently ongoing at Bouldin Island. These activities would be replaced with water-dependent recreation opportunities. The inundation of Tyler Island in sub-alternative 2e would have similar impacts.

Other habitat improvements/setback levees included in Alternative 2 which serve to improve conveyance of water would have temporary construction impacts to recreation but are thought to provide long-term benefits to recreation.

Alternative 3

Common Programs

The impacts to recreation associated with implementation of the following four common programs in the Delta Region are the same for Alternative 3 as described above in Alternative 1.

- **Ecosystem Restoration Program Plan**
- **Water Quality Program**
- **Water Use Efficiency Program**
- **Levee System Integrity Program**

Storage Facilities

The impacts associated with the in-Delta

storage components in 3b and 3i are the same as those described for storage in the Delta Region for Alternative 2.

Conveyance Facilities

Construction of the open channel isolated facility on the east side of the Delta included in 3a, 3b, 3e, and 3h (3i?) will likely result in significant impacts to existing recreation resources. Though the size of the facility varies in each of the sub-alternatives, size is not expected to vary the extent of the recreation impacts.

The open channel isolated facility would be constructed in the vicinity of several existing recreation areas including Stone Lakes National Refuge, fishing and boating access areas along several sloughs, and several trails and parks in San Joaquin County.

Construction of this facility would require temporary disruption of existing facilities. Operation may result in closure of several existing facilities to allow for construction of the various pumps, siphons, access roads, storage buildings and utilities. This would be a significant adverse impact. Mitigation measures should include provision of new facilities which provide equitable or better recreation opportunities in the vicinity of the impacted facilities.

The enclosed pipeline in sub-alternatives 3c and 3d would have similar construction impacts as the isolated conveyance facility described above. However, the operation impacts may be less severe as much of the land uses could be returned to their original condition after construction. Again, impacts to recreation resources would vary depending on the location of the various facilities associated with the channel such as pumps, siphons, access roads, storage buildings and utilities.

The development of the "Chain of Lakes" in sub- Alternative 3f would also have significant impacts to recreation resources. Depending on the islands to be inundated in this sub-Alternative the extent of recreation facilities and opportunities eliminated could be quite extensive and include marinas, picnic areas, camping sites, and fishing access areas. However, a "chain of lakes" would provide more water surface area for boating and fishing uses in the Delta. The availability of more water surface area for boating in the congested areas of the Delta would help to spread out existing boating uses and provide more area for future boating demand. Furthermore, the lands surrounding the newly flooded area could provide more shorelines for the development of boating, camping and day use support facilities.

There are several hunting clubs located along the deep water ship channel, however, these are not expected to be impacted with the implementation of Alternative 3g. The open channel isolated facility on the western side of the Delta in Sub-Alternative 3g would have similar impacts as those described for the same facility on the east side of the Delta. The pipeline through Sherman Island would have temporary construction impacts to the recreation facilities in that location.

Bay Region

A summary of potential impacts to recreation facilities, opportunities and use in the Bay Region for each alternative is shown on Table 3.

Alternative 1

Ecosystem Restoration Program Plan

The ERPP includes several actions involving

restoration in the Bay Region. In general, these actions are similar to those proposed for the Delta Region described above and are anticipated to have similar impacts on recreation activities in the Bay Region. As with the Delta Region, until specific sites are identified, impacts to existing specific recreation facilities cannot be identified.

Water Quality Program

The anticipated positive impacts of the water quality program on recreation in the Bay Region are similar to those in the Delta.

Water Use Efficiency Program

The anticipated positive impacts of the water use efficiency program on recreation in the Bay Region are similar to those in the Delta.

Levee System Integrity Program

Not applicable

Storage Facilities

There are no storage facilities proposed within the Bay Region for Alternative 1. Impacts within the Bay Region due to upstream storage facilities would be similar as though discussed for the Delta Region.

Conveyance Facilities

No conveyance facilities are proposed in the Bay Region.

Alternative 2

The impacts to recreation associated with implementation of the following four common programs in the Delta Region are the same for Alternative 3 as described above in Alternative 1.

- **Ecosystem Restoration Program Plan**
- **Water Quality Program**
- **Water Use Efficiency Program**
- **Levee System Integrity Program**

Storage Facilities

See impacts described under Bay Region - Alternative 1.

Conveyance Facilities

No conveyance facilities are proposed in the Bay Region.

Alternative 3

The impacts to recreation associated with implementation of the following four common programs in the Delta Region are the same for Alternative 3 as described above in Alternative 1, except as noted below.

- **Ecosystem Restoration Program Plan**
- **Water Quality Program**
- **Water Use Efficiency Program**
- **Levee System Integrity Program**

Storage Facilities

See impacts described under Bay Region - Alternative 1.

Conveyance Facilities

No conveyance facilities are proposed in the Bay Region.

Sacramento River Region

A summary of potential impacts to recreation facilities, opportunities and use in the

Sacramento River Region for each alternative is shown on Table 4.

Alternative 1

Ecosystem Restoration Program Plan

The majority of the ERPP actions planned for the Sacramento River Region have been developed to recover declining fish populations. Although it's difficult to predict what the exact impacts to recreation in the Sacramento River Region may be due to these actions, it seems probable that there would be an increase in sportfishing opportunities once fish populations recover and reach target levels. The conversion of existing agricultural lands to riparian habitat may also increase recreation opportunities for sportsfishing by providing additional area for shoreline access.

An additional impact to recreation could result from temperature changes of Nimbus Dam releases. Depending on the timing and extent of temperatures changes, if water is significantly cooler than the existing conditions, recreation use for activities such as swimming, tubing, canoeing, kayaking and rafting could be impacted.

Water Quality Program

The anticipated positive impacts of the water quality program on recreation in the Sacramento River Region are similar to those in the Delta.

Water Use Efficiency Program

The anticipated positive impacts of the water use efficiency program on recreation in the Sacramento River Region are similar to those in the Delta.

Levee System Integrity Program

Not applicable.

Storage Facilities

Each of the types of potential surface storage projects could have a range of significant impacts to existing recreation resources. Because no specific sites have been selected for development, this programmatic analysis will qualitatively discuss the potential impacts to recreation associated with each of the types of storage facilities.

The direct impacts to recreation associated with the raising of existing dams would be due to the inundation of existing recreation facilities and recreation opportunities currently existing around the perimeter of the reservoir. These facilities could include boat launches, marinas, camping facilities, resorts, fishing spots, piers and beaches. Any project which resulted in the inundation of these types of facilities would be required to mitigate for the impacts to the existing recreation facilities by providing new and equitable facilities associated with the new inundation area. There is the possibility that the enlarged reservoir would provide for improved recreation facilities and opportunities when compared to the existing condition. For example the enlarged reservoir would have greater surface area providing additional area for boating and a greater circumference providing a larger area for lakeside camping facilities, boat launches, marinas, and resorts. However, the actual opportunities for development of improved recreation facilities and opportunities would depend on the topography and other constraints surrounding the existing reservoir and the proposed configuration of the enlarged reservoir.

The impacts associated with the development

of new off-stream storage reservoirs would depend greatly on the location of the reservoir, the existing facilities in the area of inundation and the quality of the habitat to be inundated. The extent of the impacts could only be determined once a comparison was made of the value of the recreation facilities and recreation opportunities inundated to those created with the new reservoir. Depending on the type of recreation opportunities and facilities inundated, there is a potential that they could be replaced surrounding the new reservoir (i.e. camping). Furthermore, the new reservoir would provide a significant new recreation opportunity for boating, swimming and fishing. Additionally, a conveyance facility of some type would need to be constructed to convey water from the off-stream reservoir to users. The impacts related to the conveyance would likely be associated with construction only, and would be temporary.

New on-stream storage reservoirs would have much greater impacts to recreation than off-stream reservoirs. In addition to any land area which would be inundated, a new on-stream reservoir would also inundate some length of existing free-flowing river which, depending on the river and the location, may be an important recreation resource for rafting, kayaking and fishing. Additionally, operation of an on-stream reservoir could result in altered downstream flows and higher or lower water temperatures, both of which could impact existing recreation. A new on-stream reservoir would create new recreation opportunities, however reservoir recreation could not fully mitigate for recreation activities occurring within a free-flowing river channel.

Off aqueduct storage--to be provided

The development of .5 MAF of groundwater storage within the Sacramento region is not anticipated to result in significant impacts to recreation. The physical development of a groundwater storage facility is generally limited to the development of several injection wells which are generally compatible with most land uses, including recreation. Additionally, a conveyance facility of some type would need to be constructed to convey water from the source to the point of injection. The impacts related to the conveyance would likely be associated with construction only, and would be temporary. The diversion of .5 MAF of water would likely occur during winter stormflows(TRUE?) and would therefore not impact minimum recreation flows required during peak recreations months in the spring, summer and fall.

Conveyance Facilities

There are no conveyance facilities proposed for the Sacramento River Region in Alternative 1.

Alternative 2

The impacts to recreation associated with implementation of the following four common programs in the Sacramento River Region are the same for Alternative 3 as described above in Alternative 1.

- **Ecosystem Restoration Program Plan**
- **Water Quality Program**
- **Water Use Efficiency Program**
- **Levee System Integrity Program**

Storage Facilities

Impacts to recreation facilities associated with storage in the Sacramento River Region in Alternative 2 would be the same as those

described in Alternative 1 for the Sacramento River Region..

Conveyance Facilities

There are no conveyance facilities in the Sacramento River Region in Alternative 2.

Alternative 3

The impacts to recreation associated with implementation of the following four common programs in the Sacramento River are the same for Alternative 3 as described above in Alternative 1, except as noted below.

- **Ecosystem Restoration Program Plan**
- **Water Quality Program**
- **Water Use Efficiency Program**
- **Levee System Integrity Program**

Storage Facilities

Impacts to recreation facilities associated with storage in the Sacramento River Region in Alternative 3 would be the same as those described in Alternative 1 for the Sacramento River Region.

Conveyance Facilities

There are no conveyance facilities in the Sacramento River Region in Alternative 2.

San Joaquin River Region

A summary of potential impacts to recreation facilities, opportunities and use in the San Joaquin River Region for each alternative is shown on Table 5.

Alternative 1

Ecosystem Restoration Program Plan

In general the impacts associated with the ERPP actions in the San Joaquin River Region are similar to those anticipated in the Delta, Sacramento, and Bay Regions.

Actions planned to improve fish habitat and install fish screens should result in improved fishery populations resulting in increased fishing opportunities. Restoration and creation of riparian habitat, aquatic habitat and wetland habitat should provide increased opportunities for shoreline fishing, hunting and wildlife viewing.

Water Quality Program

The anticipated positive impacts of the water quality program on recreation in the San Joaquin River Region are similar to those in the Delta Region.

Water Use Efficiency Program

The anticipated positive impacts of the water use efficiency program on recreation in the San Joaquin River Region are similar to those in the Delta Region.

Levee System Integrity Program

Not applicable

Storage Facilities

Alternatives 1a and 1b do not include any storage facilities, therefore there are no associated impacts to recreation. However, Alternative 1c does include new storage to provide opportunities for enhanced timing and flow management to more effectively and efficiently satisfy urban, agricultural and environmental beneficial users.

Within the San Joaquin River Region, Alternative 1c includes .5 MAF of

groundwater storage. The potential impacts to recreation associated with the development of groundwater storage are described under Storage Facilities in the Sacramento River Region section.

Conveyance

There are no conveyance facilities proposed in the San Joaquin River Region in Alternative 1.

Alternative 2

The impacts to recreation associated with implementation of the following four common programs in the San Joaquin River Region are the same for Alternative 2 as described above in Alternative 1.

- **Ecosystem Restoration Program Plan**
- **Water Quality Program**
- **Water Use Efficiency Program**
- **Levee System Integrity Program**

Storage Facilities

Alternative 2 includes both surface storage facilities and groundwater storage in San Joaquin County. The impacts associated with these types of facilities are described in the Sacramento River Region section under Storage Facilities.

Conveyance Facilities

There are no conveyance facilities in the San Joaquin River Region in Alternative 2.

Alternative 3

The impacts to recreation associated with implementation of the following four common programs in the San Joaquin River

Region are the same for Alternative 3 as described above in Alternative 1.

- **Ecosystem Restoration Program Plan**
- **Water Quality Program**
- **Water Use Efficiency Program**
- **Levee System Integrity Program**

Storage Facilities

Alternative 3 includes both surface storage facilities and groundwater storage in San Joaquin County. The impacts associated with these types of facilities are described under Storage Facilities in the Sacramento Region.

Conveyance Facilities

There are no conveyance facilities in the San Joaquin River Region in Alternative 3.

SWP and CVP Service Areas Outside the Central Valley

A summary of potential impacts to recreation facilities, opportunities and use in the SWP and CVP Service Areas Outside the Central Valley for each alternative is shown on Table 6.

Alternative 1

Ecosystem Restoration Program Plan

There are no ERPP actions planned for the SWP and CVP Services Areas outside the San Joaquin Valley region.

Water Quality Program

Implementation of the water quality program should result in a positive impact to recreation resources in this region.

Improvement of quality of water flowing into and through the Delta will result in higher quality water in the aqueducts and at the terminal reservoirs throughout the SWP and CVP projects. This will enhance the recreation experience and minimize risks which may have previously existed from body contact in these water bodies.

Water Use Efficiency Program

The anticipated positive impacts of the water use efficiency program on recreation in the CVP and SWP Service Areas outside of San Joaquin Valley are similar to those in the Delta Region.

Levee System Integrity Program

Not applicable.

Storage Facilities

No storage facilities are proposed in this region. Storage facilities upstream may impact recreation facilities in this region if overall system operation results in additional water provided to the CVP and SWP system. This would result in a positive impact to recreation resources.

Conveyance Facilities

No conveyance facilities are proposed in this region.

Alternative 2

Ecosystem Restoration Program Plan

See Alternative 1.

Water Quality Program

See Alternative 1

See Alternative 1.

6.0 RELATED TOPICS

Water Use Efficiency Program

The assessment of impacts to recreation is closely linked to the Fish, Wildlife and Recreation Economics Technical Report.

See Alternative 1.

Levee System Integrity Program

Not applicable.

Storage Facilities

See Alternative 1.

Conveyance Facilities

See Alternative 1.

Alternative 3

Ecosystem Restoration Program Plan

See Alternative 1.

Water Quality Program

See Alternative 1.

Water Use Efficiency Program

See Alternative 1.

Levee System Integrity Program

Not applicable.

Storage Facilities

See Alternative 1.

Conveyance Facilities

Table 1--Summary of Impacts to Recreation Facilities, Opportunities, and Use

| | Existing Conditions | No Action | 1a | 1b | 1c | 2a | 2b | 2c | 2d | 2e | 3a | 3b | 3c | 3d | 3e | 3f | 3g | 3h | 3i | |
|-----------------------|---------------------|-----------------------|-----------------------|---|-----------------------|---|-----------------------|--|-----------------------|---|-----------------------|---|-----------------------|---|----|----|-----------------------|--|----|--|
| Delta | | Less than significant | | | | | | Potentially significant negative impacts | | | | | | | | | Less than significant | Potentially significant negative impacts | | |
| Bay | | No impact | Less than significant | | | | | | | | | | | | | | | | | |
| Sacramento River | | No impact | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | | | | | | |
| San Joaquin River | | No impact | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | Less than significant | Potentially significant adverse impacts | | | | | | |
| SWP-CVP Service Areas | | No impact | Less than significant | | | | | | | | | | | | | | | | | |

Table 2--Delta Region

| Recreation Impact | Existing Conditions | No Action | 1a | 1b | 1c | 2a | 2b | 2c | 2d | 2e | 3a | 3b | 3c | 3d | 3e | 3f | 3g | 3h | 3i |
|--|--|--|--|---|----|-----------------------|----|---|--|---|--|----|----|----|-----------------------|---------------|----|----|--|
| Temporary facility closure during construction | None | Minor impact due to construction from levee subvention project | Minor impacts due to temporary closure during construction of habitat restoration projects. | | | Same as Alternative 1 | | | | | Significant impacts during construction of open channel isolated facility or pipeline. | | | | Less than significant | Same as 3a-3e | | | |
| | | | | Minor impacts due to closure during construction of South Delta modifications | | Same as Alternative 1 | | | | | Same as Alternative a | | | | | | | | |
| Permanent closure of facilities | | | Construction for ERPP and Levee System Actions could result in permanent closure of existing facilities; however, these are expected to be less than significant | | | | | | | | | | | | | | | | |
| | | | | | | | | Potentially significant due to operation of conveyance channels | Potentially significant due to Mokelumne River floodway and Bouldin Island modifications | | Operation of open channel isolated facility or pipeline could result in permanent closure of portions of existing recreation facilities and is considered a potentially significant impact | | | | Less than significant | Same as 3a-3e | | | |
| | | | | | | | | | | Potentially significant due to inundation of Tyler Island | | | | | | | | | |
| Development of new recreation facilities | | | ERPP and Levee Program actions could result in new recreation facilities | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | Chain of Lakes would create additional surface water for boating and fishing |
| Increased opportunities due to improved habitat | | | Increased wildlife viewing, hiking, and fishing opportunities expected due to ERPP actions | | | | | | | | | | | | | | | | |
| Constraints on current practices (i.e., boating) | | | Less than significant impact to boaters due to speed restrictions and discharge restrictions | | | | | | | | | | | | | | | | |
| Visitor Use | Current recreation demand exceeds resources, especially for boating and fishing facilities | Visitor use will increase with growing population, increasing demand for recreation resources, and resulting in a potentially sign, impact on existing recreation resources. | Visitor use anticipated to increase as a result of improved habitat, wildlife and water quality. | | | | | | | | | | | | | | | | |

| Table 3--Bay Region | | | | | | | | | | | | | | | | | | | |
|--|---|----------------------------------|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Recreation Impact | Existing Conditions | No Action | 1a | 1b | 1c | 2a | 2b | 2c | 2d | 2e | 3a | 3b | 3c | 3d | 3e | 3f | 3g | 3h | 3i |
| Temporary facility closure due to impact of construction | No impact | Minor impact due to construction | Minor impacts due to temporary closure during construction of habitat restoration projects. | | | | | | | | | | | | | | | | |
| Permanent closure of facilities | No impact | No impact | Construction for ERP and Levee System Actions could result in permanent closure of existing facilities; however, these are expected to be less than significant | | | | | | | | | | | | | | | | |
| Development of new facilities | | | ERP and Levee Program Actions could result in new recreation facilities | | | | | | | | | | | | | | | | |
| Increased opportunities for improved habitat | | | Increased wildlife viewing, hiking, walking, and fishing opportunities expected due to ERP actions | | | | | | | | | | | | | | | | |
| Construction strains on current practices (i.e., boat- ing) | | | Less than significant impact to boaters due to speed restrictions and discharge restrictions | | | | | | | | | | | | | | | | |
| Use | Recreation and fishing demand for boating especially increasing, resources exceed population, demand will increase with visitor use | Current recreation resources | Visitor use anticipated to increase as a result of improved habitat, wildlife, and water quality. | | | | | | | | | | | | | | | | |

Table 4--Sacramento River Region

| Recreation Impact | Existing Conditions | No Action | 1a | 1b | 1c | 2a | 2b | 2c | 2d | 2e | 3a | 3b | 3c | 3d | 3e | 3f | 3g | 3h | 3i |
|--|---------------------|--|---|----|---|----|------------|----|----|------------|----|------------|----|------------|------------|------------|---|------------|------------|
| Temporary facility closure during construction | None | No impacts | Minor impacts due to temporary closure during construction restoration projects | | | | | | | | | | | | | | | | |
| | | | | | Potentially significant impacts during construction of surface storage and ground-water storage | | Same as 1c | | | Same as 1c | | Same as 1c | | | | | | Same as 1c | |
| Permanent closure of facilities | None | No impacts | Construction for ERP and Levee System Actions could result in permanent closure of existing facilities; however, these are expected to be less than significant | | | | | | | | | | | | | | | | |
| | | | | | Potentially significant depending on location of surface water storage facility | | Same as 1c | | | Same as 1c | | Same as 1c | | | | | | Same as 1c | |
| Development of recreation facilities | | No impacts | ERPP and Levee Program Actions could result in new recreation facilities | | | | | | | | | | | | | | | | |
| | | | | | New on-stream storage facilities could result in new recreation facilities | | Same as 1c | | | Same as 1c | | Same as 1c | | Same as 1c | Same as 1c | Same as 1c | Same as 1c and Chain of Lakes would create additional surface water for boating and fishing | | Same as 1c |
| Recreation opportunities | | Potential decrease or increase in recreation opportunities due to reoperation of Folsom Reservoir | Increased wildlife viewing, hiking, walking, and fishing opportunities due to ERPP and Water Quality Program actions | | | | | | | | | | | | | | | | |
| Recreation use | | Visitor use will increase with growing population, increasing demand for recreation resources and resulting in a potentially sign. impact on existing recreation resources | Visitor use anticipated to increase as a result of improved habitat, wildlife, and water quality | | | | | | | | | | | | | | | | |

Table 5--San Joaquin River Region

| Recreation Impact | | Existing Conditions | | No Action | | 1a | 1b | 1c | 2a | 2b | 2c | 2d | 2e | 3a | 3b | 3c | 3d | 3e | 3f | 3g | 3h | 3i |
|---|---|--|--|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Recreation Facilities | | | | | | | | | | | | | | | | | | | | | | |
| Temporary facility closure during construction | None | No Impacts | Minor impacts due to temporary closure during construction of habitat | | | | | | | | | | | | | | | | | | | |
| Development of rural lands | Retirement of agricultural lands | Development of new recreation facilities | Potentially significant impacts during construction of surface storage and groundwater storage | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c | Same as 1c |
| Development of new recreation facilities | Development of rural lands | Retirement of agricultural lands | Development of new recreation facilities | ERP and Levee Program Actions could result in new recreation facilities | | | | | | | | | | | | | | | | | | |
| Recreation Opportunities | | | | | | | | | | | | | | | | | | | | | | |
| Visitor use will increase with growing population, increasing demand for recreation resources and potentially a significant impact on existing recreation resources | Visitor use will increase with growing population, increasing demand for recreation resources and potentially a significant impact on existing recreation resources | Increased visitor use, water, energy, and fishing opportunities expected due to ERP and Water Quality Improvement Action | | | | | | | | | | | | | | | | | | | | |
| Recreation Use | Recreation Use | Visitor use anticipated to increase as a result of improved habitat, wildlife, and water quality | | | | | | | | | | | | | | | | | | | | |

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| Table 6--CVP and SWP Service Areas Outside the San Joaquin Valley | | | | | | | | | | | | | | | | | | | | |
|---|--|--|--|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---------------------|
| Recreation Impact | Existing Conditions | No Action | 1a | 1b | 1c | 2a | 2b | 2c | 2d | 2e | 3a | 3b | 3c | 3d | 3e | 3f | 3g | 3h | 3i | |
| | | | | | | | | | | | | | | | | | | | | Recreation Benefits |
| Temporary facility closure during construction | No impact | No impact | No impacts | | | | | | | | | | | | | | | | | |
| Permanent closure of facilities | No impact | No impact | No impacts | | | | | | | | | | | | | | | | | |
| Development of new recreation facilities | | | No impact | | | | | | | | | | | | | | | | | |
| Recreation Opportunities | | | | | | | | | | | | | | | | | | | | |
| Increased opportunities due to improved habitat | | | The water quality program and the water use efficiency program could result in beneficial impacts to existing recreation areas in the region | | | | | | | | | | | | | | | | | |
| Use | Recreation demand increases with current population, recreation demand for recreation exceeds recreation resources, and resulting in a potential impact on existing recreation resources | Visitor use will increase with population, recreation demand for recreation exceeds recreation resources, and resulting in a potential impact on existing recreation resources | Visitor use anticipated to increase as a result of improved water quality and potentially increased water supplied | | | | | | | | | | | | | | | | | |

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